OSED_4

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Abstract

The project P04.07.02 focuses on Separation task in En-Route. The project is part of the SESAR story-board step1.

The document proposes an operational concept based on the combination of conflict detection and conflict resolution services (including automatic conflict resolution) used by both tactical and planning controllers.

The document presents three services related to Separation in En-Route, at several maturity levels.

The Release 5 SESAR Solution #27 consists of two services, one of which is described in the current document because it has been V3-validated through RTS in 2015.

The second Solution #27 service (Monitoring Aids) is not a Separation service however it is also partly described in the current document as a side operational service.

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Rationale for rejection

Document History

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00.00.02	08/07/2016	Input for external review	DSNA	Internal review by P04.07.02 partners Consideration of SESAR Solution #27 scope
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Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground.

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Executive summary

The present document provides a description of the concept proposed by the project P04.07.02, which focuses on Separation task in En-Route Trajectory Based Environment.

Part of this concept is proposed as the SESAR Solution #27 (release 5).

The concept is part of SESAR step1, and it addresses the following Operational Improvements (OI) extracted from the European ATM master plan portal [25] using dataset 15

- **CM-0207-A** "Advanced Automated Ground Based Flight Conformance Monitoring in En Route" (release 5) ;

- (OI not defined yet) **CM-02XX** about advanced Conflict Detection and Resolution aids for the TC in en-route (release 5) ;

- (OI not defined yet) **CM-02YY** about advanced Conflict Detection and Resolution aids for the PC in en-route (out of SESAR Solution #27) ;

- **CM-0403-A** "Early Conflict resolution through CTO allocation in STEP 1" (release 8, out of SESAR Solution #27).

The project addresses these OI through a proposed concept, which relies on the provision of part or all of the following three main services:

- TRajectory Adjustment through Constraint of Time (TRACT) to early manage conflicts automatically through Time Constraints (CTO) and trajectory sharing (i.e. conflicts involving i4D-capable aircraft), in order to decrease the ATCO workload due to conflict assessment and monitoring (this service addresses CM-0403-A and is thus out of Solution#27) ;

- Conflict Detection and Resolution Aid to Planning Controller (CD/R Aid to PC), based on medium term conflict detection and resolution (MTCD) supported by a Planning Trajectory prediction ;

- Conflict Detection and Resolution Aid to Tactical Controller (CD/R Aid to TC), based on short term conflict detection and resolution supported by a Tactical Trajectory Prediction.

The objectives of the project are to assess the operational feasibility and acceptability of the foreseen concept in the SESAR context and whether it fulfils the SESAR expectations in terms of safety and performance requirements.

The current version of the OSED (D028) results from a sequence of previous releases, which progressively refined the concept and the associated requirements.

The OSED includes all Operational Requirements related to the P04.07.02 concept. The V3-validated requirements can be identified through the requirement attribute "STATUS" set to "VALIDATED".

The V3-validated requirements concern the service "CD/R Aid to TC" and MONA, and they formally define the P04.07.02 contribution to the SESAR solution #27. They address either CM-02XX or CM-0207-A.

Foreword: although the current concept includes three Separation Services for completeness, the "CD/R aid to the PC" and the "TRACT" services are out of the SESAR Solution #27 because they have not reached V3 maturity yet. Also enablers for TRACT are not available yet.

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1 Introduction

1.1 Purpose of the document

The Operational Service and Environment Definition (OSED) document describes the operational concept defined in the Detailed Operational Description (DOD) in the scope of its Operational Focus Areas (OFA).

It defines the operational services, their environment, use cases and requirements.

The OSED is used as the basis for assessing and establishing operational, safety, performance and interoperability requirements for the related systems further detailed in the Safety and Performance Requirements (SPR) document. The OSED identifies the operational services supported by several entities within the ATM community and includes the operational expectations of the related systems.

This OSED is a top-down refinement of the step1 DOD [2] produced by the federating OPS WP04.02 project. It also contains additional information which should be consolidated back into the higher level SESAR concepts using a "bottom up" approach.

The figure below presents the location of the OSED within the hierarchy of SESAR concept documents, together with the SESAR Work Package or Project responsible for their maintenance.
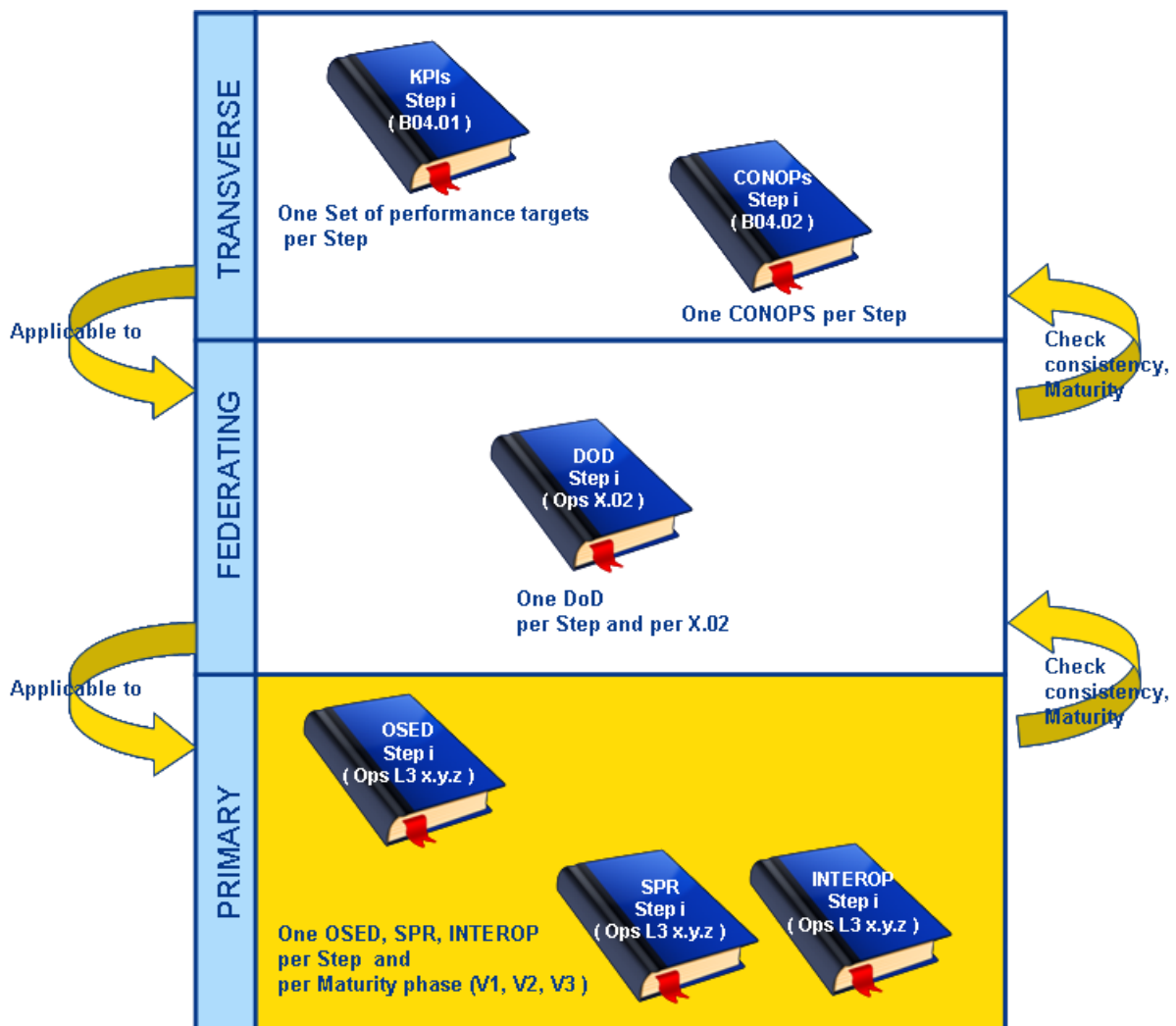
Figure 1: OSED document with regards to other SESAR deliverables

In Figure 1, the Steps are driven by the OI Steps addressed by the project in the Integrated Roadmap document [30].

The OSED is based on the available P04.02 DOD release 00.07.01 [2].

1.2 Scope

This OSED details the operational concept for the Operational Focus Area (OFA) 03.03.01 "Ground Based Separation Provision in En-Route"

The concept developed in this document is supported by services defined in P04.02 DOD168, written by OPS 04.02 for the Concept Storyboard Step1. The current OSED corresponds to an output of the project Iteration3. It reuses the OSED produced in the project Iteration4 [36] as a previous increment.

The OSED refines the processes and services (DOD elements) identified by OPS 04.02 including the following:

- "PCS-DOD-04.02-Provide_Early_Conflict_Resolution" Operational process;
- "Provide separation assurance" Operational process;
- "Ensure trajectory adherence" Operational process.

The three services that are developed by the OSED are at different maturity levels:

- The "CD/R Aid to the PC" is full V2 mature;
- The "CD/R Aid to the TC" is mainly V3 mature except for some enhanced aspects of the service e.g. the use of downlinked airborne data;
- The TRACT service is not V2 mature yet: some V2 validation exercises already took place to reach acceptability by the controllers, however additional V2 exercises are needed in order to assess other key aspects among which: the coordination impacts (how to manage TRACT constraints over sector boundaries?), the separation values that are acceptable for the ATCOs, the operational impact of delays, compliance with standardised datalink and airborne systems, Airspace Users acceptability (flight efficiency, human factors from crew perspective, …) and the best way to deal with the "Best Equipped/Best served" principle. As such, the TRACT service is out of the SESAR Solution #27.

It captures expected performance in accordance with the performance framework (B.04.01).

The OSED develops use cases and defines the Operational Requirements, based on the expected performance, scenarios and use cases.

1.3 Intended readership

The intended audience for the current OSED is:

- The other Operational projects that are neighbouring the P04.07.02 scope e.g. P05.07.02, P05.09, P04.07.08, P04.07.01, P04.07.03
- WP04.02 for consolidation;
- The mirror project P09.01 for considering the airborne aspects (impacts on i4D capability, EPP data,..);
- The mirror project P10.04.01 for developing the prototypes that has supported the V3 RTS;
- Other industrial projects that have contributed to the development of the P04.07.02 V3 prototype: P10.04.02, P10.02.01, P10.10.02, P10.10.03, 10.01.07, 10.07.01
- WPB for architecture and performance modelling;
- Transverse and federating projects;
- Stakeholders.

1.4 Structure of the document

The document starts with an Introduction section that has two side goals:

- To rapidly describe the background R&D Projects whose results have been considered in this document;

- To introduce all terms that will be used in the Operational Requirements.

The second section of the document describes the Operational Concept and the related three services in a plain and easy to understand language.

The third section of the document details the environment in which the P04.07.02 services should be implemented. In accordance with SJU guidelines, this section only details the very specific environmental characteristics among the environment definition in the P04.02 DOD [2].

Section 4 is dealing with the Operational Procedures, with and without the P04.07.02 services in operation. This aims at clarifying the impacts on the current methods of providing ATM services.

Section 5 illustrates the services in operations. This is reached through the description of Scenarios and Use Cases. It should be noted that these scenarios mainly aim at illustrating the concept so they are different from those used by V&V tasks.

The core element of this document is the Operational Requirements chapter, detailed in Section 6.

Last section lists the references that have been utilized.

In the appendixes, it can be found some Technical work that has been internally performed in order to check that the requirements are in line with the state of the art and the expectation within the time range of the project for what concerns some technical domains.

1.5 Background

The current document deeply takes advantage of previous work that has been performed on Separation services. It also benefits from results of the Validation activity, as these results and lessons-learnt has helped to improve the concept and its requirements.

1.5.1 Previous work on the same subject

This section identifies previous work performed on Separation services in En-Route.

This section originates from the P04.07.02 "Validation Strategy" document [37].

1.5.1.1 ERASMUS

ERASMUS [10] is an FP6 Project involving as partners EUROCONTROL (leader), DSNA, Honeywell, SICTA, University of Linköping and Technical University of Zurich. It aimed at assessing the technical and operational feasibility as well as the gain in capacity of new separation modes, based on improved 4D trajectory prediction, principally the Trajectory Control by Speed Adjustment (TC-SA).

TC-SA consists in separating the aircraft by uplinking time constraints automatically i.e. with no ATCO involvement in the solution elaboration and application. The time constraints are calculated so that they are achievable through minor speed adjustments of the concerned aircraft. It was shown that the controllers are not perturbed by such speed variations and that consequently they can be applied without prior controllers' agreement.

Based on the results obtained in ERASMUS in which V1 validation of TC-SA has been achieved, it was decided to further investigate this concept through the TRACT service in P04.07.02 (EUROCONTROL, DSNA and Honeywell are again partners in P04.07.02).

1.5.1.2 ERATO

Designed for the En-Route Airspace, ERATO ([11], [12]) is a French project and consists not only in a conflict detection and resolution aid fully compliant with the FASTI definition of MTCD for the planning and the tactical controllers but also in a cooperation tool and a working method.

More precisely, ERATO supports the controllers in analysing the traffic situation through filtering and agenda functions.

The filtering function applied on demand to an aircraft consists in shadowing all the flights that will not interact with it during the whole traversal of the sector. It aims at diminishing the traffic on which the controllers have to perform their own task of conflict detection. Additionally, what-if functions enable the controllers to check whether a proposed route or level change is operationally acceptable by showing them the induced changes in the filtering function.

The agenda points out the potential conflicts to be solved or at least monitored. It acts as a task manager: first the system proposes the potential conflicts, then the controllers deal with them. Both controllers can create/modify/suppress conflicts in the agenda. The planning controller is expected to prepare the agenda. S/he can also highlight situations requiring specific attention from the tactical controller. As the same information is shared through ERATO by the planning and the tactical controllers working on the same position, it appears to be an enabler for co-operation between them. Within the ERATO environment, both the planning and the tactical controllers have an identical representation of the situation (except for the time horizon).

Aside the filtering and agenda function, ERATO comprises a Monitoring Aids (MONA) function. Indeed, when an aircraft deviates from its predicted trajectory the controller is alerted through an alarm in the label. The concerned aircraft is considered as potentially in conflict with all other aircraft and appears as an interfering aircraft whenever the filtering function is applied (to any aircraft).

1.5.1.3 Episode 3 P4.3.4

In anticipation of En-Route validation activities for SESAR and within the context of the European Commission Episode 3 Project (EP3), the En-Route P4.3.4 Prototyping on Queue, Trajectory, and Separation Management [13] was conducted to assess the operability of the 4D trajectory management.

The main aims of the project were to assess the operability, from the controller perspective, of the introduction of the SESAR Reference Business Trajectories (RBT) and provide initial trends regarding expected benefits in terms of efficiency (e.g. optimised flight profile, better delivery conditions to TMA), predictability (e.g. adherence to pre-defined trajectory) and capacity (e.g. optimised airspace usage and reduced controller workload).

The methodology consisted of a series of three prototyping sessions performed in a SESAR Intermediate Timeframe En-Route Environment (SESAR 2015 traffic forecasts, with all aircraft ADS-C and i4D equipped).

For the full potential benefits of 4D trajectory management to be achieved all controllers strongly felt that the current route structure should be examined and possibly modified, and larger sectors respecting traffic flows be introduced. In addition, to support the 4D trajectory management they requested enhanced and new tools, to support conflict detection task, to issue closed loop headings for planning and tactical use, to display the required delivery sequence to TMAs and to provide the time status of the aircraft (in relation to the RBT/CTA time).

P04.07.02 will build upon these results, investigating more specifically the provision of conflict detection and resolution aids.

1.5.1.4 P1/VAFORIT

P1/VAFORIT is the current system software of DFS for ATC, which has 4D trajectory capabilities as a core enabler. It is in operational use at UAC Karlsruhe since 12.12.2010 (cutover date).

P1/VAFORIT provides tools for the planning controller including MTCD to enable the strategic planning of traffic flow from sector to sector. The tactical controller is supported in his/her task by a range of features including safety nets, conformance monitoring and ECS (Executive Conflict Search).

The optimum use of implemented functionalities (e.g. MONA, MTCD) basically depends on the timely and correct system input for all relevant 4D trajectory changes. All tactical clearances are system inputs done by the controller for individual aircraft. For example, a changed cleared flight level (CFL) or an advised speed are used for revisions of the trajectory calculation. The complete trajectory can be displayed via dynamic flight leg (DFL), which shows all estimated time over (ETOs), sector entry/exit times with flight levels, points of Top of Climb and Top of Descent.

If two or more trajectories intercept/touch, the system generates conflict messages, implying that the minimum distance between calculated positions is under-run. The VAFORIT trajectory conformance monitors lateral (e.g. track deviation), vertical deviation (e.g. deviation from cleared climb/descent rates) and time deviation.

Changes to the controller role distribution like multi-sector-planning or the introduction of functional executives is included in the VAFORIT concept and is planned to be introduced in the future.

The P1/VAFORIT system is at maturity level V6 (Current Operations) and constitutes the baseline for the envisaged separation modes and tools in the current document.

1.5.1.5 CATO

CATO [14] is a DFS activity which is carried out by the business unit control centre, the DFS centre in Munich, and the research & development department. The objective of the activity is to study the operational usability of new controller assistance tools in lower airspace thereby focusing on the possibility to gain quick wins from early implementation of the tools.

A pre-requisite for the usability of the controller tools is the input of all clearances and co-ordination results into the system. This will be achieved using the PSS (paper/stripless system) which is already in operation in parts of the German airspace and is expected to be used in all German lower airspace centres.

The following system functionalities will be evaluated within CATO:

- Conflict detection and resolution advisory;
- Flight path monitoring;
- Use of Mode-S data.

It is foreseen to implement these tools in the lower German airspace after conducting prototyping and validation activities including shadow mode and live trials.

Based on the encouraging results of the project, the developed research tools and initial validation of associated procedures achieved the V1 validation status. All these elements will be further used in P04.07.02 in order to progress to the V2 and V3 maturity.

1.5.1.6 iFACTS

Significant work has been undertaken within NATS regarding the development for advanced support tools and a complementary operational concept in order to enhance the efficiency of Area Control Operations since the late 1990s. The FACTS (Future Area Control Tools Support) project developed an initial core set of controller support tools supporting both the decision making and monitoring aspects of the air traffic control task (both tactical and planning) based upon the underlying functions of Trajectory Prediction (TP), Medium Term Conflict Detection (MTCD) and Flight Path (sometimes known as Conformance) Monitoring (FPM).

From this initial phase of concept development a first implementation project was initiated for the deployment of the tactical tools into the London Area Control Centre (LACC) based upon the existing architecture, a deployment known as Interim FACTS or iFACTS. Having completed the R&D phases of development of the iFACTS concept (as distinct to the FACTS concept owing to its reliance on existing LACC architecture) in 2003, the iFACTS system went operational across all LACC sectors in

2011. iFACTS provides tactical and planning controllers with an advanced set of support tools in order to reduce workload and so increase the amount of traffic s/he can comfortably handle. These tools, based on Trajectory Prediction and Medium Term Conflict Detection, provide decision making support and facilitate the early detection of conflicts in and around the sector; the trajectories and conflict detection criteria used are tailored to suit the different roles. The tools also include Flight Path Monitoring (FPM) and What-If functionality.

The most noticeable change from the current system is the removal of the Flight Progress Strips and the requirement to enter all tactical clearances into the system. All of the functions currently provided by the paper strips are divided between the various iFACTS components. In the operational deployment, the iFACTS tactical tools are available at all positions, both Tactical and PC, although it is expected that the PC will continue mainly to use the current LACC co-ordination assessment support, referring to the iFACTS tools in order to help to maintain a picture of the tactical situation and in specific circumstances such as the co-ordination of airspace crossing traffic.

Based on the operational deployment of the iFACTS tactical tools and the successful V3 validation of the PC tools, the current document will use and adapt the iFACTS concept elements.

1.5.1.7 FASTI

The objective of the EUROCONTROL First Air Traffic Control (ATC) Support Tools Implementation (FASTI) Programme was to co-ordinate the implementation and rapid deployment of controller support tools in a harmonised manner across ECAC by 2012. The Programme addressed short and medium term requirements but will also enable the introduction of further automation in ATC in the longer term.

FASTI complements implementation programmes such as Link 2000+ and Cascade by bringing controllers operational improvements to achieve their tasks of conflict detection, planning, co-ordination and traffic conformance monitoring through automated support.

The controller tools proposed by FASTI enable both capacity and safety benefits though a reduction in, and a more even distribution of, controller workload per aircraft resulting in increased sector, and overall ATM network, capacity. Early, more reliable and accurate conflict detection, better decision support and fewer controller tactical interventions provide safety benefits.

Between 2005 and 2012 the FASTI Programme has led the co-ordination between ANSPs, Supply Industry and Regulators to achieve rapid deployment of controller support tools across Europe:

- conflict detection tools (CDT, e.g. MTCD and Tactical support)
- Monitoring Aids (MONA)
- System supported coordination (SYSCO).

FASTI through its operational concept

- promotes a trajectory-orientated approach to planning and co-ordinating across sector boundaries.
- promotes a formal distribution of tasks where roles and working methods are defined for each member of the team, and adapted to each environment.
- considers the system as a member of the sector team; tools are integrated into the decision-making process.
- permits a gradual removal of procedural constraints such as defined by the Flight Level Allocation Schemes (FLAS), sector-avoidance procedures, LoAs, etc

A top down approach strategy used by the programme ensured that FASTI tools deployment was performance driven. During pre-implementation target performance levels have been agreed with Stakeholders; implementation at any particular Area Control Centre (ACC) has been considered in the context of the overall ATM Network

The EUROCONTROL FASTI Programme ([15], [16], [17], [18], [19], [20], [21]) concluded by providing the community with a comprehensive set of supporting documentation and guidelines for developing

founding members

and implementing controller support tools into operations. While the FASTI tools deployment is still on-going within centres across Europe, EUROCONTROL Network Management, based on the expertise gathered from the FASTI Programme activities, will continue to provide support in the areas of enhancing the network performance through controller support tools implementation.

Based on the positive results of the FASTI programme, the concept elements will be refined in the current document.

1.5.1.8 MSP Concept

In 2005, NATS and DFS independently started developing Multi Sector Planner (MSP) concepts. NATS extended their FACTS concept and DFS developed their VAFORIT/CATO concept. These projects took advantage of the benefits of advanced PC tools support on an iTEC platform and of multi-sector planning in keeping with the SESAR concept.

There are currently two approaches for the MSP concept: the "Tactical Flow Manager" MSP concept and the "Collaborative Control" MSP concept.

- The "Tactical Flow Manager' approach consists in a new role (performed by an existing person e.g. the local DCB actor or even a PC, or by a new actor) that gets a large view of the traffic flows over a set of sectors. This specific role is expected to propose control actions in order to facilitate the traffic management at sector (or "sector family" as defined in 04.02 DOD [2]) level, up to the sector teams to perform these actions. This role may benefit from similar Conflict Detection tools as those of the PC, with an extended scope (this role has been further studied in SESAR P04.07.08 as the "EAP" role).

- The aim of the "Collaborative Control" MSP concept is to develop a more flexible operation whereby one planner controller can serve not just one but two or more tactical / radar controllers. Additionally, should the PC adopt a more strategic role, being able to manage complexity and balancing workload across tactical sectors, it may be possible to increase the number of flights handled without increasing controller numbers. This would allow a more efficient deployment of controllers and result in a gain in efficiency and productivity. Further, these methods could be developed over time to take greater advantage of tactical collaboration without additional changes to the system.

  The "Collaborative Control" MSP concept can be achieved by providing tools that support the tactical controllers in their collaboration within the team and that reduce the planner controller workload in the sector enabling the PC to take on a wider, and more strategic, planning role. Tools support will aid the determination of resolution responsibility between the tactical controllers and will build on existing FACTS MTCD-based PC tools, enhancing them to include further levels of automation to free up controller workload, for example by the system automatically accepting offers that are conflict free (integrated co-ordination).

It can be noted that the key objective of SESAR P04.07.08 is to develop the roles, responsibilities and tools associated with different controller team organisations in En-Route airspace to maximise the benefits of controller tools.

1.5.2 Results from validation activities

The current document takes advantage of the Validation Report (VALR) documents that have been previously issued by the project ([38], [39], [40], [41]).

In particular, the following outcomes from the Validation activity have been used in the current document:

- 6 minutes look-ahead for tactical trajectories used by the "CD/R aid to the TC" service;

- Encounters showed by the "CD/R aid to the TC" shall be visible in all sectors which are laterally located between the begin and end of infringement area, while MONA alerts are shown in sectors responsible for the flight only;

- Manually created data in the "CD/R aid" services shall be shared with the other ATCO of the sector team, only on initiative of the ATCO who created it;

- Concerning the Tactical Controller, the information contained in any display specific to the "CD/R aid" service shall be transposed in the Radar Image.

1.6 Glossary of terms

Separation Related Terms.
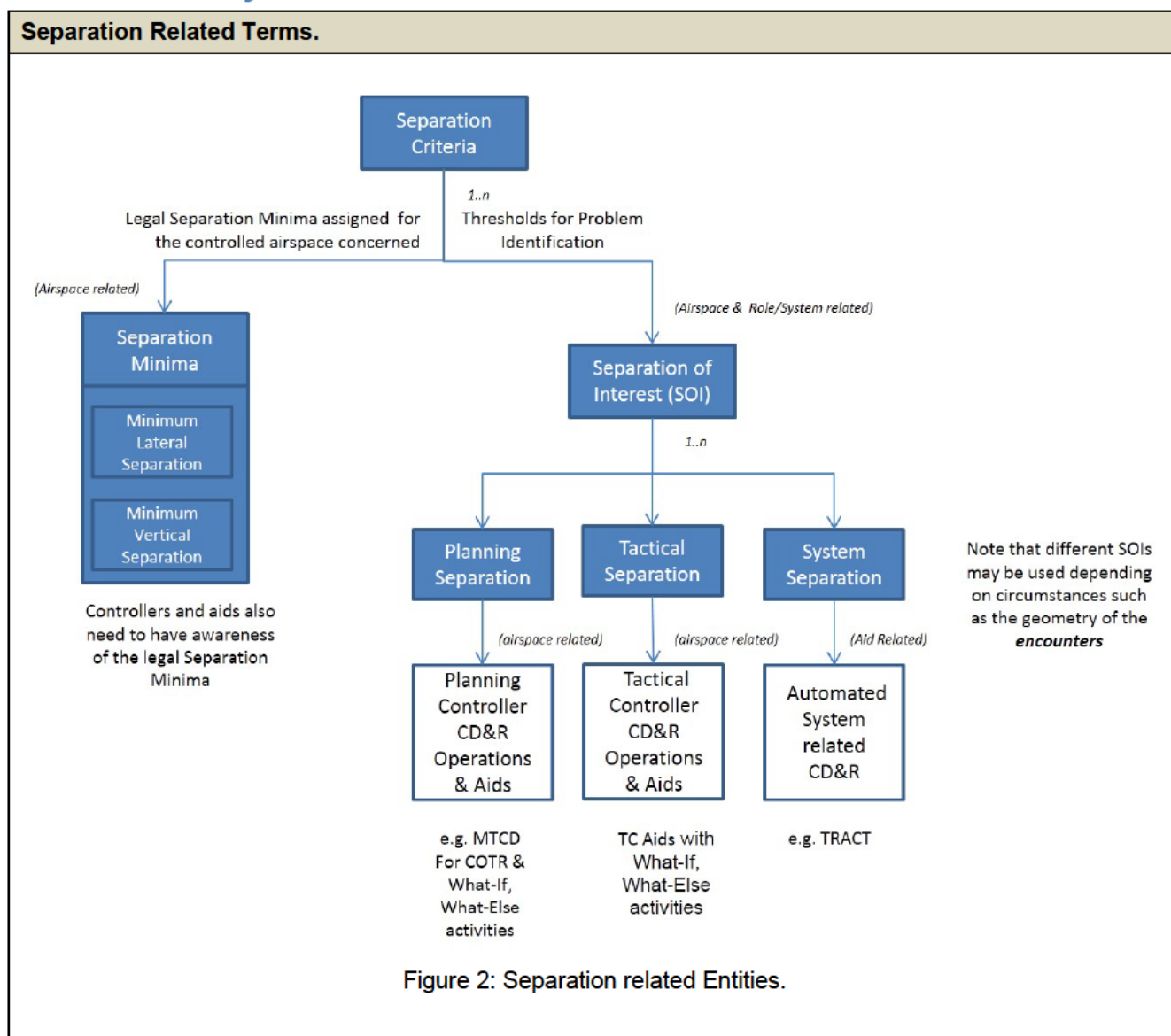
Figure 2: Separation related Entities.

Term	Definition
Separation Criteria	A generic term which covers the *Separation Minima* and the thresholds used for problem identification.
Separation	Spacing between an aircraft and a *Hazard*.
Lateral Separation	*Separation* expressed in terms of horizontal distance and function of angular convergence/divergence between tracks
Vertical Separation	*Separation* expressed in units of vertical distance
Separation Minima Related Terms	
Note: that the separation minima define the legal separation between hazards in a controlled airspace.	
Separation Minima	The minimum displacements between an aircraft and a *Hazard* which maintain the risk of collision at an acceptable level of safety.

	Note: ICAO Doc 9689 describes the methodology to be used for the determination of *Separation Minima*.
Minimum Lateral Separation	The *lateral separation* threshold above which the *separation minima* are fulfilled
Minimum Vertical Separation	The *vertical separation* threshold above which the *separation minima* are fulfilled Note: Different thresholds are applied above and below the *RVSM* limit. Any non-RVSM aircraft that is authorized to fly within an RVSM airspace shall be subject to the thresholds that are applied over the RVSM airspace.
Reduced Vertical Separation Minimum (RVSM)	A reduction to 1000 feet *vertical separation* between flights, which is used at least in Europe and on the North Atlantic, between FL290 and FL410.
Separation of Interest	The *separation* threshold below which the proximity of a pair of aircraft is considered to be of interest to a controller, for the airspace and conditions concerned. Note: At this point there may be no actual risk that *separation minima* are infringed. The values chosen for the various controller activities and tools are larger than the separation criteria in order to provide an adequate margin of safety. The controller and the aids used need to have awareness of the applicable separation minima for the airspace concerned. Note: This is a generic term, independent of the planning or tactical layers of separation activity. Particular instances of the *Separation of Interest* may be applied for each level of separation activity. The actual *separation* values used will take into account aspects such as the type of clearance issued, the requested navigation precision and the airspace rules. They will also relate to the type of trajectory used at the specific layer of concern. They may vary according to circumstances such as the geometry of the *conflicts*/*encounters* and prevailing conditions such as adverse weather.
Planning Separation (of Interest)	A particular instance of the *Separation of Interest* which is applied during planning activities. Note: This is a generic term relevant to the planning layers of separation activity. Particular instances of this may be applied for each level of layered planning separation activity. The actual *separation* values used will vary according to the circumstances. For instance, in the case of Planner Controllers coordinating traffic into and out of sectors, it is the horizontal distance/time interval threshold below which the proximity of a pair of aircraft is considered to be of interest to a Planner Controller when determining the acceptability of sector entry or exit co-ordination. The TC may choose to increase this **Planning Separation**, in which case the PC must re-coordinate the relevant aircraft.
Tactical Separation (of Interest)	A particular instance of the *Separation of Interest* which is applied by Tactical Controllers when controlling traffic under their responsibility.
System Separation (of Interest)	A particular instance of the *Separation of Interest* which is applied by automated system tools for the detection of *Encounters*. E.g. the *separation of interest* used by the TRACT tool.

Encounter management Related Terms

Figure 3: Encounter Management related Entities.

		Subject Flight				
		Planned Sequence Traj.	Entry Traj.	Exit Traj.	Deviation Traj.	Context Traj.
Environmental Flight	Planned Sequence Traj.	Planned Sequence Encounter	--	--	--	--
	Entry Traj.	--	Planning Encounter	Planning Encounter	Planning Deviation Encounter	--
	Exit Traj.	--	Planning Encounter	Planning Encounter	Planning Deviation Encounter	--
	Deviation Traj.	--	Planning Deviation Encounter	Planning Deviation Encounter	Planning Deviation Encounter	--
	Context Traj.	--	--	--	--	Context Encounter

Figure 4: Planning Aircraft vs. Aircraft Encounters.

		Subject Flight	
		Tactical Traj.	Coordination Traj.
Environmental Flight	Tactical Traj.	Tactical Encounter	--
	Coordination Traj.	--	Coordination Encounter

Figure 5: Tactical Aircraft vs. Aircraft Encounters.

(note that speculative/tentative trajectories are not considered in Figure 4 and Figure 5 for the sake of simplicity)

Hazard	The objects or elements that an aircraft can be separated from. Note: In En-Route, these can be: other aircraft, airspace with adverse weather conditions, or airspace with incompatible airspace activity.
Conflict **Potential Conflict** **Predicted Conflict**	These terms relate to any situation involving aircraft and hazards in which the applicable *separation minima* may be compromised. Note: These terms are in general widespread usage and within the context of this glossary are synonymous. They relate to potential *infringements of separation minima.* More specifically they are used in the context of ATCO activities where actions are performed in order to anticipate and resolve conflicts (potential/predicted) for separation management purposes. This is in contrast to the situations detected and processed by CD/R tools where the terminology used is '*encounters',* which relates to the applicable *Separation of Interest* used by the tool-set, rather than *Separation Minima*.
Encounter	A situation where an aircraft is predicted to be below the applicable *separation of interest* with respect to another aircraft, or a designated volume of airspace, classified respectively as "aircraft-to-aircraft" and "aircraft-to-airspace" encounters. Notes: Encounters are related to the various detection tools and may work to different look-ahead time horizons with different separation criteria, using different trajectories. Different tool configurations can therefore be expected to yield different encounters. The *Separation of Interest* thresholds are considered with respect to any applicable *uncertainty volumes* around the predicted aircraft position(s).
TRACT Encounter	A specific instance of an *Encounter* which is predicted using the *TRACT Trajectory* and the particular *System Separation.*
Planning Encounter	A specific instance of an *Encounter* which is predicted using any of the planning related *trajectories* and the *Planning Separation.*
Context Encounter	To support the controllers' traffic management task, environmental flights which may be of interest due to their anticipated vertical and lateral profiles, known as **Context flights** (or alternatively "Traffic"), will be highlighted to controllers. Context flights may not currently be involved in an encounter with the subject flight based on their current clearance or existing coordinated levels but may need to be considered by the Planner when making coordination choices for their sector. **Context Encounters** are detected between Context Trajectories. There is only one separation threshold, "Context Separation", and therefore no such concept as a "Context Conflict". When referring to **Context Encounters** operationally the

	environmental flights may just be labelled as "Traffic".
Tactical Encounter	A specific instance of an *Encounter* which is predicted using any of the tactical related *trajectories,* and the *Tactical Separation.*
Planned Sequence Encounter	A specific instance of a *Planning Encounter* which is predicted between two *Planned Sequence Trajectories*.
Coordination Encounter	A specific instance of a *Tactical Encounter* which is predicted between two *Co-ordination Trajectories.*
Planning Deviation Encounter	A specific instance of a *Planning Encounter* which is predicted using at least one *Planning Deviation Trajectory*.
Cluster	A set of one or more *Encounters* that should be treated as a whole when determining their resolution.
Planning Cluster	A *Cluster* of *Planning Encounters*. Note: A *Planning Cluster* is an operational object that may be handled by ATCOs. The grouping of *encounters* is therefore likely to be an operational decision.
TRACT Cluster	A set of one or more *TRACT Encounters* that are treated as a whole by the TRACT service.
Closest Point of Approach	The point on the *Trajectory*, which is being evaluated, where the distance to the *hazard* is predicted to be minimal. Note: In some cases the evaluation may be made on the basis of a trajectory segment, e.g. when two aircraft join the same route at the same speed. Subsequent points along the trajectory being evaluated, beyond the closest point of approach are separated from the hazard by progressively increasing distance.
Predicted Infringement Point	The point on the *Trajectory*, which is being evaluated, for a particular *Encounter*, where infringement of the applicable *Separation of Interest* is predicted at respective flight positions for the trajectories concerned.
Potential Infringement Point	The point on the *Trajectory*, which is being evaluated, for a particular *Encounter*, where infringement of the applicable *Separation of Interest* may potentially occur within the *uncertainty volumes* for the trajectories concerned.
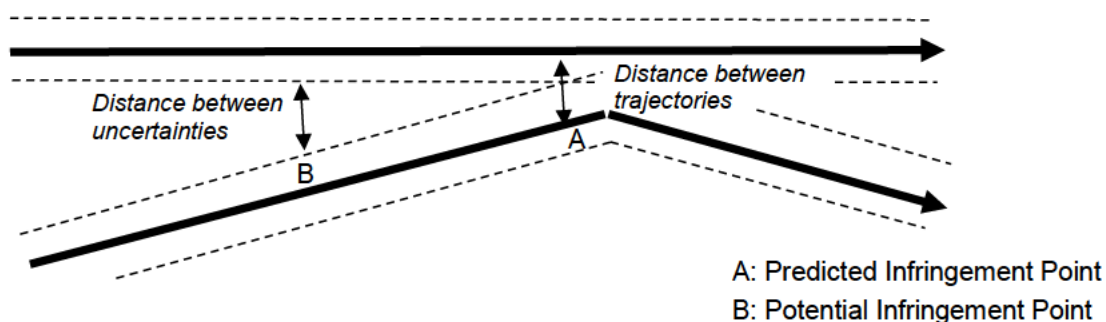
Figure 6: Predicted Infringement Point vs Potential Infringement Point.
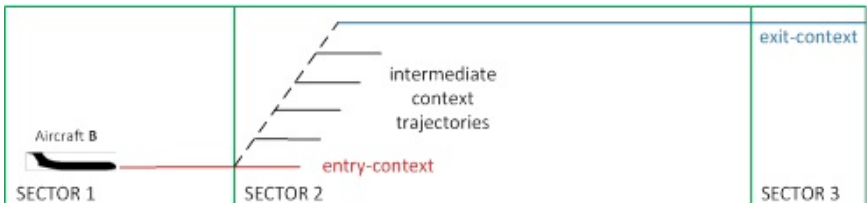
What-if Probing	A process where a private copy of a *Trajectory* that is in operational use and associated data is taken and used as a *Tentative Trajectory* to check the impact of changes to the flight data on the occurrence of predicted *Encounters*, without affecting the corresponding data for the actual flight.
	Note: On completion the what-if data and the *Tentative Trajectory* may be discarded or used to implement an update to the actual flight data and to construct the necessary clearance.
What-else Probing	A process where several *Speculative Trajectories* and associated data arising from *What-If Probing* are assessed for the impact on the occurrence of predicted *Encounters*.
	The *Speculative Trajectories* utilise flight data other than that currently committed or tentatively selected (during *What-If Probing* operations) by the controller.

Trajectory and Flight Related Terms

See Figure 2 for an overview of the trajectory usage.

Since the needs of the PC and TC differ in many respects, the trajectories produced to support the planning and tactical roles may be different.

Planning Trajectories are used to predict encounters between flights that are of concern to the PC. They take account of the original flight plan, modified by agreed co-ordination constraints and standing agreements, but possibly unconstrained by tactical instructions.

Uncertainty, Uncertainty Volume	The volume of airspace, around the nominal predicted future position of a flight, within which a flight is expected to be contained to a given statistical confidence (e.g. 95%) at the time to which the prediction relates. The uncertainty relates to the trajectory prediction and may therefore be considered as a property of the particular trajectory concerned.
	Note: The zone can be decomposed into along-track (longitudinal), across-track (lateral) and vertical dimensions.
Trajectory	The predicted behaviour of an aircraft.
	Note: the *Trajectory* is usually modelled as a set of consecutive segments linking waypoints and/or points computed by the aircraft avionics (e.g. FMS) or by the ground system to build the vertical profile and the lateral transitions.
	Note: Each point is defined by a longitude, latitude, an altitude and a time.
ADS-C EPP Report EPP Data	ADS-C EPP (Extended Projected Profile) report is the ADS-C report containing the sequence of 1 to 128 waypoints or pseudo waypoints with associated constraints and/or estimates (altitude, time, speed, etc.), gross mass and min/max speed schedule, etc. as defined in WG78/SC214 standards.
	Note: The aircraft's predicted trajectory is down-linked in accordance with its ADS-C contract parameters. The EPP Data can be used for variety of ATC services.
Tentative Trajectory	Tentative *trajectories* are created from another trajectory that is in operational use

	(Tactical, Planning or otherwise). They reflect tentative what-if flight data selected by the controller. If these conditions are then committed the Tentative trajectory and the associated data will be used to establish the new operational trajectory. If the conditions are discarded then it will also be discarded. Note: Tentative trajectories support **What-If probing** and are created during this process.
Speculative Trajectory	A **Trajectory** that uses flight data other than those currently committed or tentatively selected (during a **What-If Probing** operation), by the controller. Note: Speculative Trajectories are produced for the purpose of **What-Else probing**.
Tactical Trajectory	The **Tactical Trajectory** is calculated within a short look-ahead time (e.g. up to 15 minutes) during tactical ATC operations (sector planning layer). It therefore reflects an accurate view of the predicted flight evolution, starting from the current flight position (generally, as reported by surveillance), with low **uncertainty** and high precision. It is kept up to date with all clearances, including tactical instructions, except in case of detected deviation. During any open tactical manoeuvres it will also be reflecting those temporary conditions. It is usually determined with a fast update rate (e.g. 5 seconds) and with an optimised **Uncertainty** calculation; to maximise response and minimise the incidence of false alarms. Note: The Tactical Trajectory supports the tactical ATC operations whether the flight follows its normal behaviour or it deviates from its clearances/instructions.
Planning Deviation Trajectory	The **Planning Deviation Trajectory** provides the predicted profile of the aircraft based on the observed behaviour, extrapolated from the particular deviation from coordination. Note: **Planning Deviation Trajectories** are necessary for situations where non-compliance with a flight's coordinated behaviour is observed, with respect to an applicable tolerance threshold. The **Planning Deviation Trajectories** support Planner ATC operations when the flight has deviated from its predicted behaviour. A **Planning Deviation Trajectory** follows the cleared route of the flight, irrespective of any coordination constraints (as the flight has been observed to be deviating from these constraints). During periods where a **Planning Deviation Trajectory** is necessary it may also be used by PC CD/R Aid.
CFL Deviation Window	Interval of Flight Levels the AFL is expected to belong to. In general it is the interval between the previous AFL and the CFL.
Subject Flight	A flight that has been explicitly selected by the Controller concerned.
Subject Trajectory	The **Trajectory** of the **Subject Flight**
Environmental Flight	A flight of interest to the Controller which is not the **Subject Flight**. The **Subject Flight** will be checked for **encounters** with all **Environmental Flights**.
Context Flight	A flight that may need to be considered by the Planner ATCO when making coordination choices for the **Subject Flight**, due to the flights' anticipated vertical and lateral profiles. **Context Flights** are those **Environmental Flights** that are involved in a **Context Encounter** with the **Subject Flight**. Note: **Context Flights** may not currently be involved in a **Planning Encounter** based on their current clearance or existing coordinated levels.
Context Trajectory	**Context Trajectories** represent the expected utilisation of airspace by each flight. **Context Trajectories** are built for the **Subject Flight** and **Environmental Flights**.

	Note: Context Trajectories are similar to **Coordination Trajectories**. Each **Context Trajectory** maintains a single level and follows the lateral profile of the **Planned Trajectory**. Context Trajectories are built at every standard Flight Level from the entry-context level to the exit-context level. The identification of entry-context and exit-context levels is dictated by the information available in the system at the time of the probe. They represent the lowest and highest level at which the flight is anticipated to occupy in the sector. The Origin and Termination points on **Context Trajectories** depend on whether the flight is the **Subject flight** or an **Environmental flight** and on the flight's anticipated vertical profile. Example of Subject Flight **Context Trajectories**: Example of Environmental Flight **Context Trajectories**:
Planned Trajectory	The **Planned Trajectory** represents the stable medium to long term behaviour of the aircraft but may be inaccurate over the short term where tactical instructions that will be issued to achieve the longer term plan are not yet known. It takes into account the planned route and requested vertical profile, strategic ATC constraints, **Closed Loop Instructions/Clearances**, co-ordination conditions and the current state of the aircraft. Assumptions may be made to close **Open Loop Instructions/Clearances** issued by tactical controllers. It is calculated within the planning look-ahead timeframe, starting from the Area of Interest of the unit concerned, or the aircraft's current position (whichever is later). It is constrained during all phases of flight by boundary crossing targets (e.g. standing agreements between the Units concerned). Note: The **Planned Trajectory** supports the ATC planning operations. It is used primarily to support data distribution within the system and in the determination of the top of descent point. As such, uncertainty does not need to be calculated for this trajectory. It may also be used as the starting point for derivation of more specific local ATC trajectories.
Planned Sequence Trajectory	A **Trajectory** that is derived from the **Planned Trajectory** as it follows the vertical and lateral profile of the **Planned Trajectory**, truncated in time to an adaptable parameter (e.g. 25 minutes). **Uncertainty** is added (although the lateral uncertainty may be zero). Note: The Planned Sequence Trajectory is used for the determination of co-ordination levels and the sector penetration sequence. It is used for both manual coordination and integrated coordination purposes and may be used by the CD/R Aid (with the **Planning Separation**) for traversals of the sector concerned (CD/R for entry and exit to the sector are covered by the

	Coordination Trajectory).
Coordination Trajectory Or **[Entry/Exit] Trajectory**	A *Trajectory* that is derived from the *Planned Sequence Trajectory.* It follows the lateral profile of the *Planned Sequence Trajectory*[1] but maintains a specific coordination level relevant to the boundary between two sectors. It represents the expected behaviour of the aircraft according to the entry/exit co-ordination conditions.
	Entry Trajectory = A *Coordination Trajectory* that is built at levels associated with the sector entry coordination for the flight.
	Exit Trajectory = A *Coordination Trajectory* that is built at levels associated with the sector exit coordination for the flight.
	Note: The *Coordination Trajectory*:
	• Supports both lateral and vertical boundary co-ordinations;
	• Can have the origin and end truncated (e.g. at sector boundaries);
	• Is necessary for predicting *encounters* with flights that are co-ordinated with the sector but not yet in communication with that sector.
	Because it is only needed for boundary crossing conditions the *Coordination Trajectory* can have a relatively short prediction horizon; typically up to the point where the flight is assumed by the sector concerned.
TRACT Trajectory	A *Trajectory* that is derived from the *Planned Trajectory.* It is similar to the *Planned Sequence Trajectory* in that it follows the vertical and lateral profile of the Planned Trajectory, truncated in time to an adaptable parameter (which is suitable for the TRACT process) and *uncertainty* is included.
	Note: It is used in support of the TRACT CD/R process.
Initial Reference Business Trajectory (iRBT for Step 1)	The representation of an airspace user's intention with respect to a given flight, guaranteeing the best outcome for this flight (as seen from the airspace user's perspective), respecting momentary and permanent constraints.
	The *Reference Business Trajectory* (RBT) refers to the Business Trajectory during the execution phase of the flight. It is the Business Trajectory which the airspace user agrees to fly and the Air Navigation Service Providers (ANSP) and Airports agree to facilitate (subject to separation provision)
	Note: The iRBT is the Step 1 attempt to move towards the full SESAR Reference Business Trajectory
Trajectory revision	A trajectory revision is launched when there is a need for human intervention to change the route and/or altitude/ Flight Level and/or time features (Targets and/or Constraints),
	It is mostly triggered at Controller or Flight Crew initiative but it may also be initiated by other ground actors. However, trajectory revisions can only be implemented by ATCOs and the Flight Crew.
Trajectory update	A trajectory update implies an Air-Ground and/or Ground-Ground trajectory distribution. The trajectory update is triggered automatically, on request or periodically.
	A trajectory update is automatically triggered when the trajectory predictions continuously computed by the ground and/or aircraft system(s), differs from the previously shared trajectory predictions by more than a defined threshold
Clearance and Instruction Related Terms	

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[1] It may be possible for the lateral profile of Coordination Trajectories to be altered from that of the Planning Trajectory to take into account relevant Coordination Constraints applied at the boundary between two sectors.

CTO	An ATM imposed time constraint over a point [SESAR lexicon].
	Note: This constraint is sent by the ground system to the aircraft.
CTA	An ATM imposed time constraint on a defined merging point associated to an arrival runway [SESAR lexicon].
	Note: This constraint is sent by the ground system to the aircraft.
RTA	A function of the airborne FMS that allows the flight to comply with a CTA/CTO.
Active CTO/CTA/RTA	A *CTO* or *CTA* or *RTA* that is currently taken into account by both, the avionics (e.g. FMS) and the Ground Systems.
	Note: It is considered to be active from the moment when both the air and the Ground Systems have taken it into account, until the application point of the constraint is over-flown or until it is cancelled in the Air and the Ground systems.
Target Time of Arrival	An Arrival Time which is not a constraint but a progressively refined planning time that is used to coordinate between arrival and departure management applications. It is an ATM computed time.
Open loop Instruction/Clearance	An ATC clearance or instruction where a full trajectory extrapolation beyond the point or segment(s) affected is not possible using the normal prediction process, i.e. without special measures to assert a closure condition (e.g. time limit on headings and most probable point of return to original routing).
	Open loop instructions/clearances can be cancelled by a Closed-loop instruction/clearance.
	Note: Most tactical instructions/clearances take this form; they include heading (including track offset), level, and speed restrictions and exceptionally could also cover rates of climb or descent.
Closed loop Instruction/Clearance	An ATC clearance or instruction where a full trajectory extrapolation beyond the point or segment(s) affected is possible using the normal prediction process.
	Note: A typical example is a direct route from one point to another on the original route.
NFL, SFL	The NFL is the cleared level that the aircraft will have when it will arrive in the sector. The NFL is given by the upstream sector. The NFL is equal to the XFL of the upstream sector.
	The SFL is the second level that permits to determine the interval of flight levels in which the aircraft will arrive in the sector. So when arriving in the sector the aircraft will be between the SFL and the NFL.
Data-Link Related Terms	
ETA	Estimated Time of Arrival. The ETA is usually used not only for the arrival (i.e. last point of the Trajectory) but also for the "arrival" on any given trajectory point. In such a case and for Ground systems use only the acronym ETO – Estimated Time Over – should be preferred. In the current document, it is used in Air aspects (e.g. as an item of EPP data) only, although Ground systems namely Ground TP may use this acronym too.
TOAC	Time Of Arrival Control - the function of airborne system providing automatic speed control as to overfly given point on trajectory within given time constraint.
reliable RTA interval	The range of arrival times at a specified lateral fix which are achievable using TOAC function, with a level of confidence of 95% assuming standard meteorological uncertainty as specified in appendix J of WG85 - addendum to document ED75, and margins. This corresponds to the raw [ETAmin,max] amended with margins, and it is downlinked in the ADS-C messages as "ETAmin,max" field.
RTA Tolerance	Time tolerance around CTO/CTA/RTA constrained point defined by ATC in which airborne system overfly this point with 95% probability.

Other Terms	
[Offering/Receiving] sector	*Offering sector*: In a co-ordination process, the downstream sector that is expected to offer the responsibility of the outgoing flight to the next sector. *Receiving sector*: In a co-ordination process, the upstream sector that is expected to receive the responsibility of the incoming flight from the previous sector.
Eligible flight for TRACT	A flight to which the TRACT service may send a CTO
I4D equipped aircraft	An aircraft with capabilities that support the initial 4D trajectory operations step 1, as depicted in [29]
User Preferred Route	A preferred route that is provided by an Airspace User during the flight planning and agreement phase. In Step 1 it may take advantage from *Free Route Airspace (FRA)* for optimum routings. Note: A User Preferred Route may include published as well as non-published points defined in latitude/longitude or point bearing/distance. Such waypoints are inserted in the FMS for trajectory computation
Level Block	A level or a range of levels that is blocked off to other traffic, e.g. crossers

The following table identifies terms that may be used in the current OSED but introduced by other SESAR projects or other European programs.

Terms referenced elsewhere in SESAR	
Performance Based Navigation (PBN) **Advanced RNP (A-RNP)** **Area navigation (RNAV)**	P04.07.03
ASAS (Airborne Separation Assistance System)	P04.07.06
MSP[2] (Multi Sector Planning) and EAP (Extended ATC Planner/Planning)	P04.07.08
Complexity **Complexity Management**	P04.02 DOD, P07.02 DOD, P04.07.01
Free Route, Free Routing, Free Route Airspace (FRA)	P04.02 DOD, P07.05.03
Flexible Use of Airspace (FUA)	P07.05.02
Functional Airspace Block (FAB)	www.eurocontrol.int/articles/functional-airspace-blocks-fabs-and-single-european-sky-ses
Queue Management	P05.06, P07.02

1.7 Acronyms and Terminology

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[2] MSP concept is currently addressed by project P04.07.08 and covers both "MSP" approach (adopted by NATS) and "EAP" approach (adopted by DSNA)

Term	Definition
1P1T	*One Planner controller one Tactical controller*
2D, 3D, 4D	*Two Dimensional, Three Dimensional, Four Dimensional*
4D TM	*Four dimensional Trajectory Management*
5LNC	*Five Letters Name Code*
A/C	*Aircraft*
ACARS	*Aircraft Communications Addressing and Reporting System*
ACAS	*Airborne Collision Avoidance System*
ACC	*Area Control Centre*
ADEP	*Aerodrome of Departure*
ADES	*Aerodrome of Destination*
ADS-B	*Automatic Dependent Surveillance-Broadcast*
ADS-C	*Automatic Dependent Surveillance-Contract*
AFL	*Actual Flight Level*
AIRM	*ATM Information Reference Model*
AIS	*Aeronautical Information Services*
AMAN	*Arrival MANager*
ANSP	*Air Navigation Service Provider*
AOC	*Airlines Operations Centre*
AoI	*Area Of Interest*
APM	*Approach Path Monitor*
APW	*Area Proximity Warning*
ARN	*ATS Route Network*
ASAS	*Airborne Separation Assistance/Assurance System*
ASPA-S&M	*Airborne SPAcing Sequencing & Merging*
ATC	*Air Traffic Control*
ATCO	*Air Traffic Controller*

Term	Definition
ATFCM	*Air Traffic Flow and Capacity Management*
ATIS	*Automatic Terminal Information Service*
ATM	*Air Traffic Management*
ATN	*Aeronautical Telecommunications Network*
ATS	*Air Traffic Services*
ATSU	*Air Traffic Services Unit*
ATSAW	*Air Traffic Situational Awareness*
BGA	*Business and General Aviation*
CATO	*Controller Assistance Tools*
CB	*Cumulonimbus*
CCD	*Continuous Climb Departure*
CD	*Conflict Detection*
CD/R	*Conflict Detection and Resolution*
CDM	*Collaborative Decision Making*
CFL	*Cleared (Current) Flight Level*
COP	*CO-ordination Point*
CNS	*Communications, Navigation and Surveillance*
CPA	*Closest Point of Approach*
CPDLC	*Controller Pilot Data Link Communication*
CTA	*Control Time of Arrival*
CTO	*Control Time Over*
CWP	*Controller Working Position*
DCT	*DireCT*
DFS	*Deutsche Flugsicherung GmbH (German ANSP)*
DMAN	*Departure MANager*
DOD	*Detailed Operational Description*
DSNA	*Direction des Services de la Navigation Aérienne (Directorate Air Navigation*

Term	Definition
	Services) (French ANSP)
E-ATMS	*European Air Traffic Management System*
E-OCVM	*European Operational Concept Validation Methodology*
ECAC	*European Civil Aviation Conference*
ECS	*Executive Conflict Search*
EFS	*Electronic Flight Strip*
EPP	*Extended Projected Profile*
EP3	*Episode 3*
ERASMUS	*En-Route ATM Soft Management Ultimate System (project)*
ERATO	*En Route Air Trafic Organizer*
ETA	*Estimated Time of Arrival*
ETFMS	*Enhanced Tactical Flow Management System*
ETO	*Estimated Time Over*
EUROCAE	*EURopean Organization for Civil Aviation Equipment*
FAB	*Functional Airspace Block*
FABEC	*Function Airspace Block Europe Central*
FACTS	*Future Area Control Tools Support*
FASTI	*First ATC Support Tools Implementation (programme)*
FDMP	*Flight Data Manager Publisher*
FDPS	*Flight Data Processing System*
FIR	*Flight Information Region*
FIS	*Flight Information Service*
FL	*Flight Level*
FMS	*Flight Management System*
FRA	*Free-Route Airspace*
FTS	*Fast Time Simulation*
GA	*General Aviation*

Term	Definition
GAT	General Air Traffic
GG-IOP	Ground-Ground Interoperability
HMI	Human-Machine Interface
i4D TM	Initial 4-Dimensional (Trajectory Management)
IAS	Indicated Air Speed
IBP	Industry-Based Prototypes
IC	Integrated Co-ordination
ICAO	International Civil Aviation Organisation
iFACTS	Interim Future Area Control Tools Support
IFR	Instrument Flight Rules
IP	Implementation package
IOC	Initial Operational Capability
IOP	Interoperability
iRBT	Initial Reference Business Trajectory
ITEC	Interoperability Through European Collaboration
LACC	London Area Control Centre
MET	METeorological services
MONA	MONitoring Aids
MSAW	Minimum Safe Altitude Warning
MSP	Multi Sector Planning
MTCD	Medium-Term Conflict Detection
NATS	National Air Traffic Services (UK ANSP)
NEXTGEN	Next Generation Air Transportation System
NFL	eNtry Flight Level
NoTT	No Tactical Trajectory
OAT	Operational Air Traffic
OI	Operational Improvement

Term	Definition
OLDI	*On-Line Data Interchange*
OSED	*Operational Service(s) Environmental Description*
P04.07.02	*Project P04.07.02.*
PC	*Planning Controller*
PIR	*Project Initiation Report*
R&D	*Research and Development*
RBT	*Reference Business Trajectory*
R/F	*Radio Frequency*
RNP	*Required Navigation Performance*
R/T	*Radio Telephony*
RTA	*Requested Time of Arrival*
RTS	*Real Time Simulation*
RVSM	*Reduced Vertical Separation Minimum*
SESAR	*Single European Sky ATM Research Programme*
SFL	*Supplementary Flight Level*
SJU	*SESAR Joint Undertaking (Agency of the European Commission)*
STAM	*Short Term ATFCM Measure*
STCA	*Short-Term Conflict Alert*
SVFR	*Special Visual Flight Rules*
SYSCO	*System Supported CO-ordination*
TAWS	*Terrain Awareness and Warning System*
TC	*Tactical Controller*
TCAS	*Traffic Collision Avoidance System*
TCMP	*Tactical Conflict Management Planned*
TDB	*Track Data Block*
TRACT	*TRajectory Adjustment through Constraint of Time*
TCT	*Tactical Controller Tool*

Term	Definition
TMA	*Terminal Manoeuvring Area*
TMF	*Trajectory Management Framework*
TEMSI	*Temps Significatif (French weather forecasting map)*
TOAC	*Time Of Arrival Control*
TOC	*Top Of Climb*
TOD	*Top Of Descent*
TP	*Trajectory Prediction*
TSA	*Temporary Segregated Area*
TRA	*Temporary Reserved Area*
UAC	*Upper Airspace Control*
UIR	*Upper Flight Information Region*
V&V	*Validation and Verification*
VAFORIT	*Very Advanced Flight Data Processing Operational Requirement Implementation*
VDL	*VHF Digital Link*
VFR	*Visual Flight Rules*
VHF	*Very High Frequency*
VLJ	*Very Light Jet*
WP	*Work Package*
Term	**Definition**
SESAR Programme	*The programme which defines the Research and Development activities and Projects for the SJU.*
SJU Work Programme	*The programme which addresses all activities of the SESAR Joint Undertaking Agency.*

2 Summary of Operational Concept from DOD

This section addresses WHAT is to be developed and provides the traceability to the P04.02 DOD [2], written by OPS 04.02 for the Concept Storyboard Step1.

It details in simple terms and plain language the operational concept in the scope of the addressed Operational Focus Area 3.3.1 "Conflict Detection, Resolution and Monitoring".

2.1 Mapping tables

The following tables are coherent with the related P04.02 DOD [2] except for the OI Steps identification, which has not been finalized. In particular, CM-02XX and CM-02YY are still not defined.

Relevant OI Steps ref.	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
CM-0207-A "Advanced Automated Ground Based Flight Conformance Monitoring in En Route"	OFA03.03.01 "Ground Based Separation Provision in En Route"	Step1	M	- decision support and alerting systems
CM-02XX "Advanced Conflict Detection and Resolution aids for the TC in En Route"	OFA03.03.01 " "Ground Based Separation Provision in En Route"	Step1	M	- co-operative ground and airborne decision making tools - decision support and alerting systems
CM-02YY "Advanced Conflict Detection and Resolution aids for the PC in En Route"	OFA03.03.01 " "Ground Based Separation Provision in En Route"	Step1	M	- co-operative ground and airborne decision making tools - decision support and alerting systems
CM-0403-A "Early Conflict resolution through CTO allocation in STEP 1"	OFA03.03.01 " "Ground Based Separation Provision in En Route"	Step1	M	- ground based automated assistance to controller (TRACT)

Table 1: List of relevant OIs within the OFA

Scenario identification	Use Case Identification	Reference to DOD section where it is described
OS-4-02-Complexity Management in En Route	CM-UC-04-03	§4.2.2
OS-4-02-Complexity Management in En Route	CM-UC-06-02	§4.2.2
OS-4-03-Separation Management in En Route	UC-SEP-02	§4.2.3
OS-4-03-Separation Management in En Route	UC-SEP-03	§4.2.3

Scenario identification	Use Case Identification	Reference to DOD section where it is described
OS-4-03-Separation Management in En Route	UC-SEP-04	§4.2.3
OS-4-03-Separation Management in En Route	UC-SEP-05	§4.2.3
OS-4-03-Separation Management in En Route	UC-SEP-06	§4.2.3
OS-4-03-Separation Management in En Route	UC-SEP-08	§4.2.3
OS-4-03-Separation Management in En Route	UC-SEP-09	§4.2.3
OS-4-03-Separation Management in En Route	UC-SEP-21	§4.2.3
OS-4-03-Separation Management in En Route	UC-SEP-22	§4.2.3

Table 2: List of relevant DOD Scenarios and Use Cases

Operational Environment	Class of environment	Reference to DOD section where it is described
- En-route airspace - FABs - ATS Routes Network (ARN) - Free-route above a certain level	Airspace	§3.1.1
- iRBT - EPP downlinks	iRBT	§3.1.2
- 2017 : Traffic demand is for 22% more than in 2010	Traffic	§3.1.3
- Mix of navigation performances	Traffic	§3.1.3
- OLDI, IOP supported by SYSCO - GG-IOP - SWIM	CNS capability	§3.1.4
- 8.33kHz channel spacing - Data Link services - CPDLC - ADS-C - Advanced RNP - Improved FMS capabilities - ATSAW	CNS capability	§3.1.4
- Conflict Detection Tools (CDT) - Monitoring Aids (MONA) - SYSCO	Support tools	§3.1.6
- RVSM between FL290 and FL410 - Reduced longitudinal minima at the frontier between two ATSUs thanks to SYSCO	Separation minima	§3.1.7
- STCA, APW, MSAW, APM - TCAS, ACAS partly	Safety nets	§3.1.8
- High winds, Icing, Turbulence, CB	Weather	§3.1.9
- ATC Sector Team (with possibly MSP) - Flight Crew	Actors	§3.2.1

Table 3: List of relevant DOD Environments

Note also that P04.02 DOD did not develop Operational Services identification and definition yet, so Table 4 only deals with Processes.

DOD Process / Service Title	Process/ Service identification	Process/ Service short description	Reference to DOD section where it is described
Process	Provide Early Conflict Resolution (TRACT)	Activities related to early de-confliction via CTO allocation	§5.1.3
Process	Provide Planning Separation Assurance	Activities related to conflict detection and resolution at the planning level.	§5.1.4
Process	Provide Tactical Separation Assurance	Activities related to conflict detection and resolution at tactical level.	§5.1.5
Process	Ensure Trajectory Adherence	Activities related to the detection and resolution of deviations from the planned aircraft trajectory	§5.1.6

Table 4: List of the relevant DOD Processes and Services

DOD Requirement Identification	DOD requirement title	Reference to DOD section where it is described
REQ-04.02-DOD-0005.0017	Early Conflict resolution through CTO allocation	§6.1
REQ-04.02-DOD-0005.0030	Automated Support for Conflict Detection & Resolution in En Route using trajectory data in Predefined Routes environments	§6.1
REQ-04.02-DOD-0005.0031	Automated Flight Conformance Monitoring in En Route	§6.1

Table 5: List of the relevant DOD Requirements

2.2 Operational Concept Description

Foreword: although the current concept includes three Separation Services for completeness, the "CD/R aid to the PC" and the "TRACT" services are out of the SESAR Solution #27 because they have not reached V3 maturity yet. Also enablers for TRACT are not available yet.

The here-described concept is based on a combination of the following separation services:

- TRajectory Adjustment through Constraint of Time (TRACT),
- Conflict Detection and Resolution Aid to PC (CD/R aid to PC)
- Conflict Detection and Resolution Aid to TC (CD/R aid to TC)

Any combination of these services may be rendered together. In the case where all three services are combined, they would roughly articulate with each other as follows:

- The TRACT service detects e.g. 25 minutes ahead potential conflicts and attempts to resolve them through CTO that are achievable by the aircraft;

- The list of potential conflicts that have been resolved by TRACT is input into the CD/R aid to PC tool for information. This service then detects encounters and it provides the PC with the list of remaining potential encounters that should be handled by her/him and/or TC. Using her/his aid tool, the PC elaborates solutions that s/he either implements through the Coordination process, or proposes to the TC or sends directly to the aircraft if s/he has the ability to do so;

- The list of potential conflicts that have been resolved by the PC and TRACT are input into the CD/R aid to TC tool for information. This service then detects encounters and it provides the TC with the list of remaining potential encounters that s/he should handle. Using her/his aid tool, s/he elaborates solutions and sends them to the relevant aircraft.

More precisely the concept (with all three services) goes as follows:

Step1

The global service starts at time with the input of the aircraft predicted trajectories (TP) that may actually consist in different TPs associated to each provided separation service. The look-ahead times of the TP are on one hand e.g. 25 minutes for TRACT and CD/R aid to PC and on the other hand e.g. 6 minutes for the CD/R aid to TC. The predicted trajectories are then used by the "conflict detection" functionalities of the separation services so that a list of detected potential conflicts is obtained.

Step2

The first service to be triggered is TRACT. Based on the detected "potential encounters", the downlinked waypoints and the downlinked min/max time interval ("reliable RTA interval"), the TRACT service automatically[3] searches for solutions to the potential encounters. The encounters that are handled by TRACT are those that can be managed through a CTO on a point of the a/c route, which is achievable by the conflicting a/c. In most cases TRACT will result in less than about one minute delay within a horizon of up to 25 minutes (i.e. to increase separation by up to 7 NM). It is needed that the conflict involves at least one i4D-equipped aircraft to possibly be handled by the TRACT service. When the conflict involves two i4D-equipped aircraft the TRACT service acts on both aircraft.

It has to be mentioned that, in order to fulfil the "Most Capable Best Served" strategy, the CTO that is only supported by i4D-equipped flights may be compensated, or even give opportunity for optimization , e.g. a better FL or a better routing, than the ones originally planned. These compensatory or optimization measures need to be defined before the implementation phase.

Step3

The third step involves a coordination of the time constraints (CTO/CTA) between ground services. Because, on one hand time constraints may be sourced from a range of tools (e.g. AMAN, TRACT, etc.) and might have various operational purposes (e.g. sequencing at the arrival aerodrome, separation management etc.) and on the other hand an aircraft can handle only one time constraint at the time ([1]), it is necessary to ensure that at most one time-constraint, which should yield the maximum benefit from a network perspective, is sent at the time to an aircraft. Such constraint reconciliation mechanisms can be done at local DCB level (link with INAP). Impacts on flight efficiency will need to be assessed.

Step4

The obtained CTOs (both the point and the time constraint) are automatically uplinked to the concerned aircraft with no involvement of the ATCOs. The flight crew analyzes the implications of the ground proposed CTO and will either accept or reject it. In case of a rejection the TRACT global solution is not complete. The global situation will have to be dismissed and reconsidered again at next

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[3] In the current document, TRACT only addresses the ATCO tasks with no involvement of the EAP. However it must be noted that its time horizon is coherent with the EAP role, in which case a manual intervention by the EAP – if any - might be envisaged prior to apply the TRACT solution. Such a manual intervention is an opportunity for optimization in order to fulfil the "Most Capable Best Served" principle.

cycle (one cycle lasts at least 3 minutes, to have a chance to get all pilots answer) getting the refusing aircraft out of the eligible flights for a CTO.

Although the ATCOs are not involved into the CTOs elaboration and application, they are informed of the time constrained aircraft.

The main goal of the TRACT service is to release the ATCO workload due to continuous assessment and monitoring of the potential conflicts. As the TRACT service manages the situation and makes it become safer (separation between aircraft belonging to a TRACT solution continuously increases), the ATCO may assess the situation later and decide whether to leave the TRACT solution unchanged, or to manually manage it. The main assumption is that the TRACT solutions will be operationally relevant in most cases. However it may happen that in some cases the TRACT solution is a troublemaker for the ATCO who would prefer to solve the conflict differently for any reason. Once again, the assumption is that these cases will be very rare. In such cases, the ATCO still gets the capability to implement via R/F her/his own solution superseding the TRACT one.

<u>Step5</u>

The list of potential encounters that have been resolved by TRACT is input into the CD/R aid to PC tool. Based on this list and those detected by the "conflict detection" functionality of the CD/R aid to PC tool, the PC is informed of the remaining potential conflicts that should be handled by her/him and/or TC. In addition should any flight under TRACT management be disturbed by the ATCOs so that it generates a conflict, then this conflict has to be solved by ATCOs.

At this stage, some functions may assist the PC in organizing its work related to separation management.

<u>Step6</u>

The PC may elaborate solutions that rely on coordination conditions for example a change of the entry/exit level. This does not require any direct communication to the aircraft. The change of coordination conditions will be taken into account by the TC when operationally appropriate e.g. by a change of Clearance.

As the PC also assists the TC in solving conflicts, s/he may elaborate clearances/trajectory changes to solve some conflicts with the assistance of the "conflict resolution aid" functionality. There are then two options:

- The PC applies the actions if s/he has the ability to do so and informs the TC. In other words the PC initiates the negotiation of the new trajectory if s/he has the ability to do so. By negotiation, we mean either sending the clearance to the a/c through voice or D/L communications or starts the negotiation as described in [27] pp13.

- The PC proposes the clearances/trajectory changes to the TC which may or may not apply it.

<u>Step7</u>

Independently, and thanks to the "conflict detection" functionality of the CD/R aid to TC tool, the TC is informed of the remaining potential conflicts that s/he should handle.

As for the PC, some functionalities may assist the TC in organizing her/his separation management tasks.

<u>Step8</u>

With the assistance of the "conflict resolution aid" functionality of her/his CD/R aid, the TC elaborates clearances/trajectory changes in order to resolve the remaining conflicts and either send the clearance to the a/c through voice or D/L communications or initiate the new trajectory negotiation as described in [27] pp13.
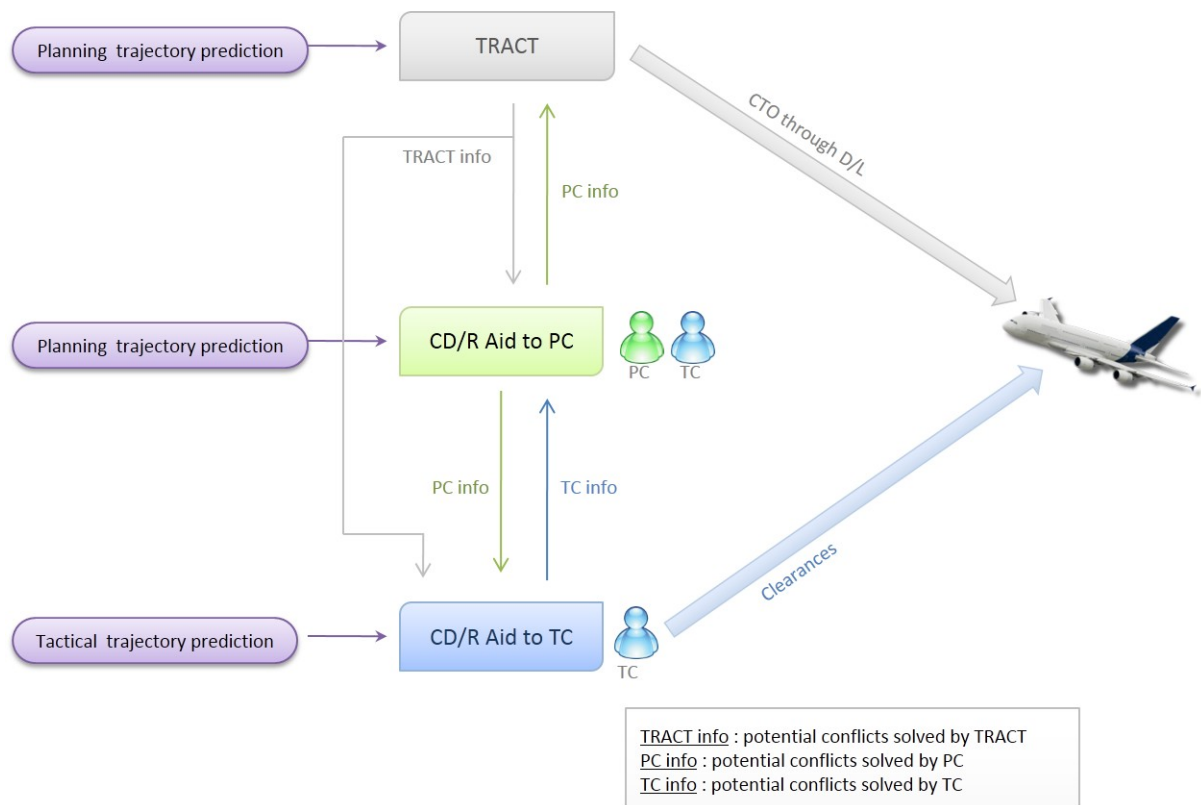
Figure 7. The Operational Concept and its three services.

The three Separation Services in the current document have different look-ahead horizon, so they "naturally" constitute a sequence of services. TRACT is supposed to first manage a set of conflicts, then remaining conflicts are handled by the "CD/R aid to the PC", and finally the last and most urgent conflicts are managed by the "CD/R aid to the TC". However nothing prevents a service from providing an aid in the time horizon of another service. Typically, it may happen that the TRACT service becomes able to manage a conflict that has already been presented through the "CD/R air to the PC", because a constraint (e.g. another conflict involving the same aircraft) has disappeared.

It is worth mentioning that each separation service requires its own MONA (Monitoring Aids) support service because the CD/R tools and associated procedures are based on hypothesis that are reflected in the predicted trajectories, and they can only work properly if deviations of the aircraft from the planning or tactical trajectory are monitored and detected by the ATC system. It is not expected that the TRACT service manages aircraft that deviated, however the two other services are able to process deviated flights and to remain helpful in such conditions.

2.3 Processes and Services (P&S)

The following "Processes" sub-sections are initiated from the P04.02 DOD section 5.

The "Services" sub-sections describe the services that P04.07.02 renders. They replace the Operational Services description that is currently missing in the WP04.02 DOD section §5.2.

In the "Services" sub-sections, the three services of the concept are described separately. However, some commonalities exist between the services, namely the "CD/R Aid to the PC" and the "CD/R Aid to the TC". These commonalities are described into the following paragraphs:

- Conflict Detection in §2.3.6.1.1;

- Conflict Resolution in §2.3.6.1.2;

- Monitoring sub-service in §2.3.8.2.

2.3.1 Process "Provide Early Conflict Resolution (TRACT)"

This process is identified as PCS-DOD-04.02-Provide_Early_Conflict_Resolution

Note: this section is strictly copied from P04.02 DOD §5.1.3

This process represents the application of a de-complexing measure consisting on the allocation of a CTO issued by the TRACT tool [..].

The TRACT tool assesses the traffic situation, detects potential medium/long term conflicts (e.g. 20/30 minutes look ahead horizon), and tries to solve them by applying small adjustments to the aircraft speed. The goal is to reduce controllers' workload by providing early conflict detection and resolution.

A TRACT resolution is possible if a set of CTO proposals involving small speed adjustments acceptable by the conflicting flights can be determined. In addition, its final applicability depends on an assessment of the value (performance impact) of the TRACT solution against other available de-complexing measures. Controllers are made aware of pending TRACT identified conflicts as well as of those flights under an effective TRACT resolution.

2.3.2 Process "Provide Planning Separation Assurance"

This process is identified as PCS-DOD-04.02-Provide_Planning_Separation_Assurance

Note: this section is strictly copied from P04.02 DOD §5.1.4

Separation assurance at planning level is a continuous process triggered on a cyclic basis in order to detect and solve potential interactions between (pairs of) aircraft and between aircraft and restricted airspace that are within his/her area of interest, at every step of the co-ordination process (e.g. receipt of an offer, selection of a suitable sector exit level etc.). According to the ATSU/ ATC team configuration, planning separation can be provided by the EAP, the MSP and/or the PC.

Conflict resolution in planning terms may involve the identification of alternative co-ordination conditions (level, route, profile etc.) at either the entry and/or exit boundaries of the sector. Alternatively, it may involve an iRBT revision by either allocating a 2D RNP route or defining a new portion of the iRBT.

2.3.3 Process "Provide Tactical Separation Assurance"

This process is identified as PCS-DOD-04.02-Provide_Tactical_Separation_Assurance

Note: this section is strictly copied from P04.02 DOD §5.1.5

This process describes how the controller (mostly the Executive, and sometimes the Planning) detects and solves potential profile problems between (pairs of) aircraft and between aircraft and restricted airspace that are within his/her area of responsibility. It addresses remaining potential interactions that have been highlighted by the planning control.

Conflict resolution in tactical terms may involve the identification of different solutions, e.g. by modifying the trajectory laterally, vertically or in terms of speed adjustments. In the envisaged operational environment priority should be given to solutions that impose a minimum deviation from the iRBT.

2.3.4 Process "Ensure Trajectory Adherence"

This process is identified as PCS-DOD-04.02-Ensure_Trajectory_Adherence

Note: this section is strictly copied from P04.02 DOD §5.1.6

This process is run on an iterative basis and consists in monitoring the traffic situation and detecting when aircraft deviate from the predicted trajectory. This may lead to safety critical situations that must be detected as early as possible so that the controller can react quickly and resolve them. Both the planning and the tactical controllers can be involved in the process.

2.3.5 Service "TRajectory Adjustment through Constraint of Time (TRACT)"

> **Foreword**: although the current concept includes three Separation Services for completeness, the TRACT service is out of the SESAR Solution #27 because its enablers are not available yet and because it has not reached V3 maturity yet.

TRACT is based on the assumption that early management of conflicts could provide the potential for controllers' workload reduction. It is expected to reduce the controller's workload associated with routine monitoring and conflict detection as well as reduce the interventions of ATC in changing flight profiles to resolve potential conflicts.

TRACT is a de-conflicting service aiming at adjusting the 4D planning trajectory in order to optimise separation management for medium and/or long term conflicts (e.g. next 25 minutes conflicts). The trajectory adjustment relies, among others, on FMS generated data (ETO min/Max window at a specified waypoint which belongs to the FMS trajectory) that will facilitate more reliable information and potentially better decision aid performance.

TRACT computes a solution made of time constraints along the trajectories, which are translated into a Controlled Time Over (CTO) operated via Datalink between ground system and airborne system, with no controller intervention, although information are displayed on flights that are under TRACT "control".

It is worth mentioning that CTO are also to be used for arrival and departure management (AMAN/DMAN) as studied in SESAR WP05.06 (for this use it is called RTA or CTA). Therefore, ground coordination will be needed in order to send the aircraft the most appropriate time constraint. It is currently agreed[4] that when a CTA for AMAN is issued while a CTO for TRACT is on-going, a human intervention is needed to decide which constraint is to be kept.

Furthermore, in order for this service to be efficient enough it is anticipated that a sufficient proportion of aircraft are equipped with i4D-capable system.

It has to be mentioned that, in order to fulfil the "Best Equipped Best Served" strategy, the CTO that is only supported by i4D-equipped flights may be compensated e.g. by an exemption from STAM measures. These compensatory measures need to be defined before the implementation phase.

TRACT includes a monitoring service to check that:

- downlinked EPP data includes the CTO as it has been uplinked;
- not i4D-equipped aircraft that are involved in a TRACT cluster are behaving as expected.

2.3.6 Service "CD/R Aid to the PC"

2.3.6.1 Commonalities of CD/R services

The CD/R service may be divided into two sub-services Conflict Detection (CD) and Conflict Resolution (CR) as described below.

2.3.6.1.1 Common aspects of Conflict Detection (CD)

CD aid assists the controller (TC and/or PC) in conflict identification and planning tasks. It provides automated early detection and filtering of potential conflicts.

The conflict detection is based on trajectories[5] with different look-ahead times (typically 6 minutes for the Tactical trajectory, and 25 minutes for the Planning trajectory), characteristics and constraints depending on the considered controller role (TC or PC). The aid may offer a temporal display of

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[4] SESAR WP4/WP5 agreement
[5] Depending on the tools, the trajectories considered are either the planning or the tactical ones.

clusters of conflicting flights, clusters possibly selected by controllers in order to highlight the conflicting flights e.g. in the radar image.

2.3.6.1.2 Common aspects of Conflict Resolution (CR)

CR aid assists the controller (TC and/or PC) in elaborating solutions to the automatically detected conflicts in a context where the controllers are responsible for the separation assurance. The resolution aid may consist in many types of functions, e.g.

- It may facilitate the identification of flexible routing/conflict free trajectories and identifies aircraft constraining the resolution of a conflict or occupying a flight level requested by another aircraft and/or offer a set of ranked resolutions to the En-Route controllers;

- On controllers demand or by conflict filtering logic in the aid, the traffic may be filtered by diminishing the appearance of flights that are not "relevant" with respect to a chosen flight;

- Functions such as "What If" probing may analyse solutions proposed by controllers;

- Functions such as "What Else" functions may propose solution(s) to a detected conflict (e.g. alternative trajectory or FL changes) which can be evaluated by the controller who may either select (one of) them or prefer to implement one of his/her own resolution.

2.3.6.2 Conflict Detection for PC

The role of the PC is twofold:

- to agree with neighbouring units (e.g. sectors, centres, airfields, military, etc.),sector entry and exit conditions that, as far as possible, are conflict-free and offer the airspace users efficient and expeditious flight profiles through the airspace s/he is responsible for;

- to ensure that the workload of the Tactical Controller (or, in a MSP organization, Controller*s*) s/he is responsible for, is managed so that it does not become excessive.

It is drawing the balance between these two responsibilities which demands the PC's problem identification and resolution skills and which are expected to benefit from the provision of system support in order to reduce workload and, as a result, to increase capacity.

Conflict Detection may aim to support the PC by identifying and classifying potential interactions between flights at the various events associated with the inter-sector co-ordination process (e.g. receipt of an offer, selection of a suitable sector exit level etc.) and on a cyclic basis to identify whether the situation has changed significantly such that (Planning) Controller intervention is required to re-evaluate and amend as necessary.

Trajectories may be generated to model the behaviour of each flight through and beyond the sector of interest and which are manipulated to represent the various co-ordinations into and out of the sector.

Conflict detection may compare these sets of trajectories, one with another, to identify potential losses of "planning separation" between aircraft and also pairs of aircraft whose co-ordinations, although not predicted to be leading to a loss of separation, will allow aircraft to enter the sector and require some action by the Tactical Controller to ensure separation.

Both of these ensure that the PC is able to monitor and manage the workload of the Tactical(s) in the medium-term future adjusting co-ordinations, routings and sector manning as operationally appropriate.

2.3.6.3 Conflict Resolution for PC

Conflict resolution in Planning terms may involve the identification of alternative co-ordination conditions (level, route, profile etc.) at either the entry and/or exit boundaries of the sector so that unacceptable workload for the Tactical Controller is avoided whilst offering as expeditious a flight profile as possible to the airspace user.

The system may build upon the tools developed for the Planning CD support. For example it may allow the PC to ask "what-if" questions to the system which will respond with similarly classified

interactions that are predicted to occur if the potential co-ordination plan were to be put in place. The PC may also use the "what-else" tool to directly be informed of the alternatives that the system evaluated on its own.

Trajectories modelling the behaviour of the aircraft and manipulated so that they are constrained by a number of alternative co-ordination possibilities (e.g. vertically or laterally) may be built and passed to the CD process.

This may allow the PC to evaluate several alternatives, potentially in parallel, before committing to a new co-ordination agreement with the neighbouring sectors and with the Tactical(s) under his jurisdiction.

2.3.7 Service "CD/R Aid to the TC"

This service inherits from commonalities of CD/R services as described in 2.3.6.1

2.3.7.1 Conflict Detection for TC

The Conflict Detection service supports the TC in assuring separation between (pairs of) aircraft and between aircraft and restricted airspace. It may aim to support the controller by identifying and classifying potential interactions between flights that are under tactical control within the Area of Responsibility. S/he will also address remaining conflicts which have been highlighted by the PC.

The conflict detection tool TCT described in this project is based on the tactical trajectory. The tool will detect potential separation infringements between those trajectories.

Trajectories will be used to model the future behaviour of each flight based on the current tactical clearance (not taking into account any strategic constraints such as standing agreements). A revision of the trajectories will occur if a new clearance was issued or if the aircraft deviates from the given clearance.

Conflict Detection may compare these sets of trajectories, one with another, to identify potential losses of tactical separation between aircraft. Moreover, also aircraft which deviate from the tactical clearance should be compared to all other aircraft because their predicted trajectory may contain a high degree of uncertainty.

2.3.7.2 Conflict Resolution for TC

Conflict Resolution in tactical terms may involve the identification of different solutions, e.g. by modifying the trajectory laterally, vertically or in terms of speed adjustments. In the envisaged operational environment priority should be given to solutions which impose a minimum deviation from the RBT. Moreover, the solution should be closed loop as far as practicable, i.e. it should be clearly defined when and how the aircraft returns on RBT.

This is very important for an accurate prediction of the trajectory and the relying Decision Support Tools.

Decision Support Tools may include "what-if" and/or "what-else" services. With this aid, it is up to the controller to identify the "best" conflict resolution with regards to the specific situation.

Then the identified "best" conflict resolution should be implemented in the most efficient manner by the controller. In case of time criticality voice is the preferred communication medium while in all other cases data link may be used.

Queue and complexity management considerations may also be taken into account by the choice of the conflict resolution if the operational situation permits.

2.3.8 Commonalities

2.3.8.1 Applicability of the Separation Services

Different traffic types and complexity induce different look-ahead time horizons for the conflict detection and resolution tasks. It is expected that the proposed solution will apply to these various situations, supporting both TC and PC, whatever the time criticality of the tasks are.

A. TRACT is expected to provide the most benefits in situations with a predominant cruising traffic (e.g. pure UIR), which facilitates the early detection of potential conflicts and which enables the setting of a CTO with a very large look-ahead time horizon (e.g. 25 minutes before the potential conflict occurrence);

B. Conflict Detection and Resolution Aid to PC is expected to support teamwork and better co-ordination process between TC and PC. In particular, the PC would have the possibility to anticipate between those conflicts that can be solved by coordination and those that require a tactical resolution (i.e. more appropriate allocation of responsibility). Also this service may be implemented as a common display, in order to support the PC-TC discussion. This is sensible when controller teams handle less time-critical situations, which typically occur in those sectors characterised by cruising traffic with some proportion of traffic in vertical transition (e.g. UIR/FIR vertical transition). In these situations conflict detection and resolution aids to PC is expected to be the most beneficial of the services. It could be provided when aircraft are close to the sector;

C. Conflict Detection and Resolution Aid to TC is expected to be more appropriate to support TC in time-critical situations, which typically occur in those sectors characterised by cruising traffic with a significant proportion of traffic in vertical transition (e.g. FIR/Approach Interface). In these situations, short-term conflict detection and resolution aid to TC is envisioned to be the service that yields the most benefits.
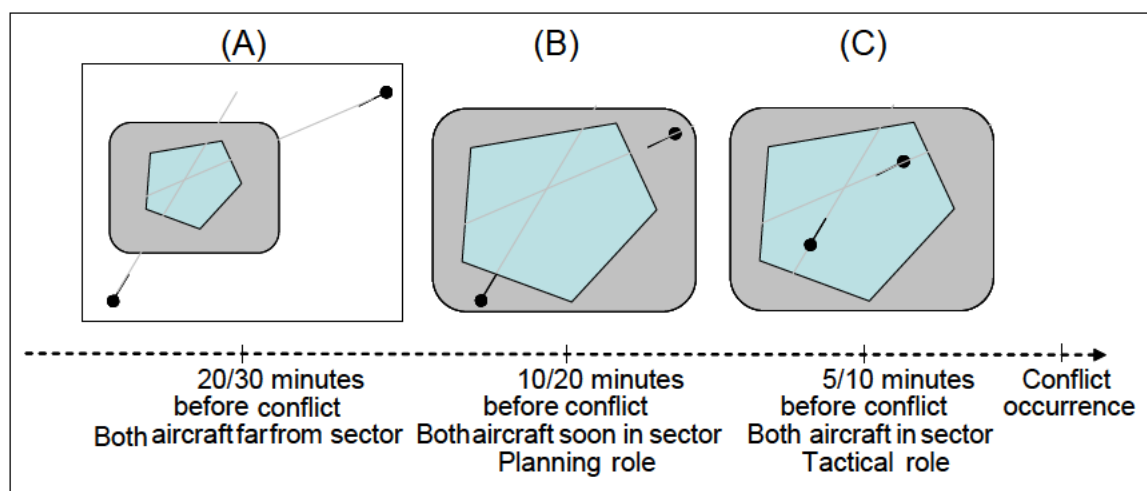
Figure 8. From early to late conflict detection and resolution.

Although each one of the considered services should yield the most benefit according to traffic types, they may be rendered in parallel for a given traffic as shown in Figure 7.

2.3.8.2 Service "Monitoring Aids (MONA)"

Given a Separation service, Monitoring Aids are essential for detection of deviations of the aircraft behaviour from the hypothesis from the predicted trajectory model used by the service.

When the model assumptions can integrate the deviations (e.g. the aircraft has a rate of climb lower than the expected one, but it remains in the uncertainties of the aircraft model), then the predicted trajectory can be updated and the Separation service can update its results accordingly. This may require a specific warning to make the ATCO aware of the changes.

When the model assumptions cannot integrate the deviations (e.g. the aircraft unexpectedly levels while it was supposed to climb), the service cannot be rendered normally and appropriate actions should be taken. Such actions are not defined yet.

For example, in the target environment the separation services assume that the aircraft follow the shared 3D trajectories. Whenever this assumption is violated the trajectory prediction input to the services may not be accurate enough and it follows that the services may not be rendered properly. This may lead to safety critical situations which must be detected as early as possible so that the controller can react quickly and resolve them.

Therefore, each Separation service should be associated to a MONA service to support detection of the aircraft deviations from the tactical (resp. planning) trajectory in case of CD/R aid to TC (resp. to PC). This comprises lateral route deviation, vertical flight level and vertical rate deviations. Whenever the aircraft are under time constraints, longitudinal deviations should also be detected.

3 Detailed Operating Method

The current section describes the envisaged Operating Method to ensure separation between aircraft versus the Operating Method that is currently adopted.

3.1 Previous Operating Method

In order to ensure separation between aircraft, the Controller Team basically uses two means:

- Modify the entry conditions in order to initiate a secure transit of the sector (mainly PC role);

- Modify the transit of the sector (TC role with PC as an assistant at least for coordinating the exit conditions in accordance with the transit modifications).

Although the current Operating Method is hereafter described as two distinct sections, it has to be noticed that the Controller Team currently works as an entity i.e. there exists a necessary cooperation between both Controllers. At least common situation awareness is required in order to avoid misunderstandings.

3.1.1 PC Operating Method

Currently a PC makes use of fairly basic co-ordination and flight data (in particular, flight progress strips displaying position, time and level data) and may have some basic system support based on radar data (e.g. ground-speed extrapolated vector lines) to identify whether an offer can be accepted or whether some flight modifications may need to be imposed (which might be a change of entry level or a direct routing agreement etc.).

Some systems (e.g. LACC) do offer an additional level of system support to the identification of potentially conflicting traffic by highlighting on the radar the track data blocks (TDBs) and electronic flight strips (EFSs) of those flights which have a common co-ordination level (this is known as "LookSee" at LACC).

However, it is left to the PC to judge the likelihood and severity of a given problem and to apply manually the test as to whether planning separation is going to be achieved (planning separation may be based on minimum time differences between flights at a common point, e.g. 5 minutes, or a minimum expected distance at closest approach, e.g. 30 nautical miles, depending on the geometry of the encounter, its geographical position with respect to the sector boundaries and the nature of any agreed separation techniques with neighbouring sectors and/or centres).

Flights which are, in the PC's judgement, expected to exceed the minimum planning separation requirements are accepted; however those which do not are either amended so that the entry co-ordination is acceptable or, in discussion with the TC who will make a judgement in context with the other flights s/he is, or will be, controlling, accepted and highlighted to the Tactical to ensure that any mitigating action is not overlooked when the flight calls on frequency.

Once the flight is coordinated at entry of the sector, the PC must identify a suitable exit level for that flight. For overflying aircraft, these two levels will be the same (traffic permitting) but in many cases there will need to be a change of level as the aircraft transits the airspace and so some judgement is required in order to determine a suitable target level.

Although the PC may choose not to deal with the exit co-ordination immediately a flight has been accepted (for example, because several other flights are awaiting entry co-ordination agreement and the PC decides that the backlog should be dealt with as a high priority) there are good reasons for the exit conditions to be set reasonably soon after acceptance.

Firstly, onward co-ordination cannot occur until an exit level is set (or, in some systems, a default level may be automatically offered on which may then lead to more workload in order to revise the co-ordination); secondly, unless the Tactical knows that there is a procedural level which can be assumed for the flight (e.g. a standing agreement between sectors), or it is clearly a flight that is not expected to change its level in the sector, it becomes difficult for the Tactical to develop his plan for managing the sector in the near-term if flights have not had their exit criteria set.

Again, the PC today must use his own judgement (supported by information from the radar and flight data display) to combine the desires and likely performance of the flight with the expected behaviour of the other flights in and around the sector to determine the nature of the future tactical task (particularly the likely complexity of the traffic and, hence, the potential workload being built up as a result of the PC's decisions) when determining what a suitable target exit level should be for the flight.

Having identified a potential level, and ensured that it is safe around the exit boundary (i.e. that there are no conflicting co-ordinations that would render it untenable for the Tactical to issue a clearance to) the PC commits the level to the system (if the system supports automatic co-ordination messages or, if it doesn't, contacts the receiving sector's PC to agree the co-ordination offer with him).

3.1.2 TC Operating Method

A) Detection of Conflicts

The TC detects a potential conflict in his sector during the continuously scanning of the traffic or when checking special aircraft pairs or special routes where potential conflicts can occur (the controller is aware of this because of his experience and his knowledge about this sector). Another possibility is that the PC has already marked aircraft pairs which might have a conflict. In most current ATC systems, the TC is supported by Range and Bearing functionalities and by a "Minimum Separation" function which allows to extrapolate the closest point of approach under the assumptions that the involved aircraft maintain current ground speed and heading.

B) Planning of Solutions

The TC is responsible for the implementation of conflicts solutions in his own sector (both PC and TC may co-build these solutions). So s/he starts now planning the solution of this problem. At this point the TC can use his own "mental solution library" as well as looking for novel solutions. The solution must be verified to see if it solves the conflict and if it does not create other problems. For example, knock-on conflicts may occur or due to the solution, the exit level has to be changed and this could create a conflict with another aircraft at this level. Depending on local facilities, the TC may be assisted by CWP tools to analyse the situation, e.g. to forecast the minimum separation distance if both aircraft maintain their current heading and speed.

If multiple solutions are available, then a selection has to take place. The TC will choose the "best" solution for this conflict in the current individual situation. The controller will determine the "best" solution according to safety considerations, anticipated traffic load, workload, time needed to implement the solution, or other factors which may be specific to the situation. As mentioned before the controller has normally a set of typical solutions to employ for typical problems (= standard solution). Today, there is no system support available for the selection of the "best" solution.

C) Implementation of Solutions

The TC selects the preferred solution. S/he implements the solution by issuing a clearance via R/T to the aircraft. The pilot acknowledges the reception via R/T and flies according to the clearance. The TC monitors that the aircraft will behave as expected. Normally, only one aircraft will receive a clearance in a typical conflict situation with two aircraft. If there are multiple clearances required to provide separation, the TC must carefully examine the most time critical clearance which needs to be given first.

Should exit conditions be affected, the TC advices her/his PC to make a revision with the next sector.

Alternatively: the TC delegates the implementation of a conflict solution to another sector (e.g. if one of the involved aircraft is not yet handed over or if the conflict is close to the sector boundary after entering the own sector). The delegation will be done by the PC on behalf of the TC.

3.1.3 Specificities in a Free-Route Airspace

The following specificities will need to be taken into account when designing the CD/R services to provide to both PC and TC.

3.1.3.1 Issues related to the PC Operating Method

PC tasks are impacted in a Free-Route airspace, namely because no published point is used to coordinate between two sectors and because sector design can hardly simplify the entry/exit conditions of the traffic.

3.1.3.1.1 Lack of COP

In a free route airspace, the PC has to manage an inbound/outbound flight without a Coordination Point (COP). Flights with a direct routing pass the frontier between two sectors over a lat,lon point.

Because the named COP is missing, it is more difficult for the PC to coordinate with the adjacent PC and namely if several direct routes concern the same border between two sectors. As the name of the COP cannot be used as a supplementary data to quicken the flight identification, ambiguities may occur.

Therefore it is highly useful that the PC is provided with a tool to unambiguously identify the flight to coordinate, like a "flight highlight" between two sectors.

3.1.3.1.2 Sector design inadequate with direct/free routes

In a Direct Routing airspace, the direct routes may be designed with no consideration of the sector current design. It is namely the case when a direct route covers the entire FAB area, in which case the individual sector specificities will be purely ignored.

In a complex Free Routing airspace, the sector design is independent from the routes followed by the aircraft. The strategic separation provided by route network disappears, so more tactical actions are needed, increasing PC and TC workload for the same level of traffic, in FRA vs. fixed route network.

Potentially the sector design could be influenced by the main traffic flows, however even those traffic flows are instable (because of daily meteorological conditions, season of the year, etc.).

Consequences of the independency between the sector design and routes:

- A sector may be shortly crossed;

- A direct route may be parallel to and near a border between two sectors, leading to potential encounters between an entry/exit flight and a transit flight near the sector boundary. This is namely an issue if this occurs at the frontier between two ATC units;

- An inbound flight and an outbound flight may have crossing routes at the boundary between sectors, while in a Fixed Route network routes are (should be) laterally separated at the frontier of a sector.

To cope with these issues:

- Procedures should be defined where a direct route short-crosses a sector, in order to bypass it when feasible;

- The PC has to detect encounters between crossing routes (and not only encounters due to the sequence of inbound/outbound flights) near the frontier of the sector, between two inbound flights, or between two outbound flights, or both.

A Separation service is highly helpful to support the PC in his/her new tasks, namely an improved Detection service that not only detects "coordination" encounters (e.g. same XFL at the same COP), but also encounters between crossing routes at the sector neighbourhood.

A new role (MSP or EAP) may also be in charge of anticipating those encounters between crossing routes at the boundary between sectors.

3.1.3.2 Issues related to the TC Operating Method

Detection/resolution related TC tasks are impacted in a Free-Routing airspace, namely because no route scheme can be used as a reference pattern.

Direct Routing airspace, with few and long segments, will impact the TC tasks less, because a (new) published route pattern exists. Even more, detection may be facilitated in a Direct Routing airspace because a crossing between two long segments is easier to assess than a crossing between two fixed routes with turning points.

The following paragraphs deal with issues linked to TC tasks in a Free-Route airspace.

3.1.3.2.1 Visual monitoring of lateral deviation

With no route scheme displayed on the screen, the TC has no means to monitor that an aircraft laterally deviates, or that a flight has been vectored for a long time without resuming navigation. When no route can be permanently displayed on screen, a MONA tool is therefore necessary to warn when an aircraft is over the lateral tolerance from the planned route.

It could also be envisaged to permanently display the planned route of all crossing flights, in order for the TC to 1) monitor the current position vs. the planned route, and 2) to give a concrete support to detect and memorize encounters between crossing routes.

3.1.3.2.2 Mental extrapolation of the traffic

In a Fixed Route Network, the only mention of the ADEP,ADES with the current heading are enough in most cases for the TC to have a clear idea of how the aircraft will cross the sector.

In a Direct Routing airspace, large DCT segments could even ease the TC task to mentally extrapolate the traffic, because the current heading could be used to extrapolate the future position of the aircraft.

At the opposite, in a Direct Routing airspace with small DCT segments (i.e. not covering the sector) or in a Free Routing airspace, the current heading cannot be used by the TC to extrapolate the future positions from the current one. It is then necessary at least to display the planned routes, or better to have the capability to easily extrapolate future positions of a set of aircraft from their Predicted Trajectories.

It could also be envisaged to visually identify aircraft with a turning point within the sector, in order to pay particular attention to such flights and to avoid to erroneously extrapolate future positions from the current heading.

3.1.3.2.3 Small angles of crossing

In a Free Routing airspace, crossing angles between flight routes are "free". They may be very small, leading to flights converging slowly.

In a Direct Routing airspace, angles of the crossings are set by route design. It is likely that DCTs with be designed to avoid such "slow converging" crossing between them. However it may be that DCTs cross Fixed Routes with a small angle

3.1.3.2.4 Close conflict points

In a Fixed Route Network, crossing points are defined not too close to the others. A single crossing point may be used by several routes, instead of creating several crossing points close to the others. Resolution schemes exist for several routes using the same point, while close crossings require as many specific resolutions, each being highly constrained by the others.

In Direct Routing or Free Routing airspaces, crossing points may be arbitrarily close to others, which may lead to potential encounters not situated on the same point but closely linked to the other.

3.1.3.2.5 Schemes of resolution

In a Fixed Route Network schemes of resolution correspond to typical encounters in the sector, and constitute a part of the local skills of the ATCOs of the ATSU.

In a Direct Routing airspace the typical schemes of resolution will be slightly modified: DCTs will be published and conflict areas and related schemes of resolution will be well-known. The difference with the Fixed Route Network will stand in the possibility to have any kind of conflicting situations that are unlikely in the Fixed Route Network, and thus the resolution scheme may be very specific.

> For example. in the Fixed Route Network, it often happens that a published point is used as a common point between several routes, leading to a given resolution scheme. In a Direct Routing airspace, it may happen that a DCT does not include such a point but passes nearby, which will modify/constrain the typical resolution schemes.

In a Free Routing airspace, schemes of resolution must be adapted to each conflicting situation. Local ATCO skills do not provide ATCOs with all possible solutions in every kind of conflict configuration. It will be very difficult for the TC to find the optimal way to solve a given encounter. The associated TC workload will increase. Specific resolution tools may support in finding the optimal solving e.g. identify the conflicting aircraft that the TC should preferentially choose for solving.

3.1.3.2.6 Typical time horizon for solving an encounter

The typical time horizon to solve a conflict may be of three kinds:

* An encounter may be solved very early when either the conflict is sure e.g. a follow-up on the same route at the same level, or the ATCO wants to get rid of it because the traffic situation is complex and/or dense and the workload is excessive; in this latter case, the solving is not optimal because the encounter is solved before it is confirmed (solving of false conflicts unnecessarily constraining the flight(s));

* An encounter may be solved "at the right time" i.e. when the conflict is almost sure and the solving does not require costly manoeuvers; in this case, the solving is optimal;

* An encounter may be solved just before the conflict occurs; such a solving often requires sharp manoeuvers, and this is not optimal, both for flight crew and ATCOs workload and situational awareness.

In a Free Routing airspace, each encounter is specific, so it is costly for the controller to periodically assess the situation in order to choose the right moment to solve it (i.e. the moment when "it is now sure that a resolution is required, and the most relevant resolution may still be implemented").

When the workload is heavy due to high complexity and/ or density of traffic, it is likely that the TC will often decide to get rid of a potential conflict by solving it very early.

On the other hand, it may also happen that the TC chooses to wait until the encounter is "sure", in order to avoid constraining the flight(s) unnecessarily. With no reference, it may be that this assessment occurs late, leading to a solving at last moment using "brutal" manoeuvers, causing extra workload and reduced situational awareness for ATCOs.

Mid-term resolutions are generally associated to the "how-to" knowledge of the TC who applies an optimal resolution, tailored to the specific conflict configuration. In a Free Routing airspace, this local skill will not be used anymore, or in a smaller proportion, so the mid-term resolution will probably be less frequent.

In a Direct Routing airspace, detection and resolution tasks will be slightly changed w.r.t. the Fixed Route Network, because DCTs do not comply with the typical design of routes (e.g. they don't make use of common points between several routes). However as DCTs are published routes it is likely that new local skills to apply adapted schemes of resolution will raise and be applied. It is likely that mid-term resolutions using the optimal solution will be used as in Fixed Routes network.

3.1.3.2.7 Resume navigation on route

In a Direct Routing or Free Routing airspace, direct segments may be very long, with extremities outside the sector or even outside the ATSU airspace.

When the TC has instructed a radar vectoring to an aircraft, he/she needs the aircraft to resume its navigation. To do so, the most frequent instruction is to give a Direct-to the next route point of the flight.

As the TC may not know the location of the next route point, it is necessary to display the direct segment before he/she instructs the aircraft. It will permit to assess what may happen if he/she gives the Direct (e.g. separation loss with a restricted airspace). As already mentioned, and because the resuming direct may be very long, it is necessary to display the great circle and not a straight line joining the current position to the target point.

If the next route point is far away, the aircraft goes a long time beside its initial route (small convergence angle), not only in the sector that instructed the Direct-to but also in the downstream sectors.

In a Direct Routing airspace, the ATCOs of the downstream sectors will have to manage aircraft out of published routes, which may impact the ATCO workload. In a Free Routing airspace, downstream sectors are not strongly impacted because routes are not published and whether an incoming flight follows a Direct instruction or not is the same..

3.1.3.2.8 Circumnavigation around reserved areas.

In main cases, the planned route is separated from active areas. However it may happen that it is not the case:

- Locally planned crossings of reserved areas may be authorized, whether they are active or not. It is then up to ATC to either coordinate with military authorities, or to tactically circumnavigate around the area;

- Following a route change or a resume instruction after a vectoring, it may happen that the modified trajectory is not separated from an active area. This may happen far from the current sector if the trajectory segment is long and the next point is situated in downstream sectors.

When the ATCO needs to instruct a circumnavigation, the published 5LNC points will support her/him. However it may be that the side of the area to circumnavigate is not obvious. It is namely the case if the route crosses the middle of the area, and/or the resulting route after the circumnavigation crosses other areas. A what-if functionality would be useful for supporting the ATCO in choosing which side of the area to circumnavigate.

To increase efficiency of ATC, a circumnavigation should be initiated as soon as possible. The less brutal the less costly.

To do so:

- Reserved areas and their activity should be shared throughout the Free Route airspace;

- A flight indicator should warn the ATCO that he/she might act on this flight for the benefit of a downstream ATCO;

- A tool should indicate to the ATCO which new route/new direct to instruct, at least when the reserved area is far from the sector.

3.2 New SESAR Operating Method

The new SESAR Operating Method makes use of the TRACT service as a new actor, and brings new aids to both PC and TC in order to take advantage of the i4D capabilities of the aircraft.

The current section is divided into three sub-sections in order to chronologically describe the Operating Method; however it does not prevent actors to interact and to perform their tasks simultaneously.

3.2.1 TRACT Operating Method

Foreword: although the current concept includes three Separation Services for completeness, the TRACT service is out of the SESAR Solution #27 because its enablers are not available yet and because it has not reached V3 maturity yet.

There are several roles that are involved:

- The TRACT service to compute and submit CTO (Controlled Time Over);
- The datalink to exchange data between Ground and Air. Both CPDLC (for uplink CTO message and downlink answer message) and ADS-C (for downlink EPP data and "reliable RTA interval" message) shall be used;
- The Air Crew to assess the submitted CTO and feed the FMS;
- The FMS to apply the CTO and computes the new Air TP;
- The FDPS to feed the TRACT service with Ground TP including downlink data from Air TP;
- The ATCOs HMI to mark ("tag") the flights belonging to TRACT clusters.

TRACT tool support might be particularly relevant for EAP role . This concept option merits to be further investigated as this may change some TRACT characteristics (e.g. a CTO may be proposed to the EAP before it is uplinked, or TRACT may be performing its task on demand of the EAP, or the time horizon/target separation may be changed as the EAP aims at de-complexifying the traffic instead of de-conflicting it). However, in the current document, TRACT only addresses the ATCO tasks with no involvement of the EAP.

The necessary initiation conditions for the TRACT service to operate are:

- The ADS-C equipped flights have initially been requested for an "ADS Contract[6]";
- TRACT may access to Ground managed Flight data;
- TRACT can use the datalink facilities on demand.

It performs its sequence of tasks cyclically.

At first, TRACT assesses the flight eligibility. It gets the current traffic of the FDPS Area of Interest (AoI) and assesses the eligibility of each flight of the current traffic. Afterwards only eligible flights may be constrained with a new CTO. Flight eligibility considers mainly the flight equipment (i4D) and the lack of any current time constraint as i4D principle is based on a single active CTO/CTA at a time.

TRACT then assesses the whole traffic and detects potential conflicts between two aircraft (eligible or not). The potential conflicts are concatenated into as small as possible "TRACT clusters" that are independent.

Once clusters are identified, TRACT computes a global solution by the application of time constraints (CTOs) on "eligible" flights that are i4D-equipped (refer "best equipped/best served issue" hereafter: 3.2.1.1).

TRACT elaborates CTOs on the CPA (Closest Point of Approach), so that distance between aircraft will increase after the CTO. The CPA is a geographical point along the trajectory, it has no name and it is not published. The aircraft "reliable RTA interval" of the waypoints surrounding the CPA are downlinked to interpolate the "reliable RTA interval" at the CPA. The CTO is calculated so that it belongs to the interpolated "reliable RTA interval"

Once the CTO are calculated, then TRACT has to check that each CTO is authorized at ATC level:

- check that the CTO will not prevent the future setting of another CTO/CTA with a higher priority (e.g. a potential CTA by an extended AMAN) => refer "TRACT/AMAN issue" hereafter (3.2.1.2);

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[6] Event contract currently well suits with P04.07.02 needs, however Periodic contract may also fit if required

- check that the CTO does not create new conflicts in other ATSUs in case the CTO position is in another ATSU airspace => refer "inter-ATSUs issue" hereafter (3.2.1.3).

To support both the "TRACT/AMAN" and the "Inter-ATSUs" issues, the proposed IOP mechanism would be as follows:

- The ATSU hosting the TRACT service may implement a CTO when it is the Flight Data Manager Publisher (FDMP : temporary owner of the shared Flight data in an IOP mechanism) only;

- Prior to implement the CTO, the ATSU will generate a what-if IOP context in which the Flight Object includes the CTO as a proposed Tactical Time Constraint;

- This alternative Flight Object will be proposed to the concerned ATSUs if the CTO location is outside the originator area, and it will be proposed to the ATSU hosting the AMAN if any;

- The FDMP will implement the CTO only if all requested stakeholders accept the what-if proposal.

In ATSUs concerned by the CTO, it will be checked whether this CTO does not locally generate any new conflict. This is the prime criterion for acceptance. Other criteria, either rule-based or manually input, may be locally implemented.

Once all the CTO of a TRACT cluster have been authorized, then for each CTO, TRACT uplinks e.g. the CPDLC message UM51 "CROSS [position] AT [time]" (refer [42]). It must be noted that, due to the delay, the "reliable RTA interval" may not be valid anymore. In such a case, the CTO will be rejected at implementation time.

Once it is displayed with this uplinked CPDLC message, the Air Crew has a set of options:

- Accept the CTO (i.e. downlink CPDLC message DM0 "WILCO"). This is the nominal option. In this case, the Air Crew is expected to input the CTO in the FMS (this is facilitated by the "auto-load" capability of the FMS of the i4D-equipped aircraft). The Air TP is computed and automatically downlinked because of the ADS Event Contract. The Ground TP is recomputed and considers the CTO as active;

- Reject the CTO (downlink CPDLC message DM1 "UNABLE"). In this case, TRACT considers the flight as "not eligible" for a time. No second attempt is performed because the computation by TRACT would probably give the same result as the one that has been rejected. Following this rejection by the pilot, TRACT uplinks a cancellation CPDLC message (message **UM336**) to all other aircraft of the cluster with a CTO and the cluster is considered as "not solved" (until the next TRACT cycle);

- Standby (downlink CPDLC message DM2 "STANDBY"). In this case TRACT discards the flight from its former computation cycles until an acceptance or a rejection. The flight is temporarily out of scope[7];

- Do nothing. In this case, TRACT behaves the same as for a "STANDBY" answer.

TRACT outputs the conflicts that are managed by an accepted CTO for the subsequent CD/R services to potentially treat them differently if they are still detected.

The ATCO is expected to consider the flights of a solved TRACT cluster in their own traffic management, and also to integrate the speed adjustments of the flights with a CTO in their situation awareness. Therefore flights of a TRACT cluster are mandatorily tagged. For information the flights close to the sector boundary, with an active CTO, may be tagged too.

3.2.1.1 "Best equipped/best served" Issue

It may contradict the "best equipped/best served" principle to put constraints on i4D-equipped flights only. However, this principle has to be balanced:

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[7] It cannot be assumed whether the trajectory will comply with the CTO or not, so the TRACT detection phase cannot consider this flight (it is considered as a flight with no TRACT trajectory).

- **The individual cost of a CTO constraint has still to be assessed**. No study from manufacturers is currently available. It may be that some CTO in certain conditions are even beneficial for fuel consumption (e.g .a CTO that requests a slight slowing down might help to reduce fuel burnt) while impacting other aspects (e.g. flight duration). To assess the impact of a CTO constraint could also be very important for the internal algorithms of TRACT in order to apply the less costly TRACT solutions.

- **The "best equipped/best served" principle has to be globally assessed at ATC level**. Several ATC services may take advantage of a flight equipment. It may be that some ATC services take benefits from aircraft equipment with no obvious advantage for the equipped aircraft (e.g. TRACT), while other ATC services directly provides a better service to those equipped aircraft (e.g. AMAN for i4D equipped aircraft). Only the global level of ATC service has to be assessed. In the frame of INAP/ local DCB for optimization of the network performance, it can be envisaged that the equipped aircraft will be given tailored consideration in the CDM/ ATSU-level DCB analysis

- At implementation time, supported by a global Cost&Benefit study, the ATC service providers might propose compensatory measures to help companies to support the cost of a new equipment: exemption of STAM measures, reduction of fees,..

Conclusion: To ensure the "best equipped/best served" principle, a global C&B study has to be performed, with the support of manufacturers to get the real cost of a CTO measure once EPP has been deployed. Following this study, compensatory measures might be proposed by ATC service providers to i4D-equipped aircraft.

3.2.1.2 TRACT/AMAN Issue

Because of the i4D principle (one single active CTO/CTA at a time), it could happen that the AMAN cannot implement a landing sequence because one aircraft is already constrained by a CTO for separation purpose.

Currently, SESAR WP4/WP5 agree to leave an ATC actor (TC or PC or EAP) choosing whether a CTA issued by the AMAN overrides an existing CTO or not.

A priori, it may be assessed that the CTA has a more important impact than the CTO, so a higher priority. It is thus propose to "authorize" or not the CTO depending on its potential to prevent the setting of a CTA.

From TRACT point of view, if the CTO is not authorized because of the "TRACT/AMAN issue", then TRACT shall consider that the corresponding aircraft is not eligible anymore for a CTO and it restarts the cycle of computation for the cluster it belongs to.

There are mainly two ways to tackle the TRACT/AMAN issue (i.e. to set a CTO only if it does not prevent the potential setting of a CTA):

3.2.1.2.1 No Ground-Ground coordination.

The trajectory parts where either a CTO may apply (the "CTO part" of the trajectory) or a CTA may apply (the "CTA part" of the trajectory) are offline segregated e.g. the demarcation could be X minutes (or based on a distance to an airspace item) before landing.

This leaves the AMAN free to apply the CTAs within the "CTA part" of the trajectory. For the "CTO part" of the trajectory, TRACT will adopt a First Come-First Served principle if several TRACT co-exist: prior to uplink a CTO, TRACT will check that there is none in the EPP data.

The main concern is about the limited range of both TRACT and the AMAN. Furthermore this limitation will likely be useless in most cases e.g. it will be rare that a flight is subject to both a CTO just X minutes before landing and a CTA just after.

This strict separation could be optimised if TRACT knows whether the ADES is AMAN equipped or not. If not AMAN-equipped, then there is no "CTA part" of the trajectory.

Another concern of less importance is about the need to share the same limit between trajectory parts: the ATSU hosting the AMAN may have a TP different than the one hosting the TRACT service,

so the "X minutes before landing" may not be exactly the same. This concern could be tackled by adopting a distance to an airspace item instead of a trajectory based criteria.

3.2.1.2.2 Ground-Ground coordination.

A Ground system hosted by the ATSU of the ADES, which could be inserted in the AMAN for the sake of efficiency, would receive the demands for a CTO from a TRACT service – thanks to IOP if needed - and it would apply a rule-based algorithm or a human decision to authorize or not the CTO.

3.2.1.3 Inter-ATSUs Issue

The TRACT service works on a defined airspace (TRACT airspace): it means that both the sending of the CTO and the place of the CTO belong to this airspace.

- On one hand, the TRACT airspace should be large enough to contain the whole duration of the CTO (typically 25 minutes);
- On the other hand, if the TRACT airspace is managed by several ground systems, a Ground-to-Ground coordination is required to share the CTO information.

This is why the default TRACT airspace is the ATSU airspace. The TRACT service may cover several ATSU if supported by IOP mechanisms that comply with the requirements for an inter-ATSUs TRACT.

3.2.2 PC Operating Method

Foreword: although the current concept includes three Separation Services for completeness, the "CD/R aid to the PC" is out of the SESAR Solution #27 because it has not reached V3 maturity yet.

The PC will receive an offer in the normal manner; however s/he will assess the suitability of that offer using the advanced tools. Planning TP and MTCD will determine any planning encounters between the offered flight and the co-ordinations of other flights in and around the sector.

Should the system determine that there are no potential conflicts the PC will accept the inbound flight. It may be possible to allow the system to accept automatically (means with no further coordination) those flights for which there is no encounter along the offered entry level, thus not troubling the PC with problem-free flights and leaving more time available for him to deal with those flights for which there are problems (in FACTS and iTEC this is known as "Integrated Co-ordination").

The balance between the benefit in terms of reduced workload through this functionality has to be assessed against the potential reduction in the awareness of the traffic situation that may result from such an automated process.

If the system determines that there are planning encounters at the offered level, the PC will be able to interrogate the system through a suite of support tools to display key information about the problem(s). HMI may be provided that will display to the PC the severity of the problem and its position in both plan and elevation (i.e. the lateral and vertical aspects of the problem).

The PC will then use similar support tools to assess a suitable exit co-ordination from the sector. The planning trajectory will aid in the assessment of expected performance for the flight and suitable HMI may depict the predicted vertical performance in context with the sector geometry (significant confliction points, sector boundaries etc.).

A set of derived trajectories probed by MTCD may provide the PC with a picture of the predicted potential problems, known as Planner Context, both at likely exit levels, but also throughout the sector between entry and exit points and levels allowing an improved judgement of the potential tactical workload which might occur as a result of setting particular co-ordination targets[8].

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[8] There is scope for Planner What-If/What-Else probes to build Tactical Tentative/Speculative trajectories.
An example would be when the Planner performs a What-If on the XFL of FL350 with a heading coordination constraint of HDG090, while the Tactical has the flight currently cleared at FL330 flying

HMI may allow the PC to interrogate the system to display both plan and elevation depictions of the identified conflicts in context with the traffic.

It is intended that the traffic set considered by the PC (and, in order to support him, by the MTCD-based tools) will be wider than current operations. Currently, the PC tends to make judgements based mainly on "known traffic" – that is traffic that has been co-ordinated with the sector (of course, ATC experience may allow the PC to look at traffic in other sectors but it is not their responsibility so to do).

Under the new operating method, the tools will identify to the PC potential problems with flights in the candidate receiving sector(s) that may also render a co-ordination offer unacceptable (from the receiving sector's point of view).

The offering PC can take this information into account and, where possible, set an exit co-ordination which is not only acceptable to him (and his Tactical), but also likely to be accepted by the receiving sector (either by the PC or by the automated "integrated co-ordination").

This method of operating is not to ask the PC to resolve conflicts in the receiving sector, merely to endeavour to make offers that are more likely to be acceptable first time (thus reducing the likelihood of amended co-ordinations which add to workload).

For example, a PC might see that offering a flight out at its cruising level will lead to a conflict in the receiving sector with a crossing flight. The crossing flight is in the cruise and intends to stay at the level throughout the FIR whereas the offered flight will need to start its descent shortly in the receiving sector. Since the level below the current level is conflict free, the offering PC selects that level instead of the cruise level and the co-ordination offer is accepted first time. If, however, there is

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on its own navigation. The PC Aid would show the results of the What-If and also (some components of) the Planner's TC Aid would show the results of a tentative tactical clearance of FL350, HDG090. When the Planner What-If ends (either by the Planner committing or cancelling the instruction) then the corresponding Tactical What-If shall end.

Additionally, it might be possible to perform a What-Else on top of a What-If (therefore requiring speculative tentative trajectories). For example, during a heading What-If, there may be a simultaneous What-Else probing different levels along that tentative heading. This applies to both the PC Aid and the TC Aid.

The controller may also wish to perform multiple flight What-If/What-Else probes, for instance perform a heading What-If on one flight and then a heading What-Else on another. During a multiple flight What-If/What-Else, all existing primary, deviation, tentative and speculative trajectories shall be probed against each other:
- During a What-If, the subject flight's primary and deviation (if it exists) trajectories will be *replaced* by the tentative trajectory;
- During a What-Else, the subject flight's primary and deviation (if it exists) trajectories will be *augmented* by speculative trajectories.

A multiple flight What-Else could be performed when the controller selects an encounter and asks the PC Aid to suggest a solution. The PC Aid would then run heading What-Else probes on both flights and display a set of acceptable headings to the controller (i.e. either a pair of headings that require the minimum deviation to each flight's route, or a range of possible headings that are free of encounters).
This could also apply when the controller is performing a level What-If (so What-If plus a multiple flight What-Else). It may be possible to extend this to multiple flight What-If & What-Else probes, e.g. if two flights are involved in level What-Ifs and the PC Aid detects an encounter, then a multiple flight heading What-Else probe could then be run.
The controller may add additional flights into the probe set, e.g. if all solutions to one encounter cause (or fail to resolve) an encounter with another flight, then the controller could decide to perform a What-Else probe including that flight too (i.e. the system would then attempt to identify a set of clearances that would resolve the encounters between all flights in the probe set).

nothing to choose between the flights (e.g. both are remaining in the cruise phase for a considerable distance), the offering PC cannot be expected to "second guess" what might be best in the receiving sector, so makes the offer at the cruise level leaving the receiving sector PC to decide on a course of action to resolve the problem.

In the same way that "integrated co-ordination" may be applied at the entry boundary, it may be possible for a similar automated process to be applied at the exit boundary too, the system identifying (from the planning trajectory) a potential achievable exit level and then testing that level, through MTCD probing of derived trajectories based on the co-ordination constraints, for its suitability (using rules which mimic the process the PC would apply).

If the proposed level is conflict-free (within some parameters), the system may set and offer that level automatically; however, should it prove to be unacceptable, the system would refer the flight to the PC for manual (system supported) level assessment.

The additional information provided to the Planner by the advanced system may also be used to support the PC operating in a "pre-Tactical" role in which conflicts within the sector, that would otherwise be left to the TC to resolve are dealt with by the Planner through up-linking instructions and constraints to the flights involved (e.g. by Datalink) so that separation is assured prior to the Tactical Controller having to devise a resolution strategy. In this mode of operation, the TC is not expected to identify (or resolve) problems that exist more than e.g. 6 minutes in the future (matter of further validation) as they may be dealt with by the pre-Tactical PC – those that are not become the responsibility of the Tactical Controller once they are predicted to occur within this time horizon.

The balance between the benefit in terms of reduced workload through this functionality has to be assessed against the potential negative impact on the TC/PC shared situation awareness and cross check action efficiency. Because such assessment has not been performed yet, this "pre-Tactical" role of the PC will be ignored in the rest of the document.

At last the PC is also an assistant-TC. As s/he works near the TC- the PC shares the global situation awareness with the TC. S/he helps the TC in anticipating his workload and s/he also helps in the early elaboration of tactical solutions. This co-operation task is very important in the sector team and it has to be supported by tools that allow the same situation awareness from both controllers. This is namely the case if PC (resp. TC) dedicated tools are available to the TC (resp. PC), and if all tools guarantee that a coherent information is provided to both controllers.

3.2.3 TC Operating Method

Initial Conditions

The TC is responsible for securing the separation minima for the flights under his jurisdiction. The jurisdiction for assuring the separation minima generally remains on an area basis (sector), unless otherwise agreed (e.g. procedure "release upon contact").

Furthermore the TC shall not handover converging traffic from his sector to the next sector, or in other words a potential conflict has to be resolved by the most upstream sector that is passed by both aircraft. The PC is responsible for co-ordination with adjacent sectors through modification of the entry and exit conditions, leading to a revision. Furthermore s/he has to assist the TC in his tasks on request. For assisting the TC on an individual basis it is necessary for him to maintain situational awareness for the traffic that is currently handled by the TC.

The Decision Support Tool for the TC is called Tactical Controller Tool (TCT). This tool supports the TC by detection of potential conflicts between two or more aircraft. Warnings will be shown e.g. in the aircraft label on the radar screen, based on clearance and radar data, if predefined lateral and/or vertical thresholds will be violated. This will be done within a defined time horizon. A What-If functionality allows the controller to test if a clearance would cause a potential conflict while a What-Else probing shows the conflict status for a wide range of possible clearances.

Operational Events

A) Detection of Conflicts

Due to complex traffic situations, unpredicted wind or aircraft speed changes, late implementation of controller clearances by the pilot, unknown or unexpected vertical profiles, technical failures and other reasons, the TCT detects a potential conflict in the sector around 6 minutes in advance, i.e. before loss of separation. This detection of possible separation infringements is continuously performed. The look-ahead time and tactical separation of interest values should be variable due to sector size and complexity. The conflict detection will also be performed if an aircraft deviates from its original clearance. In this case, different parameters may be used for trajectory prediction. The MONA function provides the required inputs in case of these deviations.

The potential conflict may only be shown in one sector to both controllers. This is the sector with the origin of the conflict. Alternatively other display and filter algorithms may be possible, e.g. to show the conflict in the sector of the origin of the conflict and in the upstream sectors which currently control these flights.

The conflicts are shown to TC and PC of all aircraft that are involved in the particular conflict. If there are more than two aircraft involved, the alarm will always be shown for aircraft pairs.

Input data of TCT:
- Tactical trajectory;
- Trajectory update/revision based on radar data (position, ground speed, heading), Controller clearance data, weather data, aircraft data (performance data e.g. which rate and speed in which altitude, trajectory updates, Mode-S DAP).

B) Planning of Solutions

Responsible for the initiation of solutions is the TC of the most upstream sector that has got flight information for both involved aircraft[9]. This TC recognizes the conflicting aircraft pair(s) and assesses the traffic situation. In a complex and busy SESAR environment the TC may decide to use the What-If or What-Else probing functionality. For the planning of solutions, s/he selects one of the concerned aircraft, either the subject or the context flight.

The selection is generally based on the following priorities:

1. Safety considerations (e.g. aircraft performance envelope, implications of aircraft non-adherence with clearances, misunderstanding or late compliance with clearance);
2. Trajectory management and network considerations: descending aircraft before, cruising aircraft before, climbing aircraft;
3. Complexity or queue management considerations (e.g. workload implications, target time of arrival, I4D-aircraft on CTA / CTO).

With support of the What-else probing (WeP) the TC immediately sees all available flight level i.e. all level that do not cause a conflict within the specified look ahead horizon of the probing tool. This look ahead horizon should be greater than the Conflict Detection look ahead horizon in order to avoid any "new" encounter at the horizon limit when the clearance is actually implemented. Level that require a specific vertical rate for a conflict free trajectory are clearly distinguished from all level that are impossible (i.e. will lead to another conflict).

Alternatively, the TC can access the WeP-'Direct' menu and immediately sees the next en-route and selected off-route waypoints (trajectory change points) and whether a 'Direct' to one of these points will lead to a potential conflict. For example, if an aircraft is subject to CTA and already late (this information may be provided by an advanced AMAN as 'time to gain') a 'Direct' may be the preferred solution strategy in order to gain some time.

Alternatively, the TC can access the WeP-'Heading' menu and immediately sees the conflict free headings with a resolution of e.g. 5° degrees. At the same time, he can also see all headings which cause a potential conflict, together with the callsign of the encounter aircraft.

The TC can also suppress the display of the conflict (e.g. if the conflict will be solved by another solution strategy or the TC concludes that it may be a false alarm). The conflict detection function

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[9] There may be situations where the PC initiates the conflict resolution by delegating it to an upstream sector which currently controls one of the concerned flights

shows the conflict with these two aircraft again if the previous conflict has been solved and yet another conflict with the same aircraft pair appears.

C) Implementation of Solutions

In general, a closed loop clearance is always preferred to an open loop clearance because an open loop clearance impairs flight predictability and requests the controller to issue the end clearance afterwards. Speed clearances should be avoided in order to prevent possible side effects with TRACT or aircraft on CTA/CTO.

According to the described priorities the TC selects the preferred solution, either from the available WeP suggestions or from his own judgement. She/he implements the solution by issuing a clearance via R/T to the aircraft and inputs the clearance into the ATC ground system. The pilot acknowledges the reception via R/T and modifies the trajectory accordingly. Except for "open" clearances (clearances with no specified resume on trajectory), the pilot is also expected to revise the trajectory in the FMS. It is worth mentioning that in SESAR step1 it is not required for the aircraft to be equipped with "autoload capable" FMS (except for i4D_equipped aircraft), which impedes the ATCOs to issue complex instructions such as resuming navigation on a lat,lon point.

Both the TC and the PC monitor that the aircraft will behave as expected. Shortly after the trajectory revision issued by the ATCO (one radar update after implementation of the solution) and on trajectory update the TCT recalculates the overall traffic situation and the conflict alert disappears.

Alternatively, the TC delegates the implementation of a conflict solution to another sector (e.g. if one of the involved aircraft is not yet handed over or if the conflict is close to the sector boundary after entering the own sector). The delegation will be done by the PC on behalf of the TC. In this case, if the operational situation permits, also data link can be used.

Changes to planning data:
- planning trajectory will be updated/revised with latest data changes: aircraft position, speed and heading, vertical speed, controller clearance data[10];
- recalculation of tactical trajectories with updated data.

3.3 Differences between new and previous Operating Methods

The new SESAR Operating Method makes use of the TRACT service as a new actor, and brings new aids to both PC and TC in order to take advantage of the i4D capabilities of the aircraft.

The PC and TC will have to take into account aircraft involved in TRACT management.

Aircrew will be required to check the suitability of the CTOs issued by TRACT via Datalink and feed these into the FMS.

3.3.1 PC Operating Method

Coordination tasks will be supported by MTCD (including "What If" & "What-Else" probing). For example, current LACC "What If" probing highlights all flights that share a common coordination level, whereas the PC Aid will only highlight the flights that pose a coordination issue. The PC Aid should speed up the PC's tasks of assessing coordination offers.

Currently the PC has to make a judgement using basic tools about whether an aircraft entering the sector poses a coordination issue. The PC Aid will support this process by modelling the aircraft's trajectories and highlighting any planning encounters. The PC Aid should help to reduce the number of late revisions to co-ordinations made to each flight (because the PC should accept Offers in at the optimum safe level).

When choosing an exit level for a flight the PC currently uses their own judgement to determine the nature of the tactical task required to get the aircraft from its entry level to its exit level. The PC Aid

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[10] The planning trajectory may not be used for the TC Aid algorithm but the update is needed for consistency and improved accuracy of all trajectories used in the ground ATC system

will show encounters involving the aircraft as it traverses the sector as well as displaying coordination issues surrounding the flight's exit coordination.

"What Else" probing will show the PC the conflicts which may exist at different levels should they choose to change the entry or exit coordination level.

The PC may have a proportion of his coordination tasks automated (by IC). This automation will reduce the PC's workload, allowing them to act as an assistant TC, helping in the resolution of TC encounters.

The PC Aid will enable to the PC to detect encounters earlier and more accurately than is possible with current operating methods. This will help the PC coordinate aircraft into and out of the sector more efficiently, reducing their TC's workload.

When MTCD detects an encounter that is being managed by TRACT, such encounter has to be highlighted to the PC. The PC is expected to continue to monitor it[11].

3.3.2 TC Operating Method

A) Detection of Conflicts

The TC will be alerted to potential conflicts earlier than when just supported by STCA (STCA has a look-ahead time of ~2 minutes). The TC will still use their experience and knowledge to detect conflicts but the system will support them in this role, potentially highlighting conflicts that could be missed by the TC. Due to MONA, this is also the case if an aircraft deviates from the controller clearance.

Due to the presence of TRACT and the advanced PC tools, there may be fewer interactions for the TC to manage.

B) Planning of Solutions

The TC will still use their knowledge and experience to find solutions to interactions, but "What Else" probing will show which solutions (in terms of conflict-free controller clearances) solve the interactions and whether these solutions create any further interactions.

C) Implementation of Solutions

Monitoring Aids continuously compare the aircraft's actual behaviour with the expected trajectory. Any deviation from the clearance given by the TC will be highlighted and any interactions found against the deviating trajectory will be shown to the TC.

3.3.3 Enhancements regarding FASTI

According to FASTI baseline [20], the Operational Services described in the current document are in line with and sometimes beyond FASTI requirements:

- TRACT is not considered by FASTI. Its level of automation is far beyond FASTI. However note that TRACT is part of the current concept but out of SESAR Solution#27.

- The "CD/R Aid to the TC" is beyond FASTI at least for the following items:

    o Comparison of Mode S DAP with clearance input from controllers for conformance monitoring;

    o Use of Mode S enhanced data for calculation of current wind speed and direction for TP;

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[11] Interference between PC operations and TRACT is subject to validation

- o Use of actual vertical rates including uncertainty buffers for TP, encounter calculation and conformance monitoring;

- o Use of actual aircraft data (Mode S, radar and track data, in future also EPP) for TP and encounter calculation -> much more accurate in the short term than aircraft performance model;

- o Detection of Level Bust for conformance monitoring;

- o What-Else-Probing using flight level probing including vertical rates, en-route and selected off-route Directs, and headings.

- The "CD/R Aid to the PC" is at least in line with FASTI. An implementation validated through the exercises VP797 and VP798 constitutes an enhancement regarding the FASTI principles in the case of "CD/R Aid to the PC" is chained with the "CD/R Aid to the TC" in the implementation. Actually, in such a case, the "CD/R to the PC" is proposed to detect only the doubtless encounters instead of detecting all potential conflicts, which include a large proportion of false conflicts.

4   Detailed Operational Environment

This section of the OSED is a vehicle for the detailed description of the environment for the Operational Processes and Services described in section 2.3.4, in order to get knowledge of the fundamental operational and technical characteristics that govern requirements (including Operational, Safety and Performance).

In the case where an Environment is specific to a given Service, this will be indicated.

The scenarios and use cases that illustrate the domain of operation are in section 5.

4.1   Operational Characteristics

This section describes the operational envelope for which the three P04.07.02 Operational Services are being defined.

The information provided in this section includes any principles, limitations and assumptions relevant to the three P04.07.02 Operational Service descriptions.

- airspace characteristics,

- traffic characteristics such as separation standards,

- …

4.1.1 SESAR Environment Basics

The Project 04.07.02 addresses

Separation Management in En-Route based on a **Trajectory Based Environment**

Therefore this chapter puts emphasis on the Basic Trajectory Based Environment looking at different aspects:

Evolution of the trajectory based environment with respect to SESAR objectives & operational improvements:

Trajectory Based Operations are at the core of the SESAR Concept along with other important objectives:

- enhanced predictive capabilities facilitating improved and more accurate predicted trajectories;
- reactivity of the network to facilitate optimal routings when needed;
- improved strategic ATM decision making process prior to departure facilitating agreed trajectories and increased stability during the execution phase;
- improved ground-ground and air-ground information sharing providing potential for synchronized use of data;
- collaborative processes providing improved awareness and involvement, when needed, for the airspace users when changes are required.

The Trajectory Management concept itself ensures:

- the systematic sharing of aircraft trajectory and associated data between various participants in the ATM process;
- that all participants have a common view of a flight and access to the most accurate data available to perform their tasks.

4D Trajectory Management and planning processes support to some degree the pre-deconfliction of traffic flows resulting in less tactical interventions during flight execution.

The 4D Trajectory is a principal enabler for more accurate information exchange supporting CDM, planning and analysis, separation and automation. The principles are best outlined in B.04.02 Trajectory Management Document_00.01.00 [32] and in B.04.02 iTOPS [29].

Baseline Ground environment:

The project will start from the IP1 Baseline characterised by Strip-/Paperless environment, System Supported Coordination (SYSCO), trajectory-based conflict detection systems (MTCD), initial Data Link applications, Continuous Descent Approach (CDA), basic level of SWIM, FUA, initial conformance monitoring and flexible sectorisation.

Baseline airborne environment:

The recent types of aircraft equipped with a Flight Management System (FMS) frequently also have the capability to comply with a Requested Time of Arrival (RTA) at a specified point given for specific part of the flown trajectory. This includes the capability to receive and accept/reject the corresponding time constraint as a Controlled Time Over (CTO) or Controlled Time of Arrival (CTA) from ATC via Controller Pilot Data Link Communications (CPDLC).

In 2010, it was estimated that 39%of flights in the ECAC (European Civil Aviation Conference) region were equipped with RTA functionality ([32]).[12]

The required RTA tolerance, robustness to weather disturbances as well as enhancement of this functionality for the descent phase of flight is currently under development.

The capabilities available for Business and General Aviation (BGA) also need to be investigated.

Assumed future airborne capability:

The use of the RTA function, together with extended AMAN, is expected to become prevalent for en-route traffic.

4.1.2 Airspace Characteristics

This section describes the Airspace characteristics that possibly impact the Operational and Functional requirements of the CD/R services.

The Airspace is expected to meet the Airspace Concept as depicted in the "2015 Airspace Concept & Strategy for the ECAC Area & Key Enablers" EUROCONTROL document [3].

In the paragraphs below, we outline key airspace characteristics. Any other information may be found within the applicable document [3].

During the time frame of SESAR Step 1 the future European airspace organisation will initially be based on current ICAO ATS airspace classifications, regulations and applicable rules, including Visual Flight Rules (VFR) and Instrument Flight Rules (IFR).

Classifications and rules will be adopted consistently by all States, thus ensuring uniformity of their application and a simplification of airspace organization throughout the whole ECAC region.

This will provide a progress towards an airspace continuum where the only distinction is between two Airspace classes (i.e. Managed and Unmanaged Airspace). However, this will not be achieved in SESAR Step 1.

Airspace use will be optimised through dynamic demand and capacity management, queue management, flexible military airspace structures, free, direct and fixed routing and a reduced number of airspace categories. The objective is to have an airspace organisation that:

- Is as transparent and simple as possible with regard to user perception;

- Permits unambiguous rules for ATS service provision;

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[12] This does not mean that the number of i4D aircraft will be the same, since it is linked to a lot of retro fit etc., and no mandate on i4D equipage

- Allows simple documentation of the requirements for aspects such as flight planning, airspace reservations, communication actions and minimum equipage.

4.1.2.1 Airspace Structure

The Airspace considered by the current document is a **managed airspace**, where a separation service will be provided.

In such airspace the role of the separator may in some cases be delegated to the pilot. However this capability is out of the document's scope.

The vertical scope considered by the current document extends from FL0 to FL660 wherever en-route traffic is controlled. This comprises upper airspace as well as lower airspace (e.g. TMA), but this excludes airspace dedicated to final approach and aerodrome neighbourhood.

The Airspace is RVSM up to FL410.

The Class of Airspace is "**Class C**" or above:

Operations may be conducted under IFR, SVFR, or VFR. All flights are subject to ATC clearance. Aircraft operating under IFR and SVFR are separated from each other and from flights operating under VFR. Flights operating under VFR are given traffic information in respect of other VFR flights. (OACI definition).

The Airspace is divided into separate areas of responsibility (Sectors). The sectors may be grouped together when traffic is low enough and they will be de-grouped when traffic increases. This is operated by the Operational Supervisor on operational criteria.

4.1.2.2 Airspace Configuration

4.1.2.2.1 Sector Configuration

The assignation of volumes to sectors is called "sector configuration". The sector configuration results in the boundaries of each sector. This is not the operation of combining/splitting sectors that will be operated the same way as today.

It is possible to change the sector configuration (i.e. sector boundaries) in real time, in order to tackle issues relative to airspace.

The Sector Configuration is part of the Airspace Configuration, which not only modifies sector boundaries but also authorizations on limited and restricted areas, and conditional routes. The Airspace Configuration is a way to ensure the consistency between all changes that are linked to the same cause (e.g. closure of a restricted area).

As depicted in the following figure, the sectors are to be configured differently whether a border TSA is active or not: when such a TSA is active, its by-path has to be entirely included in a sector.
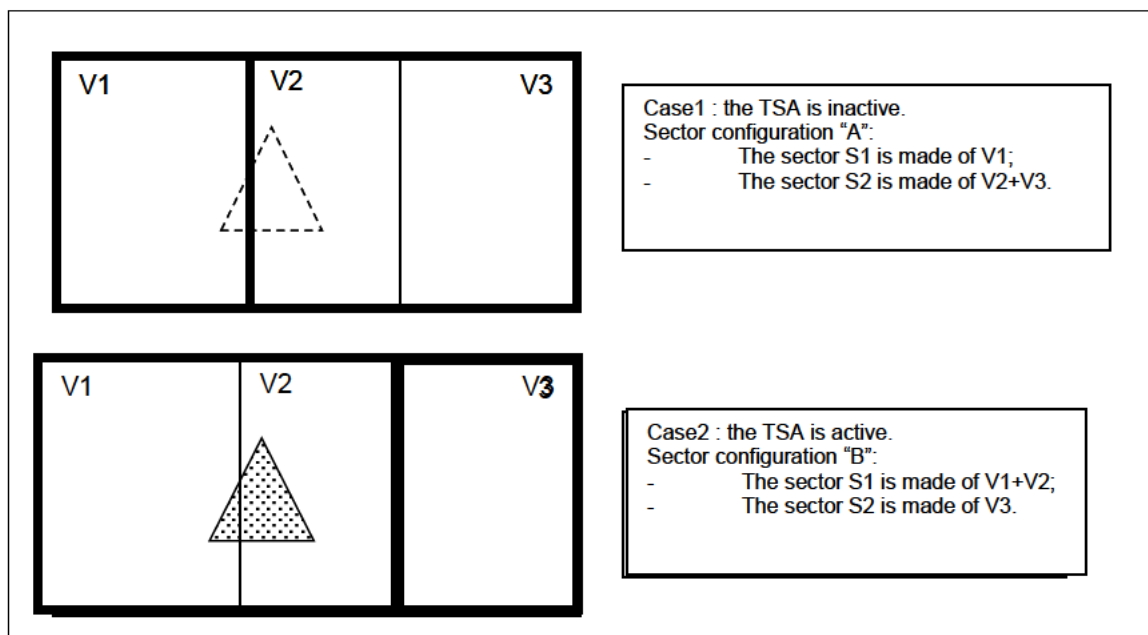
Figure 9: Dynamic sectors configuration.

4.1.2.2.2 Route Configuration/Network

In Fixed-Routes Airspace, advanced RNP will be in place according to AOM-0404 "Optimised Route Network using Advanced RNP" (release 5).

More and more ATS routes of the ARN will become conditional, as a function of airspace configurations (for more information refer to the "Sectors" section above).

The route network will evolve to fewer pre-defined routes with the exploitation of advanced navigation capabilities.

The introduction of Functional Airspace Blocks (FABs) has the potential to reduce many of the geographical constraints existing between internal FIR boundaries within the participating states. The collaborations established within each FAB, including the measures coming from Flexible Use of Airspace initiatives and the move towards more dynamic airspace reservation should be effective in establishing better airspace design across frontiers, with improved Letters of Agreement.

This is expected to open up increased opportunities for more optimised routings. One of the operational improvements, arising from these initiatives, and expected in Step 1, will be increased possibilities for direct and free routing with reduced State and FIR boundary related constraints. The local ATSU level toolset for separation management will work with these free routings, during the execution phase, dealing with flights which traverse directly across large regions of FAB airspace. When changes are needed they will take advantage from the increased cross border flexibility and reduced boundary constraints within the FABs.

However, in complex airspace (i.e. core Europe or similar) a feasible compromise between on the one hand, free routing and user preferred routes, and on the other, the need for a fixed route structure, will have to be resolved in order to ensure maximum capacity. This is essential to support an environment in which ATC has to manage a traffic mix of aircraft which are cruising, descending (on CTA, CDA) and climbing (on CCD) in situations where two or more enhanced AMAN horizons could overlap. However, for safety reasons, this must be achieved thanks to static characteristics. No dynamic change of the airspace status (i.e. free-route vs. fixed-route network) is currently envisaged.

4.1.2.2.3 Free-Route Airspace

The Free-Route Airspace is depicted in the Free-Route OSED document [35].

The Free-Route airspace is a **managed airspace**, where a separation service is provided, and which allows Airspace Users to plan their preferred business trajectories without the need to adhere to a predefined published route.

It extends laterally to the outer limits of a FAB. It addresses all Flight Levels above a defined Level floor. In order to fit with the OI AOM-501 (step 1, release 3 from the release strategy), this Level floor is here assumed to be harmonized and sufficiently high to reduce the number of vertically evolving flights.

The Free-Route Airspace is published in national AIS together with its entry and exit points, which allows Airspace Users to plan:

- Either a conventional route that fits with the route network;

- Or any sequence of route items (e.g. portions of ATS routes, published points, or geographical point) between the entry point and the exit point of the Free-Route Airspace, provided that the length of the resulting route segments complies with the specified limits.

The segregated airspace within the Free-Route airspace and their activity are published to allow Airspace Users to plan their circumnavigation where and when needed. New 5-digits named points around the segregated areas are published in order to allow their circumnavigation.

4.1.2.3 CNS-Coverage

For what concerns Separation services, the major item of CNS is the Communication one. This is expected to improve voice and data exchanges between service actors within the system.

Other items are less suited to Separation services:

- Navigation technologies that enable precision positioning are primarily designed for Lower Airspace. Of course, with RNP the ability to offset and design routes with reduced spacing between centrelines would benefit all airspace. However it does not specifically impact the here-described concept;

- Surveillance technologies are globally important but no feature is specific for the proposed Separation services.

4.1.2.3.1 Air/Ground Data Exchange

A great deal of work related to Air-Ground Communications is achieved within the WG78 and WG85 for EUROCAE and SC214 for RTCA which are conjointly in charge of the standards for advanced ATS supported by data communication.

The operational needs expressed by SESAR, NEXTGEN and ICAO OPLINK panel have been considered, in particular the following new air-ground data exchanges required to support initial 4D operations:

- **CPDLC message to support CTO** allocation including required resolution and tolerance;

- **ADS-C EPP Extended Projected Profile** to support the automatic downlink of trajectory data (1 to 128 published and/or computed waypoints with associated constraints and/or estimates in the 4 dimensions, etc.). ADS-C data are downlinked according to the contract that is negotiated between Ground and Air parties. Three types of contract exist for ADS-C EPP report: "on event, on demand & periodic". The "on event" form of contract is used to allow the on-board predicted trajectory to be downlinked when it has changed by a specified threshold from the previously downlinked version;

- **ADS-C "reliable RTA interval" report** to support the automatic downlink of the reliable RTA interval on the merge point indicated in the ATC request. Two types of contract exist for ADS-C report: "on demand & periodic";

- **Mode-S enhanced surveillance**;

- **ADS-B out data**.

Other air ground data exchanges standardised by WG78/SC214 are **D-TAXI** (CPDLC) and **D-OTIS** (FIS).

A mature draft of SPR and INTEROP is now available (refer [27]).

4.1.2.3.1.1 Voice services

While the ATM Target Concept is oriented toward data exchanges between aircraft and ATM ground systems, voice will remain an essential means of communication at least until the 2020 timeframe.

Voice services are expected to continue to be based on the premise of one channel per controller/sector. Beyond 2020, and as defined by the SESAR CONOPS[1], voice will remain the primary means of communications, only in certain circumstances. The role of voice communications will essentially be a safety back-up means of communication; however voice will remain an essential means for pilots to get information and to obtain confirmation of the ATC instructions. During negotiations, voice will help ATCOs in gaining the support of air crew and it may avoid pilot rejections.

In the near term, air traffic control operations and aeronautical operations control (AOC) will continue to use the allocated VHF spectrum (118-137 MHz) for voice communications.

The voice service for 2020 will be complemented by SATCOM for oceanic and remote areas.

4.1.2.3.1.2 Data services

Data exchange will be progressively introduced for routine communications.

In the near term, the point-to-point air/ground data service link is based on ATN/VDL Mode 2 technology.

This initial step will need to be enhanced and/or complemented to support the full deployment of the ATM Target Concept. It is important to highlight that higher performance (e.g. predictability, security, latency, availability, integrity and throughput) data-links will be required to support advanced services, such as the 4D contract, trajectory exchanges, as well as the increasing air-traffic volumes and density.

To meet the long-term data communication needs, a dual link system is likely to be necessary to cope with the higher availability requirements.

New terrestrial mobile communication technology systems and satellite technologies can provide the advantage to offer complementarities in terms of infrastructure and radio spectrum diversity, and coverage.

4.1.3 Traffic Characteristics

Traffic characteristics will vary by airspace type:

- Upper Airspace e.g. above FL285: Mainly levelled flights and some descending/climbing aircraft;
- Lower Airspace e.g. under FL285: A mix of levelled and descending/climbing aircraft depending on the sector. A higher proportion of airfield inbounds and outbounds to both airfields within and outside the sector of interest.

In the most-likely scenario there will be 14 million IFR movements in Europe by 2035, 1.5 times more than in 2012 (refer [43]).

4.1.4 Separation Characteristics

This section puts the P04.07.02 separation modes in the context of the SESAR separation modes as being defined in the SESAR CONOPS [1]. It positions these separation modes to the operational environment related to airspace complexity. The P04.07.02 modes have to be tailored to the local environment and performance needs. All modes can be used but individual configuration parameters (e.g. conflict look ahead horizon) should be set according to sector, airspace, and traffic characteristics.

The following subsections briefly explain the P04.07.02 separation services and their relation to the other SESAR separation modes.

Mode	ATM Level	Applies in complexity	Use
Conventional			
Surveillance including PC Aid and TC Aid	0-4	**L/M/H**	**normal mode**
procedural	0	L/M/H	normal mode
New ANSP modes			
TRACT	**2-4**	**L/M**	**Low/medium complexity operations**
New airborne modes			
Cooperative Separation: ASAS	3-4	M/H	On ATC initiative
Self-Separation: ASAS	4	L/M/H	On ATC initiative

Table 6: En-Route Separation Modes and Application.

4.1.4.1 Separation Minima

Separation minima are expected to continue to be based on guidance, regulations, and factors used in today's environment (ICAO Doc 4444 Procedures for Air Traffic Management [24], especially Chapter 5):

- Vertical separation: FL< 410 → 1000ft separation (RVSM);
- Horizontal separation: En-Route Radar Separation: 5NM.

The radar separation standard may not be constant throughout the En-route sectors. Different separation standards might be required e.g.:

- A non-RVSM flight that is authorized to fly within an RVSM airspace remains subject to separation standard that is applicable above the RVSM limit (i.e. in a non-RVSM airspace);

- At the edges of multi-radar cover or in the case of a reduction in radar service where the radar separation minimum may be increased to 10 NM

- The sectors that interface the lower En-route sectors may be operating a lower radar separation standard (procedures ensure that the separation is established prior to transfer of control in this case).

Therefore the choice of separation standard is made on a case-by-case basis depending on both the pair of elements to assess and the airspace where the separation is assessed, and it may not be homogeneous throughout the whole controlled sector.

4.1.4.2 Support to ASAS Services

It is worth mentioning that ASAS aspects are out of scope of the current document as they are addressed in other SESAR projects, notably:

- P04.07.06 "En-Route Trajectory and Separation Management – ASAS Separation (Cooperative Separation)" (*currently suspended*);
- P05.06.06 "ASAS Sequencing and Merging".

	ASAS Spacing	ASAS Separation
PC Aid	Co-exist.	Co-exist, impact on changes to entry/exit flight level is matter of further validation.
TC Aid	Co-exist, if a conflict is detected or a resolution advisory is being applied, ASAS may be terminated.	Co-exist as "supporting service"; if a conflict is detected or a resolution advisory is being applied, ASAS is terminated.
TRACT	Co-exist, whether an aircraft following an active CTO can perform an ASPA manoeuver (and vice-versa) is matter of further validation.	Co-exist, pilot may refuse at own discretion. Matter of further validation.

4.1.4.3 Support to Free Route Airspace

GAT flights, entering and exiting Free Route Airspace will normally do so via the fixed route network. Flights traversing boundaries between ACCs will continue to be subject to rules, procedures and Letters of Agreement.

Where required, local procedures may allow GAT flights to flight plan climb/descent entry and/or exit at random points. OAT flights entering and exiting Free Route Airspace are not confined to fixed entry and exit points. They may be subject to rules, procedures and agreements for the purpose.

Free Route airspace is expected to have a significant impact on the location, dispersion and predictability of potential conflicts.

	Free Route
PC Aid	Co-exist, but limited to the boundaries of the free route airspace.
TC Aid	Co-exist; subject to further validation.
TRACT	Co-exist.

4.1.5 Aircraft Capabilities

The aircraft capabilities will remain heterogeneous in the target environment. They will cover a range from existing capabilities and standards as described in the Minimum Aviation System Performance Specification (MASPS) ([26], to the i4D capabilities as described in the P09.01 deliverables ([34]).

It is assumed that the highest level of aircraft capabilities available in Time Based Operations (SESAR step1) can be summarized as follows:

- **Data link**:
  - CPDLC and ADS-C for ATC via ACARS (oceanic flights) and via ATN (continental flight) (ED122, ED 100A for FANS 1/A+, ED 110B/120 for continental Europe ATN B1);
  - FIS: ATIS with ATC via ACARS;
  - MET data (winds/temperatures, TEMSI, etc.) with AOC via ACARS.
- **Navigation** (figures currently being assessed by WG85):
  - 2D RNP1 in en-route and 2D RNP0.3 in approach (2D RNP means lateral containment i.e. not only a required accuracy but also a required integrity and

continuity, e.g. the aircraft will remain within +/-1nm 95% of the time and within +/-2nm 99,99% (10^{-7}) of the time for RNP1);

- ○ Concerning the vertical dimension, the following is required in [5] section 7 "RVSM performance" JAR 25.1325(e) : *"Each system must be designed and installed so that the error in indicated pressure altitude, at sea-level, with a standard atmosphere, excluding instrument calibration error, does not result in an error of more than ± 30 ft per 100 knots speed for the appropriate configuration in the speed range between 1.3 VS0 with wing-flaps extended and 1.8 VS1 with wing-flaps retracted. However, the error need not be less than ± 30 ft"*;

- ○ A time constraint (RTA) is achieved with an accuracy of at least +/-30 seconds for en-route operations and at least +/- 10 seconds for arrival operations in the terminal area 95% of the time; with 10kts wind error (ED-75D). The time estimates accuracy is around 1% of Time To Go for open loop time control function, e.g. +/-15 seconds at 25 minutes. It is to be noted that these statements are guaranteed only in i4D operational conditions, i.e. end of cruise and descent approach (excluding fixes from decelerate to threshold runway).

- **Surveillance:**
  - ○ ADS-B in/out via Mode-S 1090 transponder and ATSAW applications;
  - ○ TAWS;
  - ○ ACAS for the safety net.

The focus here is mainly on Commercial aircraft (legacy, low fare, regional) and on Business aircraft[13].

There is generally less capability for GA-VLJ-Helicopter and Military aircraft (data link alike, FMS alike, ACAS for transport only).

4.2 Roles and Responsibilities

As a legal foundation, the controller is responsible for maintaining the minimum prescribed separation between aircraft.

Due to the introduction of new services and support tools, tasks and operating methods will change. Table 7 provides an overview of these changes.

Actors	Change of tasks and responsibilities
Multi-Sector Planner / EAP	"PC Aid": search of conflicts that are entering the MSP/EAP area is now supported by MTCD; planning of conflict solutions now supported by what-if & what-else probing;.
	TRACT: Situation awareness for aircraft that are subject to speed adjustments.

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[13] Mainline and BGA equipage level can be very different

Planning Controller (PC)	No change of responsibilities.
	"PC Aid": search of conflicts involving entering/exiting flights is now supported by MTCD; planning of conflict solutions now supported by what-if probing.
	TRACT: Situation awareness for aircraft that are subject to speed adjustments.
Tactical Controller (TC)	No change of responsibilities. In particular the TC remains responsible for aircraft managed by TRACT.
	"TC Aid": search of conflicts within the sector is now supported by TCT; planning of solutions is now supported by what-if & what-else probing; clearances need to be entered into the FDPS.
	TRACT: Situation awareness for aircraft that are subject to speed adjustments.
Aircrew (Pilot Flying, Pilot Non Flying)	No change of responsibilities. The flight crew is still considered to be the last line of defence for the flight safety.
	TRACT: Assessment of the submitted CTO, answer to the CPDLC messages related to the suggested CTO (accept, reject, standby), and update of FMS.

Table 7: Changes related to P04.07.02 separation services.

For the air traffic controllers the changes associated with the new separation services are mainly related to the tasks of conflict search, solution planning and implementation but also the other tasks are affected to some extent. For the different operational scenarios generally the same tasks apply (refer to Figure 10), although the characteristics, the priority and the associated task load may differ significantly.

The new Separation Management services will be conducted in parallel with the other SESAR Step 1 operational improvements, which may introduce further controller responsibilities such as agreement of time constraints (only one allowed in step 1) for other operations such as CTO from complexity Management or CTA from Arrival Management etc….

Procedures associated with the P04.07.02 separation services do not require phraseology changes as defined in ICAO Doc 4444.

	Conflict Detection	Solution Planning and Implementation	Communication with a/c	Coordination	Update data	Monitoring	Handover	Emergency
Roles & Responsibilities	TRACT PC/TC with MTCD or TCT	TRACT PC/TC with MTCD or TCT	TRACT TC	PC	TC/PC	TC/PC with FPM	TC	TC/PC

Figure 10: Overview of controller and TRACT tasks.

Hereafter it is described how the P04.07.02 services modify the tasks of the main actors. Only TC, PC and TRACT actors are tackled because:

- Handling of RTA/CTO by Air Crew is not specific to P04.07.02;

- Definition of the MSP role is not in the scope of the current document but it should result from P04.07.08. This role is here supposed to perform the Planner Controller Tasks as the PC.

TRACT Tasks:

> **Foreword**: although the current concept includes three Separation Services for completeness, the TRACT service is out of the SESAR Solution #27 because its enablers are not available yet and because it has not reached V3 maturity yet.

1. Conflict detection

TRACT detects the potential aircraft-to-aircraft conflicts that involve aircraft in the TRACT area. It then groups the detected conflicts into clusters. Roughly speaking, a cluster is a group of conflicting aircraft that may interact. Note that the look-ahead time for detecting conflicts is about 25 minutes.

2. Planning of solutions

On a cyclic basis which may be about 3 minutes (parameter TBD) TRACT builds a solution to manage as many detected clusters as possible using an algorithm that takes into account all necessary constraints (e.g. airborne "reliable RTA interval", prohibited and restricted airspace, danger areas, terrain…). The solutions are made of CTOs. Note that by taking into account the "reliable RTA interval" it is quite ensured that the aircraft is technically capable of flying the produced CTOs.

3. Communication and implementation of solutions

The CTOs are uplinked to the appropriate aircraft (no more than one time constraint concurrently applied to the same flight respective to the i4D requirement). ATCO's HMI informs controllers that TRACT has sent a CTO to those aircraft. The management of the CTOs is then made by TRACT. It is expected that most aircraft will accept the proposed CTO so that the case where a CTO is not accepted is rare (a dedicated scenario is described in section 5).

All the aircraft involved in a solved TRACT cluster are tagged i.e. specifically highlighted on the radar display so that the PC and TC are aware of them. Then they can avoid changing these flights behaviour in order not to disturb the on-going TRACT solution.

Once a CTO has been reached, then the aircraft is no longer tagged.

4. Monitoring and detection of deviations from flight track

TRACT monitors the case when an aircraft does not follow any CTO while it was expected to (e.g. pilots answered WILCO but didn't input the FMS). Therefore TRACT must include an internal monitoring function.

Planner Controller Tasks:

> **Foreword**: although the current concept includes three Separation Services for completeness, the "CD/R aid to the PC" is out of the SESAR Solution #27 because it has not reached V3 maturity yet.

1. Conflict detection

In sectors with predominantly cruising and a minor proportion of evolving traffic (e.g. UIR) many conflicts may be early detected by the PC. The PC is hereby supported by a conflict detection tool (MTCD) which detects conflicts for aircraft that are entering/exiting the sector. These flights are specifically highlighted on the radar display.

2. Planning of solutions

The PC will plan solutions by the modification of ATC constraints (entry and exit conditions) on the planning trajectory. S/he will always plan solutions on a closed loop basis in order to maintain a reliable planning trajectory.

S/he will be assisted by a what-else probing tool for PC based on the planning trajectory. This tool indicates possible entry and exit conditions that do not produce a planning conflict.

Information on aircraft that are subject to speed adjustments (TRACT) will be available to the PC. If needed, the PC will consider this when planning solutions.

3. Co-ordination and implementation of solutions

The Planner Controller will primarily be responsible for setting and agreeing the entry and exit co-ordination contracts with neighbouring sectors. The PC will initiate co-ordination requests to the upstream PC or the upstream TC (co-ordination processing via upstream PC) or the downstream PC because of his solution planning. Furthermore the PC performs co-ordination activities to the downstream PC on request of her/his TC colleague.

On receipt of an offer of entry co-ordination (from an "offering sector"), the PC will use the radar and support tools to assess the acceptability of that offer in context with the other flights that have been notified to the sector. If there are no conflicts at the offered entry level, or, in the PC's judgement (potentially with the explicit agreement of the TC) any conflicting traffic can be dealt safely by the TC then the PC will accept the flight as proposed. Should there be conflicting traffic that would make the co-ordination unacceptable, the PC will either accept the traffic but with revised vertical, lateral and/or speed constraints or, exceptionally, reject the traffic. The PC will ensure that traffic entering the sector that is not conflict-free is clearly identified to the TC along with whichever are the conflicting flights (it may be that the automated support aids or even supplants this task).

Having accepted a flight, the PC will set a target exit level to be achieved by the TC. In order to do this, the PC will use the radar and support tools to assess the likely workload of the TC, the complexity within the sector, the performance and desires of the flight and any procedural constraints (such as standard levels). Any necessary lateral and/or speed constraints will also be identified and applied. The PC will commit the target exit conditions to the system which will transmit those to the "receiving sector" at co-ordination time.

If the receiving sector accepts the co-ordination offer, the PC need take no further explicit action with respect to that flight. However, should the receiving sector either revise the offer or, exceptionally, reject the flight the PC must reassess the exit co-ordination to ensure it remains achievable and suitable given the traffic situation.

The PC will also liaise and co-ordinate with other units (e.g. military, airfields, other ACCs) as necessary to ensure the safe, orderly and expeditious air traffic service in and around his sector(s) or responsibility.

4. Update of data

The system will be capable of SysCo, i.e. whenever possible co-ordination offers will be sent between sectors electronically and the acceptance and revision messages likewise. However telephone co-ordination may be necessary in some situations and it would normally be the PC's responsibility to undertake this task and update the system.

5. Monitoring

In general, the PC is responsible for monitoring the sector traffic to ensure the various co-ordination agreements remain achievable and that the workload of the TC is not unduly high (or even overloaded) such that safety is potentially compromised. The PC should amend co-ordination agreements as necessary to maintain an acceptable level of tactical workload.

Where possible (and in general when operating in a 1P1T configuration) the PC should monitor the R/T frequency for the sector in order to help build his high-level understanding of the traffic environment and to act as a second line of defence against incorrect pilot read-back of clearances and other critical transmissions. The PC should bring to the attention of the TC any situations which, in his opinion, the TC has overlooked and which, if not remedied, could lead either to a loss of separation or to an aircraft not being able to achieve the agreed sector exit conditions.

6. Emergency

The PC will offer necessary support to the Tactical should an unexpected or emergency situation develop in the sector and will liaise with other teams and organizations as operationally appropriate so that the situation is handled as successfully as possible and with regard to the safety of the other flights in and around the sector.

Tactical Controller Tasks:

1. Conflict detection

The Tactical Controller is primary responsible for assuring and maintaining separation between flights under his control (and against flights which are known to him, but may be under the control of another sector) whilst ensuring that flights achieve their co-ordinated sector exit conditions. Note that the TC has to mentally integrate the speed adjustments eventually performed by TRACT. These flights are specifically highlighted on the radar display.

The maintenance of separation against prohibited and restricted airspace and from danger areas is also the responsibility of the Tactical Controller (as is, as far as possible, the requirement to ensure traffic remains within Controlled Airspace unless specifically cleared to leave). Terrain clearance is also the responsibility of the TC providing a Radar Control Service, although this is usually achieved through the procedural limitations on flight levels that may be allocated to aircraft in a particular sector or parts of a sector.

In order to detect conflicts or interactions between aircraft that require some positive action the TC will make use of the radar and other automated support tools. In airspace with increasing proportion of evolving traffic (e.g. FIR and TMA) the TC will require the assistance of a conflict detection tool (TCT).

In airspace with a low proportion of evolving traffic the TC may also take advantage of the MTCD, e.g. for information gathering of conflicts or communication with the PC.

2. Planning of solutions

In airspace with a low proportion of evolving traffic most conflicts can be detected and solutions planned beforehand by the PC. With an increasing proportion of evolving traffic the TC will detect and plan solutions to conflicts on a shorter term.

The TC is assisted by a what-else probing tool based on the speculative trajectory. This tool indicates possible CFLs with or without cleared rates, possible directs and headings/tracks that would not produce a potential conflict display by the CD for TC tool. Whenever possible the TC will plan closed loop solutions in order to maintain a reliable planning trajectory.

Information on aircraft that are subject to speed adjustments (TRACT) will be available to the TC. If needed, the TC will consider this when planning solutions.

3. Communication and implementation of solutions

The TC will maintain communications with the aircraft, and ensure communications are successfully transferred to the receiving unit at the appropriate time. The TC will issue clearances that will dictate how each aircraft should operate within the sector applying only those constraints necessary to ensure the safe, orderly and expeditious flow of traffic through the sector and allowing each aircraft the freedom to fly as desirable a profile as possible within those constraints. When issuing time-critical clearances the TC will use the voice channel. Non time-critical clearances should be issued by CPDLC whenever the respective aircraft is equipped in order to reduce frequency occupancy time.

4. Update of data

The TC is responsible for maintaining and updating the flight data display (be it paper or electronic strips, or other advanced HMI) with the clearance instructions and constraints (and other pertinent data) that have been issued to the flights under his jurisdiction. This database may be integrated with automated communication support (such as CPDLC) and/or the automated problem detection and resolution support.

5. Monitoring and detection of deviations from flight track

The TC will monitor aircraft and identify deviations from clearances (pilot deviation and deviation between clearances and plan), e.g. deviation from cleared FL, cleared Rate, cleared Route, cleared Track. S/he will be assisted by Monitoring Ads (MONA).

6. Handover instructions

Shortly before leaving the own sector the TC will hand aircraft over to the adjacent sectors. S/he should hereby use the CPDLC channel whenever the respective aircraft is equipped in order to reduce workload and frequency occupancy time.

7. Emergency

The Tactical Controller will take action to provide the necessary help to an aircraft in difficulty or suffering an emergency whilst ensuring that other traffic is neither unnecessarily involved in the emergency nor overlooked so that they are, themselves, put into an unsafe situation. The TC should ensure that the nature of the emergency is made known to the PC and other controllers as operationally appropriate as soon as possible so that supportive action can be put in place.

4.3 Constraints

Currently no specific technical constraint impacts the concept or the solution for SESAR Step 1 enabled systems.

5 Use Cases

5.1 Operational Scenario 1: FIR

5.1.1 Conflict Detection and Resolution with TCT

5.1.1.1 Scope

Component, black-box.

5.1.1.2 Level

Sub function

5.1.1.3 Summary

This UC describes the detection of conflicts with the TCT. The controller will be warned of the potential conflict and decides how to deal with this information.

5.1.1.4 Actors

The Tactical Controller (primary actor) TC

The Planner Controller (support actor) PC

The Air Crew (support actor)

5.1.1.5 Pre-conditions

At least two aircraft have conflicting trajectories (lateral and/or vertical).

5.1.1.6 Post-conditions

5.1.1.6.1 Success end state

The aircraft are clear of conflict, no conflicting trajectories anymore. The warning is no longer displayed.

5.1.1.6.2 Failed end state

Several failures may occur:

- The TCT detects a conflict which is not a conflict (False alarm)

- The TCT does not detect a conflict although the minimum separation will be infringed if no action was taken by the controller (missed alarm)

- The controller ignores the warning about a conflict although the conflict is valid and the controller does not apply a solution

- The controller applies a solution which causes secondary subsequent conflict

5.1.1.7 Notes

If a conflict between conflicting aircraft trajectories has not been detected by the TCT the main flow will not be entered. However, this is a severe failure case which is not described here because the UC trigger is missing (refer to Failed end state).

5.1.1.8 Trigger

The TCT detects conflicting trajectories (CPA is below tactical separation) and shows a warning to the Tactical and Planner Controller.

5.1.1.9 Main Flow

1. The TC and PC perceive the warning and the TC checks the validity (correctness) of the warning.

2. The TC checks whether the conflict is relevant to him (not relevant: let situation evolve, separation is sufficient).

3. If valid and relevant: the TC decides how to solve the conflict using solutions from his "mental library" (without tool support).

4. The TC implements the solution by providing a voice clearance to the air crew.

5. The TC updates the ground system with the new clearance data.

6. The air crew executes the clearance by modifying the trajectory, i.e. updates the FMS.

7. At latest at the next radar update the TCT recalculates the overall traffic situation and the previous warning disappears (as soon as the CPA is above the threshold for tactical separation).

8. The TC and PC monitor the execution of the clearance and check that the conflict has been solved and the TCT warning disappears.

5.1.1.10   Alternative Flows

5.1.1.10.1   Step 2 – the conflict is not relevant

1. The TC suppresses the warning and keeps monitoring the overall traffic situation because the situation may evolve and the conflict is not relevant (according to his assessment) although correctly predicted by the TCT according to the algorithm.

5.1.1.11   Failure Flows

5.1.1.11.1   Step 1 – the TCT warning is not valid

1. The TC suppresses the warning and keeps monitoring the overall traffic situation because the TCT issued a false alarm (nuisance alert).

5.1.1.11.2   Step 2 – the TC ignores the warning

1. The TC suppresses the warning and keeps monitoring the overall traffic situation.

2. The conflict remains unsolved. The conflicting aircraft keep approaching each other while the actual separation value is decreasing.

3. Other safety layers detect the conflict and warn the TC (Planning controller, tools like STCA).

5.1.1.11.3   Step 7 – a secondary conflict is detected

1. The TCT detects a secondary conflict with one of the previously involved aircraft. The flow restarts at Main Flow, step 1.

5.1.1.12   Version Information

SESAR template: "*Overall Target Architecture Activity (OATA) Use Case Template*", version 02.00.00

5.1.2 Conflict Resolution with What-Else probing

5.1.2.1 Scope

Component, black-box.

5.1.2.2 Level

Sub function

5.1.2.3 Summary

This UC describes how to plan a conflict solution using the what-else probing tool.

5.1.2.4 Actors

The Tactical Controller (primary actor) TC

The Planner Controller (support actor) PC

The Air Crew (support actor)

5.1.2.5 Pre-conditions

At least two aircraft have conflicting trajectories (lateral and/or vertical). The TCT detects conflicting trajectories and shows a warning to the Tactical and Planner Controller.

5.1.2.6 Post-conditions

5.1.2.6.1 Success end state

The aircraft are clear of conflict, no conflicting trajectories anymore. The warning is no longer displayed.

5.1.2.6.2 Failed end state

5.1.2.7 Notes

5.1.2.8 Trigger

The conflict is valid and relevant.

5.1.2.9 Main Flow

1. The TC decides to plan a solution and solve the conflict by using the What-Else probing functionality.

2. The TC selects one of the conflicting aircraft and applies the a) Flight Level including vertical rates, b) en-route and selected off-route Direct and c) Heading What-Else probing. The conflict free Flight Levels, Directs and Headings will be shown to the TC (as well as the conflicting ones).

3. The TC selects his preferred solution and cross checks that the chosen solution is conflict free and has no unintended side effects (e.g. secondary conflicts, traffic flow considerations, RTA compliance…).

4. The TC implements the solution by providing a voice clearance to the air crew.

5. The TC updates the ground system with the new clearance data.

6. The air crew executes the clearance by modifying the trajectory, i.e. updates the FMS.

7. At the next radar update the TCT recalculates the overall traffic situation and the previous warning disappears (as soon as the CPA is above the threshold for tactical separation).

8. The TC and PC monitor the execution of the clearance and check that the conflict has been solved and the TCT warning disappears

5.1.2.10   Alternative Flows

5.1.2.11   Failure Flows

5.1.2.12   Version Information

SESAR template: "*Overall Target Architecture Activity (OATA) Use Case Template*", version 02.00.00

5.1.3 Detection of Deviations with MONA

5.1.3.1 Scope

Component, black-box.

5.1.3.2 Level

Sub function

5.1.3.3 Summary

This UC describes the detection of deviations of the flight track from the controller clearances.

5.1.3.4 Actors

The Tactical Controller (primary actor) TC

The Planner Controller (support actor) PC

Flight Data Assistant (support actor)

The Air Crew (support actor)

5.1.3.5 Pre-conditions

An aircraft is deviating from its clearance. It is on sector frequency.

5.1.3.6 Post-conditions

5.1.3.6.1 Success end state

The aircraft follows the controller clearance (no deviation between flight track and clearance).

5.1.3.6.2 Failed end state

The controller ignores the warning about a deviation although the warning is valid.

5.1.3.7 Notes

If a deviation has not been detected the main flow will not be entered. However, this is a severe failure case which is not described here because the UC trigger is missing. In case of deviations

between controller clearance data and Mode-S DAP (e.g. Selected Altitude) it has to be ensured that no deviation warning is generated if the pilot enters the new clearance faster than the controller into the respective system.

Therefore, a latency time shall be introduced after reception of a Mode-S DAP. If it does not fit with the controller clearance, a deviation warning is shown to the controller.

Similarly, a latency time shall be introduced after a new controller clearance to wait for reception of the corresponding Mode-S DAP.

5.1.3.8 Trigger

The Monitoring Aids (MONA) functionality detects a deviation between the current ATC clearances and either the observed behaviour (Surveillance data) or the flight intentions (Mode-S data), and consequently it shows a warning to the Tactical and Planner Controller indicating the kind of deviation (route, vertical rate, flight level, no valid flight plan, Mode-S DAP not consistent with controller clearance).

5.1.3.9 Main Flow

1. The TC and PC perceive the MONA warning and the TC checks the validity (correctness) of the warning. Additionally, the TC may also checks that the entered system clearance data are correct.

2. In case of route, vertical rate or CFL deviation issued from Surveillance data: the TC contacts the air crew and asks for confirmation of current clearance data.

3. In case of Mode-S DAP deviation: the TC contacts the air crew and asks for confirmation of the currently selected parameter (e.g. Selected Flight Level).

4. The air crew confirms the current clearance and resumes navigation according to this clearance.

5. As soon as the deviation is below the threshold the MONA warning disappears.

6. The TC and PC monitor the aircraft and check that the warning has disappeared.

5.1.3.10   Alternative Flows

5.1.3.10.1   Step 1 – MONA is not valid

1. The TC deletes the warning and monitors the aircraft (e.g. in case of route deviation when heavy aircraft fly curved flight segments and exceed MONA threshold).

5.1.3.10.2   Step 2 – no valid flight plan available

1. The TC contacts the Flight Data Assistant (or Supervisor) and asks for update of flight plan data in the Ground System.

2. The Flight Data Assistant updates the Ground System with the available flight information.

3. The MONA warning disappears.

5.1.3.10.3   Step 3 – new clearance issued

1. The air crewcannot comply with the current clearance and informs the TC about this situation.

2. The TC issues a new clearance via voice.

3. The TC updates the ground system with the new clearance data.

4. The air crew executes the clearance by modifying the trajectory, i.e. updates the FMS.

5. Continue with Main Flow, step 4

5.1.3.11   Failure Flows

5.1.3.11.1   Step 1 – the TC ignores the warning

1. The TC suppresses the warning and keeps monitoring the overall traffic situation. However, the aircraft is not following the current clearance (or the MONA tool does not work as designed, malfunction).

5.1.3.12   Version Information

SESAR template: "*Overall Target Architecture Activity (OATA) Use Case Template*", version 02.00.00

5.2 Operational Scenario 2: UIR/FIR

Foreword: although the current concept includes three Separation Services for completeness, the "CD/R aid to the PC" is out of the SESAR Solution #27 because it has not reached V3 maturity yet.

This scenario describes the operation in a high-density En-route operation in which aircraft in cruise-flight are integrated with aircraft climbing and descending into and out of one or more Approaches. The airspace will be both FIR (base to limit FL e.g. FL245 in U.K.) and UIR (limit FL e.g. FL245 in U.K. to FL660) and some sectors will cover that entire vertical range whereas others will cover only a range of levels within the overall FIR/UIR extent.

The scenario will assume full radar coverage, although, in reality, there may be extremities of some sectors that are outside radar cover (due to the distance from a radar head) or below radar cover as a result of high terrain.

The general environment that will be represented by this scenario will include significant elements of the following characteristics:

1. A proportion of traffic will be in cruise flight and will be overflying the entire region (i.e. no climb or descent is expected in or near the sectors of interest). The majority of this traffic will be high-level (e.g. intercontinental) overflights, but it will also include some medium level (e.g. regional) cruising flights.

2. A proportion of traffic will enter the sectors in cruise flight but will reach the top-of-descent point within the sectors of interest and will expect the early stage of descent before leaving the sectors.

3. A proportion of traffic will enter the sectors of interest before achieving the top-of-climb and will expect to be cleared to the requested flight level during the transit of the sectors.

4. A proportion of traffic will be inbound to and outbound from at least one, if not more than one, Control Zone/Area which is situated close to (or underneath) the sectors of interest and which will be descending or climbing throughout most of their transit through the sectors of interest.

5. Traffic flows will interact with each other in opposite direction, crossing and similar direction geometries.

6. Traffic levels will generally be busy and complexity will generally be high.

7. A representative set of aircraft types with varying speed and vertical performance characteristics will be reflected.

8. The environment should provide for the potential integration of military traffic with the civil flights (e.g. military crossing of Controlled Airspace).

The controller team will be based on the traditional Planner-Tactical two-person operation of a sector (or group of combined sectors).

Since the needs of the PC and TC differ in many respects, the trajectories produced to support the planning and tactical roles are different. The planning trajectory is used to predict encounters between flights that are of concern to the PC. The planning trajectory takes account of the original

flight plan, modified by agreed co-ordination conditions and standing agreements, and takes into account closed loop instructions. It is unconstrained by tactical open loop instructions.

Planning trajectories extend across the whole sector (and into the next sector) and take into account the aircraft's route and desired vertical profile. Tactical trajectories which only last as long as the open loop clearance is valid for (or 6 minutes) may not extend across whole sector. Tactical open loop clearances (e.g. a heading) may be given to aircraft in order to resolve encounters but the aircraft will (in most cases) return to their filed route before leaving the sector. The planning trajectories therefore give strategic information about how an aircraft will traverse the sector (i.e. which route will it follow, whether it will need to climb/descend in the sector).

TRACT would focus on encounters between those aircraft that are in cruise phase across the whole sector. The proportion of flights which are in cruise phase may vary from sector to sector.

The "PC Aid" will allow the PC to assess conflict situations and to mitigate their effects by taking action as part of the planning and co-ordination process, rather than postponing resolution to the tactical phase. In effect, by enabling a more efficient and effective planning and co-ordination process the TC's workload will be reduced.

5.2.1 Use Case 1: MTCD-Supported Assessment of Entry Coordination

5.2.1.1 Scope and Summary

This use case describes how the Planning Controller manages a Coordination offer for a flight into their sector using the PC Aid.

The use case begins when a Coordination offer for a flight is received by the sector. The use case ends when the offer is either accepted into the sector or rejected.

5.2.1.2 Actors

Receiving Sector Planner Controller (primary).

Offering Sector Planner Controller (support).

Receiving Sector Tactical Controller (support).

5.2.1.3 Pre-conditions

The receiving sector is equipped with the "PC Aid".

Integrated Coordination has not automatically accepted the offer into the receiving sector (see Use Case 3).

5.2.1.4 Post-conditions

5.2.1.4.1 Success end state

There are two possible successful end states:

1. The flight's entry coordination offer is accepted into the receiving sector:

   • Such that the entry level is free of planning encounters;

   • Such that the entry conditions do not deteriorate the presentation of traffic to the Tactical Controller (i.e. the flight's entry coordination does not create unnecessary Tactical complexity which could be avoided if flight was coordinated into the sector at a different level or with a different coordination condition/constraint);

   • At a sensible time (i.e. the PC at the receiving sector has enough time to plan the flight into and out of the sector, and definitely before executive control of the flight is passed to the TC at the receiving sector).

2. The flight's entry coordination offer is rejected by the receiving sector.

5.2.1.4.2 Failed end state

If the realisation of the Use Case failed then the flight's entry coordination offer would be accepted into the receiving sector, however:

- The entry level may not be free of planning encounters;
- The entry conditions may deteriorate the presentation of traffic to the Tactical Controller;
- The flight may be accepted into the sector too late.

5.2.1.5 Notes

The offering and receiving of coordination offers between sectors is supported either by existing systems or by systems provided by SESAR projects other than P04.07.02. The here-described concept does not change the underlying coordination process between sectors.

Flights may be "Hooked" by clicking on their Track Data Block (TDB) or on selected other components where their call-sign appears. Hooking a flight will cause that flight to be the subject flight of any PC Aid tools which are open.

5.2.1.6 Trigger

The use case starts when a Coordination offer for a flight is received by the sector.

5.2.1.7 Main Flow

1. The receiving sector receives a coordination offer for flight A.
2. The PC Aid builds a Entry Trajectory for flight A at each of the offered levels.
3. The PC Aid alerts the PC about the coordination offer for flight A.
4. The PC "hooks" flight A by clicking on the coordination offer alert.
5. Flight A now becomes the subject flight of the PC Aid.
6. The PC Aid compares flight A's Entry Trajectory against every other Coordination Trajectory built at the sector.
7. The predicted encounters (if any) are then displayed to the PC (HMI may be implementation specific).
8. The PC Aid builds Speculative Entry Trajectories for flight A at all other levels applicable to the entry boundary, apart from the offered levels.
9. The PC Aid compares flight A's Speculative Entry Trajectories against every other Coordination Trajectory built at the sector.
10. The predicted encounters (if any) are then displayed to the PC in an elevation view HMI component (this HMI may be implementation specific).
11. The PC may now decide to use the elevation view HMI, or different (implementation specific) HMI component to assess a different entry boundary coordination level, <PC Probes Tentative Level>.
12. The PC may now decide to use assess tentative coordination constraints, <PC Probes Tentative Coordination Constraints>.
13. The PC may decide to consult with their Tactical Controller about whether any coordination into the sector is acceptable, or to alert them to any potential encounters.
14. Once the PC is satisfied with either the offered coordination or a revised tentative coordination then they may decide to accept the offer.

15. If the PC cannot find an acceptable coordination into the sector then they may decide to reject the offer.

16. The use case ends when the offer for flight A is either accepted into the sector or Rejected.

5.2.1.8 Alternative Flows

5.2.1.8.1 PC Probes Tentative Level

11. The PC selects a tentative level (or range of levels) by selecting a level using either the elevation view HMI component or alternative coordination HMI component.

12. The PC Aid builds a Tentative Entry Trajectory for flight A at the selected level(s).

13. The PC Aid compares flight A's Tentative Entry Trajectory (remember there may be more than one trajectory if multi-level coordination) against every other Coordination Trajectory built at the sector.

14. The predicted encounters (if any) are then displayed to the PC (HMI may be implementation specific).

15. The PC may now decide to assess another different tentative entry boundary coordination level, <PC Probes Tentative Level>.

16. The PC may now decide to revise the coordinated level to the tentative level.

17. The PC may cancel the tentative probe at any time and return to the coordination offer.

18. The flow continues at step 12.

5.2.1.8.2 PC Probes Tentative Coordination Constraints

12. The PC selects tentative coordination constraint(s).

13. The PC Aid builds a Tentative Entry Trajectory for flight A incorporating the selected coordination constraint(s).

14. The PC Aid compares flight A's Tentative Entry Trajectory (remember there may be more than one trajectory if multi-level coordination) against every other Coordination Trajectory built at the sector.

15. The predicted encounters (if any) are then displayed to the PC (HMI may be implementation specific).

16. The PC may now decide to assess another different tentative entry boundary coordination constraint, <PC Probes Tentative Coordination Constraints>.

17. The PC may now decide to revise the coordination with the tentative coordination constraints.

18. The PC may cancel the tentative probe at any time and return to the coordination offer.

19. The flow continues at step 13.

5.2.2 Use Case 2: MTCD-Supported Assessment of Exit Coordination

5.2.2.1 Scope and Summary

This use case describes how the Planning Controller manages the Coordination of a flight out of their sector using the PC Aid.

The use case begins when a flight is accepted into the sector. The use case ends when the flight is accepted out of the sector.

After a flight has been accepted into the sector it is then the responsibility of the PC to coordinate the flight out of the sector. The PC selects the flight to access the exit coordination HMI component. The

system automatically populates the exit coordination details with the most suitable exit level (XFL) for the aircraft (based on the aircraft's Requested Flight Level and performance) and the next sector name. The system will then show the PC any planning encounters detected which relate to that flight's exit coordination. The PC then has the following options:

- S/he could keep the exit level as it is and allow it to be sent to the next sector (which will be done automatically at the co-ordination time). If the system showed any encounters then it may be expected that the receiving sector will try to revise this coordination;

- S/he could "What If" probe another level (or range of levels) to find an exit level which is free of planning encounters. The system would update the next sector automatically if required, or give the PC a choice of next sectors if the next sector was ambiguous (e.g. vertical coordination where there are more than two sector volumes on the other side of the vertical boundary).

5.2.2.2 Actors

Offering Sector Planner Controller (primary).

Receiving Sector Planner Controller (support).

Offering Sector Tactical Controller (support).

5.2.2.3 Pre-conditions

The offering sector is equipped with the "PC Aid".

5.2.2.4 Post-conditions

5.2.2.4.1 Success end state

The flight is coordinated out of the sector (i.e. the receiving sector has accepted the offer sent by the offering sector).

5.2.2.4.2 Failed end state

If the realisation of the Use Case failed then the flight would not be coordinated out of the sector. A phone call is necessary.

5.2.2.5 Notes

The offering and receiving of coordination offers between sectors is supported either by existing systems or by systems provided by SESAR projects other than P04.07.02. The P04.07.02 concept does not change the underlying coordination process between sectors.

Flights may be "Hooked" by clicking on their Track Data Block (TDB) or on selected other components where their call-sign appears. Hooking a flight will cause that flight to be the subject flight of any PC Aid tools which are open.

5.2.2.6 Trigger

The use case starts when a flight is accepted into the offering sector.

5.2.2.7 Main Flow

1. The receiving sector accepts a coordination offer for flight A.

2. The PC Aid attempts to:

   a) find a suitable exit level, and

   b) identify the corresponding next sector

such that flight A is given the most efficient route and level as possible and its coordination out of the sector is conflict free <PC Aid selects exit level and next sector>.

3. If the PC Aid can find a suitable exit level and next sector then it will update flight A's EFS to show that the exit boundary coordination has been Set. If the PC Aid cannot find a suitable exit level or next sector then the exit boundary coordination field of flight A's EFS will remain blank and the PC will have to <manually select exit level and next sector>.

4. If flight A's exit boundary coordination has been set then, at a system defined time, a coordination offer for flight A will be sent from the offering sector to the receiving sector.

5. If the coordination offer is revised by the receiving sector then flight A's EFS and Primary Exit Trajectory will be updated to show the revision(s).

6. If the coordination offer is rejected by the receiving sector then flight A's EFS will be highlighted to the PC and the PC will be required to <manually select exit level and next sector> and then manually send the offer.

7. The use case ends when the receiving sector accepts the offer for flight A.

5.2.2.8 Alternative Flows

5.2.2.8.1 Manually select exit level and next sector

7. The PC hooks flight A.

8. The PC Aid builds Speculative Exit Trajectories for flight A at all levels applicable to the exit boundary (apart from any levels at which Primary or Tentative Exit Trajectories are being built).

9. The PC Aid compares flight A's Speculative Exit Trajectories against every other Primary Coordination Trajectory built at the sector.

10. The predicted encounters (if any) are then displayed to the PC in an elevation view HMI component (this HMI may be implementation specific).

11. Flight A's predicted vertical profile is also displayed in the elevation view HMI component.

12. The PC uses the elevation view HMI component (or alternative coordination HMI component)to choose an exit boundary coordination level.

13. The PC Aid builds a Tentative Exit Trajectory at that level.

14. The PC Aid compares flight A's Tentative Exit Trajectory against every other Primary Coordination Trajectory built at the sector.

15. The predicted encounters (if any) are then displayed to the PC (HMI may be implementation specific).

16. The PC Aid may be able to identify the appropriate next sector automatically (based on the sector exit boundary and exit level). If not then the PC will be able to select the next sector from a list.

17. The PC then Sets flight A's exit boundary coordination.

18. The PC Aid builds a Primary Exit Trajectory at the set exit level(s).

19. The flow continues at step 7.

5.2.2.8.2 PC Aid selects exit level and next sector

3. The PC Aid identifies a range of levels that flight A could achieve by the sector exit boundary (taking into account aircraft performance and flight A's Requested Flight Level). These levels will be ranked in order of preference (with respect to the Requested Flight Level).

4. The PC Aid builds Speculative Exit Trajectories at each identified level.

5. The PC Aid compares flight A's Speculative Exit Trajectories against every other Primary Coordination Trajectory built at the sector.

6. The most preferred level that is found to be conflict free will be selected as the exit level.

7. The PC Aid then identifies the appropriate next sector (based on the sector exit boundary and exit level).

8. The PC Aid Sets flight A's exit boundary coordination and builds a Primary Exit Trajectory at each of the set exit levels.

9. The flow continues at step 3.

5.2.3 Use Case 3: Integrated Coordination over the Entry Boundary

5.2.3.1 Scope and Summary

This use case describes the process of Integrated Coordination (IC) over the sector entry boundary.

The use case begins when a coordination offer for a flight is received by the sector. The use case ends when the offer is either accepted into the sector by IC or referred to the PC for manual (MTCD-supported) assessment (see Use Case 1).

5.2.3.2 Actors

Integrated Coordination (primary).

5.2.3.3 Pre-conditions

The receiving sector is equipped with the "PC Aid".

5.2.3.4 Post-conditions

5.2.3.4.1 Success end state

The flight's entry coordination offer is accepted into the receiving sector.

5.2.3.4.2 Failed end state

If the realisation of the Use Case failed then the flight's entry coordination offer would be referred to the PC for manual (MTCD-supported) assessment (see Use Case 1).

5.2.3.5 Notes

The offering and receiving of coordination offers between sectors is supported either by existing systems or by systems provided by SESAR projects other than P04.07.02. The P04.07.02 concept does not change the underlying coordination process between sectors.

5.2.3.6 Trigger

The use case starts when a Coordination offer for a flight is received by the sector.

5.2.3.7 Main Flow

1. The receiving sector receives a coordination offer for flight A.

2. The PC Aid builds a Primary Entry Trajectory for flight A at each of the offered levels.

3. The PC Aid compares flight A's Primary Entry Trajectory against every other Primary Coordination Trajectory built at the sector.

4. Integrated Coordination checks flight A's entry coordination against a rule base. The primary rule is that no planning encounters are detected against flight A's Primary Entry Trajectory. Secondary rules may cover tactical encounters, time parameters and level use. These rules may also be sector specific.

5. If flight A's entry coordination passes IC's rule base then IC Accepts flight A into the sector. If flight A's entry coordination doesn't pass IC's rule base then IC Refers flight A to the PC for manual (MTCD-supported) assessment (see Use Case 1).

6. The use case ends when either the offer for flight A is Accepted into the sector or Referred to the PC.

5.3 Operational Scenario 3: UIR

Note: all figures in the following Use Cases are subject to further validation.

Foreword: although the current concept includes three Separation Services for completeness, the TRACT service is out of the SESAR Solution #27 because its enablers are not available yet and because it has not reached V3 maturity yet

5.3.1 The TRACT service discards a TRACT flight

5.3.1.1 Scope

Component, black-box.

5.3.1.2 Level

Sub function

5.3.1.3 Summary

This Use Case is a generic UC. It is referred to by other UC's.

For whatever reason, TRACT considers a TRACT flight (with a CTO or not) out of its management.

Therefore TRACT has to discard its management of the encounters that involve this flight.

So not only the CTO (if any) of the primary flight has to be removed, but also the CTO of the other flights of the related TRACT encounters <u>if these CTOs are not used to manage any other TRACT encounter</u>.

It is out of the scope of this use case to determine whether the discarded TRACT flight has to be managed again by TRACT at the next resolution cycle, or not.

5.3.1.4 Actors

TRACT (primary actor) detects and manages conflicts up to 25 minutes before they occur.

The **Air Crew** (primary actor) decides to follow or to discard the FMS proposals.

The **Flight system** (support actor) answers the TRACT requests for "reliable RTA interval" information, it revises the Air Trajectory with a new point and a CTO on request, and it continuously monitors that the CTO is achievable.

The **CWP** (support actor) displays information from TRACT to the Controllers. In particular it is in charge of highlighting the TRACT flights ("tag").

5.3.1.5 Pre-conditions

One flight belongs to at least one TRACT encounter.

The flight paths of the i4D-equipped aircraft are synchronized and CPDLC and ADS-C remain connected and available.

5.3.1.6 Post-conditions

5.3.1.6.1 Success end state

The flight is no longer considered as being a TRACT flight and the management of the related TRACT encounters are discarded. All useless CTO's are removed.

5.3.1.6.2 Failed end state

One or more useless or inaccurate CTO's are followed by the aircraft.

5.3.1.7 Notes

The TRACT flight to discard is here called the "primary" flight. The other TRACT flights that are discarded are here "secondary" flights.

5.3.1.8 Trigger

The current Use Case is a sub-function, thus it is called by another Use Case. The trigger is when the calling Use Case needs that one TRACT flight is no longer under TRACT management.

5.3.1.9 Main Flow

1. TRACT checks that the primary TRACT flight (flight A) has a CTO
2. TRACT uplinks the UM336 CPDLC "CANCEL TIME CONSTRAINT" message to flight A
3. The air crew of flight A removes the CTO from the FMS and sends WILCO
4. The Air System of flight A downlinks the EPP data with no CTO any more
5. In parallel, TRACT un-tags the flight A in the CWP so that it appears no longer under TRACT management

The next steps apply to all other TRACT flights that are involved in the TRACT encounters including the flight to discard i.e. the secondary TRACT flights

6. TRACT checks that the secondary TRACT flight (flight B) has a CTO
7. TRACT checks that flight B is not involved in another TRACT encounter
8. TRACT uplinks the UM336 CPDLC "CANCEL TIME CONSTRAINT"message to flight B
9. The air crew of flight B removes the CTO from the FMS and sends WILCO
10. The Air System of flight B downlinks the EPP data with no CTO any more
11. In parallel, TRACT un-tags the flight B in the CWP so that it appears no longer under TRACT management

5.3.1.10　　Alternative Flows

5.3.1.10.1　　Step 1 – the primary TRACT flight to discard has no CTO

2. The flow continues at step 5

5.3.1.10.2　　Step 6 – the secondary TRACT flight to discard has no CTO

7. The flow continues at step 11

5.3.1.10.3　　Step 7 – the secondary TRACT flight is involved in another TRACT encounter

8. The flow continues at step 6 with another secondary TRACT flight

5.3.1.11   Failure Flows

This case should not fail for a human reason because it is unlikely that the air crew refuses or delays the removal of a constraint.

However it may happen that for technical reason the removal of the CTO is delayed or discarded. This case is considered rare enough to not be reflected in the Operational Requirements.

5.3.1.11.1   Step 4 – the EPP data still contains the CTO

This case corresponds to a delay of the air crew in updating the air systems following the reception of the CPDLC message. The ATCO has to be sure that the CTO removal is well taken into account onboard.

4. The EPP data still contains the CTO a time threshold after the CTO removal has been uplinked
5. The CWP warns the controller about the inconsistency
6. The controller and the air crew together make the situation consistent by voice

5.3.1.12   Version Information

SESAR template: "*Overall Target Architecture Activity (OATA) Use Case Template*", version 02.00.00

5.3.2 The three P04.07.02 services working together in a nominal way

5.3.2.1 Scope

System, black box.

5.3.2.2 Level

Summary.

5.3.2.3 Summary

The TRACT service is working at its area level, covering the current sector that is managed by a PC-TC team supported by the two services "CD/R Aid to PC" and "CD/R Aid to TC". The traffic is nominal and it is made of some flights that are i4D-equipped. The traffic presents some potential conflicts between aircraft.

5.3.2.4 Actors

TRACT (primary actor) detects and manages conflicts up to 25 minutes before they occur.

The **PC** (primary actor) coordinates with controllers of the adjacent sectors to set the entry and exit conditions at the boundaries of the sector. S/he also assists the TC in her/his tasks.

The **TC** (primary actor) ensures separation between aircraft within the sector. S/he is also expected to solve conflicts that involve one of the aircraft s/he is responsible of, in case it has been coordinated that s/he had the responsibility for implementing the solution. The TC is the only controller that may use R/T frequency to communicate with air crew of the aircraft s/he is responsible of.

The **Air Crew** (primary actor) decides to modify the FMS parameters according to the CPDLC messages that the Ground system sent. S/he is also the interlocutor of the TC via R/T frequency.

The **"CD/R Aid to PC"** (support actor) supports the PC in detecting and solving conflicts up to 20 minutes before they occur.

The **"CD/R Aid to TC"** (support actor) supports the TC in detecting and solving conflicts up to 6 minutes before they occur.

The **Flight System** (support actor) answers the TRACT requests for "reliable RTA interval" information, it also revises the Air Trajectory with a new point and an CTO. It monitors that the CTO remains achievable.

The **CWP** (support actor) displays information from TRACT to the Controllers. In particular it is in charge of highlighting the TRACT flights ("tag").

The **Controllers of the adjacent sectors** (offstage actors) coordinate with the PC for setting the entry and exit conditions at the boundaries of the sector.

5.3.2.5 Pre-conditions

TRACT is running at ACC level.

The "CD/R Aid to PC" and the "CD/R Aid to TC" are running at CWP level.

The air traffic is made of a mix of i4D-equipped flights and non-equipped flights.

The flight paths of the i4D-equipped aircraft are synchronized between ground and air and CPDLC and ADS-C remain connected and available.

5.3.2.6 Post-conditions

5.3.2.6.1 Success end state

The conflicts are all solved (whatever the solver) before loss of separation

5.3.2.6.2 Failed end state

The safety nets are used to avoid collision as a last resort in case at least one conflict has not been solved.

5.3.2.7 Notes

<empty>

5.3.2.8 Trigger

The use case starts when the three services are running normally. The use case reflects a continuous sequence of actions.

5.3.2.9 Main Flow

The following steps concern the "TRACT" service:

1. Every 3 minutes TRACT gets all Planning Trajectories that cross the TRACT Area in the next 25 minutes and detects potential conflicts up to 25 minutes ahead of time

2. TRACT groups the potential conflicts into TRACT clusters and filters out the TRACT clusters that include conflicts out of TRACT scope

3. TRACT monitors that the conflicts situation remains unchanged during the TRACT computation (up to step 6)

4. For every i4D-equipped aircraft in a TRACT cluster, TRACT uplinks two demands to request the "reliable RTA interval" of the waypoints surrounding the CPA (Closest Point of Approach) of the last conflict the aircraft is involved in. These two intervals will permit to interpolate the "reliable RTA interval" of any geographical point between these two waypoints.

5. The Flight System downlinks the two "reliable RTA intervals" requested by TRACT

6. TRACT computes an optimal global solution. The global solution is made of CTOs that fulfill the following criteria:
   - they are situated at the CPAs (note that each pair of CPAs is overflown at the same time);

- they are achievable with less than ±5% average speed adjustment;
- they fit with the interpolated values of the "reliable RTA interval".

The following steps concern the implementation of the TRACT global solution. These steps are performed for each CTO.

7. TRACT uplinks a CPDLC message including the geographical point and the CTO constraint

8. The CWP tags the aircraft

9. Once the air crew has agreed with the request and the Flight system has been updated, the Flight system downlinks the EPP data including the CTO point

10. TRACT checks that the EPP data includes the CTO point

The following steps concern the "CD/R Aid to PC" service:

11. In parallel, the "CD/R Aid to PC" continuously detects conflicts up to 20' ahead of time

12. The PC is supported by the "CD/R Aid to PC" to detect conflicts

13. The PC is supported by the "CD/R Aid to PC" to build solutions

14. The PC directly solves some conflicts by negotiating new co-ordination data with controllers of the adjacent sectors.

15. The PC is supported by the "CD/R Aid to PC" to analyze the other conflicts in order to support the TC

The following steps concern the "CD/R air to TC" service:

16. In parallel, the "CD/R Aid to TC" continuously detects conflicts up to 6' ahead of time

17. The TC is supported by the "CD/R Aid to TC" to detect short term conflicts

18. The TC is supported by the "CD/R Aid to TC" to build solutions

19. The TC solves the conflicts by giving instructions/clearances to the air crew

5.3.2.10   Alternative Flows

5.3.2.10.1   Step 3 – a potential conflict disappears during TRACT computation (up to step 6) [14]

4. TRACT detects that a Planning Trajectory has changed, which implies that a potential conflict has disappeared

5. TRACT identifies the TRACT cluster that included the potential conflict that has disappeared, then it re-groups all potential conflicts of that TRACT cluster into one or several new TRACT clusters

6. The flow continues where the detection occurred i.e. already received "reliable RTA intervals" remain applicable [15], and they are ignored if they concern flights that are only involved in the conflict that has disappeared

5.3.2.10.2   Step 3 – a conflict between two clusters appears during TRACT computation (up to step 6)

4. TRACT detects that a Planning Trajectory has changed, which implies that a new potential conflict has appeared between two aircraft of different TRACT clusters

5. TRACT groups together the two TRACT clusters

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[14] After the TRACT computation, the TRACT solution is being implemented and it is then the role of the ATCOs to monitor the relevance of the TRACT solution
[15] The "reliable RTA intervals" are deemed valid during the whole computation phase

6. For the TRACT clusters that remain unchanged, the flow continues where the detection occurred i.e. the already received "reliable RTA intervals" remain applicable

7. Within a time threshold after the TRACT cycle began: for the new TRACT clusters, the flow starts at step4, taking advantage of the already received "reliable RTA intervals" when relevant

8. After a time threshold after the TRACT cycle began: the TRACT does not solve the new TRACT cluster (it will be handled at next cycle)

5.3.2.10.3   Step 3 – a new conflict within a cluster appears during TRACT computation (up to step 6)

4. TRACT detects that a Planning Trajectory has changed, which implies that a new potential conflict has appeared between two aircraft not belonging to different TRACT clusters

5. For the other TRACT clusters, the flow continues where the detection occurred i.e. the already received "reliable RTA intervals" remain applicable

6. Within a time threshold after the TRACT cycle began: for the modified TRACT cluster, the flow starts at step4, taking advantage of the already received "reliable RTA intervals" when relevant

7. After a time threshold after the TRACT cycle began: the TRACT does not solve the modified TRACT cluster (it will be handled at next cycle)

5.3.2.10.4   Step 3 – a conflict is modified during TRACT computation (up to step 6)

4. TRACT detects that a Planning Trajectory has changed, which implies that a potential conflict has changed

5. For the other TRACT clusters, the flow continues where the detection occurred i.e. the already received "reliable RTA intervals" remain applicable

6. Within a time threshold after the TRACT cycle began: for the modified TRACT cluster, the flow starts at step4, taking advantage of the already received "reliable RTA intervals" when relevant

7. After a time threshold after the TRACT cycle began: the TRACT does not solve the modified TRACT cluster (it will be handled at next cycle)

5.3.2.10.5   Step 8 – the air crew refuses the CTO

The air crew may refuse a CTO for several reasons, among which: the FMS warns that the CTO is over the "reliable RTA interval", or the FMS warns that the CTO point cannot be added because of a full USER WAYPOINT database, or the aircraft has already been constrained several times, or to comply with company recommendations, or to not accumulate delays, or any other reason.

8. The Flight system downlinks the refusal message;

9. TRACT discards all TRACT resolutions involving that aircraft (refer the Use Case "TRACT discards a TRACT flight")

10. TRACT stores the fact that this aircraft can't be subject to CTO for the next 3 cycles of resolution. This delay permits to avoid proposing the same CTO at next cycle.

11. The flow continues at step 11 ("CD/R Aid to PC")

5.3.2.10.6   Anywhere – the FMS is unable to comply with the CTO

It may happen that for whatever reason (e.g. severe meteorological conditions) the FMS is not able to reach the CTO while it initially accepted it. In such a case an "RTA missed" is displayed to the air

crew[16], who then contact the ATC. This is the subject of the use case "The flight cancels a CTO that is non-reachable".

5.3.2.10.7   Anywhere – an aircraft deviates from the predicted trajectory

1. TRACT stores that the flight has deviated and put it out of its scope

2. The CWP un-tags the aircraft

3. The "CD/R Aid to PC" computes the deviation trajectory of this flight

4. The "CD/R Aid to TC" upgrades the tactical trajectory of this flight

5. The flow continues at step 11 ("CD/R Aid to PC")

5.3.2.11   Failure Flows

5.3.2.11.1   Step 7 –TRACT implements a wrong solution

11. The "CD/R Aid to PC" detects the unsolved conflict once it is 20 minutes ahead of time

12. The PC assesses the traffic with support of the "CD/R Aid to PC" and s/he detects that TRACT is wrong

13. The PC warns the TC that TRACT is wrong

14. The "CD/R Aid to TC" detects the unsolved conflict once it is 6 minutes ahead of time

15. The TC assesses the traffic with support of both the PC and the "CD/R Aid to TC" and s/he detects that TRACT is wrong

16. The TC implements its own solution (refer the Use Case "The ATCO cancels a TRACT solution")

5.3.2.11.2   Step 11 – the "CD/R Aid to PC" wrongly supports the PC

11. The "CD/R Aid to PC" does not detect a conflict or it wrongly supports the PC task of resolution (e.g. wrong what-if)

12. The PC does not solve that conflict

13. The "CD/R Aid to TC" detects the conflict once it is 6 minutes ahead of time

5.3.2.11.3   Step 16 – the "CD/R Aid to TC" wrongly supports the TC

16. The "CD/R Aid to TC" does not detect a conflict or it wrongly supports the TC task of resolution (e.g. wrong what-if)

17. The TC does not solve that conflict

18. The use case ends when a safety net is triggered

5.3.2.12   Version Information

SESAR template: "*Overall Target Architecture Activity (OATA) Use Case Template*", version 02.00.00

5.3.3 The flight cancels a CTO that is non-reachable

5.3.3.1 Scope

Component, black box.

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[16] The corresponding EPP report is not directly used by the TRACT service because it does not reflect the future behaviour of the aircraft. The air crew may choose either to discard the CTO or to increase the aircraft capabilities.

5.3.3.2 Level

User Goal

5.3.3.3 Summary

The CTO has been implemented because it fitted with the "reliable RTA interval" and the air crew has agreed with it. However, due to change of circumstances (e.g. unexpected wind after the CTO has been implemented) the constraint can't be reached any more according to the FMS. The CTO has to be removed and the flight will revert back to its optimal cost index.

5.3.3.4 Actors

The **TRACT** service (primary actor) detects and manages conflicts up to 25 minutes before they occur.

The **Air Crew** (primary actor) decides to follow or to discard the FMS proposals.

The **TC** (primary actor) removes the CTO in the Ground systems following air crew information.

The **Flight System** (support actor) answers the TRACT requests for "reliable RTA interval" information, it also revises the Air TP with a new point and a CTO. It monitors that the CTO remains reachable.

The **CWP** (support actor) displays information from TRACT to the Controllers. In particular it is in charge of highlighting the TRACT flights ("tag").

5.3.3.5 Pre-conditions

TRACT has set a CTO on the flight.

The flight paths of the i4D-equipped aircraft are synchronized and CPDLC and ADS-C remain connected and available.

5.3.3.6 Post-conditions

5.3.3.6.1 Success end state

The flight has no CTO. ATCOs have to manage the potential conflict by their own.

5.3.3.6.2 Failed end state

<empty>

5.3.3.7 Notes

<empty>

5.3.3.8 Trigger

The FMS calculates that the CTO is no longer reachable.

5.3.3.9 Main Flow

1. The FMS detects that the CTO is no longer reachable
2. The FMS warns the air crew
3. The air crew communicates to the TC that the flight can't reach the CTO
4. The TC accepts the cancellation of the CTO
5. The air crew manually removes the CTO from the FMS

6.   The TC manually removes the CTO from the Ground Systems

7.   TRACT discards all TRACT resolutions involving that aircraft (refer the Use Case "TRACT discards a TRACT flight")

8.   The Flight System downlinks the EPP data in which no CTO is present

5.3.3.10   Alternative Flows

<empty>

5.3.3.11   Failure Flows

<empty>

5.3.3.12   Version Information

SESAR template: "*Overall Target Architecture Activity (OATA) Use Case Template*", version 02.00.00

5.3.4 The ATCO cancels a TRACT solution

5.3.4.1 Scope

Component, black box.

5.3.4.2 Level

User Goal

5.3.4.3 Summary

The TRACT service has implemented its solution. However the ATCO assesses that the situation is not completely safe, or s/he prefers to adopt an immediate and definitive solution e.g. a change of FL. The ATCO therefore implements her/his own solution and inputs the system with the corresponding instructions.

The TRACT service detects these ATCO inputs and considers that the situation is now under ATCO close management and discards all CTOs that are now useless.

5.3.4.4 Actors

The **TRACT** service (primary actor) detects and manages conflicts up to 25 minutes before they occur. It discards its own solution when an input of the ATCO indicates that the situation is now under ATCO manual management.

The **Air Crew** (primary actor) decides to remove the CTO following a request by TRACT.

The **TC** (primary actor) implements her/his own resolution.

The **CWP** (support actor) displays information from the TRACT to the Controllers. In particular it is in charge of highlighting the TRACT flights ("tag").

5.3.4.5 Pre-conditions

TRACT has set a CTO on the flight.

The flight paths of the i4D-equipped aircraft are synchronized and CPDLC and ADS-C remain connected and available.

5.3.4.6 Post-conditions

5.3.4.6.1 Success end state

The flight has no CTO. ATCOs have to manage it by their own.

5.3.4.6.2 Failed end state

<empty>

5.3.4.7 Notes

<empty>

5.3.4.8 Trigger

The TC decides to implement its own solution by changing the behaviour of a TRACT flight.

5.3.4.9 Main Flow

1. The TC informs the air crew about the removal of the CTO constraint;

2. The TC inputs TRACT with the removal of the CTO;

3. The TC provides the air crew with an instruction of control and inputs it in the Ground system

4. TRACT discards all TRACT resolutions involving that aircraft (refer the Use Case "TRACT discards a TRACT flight")

5.3.4.10 Alternative Flows

<empty>

5.3.4.11 Failure Flows

<empty>

5.3.4.12 Version Information

SESAR template: "*Overall Target Architecture Activity (OATA) Use Case Template*", version 02.00.00

6 Requirements

6.1 Principles

Important: to display all fields of the requirements, it is necessary that the reader is provided with the

non-printable characters (toggle the ¶ button if necessary).

6.1.1 Notation

It has been adopted the following principle to identify the Operational Requirements:

- "REQ-04.07.02-OSED-" as the prefix suggested by SJU template;
- XXXX : four digit representing the service:
    - o 0001 for "CD/R Aid to TC";
    - o 0002 for "CD/R Aid to PC";
    - o 0003 for "TRACT";
    - o 0004 for interactions between services.
- YYYY : four digit representing:
    - o The first digit: the "depth" of the requirement : from 1 (highest level) to 7 (lowest level);
    - o The three other digits: an incrementing number in the depth.

6.1.2 Links between requirements

It has to be noted that the requirements have been written in a top-down method, so an OR of a given depth may be followed by one or several ORs of a lower depth which provide sub-requirements to meet it.

There is no commitment on the completion of an OR by the ORs at a lowest level. To conform to all the "children" ORs does not automatically imply the complete conformance to the "parent OR".

6.2 Requirements

[REQ]

Identifier	REQ-04.07.02-OSED-0000.0001
Requirement	The system shall provide at least one of the following services in an En-Route ACC: - CD/R Aid for the Tactical Controller ("TC Aid") - CD/R Aid for the Planner Controller ("PC Aid") - Trajectory Adjustment through Constraint of Time (TRACT)
Title	P04.07.02 Concept
Status	<In Progress>
Rationale	Depending on the environment, some services are necessary whereas some are not (e.g. TRACT provides the most benefit when most aircraft are in cruise but can do little when most aircraft are in climb/descent).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-	N/A

		Provide Separation Assurance	
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.1 Requirements of the "CD/R Aid to the TC" service

The "CD/R Aid to the TC" is part of the SESAR Solution #27. As such, this service has been V3-validated through V3 validation activities in SESAR 1.

However, the scope of the SESAR validation exercises could not address all aspects of the "CD/R Aid to the TC", and some requirements are still "in progress".

This does not question the V3 level of the core service. This core service is complete as a first version of the "CD/R Aid to the TC" release. As such, the core service already provides major operational improvements.

To issue a full service, the industrialization phase will have to confirm the aspects that have not been formally V3-validated.

6.2.1.1 Basic Requirements

[REQ]

Identifier	REQ-04.07.02-OSED-0001.1001
Requirement	The system shall provide the "TC Aid" service at every CWP.
Title	"TC Aid" service
Status	<Validated>
Rationale	Depends on a local decision from ops people. Recommendations on the relevant conditions & environment for implementing the service shall be provided.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0000.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2001
Requirement	At each CWP, an eligible operator shall be capable of enabling or disabling the "TC Aid".
Title	Switch off/on the "TC Aid"
Status	<Validated>
Rationale	Switch off/on the "TC Aid"
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-	N/A

		Provide Tactical Separation Assurance	
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3001
Requirement	The "TC Aid" shall be capable of operating within all types of airspace.
Title	Airspace where "TC Aid" applies
Status	<In Progress>
Rationale	Examples: En-route airspace, TMA, Free Route Airspace, Approach areas.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2005
Requirement	The "TC Aid" shall perform the following processing for the respective flights each time when it receives new clearance and/or track data: a) determine deviations from given lateral, vertical and speed clearances b) determine tactical trajectories of the aircraft concerned c) determine potential conflicts based upon the tactical trajectory and issue related conflict reports d) determine what-else probing data for the decision making support on the basis of tactical trajectories e) determine co-ordination trajectories based on the current flight profile and co-ordination data f) determine potential planning conflicts based upon the co-ordination trajectory and issue related conflict reports g) determine what-else probing data for the decision making support on the basis of co-ordination trajectories
Title	General Processing Functionalities
Status	<In Progress>
Rationale	Condition for detection of tactical encounters, what-else probing and deviations.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2002
Requirement	The "TC Aid" shall accept, process and verify input data from the flight data processing systems and the surveillance data processing systems for any active flight.
Title	Data input to "TC Aid"
Status	<In Progress>
Rationale	FDPS and SDPS are the main data sources for the TC Aid. This includes clearance and co-ordination data, flight plan data, radar and track data
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2042
Requirement	The "TC Aid" shall provide at least the following processed data to the ATM system for any processed flight: - Tactical trajectory - Co-ordination trajectory - Alerts - Warnings - Resolution advisories.
Title	Data output from "TC Aid"
Status	<In Progress>
Rationale	Other processed data might be useful to provide, to be further defined.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.2 Pre-Processing Requirements

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3122
Requirement	For a given aircraft, the "TC Aid" shall determine the applicable route based on the flight plan data, SID, STAR and approach dedication and the active limit of the route clearance.
Title	Route Determination
Status	<In Progress>
Rationale	Defines route as pre-requisite for tactical and co-ordination trajectory calculation

Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3091
Requirement	The "TC Aid" shall accept lateral clearance input from the controller and consider the reaction time of controller and pilot for calculation of the tactical trajectory..
Title	Lateral clearance processing
Status	<Validated>
Rationale	A fixed time buffer plus an additional variable time buffer dependant on the turn progress of the aircraft shall be used.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2043
Requirement	For a given aircraft, the "TC Aid" shall calculate a tactical reference flight path based on the route and the active lateral clearance(s)..
Title	Tactical Reference Flight Path
Status	<Validated>
Rationale	This reference is required for flight path monitoring in order to determine lateral deviations. The tactical reference flight path reflects the current clearance status of the flight.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3123
Requirement	For a given aircraft, the "TC Aid" shall calculate a co-ordination reference flight path that reflects the current lateral clearances and co-ordination for the

	aircraft.
Title	Co-ordination Reference Flight Path
Status	<In Progress>
Rationale	This reference is required for the lateral part of the co-ordination trajectory. The co-ordination reference flight path reflects the current coordination status of the flight.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3124
Requirement	The TC Aid shall accept vertical clearance input from the controller and consider the reaction time of controller and pilot for calculation of the tactical trajectory.
Title	Vertical Clearance Processing
Status	<Validated>
Rationale	CFL, vertical rate
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3089
Requirement	Each aircraft shall have a Cleared Flight Level (CFL) based on the system flight plan data, defaulted to the Entry Flight Level (NFL) of the first controlled sector if no CFL is available, or be dealt with as if it is CFL deviated if neither CFL nor NFL are available..
Title	CFL setting
Status	<Validated>
Rationale	Makes sure that each flight has a CFL. Pre-requisite for trajectory calculation and FPM.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	PCS-DOD-04.02-	N/A

		Provide Tactical Separation Assurance	
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3007
Requirement	The "TC Aid" shall base the speed of an aircraft on the ground speed, taking into account the expected speed change at a different altitude.
Title	Predict the Ground speed
Status	<Validated>
Rationale	For the expected speed increase/decrease with increasing/decreasing altitude a constant acceleration is assumed.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3112
Requirement	The "TC Aid" shall base the speed and altitude change of the aircraft on the actual rate (or cleared rate if available) from AFL to CFL if the aircraft climbs or descends towards the CFL.
Title	Predict the vertical trajectory
Status	<Validated>
Rationale	Predict the vertical trajectory
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3008
Requirement	The "TC Aid" shall take into account wind data when Enhanced-Mode S Data are available.
Title	Enhanced Mode S Data
Status	<In Progress>
Rationale	Improves accuracy of trajectory prediction with airborne data.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>

<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3125
Requirement	The TC Aid shall determine the phase of flight for each aircraft depending on the route clearance limit and the actual position of the aircraft.
Title	Determination of Flight Phase
Status	<In Progress>
Rationale	Distinguish between en-route phase and approach phase. Phase of flight is important to determine because different (look ahead time) parameters may apply for different phases of flight.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.3 Flight Path Monitoring – Lateral

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2004
Requirement	The "TC Aid" shall determine if an aircraft deviates from its lateral clearances: a) Lateral route deviation; b) No valid flight plan data available, beyond route, before route (noTT).
Title	Conditions for a lateral Deviation
Status	<Validated>
Rationale	A deviation assumes that the aircraft does not follow the current controller clearance..
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3024
Requirement	The "TC Aid" shall detect a NoTT deviation if a) no valid route information is available for a flight; b) the aircraft is beyond or before its cleared (filed) route.

Title	Detection of unavailability of a route information
Status	<Validated>
Rationale	Also the status "near" NoTT should be detected if the aircraft is close to the last known way point
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4037
Requirement	A route deviation shall be discarded if a NoTT status has been detected.
Title	Discard a route deviation
Status	<Validated>
Rationale	Route deviation not meaningful anymore if no route is available.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3024	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3020
Requirement	The "TC Aid" shall detect route deviations if all the following conditions are met: a) the actual track position differs from the cleared flight path and the closest waypoint position by more than a parameter, b) the actual track position is outside a radius around a waypoint, or a route deviation existed in the previous cycle
Title	Detection of a route deviation
Status	<Validated>
Rationale	The latest sub condition avoids a cancellation of an existing route deviation if an aircraft enters a way point radius.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>

<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Process>	PCS-DOD-04.02-Ensure_Trajectory_Adherence	N/A
<APPLIES TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

1 - a/c has route deviation;
To be maintained also
around waypoint ⬤
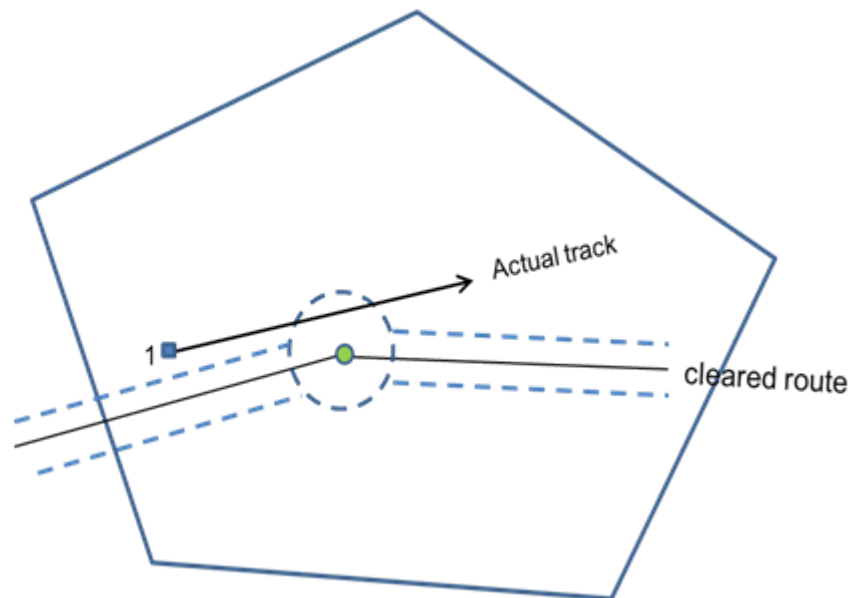
6.2.1.4 Flight Path Monitoring – Vertical

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3126
Requirement	The "TC Aid" shall determine if an aircraft deviates from its vertical clearances based on the following detected conditions: a) Cleared flight level (CFL) deviation; b) Vertical rate deviation; c) Level Bust.
Title	Conditions for a vertical Deviation
Status	<Validated>
Rationale	A deviation assumes that the aircraft does not follow the current controller clearance.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Ensure_Trajectory_Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3022

Requirement	A Cleared Flight Level (CFL) deviation shall be detected if the aircraft leaves a CFL Deviation Window by more than a threshold parameter.
Title	Detection of a CFL deviation
Status	<Validated>
Rationale	When a new AFL is available, the CFL Deviation Window shall be calculated as the range between the previous AFL and the CFL.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Ensure_Trajectory_Adherence	N/A
<APPLIES TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3090
Requirement	The system shall cancel a cleared vertical rate if the difference between AFL and CFL is less than a threshold.
Title	Cancel a vertical rate clearance
Status	<Validated>
Rationale	Defines validity of vertical rate clearance.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3021
Requirement	The "TC Aid" shall detect vertical rate deviations if the actual rate differs from the cleared vertical rate by more than a parameter
Title	Detection of a cleared rate deviation
Status	<Validated>
Rationale	Several cases need to be considered (e.g. sharp vertical rate, "or more" rate). Reaction time and aircraft performance need to be considered (latency). No CFL Deviation must be present at the same time..
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>

<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3023
Requirement	The "TC Aid" shall detect a Level Bust if the actual vertical rate for climb and/or descent close to the CFL exceeds a threshold.
Title	Detection of a Level Bust
Status	<In Progress>
Rationale	Level bust provides early indication that cleared flight level might be violated.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.5 Flight Path Monitoring – Mode S enhanced surveillance

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3026
Requirement	The "TC Aid" shall detect if the controller clearance data differ from the following Mode-S DAP: a) Mode S Selected Flight Level Monitoring b) Mode S Heading Monitoring c) Mode S Indicated Air Speed Monitoring.
Title	Adherence of downlink parameters to clearances
Status	<Validated>
Rationale	Reaction time of controllers and pilots needs to be taken into account (latency).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0001.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.6 Tactical Trajectory Prediction

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3127
Requirement	The "TC Aid" shall calculate tactical trajectories for all aircraft currently known to the system describing the expected future movement of the aircraft from the current position up to the next sector entry but at least for a time parameter if the aircraft is close to the sector boundary.
Title	Tactical Trajectory Prediction
Status	<Validated>
Rationale	The tactical trajectory starts from the current aircraft position and ends at the sector boundary. In case the aircraft is close to the sector boundary the tactical trajectory looks for a certain time parameter into the adjacent sector. Separately for the lateral aspect and the vertical aspect; in order to model lateral uncertainty a second tactical trajectory should be created that approximates the flight profile around waypoints.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3093
Requirement	If no lateral deviation has been detected by FPM, the "TC Aid" shall calculate the lateral part of the Tactical Trajectory from the actual position: a) NO LATERAL CLEARANCE: along the cleared route; b) OPEN HEADING: to extrapolated lat/long position based on the cleared heading c) ON-ROUTE DIRECT: to the cleared fix, and then along the cleared route d) OFF ROUTE DIRECT: to the cleared fix
Title	Conditions to predict the lateral part of the trajectory
Status	<Validated>
Rationale	Lateral part of the Tactical Trajectory (no deviation detected). In case of an OFF ROUTE DIRECT the trajectory ends at the fix.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3010
Requirement	If FPM has detected a lateral deviation the "TC Aid" shall calculate the lateral part of the tactical trajectory from the current track position of the aircraft to

	the extrapolated lat/long positions based on the current track and ground speed whitin a time horizon.
Title	Predict the lateral trajectory in case of a lateral deviation
Status	<Validated>
Rationale	In case of lateral deviation the current aircraft behaviour is assumed.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2004	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3011
Requirement	The "TC Aid" shall calculate the vertical part of the tactical trajectory either based on the actual rate plus a rate buffer if the aircraft shows any vertical movement, or else based on a minimum and maximum rate if the aircraft is still at level and the controller has given a vertical clearance beforehand.
Title	Predict the vertical part of the trajectory
Status	<Validated>
Rationale	The actual rate is derived from downlinked Mode-S DAP if available. Rate buffer reflects vertical uncertainty; several cases need to be distinguished (e.g. in case of vertical deviation). The change of the ground speed during climb or descent shall be respected
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2004	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.7 Conflict Detection - Tactical Conflict Search

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2007
Requirement	The "TC Aid" shall detect potential conflicts within a defined conflict area within a certain time horizon between any two aircraft by determining the minimal lateral and vertical distances reached along the predicted tactical trajectories of the two aircraft
Title	"TC Aid" detection of tactical encounters
Status	<Validated>
Rationale	At least one aircraft needs to be within the conflict detection area.
Category	<Operational>
Validation Method	<Real Time Simulation>

Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3120
Requirement	For the "TC Aid" detection of tactical encounters, an eligible operator shall be capable of configuring different lateral and vertical separation parameters for specific aircraft.
Title	Thresholds depending on aircraft
Status	<Validated>
Rationale	Example: State aircraft and non-RVSM equipped aircraft need a vertical separation minimum of 2000ft
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3035
Requirement	An eligible operator shall be capable of configuring different lateral and vertical separation parameters and TC Conflict Search look ahead horizon depending on the airspace.
Title	Thresholds depending on airspace
Status	<Validated>
Rationale	This may reflect military areas, holding volumes or certain parts of a sector for which other separation minima apply.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4051
Requirement	An eligible operator shall be capable of excluding Airspace volumes from Conflict Detection.
Title	Airspace out of the "TC Aid" detection of encounters
Status	<In Progress>

Rationale	Airspace out of the "TC Aid" detection of encounters
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3032	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3032
Requirement	The "TC Aid" shall detect encounters between aircraft and airspace volumes (e.g. TRA).
Title	Encounters between aircraft and airspace
Status	<In Progress>
Rationale	Encounters between aircraft and airspace
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3094
Requirement	The "TC Aid" shall take into accout a ground speed uncertainty for the identification of tactical encounters.
Title	Ground speed uncertainty
Status	<Validated>
Rationale	Helps e.g. to identify aircraft which are on parallel tracks (speed change does not decrease or increase lateral separation).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3027
Requirement	The "TC Aid" shall identify aircraft pairs that have the potential, based on the existing clearance, to infringe the lateral separation of interest within a configurable look ahead time.

Title	Lateral conflict detection
Status	<Validated>
Rationale	Check lateral separation minima…
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3028
Requirement	The "TC Aid" shall identify aircraft pairs that have the potential, based on the existing clearance, to infringe the vertical separation of interest within a configurable look ahead time based on the interval between minimum FL and maximum FL
Title	Vertical conflict detection
Status	<Validated>
Rationale	Check vertical minima. The minimum and maximum FL shall be calculated by taking into account the vertical minimum and maximum rate buffer of the trajectories.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3041
Requirement	The "TC Aid" shall detect a potential conflict if a time interval exists where all three conditions with regards to area applicability (REQ-04.07.02-OSED-0001.3035), lateral infringement (REQ-04.07.02-OSED-0001.3027) and vertical infringement (REQ-04.07.02-OSED-0001.3028) are fulfilled.
Title	Potential Conflict Detection
Status	<Validated>
Rationale	Determine conditions for potential conflict detection.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.8 Tactical Conflict Resolution Advisory

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3038
Requirement	The "TC Aid" shall perform a What Else Probing periodically whenever new data is available by simulating different possible (fictive) clearances for a particular aircraft and determine if such a clearance would result in a conflict with any of the other aircraft for which the currently active clearances are assumed.
Title	TC Resolution Advisory
Status	<Validated>
Rationale	What-Else look ahead time should always be longer than TC conflict detection look ahead time because the probing must not trigger an alarm after implementation.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2009	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4009
Requirement	The "TC Aid" shall calculate lateral and vertical what-else probes at each track update for all aircraft: a) Level clearances including rates (all suitable level clearances multiplied by number of vertical rates); b) Direct clearances – for fixes on route and off route. c) Open heading/track clearances (relative and absolute open heading clearances in steps).
Title	What-else probes
Status	<Validated>
Rationale	No speed probing needs to be applied. Result of the probes delivers whether clearance is conflict-free or not. About 600 clearance probes to be calculated during each track update.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3038	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.9 Co-ordination Trajectory

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2034
Requirement	The "TC Aid" shall calculate a co-ordination trajectory for all aircraft currently known to the system describing the expected future movement of the aircraft with regards to the valid lateral and vertical co-ordination. The lateral co-ordination status will be derived from the co-ordination reference trajectory and the vertical status will be derived from the Entry Flight Level (NFL) and Supplementary Flight Level (SFL) with respect to the coordinated sector entries.
Title	Conditions for Co-ordination Trajectory
Status	<In Progress>
Rationale	Separately for the lateral aspect and the vertical aspect; in order to model lateral uncertainty a second co-ordination trajectory should be created that approximates the flight profile around waypoints.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3100
Requirement	The "TC Aid" shall calculate the co-ordination trajectory up to the Initial Approach Fix or the en-route clearance limit.
Title	Range of Co-ordination Trajectory
Status	<In Progress>
Rationale	Range of Co-ordination Trajectory
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2034	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3095
Requirement	The "TC Aid" shall use the co-ordination reference flight path for the determination of the lateral part of the co-ordination trajectory
Title	Lateral part of Co-ordination Trajectory
Status	<In Progress>
Rationale	Need to distinguish current sector and downstream sectors.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2034	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4052
Requirement	The "TC Aid" shall calculate the speed change of the aircraft and the sector entry times of the Co-ordination Trajectory assuming a nominal vertical rate if NFL and XFL are different.
Title	Speed part of Co-ordination Trajectory
Status	<In Progress>
Rationale	The speed increase/decrease with changing altitude will be modelled in order to improve the estimated time over for the waypoints.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3099	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3099
Requirement	The "TC Aid" shall determine a vertical profile based upon the individual segments of the lateral co-ordination trajectory: a) Actual FL for the current segment b) NFL for all other downstream segments.
Title	Vertical part of Co-ordination Trajectory
Status	<In Progress>
Rationale	Vertical part of Co-ordination Trajectory
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2034	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.10   Conflict Detection – Coordination encounters Search

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4041
Requirement	The "TC Aid" shall detect Coordination encounters within a defined conflict area within a certain time horizon between any two aircraft by determining the

	minimal lateral and vertical distances reached along the extrapolated co-ordination trajectories of the two aircraft
Title	Detection of Coordination Conflicts
Status	<In Progress>
Rationale	Detection of Co-ordination Conflicts
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3102	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4061
Requirement	For the "TC Aid" detection of coordination encounters, an eligible operator shall be capable of configuring different lateral and vertical separation parameters for specific aircraft.
Title	Thresholds depending on aircraft
Status	<In Progress>
Rationale	Example: State aircraft and non-RVSM equipped aircraft need a vertical separation minimum of 2000ft
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3102	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4062
Requirement	For the "TC Aid" detection of coordination encounters, an eligible operator shall be capable of configuring different lateral and vertical separation parameters and Coordination Encounter Search look ahead horizon depending on the airspace.
Title	Area applicability
Status	<In Progress>
Rationale	This may reflect military areas, holding volumes or certain parts of a sector for which other separation minima apply.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3102	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	PCS-DOD-04.02-	N/A

		Provide Tactical Separation Assurance	
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2035
Requirement	The "TC Aid" shall identify aircraft pairs that have the potential, based on the calculated Co-ordination Trajectories, to infringe the horizontal separation of interest within a configurable look ahead time.
Title	Lateral Detection of Coordination Encounters
Status	<In Progress>
Rationale	Lateral Detection of Coordination Encounters
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3101
Requirement	For the identification of Coordination Encounters, the "TC Aid" shall take into account a ground speed uncertainty.
Title	Ground speed uncertainty
Status	<In Progress>
Rationale	Ground speed uncertainty
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2035	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3102
Requirement	The "TC Aid" shall identify aircraft pairs that have the potential, based on the calculated Co-ordination Trajectories, to infringe the vertical separation in the following sectors if the interval between NFL (and SFL if available) of both trajectories is below the vertical separation.
Title	Vertical detection of Coordination Encounter
Status	<In Progress>
Rationale	In the current sector the TC conflict search is being applied
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2035	<Partial>

<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3130
Requirement	The " TC Aid " shall detect a Coordination Encounter if a time interval exists where all three conditions with regards to area applicability (REQ-04.07.02-OSED-4062), lateral infringement (REQ-04.07.02-OSED-0001.2035) and vertical infringement (REQ-04.07.02-OSED-0001.3102) are fulfilled.
Title	Potential Conflict Detection
Status	<In Progress>
Rationale	Determine conditions for coordination encounter
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.11   Coordination Encounter resolution advisory

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2036
Requirement	The "TC Aid" shall provide a What-else probing that is based on the same requirements as for Entry Trajectory calculation and conflict detection.
Title	Computation of a What-else probing
Status	<In Progress>
Rationale	Computation of a What-else probing
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3106
Requirement	For each what-else probing, the "TC Aid" shall probe one NFL within a configurable look ahead time for a single aircraft against the actual traffic situation, i.e. all other Entry Trajectories.
Title	Computation of a What-else probing
Status	<In Progress>
Rationale	The trajectory considered will always assume compliance with the fictive clearance.

Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2036	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.12   Conflict Detection – Dependency Tool

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3128
Requirement	The " TC Aid " shall detect potential dependencies within a defined conflict area within a certain time horizon between the aircraft probed and all other aircraft known to the system by determining the minimal lateral and vertical distances reached along the co-ordination trajectories of the two aircraft.
Title	Dependency Tool
Status	<In Progress>
Rationale	The controller probes one aircraft and gets information about the dependency of this aircraft to other aircraft, in particular an overlap between entry and exit flight levels of the involved aircraft (if the lateral flight paths are closer than the minimum separation distance).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.1.13   Filter algorithms

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3019
Requirement	The "TC Aid" shall display the deviation warnings for aircraft depending on sector frequency status and actual position.
Title	Conditions for displaying a deviation warning
Status	<Validated>
Rationale	Conditions for displaying a deviation warning
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A

<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3037
Requirement	The "TC Aid" shall only display a TC Conflict Search alert at the controller working positions concerned by such alert.
Title	Responsible for solving the encounter
Status	<Validated>
Rationale	Concerned CWP is defined by location of the aircraft and infringement: begin/end of infringement in Area of Responsibility and at least one aircraft located vertically in the sector.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2008	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2008
Requirement	For each tactical encounter, the "TC Aid" shall provide the following information:a) identification of the conflicting aircraft pair b) area for which the conflict has been identified (e.g. default, 3NM, FL410+) c) times relative to the current time, positions and altitude of the beginning of separation infringement on the extrapolated trajectories of the two aircraft d) times relative to the current time, positions and altitude of the Closest Points of Approach (CPA) on the extrapolated trajectories of the two aircraft, as well as the lateral distance between the two points and middle point between those two points e) times relative to the current time, positions, altitude of the end of separation infringement on the extrapolated trajectories of the two aircraft.
Title	Charateristics of an encounter
Status	<Validated>
Rationale	This information should be available at the concerned CWP.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3129
Requirement	The " TC Aid " shall only display a Coordination Encounter Search alert at the controller working positions concerned by such alert.

Title	Responsible for solving the encounter l
Status	<In Progress>
Rationale	Concerned CWP is defined by location of the aircraft and infringement: begin/end of infringement in Area of Responsibility and at least one aircraft located vertically in the sector
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2042	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3104
Requirement	For each Coordination Encounter, the "TC Aid" shall provide the following information: a) the identification of the conflicting aircraft pair b) the times relative to the current time, positions and altitude of the beginning of the separation infringement on the extrapolated trajectories of the two aircraft c) the times relative to the current time, positions and altitude of the Closest Points of Approach (CPA) on the extrapolated trajectories of the two aircraft, as well as the lateral distance between the two points and the middle point between those two points d) the times relative to the current time, positions, altitude of the end of the separation infringement on the extrapolated trajectories of the two aircraft
Title	Characteristics of a Coordination Encounter
Status	<In Progress>
Rationale	This information should be available at the concerned CWP
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2035	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.2 Requirements of the "CD/R Aid to the PC" service

Foreword: although the current concept includes three Separation Services for completeness, the "CD/R aid to the PC" is out of the SESAR Solution #27 because it has not reached V3 maturity yet

6.2.2.1 Basic Requirements

[REQ]

Identifier	REQ-04.07.02-OSED-0002.1002
Requirement	The system shall provide the "PC Aid" service at every CWP.

Title	"PC Aid" service
Status	<In Progress>
Rationale	"PC Aid" service
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0000.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2010
Requirement	At each CWP, an eligible operator shall be capable of enabling or disabling the "PC Aid".
Title	Switch off/on the "PC Aid"
Status	<In Progress>
Rationale	Switch off/on the "PC Aid"
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3041
Requirement	The "PC Aid" shall be capable of operating within all types of airspace.
Title	Airspace where "PC Aid" applies
Status	<In Progress>
Rationale	E.g. sectors whose boundaries are defined by a geographical area and upper and lower levels (which may not be the same throughout the whole sector), with free route airspace, with TMA.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3042
Requirement	The "PC Aid" shall support all possible controller team organisations.

Title	Controllers that "PC Aid" supports
Status	<In Progress>
Rationale	For example single-sector planner, multi-sector planner (MSP) or single person operations (SPO).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3043
Requirement	The "PC Aid" shall support communication between the Planner and Tactical Controllers relating to the traffic situation.
Title	"PC Aid" supports communication with sector team
Status	<In Progress>
Rationale	The content and method of communication is yet to be decided. They may consist of: • TDB point outs (individual flights and encounters); • Coordination constraints and conditions; • Task messages; • As yet undefined messages. So the system needs to be flexible.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3044
Requirement	The "PC Aid" shall support communication between the Planner Controllers working on different sectors relating to the suitable transfer of flights between sectors.
Title	"PC Aid" supports communication between PCs
Status	<In Progress>
Rationale	The content and method of communication is yet to be decided. They may consist of: • TDB point outs (individual flights and encounters); • Coordination constraints and conditions; • Task messages; • As yet undefined messages. So the system needs to be flexible.
Category	<Operational>
Validation Method	<Real Time Simulation>

Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2010	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.2.2 Trajectory Prediction

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2011
Requirement	The "PC Aid" shall predict the trajectory of each flight that either is expected to enter the sector, or is expected to enter the Area of Interest (if any), or is manually selected.
Title	Flights with a "PC Aid" trajectory
Status	<In Progress>
Rationale	Flights with a "PC Aid" trajectory
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3045
Requirement	The "PC Aid" shall predict the trajectory of the flight, taking into account: - flight plan data - aircraft performance - meteorological data - coordination data, including standing agreements - tactical clearances - surveillance (radar) data, if available.
Title	Input data for "PC Aid" trajectory
Status	<In Progress>
Rationale	Input data for "PC Aid" trajectory
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3046
Requirement	The "PC Aid" shall predict the trajectory of the flight, which is capable of handling all phases of flight, methods of navigation and speeds.
Title	Trajectory capabilities
Status	<In Progress>
Rationale	I.e. Climb/Cruise/Descent, Direct routings/Headings, Constant IAS/Mach.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3076
Requirement	The "PC Aid" shall generate trajectories based on tentative coordination data on demand.
Title	Tentative trajectory on demand
Status	<In Progress>
Rationale	Tentative trajectories are used in What-Ifs (when the system shows the results after the controller has selected a possible coordination or clearance).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3077
Requirement	The "PC Aid" shall generate trajectories based on speculative coordination data on demand.
Title	Speculative trajectory on demand
Status	<In Progress>
Rationale	Speculative trajectories are used in What-Else's (when the system shows the controller the results of potential coordinations and clearances other than the current one).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A

<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.2.3 Coordination Trajectory Prediction

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3119
Requirement	The "PC Aid" shall derive a set of Coordination trajectories for each flight that either is expected to enter the sector, or is expected to enter the Area of Interest (if any), or is manually selected.
Title	Coordination Trajectories
Status	<In Progress>
Rationale	Coordination Trajectories
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2012	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4054
Requirement	The "PC Aid" shall create Entry Trajectories at levels that have been identified in the sector entry coordination for the flight (if it is not yet under the control of that sector), or at its current cleared level (if it is under the control of that sector).
Title	Coordination Trajectories at entry
Status	<In Progress>
Rationale	Coordination Trajectories at entry
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3119	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4055
Requirement	The "PC Aid" shall create Exit Trajectories at levels that have been identified in the sector exit coordinations for the flight.
Title	Coordination Trajectories at exit
Status	<In Progress>
Rationale	Coordination Trajectories at exit
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3119	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4056
Requirement	For a coordination that involves a range of levels (a coordinated climb or descent), the "PC Aid" shall create a Coordination Trajectory at every standard flight level from the constraint level to the target level inclusive.
Title	Range of Coordination Trajectories
Status	<In Progress>
Rationale	Range of Coordination Trajectories
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3119	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.2.4 Conflict Detection

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3047
Requirement	The "PC Aid" shall detect planning encounters relating to a flight's entry coordination into the sector, its exit coordination out of the sector and its progress through the sector.
Title	CD/R service from entry to exit
Status	<In Progress>
Rationale	CD/R service from entry to exit
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2012	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3120
Requirement	The "PC Aid" shall detect tentative planning encounters which would involve the subject flight on ATCO's request for assessing a possible coordination or clearance.
Title	Tentative encounters based on ATCO's demand

Status	<In Progress>
Rationale	The tentative encounters support Conflict Detection.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3049
Requirement	The "PC Aid" shall detect speculative planning encounters which would involve the subject flight if the controller changed the coordinated entry or exit level.
Title	Speculative encounters based on coordination levels
Status	<In Progress>
Rationale	The speculative encounters support Conflict Resolution.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2012	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2012
Requirement	The "PC Aid" shall provide CD/R services for aircraft as they are coordinated into and out of the sector.
Title	Flights with a CD/R service
Status	<In Progress>
Rationale	Flights with a CD/R service
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2013
Requirement	The "PC Aid" shall provide CD/R services for aircraft as they traverse the sector.

Title	CD/R service within the sector
Status	\<In Progress>
Rationale	CD/R service within the sector
Category	\<Operational>
Validation Method	\<Real Time Simulation>
Verification Method	\<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES>	\<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	\<Partial>
\<SATISFIES>	\<ATMS Requirement>	REQ-04.02-DOD-0005.0030	\<Partial>
\<APPLIES_TO>	\<Operational Focus Area>	OFA03.03.01	N/A
\<APPLIES_TO>	\<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
\<APPLIES_TO>	\<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3087
Requirement	The "PC Aid" shall update the planning encounters that are detected, either cyclically or on demand.
Title	Update of detected encounters
Status	\<In Progress>
Rationale	The encounters will be updated either by a user action or when information used to detect planning encounters is updated, for example by using the latest trajectory information. This is to support the real-time display of planning encounters affecting the current co-ordinations for aircraft.
Category	\<Operational>
Validation Method	\<Real Time Simulation>
Verification Method	\<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES>	\<ATMS Requirement>	REQ-04.07.02-OSED-0002.2013	\<Partial>
\<SATISFIES>	\<ATMS Requirement>	REQ-04.02-DOD-0005.0030	\<Partial>
\<APPLIES_TO>	\<Operational Focus Area>	OFA03.03.01	N/A
\<APPLIES_TO>	\<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
\<APPLIES_TO>	\<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3051
Requirement	The "PC Aid" shall provide the facility to filter encounters so that they are displayed only to the Team, or Teams, controlling the sector(s) that have the responsibility to resolve them.
Title	Encounters displayed to responsible actors only
Status	\<In Progress>
Rationale	Encounters displayed to responsible actors only
Category	\<Operational>
Validation Method	\<Real Time Simulation>
Verification Method	\<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES>	\<ATMS Requirement>	REQ-04.07.02-OSED-0002.2013	\<Partial>
\<SATISFIES>	\<ATMS Requirement>	REQ-04.02-DOD-0005.0030	\<Partial>
\<APPLIES_TO>	\<Operational Focus Area>	OFA03.03.01	N/A
\<APPLIES_TO>	\<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
\<APPLIES_TO>	\<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3052
Requirement	The "PC Aid" shall determine the classification of an encounter according to the proximity, geometry and uncertainty of the predicted aircraft positions and the clearance or co-ordination conditions under which those flights are operating.
Title	Classification of an encounter
Status	<In Progress>
Rationale	Classification of an encounter
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2013	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4012
Requirement	The "PC Aid" shall support different minimum acceptable separation parameters for different volumes of airspace.
Title	Thresholds depending on airspace
Status	<In Progress>
Rationale	Thresholds depending on airspace
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2013	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4058
Requirement	The "PC Aid" shall support different minimum acceptable separation parameters for specific aircraft.
Title	Thresholds depending on aircraft
Status	<In Progress>
Rationale	State aircraft and non-RVSM equipped aircraft need a vertical separation minimum of 2000ft
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2013	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A

<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.2.5 Context Trajectories and Context Encounters

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2038
Requirement	For a subject flight, the PC Aid shall identify "Planner Context" flights, which may be of interest due to their anticipated vertical and lateral profiles.
Title	Context flights related to one subject flight
Status	<In Progress>
Rationale	Planner Context flights may not currently be involved in an encounter with the subject flight based on their current clearance or existing coordinated levels but may need to be considered by the planner when making coordination choices for the planning-sector.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3109
Requirement	The PC Aid shall compute Context Encounters based on Context Trajectories for flights from the time that they are targeted for coordination into a planning-sector.
Title	Condition for Context Trajectory
Status	<In Progress>
Rationale	The range of trajectories represents the flight's anticipated utilisation of airspace in the planning–sector
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2038	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4045
Requirement	The "PC Aid" shall compute Context trajectories that follow the lateral constraint of the filed route and shall revise them by subsequent changes to the cleared route. i.e. clearances from present position direct to a fix further along the flight route.
Title	Lateral part of a Context Trajectory
Status	<In Progress>
Rationale	Unlike planner coordination trajectories, context trajectories shall not

	subscribe to coordination constraints (heading or route and/or speed).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3109	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4046
Requirement	The "PC Aid" shall build Context trajectories at each standard flight level at which the flight is expected to fly in the planning sector.
Title	Vertical range of Context Trajectories
Status	<In Progress>
Rationale	The range of trajectories represents airspace occupancy in the planning–sector.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3109	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3110
Requirement	The "PC Aid" shall identify Environmental Flights which are involved in Context Encounters, as "Planner Context Flights".
Title	Context Flights
Status	<In Progress>
Rationale	Context Flights
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2038	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4047
Requirement	The "PC Aid" shall use the nominal prediction only for the identification of the context flight set.
Title	Identification of Context Flights

Status	<In Progress>
Rationale	Across or along track uncertainty is not required in Context MTCD calculations.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3109	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4048
Requirement	The "PC Aid" shall make available for display the flights identified as "Planner Context Flights".
Title	Display of Context Flights
Status	<In Progress>
Rationale	Display of Context Flights
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3109	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.2.6 Monitoring

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2014
Requirement	The "PC Aid" shall assess the achievability of each flight's entry and exit coordination.
Title	Monitoring of achievable entry/exit conditions
Status	<In Progress>
Rationale	Basic flight performances are used. If a flight is not predicted to achieve its coordinated level by the sector boundary then the Planner Controller needs know about this so that they can either (a) amend the coordinated level or (b) request that the Tactical Controller who has control of that flight (who may or may not be in the Planner Controller's team) take action to climb/descend the flight to the coordinated level.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>

<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3053
Requirement	The "PC Aid" shall monitor for deviations from each flight's entry and exit coordination conditions.
Title	Monitoring of deviations wrt the entry/exit conditions
Status	<In Progress>
Rationale	Monitoring of deviations wrt the entry/exit conditions
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2014	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.2.7 HMI requirements

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2015
Requirement	The "PC Aid" shall present information to the user through a graphical HMI.
Title	Display of "PC Aid" results
Status	<In Progress>
Rationale	Display of "PC Aid" results
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3054
Requirement	An eligible operator shall be capable of opening and closing each of the graphical HMI components (tools) at every "PC Aid" equipped workstation.
Title	Switch off/on the "PC Aid" tools
Status	<In Progress>
Rationale	Switch off/on the "PC Aid" tools

Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3099
Requirement	The "PC Aid" service shall be configurable to allow the ATCO to show required encounters.
Title	Required encounters on demand
Status	<In Progress>
Rationale	e.g. where a "TC-Aid" service detects encounters in an exaustive way, the ATCO may show the only encounters with a high probability to turn into conflicts. e.g. where encounters are highly categorized, the ATCO may choose to show encounters of a given category only.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3055
Requirement	The ATCO shall be able to select a single flight as the subject of the "PC Aid" tools.
Title	Manual selection of the subject flight
Status	<In Progress>
Rationale	Note: The selected flight will become the subject of conflict detection and resolution at the workstation at which the selection is made.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3056
Requirement	The "PC Aid" shall be capable of displaying planning trajectory and encounter information in elevation view for a selected subject flight.
Title	Display in the Elevation view
Status	<In Progress>
Rationale	In the UIR/FIR environment it is essential that information can be displayed in an elevation view. Interaction information includes tentative and speculative encounters (thus supporting Conflict Resolution).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4013
Requirement	When displaying encounter information in elevation view, the "PC Aid" shall indicate the time when planning separation is lost, the classification and the encounter geometry of each displayed encounter.
Title	Data to display in Elevation view
Status	<In Progress>
Rationale	Classifying the encounter (and showing its geometry) allows the controller to prioritise and assess the encounters and resolutions.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3056	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3057
Requirement	For a selected subject flight, the "PC Aid" shall be capable of displaying all types of trajectory and encounter information in plan view on the radar situation display.
Title	Data to display in Plan view
Status	<In Progress>
Rationale	Encounter information includes tentative and speculative encounters (thus supporting Conflict Resolution).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>

<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4014
Requirement	When displaying encounter information in plan view, the "PC Aid" shall display the trajectory of the subject flight and the environmental flight involved in each encounter.
Title	Flight data to display wrt the Subject flight
Status	<In Progress>
Rationale	Displaying the trajectories of the flights involved in each encounter provides the controller with the information required to assess the encounter and identify a resolution.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3057	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4015
Requirement	When displaying encounter information in plan view, the "PC Aid" shall be capable of indicating the classification of each displayed encounter, and the encounter geometry.
Title	Encounter data to display wrt the Subject flight
Status	<In Progress>
Rationale	Classifying the encounter (and showing its geometry) allows the controller to prioritise and assess the encounters and resolutions.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3057	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.2.8 Coordination support

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3058
Requirement	The "PC Aid" shall support the PC in assessing the suitability of sector entry and exit conditions for a flight by reviewing encounters relating to that flight.
Title	"PC Aid" for entry and exit conditions
Status	<In Progress>

Rationale	"PC Aid" for entry and exit conditions
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4016
Requirement	The "PC Aid" shall support the addition of lateral constraints (e.g. headings, routes and speeds) to sector entry and exit boundary coordinations.
Title	Adding of lateral constraints to entry/exit conditions
Status	<In Progress>
Rationale	Lateral constraints are used by the PC to manage the presentation of flights into and out of the sector, helping the TC's task. Conflict detection will be supported by informing the "PC Aid" of the constraints associated with agreed (rather than cleared) traffic presentation over a sector boundary.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3058	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4017
Requirement	The "PC Aid" shall alert the controller to any deviations from coordination conditions.
Title	Detection of deviations from entry/exit conditions
Status	<In Progress>
Rationale	Detection of deviations from entry/exit conditions
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3058	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3059

Requirement	On a cyclic basis, the "PC Aid" shall make all planning encounters available for display.
Title	Cyclic update of displayed encounters
Status	<In Progress>
Rationale	Encounters may be generated and evolve over time. The PC Aid must be able to monitor and display these encounters to the PC in real time.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4018
Requirement	The "PC Aid" shall alert the Planning Controller to any flights which are not expected to achieve their coordinated level.
Title	Detection of entry/exit level not achievable
Status	<In Progress>
Rationale	If a flight is not predicted to achieve its coordinated level by the sector boundary then the Planner Controller needs know about this so that they can either (a) amend the coordinated level or (b) request that the Tactical Controller who has control of that flight (who may or may not be in the Planner Controller's team) take action to climb/descend the flight to the coordinated level.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3059	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.2.9 Integrated Coordination (IC)

[REQ]

Identifier	REQ-04.07.02-OSED-0002.2016
Requirement	The "PC Aid" shall be able to automate the coordination process, dependant on the encounters detected by MTCD.
Title	Integrated Coordination function
Status	<In Progress>
Rationale	This feature is known as Integrated Coordination (IC).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.1002	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.3060
Requirement	At each CWP, an eligible operator shall be capable of enabling or disabling IC over the Entry or Exit boundary.
Title	Switch on/off the IC at entry or Exit
Status	<In Progress>
Rationale	Switch on/off the IC at entry or Exit
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.2016	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4019
Requirement	IC shall automatically accept offers for flights into the sector if the offer is acceptable.
Title	Automatic acceptance of entering flight
Status	<In Progress>
Rationale	The acceptability of offers will be decided by a rule base which will include whether any encounters are found.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4020
Requirement	The "PC Aid" shall refer flights that are not automatically accepted by IC, to the PC for manual (system supported) level assessment.
Title	Manual assessment of entering flight
Status	<In Progress>
Rationale	Manual assessment of entering flight
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4021
Requirement	At the appropriate time, IC shall identify a potential achievable exit level and the next sector in the coordination sequence.
Title	Computation of the exit level
Status	<In Progress>
Rationale	The appropriate time will depend on the type of coordination (e.g. vertical/lateral). Potential from the point of view that it is achievable by the aircraft.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4022
Requirement	IC shall set the identified exit level if it is acceptable.
Title	Automatic setting of the exit level
Status	<In Progress>
Rationale	The acceptability of the exit level will be decided by a rule base which will include whether any encounters are found.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0002.4023
Requirement	The "PC Aid" shall refer flights that do not have their exit coordination level automatically set by IC, to the PC for manual (system supported) level assessment.
Title	Manual setting of the exit level
Status	<In Progress>
Rationale	Manual setting of the exit level
Category	<Operational>

Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0002.3060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.3 Requirements of the "TRACT" service

Foreword: although the current concept includes three Separation Services for completeness, the TRACT service is out of the SESAR Solution #27 because its enablers are not available yet and because it has not reached V3 maturity yet.

6.2.3.1 Basic Requirements

[REQ]

Identifier	REQ-04.07.02-OSED-0003.1003
Requirement	The system shall provide the TRACT service in an En-Route airspace.
Title	Provision of TRACT
Status	<In Progress>
Rationale	Provision of TRACT
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0000.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.3.2 Encounters Detection

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2017
Requirement	The TRACT service shall detect all TRACT encounters between flights that have a predictable behaviour within the TRACT area.
Title	TRACT Detection
Status	<In Progress>
Rationale	The TRACT area shall be defined off-line.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A

<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3121
Requirement	The TRACT service shall take into account different lateral and vertical separation parameters for specific aircraft.
Title	TRACT Separation thresholds
Status	<In Progress>
Rationale	State aircraft and non-RVSM equipped aircraft need a vertical separation minimum of 2000ft
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.3.3 Elaboration of a TRACT solution

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2018
Requirement	The TRACT service shall cyclically attempt to solve the maximum number of TRACT encounters without creating any new unsolved TRACT encounter.
Title	Elaboration of a TRACT solution
Status	<In Progress>
Rationale	The cycle duration shall permit the solution to actually be implemented by the air crew. Currently the cycle duration is set to three minutes. The cycle is necessary to assume that the previous uplinked CTOs have been implemented and the traffic is stable. Then the TRACT service can assess the global situation and determine the best solution.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3080
Requirement	The TRACT service shall not attempt to solve the TRACT encounters that are out of the TRACT scope: - convergences or divergences with a small angle.
Title	Encounters out of TRACT scope
Status	<In Progress>

Rationale	First phase of the solving process: filtering of the TRACT encounters to solve.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2018	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3061
Requirement	The TRACT service shall compute a global solution considering all detected TRACT encounters.
Title	TRACT Global Solution
Status	<In Progress>
Rationale	Second phase of the solving process: determination of the solution. Note that a TRACT encounter that is out of the TRACT scope cannot be managed, so the TRACT cluster it belongs to cannot be managed by the TRACT service.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2018	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4042
Requirement	The TRACT service shall manage all the TRACT encounters of a TRACT cluster, or none.
Title	Clusters not partially managed
Status	<In Progress>
Rationale	No partial management of a TRACT cluster.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3061	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4053
Requirement	The TRACT service shall compute a solution that does not disturb the TC situation awareness.

Title	No interference with TC scope
Status	<In Progress>
Rationale	A possible implementation is to forbid a CTO in the TC horizon time e.g. less than 10 minutes before the application point.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3061	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.3.4 Computation of the CTO

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4024
Requirement	The TRACT service shall compute a global solution made of a maximum number of CTOs.
Title	Maximum number of CTO
Status	<In Progress>
Rationale	All i4D aircraft involved in the global solution shall have a CTO, so that the effort is shared.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3061	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.5001
Requirement	The TRACT service shall compute a CTO only for flights that are i4D-capable.
Title	i4D-capable flights
Status	<In Progress>
Rationale	A flight that is i4D-capable means here that it complies with aircraft capabilities as listed in [29]: - CPDLC: WG78 messages related to CTA allocation with selectable tolerance; - ADS: WG78 messages related to ETA min/max and EPP data - enhanced FMS capabilities.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.4024	<Partial>

<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.6001
Requirement	The TRACT service shall consider that a flight is eligible for a CTO if: - the flight has currently neither a speed constraint nor any open-loop constraint, and - the flight has not accepted more than two CTO/RTA at the last two hours.
Title	Eligible Flights for a CTO
Status	<In Progress>
Rationale	The first condition reflects the higher priority of an on-going ATCO order, while the last condition permits to avoid disturbing too many times the same aircraft. The second condition has not been validated yet.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.5001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.5005
Requirement	The TRACT service shall compute a CTO on an application point that is aligned on the FMS trajectory.
Title	CTO application point
Status	<In Progress>
Rationale	The application point of the CTO is defined as a distance-to-fly from a point that is currently belonging to the EPP data.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.4024	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.5006
Requirement	The TRACT service shall place the CTO where the aircraft is predicted to move away from the last aircraft it encounters with.
Title	CTO at the divergence point
Status	<In Progress>
Rationale	So that once the CTO is over, the two flights cannot conflict again whatever their speed change. As a consequence, the TRACT service shall not solve a TRACT encounter if it

	occurs at the limit of the time horizon when it is unknown whether the two flights will move away after the CTO or not. When the aircraft is involved in several TRACT encounters, the CTO has to be placed on the last encounter.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.4024	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.5007
Requirement	The TRACT service shall use the following assumptions for CTO computation : - there is a delay between the sending of a CTO by the TRACT service and its implementation in the FMS by the air crew; - the FMS will initially perform a unique speed adjustment to reach the CTO, at the moment when the CTO is implemented and when the aircraft is cruising; - the FMS will adjust in real-time the speed in closed loop in order to reach the CTO with the requested accuracy; - once the CTO is over, the aircraft will revert back to its normal speed.
Title	CTO computation
Status	<In Progress>
Rationale	The delay between the sending of the CTO and its implementation by air crew represents the total time for: - the ground system to send the CTO to the aircraft through the data-link; - the air crew to consider the CPDLC message - the air crew to insert the CTO into the FMS to process an alternate flight plan; - the air crew to activate the alternate flight plan in the FMS; - the air crew to send the acknowledgment to the ground (e.g. WILCO) through the data-link.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.4024	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.5009
Requirement	The TRACT service shall compute a CTO that belongs to the "reliable RTA interval" of the application point.
Title	Constraints on CTO computation
Status	<In Progress>
Rationale	The "reliable RTA interval" of the application point may be interpolated from

	the surrounding EPP points.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.4024	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.5008
Requirement	The TRACT service shall compute CTOs that do not result in time conflicts with the activity schedule of the traversed areas.
Title	No conflicts with reserved areas
Status	<In Progress>
Rationale	This may happen when e.g. a flight is slowed down while it was expected to exit a Restricted Area just before its activation.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.4024	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.3.5 Communication with aircraft

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3062
Requirement	The TRACT service shall implement the global solution by sending CTOs to the aircraft through datalink.
Title	Implementation of a TRACT solution
Status	<In Progress>
Rationale	Third phase of the solving process: implementation of the solution All CTOs are sent, then the TRACT service waits for the answers from the pilots: WILCO, UNABLE or STANDBY
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]s

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2018	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4026
Requirement	While no answer is received from the aircraft, the TRACT service shall consider it as a STANDBY answer.
Title	No answer by air crew
Status	<In Progress>
Rationale	No answer by air crew
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3062	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4027
Requirement	On WILCO answer by the aircraft, the TRACT service shall publish the CTO towards the other Ground systems.
Title	WILCO answer
Status	<In Progress>
Rationale	For consistency between services, it is important that the CTO is considered by all services of the Ground system (e.g. the MTCD). On WILCO, the TRACT service considers the CTO as actually implemented. It does not reflect the reality because WILCO does not mean that the air crew has actually input the FMS with the CTO. However the delay for the TRACT service to get a feedback from the FMS is currently too long (two minutes on average).This is why the current version of the TRACT service prefers to trust on WILCO, assuming that refusal by the pilots in en-route phase is unlikely to happen.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3062	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4028
Requirement	On UNABLE answer by the aircraft, the TRACT service shall not send any CTO to this aircraft until 15 minutes.
Title	UNABLE answer
Status	<In Progress>
Rationale	The goal is to avoid proposing again the same CTO immediately after the refusal. The value has not been validated yet but it permits to ensure that the same CTO is not proposed twice.
Category	<Operational>

Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3062	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4050
Requirement	On UNABLE answer by the aircraft, the TRACT service shall consider as unsolved all TRACT encounters of the TRACT cluster the aircraft is involved in.
Title	Removal after an UNABLE answer
Status	<In Progress>
Rationale	No partial solution of a TRACT cluster.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3062	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.4029
Requirement	On STANDBY answer by the aircraft, the TRACT service shall discard the aircraft from detection and resolution of encounters until the definitive answer by the aircraft.
Title	STANDBY answer
Status	<In Progress>
Rationale	It cannot be assumed whether the trajectory will comply with the CTO or not, so the detection phase cannot consider this flight (it is considered as a flight with no TRACT trajectory).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3062	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

6.2.3.6 Information towards the ATC actors

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2019
Requirement	The TRACT service shall inform the ATCOs about the solved TRACT encounters.
Title	Information to ATCOs
Status	<In Progress>
Rationale	Information to ATCOs
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3065
Requirement	The CWP shall tag the flights constrained by a CTO.
Title	Highlight flights with a CTO
Status	<In Progress>
Rationale	In order to warn the ATCO about the eventual changes of speed due to the FMS managing the CTO, and to make the ATCO aware of an existing ATC constraint on the flight. For this reason the flight has to be tagged as soon as the ATC constraint is uplinked to the air crew.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2019	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3107
Requirement	The CWP shall tag all flights involved in a solved TRACT encounter.
Title	Highlight flights involved in the TRACT solution
Status	<In Progress>
Rationale	Even flights with no CTO, if any, are tagged. This aims at informing the ATCO that a TRACT solution is on-going so that s/he can avoid disturbing it (if possible). As soon as the TRACT cluster is solved, then the flights are tagged. Whether the flights with a CTO are tagged the same way as flights with no CTO, is part of local implementation.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2019	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>

<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3066
Requirement	The CWP shall display the solved TRACT encounters on demand.
Title	Display TRACT encounters
Status	<In Progress>
Rationale	Display TRACT encounters
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2019	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3067
Requirement	The CWP shall display the CTO attributes on demand.
Title	Display CTO attributes
Status	<In Progress>
Rationale	This is necessary for the ATCO to be able to answer any request from the air crew about the CTO. The CTO is made of the time constraint and its application point, together with the originator of the CTO (e.g. TRACT) and the current status (e.g. "sent to aircraft", "accepted by air crew",..)
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2019	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2037
Requirement	The TRACT service shall make available the TRACT encounters and the uplinked CTOs, for the benefit of the other Ground services.
Title	Information to ATC services
Status	<In Progress>
Rationale	For any other service to get up-to-date information on TRACT current status. It is up to the other services to detect when a CTO is uplinked or when it has been removed. All detected TRACT encounters are made available, whether they have been solved or not.
Category	<Operational>
Validation Method	<Real Time Simulation>

Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.3.7 Removal of a CTO

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3117
Requirement	The TRACT service shall consider that a CTO is discarded from Air side if the CTO has been removed from the EPP report or following the UNABLE answer.
Title	CTO removal from Air side
Status	<In Progress>
Rationale	To ensure air-ground consistency
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2037	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2040
Requirement	On discard of a CTO from Ground side, the TRACT service shall inform the air crew in order to upgrade the FMS
Title	CTO removal from Ground side
Status	<In Progress>
Rationale	To ensure air-ground consistency
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3113
Requirement	On ATCO manual input to discard a CTO, the TRACT service shall discard the CTO.
Title	ATCO removal of a CTO

Status	<In Progress>
Rationale	This may be used in two cases: - When a CTO is not reachable, it may happen that the pilot informs the ATCO before the information is downlinked to the TRACT service. It is up to the ATCO to input the system with that information. - It is also a way for the ATCO to keep the traffic in hand and to discard the TRACT solution in order to implement her/his own solution.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2040	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3114
Requirement	On ATCO instruction to change the flight behaviour, or on ATCO instruction to maintain speed, the TRACT service shall discard the CTO.
Title	CTO removal following an ATC instruction
Status	<In Progress>
Rationale	It is assumed that the ATCO implements her/his own solution, so the CTO must be removed to not interfere
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2040	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3115
Requirement	On UNABLE answer by an aircraft, the TRACT service shall discard all uplinked CTOs of the TRACT cluster the aircraft is involved in.
Title	All CTO removed after an UNABLE
Status	<In Progress>
Rationale	These CTOs are not useful any longer
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2040	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02- Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3116
Requirement	The TRACT service shall discard the CTO if the aircraft is only involved in TRACT encounters with flights with a discarded CTO.
Title	CTO removal if useless
Status	<In Progress>
Rationale	To avoid useless CTO If the aircraft is involved in one TRACT encounter only, then its CTO is automatically removed when the CTO of the other flight is removed. On the other hand if the aircraft is involved in another solved TRACT encounter then the CTO is left unchanged
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2040	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2039
Requirement	The TRACT service shall warn the ATCOs when it discards the solving of a TRACT encounter.
Title	Warning on removal of a CTO
Status	<In Progress>
Rationale	Warning on removal of a CTO
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3108
Requirement	The CWP shall un-tag a flight if it is only involved in TRACT encounters whose solving is discarded.
Title	De-highlight non-TRACT flights
Status	<In Progress>
Rationale	For example all flights involved in a TRACT cluster whose one aircraft answered UNABLE
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2039	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>

<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3078
Requirement	The CWP shall un-tag a flight with a discarded CTO.
Title	De-highlight flights with no CTO
Status	<In Progress>
Rationale	De-highlight flights with no CTO
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2039	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.3.8 Monitoring of the TRACT service

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2020
Requirement	The CWP shall warn when the TRACT service is lost or the TRACT service is degraded.
Title	Warning on TRACT failure
Status	<In Progress>
Rationale	High level monitoring of the service itself
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2041
Requirement	The CWP shall warn when a flight involved in the TRACT solution behaves differently than predicted when the TRACT solution was implemented.
Title	Warning on wrong TP
Status	<In Progress>
Rationale	Monitoring of behaviours not predicted, e.g. a longitudinal deviation of a non-CTO flight. Such deviations may not raise any warning otherwise.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Ensure_Trajectory_Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.2031
Requirement	The CWP shall warn when a CTO is not implemented as expected.
Title	Warning on false CTO implementation
Status	<In Progress>
Rationale	Monitoring of the implementation of the TRACT solution
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.1003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Ensure_Trajectory_Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3088
Requirement	The TRACT service shall consider that a CTO is not implemented as expected when the aircraft has not answered WILCO or UNABLE more than N seconds after the CTO has been uplinked.
Title	No answer by air crew for too long
Status	<In Progress>
Rationale	No answer by air crew for too long
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2031	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0003.3085
Requirement	The TRACT service shall consider that a CTO is not implemented as expected, when the EPP data still not includes the CTO four minutes after the WILCO answer by the aircraft.

Title	Missing CTO in EPP
Status	<In Progress>
Rationale	The value has not been validated yet. It includes the delays coming from: the pilot's action, the airborne systems, the datalink and the communication between ground systems. It is theoretical and corresponds to the next generation of airborne systems which have not been validated yet in particular in operational conditions.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2031	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES TO>	<Operational Process>	PCS-DOD-04.02-Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.2.4 Requirements of the interactions between the services

Foreword: although the current concept includes three Separation Services for completeness, the "CD/R aid to the PC" and the "TRACT" services are out of the SESAR Solution #27 because they have not reached V3 maturity yet. Also enablers for TRACT are not available yet.

6.2.4.1 Coherency of Separation services

[REQ]

Identifier	REQ-04.07.02-OSED-0004.1004
Requirement	The system shall ensure that the outputs of the TRACT, "PC Aid" and "TC Aid" services are clearly distinguishable from a given ATCO point of view.
Title	Distinguishable sources of detected encounters
Status	<In Progress>
Rationale	Because the ATCO may use all services, it is important to show whether an encounter results from a "planning" service or from a "tactical" service. Both kinds of service potentially output different encounters.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0000.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2021
Requirement	The "PC Aid" (resp. "TC Aid") service should provide information to the "TC Aid" (resp. "PC Aid") service.
Title	Inter-knowledge between PC Aid and TC Aid
Status	<In Progress>
Rationale	Inter-knowledge between PC Aid and TC Aid
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1004	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.1005
Requirement	Every service shall output a coherent information to the sector team.
Title	Coherent display to all ATCO
Status	<In Progress>
Rationale	Namely for PC-TC cooperation. The PC is an assistant-TC among other roles so both controllers have to be provided with coherent data. Coherent data does not mean the same data e.g. depending on the time horizon the PC and the TC may be provided with different representations of the same input data
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0000.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

6.2.4.2 Responsibility of solving an encounter

[REQ]

Identifier	REQ-04.07.02-OSED-0004.1006
Requirement	The system shall notify any operator that is elegble to solve a conflict, of

	solutions already implemented by another actor
Title	Notification of a solution to other actors
Status	<In Progress>
Rationale	To avoid that several actors (TRACT, PC, TC, adjacent ATCO) implement solutions on the same separation issue in parallel.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0000.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2025
Requirement	The "PC Aid" (resp. the "TC Aid") service shall distinguish between the encounters that it has detected and those that have been solved by the TRACT service.
Title	Display of TRACT solutions in the "PC Aid"
Status	<In Progress>
Rationale	Display of TRACT solutions in the "PC Aid"
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1006	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2026
Requirement	The CWP shall inform operators that an encounter has a responsibility assigned.
Title	Display of the responsible actor
Status	<In Progress>
Rationale	Could be a simple tag to display, but probably the algorithms will have to consider it too.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1006	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.3070
Requirement	The "PC Aid" and "TC Aid" services should enable the controller to declare that s/he is responsible of a given separation issue.
Title	Declaration of the responsible actor
Status	<In Progress>
Rationale	Could be an automatic setting when some conditions are met e.g. the TC is responsible for an urgent conflict in the sector.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.2026	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.3071
Requirement	The TRACT service shall attempt to solve the encounters that have no responsible operator
Title	TRACT where no ATCO pre-emption
Status	<In Progress>
Rationale	TRACT where no ATCO pre-emption
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.2026	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.3072
Requirement	Given a sector team, the associated "PC Aid" and "TC Aid" services should distinguish between the encounters out of responsibility and those that may require the controllers involvement.
Title	Display of degree of responsibility
Status	<In Progress>
Rationale	Could be encounters that have to be solved by an adjacent sector
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.2026	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.4057
Requirement	A controller shall be able to identify the responsibility of an encounter using "PC Aid" and "TC Aid"
Title	Input of each responsibility
Status	<In Progress>
Rationale	Input of each responsibility
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.3072	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2027
Requirement	Controllers shall be able to negotiate with other sector teams, the responsibility for solving encounters supported by "PC Aid" and "TC Aid" tools
Title	Negotiation of responsibility
Status	<In Progress>
Rationale	To help controllers negotiating the responsibility of solving the potential conflicts.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1006	<Partial>

<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A

6.2.4.3 Coherency with other ATC systems

[REQ]

Identifier	REQ-04.07.02-OSED-0004.1007
Requirement	The system shall ensure that the TRACT, "PC Aid" and "TC Aid" services are coherent with other Ground Services.
Title	Coherency with other ATC services
Status	<In Progress>
Rationale	Coherency with other ATC services
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0000.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Planning Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Tactical Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2028
Requirement	The ground systems shall coherently send time constraints to the aircraft.
Title	Coherency of the uplinked time constraints
Status	<In Progress>
Rationale	Air crew considers the Ground system as a unique actor, therefore it requires synchronization between ground services.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide Early Conflict Resolution	N/A
<APPLIES TO>	<Operational Service>	TRACT	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2029

Requirement	The TRACT, "PC Aid" and "TC Aid"services should support the Complexity and Queue Management functions.
Title	Interactions with Complexity and Queue Management services
Status	<In Progress>
Rationale	The separation services could take advantage of the Complexity and Queue Management services to optimise the solutions. The inter-services interactions have to be studied further.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0017	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Early_Conflict_Resolution	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Planning_Separation_Assurance	N/A
<APPLIES_TO>	<Operational Process>	PCS-DOD-04.02-Provide_Tactical_Separation_Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES_TO>	<Operational Service>	TRACT	N/A

6.3 Information Exchange Requirements

This section contains the major exchange elements.

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-04.07.02-OSED-0000.0001	Ground TP	FDPS	TRACT; CD/R aid to the PC; CD/R aid to the TC	iRBT	Separate Traffic	iRBT is needed at initiation of TP of each service	<In Progress>	iRBT is provided to initiate TP of each Separation Service	N/A	N/A
IER-04.07.02-OSED-0000.0002	Reliable RTA interval	Air system	TRACT	reliable RTA interval	Separate Traffic	The interval is requested before computation of a CTO	<In Progress>	The interval permits to check that the CTO is reachable by the aircraft	N/A	N/A
IER-04.07.02-OSED-0000.0003	CTO	TRACT	Flight crew: Queue service; PC; TC; MSP	CTO	Separate Traffic	CTO creation/deletion. No CTO upgrade.	<In Progress>	TRACT provides the CTO to implement a conflict resolution. This data is needed for implementation, for information to ATCO and for information to other ATC services	N/A	TRajectory Adjustment through Constraint of Time (TRACT)
IER-04.07.02-OSED-0000.0004	TRACT cluster	TRACT	CD/R aid to the PC; CD/R aid to the TC; PC; TC; MSP	TRACT clusters	Separate Traffic	TRACT cluster is exchanged each time it is updated	<In Progress>	TRACT provides the TRACT clusters for the other Separation services to treat them specifically. It is also used to inform the ATCO about the flights currently in a TRACT solution	N/A	TRajectory Adjustment through Constraint of Time (TRACT)
IER-04.07.02-OSED-0000.0005	Planning encounters	CD/R aid to the PC	PC; MSP	Planning encounters	Separate Traffic		<In Progress>	Planning encounters are provided to the PC to help anticipating separation actions	N/A	CD/R Aid to the PC

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-04.07.02-OSED-0000.0006	Tactical encounters	CD/R aid to the TC	TC	Tactical encounters	Separate Traffic		<Validated>	Tactical encounters are provided to the TC to help anticipating separation actions	N/A	CD/R Aid to the TC
IER-04.07.02-OSED-0000.0007	Planning what-if encounters	CD/R aid to the PC	PC; MSP	Planning what-if encounters	Separate Traffic		<In Progress>	Planning what-if encounters are provided to the PC to support the building of a separation solution	N/A	CD/R Aid to the PC
IER-04.07.02-OSED-0000.0008	Tactical what-else encounters	CD/R aid to the TC	TC	Tactical what-else encounters	Separate Traffic		<Validated>	Tactical what-else encounters are provided to the TC to propose a separation solution	N/A	CD/R Aid to the TC

Table 8: Information Exchange Requirements

7 References

7.1 Applicable Documents

This OSED complies with the requirements set out in the following documents:

[1] SESAR Concept of Operations Step 1, edition 01.00.00, 09/05/2012.

[2] SESAR P04.02 – D98 En Route Detailed Operational Description Step1_update, edition 00.07.01, 22/06/2015

[3] EUROCONTROL - SCG/7 2015 Airspace Concept & Strategy for the ECAC Area & Key Enablers, 28/02/2008

[4] SC214/WG78: ISPR Version I Part 6 (ADS Application DRAFT), April 2011
http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/sc214/current_docs/version_i/

[5] JAA TGL6 Administrative and Guidance Material "Guidance Material on the Approval of Aircraft and Operators for Flight in Airspace above Flight Level 290 where a 300M (1,000 ft) Vertical Separation Minimum is applied"

[6] SESAR Template Toolbox 03.00.00
https://extranet.sesarju.eu/Programme%20Library/SESAR%20Template%20Toolbox.dot

[7] SESAR Requirements and V&V Guidelines 03.00.00
https://extranet.sesarju.eu/Programme%20Library/Requirements%20and%20VV%20Guidelines.doc

[8] SESAR Templates and Toolbox User Manual 03.00.00
https://extranet.sesarju.eu/Programme%20Library/Templates%20and%20Toolbox%20User%20Manual.doc

[9] EUROCONTROL ATM Lexicon
https://extranet.eurocontrol.int/http://atmlexicon.eurocontrol.int/en/index.php/SESAR

7.2 Reference Documents

The following documents were used to provide input/guidance/further information/other:

[10] ERASMUS Deliverable D4.6 Final report, May 2009.

[11] ERATO Expression de besoin opérationnel, fonction filtrage, février 2010.

[12] ERATO Expression de besoin opérationnel, fonction agenda, février 2010.

[13] EPISODE 3 E3-WP4 – D4.3.4-02 Consolidated Validation Report on Prototyping on Queue, Trajectory and Separation Management, v0.04.

[14] CATO Controller Assistance Tools, Short Summary, Edition 1.2, August 2010.

[15] FASTI ATC Manual, Guidelines for FAST tools implementation, Edition 1.0, January 2009.

[16] FASTI Operational Concept, Edition 1.1, March 2007

[17] FASTI Human Factors Case Report, Edition 1.0, October 2007.

[18] FASTI Preliminary Safety Case Report, Edition 1.0, May 2008.

[19] FASTI Business Case Report, D4, Edition 2.0, February 2008.

[20] FASTI Baseline Description, Stephen Morton, 19/06/2007, Edition 1.1.

[21] FASTI Operational Performance Requirements Analysis for the Conflict Detection Tool (CDT), 2nde Edition, April 2012

[22] E-OCVM European Operational Concept Validation Methodology. V3.0, volume I and II. March 2010.

[23] SESAR P04.07.02 - Separation Task in En-Route Trajectory Based Environment. Project Initiation Report (PIR). Edition 00.03.00, May 2010.

[24] ICAO – DOC 4444 ATM/501, Procedures for Air navigation Services, Air Traffic Management, edition 15, 2007

[25] SESAR European ATM Master Plan, edition 2, October 2010
https://www.atmmasterplan.eu/working

[26] RTCA DO-236C. Minimum Aviation System performance Standards: Required Navigation Performance for Area Navigation. June 2013.

[27] RTCA DO-353A, Interoperability Requirements Standard for Baseline 2 ATS Data Communications, ATN Baseline 1 Accommodation (ATN Baseline 1-Baseline 2 Interop Standard). March 2016

[28] . RTCA SC-214/EUROCAE WG-78, September 2013.
http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/sc214/current_docs/version_l_m/

[29] SESAR B.04.02 - initial 4D Trajectory Operations iTOPS. Edition 00.01.00. 19.10.2011

[30] WPB.01 Integrated Roadmap DS15, edition 00.01.00, 21/12/2015

[31] SESAR B.04.02 - Actors - Roles and Responsibilities, edition 00.01.05, 11/05/2011

[32] SESAR B.04.02 – Trajectory Management Document, edition 00.01.00, 05/07/2012

[33] IATA "2010 AVIONICS SURVEY Available and Planned Aircraft Capabilities and Gaps"

[34] SESAR P09.01 - D01 Aircraft and System Performance and Functional requirements step 1, edition 1.3, 24/11/2010

[35] SESAR P04.07.02 - D37 Free Route Operational Service and Environment Definition (OSED) for Step 1 – Iteration 2, edition 00.02.01a, 18/12/2015

[36] SESAR P04.07.02 - D22 Preliminary OSED_4, edition 01.00.00, 15/01/2016.

[37] SESAR P04.07.02 - D02 Validation Strategy_1, October 2010.

[38] SESAR P04.07.02 - D05 V2 Validation Report_1 (VALR), 14/01/2013

[39] SESAR P04.07.02 - D18 V2 Validation Report_2 (VALR), 16/10/2014

[40] SESAR P04.07.02 - D09 Validation Report_3 (VALR), 16/10/2015

[41] SESAR P04.07.02 - D21 Validation Report_4 (VALR), 28/08/2016

[42] ICAO - Global Operational Data link Document (GOLD), Second Edition, 26 April 2013

[43] EUROCONTROL - Challenges of Growth 2013, June 2013

Appendix A   Justifications

To support the current OSED, several Technical Notes have been written by the technical experts on the key domains – ground trajectory prediction, on-board trajectory prediction, weather modelling and meteorological office operations, human factors aspects and airborne trajectory datalink services.

These notes aimed at checking that Operational Requirements comply with the current State of the Art, or, at least, that they comply with what looks feasible by the expected implementing date.

For the sake of lightness, these notes are not included within the document. They can be found on the SESAR extranet at the same place as the current document.

A.1 Ground TP

This Technical Note deepens the State of the Art and the expected mid-term evolution of the Trajectory prediction by Ground systems. It describes how Aircraft Derived Data (ADD) improve the Ground TP, which supported the writing of TCT requirements. It also gives the key factors that impact the quality of the prediction and provides with figures about the global TP performance.

Last , it opens a perspective about the potential use of EPP data in the Ground TP, which is a matter for further SESAR studies.

A.2 Air TP

This Technical Note provides insight and supportive material for purpose of SESAR P04.07.02 OSED development.

First, methodology and considered inputs and outputs of the Airborne Flight Management System generated trajectory are presented. Further, Airborne System Capabilities as well as important standardization committees RTCA SC214/EUROCAE WG78 and EUROCAE WG85 are discussed.

This document also introduces:

- Airbus's Theoretical Analysis on Major Contributors to ETA Errors;
- Eurocontrol's Data Analysis Report on FMS 4D Trajectory Prediction;
- Honeywell's Air Trajectory Prediction accuracy analysis from Erasmus studies;
- Honeywell FTS analysis of the ETA open and closed loop predictions.

A.3 Weather Models

This Technical Note reviews the Meteorological capabilities and describes the current Meteorological operational products, to achieve the P4.7.2 degree of accuracy in the Separation Insurance and finally to suggest improved methods to take into account the Meteorological information in the Air or Ground TP for the Separation Insurance.

This technical note present some results about uncertainties introduced by the methodology currently used for the MET information in the ground and Air TP algorithms.

The document ends with some recommendations, which are to be confirmed by special MET experiment during future R&D activities.

A.4 Human Factors

This document provides a global Human Factors (HF) assessment of the 04.07.02 concept, from both the controllers' and pilots' perspectives. Experts from both sides analysed the concept with regards to several HF aspects. This has permitted to highlight some HF issues related to the concept and influences the definition of the concept itself

A.5 Usability of airborne EPP data for ATM applications

Two documents deepen the knowledge of ADS-C EPP report content and how those data could be potentially used by ATM systems:

- **White Paper "The ADS-C EPP data description and airborne industry experts suggestions"** – The document describes the ADS-C service with focus on EPP and ETA min/max data content. Short description of each parameter and air system expert suggestions how those data can be used for ground TP reconstruction is provided.

- **White Paper "Catalogue of aircraft manoeuvres with examples of ADS-C EPP profiles"** – The catalogue collects set of specific flight scenarios and describes the behaviour of EPP (4D trajectory) as reaction on those manoeuvres. Intention is to introduce some basic patterns in EPP data which can be expected in real traffic when 4D trajectories are used for traffic management.

Appendix B   New Information Elements

B.1 Information Element for Information Exchange Requirement IER-04.07.02-OSED-0000.0003

Identifier	IE-003
Name	CTO
Description	Controlled Time Over a point. It is issued by the TRACT service, and transmitted to the Air systems.
Properties	CTO are requested to the pilot
Rules applied	
Comments	TRACT provides the CTO to implement a conflict resolution. This data is needed for implementation, for information to ATCO and for information to other ATC services

B.2 Information Element for Information Exchange Requirement IER-04.07.02-OSED-0000.0004

Identifier	IE-004
Name	TRACT cluster
Description	All flights conflicting with another flight of the cluster. TRACT tries to solve all conflicts of a cluster, or none.
Properties	
Rules applied	
Comments	TRACT provides the TRACT clusters for the other Separation services to treat them specifically. It is also used to inform the ATCO about the flights currently in a TRACT solution

B.3 Information Element for Information Exchange Requirement IER-04.07.02-OSED-0000.0005

Identifier	IE-005
Name	Planning encounters
Description	
Properties	
Rules applied	
Comments	Planning encounters are provided to the PC to help anticipating separation actions

B.4 Information Element for Information Exchange Requirement IER-04.07.02-OSED-0000.0006

Identifier	IE-006
Name	Tactical encounters
Description	
Properties	
Rules applied	
Comments	Tactical encounters are provided to the TC to help anticipating separation actions

B.5 Information Element for Information Exchange Requirement IER-04.07.02-OSED-0000.0007

Identifier	IE-007

Name	Planning what-if encounters
Description	
Properties	
Rules applied	
Comments	Planning what-if encounters are provided to the PC to support the building of a separation solution

B.6 Information Element for Information Exchange Requirement IER-04.07.02-OSED-0000.0008

Identifier	IE-008
Name	Tactical what-else encounters
Description	
Properties	
Rules applied	
Comments	Tactical what-else encounters are provided to the TC to propose a separation solution

Appendix C   Deleted Requirements

DELETED OPERATIONAL REQUIREMENTS

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2033
Requirement	The calculated trajectory shall be a Tactical Trajectory if no deviation, as detected by Flight Path Monitoring, occurred. Otherwise it is referred to as Deviation Trajectory.
Title	Tactical vs Deviation Trajectories
Status	<Deleted>
Rationale	Trajectory calculation shall check conditions of Flight Path Monitoring and computes trajectory accordingly. This requirement has been deleted because Deviation Trajectory is not used any longer.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3025
Requirement	The "TC Aid" shall detect if a deviation does not exists anymore.
Title	Monitor the end of a deviation
Status	<Deleted>
Rationale	In this case the displayed warning should disappear. This requirement has been deleted because the monitoring of deviations is now more specific
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4008
Requirement	The "TC Aid" shall maintain a route deviation if the actual track position is within a radius around a waypoint but a route deviation was already present before the aircraft has entered the radius around a waypoint.
Title	Route deviation during a turn
Status	<Deleted>

Rationale	It is assumed that in this case the previously detected route deviation according to 0001.3020 is still operationally relevant. This requirement has been deleted because too specific
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3020	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4059
Requirement	The "TC Aid" shall generate a warning a latency time after reception of Mode-S DAP if a deviation is detected between controller clearance and Mode-S DAP.
Title	Adherence of downlink parameters to clearances after latency
Status	<Deleted>
Rationale	Avoid nuisance alerts if the pilot enters the new clearance faster than the controller. This requirement has been replaced by REQ-04.07.02-OSED-0001.3026, which is more specific
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3026	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0001.0031	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4060
Requirement	The "TC Aid" shall generate a warning a latency time after new controller clearance if a deviation is detected between controller clearance and Mode-S DAP.
Title	Adherence of clearances to downlink parameters after latency
Status	<Deleted>
Rationale	Latency should allow for reception of Mode S DAP before comparison. Both latency times may be different and should be adjusted to operational needs. Note that in both cases the reference of the latency is also different. This requirement has been replaced by REQ-04.07.02-OSED-0001.3026, which is more specific
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3026	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0001.0031	<Partial>

<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3006
Requirement	The "TC Aid" shall calculate the vertical part of the tactical trajectory if no vertical deviation has been detected by FPM, based on the actual rate (or cleared rate if available) plus a rate buffer if the aircraft moves towards the CFL. If the aircraft is still at level, the "TC Aid" shall use a minimum and maximum rate instead.
Title	Conditions to predict the vertical trajectory
Status	<Deleted>
Rationale	A cleared vertical rate should be discarded when the CFL is reached. Rate buffer reflects vertical uncertainty. This requirement has been replaced with REQ-04.07.02-OSED-0001.3011, following concept refinements.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2043	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3012
Requirement	If FPM has detected a CFL deviation, the "TC Aid" shall calculate the vertical part of the deviation trajectory based on the actual rate plus a rate buffer. The speed and altitude change of the aircraft shall be based on the actual climb or descent rate from the AFL to a maximum or minimum flight level.
Title	Predict the vertical trajectory after a CFL deviation
Status	<Deleted>
Rationale	Rate buffer shall reflect vertical uncertainty in case of CFL deviation because it is not defined how the aircraft/pilot will adjust the rate. This requirement has been replaced with REQ-04.07.02-OSED-0001.3011, following concept refinements.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2004	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4038
Requirement	the "TC Aid" shall differentiate between infringed separation minima based on the original speeds of the trajectories and those resulting from speed

	variations.
Title	Predicted encounters vs potential encounters
Status	<Deleted>
Rationale	Predicted Encounters are based on the original speeds while potential encounters take into account potential speed variations. This requirement has been replaced by REQ-04.07.02-OSED-0001.3094
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3094	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2009
Requirement	The "TC Aid" shall provide a What-if and a What-else probing.
Title	"TC Aid" probing functions
Status	<Deleted>
Rationale	Based on the same requirements as for trajectory calculation and conflict detection. This requirement has been suppressed because the "TC aid" does not provide what-if service. What-else probing service is specified in many other requirements.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3039
Requirement	The "TC Aid" shall calculate defined What-else probes for all aircraft. What-if probes shall be calculated on controller request.
Title	Trigger for probing computation
Status	<Deleted>
Rationale	Trigger for probing computation This requirement has been suppressed because the "TC aid" does not provide what-if service. What-else probing service is specified in many other requirements
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2009	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3040
Requirement	For each What-If probe, the "TC Aid" shall provide the following data: 1) Flight level probes: a) level is conflict free; b) level is blocked; c) level can only be reached if a vertical rate is provided. 2) In case of 1c) conflict free vertical rates shall be indicated. 3) Direct and heading probes: a) direct or heading is conflict free; b) direct or heading is not conflict free.
Title	Charateristics of a What-if probe
Status	<Deleted>
Rationale	If a controller opens the What-If Flight level probe menu the actual Flight Level should be in the centre of the menu. Open probe windows shall be updated whenever more actual data is available. This requirement has been suppressed because the "TC aid" does not provide what-if service.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2009	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4010
Requirement	The "TC Aid" shall calculate the following what-if probes on request by the controller: a) Closed heading followed by an on route fix (rejoin point) b) Direct clearances to fixes off route followed by a fix on the route (rejoin point).
Title	What-if probes
Status	<Deleted>
Rationale	Ensures that th e system shows if the chosen controller solution for closed heading or Direct is conflict free or not. This requirement has been suppressed because the "TC aid" does not provide what-if service.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3039	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3097
Requirement	The "TC Aid" shall derive the speed at each sector entry boundary from the

	current ground speed taking into account the expected speed change with altitude, i.e. constant CAS/constant Mach.
Title	Speed part of an Entry Trajectory
Status	<Deleted>
Rationale	For the expected speed increase/decrease with increasing/decreasing altitude a constant acceleration shall be assumed. Similar to Tactical Trajectory. This requirement has been suppressed because too specific for an operational requirement.(technical implementation detail).
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2034	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3105
Requirement	The "TC Aid" shall discard a Coordination Encounter between a pair of aircraft if vertical and horizontal separation parameters are not infringed anymore.
Title	Removal of a Coordination Encounter
Status	<Deleted>
Rationale	Removal of a Coordination Encounter This requirement has been suppressed because it is implicitly covered by the requirements about the detection of a Coordination Encounter
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2035	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4040
Requirement	The "TC Aid" shall differentiate between infringed separation minima based on the original speeds of the entry trajectories and those only resulting because of speed variations.
Title	Predicted encounters vs potential encounters
Status	<Deleted>
Rationale	Predicted encounters vs potential encounters This requirement has been replaced by REQ-04.07.02-OSED-0001.3094
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3101	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A

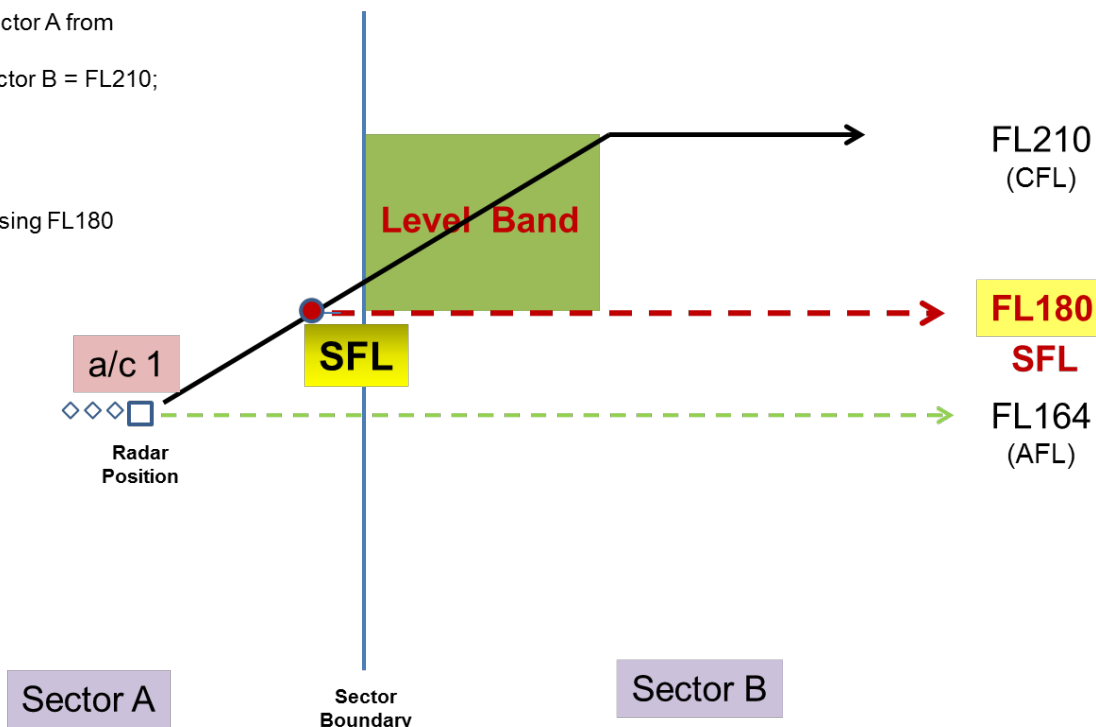| <APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3103
Requirement	The "TC Aid" shall detect a Coordination Encounter within the limits of the lateral infringement for the part of the Entry Trajectory in the current sector with the part of the Entry Trajectories in the next and following sectors if the interval between NFL and SFL (next and following sectors) and minimum and maximum FL (current sector) is below the vertical separation.
Title	Vertical detection across the frontier of sector
Status	<Deleted>
Rationale	Vertical detection across the frontier of sector This requirement has been replaced by REQ-04.07.02-OSED-0001.3102
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2035	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

a/c 1 cleared in sector A from
FL150 to FL210;
Entry FL (NFL) sector B = FL210;

Actual FL164,
CFL=210
SFL=180
(a/c handover passing FL180
climbing FL210).

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3118
Requirement	The "TC Aid" shall detect and display the following deviations between actual track data and controller clearance data: a) Route deviation (ROUTE); b) Vertical rate deviation (RATE); c) Cleared flight level deviation (CFL);

	d) No valid Flight Plan data are available (NoTT).
Title	Adherence to clearances
Status	<Deleted>
Rationale	Trigger conditions: if met deviation trajectory will be created and used for CD/R. This requirement has been split into several requirements, among which REQ-04.07.02-OSED-0001.2004
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0031	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Process>	Ensure Trajectory Adherence	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3036
Requirement	If two aircraft are involved in more than one encounter with each other, the "TC Aid" shall display only the first encounter.
Title	Priority between similar encounters
Status	<Deleted>
Rationale	It is assumed that secondary encounters will disappear as soon as the first encounter has been solved. This requirement has been deleted because it is not relevant
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2008	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.4039
Requirement	If two aircraft are involved in yet another encounter with each other, the "TC Aid" shall keep the same conflict ID, based on the previously detected encounter.
Title	Unique encounter Id between two aircraft
Status	<Deleted>
Rationale	If assumption of previous requirement 0001.0036 is not valid. This requirement has been deleted because operationally useless
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.3036	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	Provide Separation Assurance	N/A

| <APPLIES TO> | <Operational Service> | CD/R Aid to the TC | N/A |

[REQ]

Identifier	REQ-04.07.02-OSED-0001.3034
Requirement	The "TC Aid" shall discard an encounter between a pair of aircraft if vertical and horizontal separation is not infringed anymore.
Title	End of an encounter
Status	<Deleted>
Rationale	Also discard if end of separation infringement has been reached. This requirement has been suppressed because it is implicitly covered by the requirement about the detection of an encounter
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.2007	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0001.2041
Requirement	The "TC Aid" shall calculate a Tactical Trajectory when a) track data, and b) either CFL or NFL for the next controlled sector are available for a flight.
Title	Eligible Flights for Tactical Trajectory
Status	<Deleted>
Rationale	Defines eligible flights for tactical trajectory calculation. This requirement has been re-assessed and finally deleted. It is replaced with REQ-04.07.02-OSED-0001.3127
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0001.1001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2023
Requirement	The system shall use the same "PC Aid" and "TC Aid" data for a given sector team.
Title	Coherent data to all ATCO
Status	<Deleted>
Rationale	Input data shall be the same whatever the service user in the sector team This requirement has been replaced with REQ-04.07.02-OSED-0004.1005
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES_TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

[REQ]

Identifier	REQ-04.07.02-OSED-0004.2024
Requirement	The system shall provide the tactical and planning controllers with possibly different representations of the same input data e.g. depending on the time horizon
Title	Coherent but different tools
Status	<Deleted>
Rationale	Coherent but different tools This requirement has been replaced with REQ-04.07.02-OSED-0004.1005
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0004.1005	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-04.02-DOD-0005.0030	<Partial>
<APPLIES TO>	<Operational Focus Area>	OFA03.03.01	N/A
<APPLIES_TO>	<Operational Process>	Provide Separation Assurance	N/A
<APPLIES_TO>	<Operational Service>	CD/R Aid to the PC	N/A
<APPLIES TO>	<Operational Service>	CD/R Aid to the TC	N/A

-END OF DOCUMENT-