

NAVIGATION DOMAIN

ACTION PLAN

Reference : *TBD* *Edition* *2.6* *Effective Date* *4/1/04*

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DOCUMENT CONTROL

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Edition history

<i>Edition Number</i>	<i>Effective Date or Status</i>	<i>Authors</i>	<i>Reason</i>
2.0	26/8/03	Roland Rawlings	Update for release
2.1	6/10/03	Roland Rawlings	Update for release
2.2	13/11/03	N Ashley	<ul style="list-style-type: none">• Alignment to EORG Model• Alignment to Revised Guidelines for Preparing a Domain Action Plan
2.3	19/11/03	N Ashley	Update to address review comments of Ted Hall
2.4	28/11/03	N Ashley	Update to include costs
2.5	5/12/03	R. Rawlings	Update following Nav Team reviews
2.6	4/1/04	R. Rawlings	Updated following special ANT meeting 15/12/03

Acknowledgements

Name	Location

Filename and Path

P:\BusinessPlanningSupport\Support To Domains

TABLE OF CONTENTS

DOCUMENT CONTROL	i
Copyright notice.....	i
Edition history	i
Acknowledgements	i
Filename and Path	i
TABLE OF CONTENTS	ii
1. INTRODUCTION	1
1.1 The Navigation Domain.....	1
1.2 Objective of the Navigation Domain Action Plan.....	1
1.3 Areas of Activity	2
1.4 Navigation Domain Structure	4
2. CONTRIBUTION TO THE ATM STRATEGY	4
3. DOMAIN WORK PACKAGES.....	6
3.1 Domain Evolution	6
3.1.1 WP01 - Domain Management	6
3.1.2 WP02 - Application of P-RNAV in Terminal Airspace	7
3.1.3 WP04 - Long Term Application of 4D RNAV	8
3.1.4 WP05 - RNAV Approaches	9
3.1.5 WP06 - Precision Approach and Landing	12
3.1.6 WP07 Navigation Avionics	15
3.1.7 WP08 - Optimum Navigation Infrastructure Requirements for RNAV Operations	17
3.1.8 WP09 – Enabling GNSS for all Phases of Flight.....	19
3.1.9 WP10 - Data Quality for Gate to Gate Operations	22
3.1.10 WP11 – Stakeholder Communications: Impact Evaluation of Proposed Nav Developments and User Support	23
3.1.11 WP12 - Analysis of Performance and Safety Assessment of Nav Developments.....	24
3.1.12 WP13 - R & D Co-ordination & Technology Watch.....	25
3.2 Programme or Service Definition & Initiation.....	26
3.2.1 WP03 - Application of RNP RNAV in Medium Term	26
3.3 Planning & Feasibility	28
4. RESOURCES AND BUDGET	29
4.1 Breakdown of Budget & Resources By Work Package For HQ.....	Error!
Bookmark not defined.	
4.2 Staff Costs for Bretigny	Error! Bookmark not defined.
5. REFERENCES	30

6. ABBREVIATIONS AND ACRONYMS.....30

1. INTRODUCTION

1.1 The Navigation Domain

The Navigation Domain concentrates on enhancing navigation capabilities within a harmonised and integrated common framework in order to support the provision of cost-effective increases in airspace and airport capacity, improvements to safety and amelioration of the environmental impact.

The **EUROCONTROL Navigation Strategy** for ECAC states, endorsed by the Provisional Council in 1998, provides a roadmap for the development of Future Navigation Applications together with the navigation infrastructure needed to achieve these applications. In order to plan, co-ordinate, and monitor the implementation of the Navigation Strategy, a transition plan has been produced describing the various actions required for moving from the strategic intent to the actual implementation of each navigation application identified in the Navigation Strategy.

1.2 Objective of the Navigation Domain Action Plan

This **Navigation Domain Action Plan** covers the period 2003 – 2018 and defines the tasks and resources needed to develop the Navigation Applications and the associated infrastructure (identified in the Navigation Strategy) to the stage that an implementation go-ahead can be given. For each Navigation Application there will be a number of deliverables leading to a “Go/No Go” decision which has the potential to create a new navigation implementation programme. The work will be co-ordinated with other domains as appropriate. The primary interface is with Airspace Management. Navigation developments also require close co-ordination with other domains and services including AIS, ATC, frequency management and communications.

The **EUROCONTROL Navigation is Strategy**, has proved to be a firm foundation for the Navigation Domain activities. The expected developments have proceeded very closely in accordance with expectations. However, as is to be expected in the 7 years since the strategy was written, some changes to timescales of Nav developments have occurred. In some instances these have resulted in an acceleration of developments, in others due to a change in priorities or delays caused by external constraints, delays have occurred to some developments. At its October 2003, The Airspace and Navigation Team endorsed a review of the Navigation strategy to take account of these developments. It also requested that the review take due account of the outcome of ICAO Air Navigation Conference 11 (ANC/11). This update is expected to be completed in 2004 with a consequent need to review the Navigation Domain action plan in 2005.

The scope of this Navigation Domain Action Plan covers:

- Identifying and defining the requirements for onboard navigation systems, navigation aid infrastructure and the Instrument Flight Procedures required to enable the ECAC Navigation Strategy.
- Confirming, in co-ordination with other domains, as appropriate, that the expected operational benefits of the proposed technical and operational changes can be realised.
- Identifying risks to the implementation of the ECAC Navigation Strategy and developing concepts for their mitigation.

- Performing CBAs to assess the costs and benefits (capacity and efficiency) of the proposed changes to stakeholders.
- Ensuring that stakeholders are adequately aware of the implications of expected future developments to enable local decisions to take due account of the global perspectives.
- Working with Safety Management to ensure the changes meet the required safety targets.

Note:

Many of the capabilities being enabled by the work of the Navigation domain will not result in a co-ordinated implementation programme. This is particularly true of Approach and Landing, where it is clear from ICAO ANC/11 that there will not be a rapid transition to a future single, globally established, guidance system. Many of the implementations of airport and terminal Area related applications will depend upon the specific business decision of that airport. These decisions will be based upon the mix of traffic and operators at an individual airport as well as environmental and operational needs. As a result implementations are likely to result not only in different implementation timescales but also, potentially, in different end points in terms of choice of approach and landing guidance system. As a result the Navigation Domain must seek to ensure that the all options are adequately addressed, sufficient data provided to assist stakeholders in their decision making as well as being in a position to provide support meeting the wide variety of needs of the stakeholder community.

1.3 Areas of Activity

To develop the Navigation Applications to the stage that an implementation go-ahead can be given, the Navigation Domain will be responsible to provide:

- Evaluation of the operational and technical requirements for navigation applications. This work is to take due account of requirements set out in ATM 2000+ and identify, in co-ordination with other domains of EATM, how existing and potential navigation capability can be most effectively developed to improve the overall efficiency on ATM in ECAC.
- Evaluation of the benefits and implementation costs in support of the go-ahead decision for implementation. Whilst the benefits to operations in ECAC are to be given due priority, the navigation Domain must take due account of the global nature of aviation and the consequent needs of compatibility with requirements in other areas and Regions. This is of particular relevance in the application of GNSS where a global capability is provided and where the cost advantages of a development can only be realised when viewed from a global perspective.
- Development of functional and operational specifications for airborne equipment necessary to enable the navigation application to support the Airspace and Airport requirements.
- Development of functional and operational requirements and quality standards for the navigation data to support the navigation application.
- Assurance of the capability of the navigation infrastructure to meet the required quality of service. This includes both terrestrial and satellite based navigation.
- Definition of radio spectrum requirements for the navigation infrastructure and support activities to ensure the availability of required navigation aid spectrum capacity to meet future developments.

- Provision of assurance that the navigation system can meet the integrity, continuity of function and provide suitable reversionary operational performance to allow safe operation in the European ATM environment.
- Development of navigation safety policies, in co-ordination with the Safety Unit, meeting the EATM safety objectives, and the execution of safety evaluations.
- Provision of support to the implementation of navigation applications, at both State and ECAC levels.
- Post implementation monitoring processes assuring that the navigation application continues to meet the required safety targets.

The Navigation Domain activities are split into the following Work Packages (WPs), which are described in more detail in Section 2 of this document:

Work Package	Work Package Title	Current EORG Business Model Phase	Start of Programme if appropriate
WP01	Domain Management	All phases	N/A
WP02	Application of P-RNAV in Terminal Airspace	Evolution Phase	N/A
WP03	Application of RNP RNAV in Medium Term	Initiation Phase (enters Feasibility end of 2004)	2007
WP04	Long Term Application of 4D RNAV	Evolution Phase	End of 2008
WP05	RNAV Approaches	Evolution Phase	N/A*
WP06	Precision Approach and Landing	Evolution	N/A*
WP07	Navigation Avionics	Evolution	N/A
WP08	Optimum Navigation Infrastructure Requirements for RNAV Operations	Evolution	N/A
WP09	Enabling GNSS for all Phases of Flight	Evolution	N/A
WP10	Data Quality for Gate to Gate Operations	Evolution	N/A
WP11	Stakeholder Communications: Impact Evaluation of Proposed Nav Developments & User Support	Evolution	N/A
WP12	Analysis of Performance & Safety Assessment of NAV Developments	Evolution	N/A
WP13	R&D Co-ordination & Technology Watch	Evolution	N/A

* Note: The application of new capabilities for approach and landing are likely to be implemented in accordance with the business requirements of individual airports. It is therefore unlikely that common target dates or business cases will be achievable. They will therefore not meet the criteria for an EATM programme. The role of the Navigation Domain will be to ensure that the necessary enabling capabilities are provide to allow stakeholders to implement in accordance with the local requirements. However, this assumption will need to be kept under review as there may be a requirement to provide support to stakeholders if a need develops for a co-ordinated initiative.

1.4 Navigation Domain Structure

The Domain is structured according to the following diagram:

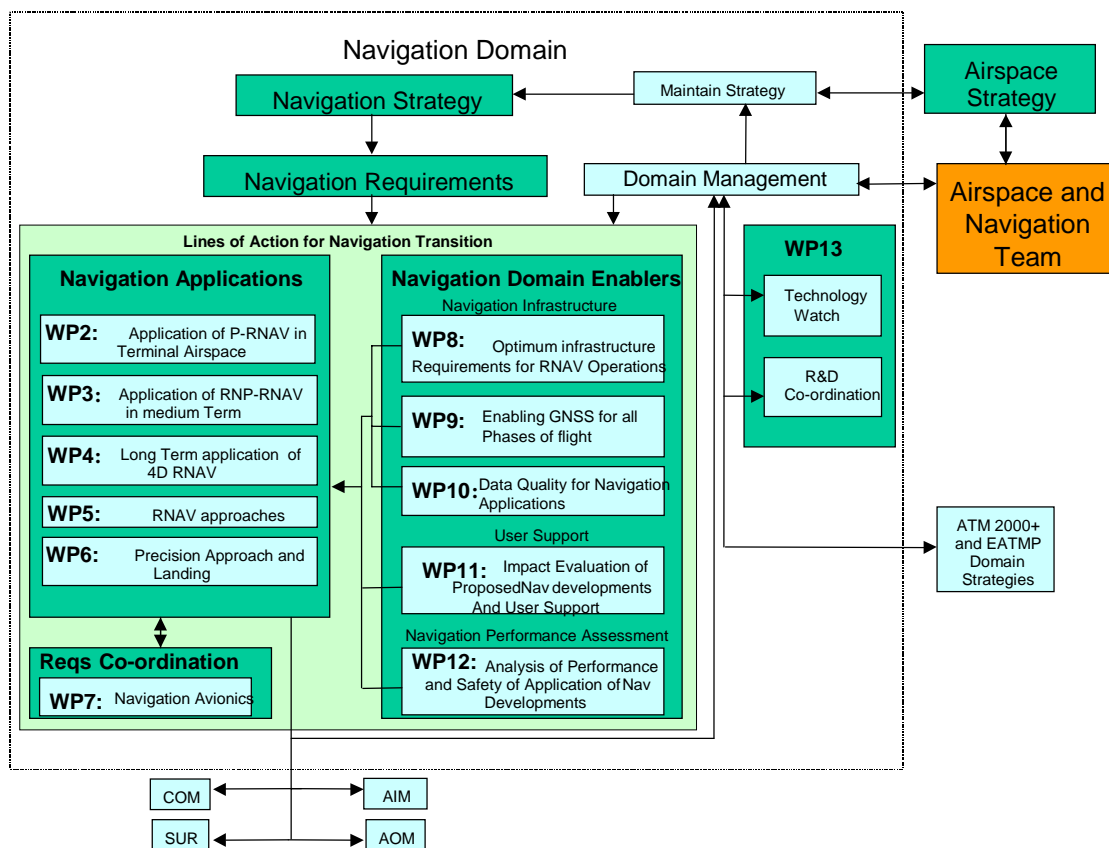


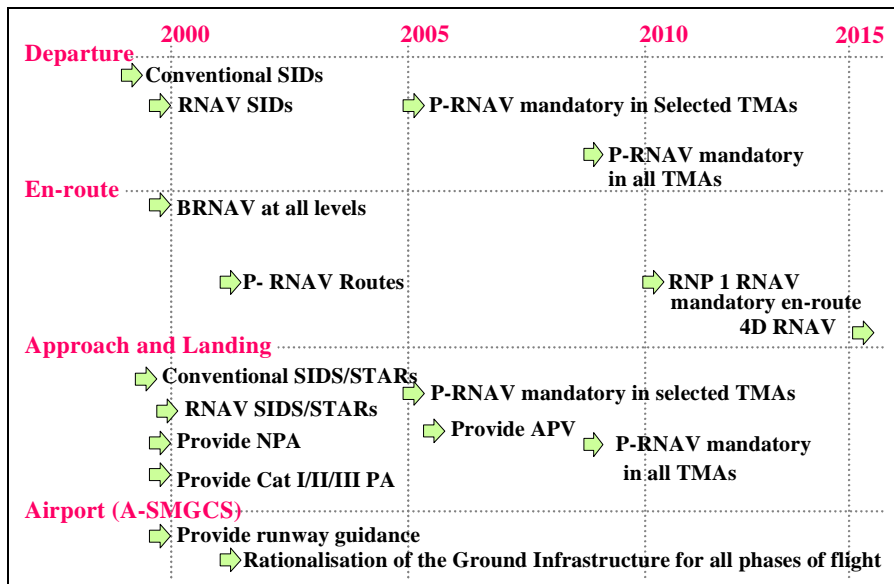
Diagram Depicting Navigation Domain Structure

2. CONTRIBUTION TO THE ATM STRATEGY

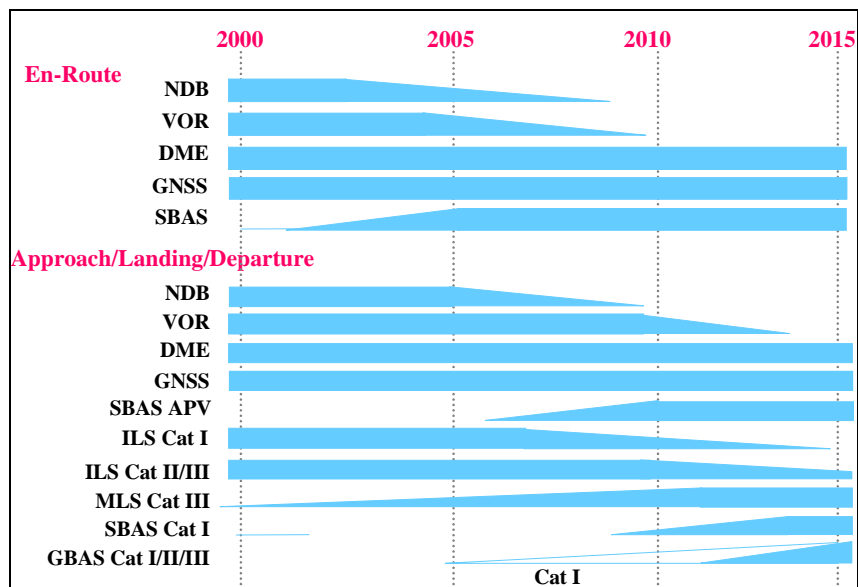
The evolution of the Navigation Domain will follow closely the strategic principles and objectives of the EUROCONTROL ATM 2000+ Strategy. The strategy describes the evolution of air navigation systems in terms of performance, functionality and corresponding infrastructure, taking due account of the principle of global interoperability.

Within the framework of the ATM 2000+ strategy, ECAC Navigation and Airspace Strategies, ICAO and JAA/EASA material, the Navigation domain will address the technical, regulatory and institutional aspects regarding the application of the navigation functions for all phases of operations from gate-to-gate.

The EUROCONTROL Navigation Strategy for ECAC represents one of the main means to achieve the required improvements capacity and economy of operation whilst allowing operations to meet the increasingly severe environmental constraints.



EUROCONTROL Navigation Strategy for ECAC – Navigation Applications



EUROCONTROL Navigation Strategy for ECAC – Navigation Infrastructure

Note: any changes to Navigation Strategy, once endorsed through the EATM procedures, will need to be reflected in a revision to this Domain Action Plan

3. DOMAIN WORK PACKAGES

3.1 Domain Evolution

3.1.1 WP01 - Domain Management

This WP (work package) is concerned with planning, co-ordinating and monitoring the implementation of the EUROCONTROL Navigation Action Plan.

3.1.1.1 Objectives

- To ensure a harmonised implementation of the Navigation Strategy within all ECAC States.
- To maintain reliability and coherency of the Navigation Strategy by ensuring that the rationale for the next step forward remains valid in the light of the progress made and experience gained, and to reflect the impact of any technology developments on navigation.
- To ensure the coherence of ECAC navigation requirements with Global navigation requirements.
- To ensure continued conformance to the EATM 2000+ Strategy by reviewing the impact of changes in navigation applications on the EATM 2000+ Strategy
- To ensure that any changes in EATM 2000+ operational requirements that impact the Navigation Strategy are reflected in changes to the Navigation Strategy and also to the updated action plan
- To identify interactions with other Domain Plans and Programmes and to ensure that the Navigation Domain provides deliverables in accordance with the stakeholder requirements.
- To manage the Domain R&D and technology watch.
- To ensure that the outputs from the WPs are reported through the appropriate EATM decision-making bodies.

3.1.1.2 Work Organisation

The Navigation Domain Action Plan will be implemented and reported through the parent "Airspace & Navigation Team" (ANT) and its Navigation Applications Sub-Group and Navigation Infrastructure Sub-Group to ensure appropriate steering and co-ordination with all stakeholders.

3.1.1.3 Deliverables

Item	End date
Navigation Domain Action Plan	On-going
Schedule	On-going
Progress Reports	On-going
Risk & Issue Register	On-going
Decision Register	On-going
Updated Navigation Strategy	As required- next update Oct 2004

3.1.2 WP02 - Application of P-RNAV in Terminal Airspace

The Operational Requirements for RNAV in the Terminal Airspace are to:

- Increase operational efficiency and reduce environmental impact through the provision of RNAV terminal procedures;
- Improve safety by reducing the controller and pilot workload, enhancing the situational awareness on the flight deck and reducing the risk of collision with obstacles and other aircraft.

3.1.2.1 Objectives

- Define the navigation requirements for the safe operation of RNAV in Terminal Airspace
- Provide guidance to States as to the correct definition of RNAV procedures. This is to include advice as to the limitations of RNAV that must be accounted for in the procedure design and implementation.
- Develop standards and guidance material for procedure design, procedure description and charting to ensure data base suppliers and users correctly interpret the procedure requirements.
- Provide support to enable a uniform application of RNAV where States, ANSPs or airports responsible for the introduction of RNAV deem the use of RNAV to be appropriate.

3.1.2.2 Work Organisation

Activities will be performed through close co-operation between the NAV and ASM domains. The main forum will be the Navigation Applications Sub-Group. Progress reporting will be to ANT.

The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept the deliverables.

3.1.2.3 Deliverables

Item	End Date
Development of Operational and Technical Requirements	
Provide follow up for the Doc 7030 updates	31/12/03
Updated Nav Procedure Design Guidelines	31/12/03
Updated Draft amendment to ICAO Doc 7030/4 EUR or draft amendment to ICAO Doc 4444 following ICAO Consultation processes	31/12/03
Development of Quality Standards for Navigation Data	
Definition of quality requirements for terrain and obstacle data, in particular for RNAV operations in TMA	31/06/04
Safety Evaluation	
Validated P-RNAV Safety Case	31/12/03
Support to Implementation	
Validated Implementation Strategy	31/12/03
RNAV/TMA Implementation Guidance Material for States	31/12/03

Item	End Date
Provide focal point for co-ordination of State's implementation plans	Continuous to 2010
Produce Educational Package, Provide Workshops and respond to needs identified by States for support in implementing RNAV in the TMA	Continuous to 2010
Provide PANS OPS Consultancy	Continuous to 2010

Note: WP 8 provides deliverables supporting P-RNAV integrated initiative. These include the flight calibration standards.

3.1.3 **WP04 - Long Term Application of 4D RNAV**

The Operational Requirements for 4D RNAV are to increase capacity levels and operational efficiency for all phases of flight from take-off to touchdown. Their feasibility has been demonstrated by research programmes such as PHARE. Significant benefits, in terms of system capacity and operational efficiency, were shown to be possible given an aircraft's capability to fly 4D trajectories accurately, and to negotiate user preferred trajectories, via data link, with advanced ATC tools. FMS equipment capable of 4D-control in the en-route and terminal area are becoming available and ATC tools such as arrival and departure managers and conflict probe are also being developed. Programmes such as Link 2000 are putting in place the necessary data communications infrastructure. All these improvements are necessary for an integrated ATM as defined in ATM 2000+ Strategy for operations by 2015.

This WP will address the issues from an airborne perspective by initiating studies and trials to evaluate and quantify the benefits of 4D RNAV.

3.1.3.1 Objectives:

- To evaluate the potential benefits of 4D RNAV in an integrated ATM environment.
- To develop concepts for the potential phasing of the requirements
- To define Operational Requirements for each of these phases in a 4D RNAV application.
- To identify the main dependencies
- To provide input to the design of the overall ATM system architecture to accommodate advanced 4D FMS capabilities.

3.1.3.2 Work Organisation

Activities will be performed through close co-operation between the NAV, ASM, AEM, ATS and CSM domains. The Navigation Domain will provide the overall co-ordination. Progress reporting will be through the Navigation Application Sub-Group and ANT.

The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept deliverables.

Budgetary constraints are presently preventing further progress on this WP. Due regard will be paid to methods by which WP 3 output (especially prototyping facilities) can be used in future years to enable this work to proceed. The deliverable timescales are those needed to enable 4D RNAV to be implemented in the timescales set out in the Navigation Strategy. At present delays of at least one year must be expected.

3.1.3.3 Deliverables

Item	End date
Evaluation of Benefits and Implementation Costs	
Business Case for a 4D RNP-RNAV Environment	01/07/06
Development of Operational and Technical Requirements	
Strategy for 4D RNP-RNAV application	01/07/06
Standard for 4D RNP-RNAV Applications	31/12/06
RNP-RNAV Procedure Design Specification	31/01/08
Conduct Simulations and Trials to validate 4D RNP-RNAV capabilities and develop/update ATS procedures	31/12/08
Draft amendment to ICAO Doc 7030/4 EUR and/or Doc 4444,	31/12/08
Development of Quality Standards for Navigation Data	
Definition of quality requirements for meteorological data, in particular for datalink applications to support RNAV operations	TBD, in accordance with ADS programme
Assessment of Capability of Navigation System to Meet Integrity, Continuity and Reversion Requirements	
Validation Report for Aircraft 4D RNP-RNAV	TBD
Safety Evaluation	
Initial Safety Case for 4D RNP-RNAV	30/06/08
Specification of Improved Safety Nets for 4D-RNAV	30/06/10
Validated Safety Case	TBD
Feasibility Report	30/6/08
Support to Implementation	
Validation report for 4D RNP RNAV performance requirements	TBD
Implementation Plan for 4D RNP-RNAV	30/06/08
Draft AIC for 4D RNP-RNAV	31/7/08

3.1.4 WP05 - RNAV Approaches

The Operational Requirements for RNAV Approaches with Vertical Guidance are:

- To increase safety through the provision of RNAV approaches as a replacement of conventional non-precision approaches (NDB/VOR/LLZ). This will be achieved through the provision of increased accuracy and integrity of positional data with consequent enhancement of situational awareness. The provision of vertical guidance and continuous distance to threshold information will also enable standardisation of approach operations. These together will significantly reduce the risk of CFIT
- To increase capacity and operational efficiency during poor visibility conditions at airports which are not suitably equipped for precision approach and landing.
- To use the RNAV capability to provide approach paths that avoid noise sensitive areas or where vertical obstructions on the extended centreline, or in the missed approach, would prevent a non-RNAV instrument approach.

The assumed navigation infrastructure will be primarily GNSS based, with EGNOS availability enabling a geometric vertical path to be flown. Whilst such approaches at the

level of APV 1 have been identified by ANC/11 as an appropriate target for global applicability, it is recognised that stakeholders have differing operational requirements. Not all will wish to achieve APV 1 as similar performance capabilities (eg DA/H) are achievable with appropriate airborne architecture. In addition many operators will be capable of realising many of the expected safety gains using existing RNAV/FMS equipment, there is therefore potential for early and cost effective implementation using Basic GNSS and DME based approaches with Barometric VNAV..

Additionally, whilst APV I is the common level proposed by ANC/11, EGNOS, is expected to be able to provide an enhanced capability identified as APV II and this needs to be addressed in the Navigation domain

As a result it is considered essential that the Navigation Domain addresses the whole range of RNAV approach capabilities to ensure that stakeholders are able to safely implement the level of capability identified for their individual business needs. There is a high degree of commonality in the requirements for these procedures in respect of the procedure design material, RNAV/FMS specification, collision risk analysis etc. As a result, the wide range of stakeholder needs can be effectively addressed concurrently so long as this commonality is taken into account at the start of the preparation of the material. The Navigation Domain will develop support material enabling a common methodology for the implementation of the RNAV procedures and will work with JAA/EASA in the specification of equipment and operational procedures.

3.1.4.1 Objectives

RNAV approaches will be gradually implemented as a local need is identified and business cases approved. As such the Navigation Domain role will be one of ensuring that the necessary material is available to enable States/airports to implement RNAV approaches in a commonly agreed manner and to common standards. In this context the objectives of this WP are:

- To facilitate the early implementation of RNAV Approaches with Vertical Guidance in ECAC states using aircraft equipped with RNAV/Baro-VNAV and Augmented GNSS (APVI and APV II). Appropriate emphasis will be placed on APV I in view of the decision of ANC/11.
- To develop guidance material, to validate standards and procedures, and to undertake the generic safety assessment (safety argument) to enable States to more readily implement RNAV approaches.
- To support states where implementation is proposed.
- To ensure, through co-ordination with stakeholders, that implementation can be undertaken in a common manner.
- To develop the safety cases needed to enable implementation of RNAV Approaches
- support WP 12 in undertaking safety assessments post implementation.

3.1.4.2 Work Organisation

Activities will be performed through close co-operation between the States, ANSPs, Airspace Users and equipment providers, and EUROCONTROL AFN, ASM, AEM, AIM domains. Navigation Domain will provide the overall co-ordination. It is expected that EGNOS related activities would be co-ordinated with the Galileo Joint Undertaking; the Navigation Domain being responsible for the management of the workplan for the introduction of the EGNOS in aviation Services on behalf of the GJU.

Progress reporting will be to ANT through Navigation Applications Sub-Group.

The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept the deliverables.

3.1.4.3 Deliverables

Item	End date
Evaluation of Benefits and Implementation Costs	
Business Case for RNAV Approaches (RNAV systems meeting TGL XY)	31/12/04
Business Case for RNAV Approaches (RNAV systems meeting TGL XZ)	1/7/05
Development of Operational and Technical Requirements	
EUROCONTROL RNAV approach procedure design specification	1/7/05
PANS-OPS changes(extensions to cover SBAS)	1/7/06
Conduct simulations and trials to validate RNAV approach capabilities and develop/update ATS procedures	31/12/06
Draft amendment to ICAO Doc 7030/4 EUR and/or Doc 4444 to cover RNAV approaches (APV using SBAS and LNAV/VNAV)	31/12/05
Charting requirements for RNAV approaches	1/7/05
Validation report on operational criteria for RNAV Approaches following simulations and trials	31/12/06
Development of Quality Standards for Navigation Data	
Data quality requirements for APV specified	31/10/04
Identification of regulatory process for data associated with APV	1/1/05
Set up and application of validation and audit process for approach co-ordinate data	1/12/06
Support to RNAV Approaches with Vertical Guidance for the map display requirements	31/12/05
Assessment of Capability of Navigation System to Meet Integrity, Continuity and Reversion Requirements	
Validation reports for RNAV Approaches (systems performance assessment) LNAV/VNAV; APV I; APV II	31/12/06
Safety Evaluation	
Initial Safety Case for RNAV Approaches with Baro Vertical guidance	28/08/03
Reviewed, updated and endorsed safety case for RNAV Approaches with Baro Vertical guidance	1/10/04
Initial Safety Case for RNAV Approaches with SBAS (APV I and APV II)	31/12/05
Reviewed, updated and endorsed safety case for APV I and APV II RNAV Approaches	1/7/06
Support to Implementation	
Implementation Strategy for RNAV Approaches (Co-ordinated with strategy on RNP-RNAV)	31/12/05
Draft AIC for RNAV Approaches	31/08/05
Guidance material for implementation of RNAV approach	31/12/04
Post Implementation Monitoring and Follow Up	
Post implementation monitoring of aircraft approval status, track performance, procedure design, data integrity, navaid coverage.	1/1/2006

Item	End date
Flight trials to support validation of design guidelines for RNAV approaches	31/06/07
Update Guidance Material and provide draft amendments to ICAO Material for RNAV Approaches following assessment of operation	31/12/07

Note: WP 8 addresses flight calibration/inspection guidelines

3.1.5 WP06 - Precision Approach and Landing

The long-term aim of the Navigation Strategy is to transition to a GNSS based landing system. . ANC/11 concluded that there is no technical reason why GNSS cannot be used for all phases of flight. However, the technical capability of GNSS to be applied in all precision approach and landing visibility categories still need to be confirmed. This will start with the validation of Cat I performance. In addition there is a significant task to be carried out to prepare a safety case for the application of GNSS as the only available guidance system for precision approach and landing.

Prior to any transition to a GNSS based landing system, safety and security issues have to be adequately addressed and mitigated, in addition to the primarily technical and operational evaluations. Moreover, a sound and transparent business case has to be developed.

ILS will be maintained for as long as practicable. However, the expected limitations to the long term maintenance of ILS at some airports, due to multipath and interference issues, and the continuing developmental status of GNSS landing systems, mean that MLS is the only system capable of replacing ILS for Cat II/III operations at present. For this reason, MLS has been retained in the Navigation Strategy.

The current uncertainties surrounding the proposed use of GNSS for all categories of approach and landing can only be resolved by appropriate analysis and trials, some of which will be conducted under WP 09. The work under this WP will concentrate on the application of the landing system whilst WP09 concentrates on the signal in space performance.

This WP will address, inter alia, the continuing pressure on radio frequencies allocated to air navigation, and the need to provide stakeholders with data to support future plans.

This work package will include the identification of:

- the constraints upon ILS and hence the timeframe within which the transition to a new PA (GLS/MLS) aid will be necessary;
- the advantages and limitations of each of the options as a future PA aid;
- the ECAC wide implications of these considerations on the future PA environment including safety case the timescales/costs for its achievement.

3.1.5.1 Objectives:

- Propose a detailed planning for the most efficient and advantageous means of transitioning to the future ECAC Precision and Landing System.
- Identify operational requirements for a future landing system and review:
- The ability of the candidate precision approach systems to meet these requirements
- The safety targets for PA Operations in the ECAC environment.
- The Quality of Service requirements for PA Operations in the ECAC environment
- Identify Technical and Operational Characteristics of the available options in terms of: advantages and limitations, feasibility, availability, time-scales, order of costs.

- Conduct a safety assessment of GNSS for Precision Approach and develop appropriate safety cases for GNSS Cat I and subsequently for Cat II/III.

3.1.5.2 Work Organisation

It is recognised that a considerable amount of work has been undertaken in the European Region by the ICAO AWOG. This Work Package will take account of the AWOG activities and will be co-ordinated and performed in close co-operation with EUROCAE, JAA/EASA, ICAO, OEMs, etc. Navigation Domain will ensure that there is coherency in the availability of Standards/Guidance Material. Progress reporting will be to ANT through Navigation Applications Sub-Group.

3.1.5.3 Deliverables

Item	End date
Evaluation of Benefits and Implementation Costs	
Review of PA transition options	1/9/04
Review of technical limitations of ILS and impact on long term application of ILS to LVP	31/4/05
Identification and quantification of limitations and advantages of transitions from ILS to MLS and/or GLS	1/1/06
Strategy for transition to a final approach and landing system	31/10/06
Recommendations of changes to ICAO Strategy on Precision approach (if required)	31/12/06
Development of Operational and Technical Requirements	
Operational Requirements for Precision Approach and Landing up to 2015	TBD
GBAS CAT-I Concept of Operations	31/12/03
Concept of operation for mixed mode ILS/MLS/GLS	1/7/05
GBAS Roadmap Update (initial update to take account of lessons learned – further periodic updates as required)	31/12/05
Final revisions to ICAO Doc 7030 and/or Doc 4444 to support GNSS Cat I operations	31/12/06
GBAS CAT-II/III Concept of Operations	31/12/05
Provide data to support confirmation of technical requirement for GNSS system (Galileo/GPS/GBAS) capable of meeting requirements for the use of GLS as sole service for Cat II/III operations in ECAC	31/07/05
Initial operational feasibility review for GNSS Cat II/III	31/06/05
Initial review of obstacles and potential mitigation's to GNSS sole service for Precision Approach and Landing systems.	31/12/05
Initial proposals for changes to ICAO Doc 7030 and/or Doc 4444 to support GNSS Cat II/III operations	TBD
Papers on Navigation Application issues supporting studies on legal, institutional and political issues associated with GNSS providing the service (potentially sole service) for precision approach and landing	TBD
GBAS Approach and Landing Procedure Design Specification	31/12/04
Operational validation of GBAS standards for Cat II/III	31/12/09
Development of Quality Standards for Navigation Data	

Item	End date
Data quality requirements for GNSS Cat I/II/III	31/01/04
Confirmation of Capability of Navigation System to Meet Integrity, Continuity and Reversion Requirements	
Validation Report for GNSS Cat I (costings assume initial operations, commencing in 2006 will enable cost effective data collection using in service aircraft)	31/12/07
Validation Report for GBAS Cat II/III	TBD
Safety Evaluation	
Initial Safety Case for GBAS Cat I	31/10/04
Final Safety Case for GBAS Cat I	31/12/05
Initial Safety Case for SBAS Cat I (if appropriate)	TBD
Final Safety Case for SBAS Cat I (if appropriate)	TBD
Initial Safety Case for GNSS Cat II/III	31/12/05
Safety Case for Galileo/Enhanced GPS PA	31/12/07
Vulnerability issues associated with GNSS PA	1/1/05
Barriers to sole GNSS alone providing ECAC PA structure	1/1/07
Potential mitigations for vulnerabilities supporting Cat II/III	1/1/09

3.1.6 WP07 Navigation Avionics

This WP will co-ordinate the development and validation of the functional requirements for airborne systems supporting the navigation applications. The Navigation developments are seldom undertaken in large steps, rather each generation of system provides additional capability that meets the next significant operational improvement by incremental steps. The Navigation domain, whilst providing the direction of future developments has to take due account in its planning of the relatively long lifetime of systems and the resulting large range of capabilities existing in the fleet at any time.

The work will focus on three aspects:

- The co-ordination of requirements between the navigation applications, and taking due account of the expected Navigation infrastructure developments (GNSS and terrestrial systems) thereby minimising cost for the provision of the Nav System (RNAV/FMS and Precision Approach) capability for all phases of flight.
- The identification of capabilities of existing systems that can be used to support future navigation applications

The quantification of navigation performance

The overall aim will be to maximise the benefits that can be obtained from existing systems and to minimise the future costs of systems capable of meeting the requirements of the navigation strategy

Where new functionality is required, this may be initially incorporated into EUROCONTROL Standards but in the majority of cases the main implementation methods will be through the provision of support to JAA (EASA).

Cost studies (feasibility and cost) and, where appropriate, simulations and trials will be conducted to validate the realisation of the capability.

The FMS/RNAV system is central to many of the proposed applications requiring data on aircraft position and intent. The Nav avionics activities will liaise with other EATM domains and programmes to ensure future FMS standards meet the broader EATM 2000+ Strategy requirements.

3.1.6.1 Objectives

- To confirm the applicability of existing guidance material concerning navigation applications and support JAA (EASA) in producing updates as appropriate.
- To evaluate avionics requirements for RNAV approaches with Baro-VNAV and Geometric VNAV (GNSS)
- To evaluate avionics requirements for RNP-RNAV
- To evaluate avionics requirements for long term, e.g. 4D RNAV, improved meteorological forecasts, datalink and ground planning tools etc.
- To develop standards in co-ordination with JAA (EASA) for RNAV Approach, RNP-RNAV, GBAS Cat I/II/III, SBAS Cat I and 4D RNP-RNAV.
- To define navigation avionics requirements for data link applications, e.g. ADS, ASAS, and A-SMGCS in support of other EATM programmes.

3.1.6.2 Work Organisation

Activities will be performed through close co-operation between the States, Airspace Users and equipment providers, and EUROCONTROL ASM, AEM, AIM domains. The Navigation Domain will provide the overall co-ordination. Progress reporting will be through Navigation Applications Sub-Group to ANT.

The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept the deliverables.

3.1.6.3 Deliverables

Item	End date
Development of Functional and Operational Specifications for Airborne Equipment	
ORD for Aircraft RNAV Approaches	31/05/04
Guidance material for certification and operational approval of aircraft RNAV approaches including APV I and APV II (EASA)	31/12/03
ORD for Aircraft RNP-RNAV	1/07/05
Revised RNAV Standard for RNP-RNAV	1/06/05
Guidance material for certification and operational approval of aircraft RNP-RNAV (EASA)	31/12/06
ORD for Aircraft 4D RNP-RNAV	31/03/06
Revised RNAV Standard for 4D RNP-RNAV	30/11/06
Guidance material for certification and operational approval of aircraft 4D RNP-RNAV (EASA)	31/7/09
Guidance material for certification and operational approval of GNSS Cat I (SBAS and GBAS) (JAA/EASA)	21/12/05
Guidance material for certification and operational approval of GNSS Cat II/III (EASA)	TBD
Validation of functional requirements for advanced FMS/RNAV	01/01/06
Validation of functional requirements for 4D RNP-RNAV	31/12/07
Analysis of P-RNAV track keeping performance, lateral and vertical	31/12/03
Analysis of RNP-RNAV track keeping performance, lateral and vertical	31/12/08
Analysis of 4D RNP-RNAV track keeping performance, lateral and vertical	31/12/09
Analysis of RNAV approach track keeping performance, lateral and vertical	01/07/07
Analysis of GNSS Cat I performance, lateral and vertical	31/12/06
Analysis of GNSS CatII/III performance, lateral and vertical	01/07/09
Navigation/avionics architecture definition document	TBD
Validation report on navigation performances during ADS trials	TBD

3.1.7 WP08 - Optimum Navigation Infrastructure Requirements for RNAV Operations

The navigation infrastructure must be capable of providing the appropriate level of performance to support all of the Navigation applications for the different phases of flight. For the existing and future infrastructure assessments a considerable amount of data will need to be collected and managed for input to safety assessments. This includes the number and locations of navigation aids, costs for installation and maintenance, failure modes and failure rates.

3.1.7.1 Objectives

- To define the most cost effective navigation infrastructure necessary to support the requirements of the Navigation Applications, in line with the Navigation Strategy.
- To assess the current navigation infrastructure performance.
- To assess the future navigation infrastructure performance requirements for proposed navigation applications.
- To assess the most cost effective means of safely achieving the navigation infrastructure requirements
- To ensure a harmonised approach to the approval of the provision of GNSS based services for RNAV applications throughout ECAC.
- To provide data for safety assessment(s) of navigation applications.
- To assess the impact of navigation infrastructure rationalisation plans.
- To produce guidelines for optimum navigation infrastructure planning.
- To evaluate navigation frequency requirements.
- To develop requirements for the validation and flight testing of the navigation infrastructure.

3.1.7.2 Work Organisation

This work will be carried out in co-operation with ANSPs and various EATM Domains. The infrastructure requirements for navigation applications, as defined in the Navigation Strategy, will be received as inputs from WPs 2-7. WP 09 will provide the necessary GNSS performance data.

Progress reporting will be through Navigation Infrastructure Sub-Group to ANT

The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept the deliverables.

3.1.7.3 Deliverables

Item	End date
Evaluation of Benefits and Implementation Costs	
Business Case for infrastructure to support RNP-RNAV	31/12/07
Business Case for infrastructure to support 4D –RNAV	31/12/08
Assess options for Nav infrastructure enhancements to support RNP-RNAV	31/12/07
Assess options for Nav infrastructure enhancements to support 4D -RNAV	31/12/07

Item	End date
Development of Operational and Technical Requirements	
Establish data repository for navaid reliability, failure modes and failure rates	31/12/04
Establish data repository for numbers of navaids, installation & maintenance costs.	31/12/04
Guidance on infrastructure requirements to support P-RNAV	31/06/04
Establish navigation requirements for RNP-RNAV	31/03/04
Guidance material for RNP-RNAV infrastructure service provision	31/12/08
Establish navigation infrastructure requirements for 4D-RNAV	31/03/06
Guidance material for 4D -RNAV infrastructure service provision	31/06/09
Development of modification to ICAO ANP	As required
Development of Functional and Operational Specifications for Airborne Equipment	
Initial Version of Flight Calibration Standard	31/9/04
Flight Calibration specification for NAV infrastructure (P-RNAV)	31/12/05
Flight Calibration specification for NAV infrastructure (RNP-RNAV)	31/12/06
Draft amendments to ICAO Documentation	31/12/05
Assessment of Navigation Infrastructure Capability to meet Required Quality of Service	
DME Coverage Assessments for P-RNAV in Terminal Areas	On-going
Application of SBAS to P-RNAV	31/08/04
Assessment of issues related to reception of geostationary satellites in areas of mountainous terrain	31/12/05
Assessment of current NAV infrastructure against RNP-RNAV requirements	31/05/05
Application of SBAS to support RNP-RNAV	31/12/07
Validation Report for Nav infrastructure for RNP-RNAV	31/12/07
Assessment of current NAV infrastructure against 4D –RNAV requirements	31/06/07
Application of SBAS to support 4D –RNAV	31/12/07
Validation Report for Nav infrastructure for 4D –RNAV	31/12/08
Assessment of Radio Spectrum Requirements	
<i>Preparation of initial review of impact of Navigation Applications on spectrum requirements</i>	1/7/05
<i>Preparation of final material supporting WRC 2007</i>	1/12/06
Safety Evaluation	
Vulnerability Assessment of optimised ECAC Navigation Infrastructure for supporting RNAV operations en-route and TMA in accordance with Nav Strategy	1/7/05
Vulnerability Assessment of optimised ECAC Navigation Infrastructure for supporting RNAV operations en-route and TMA based solely on GNSS	1/6/06
Study of Mitigation Means for identified vulnerabilities for RNAV operations	1/7/07
Implementation	
Implementation Plan for Nav infrastructure for RNP-RNAV	31/12/08

3.1.8 WP09 – Enabling GNSS for all Phases of Flight

This WP addresses the work required to allow the navigation applications to maximise the use of GNSS for all phases of flight and to support the application of GNSS to ASMGCS supporting Airport Operations Domain

3.1.8.1 Objectives

Whilst the ANC/11 concluded that there is no obstacle to GNSS being used in all phases of flight, the degree of application is still dependent upon a confirmation of GNSS performance. This WP will provide the studies and trials needed to confirm GNSS capability and provide the data needed to support the system definitions and safety cases prepared in respect of GNSS use in the Navigation Applications of WPs 2-6.

This work will form part of a European wide work programme of GNSS avoiding unnecessary duplication and ensuring that all required data needed to support proposed navigation applications are made available in a timely and cost effective manner. Within this framework the objectives are:

- To determine the capability of GNSS (GPS/Galileo) and the augmentation systems (SBAS/GBAS) in meeting the technical requirements for the planned navigation applications
- To assess the degree to which the EGNOS performance can meet the navigation application requirements.
- To develop and maintain tools to support the assessment of EGNOS performance against defined requirements and in co-ordination with work being carried out by ECAC States
- To develop a methodology to evaluate GBAS technical performance against Cat I/II/III performance requirements
- To develop and maintain tools to support the assessment of GBAS performance against Cat I/II/III requirements
- Identification of siting requirements and development of prototype tools to aid site approval and support operational approval and safety assessment
- To support the development and validation of GBAS Cat I and Cat II/III Standards
- To assess the degree to which the Galileo/GPS performance can meet the navigation application requirements.
- To adapt tools developed for the EGNOS/GBAS activities to support future assessments of GPS and Galileo.
- To provide data to support the development of safety cases for RNAV and Precision Approach operations using GNSS
- To determine the ultimate performance limits of all GNSS systems, including both SBAS and GBAS. This includes:

- Investigations into multipath characteristics for both GNSS and VDB signals improve performance for PA CAT II/III and A-SMGCS operations;
- VDB coverage investigations support GBAS use for future RNAV operations;
- Validation of Ionosphere delay prediction for dynamic events supports more reliable operation of both EGNOS and GBAS;
- Application of GNSS signal delay characteristics as an input to the Numerical Weather Prediction model.

3.1.8.2 Work Organisation

This work will be carried out in co-operation with ANSPs, other stakeholders and the Navigation Applications Sub-Group. The results of this work will be input to WP5, WP6 and WP8 to support the overall assessment of navigation infrastructure requirements for navigation applications. Progress reporting will be through Navigation Infrastructure Sub-Group to ANT.

Significant elements of this WP are expected to fall within the context of a joint programme with the Galileo Joint Undertaking on EGNOS. Appropriate working and reporting arrangements will need to be established.

The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept the deliverables.

3.1.8.3 Deliverables

Item	End date
Development of Operational and Technical Requirements	
Develop Pegasus tool for evaluation of EGNOS Signal In Space performance	01/05/04
Confirmation of technical requirements of APV on EGNOS	31/12/05
Develop MARS Phase III tool for evaluation of GBAS performance	30/09/04
Technical feasibility assessment including identification of local system requirements for GBAS CAT-II/III	30/06/05
Standards validation for GBAS CAT-II/III	31/12/09
Development of prototype tools to aid States in the site assessments	TBD
Co-ordinate development of GNSS charging mechanisms with ESSP/JU	TBD
Assessment of Navigation Infrastructure Capability to meet Required Quality of Service	
SBAS signal-in-space validation	1/7/06
Validation of SBAS meeting technical requirements for APV	31/7/06
GBAS signal-in-space validation	31/12/05
Interim validation that GBAS meets requirements for Cat I operation	31/12/05
Final validation that GBAS meets requirements for Cat I operation	31/12/06
Galileo signal-in-space validation	TBD
Galileo –validation of system performance system performance	1/01/09
System performance Validation Report for GNSS Landing Cat II/III	TBD
Safety Evaluation	

Item	End date
Support to Galileo application – identification of failure modes, hazards and identification of safety objectives for Nav application	1/6/05
Galileo/enhanced GPS preliminary safety assessment – failure modes analysis	1/6/07
Vulnerability Issues related to GNSS (SBAS/GBAS Galileo/GPS)	31/12/06
Identification of technical mitigations for PA vulnerabilities (Cat II/III)	31/12/07
Support to Implementation	
Support to GNSS Policy Office in the context of legal, institutional, and political dimensions of GNSS Application	31/12/05
Support to States developing national safety cases/business cases for use of GNSS including SBAS/GBAS	TBD
Support to States introducing GNSS charging mechanisms.	TBD

3.1.9 WP10 - Data Quality for Gate to Gate Operations

This WP concerns requirements for the provision of navigation and meteorological data at the quality (accuracy, resolution, assurance level, traceability, timeliness, completeness and format) required to support navigation and other applications in the future ECAC CNS/ATM environment. The use of GNSS for terminal operations, approach and landing, and surface operations, will place additional significance on the integrity and accuracy of data and this will be included in requirements.

3.1.9.1 Objectives

- To define a common Vertical Geodetic Reference Frame for navigation applications in support of the Navigation Strategy for ECAC.
- To validate the data quality (Accuracy, integrity, timeliness) requirements set out in ICAO Annex 15.
- To establish whether the current published co-ordinate data accuracy and integrity levels meet the requirements of ICAO Annex 15.
- To develop proposals for the amendment of appropriate ICAO material covering Terrain and Obstacle Data.
- To develop guidance material and standards for the origination of data and its subsequent management prior to the transfer of data to AIS.
- To review the meteorological data requirements for navigation and the impact on datalink of the provision of these data (PHARE studies).

3.1.9.2 Work Organisation

Activities will be performed through close co-operation between NAV, ASM, and AIM domains along with the EAD. Involvement from the Experts within member States, data suppliers and data users will be sought for this WP.

The main forum for discussions will be the Navigation Infrastructure Sub-Group reporting to the ANT. The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept the deliverables.

3.1.9.3 Deliverables

Item	End date
Evaluation of Benefits and Implementation Costs	
Provision of information on data quality requirements and implications on data maintenance costs for CBAs and safety cases for RNAV applications	As required
Development of Quality Standards for Navigation Data	
Definition of the vertical reference frame for co-ordinate data to support RNAV Applications	31/06/05
Definition of quality requirements for terrain and obstacle data, in particular for RNAV operations in TMA	31/06/04
End-User guidelines for Quality Assessment of Database Integrity and Accuracy to support compliance to ED76	31/12/04
Definition of quality requirements for meteorological data, in particular for datalink applications to support RNAV operations	TBD, in accordance with ADS programme

Item	End date
Draft Data origination and maintenance standard/Guidance Material	31/12/03
Finalise Data origination and maintenance standard/Guidance Material	31/12/04
Vertical Datum Requirements	31/01/04
ORD for Aircraft 4D-RNAV (met data etc)	31/10/05
Navigation data quality requirements for surface operations	01/01/2005-30/12/2006
Safety Evaluation	
Provision of information on data quality requirements and implications on data maintenance costs for CBAs and safety cases for RNAV applications	As required
Support to Implementation	
Support education of States	31/12/04
Post Implementation Monitoring	
Monitor improvements to data quality	Annual to 2010

3.1.10 WP11 – Stakeholder Communications: Impact Evaluation of Proposed Nav Developments and User Support

This WP provides the data required to assess the economic impact of the proposed navigation applications and to enable calculations to be made of the transition costs. The target is to achieve the required quality of service enabling the implementation of the EATM Navigation Domain priorities at the best overall benefit to cost ratio.

3.1.10.1 Objectives

- Perform detailed CBAs
- Assess the optimum technical means of meeting the RNAV and RVSM requirements.
- Maintain up to date knowledge of the navigation market to assess ability of equipment to meet functional and operational requirements of the proposed navigation developments.
- Maintain detailed technical information on RNAV and landing system capability and equipage of the European and world-wide fleets.
- Maintain expertise in the certification and operational approval of RNAV, Precision Approach and altimetry.
- Maintain the database developed for the BRNAV and RVSM Implementation and enhance to include data on RNAV and PA capability of airframes above the baseline BRNAV requirement.
- Maintain reference material on avionics requirements and capability and contact lists for world-wide certification authorities.

3.1.10.2 Work Organisation

This WP will be managed by the Navigation Domain in co-ordination with the JAA (EASA). Work will be reported to ANT and supported by Navigation Applications SG. Contact will be maintained with: Certification Authorities, Aircraft & Avionics manufacturers, and Maintenance Organisations.

3.1.10.3 Deliverables

Item		End date
P-RNAV	Equipage status for first review of implementation date	June 2003
	Assessment report on impact of P-RNAV	Dec 2004
	Status update prior to final go ahead decision	April 2004
	Support to Operators in achieving compliance	Continuous
RVSM	Review of RVSM Approved aircraft (# of aircraft & operations)	every year
	Follow up of aircraft not approved operating in RVSM airspace	Continuous
	Support to operators in achieving compliance	Continuous
RNP RNAV	Equipage status for first review of business case	June 2003
	Impact report of RNP-RNAV implementation on operators	Dec 2005
	Status update prior to final go ahead decision	April 2006
	Support to Operators in achieving compliance	Continuous from 2006
4D RNAV	Equipage status for first review of business case	June 2006
	Status update prior to final go ahead decision	April 2008
	Support Operators in achieving compliance	Continuous from 2008
	Impact report on 4D - RNAV implementation on operators	Dec 2007

3.1.11 **WP12 - Analysis of Performance and Safety Assessment of Nav Developments**

Proposed navigation applications and Airspace Management changes (e.g. RNAV in Terminal Airspace, Free Routes etc) that will enable the ECAC airspace to respond to future growth in air traffic must be planned and implemented in line with EATM Safety Policy, and must respect and contribute to the "Safety" Top Level Objective of the ATM Strategy for 2000+.

3.1.11.1 Objectives

- To define the Safety policy for individual Navigation Developments in accordance with the EATM Guidelines.
- To develop tools and methodologies which can be used to support Safety Case studies.
- To develop and operate the means to collect data needed to be used in the safety assessment of navigation applications.
- To produce and document the information necessary to prove that a planned system implementation or change is acceptable for operational use.
- To undertake safety assessment of Navigation Changes once implemented to ensure that the required levels of safety are being achieved. This action includes the operation of the Regional Monitoring Agency for RVSM post implementation verification. The data collection and safety analysis capability developed for RVSM will also be used for lateral performance analysis

3.1.11.2 Work Organisation

Work with DAS/SSM and SRU in establishment of safety plan for the Navigation Domain. Reporting will be to ANT through Navigation Applications Sub-Group. Where formal reports are to be provided to SRC or upward to EANPG, these are to be approved through the normal EATM channels.

3.1.11.3 Deliverables

Item	End date
Safety policy and plan for Navigation	1/6/03
3D Collision Risk Model for en-route flight.	1/7/04
3D CRM that considers obstacle and terrain clearance.	31/12/04
4D Collision risk methodology. The deliverable may be phased to consider certain phases of flight or applications separately	31/12/06
Post implementation safety assessments	
Assessment for B-BRNAV	31/12/04
assessment for P-RNAV	31/12/06
assessment for RNAV Approaches	31/12/07
assessment for GNSS Cat I	31/12/10
assessment for RNP-RNAV	31/12/14
assessment for 4D RNP-RNAV	31/12/18
RVSM	
Continued safety validation of RVSM (annual reports to EANPG)	Annually from Nov 2003

3.1.12 WP13 - R & D Co-ordination & Technology Watch

The development and implementation of the Navigation Strategy requires significant amount of technology development and validation. In this context any GNSS developments which could influence the Navigation Strategy are of particular importance.

Overall co-ordination of R&D within the framework of the ARDEP database as well as a technology watch will ensure that the Navigation Domain benefits from R&D work carried out elsewhere.

3.1.12.1 Objectives

- Identify R&D needs of the Navigation Strategy.
- Communicate those needs to the R&D community.
- Ensure feed-back between R&D plans and activities and Nav Projects.
- Assist Domain managers in using R&D products and services.

3.1.12.2 Work Organisation

The Navigation Domain manager & Domain activity managers will monitor technological developments through their day to day active participation in the various other EATM projects and Services. To achieve the objectives of the AFN Business Division R&D Co-ordination,

the AFN Head of the Airspace Modelling Service has been nominated as the R&D focal point for both Nav and AOM activities.

The Navigation Domain manager is the focal point for streamlining and documenting technology relevant technology developments.

Reporting to ANT through the two Navigation domain sub-groups

3.1.12.3 Deliverables

Item	End date
Technology Watch	
Reports to Airspace Management & Navigation Team on R&D requirements, both current needs and likely future trends.	Annual at ANT Meetings
Updates to the ARDEP database on AFN R&D activities	As required
Presentation of Unit requirements and activities to R&D Fora.	As required
Maintenance of Technology Watch Register.	On-going
Communication Bulletin, as required.	as required

3.2 Programme or Service Definition & Initiation

3.2.1 **WP03 - Application of RNP RNAV in Medium Term**

The Operational Requirements for RNP RNAV are to improve the aircraft operational efficiency and support an increase in airspace capacity by enabling reductions in route spacing. This WP will investigate and quantify the potential improvements that can be achieved within the medium term by the availability of a total RNAV environment made possible by the use of RNP RNAV equipment in the aircraft.

The benefits of this work package will be the ability to support RNAV applications in medium to high-density traffic conditions with the integrated support of advanced ATC support tools, thereby providing fuel efficient and environmentally friendly operations, which otherwise could only be achieved under low-density traffic conditions.

3.2.1.1 Objectives

- To demonstrate that, within the medium term (current target date set out in the Eurocontrol Navigation Strategy is 2010) a cost effective transition can be made to a total RNAV environment (en-route and in TMA) in accordance with the Navigation Strategy.
- To demonstrate the safety, capacity, economic and environmental benefits to be derived from a total RNAV environment.
- To identify the opportunities to exploit ATC support tools, where available, to further enhance the benefits derived from RNP-RNAV.
- To develop and validate standards, procedures and software tools necessary to achieve the above application.

3.2.1.2 Work Organisation

Activities will be performed through close co-operation between the NAV, ASM, AEM and ATS-DP domains. NAV will provide the overall co-ordination. Progress reporting will be through the ANT and, where appropriate, AOT, AIST and ADT.

The Navigation Applications Sub-Group will review and validate the deliverables and ANT will accept deliverables.

A Proposal for the Programme will be developed and offered for approval.

If successful the next phase will comprise developing a Charter for the Programme, outlining the overall Programme lifecycle work plan and phase deliverables and developing in detail the Planning and Feasibility phase work packages.

Subsequent to approval of the Charter the next phase will be the execution of the Planning and Feasibility work packages. This will deliver feasibility reports, a set of options, a business case and a safety case together with detailed plans for the next phase in the Implementation cycle of the Programme.

3.2.1.3 Deliverables

Item	End date
Evaluation of Benefits and Implementation Costs	
Business Case for a full RNP-RNAV Environment	1/7/04
Development of Operational and Technical Requirements	
Strategy for RNP-RNAV application	31/12/04
RNP-RNAV Procedure Design Specification	31/12/06
Conduct Simulations and Trials to validate RNP-RNAV capabilities and develop/update ATS procedures	1/1/06
Draft amendment to ICAO Doc 7030/4 EUR and/or Doc 4444,	31/12/06
Assessment of Capability of Navigation System to Meet Integrity, Continuity and Reversion Requirements	
Validation Report for Aircraft RNP-RNAV	31/07/06
Validation report for RNP RNAV performance requirements	30/07/07
Safety Evaluation	
Initial Safety Case for RNP-RNAV	31/07/06
RNP-RNAV Route Spacing en-route and TMA	31/12/04
Safety validation of application of RNP to the use of lower take-off minima.	31/12/05
RNP-RNAV Safety Net Impact Report (impact of reduced route spacings etc)	31/12/06
Validated RNP-RNAV Safety Case	TBD
Feasibility Report	31/08/07
Support to Implementation	
Implementation Plan for RNP-RNAV	31/08/07
Support to handover for implementation	31/8/07
Validated Implementation Strategy	TBD
Final Go ahead RNP-RNAV implementation	31/08/07
Implementation Guidance Material for States	31/12/03
Draft AIC for RNP-RNAV giving advance notice of 2010 implementation	31/06/06

3.3 Planning & Feasibility

4. RESOURCES AND BUDGET

5. REFERENCES

Document Name	Reference
Navigation Strategy	Version 2.1 dated March 1999
Transition Plan for Implementation of Navigation Strategy	Version 3.0 dated 24.05.2000.

6. ABBREVIATIONS AND ACRONYMS

For the purposes of this document the following abbreviations and acronyms shall apply:

AIC	Aeronautical Information Circular
AFN	Airspace Flow Management and Navigation
ANSP	Air Navigation Service Provider
ANT	Airspace & Navigation Team
AOP	Aeronautical OSI Profile
AOT	Airport Operations Team
ASMGCS	Advanced Surface Movement Guidance & Control System
ATC	Air Traffic Control
ATD	Actual Time Departure
ATM	Air Traffic Management
AWOG	All Weather Operations Group
BRNAV	Basic Area Navigation
CAT x	Category x Precision Approach
CBA	Cost Benefit Analysis
CFIT	Controlled Flight into Terrain
DME	Distance Measuring Equipment
EATM	European Air Traffic Management
ECAC	European Civil Aviation Conference
GBAS	Ground Based Augmentation System
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ICAO	International Civil Aviation Organisation
JAA	Joint Aviation Authority
LNAV	Lateral Navigation
MLS	Microwave Landing System
NAV	Navigation Domain
NDB	Non Directional Beacon
NPA	Non Precision Approach
NSG	Navigational Sub Group
OEM	Original Equipment Manufacturer
P-RNAV	Precision Area Navigation
R&D	Research & Development
R&D	Research and Development
RNAV	Area Navigation
RNP	Required Navigation Performance
SARP	Signal Automatic Radar Processing
SBAS	Space/Satellite Based Augmentation System
SID	Standard Instrument Departure
STAR	Standard Arrival Route
TARA	Terminal Area RNAV Applications Task Force
TGL	Temporary Guidance Leaflet
TMA	Terminal Manoeuvring Area
VNAV	Vertical Navigation
VOR	VHF Omni-Directional Radio Range
WP	Work Package