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TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 6: Future direction
6.1: Implementation plans and methodologies

NARAE, THE REPUBLIC OF KOREA'S ATM MODERNIZATION MASTER PLAN

(Presented by the Republic of Korea)

1. INTRODUCTION

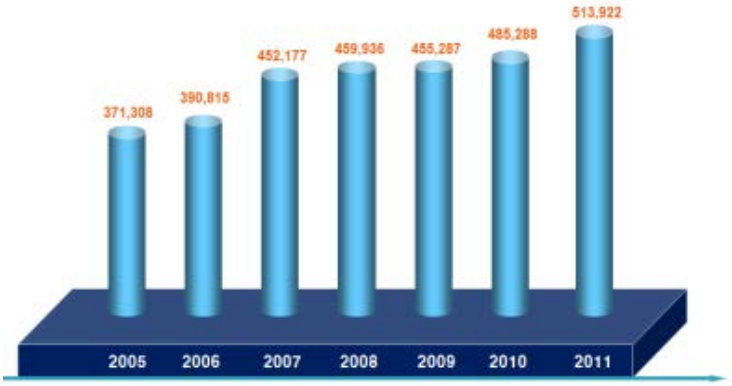
1.1 Over the past decades, ICAO, States and different stakeholders have been facing major transformation in the air navigation system as well as advanced aircraft on-board equipage. Also, the ICAO forecasts the volume of air traffic growth within the Asia/Pacific Region will increase by a rate of 5.1 per cent annually in average from 2009 to 2030.

1.2 Withstanding such change, the effort to build safer, more efficient and sustainable air transportation system has been taking place by many regions in the world with the concept of “One Sky”, in turn “Seamless ATM”, introduced by ICAO.

1.3 ICAO’s *Global Air Navigation Plan* (Doc 9750) *Global Air Traffic Management Operational Concept* (Doc 9854) and aviation system block upgrades (ASBU) methodology serve as basis for planning air traffic management (ATM) modernization, and its best known global level initiatives are the NextGen (Next Generation Air Transport System) of the United States and the SESAR (Single European Sky ATM Research) of the European Union (EU).

2. THE NARAE

2.1 Air traffic volume in the Republic of Korea has been steadily increasing in the past decade, and observed increase with average annual traffic growth rate of 4.75 per cent between 2005 - 2011. Considering the traffic growth trend in recent years, the air traffic demand is expected to increase beyond the current capacity within the next decade. At the same time, expected demand growth calls for greater emphasis on integrated and systematic approach in the air traffic management and operational procedures to provide safe and convenient air travel environment to proactively manage future congestion.



Air traffic volume in the Incheon FIR between 2005-2011

2.2 Based on this awareness and in order to align with the trend of transition to the future ATM system, the Republic of Korea is in the progress of developing the national ATM modernization plan called the National ATM Reformation and Enhancement (NARAE), which encompasses the ICAO ASBU, NextGen, SESAR, etc. The NARAE is expected to be prepared by the end of 2012.

2.3 Details of the NARAE, including vision, operational concepts, relation with the ASBU framework, etc., are described in the appendix.

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Connecting around the globe, A new Challenge in the sky

National ATM Renovation & Enhancement Plan

MLTM
Ministry of Land, Transport and Maritime Affairs
Republic of Korea

Contents

01 Introduction

Background

2012 marks the 40th anniversary for the Republic of Korea(ROK)'s first trans-pacific flight. Over the past decades, ROK has seen a tremendous growth in air navigation sector fueled by robust economic growth, along with a demonstrated operational capability to handle increasing demand.

In recent years, ROK has been actively investing in modernizing of air navigation system, including CNS/ATM, aviation technology, and so forth. In 2011, ROK initiated on a transition to the future ATM system and is establishing future ATM plan called NARAE, National ATM Renovation And Enhancement, which means the 'wing' in Korean.

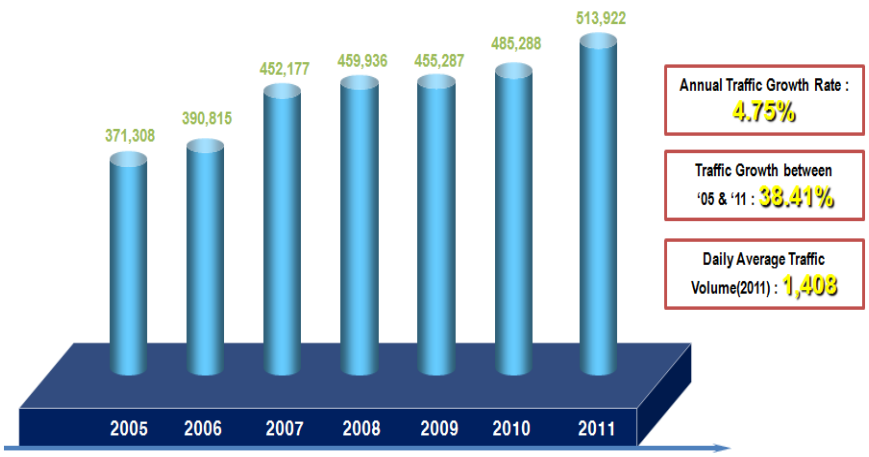
ROK subsequently commissioned the working group in November 2011 as a group of researchers from academia and civil aviation organizations to prepare the draft of NARAE for the future ATM system. This is a historical move towards a more integrated and collaborative approach which previously relied on an individual program-oriented approach.

NARAE will provide a safer and more efficient ATM environment with increased capacity, more flexibility and predictability to ensure equity to meet future increases in air traffic demand.

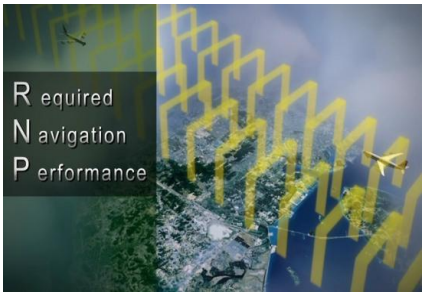
The NARAE initiative is aligned with the ICAO guidelines and refers to the leading precedents such as NextGen and SESAR, emphasizing integrative and performance-driven systems in a harmonized global environment.

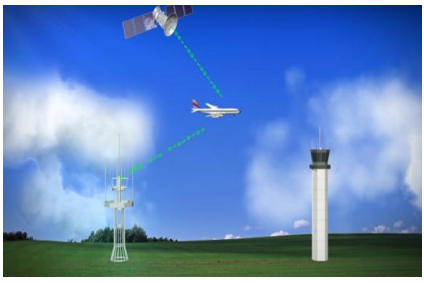
In the near term, NARAE will expand the current system capability towards a more strategic and collaborative ATM environment, departing from a high dependency on tactical control driven by human capabilities. Some of the primary focus areas in the near term are strategic flow management; the centralized aviation data management and dissemination; the identification of research and development areas for operation and technological enablers; the human resource planning and management; the business oriented ATM applications; and the integrated safety management. In the medium and long term, NARAE will provide a safer and more efficient ATM environment with increased capacity, more flexibility and predictability to ensure equity to meet future increases in air traffic demand

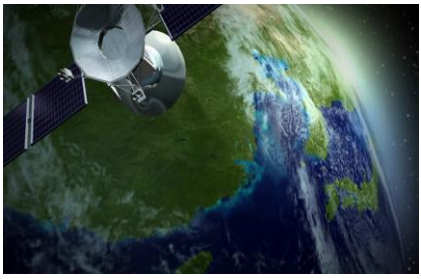
Air traffic volume



Air traffic volume in ROK has been steadily increasing over the past decades. Especially, between 2005 and 2011, ROK observed a traffic volume increase of nearly 40% with an average annual traffic growth rate of 4.75%.







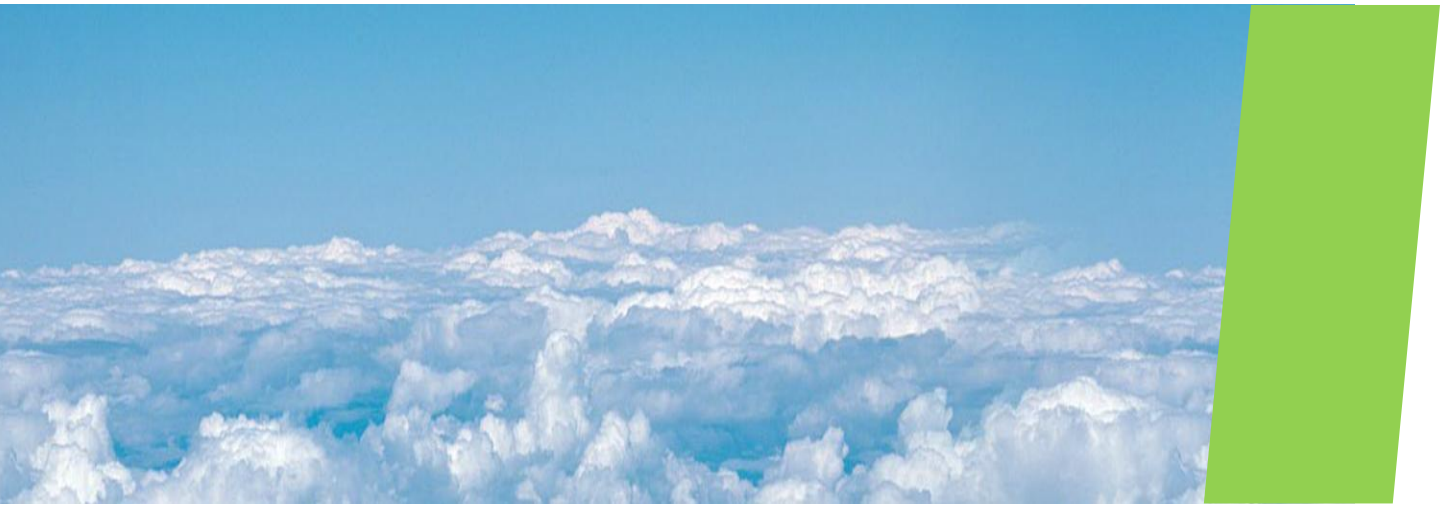
02 Vision & Objectives

Vision

NARAE will bring major changes to the national air transport system in the future with minimum disruption and maximum convenience by taking the advantages of advanced technology and more integrated air traffic management.

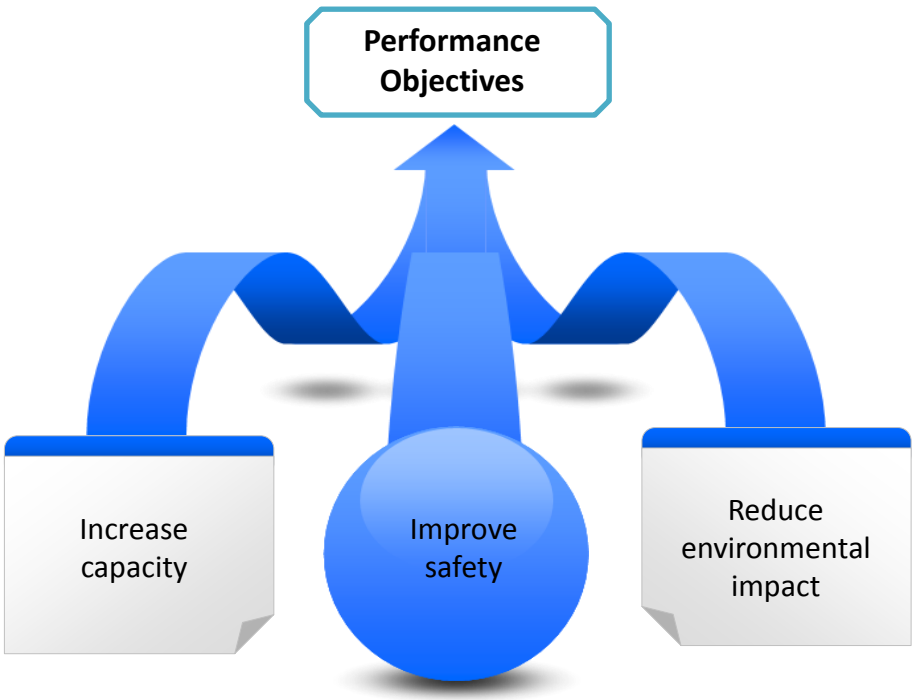
Satellite-based technology will deliver accurate air navigation and surveillance capabilities both in the air and on the ground. A collaborative decision approach in all phases of flight will bring fundamental changes balancing the various needs and objectives of multiple stakeholders in near real-time. Enhanced situational awareness in the air and on the ground will result in better operational outcomes for individual flights and for the system overall. Departure from voice-intensive to data-driven communications will become the backbone of system wide data collection and information distribution.

- Improved safety and efficiency levels
- Proven business benefits with minimal environmental impact
- Reliable and convenient air travel
- Regional integration and global harmonization



Objectives

NARAE will offer more business benefits and passenger convenience with reliable schedules and flexible routing. The capability to identify and predict the demand and capacity will lead to robust air traffic flow management. The aviation sector will also become more environment-friendly with fuel-efficient aircraft design and operations as well as alternative fuel choices.



03 Concepts of operation

Operational Concepts of NARAE

In the ICAO Doc 9854 (Global ATM Operational Concepts), ICAO defines ATM as “the dynamic, integrated management of air traffic and airspace - safely, economically and efficiently - through the provision of facilities and seamless services in collaboration with all parties”. The operational concepts provide focus areas and describe what services will be available to deliver the future ATM vision, which evolves over time as the ATM system evolves.

Following the ICAO guidelines, NARAE will provide more flexible and predictable ATM environment that follows the intended trajectory as closely as possible in a safe and cost-effective way through a continuous and collaborative ATM decision process involving data, people, facilities, and services. Performance-driven service provision and assessment will become the foundation to determine current system status, and set the direction of development to achieve the long-term vision.

- Collaborative decision making(CDM)
- Integrated information network
- Performance-based operations
- Human in the system
- Time-based trajectory
- Airspace management
- Airport operation
- Safety management
- Global harmonization

01 Collaborative decision making (CDM)

Decisions on critical ATM process are made in a collaborative manner, reflecting user preferences in a resource-restricted and multi-faceted ATM system. Management of restricted resources such as airspace and airport slots will benefit from the CDM, with improved quality of decisions especially in strategic flow management. Timely delivery of relevant information, automated decision support tools and the participation and agreement of ATM stakeholders are keys to successful CDM implementation.

02 Integrated information network

Integrated data collection and information distribution will become the backbone of the NARAE operational environment, where increased access to system status information such as surveillance data and aeronautical information provides shared situational awareness to all interested stakeholders. Business objectives are integrated in the system and result in more effective demand and capacity balancing. Provision of the necessary automated tools to analyze a large amount of data is crucial for timely generation and distribution of relevant information best targeting various stakeholder needs in the integrated network environment.

03 Performance-based operations

Transition to performance-based operations and services are the NARAE main targets. Following ICAO guidelines, requirements will be described not in specific technical terms or equipment, but in performance terms. System users are to be served according to performance level in a flexible and multi-tiered service structure defined by the Air Navigation Service Provider (ANSP). The ANSP will support performance-driven operations with the necessary requirements, including facilities, procedures, and regulations. Performance-based operations allow variability in user capacity and certification levels in the same system. Aircraft owners are encouraged to invest in the future changes to achieve business goals knowing that the NARAE environment will follow the better-performance better-service paradigm.

04 Human in the system

The responsibility of people in the NARAE environment will focus on making key strategic and tactical decisions in an information-rich environment. Traditional responsibilities such as separation assurance and conflict resolution will be either delegated or shared with capable aircraft. Automated tools analyze a large amount of data flowing in an integrated information network to display relevant situational information or to generate decision alternatives for people to choose from.

05

Time-based trajectory

A four-dimensional trajectory (4DT) will be the foundation in all phases of flight to support the Time Based Operation (TBO). Flow management of TBO-capable aircraft ranges from strategic flight planning to tactical adjustment in all phases of flight to meet the timing requirement. 4DT and TBO are fundamental change from the current ATM system, where flight execution relies heavily on clearance and handovers which are the main responsibility of ATM personnel. With 4DT, separation, spacing, and merging responsibilities may be delegated to TBO-capable aircraft equipped with automated tools and displays on board when such is beneficial for system efficiency and safety.

06

Airspace management

To accommodate increasing air traffic demand with a growing variety of business objectives and operational capabilities, flexible airspace management is necessary to increase system capacity. Airspace is managed in a more flexible and dynamic way, responding to current and anticipated demand across the system. Such transformation is crucial, especially for TBO-capable aircraft, which can attain maximum benefit within an airspace structure that is defined and changeable in time as well as space. Current airspace structure, defined in longitudinal dimensions with static boundaries, severely limits the intended benefits of the NARAE operational environment.

07

Airport operations

From the ATM perspective, current airport operational management mostly determined by human judgment under limited decision support will undergo major transformations in NARAE. Arrival and departure demands and capacity balancing, surface operations, and low-visibility operations will be improved by the advanced capabilities such as RNAV/RNP. Trajectory based operation also affects airport operations to increase throughput and predictability.

08

Safety management

In accordance with the ICAO Doc 9859 (Safety Management Manual), NARAE will follow an integrated approach, including elements such as the safety management system (SMS), to mitigate safety risks in a proactive and predictable way. Both the system provider and users implement their own SMS to identify potential hazards and prevent undesirable risk propagation in the system. SMS is an organizational effort that covers all factors involving ATM stakeholders and policy makers, with assurance and promotions being key factors in the SMS.

09

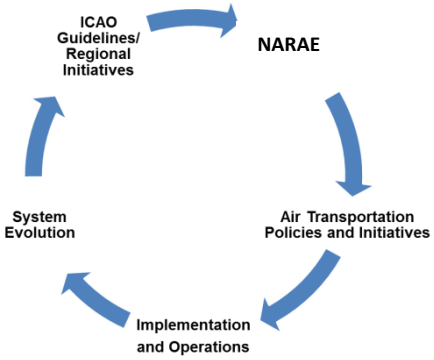
Global harmonization

NARAE will be implemented in global harmonization through integration with global ATM environment. Foreign carriers will be able to extend benefits according to their performance level while national carriers will do the same in the global environment. The system provider will extend its operational knowledge experience to regional partner states through collaboration in the development .

04 NARAE

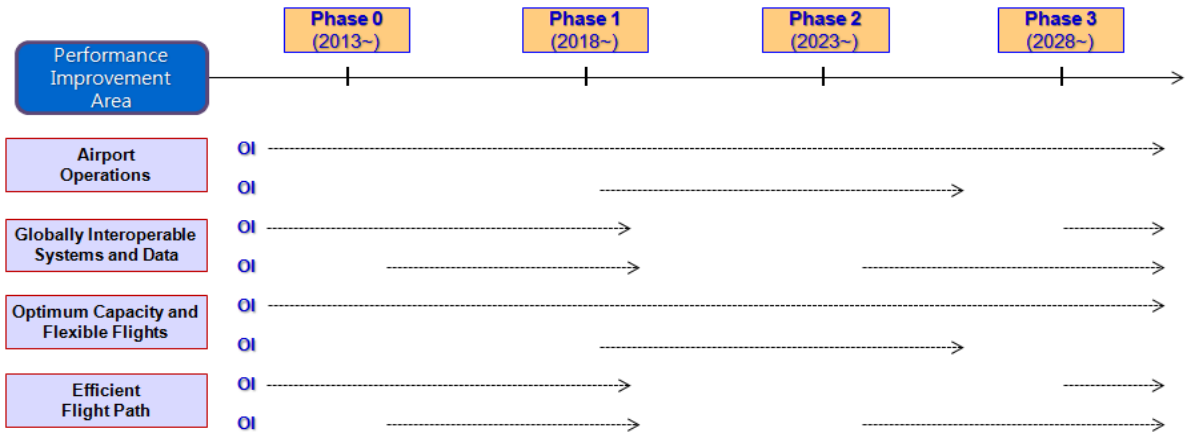
Planning framework

NARAE will evolve over times as the operational concepts and capabilities are evaluated and adjusted throughout the incremental transition of the ROK's ATM system to the future system. NARAE will reflect the ICAO guideline updates and regional initiatives changes in a timely manner.



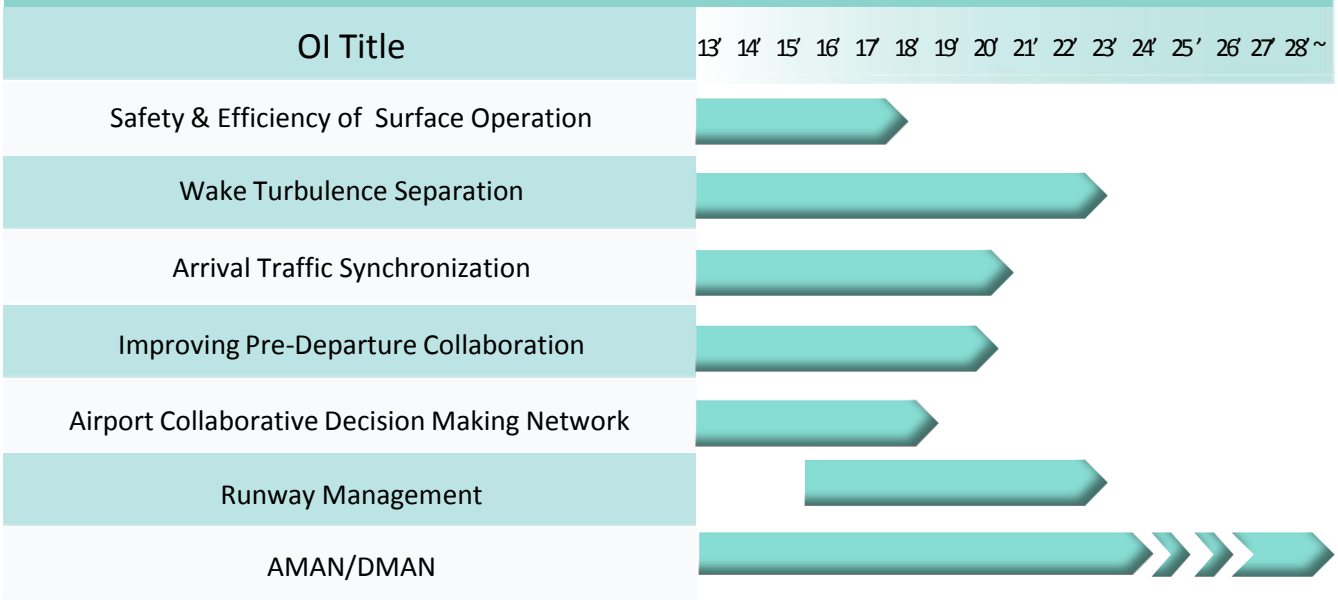
The lifecycle of NARAE begins with an assessment of current system status and stakeholder needs in the context of performance objectives. Referring to the ICAO guidelines and examples of leading precedents, NARAE sets research, development and implementation directions to satisfy NARAE performance goals.

ICAO Aviation System Block Upgrade (ASBU) is defined with four components: module, block, thread and four performance improvement areas. NARAE implementation guidelines is based on the ICAO ASBU framework.

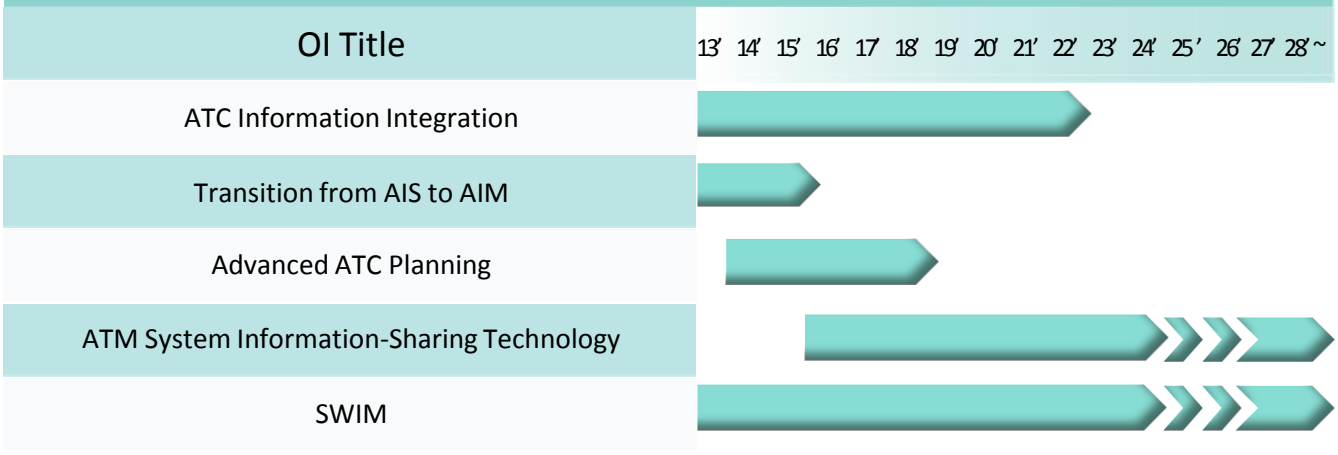


Implementation plan

Performance Improvement Area 1:
Greener Airports



Performance Improvement Area 2:
Globally Interoperable Systems and Date
– Through Globally Interoperable System Wide Information Management



Performance Improvement Area 3:

Optimum Capacity and Flexible Flight – Through Global Collaborative ATM

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Situational Awareness	
Optimizing Airspace Allocation and Usage	
Improvement of Air Traffic Flow	
Safety Nets Improvements (TMA, En Route)	
Flexible airspace management	
Flexible Route Network	
System Capacity Management Improvement	
Airspace Reclassification	
User preferred Routing Environment	
Developing System-wide Flow Model	
ASAS Self-separation	

Performance Improvement Area 4:

Efficient Flight Path – Through Trajectory-based Operations

OI Title	13' 14' 15' 16' 17' 18' 19' 20' 21' 22' 23' 24' 25' 26' 27' 28'~
Enhancing Terminal Airspace	
Optimizing Climb/Descent(CCO/CDO)	
Arrival Traffic Synchronization	
Remotely Piloted Aircraft	

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