



SIP/2009-WP/11
Performance
Framework

Global Air Navigation System ~Global Plan~

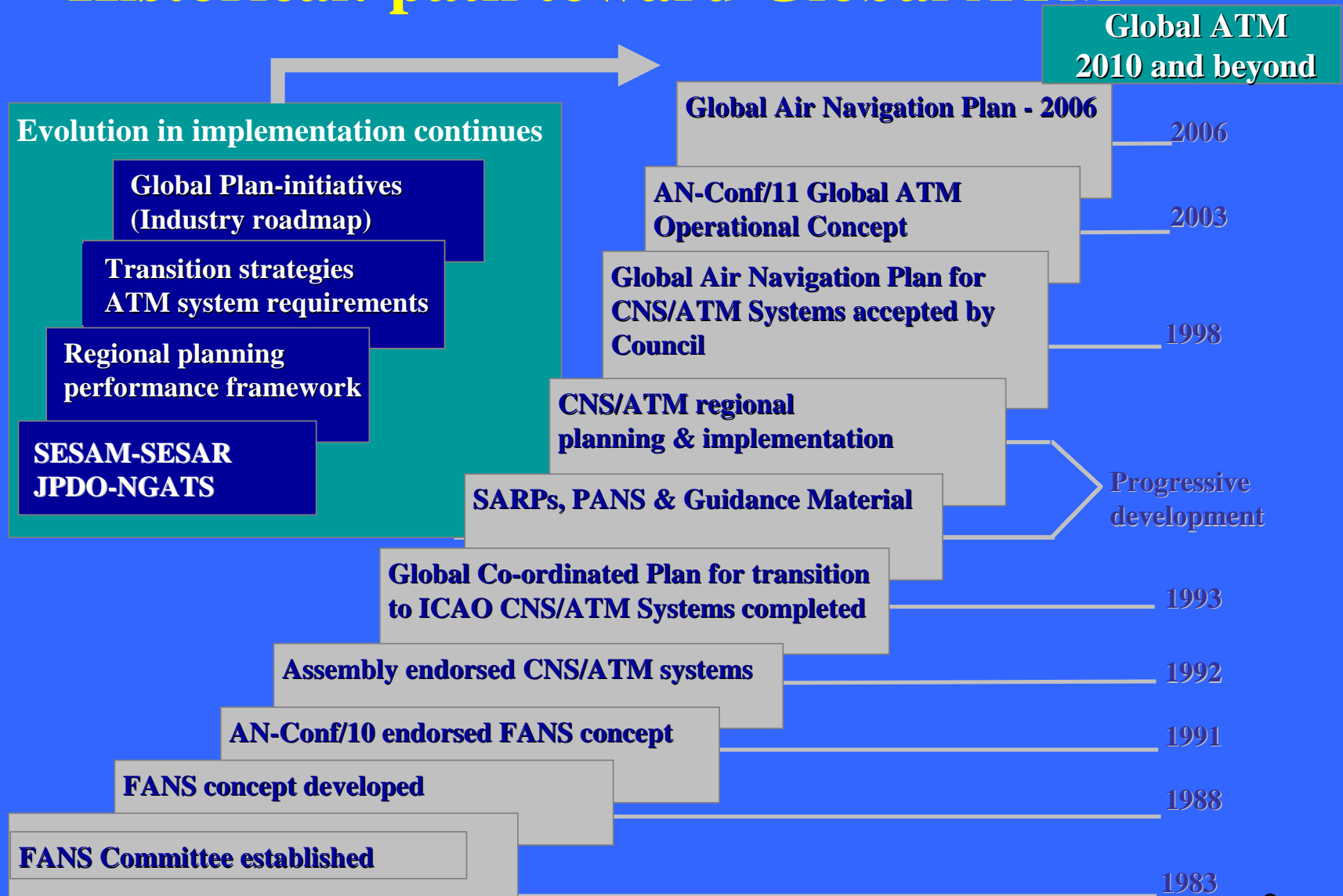
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International Civil Aviation Organization**

**Workshop on the Development of
National Performance Framework
(Lima, 13-17 April 2009)**

Presentation Outline

- **Historical**
- **Global Air Traffic Management**
- **Eleventh Air Navigation Conference**
- **Partnering with Industry**
- **Global Plan Initiatives**
- **Achieving a global ATM system**
- **Regional Integration**
- **Measuring success**

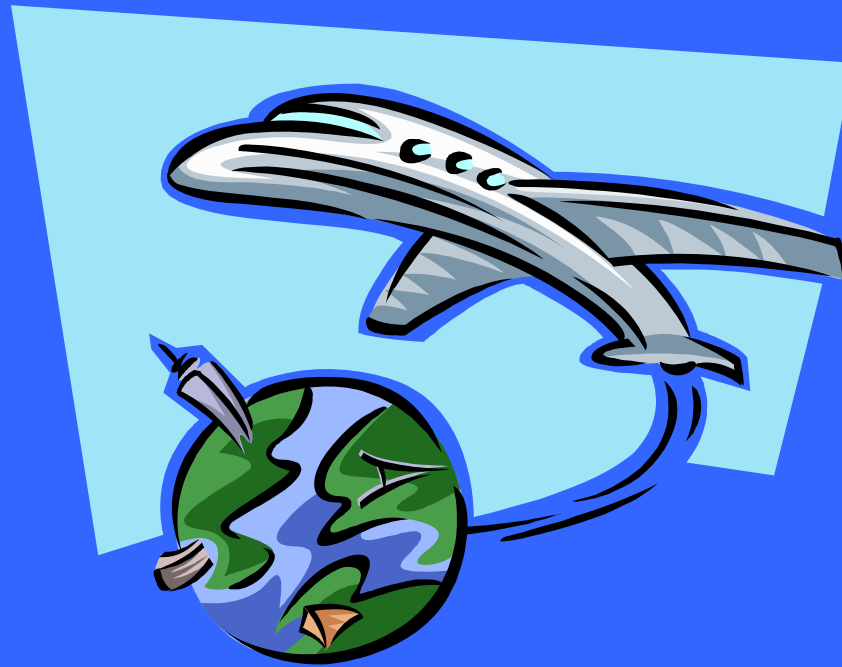
Historical: path toward Global ATM



Global Air Traffic Management

What is it, how do we get there

INTEROPERABILITY



SEAMLESS

SAFETY

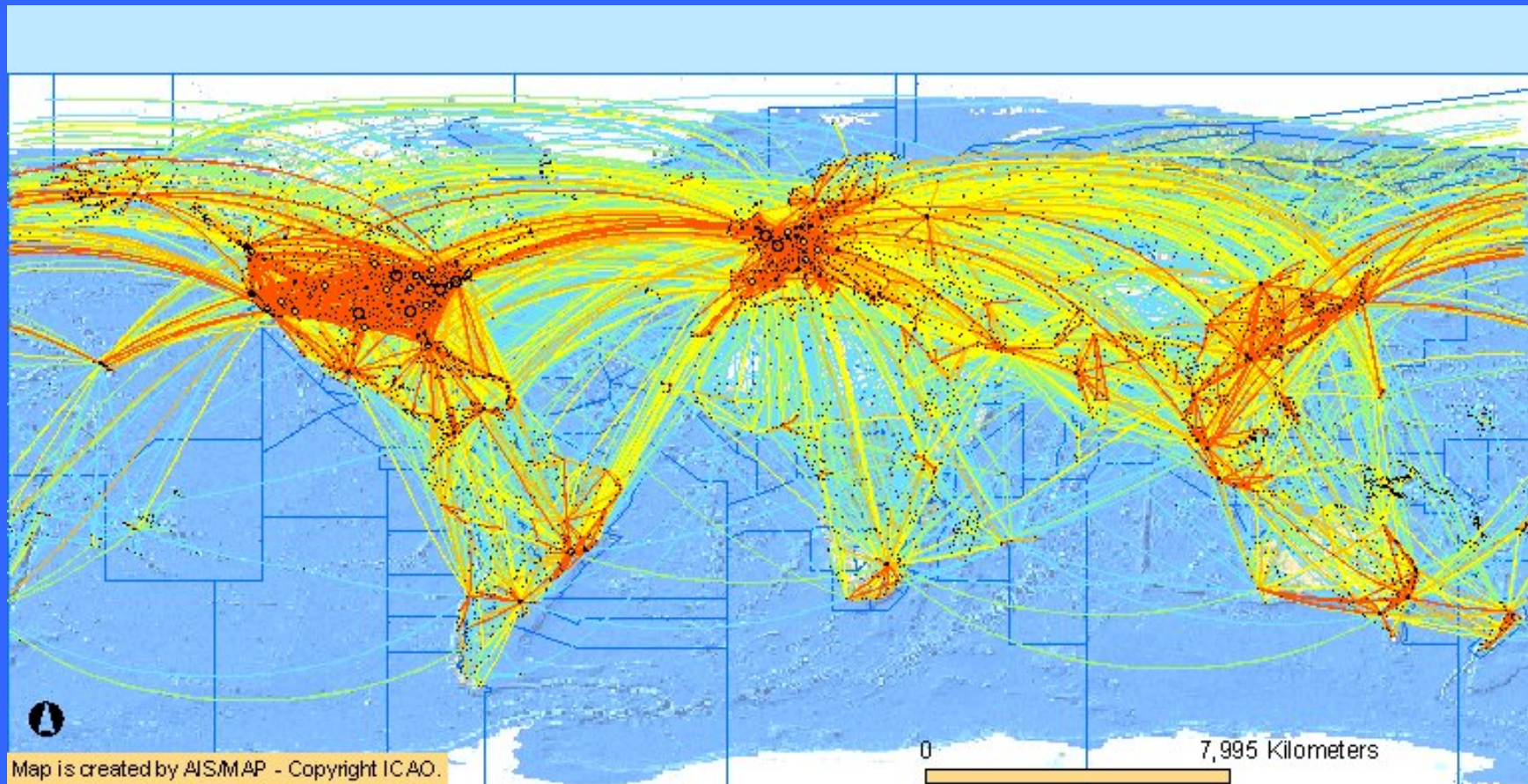
Global ATM System

A Worldwide system that achieves interoperability and seamlessness based on:

- **Physical interconnectedness**
 - **Homogeneous ATM areas and Major Traffic flows**
- **Common requirements, Standards and procedures**
 - **Integration (TMAs, aerodromes)**
 - **Performance based equipment carriage requirements**
- **Seamless safety across all regions**
 - **For all users during all phases of flight**
 - **Provides for optimum economic operations**
 - **Environmentally.....**
 - **Meets security.....**

Physical Interconnectedness

Major traffic flows



Eleventh Air Navigation Conference

- **Endorsed the global ATM operational concept**
- **Requested ICAO to:**
 - **develop ATM system requirements**
 - **address interoperability and seamlessness**
 - **define requirements for global AIM**
 - **publish the operational concept**
 - **amend the Global Plan**
 - **harmonize interregional AN systems**
 - **establish an ICAO air navigation database**
 - **develop a performance framework**

Eleventh Air Navigation Conference (AN-Conf/11) — Outcome

- **That States and PIRGs consider the Global Air Navigation Plan as a catalyst for change, providing a global safety and interoperability framework while allowing regional or local adaptation to efficiently meet regional and local needs**

Partnering with Industry

ANC Industry Meeting – Conclusions

- **That those industry partners in a position to do so, work together toward the development of a common roadmap/global action plan, aimed at attaining operational benefits in the near to medium term for inclusion in the ICAO Global Air Navigation Plan**

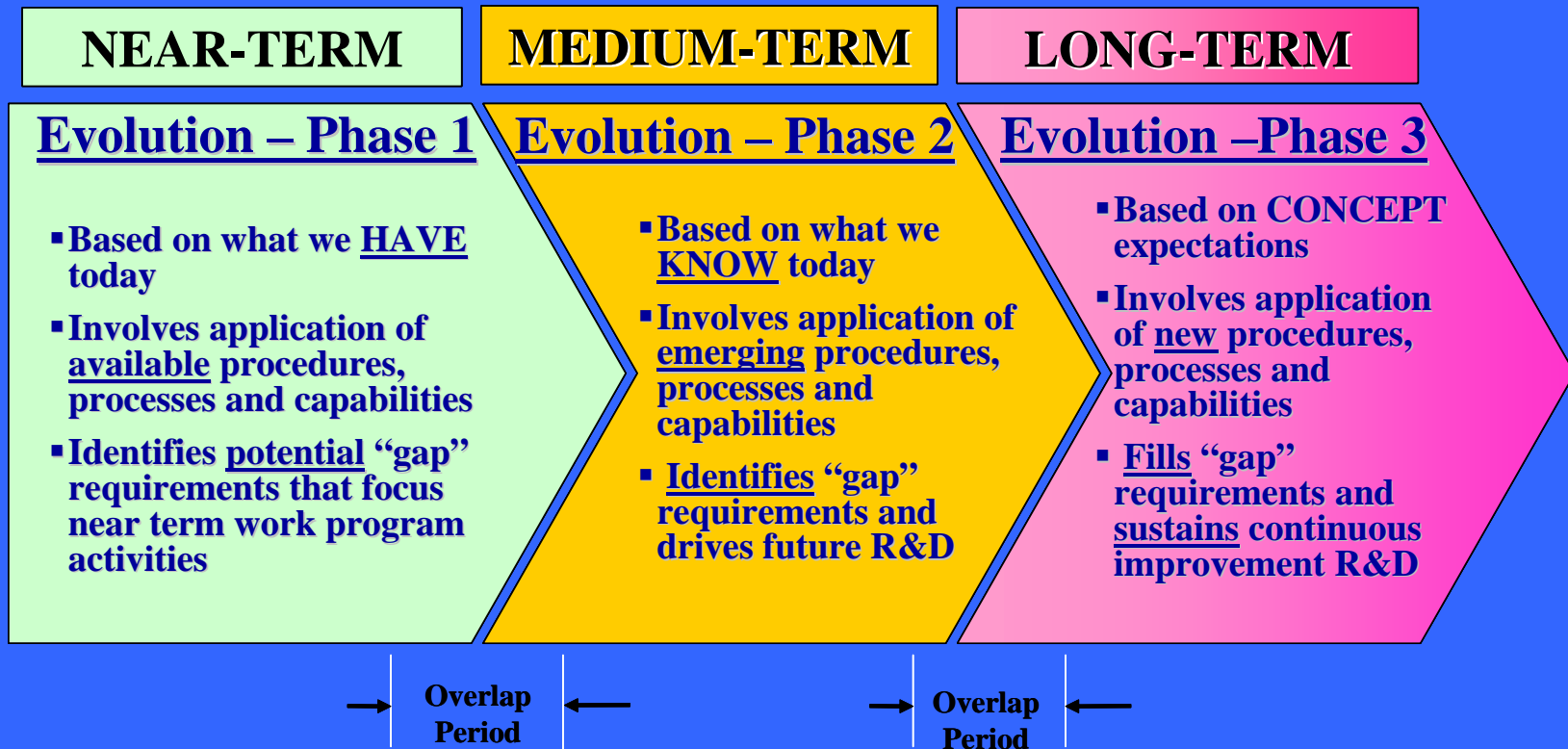
Partnering with Industry

- To ensure that the capabilities and capacities offered through existing aircraft equipage, ATM infrastructure and ATC systems is utilized to the maximum extent possible
- To deliver transitional benefits while we continue our evolution

Global Plan as a transition roadmap

- **Revised Global Plan** developed on the basis of
 - Recommendations of AN-Conf/11
 - Global ATM Operational Concept, which provides the target system
 - Industry Roadmap, which provides the near and medium industry requirements
- **Global Plan** provides guidance on environment, business case, costs, human resources, etc.

Transition Strategy



The “Overlap Period” indicates that there is no set date by which the objectives of each transition should be met – other than within a time band of perhaps 2-3 years. It also recognizes that some States or Regions may not have a specific performance requirement that would need the application of changes identified in the transition maps at the same time as another State or Region.

What is new in the revised Global Plan?

No	Earlier version	Current version
1	Covers only CNS and ATM elements; known as Global ANP for CNS/ATM systems	Expands to related elements such as AIM/AGA/MET thus known as Global ANP
2	ICAO developed with indirect participation from industry and States	ICAO developed with direct participation from industry and States

What is new in the revised Global Plan?

No	Earlier version	Current version
3	Extends to near-mid-long- term	Restricted to near-and mid-term, with long-term to be addressed through ATM operational concept
4	Focuses on objectives & systems	Relates to Performance
5	P (paper)–based	E (electronic)–based

What is new in the revised Global Plan?

No	Earlier version	Current version
6	Provided passive harmonization	Ensures active harmonization
7	Implementation based on 45 objectives and systems	45 objectives have been refined and aligned to performance based 23 Global Plan Initiatives
8	Does not support planning tools for its implementation	Number of planning tools (software, web-based, project mgt, etc.) available

Approach to implementation

The approach to implementation of GPIs builds on:

- **progress already achieved**
- **experience gained by PIRGs in the previous cycle of CNS/ATM systems implementation process**
- **existing capabilities of the air navigation systems; and**
- **successful regional implementation**

Global Plan Initiatives (GPI)

- **Options for ATM improvements**
- **Relate to ATM objectives**
- **Result in direct performance enhancements**
- **Meet performance objectives**
- **Based on Industry Roadmaps and current regional activities**
- **Bring near- and medium-term benefits to aircraft operators**

Global Plan Initiatives

(GPI-1) Flexible use of airspace

- **Scope:** The optimization and equitable balance in the use of airspace between civil and military users, facilitated through both strategic coordination and dynamic interaction.
- **Related Operational Concept Components:**
AOM, AUO
- **Civil/military cooperation. Global Forum in Montreal in later half of 2009**

Global Plan Initiatives

(GPI-2) Reduced vertical separation minimum

- **Scope: The optimization of the utilization of airspace and enhanced aircraft altimetry systems.**
- **Related Operational Concept Components: AOM, CM**
- **Implemented in all of ICAO regions on major international traffic flows**

Global Plan Initiatives

(GPI-3) Harmonization of level systems

- **Scope:** The adoption by all States of the ICAO Flight Level Scheme based on feet as contained in Appendix 3 to Annex 2 – *Rules of the Air*.
- **Related Operational Concept Components:** AOM, CM, AUO
- **Imperial/metric systems for altitudes and levels.** Hence harmonization of level systems is to be pursued

Global Plan Initiatives

(GPI-4) Alignment of upper airspace classifications

- **Scope:** The harmonization of upper airspace and associated traffic handling through application of a common ICAO ATS Airspace Class above an agreed division level.
- **Related Operational Concept Components:** AOM, CM, AUO
- **Should be based on Annex 11 airspace classification**
 - Class A to G both intra-regionally and across several regions to ensure continuum of airspace

Global Plan Initiatives

(GPI-5) Area Navigation (RNAV) and Required Navigation Performance (RNP)

- Scope:** The incorporation of advanced aircraft navigation capabilities into the air navigation system infrastructure.
- Related ATM objectives:** Application of required navigation performance; Application of required surveillance performance; Reduced longitudinal separation; Reduced lateral separation

Application of PBN; regional and national PBN plan ?

Global Plan Initiatives

(GPI-6) Air traffic flow management

- **Scope:** The implementation of strategic, tactical and pre-tactical measures aimed at organizing and handling traffic flows in such a way that the totality of the traffic handled at any given time or in any given airspace or aerodrome is compatible with the capacity of the ATM system.
- **Related Operational Concept Components:** AOM, AO, DCB, TS, CM, AUO
- **Implementation of demand and capacity measures**

Global Plan Initiatives

(GPI-7) Dynamic and flexible ATS route management

- **Scope: The establishment of more flexible and dynamic route systems, on the basis of navigation performance capability, aimed at accommodating preferred flight trajectories**
- **Related Operational Concept Components: AOM, AUO**
- **Change of routing requests from aircraft-RNAV routes**

Global Plan Initiatives

(GPI-8) Collaborative airspace design and management

- **Scope:** The application of uniform airspace organization and management principles on a global basis, leading to a more flexible airspace design to accommodate traffic flows dynamically.
- **Related Operational Concept Components:** AOM, AUO
- **Required time of arrival function in FMS, data link applications and integrated decision making**

Global Plan Initiatives

(GPI-9) Situational awareness

- **Scope: Operational implementation of data link-based surveillance. The implementation of equipment to allow traffic information to be displayed in aircraft supporting implementation of conflict prediction and collaboration between flight crew and the ATM system. Improve situational awareness in the cockpit by making available electronic terrain and obstacle data of required quality.**
- **Related Operational Concept Components: AO, TS, CM, AUO**
- **eTOD, MSAW, surveillance for surface movement, terminal, enroute and oceanic airspace: ADS-C; ADS-B, Multilateration**

Global Plan Initiatives

(GPI-10) Terminal area design and management

- **Scope: The optimization of the terminal control area (TMA) through improved design and management techniques.**
- **Related Operational Concept Components: AOM, AO, TS, CM, AUO**
- **RNAV and RNP arrival and departure procedures, wake vortex detection and mitigation, RNP based approach procedures**

Global Plan Initiatives

(GPI-11) RNP and RNAV Standard instrument departures (SIDs) and Standard terminal arrivals (STARs)

- **Scope: The optimization of the terminal control area (TMA) through implementation of improved ATS route structures based on RNP and RNAV, connecting the enroute phase of flight with the final approach, based on improved coordination processes.**
- **Related Operational Concept Components: AOM, AO, TS, CM, AUO**
- **Segregation of departing traffic from arriving traffic, maintaining obstacle clearance requirements and environmental requirements**

Global Plan Initiatives

(GPI-12) functional integration of ground systems with airborne systems

- **Scope: The optimization of the terminal control area (TMA) to provide for more fuel efficient aircraft operations through FMS-based arrival procedures and functional integration of ground and airborne systems**
- **Related Operational Concept Components: AOM, AO, TS, CM, AUO**
- **Continuous decent capabilities, time of arrival computations and increased automation**

Global Plan Initiatives

(GPI-13) Aerodrome design and management

- **Scope: The implementation of management and design strategies to improve movement area utilization.**
- **Related Operational Concept Components: AO, CM, AUO**
- **Lighting, taxiway, runway, high speed exists, surface guidance in all weather conditions**

Global Plan Initiatives

(GPI-14) runway operations

- **Scope: Maximize runway capacity.**
- **Related Operational Concept Components: AO, TS, CM, AUO**
- **Establish runway capacity bench marks, achieving optimum capacity for each runway, reduced runway separations, PRM, RNP approaches for closely spaced parallel runways**

Global Plan Initiatives

(GPI-16) Decision support and alerting systems

- **Scope: Implement decision support tools to assist air traffic controllers and pilots in detecting and resolving air traffic conflicts and in improving traffic flow.**
- **Related Operational Concept Components: DCB, TS, CM, AUO**
- **ATC automation tools such as MSAW, MTCA/STCA, FDPS, sequencing , AIDC**

Global Plan Initiatives

(GPI-17) data link applications

- **Scope: Increase the use of data link applications.**
- **Related Operational Concept Components: DCB, AO, TS, CM, AUO, ATMSDM**
- **D-ATIS, CPDLC for all phases of flight**

Global Plan Initiatives

(GPI-18) aeronautical Information

- **Scope: To make available in real-time, quality assured electronic information (aeronautical, terrain and obstacle).**
- **Related Operational Concept Components: AOM, DCB, AO, TS, CM, AUO, ATMSDM**
- **eTOD, eAIP, WGS 84**

Global Plan Initiatives

(GPI-15) match IMC and VMC operating capacity

- **Scope: Improve the ability of aircraft to manoeuvre on the aerodrome surface in adverse weather conditions.**
- **Related Operational Concept Components: AO, CM, AUO**
- **Maintain VMC capacity during IMC conditions; A-SMGCS, Synthetic vision for situational awareness, Head-up displays, enhanced conflict detection like STCA/MTCAs**

Global Plan Initiatives

(GPI-19) Meteorological systems

- **Objective: To improve the availability of meteorological information in support of a seamless global ATM system.**
- **Related Operational Concept Components: AOM, DCB, AO, AUO**
- **Access to real time OPMET information, global systems such as WAFS, IAWA, TCWS, D-ATIS, D-VOLMET**

Global Plan Initiatives

(GPI-20) WGS-84

- **Objective: The implementation of WGS-84 by all States.**
- **Related Operational Concept Components: AO, CM, AUO**
- **Migration from local geodetic datum to universal reference system –WGS 84 – 1 Jan 1998; Fundamental to GNSS**

Global Plan Initiatives

(GPI-21) navigation systems

- **Scope: Enable the introduction and evolution of performance-based navigation supported by a robust navigation infrastructure providing an accurate, reliable and seamless global positioning capability.**
- **Related Operational Concept Components: AO, TS, CM, AUO**
- **GNSS for all phases of flight**

Global Plan Initiatives

(GPI-22) Communication infrastructure

- **Scope:** To evolve the aeronautical mobile and fixed communication infrastructure, supporting both voice and data communications, accommodating new functions as well as providing the adequate capacity and quality of service to support ATM requirements.
- **Related Operational Concept Components:** AO, TS, CM, AUO
- **VHF data link Mode2, HF data link and satellite data link and VHF and SATCOM for voice**

Global Plan Initiatives

(GPI-23) aeronautical radio spectrum

- **Scope: Timely and continuing availability of adequate radio spectrum, on a global basis, to provide viable air navigation services (communication, navigation and surveillance).**
- **Related Operational Concept Components: AO, TS, CM, AUO, ATMSDM**
- **WRC 2011- call for support to ICAO position**

Table 1. Global Plan initiatives & their relationships to the major groupings ... (1/3)

GPI		En-route	Terminal Area	Aerodrome	Supporting Infrastructure	Related Operational Concept Components
GPI-1	Flexible use of airspace	X	X			AOM, AUO
GPI-2	Reduced vertical separation minima	X				AOM, CM
GPI-3	Harmonization of level systems	X				AOM, CM, AUO
GPI-4	Alignment of upper airspace classifications	X				AOM, CM, AUO
GPI-5	RNAV and RNP (Performance-based navigation)	X	X	X		AOM, AO, TS, CM, AUO
GPI-6	Air traffic flow management	X	X	X		AOM, AO, DCB, TS, CM, AUO
GPI-7	Dynamic and flexible ATS route management	X	X			AOM, AUO
GPI-8	Collaborative airspace design and management	X	X			AOM, AUO

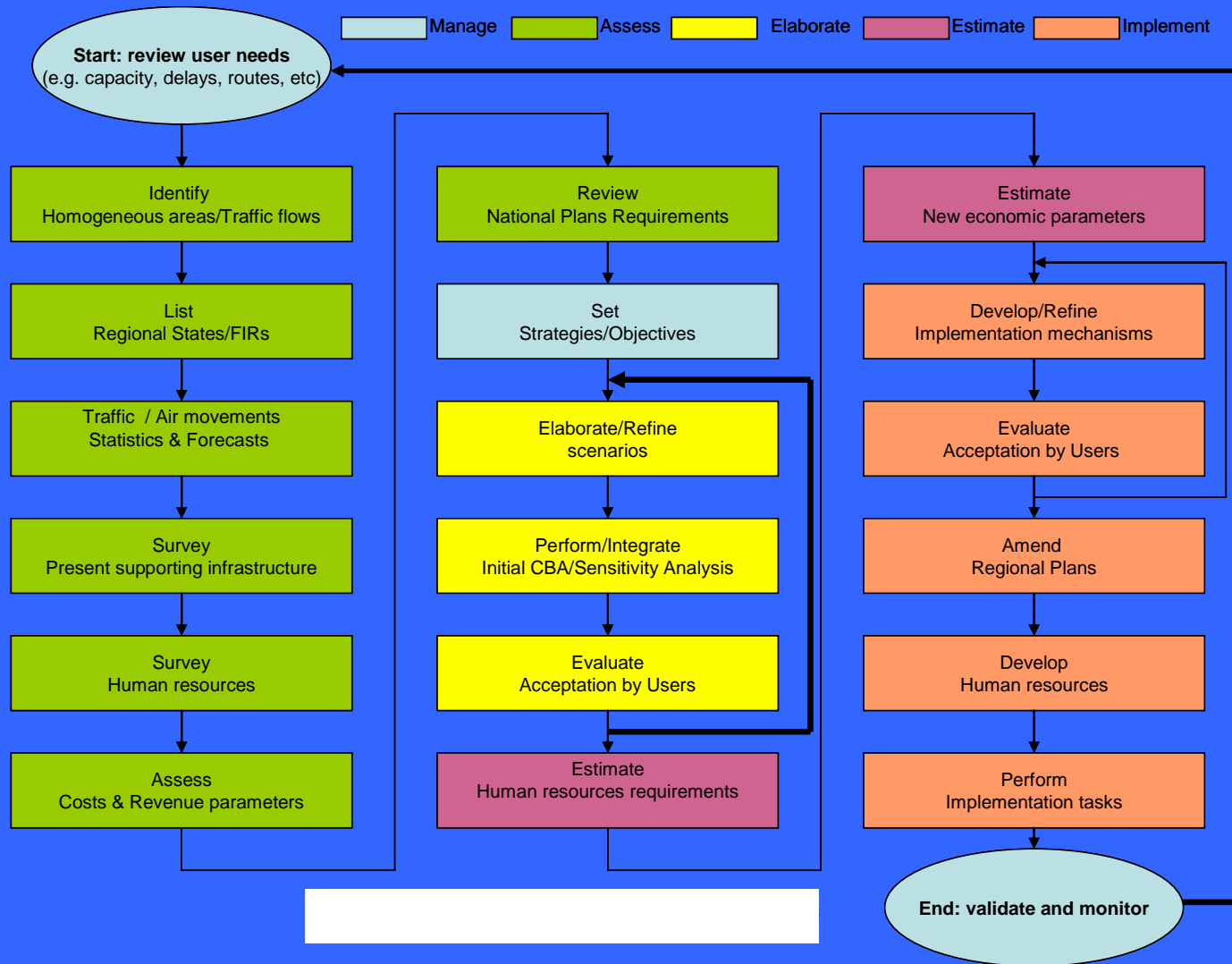
Table 1. Global Plan initiatives & their relationships to the major groupings ... (2/3)

GPI		En-route	Terminal Area	Aerodrome	Supporting Infrastructure	Related Operational Concept Components
GPI-9	Situational awareness	X	X	X	X	AO, TS, CM, AUO
GPI-10	Terminal area design and management		X			AOM, AO, TS, CM, AUO
GPI-11	RNP and RNAV SIDs and STARs		X			AOM, AO, TS, CM, AUO
GPI-12	Functional integration of ground systems with airborne systems		X		X	AOM, AO, TS, CM, AUO
GPI-13	Aerodrome design and management			X		AO, CM, AUO
GPI-14	Runway operations			X		AO, TS, CM, AUO
GPI-15	Match IMC and VMC operating capacity		X	X	X	AO, CM, AUO
GPI-16	Decision support systems and alerting systems	X	X	X	X	DCB, TS, CM, AUO

Table 1. Global Plan initiatives & their relationships to the major groupings ... (3/3)

GPI		En-route	Terminal Area	Aerodrome	Supporting Infrastructure	Related Operational Concept Components
GPI-17	Data link applications	X	X	X	X	DCB, AO, TS, CM, AUO, ATMSDM
GPI-18	Aeronautical information	X	X	X	X	AOM, DCB, AO, TS, CM, AUO, ATMSDM
GPI-19	Meteorological systems	X	X	X	X	AOM, DCB, AO, AUO
GPI-20	WGS-84	X	X	X	X	AO, CM, AUO
GPI-21	Navigation systems	X	X	X	X	AO, TS, CM, AUO
GPI-22	Communication infrastructure	X	X	X	X	AO, TS, CM, AUO
GPI-23	Aeronautical radio spectrum	X	X	X	X	AO, TS, CM, AUO, ATMSDM

Global Planning Methodology



Performance objectives – examples (1/2)

- ATM
 - Optimize ATS route structure in both terminal and en-route airspace (GPIs 4, 5,7,8,10,11 and 12)
 - Improve demand and capacity balancing (GPI 6)
 - Enhance civil/military coordination and cooperation (GPI 1)
 - Align upper airspace classification (GPI 4)
 - Implement vertically guided RNP approaches (GPI 5,7,8,11and 12)
- CNS
 - Protection of aeronautical frequency spectrum (GPI 23)
 - Enhance situational awareness (GPI 9)
 - Improve ground-to-ground communication (GPI 22)
 - Implement advanced technologies to support data link services (GPIs 22 and 17)

Performance objectives – examples (2/2)

- **AIM**
 - Improve quality and efficiency of AIS (GPIs 8 and 20)
 - Implementation of new ICAO flight plan (GPI 18)
 - Implementation of WGS-84 and eTod (GPI 5, 18 and 20)
- **AGA**
 - Enhance safety of runway operations (GPIs 13, 14 and 21)
 - Implement Aerodrome certification (GPIs 13 and 14)
 - Implement superior rescue and fire fighting provisions (GPI 13)
- **MET**
 - Implementation of SIGMET (GPI 19)
 - Implementation of QMS (GPI 19)
 - Migration from alpha-numerical codes to XML(GPI 19)

Measuring success ...

- **Success of ICAO**
 - Business Plan and timelines
- **Success of the Global air navigation system**
 - capacity
 - efficiency
 - environment
 - flexibility
 - interoperability
 - Safety

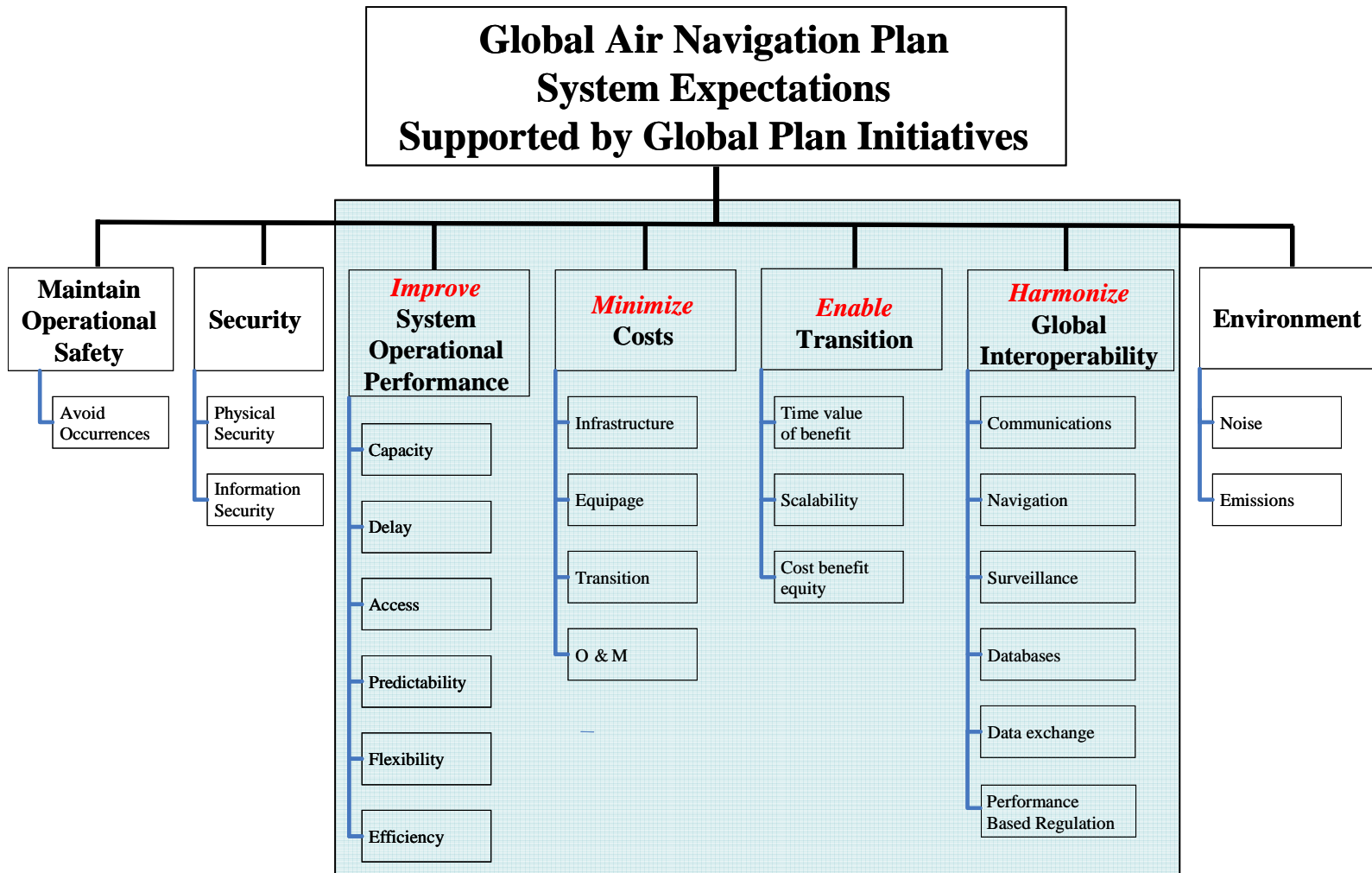
Measuring success

- **Choosing metrics:** Metrics are quantitative measure of system performance – how well the system is functioning
 - **Safety:** number of accidents per 100,000 departures
 - **Capacity:** Air cargo- Tons per year; Air side capacity- number of ops/hour; air borne delay- minutes per flight
 - **Cost effectiveness:** Total operating cost plus cost of capital divided by IFR flights
 - **Efficiency 1:** Estimated fuel savings (based on year 2000 as baseline)
 - **Efficiency 2:** Number of PBN routes/Number of APV approaches to runway ends
 - **Environment:** CO₂ burn
- **GREPECAS to choose appropriate 5 to 6 metrics**
- **GREPECAS to call upon States to provide requisite data to Regional office for the chosen metrics**

Measuring success

- **Develop performance indicators: Use SMART approach**
 - **Specific:** The measure is unambiguous, it is tied to a single aspect and the control of the aspect ratio is well known, for instance, delay is not specific for all the reasons above.
 - **Measurable:** There is a well-defined set of values that can be gathered and for which a scale of behavior can be described. Fuel burned is measurable; flight time is measurable; flexibility is not (at least not yet).
 - **Accurate:** The measure is capable of valuing small and large variations. A meter stick is not an accurate measure of hair thickness.
 - **Reliable:** The system produces values that can be measured in all but the most extreme circumstances. Once again, delay is not a reliable measure .
 - **Timely:** One doesn't need to wait years to measure. Although retrospective analysis is good, one needs to be able to measure performance in a time equal to the period of interest. If one is interested in the previous day a measure that requires one to wait a year to capture the value is not timely

Expectations



Efficiency Strategic Objective Focus Areas



- Provides consistent information for performance measurement

- Automates & integrates Business Plan processes

**The
Global Air
Navigation Plan
is an Implementation
Framework
that ...**

- Produces the baseline for measurable achievements and implementation of the ICAO ATM Operational Concept

- Shares common data & processes

Thank you