Next Generation Air Transportation System
Joint Planning and Development Office

Fact Sheets

NextGen Functional Areas

Joint Planning and Development Office

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Washington, DC 20005

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NextGen Functional Area Fact Sheets

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ICAO Global Plan Initiatives: GPI-1, GPI-6, GPI-7, GPI-10
SESAR Key Performance Areas: Safety, Cost Effectiveness, Capacity, Efficiency, Flexibility
FAA Solution Sets: HD, Flex Term, RWI, Facilities

Airport Operations and Support

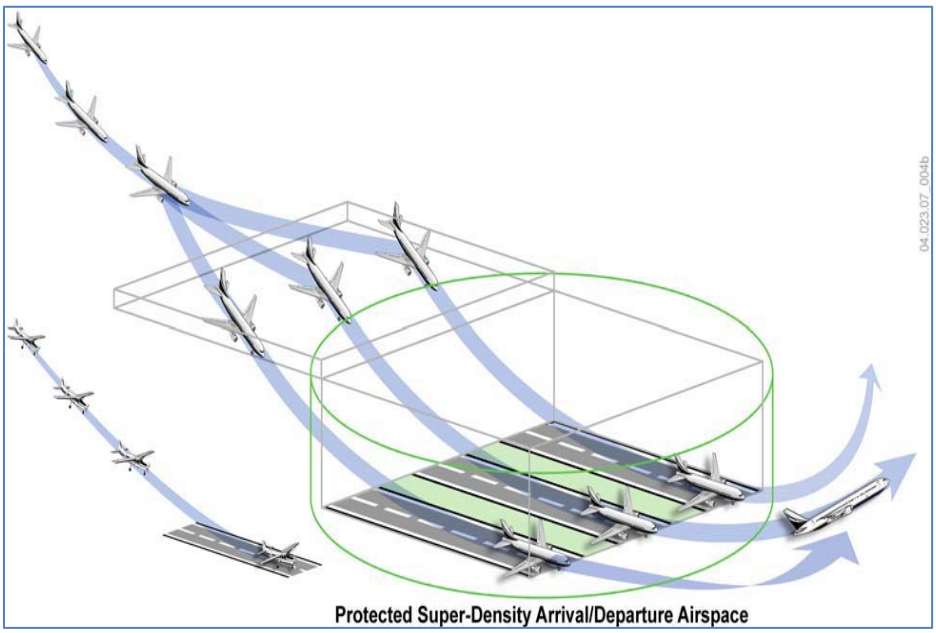
Airport Operations:

- In high density terminal areas, increased capacity will be achieved through use of equivalent visual operations, reduced wake separation, and increased operations on closely spaced parallel runways
- In the terminal area, flights are separated based on precise 4-dimensional trajectories instead of being restricted to dedicated airspace
- On the ground, time-based taxi trajectories are used to prevent runway incursions and to improve the flow of surface traffic providing greater efficiencies

Airport capacity is potentially a major constraint in the total capacity of the air transportation system as the integrative space between ground and air transportation systems. Airport operations must enable aircraft to arrive and depart in a safe, efficient, and secure manner, while also facilitating the movement of people and cargo on and off aircraft.

NextGen faces a significant challenge to achieve the capacity growth needed to meet future demand for aircraft operations and passenger and cargo movements at airports.

What it Will Do: Advanced ATM procedures and technologies will improve the operational capacity of existing airport runways and the efficiency of surface operations. This includes, for example, accurate satellite-based surveillance and performance-based navigation to provide Visual Flight Rule (VFR)-equivalent operations during Instrument Meteorological Conditions (IMC). On the airport surface, synthetic vision, moving maps, and automated alert and de-confliction systems will provide for safe navigation of aircraft and ground support equipment during normal and low-visibility conditions.



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SESAR Key Performance Areas: Safety, Cost Effectiveness, Capacity, Efficiency, Flexibility
FAA Solution Sets: HD, Flex Term, RWI, Facilities

ICAO Global Plan Initiatives:

- Flexible use of airspace (GPI-1)
- Air traffic flow management (GPI-6)
- Dynamic and flexible Air Traffic route management (GPI-7)
- Terminal area design and management (GPI-10)

Benefits:

Safety: Runway incursions will be reduced with time-based taxi trajectory management tools to de-conflict crossing runways and traffic streams

Capacity: Improved capacity will be achieved with Required Navigation Performance (RNP) operations on parallel and converging runways. Reduced wake vortex constraints and smaller minimum separations will be possible

Efficiency: Procedures are possible for permitting visual-like operations to continue into marginal or instrument meteorological conditions

Flexibility: Time-based taxi trajectories can be used, permitting flexibility in managing changing weather conditions

New procedures at airports will improve runway utilization, safely reduce spacing and separation, and better manage overall flows in and out of high density metropolitan airspace providing maximum use of the highest-demand airports. In super-density airspace, flows to and from airports may no longer be given dedicated airspace. Instead, flight trajectories are separated from each other based on the anticipated four-dimensional path that the aircraft will fly through the airspace. Precise knowledge of aircraft location, in four-diminsions, allow the safe reduction of minimum separation standards. High arrival and departure rates to primary airports are provided while allowing better access to satellite airports.

Global Harmonization: Using air transportation services provided by scores of service providers across the world, operators deliver people and goods to countless destinations daily, producing significant economic benefits in return. The increasingly global nature of air transportation requires greater effort at creating a harmonized environment in which operators can flow seamlessly between Flight Information Regions and operate into an out of the world's airports using consistent standards and practices in each area. Terminal and airport operations are a significant portion of the overall environment and one in which numerous options are available. NextGen supports global initiatives to develop interoperable systems and achieve agreement on recommended standards and practices. These initiatives will help standardize aircraft equipage and flight crew procedures, while reducing training requirements and operating costs.

Integration and Interoperability: The continued growth of aviation lies partly in achieving greater integration and interoperability among service providers. Achieving consensus on standards and practices is a key. Standards and practices are critical to both operators in terms of equipage and training requirements, but also to service provides. For service providers, more integrated and interoperable capabilities would enhance information sharing leading to improved collaborative decision making, security, and operational efficiencies. To achieve this may require adjusting institutional arrangements in order for global governance to address new systems and procedures, to leverage new aircraft performance capabilities, and to provide supporting infrastructure and training.

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ICAO Global Plan Initiatives: GPI-12

SESAR Key Performance Areas: Environment

FAA Solution Sets: Flex Term, SSE

Environmental Management Framework

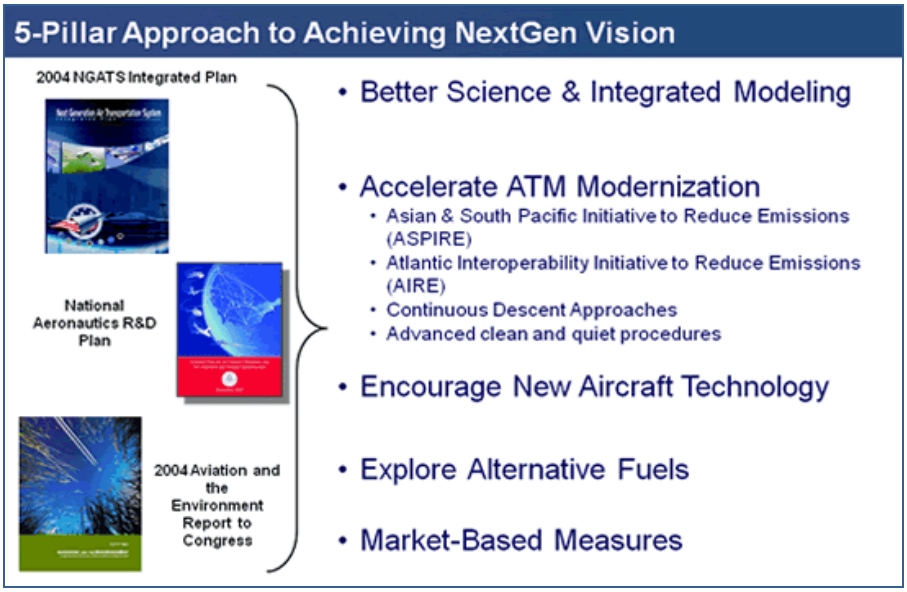
As air traffic demand continues to grow, key environmental issues, such as noise footprints, air quality, water quality, and the global climate, do as well. Over the past decade, environmental issues have resulted in the delay and/or down-scaling of certain airport capacity and airspace redesign projects. Climate change polices are producing pressures to reduce aviation's environmental footprint.

NextGen is developing a systematic and comprehensive Environmental Management Framework (EMF) to mitigate the impacts of aviation on the environment while continuing to allow for sustained aviation growth.

What it Will Do: EMF includes support of research, aircraft technology and alternative fuels development, operational enhancements, and other policy initiatives to achieve near-term gains. The EMF will account for interdependencies among many environmental issues so that in addressing some, others are not exacerbated. At the same time, the EMF will ensure aviation safety, national security and economic well-being.

Atlantic Interoperability Initiative to Reduce Emission (AIRE): Seeks to reduce aviation's environmental footprint through a "gate-to-gate" quality initiative led by the FAA and the European Commission. AIRE provides an opportunity to test next-generation technology and procedures that will reduce carbon emissions and save fuel on trans-Atlantic routes.

Asia & South Pacific Initiative to Reduce Emissions (ASPIRE): Seeks technological innovation and operational improvements that contribute to improved environmental standards and integrated best practices for air traffic management. ASPIRE is a partnership between Airservices Australia, Airways New Zealand and the U.S. FAA.



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ICAO Global Plan Initiatives: GPI-12

SESAR Key Performance Areas: Environment

FAA Solution Sets: Flex Term, SSE

ICAO Global Plan Initiatives:

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

Benefits:

Environment: Reduces the impact on climate and aviation's contribution to noise, water, and air pollution

Global Harmonization: NextGen must achieve a balance between aviation's need for increased capacity and efficiency and the impacts to the environment, both key societal objectives. There are a number of constraints that limit the efficiency of flight - whether they are procedural, cultural or due to the availability of, or access to, technology. The challenge of identifying and removing these constraints must be shared globally with civil aviation authorities and their governments. AIRE and ASPIRE are indicative of early commitments to this global challenge. Integral to NextGen, is FAA's commitment to providing stewardship to enhance international collaboration and to speed cost–benefit solutions for reducing aviation's environmental footprint. Technology solutions are available and in use to apply the recommended practices. Innovation is needed to accelerate development of new aircraft and engine technologies that reduce noise and emissions and to advance the use of alternative aviation fuels. In addition, policy and financial incentives will be needed to accelerate the introduction of these environmentally friendly aviation improvements in the U.S. and across the world.

Integration and Interoperability: To facilitate research and innovation, advances are needed for automated collection of applicable environmental data and energy use, using standardized processes and a common set of metrics to measure environmental impacts. In the strategic sense, a network of environmental communication is needed to enable users of the air transportation system to access the best possible information to assist in selecting and implementing cost-beneficial management options. Research, development, and innovation will be pursued toward the following goals:

1. accelerate the development and implementation of operational procedures to reduce the environmental footprint for all phases of flight on an operation by operation basis, from gate to gate;
2. facilitate world-wide interoperability of environmentally friendly procedures and standards;
3. capitalize on existing technology and best practices;
4. develop shared performance metrics to measure improvements in the environmental performance of the air transport system; and
5. provide a systematic approach to ensure appropriate mitigation actions with short, medium and long-term results.

ICAO Global Plan Initiatives: None
SESAR Key Performance Areas: Security
FAA Solution Sets: CATM, SSE

Layered Adaptive Security

Layered Adaptive Security: Provides a defense of the aviation system without unduly restricting mobility or commerce through seven layers:

- **Integrated Risk Management:** Net-enabled integration and sharing of security information among users
- **Secure Airports:** Perimeter security, access controls to secure areas, counter IED/VBIED
- **Secure People:** Passenger pre-screening and physical screening; credentialing of employees and crew members
- **Secure Checked Baggage:** Physical screening and sorting of checked bags
- **Secure Cargo / Mail:** Physical screening and secure distribution of cargo; risk-based screening of shippers
- **Secure Airspace:** Monitoring of flights and airspaces
- **Secure Aircraft:** Crew member security training, detection devices, and mitigation on board flight to ensure safe arrival to the planned destination

Layered, adaptive security is a risk-informed security strategy that uses multiple technologies, policies, and procedures - adaptively scaled and arranged - to defeat known threats and reduce vulnerabilities.

What it Will Do: The NextGen layered adaptive security model describes an aviation security system that strives to balance effective layered security with efficient operations. NextGen security layers are conceived to ensure the full mobility of people and cargo, maintain respect for the civil liberties of users and providers, while focusing on minimally impacting the efficient and flexible nature of operations

Layered Security: Each layer in the NextGen security concept serves to reduce the risk of a threat reaching its target. Failures in any one layer will, conceptually, be contained by countermeasures in the other layers.

Adaptive Security: Security countermeasures will adjust in response to the changing profile of risk. Responses to anomalies and incidents are proportional to the assessed risks of involved flights, individuals, cargo, and external factors. This adaptability permits the use of increased variability in system operations, which creates additional uncertainty for terrorists.

Net-Enabled Operations With Shared Situational Awareness

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ICAO Global Plan Initiatives: None
SESAR Key Performance Areas: Security
FAA Solution Sets: CATM, SSE

In addition, the NextGen security system will have the ability to scale its systems and procedures to the risk level of a threat in a given situation rather than being bound to an inflexible "one size fits all" approach.

Integrated Risk Management (IRM): IRM is a federated risk assessment and risk mitigation framework for guiding multiple security service providers in making decisions, allocating resources, and taking actions under conditions of uncertainty. At the strategic level, IRM will integrate prognostic tools, analytical models, and simulations to support decision makers in developing cost-effective "best practices" into the design, acquisition, deployment, and operation of aviation security system assets and infrastructures.

At the tactical level, IRM will integrate data sources from aircraft, airports, intelligence, security and defense service providers concerning current threats and vulnerabilities in order to support decision makers in an effective and timely mitigation response for specific flight objects.

Risk Profile: Generated risk profiles for various entities in the aviation system, such as air spaces, flights, airports, cargo, and baggage, will guide flight planning, security restrictions, and response to anomalies/incidents. The risk assessment criteria may include many variables, like size and performance of aircraft, type of operator and proximity or actual access to restricted airspace. Risk profiles will be monitored by air traffic managers, defense managers, and security managers to detect and collaboratively respond to aviation security risks or events.

Global Harmonization: Aviation security is a global objective that will require agreed upon and integrated security objectives, policies, procedures, and information requirements, and associated technologies among the widest possible base of international aviation partners.

Integration and Interoperability: Universal standards and minimum data requirements for passenger, baggage, and cargo screening will need to be defined among all international partners. Bilateral agreements will also be needed for certain operations, such as international reentry of hypersonic vehicles and unmanned vehicles.

Benefits:

Cost Effectiveness: Integrated Risk Management will provide the basis for improved decision making on the acquisition and operations of enhanced security systems

Situational Awareness: Risk profiles will provide the basis for consistent and timely information sharing among security partners and system users

Security: Layered Adaptive Security will enable improved shared situational awareness for prevention, detection, response, or recovery to appropriate security stakeholders in the aviation security environment

ICAO Global Plan Initiatives: GPI-9, GPI-12, GPI-16, GPI-17, GPI-18, GPI-19, GPI-21, GPI-22
SESAR Key Performance Areas: Access & Equity, Capacity, Cost Effectiveness, Efficiency, Flexibility, Global Interoperability, Predictability, Safety, and Security
FAA Solution Sets: TBO, HD, Flex Term, CATM, RWI, SSE

Net-Centric Infrastructure Services

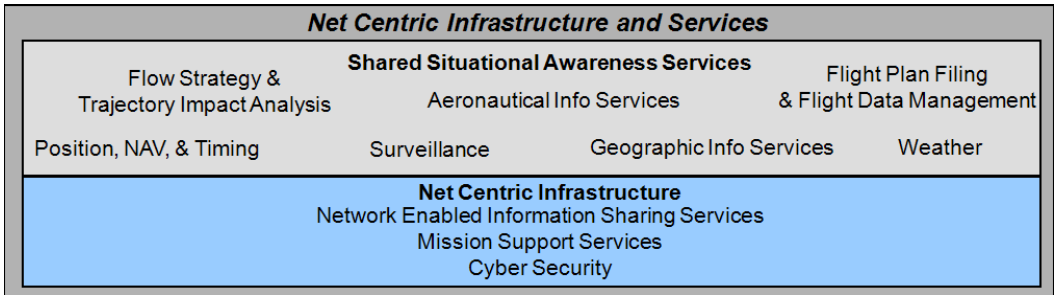
Net-Centric Infrastructure Services (NCIS): Connects key service provider and user nodes involved in air transportation (e.g., weather, surveillance, aircraft operators, air navigation service providers and airport operators) via ground-to-ground, air-to-ground, and air-to-air segments

Net-Centric Infrastructure Services (NCIS) will leverage the abilities of a web-based, service oriented architecture to enable greater information sharing and improved shared situational awareness. The NCIS establishes an enterprise distribution bus that facilitates timely, secure, and reliable communications.

NextGen NCIS consists of two primary components - *Infrastructure Services* and *Information Services*.

Infrastructure Services will provide communications infrastructure services across the ground-to-ground, air-to-ground, and air-to-air network environment to ensure that information flows reliably and securely. This infrastructure will provide access control, transport of data, bandwidth provisioning, network monitoring and diagnostics. Cyber security requirements for access control, network protection, and data sharing policies are addressed as part of infrastructure services.

Information services are focused on providing critical information to the appropriate users in a timely manner. Information services, enabling shared situational awareness, will employ a service oriented approach to collect, mange, and distribute data across the NextGen enterprise. Information will be tailored to various specific user needs within the aviation transportation system. Information services include, for example, weather, surveillance, aeronautical information, ATM information, navigation, and geographical grid data.



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SESAR Key Performance Areas: Access & Equity, Capacity, Cost Effectiveness, Efficiency, Flexibility, Global Interoperability, Predictability, Safety, and Security
FAA Solution Sets: TBO, HD, Flex Term, CATM, RWI, SSE

ICAO Global Plan Initiatives:

- Situational Awareness (GPI-9)
- Functional integration of ground systems with airborne systems (GPI-12)
- Decision support systems and alerting systems (GPI-16)
- Data link applications (GPI-17)
- Aeronautical information (GPI-18)
- Meteorological systems (GPI-19)
- Navigation systems (GPI-21)
- Communication infrastructure (GPI-22)

Benefits:

NCIS is a cross-cutting enabler for all NextGen capabilities. Ubiquitous communication and data sharing, whether in the air or on the ground, is a foundational principal of the NextGen evolution. As such, it will be integral to all future ATM enhancements.

What it Will Do: NCIS is a critical enabler of NextGen's Shared Situational Awareness capability. It will enhance collaborative decision making among all operators and service providers leading to enhanced efficiency and predictability of operations, better access and equity among users, improved system security, and potentially, cost savings for both operators and service providers.

The **ground network** is the backbone of the net-centric infrastructure, providing the gateways between agencies and other organizations. The ground network will also be an essential support for the air-ground segment, by transporting data to and from the appropriate air-ground radio equipment.

The **air-ground network** will carry data from ground systems to the cockpit, and vice versa. This critical segment will ensure the delivery of real-time surveillance and weather data to the cockpit, as well as enabling the negotiation of complex trajectories and separation responsibility contracts. The air-ground segment also supports surface movement operations.

The **air-air network** will build on existing technologies to allow aircraft to share critical real-time information, such as position and intent information.

Global Harmonization: To ensure seamless sharing of information among U.S. and International users, NCIS will require a governance process and agreements on communications protocols among global partners and system users.

Integration and Interoperability: In order to ensure interoperability of systems among international partners, aircraft operators will need equipage to support net-centric operations. The international community will need to define and agree on the technical requirements for communication protocols and data service standards. Operational service-level agreements can serve as frameworks to start the development of systems to ensure future interoperability. Interoperable systems in concert with agreed to standards and practices will enable the seamless integration of information, situational awareness, and, ultimately, effective aviation operations both domestically and globally.

ICAO Global Plan Initiatives: GPI-1, GPI-6, GPI-7, GPI-11, GPI-12
SESAR Key Performance Areas: Capacity, Efficiency, Flexibility, and Predictability
FAA Solution Sets: TBO, HD, Flex Term, RWI

Position, Navigation, & Timing (PNT) Services

PNT Services: Improve efficiency, capacity, and safety of the system identifying

Position: Current latitude, longitude, and altitude

Navigation: Controlling the flight path along a desired route

Timing: Common, accurate, and precise timing source for all users from a standard universal coordinated time

Today's air traffic management system has evolved into a primarily ground-based, human centric communications, navigation and surveillance system. Aircraft navigation has long been constrained by the capabilities of ground-based Navigation Aids (NAVAIDs) and routes that are tied to the locations of these NAVAIDs. Reliance on ground-based systems has also constrained airspace design.

NextGen Position, Navigation, & Timing (PNT) services will provide the foundation for performance-based navigation operations, including those that specify Required Navigation Performance (RNP), through the use of satellite, aircraft, and ground-based systems.

What it Will Do: PNT services will provide the ability to precisely determine the aircraft's current location and orientation, as well as the aircraft's desired path and position. Enabling the application of corrections to course, orientation, and velocity, it will be possible to attain an accurate and precise position and time anywhere on the globe. These capabilities will allow for user-defined trajectories based on business or other operational parameters/objectives.

Improved PNT services combined with integrated ground-to-ground, air-to-ground, and air-to-air communications improves surveillance situational awareness for operators and service providers thereby enabling improved safety, security, and reliable aircraft operations in nearly all conditions

ICAO Global Plan Initiatives: GPI-1, GPI-6, GPI-7, GPI-11, GPI-12
SESAR Key Performance Areas: Capacity, Efficiency, Flexibility, and Predictability
FAA Solution Sets: TBO, HD, Flex Term, RWI

ICAO Global Plan Initiatives:

- Flexible use of airspace (GPI-1)
- Air traffic flow management (GPI-6)
- Dynamic and flexible Air Traffic route management (GPI-7)
- RNP and RNAV SIDs and STARs (GPI-11)
- Functional integration of ground systems with airborne systems (GPI-12)

Benefits:

Capacity: PNT will enable increased availability of guided approaches at smaller airports for general aviation by enabling lower approach minima

Efficiency: PNT services will enable greater use of performance-based arrival routes to better achieve system objectives, reduce controller workload, and increase efficiency

Flexibility: Air routes can be independent of the location of ground-based navigation aids. Airspace design will be less constrained allowing for more flexible configurations.

Predictability: System performance will more reliably meet operational needs to service the demand

PNT services provide appropriate signals in space, mostly from satellite-based infrastructure, that are discernable by aircraft avionics and ground based systems. They are highly accurate and reliable for use in advanced NextGen air traffic management operations enabling capacity, efficiency, flexibility, and predictability benefits. PNT services are the foundation for performance-based and trajectory-based operations including those that have specified Required Navigation Performance (RNP).

Timing services will employ a standard universal coordinated time and enable the precise synchronization of operations and the reduction of uncertainties associated with disparate timing sources.

Global Harmonization: All PNT service capabilities will need to be harmonized internationally so operations in oceanic, U.S. and non-U.S. airspace will be transparent to users. This will involve bi-lateral and multilateral (e.g., ICAO) negotiations with partner nations and around the world.

Integration and Interoperability: PNT services will require the standardization of equipment for receiving precise information from surveillance, navigation and timing sources. They will also require international cooperative agreements for implementing processes and procedures to leverage PNT services.

ICAO Global Plan Initiatives: GPI-14, GPI-15
SESAR Key Performance Areas: Safety and Security
FAA Solution Sets: TBO, HD, Flex Term, CATM, RWI, SSE

Safety Management

Safety Management: Transform a reactive, forensic-based approach to an integrated, predictive, and proactive capability using cooperative historical data and prognostic evaluations to improve management of safety risks

Safety Management System: Evaluate each planned operational improvement in terms of the technology, procedure, or human-machine interface to ensure the highest standards of operational safety are achieved

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Improving safety is an indispensible priority for transforming the air transportation system because even a perceived lack of safety negatively affects long-term economic strength and user-acceptance of the air transportation system. The anticipated growth and increased complexity in the air transportation system requires a fundamental change in the way safety is managed.

The safety initiatives for NextGen are intended to permit increases in capacity and efficiency while ensuring that the overall safety of the system is maintained or enhanced.

What it Will Do: Advanced ATM procedures and technologies will improve safety in the nation's high density airspace and busiest airports. Airport surface, synthetic vision, moving maps, and automated alert and de-confliction systems will provide for safe navigation of aircraft and ground support equipment during low-visibility conditions.

NextGen will include the U.S. Aviation Safety Information Analysis and Sharing (ASIAS) capability, which is an evolving facility for the integration, analysis, and sharing of aviation safety data. It will provide tools for prognostic risk management, contributing factor analysis, safety assurance, and safety risk management.

Safety considerations will influence all aviation system improvement activities and investments in the NextGen environment. The design, manufacture, operation, maintenance, and control of air traffic, as well as the way humans interact with the equipment and systems, will be addressed with an embedded safety approach, which provides the following:

- Aviation-wide baseline criteria and safety performance benchmarks for acceptance and implementation of new procedures and technologies.
- Integration of safety requirements and safety engineering in the early stages of program planning and implementation.
- Timely acceptance of proposed new safety-enhancing technology, procedures, and training products.

ICAO Global Plan Initiatives: GPI-14, GPI-15
SESAR Key Performance Areas: Safety and Security
FAA Solution Sets: TBO, HD, Flex Term, CATM, RWI, SSE

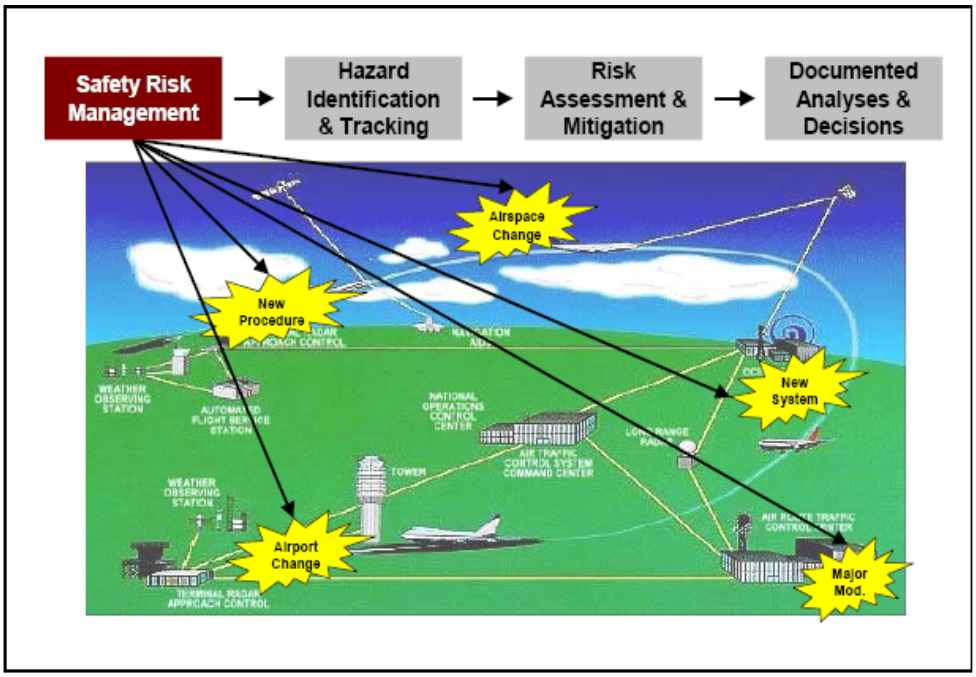
ICAO Global Plan Initiatives:

- Runway Operations (GPI-14)
- Match IMC & VMC Operating Capacity (GPI-15)

Benefits:

Safety: Enhanced ground and air-borne systems will reduce accidents both on the air and the runways

- Early identification of safety risks allowing intervention strategies to avoid accidents and incidents.
- Alignment of R&D efforts maximizing safety benefits.



Global Harmonization: NextGen supports the ICAO Global Aviation Safety Roadmap vision. The U.S. FAA will collaborate and participate in information sharing opportunities that serve to increase safety awareness and implement new air transportation safety initiatives. Reaching consensus on global standards and practices is a priority. Standardized equipage and training are the keys to improving safety within U.S. airspace as well as international air transportation system.

Integration and Interoperability: To ensure interoperability and to enable seamless integration of information, situational awareness, and safe aviation operations, it is necessary to align technical requirements and operational practices internationally for all emerging systems. The U.S. FAA will work with its international partners toward these mutual goals.

ICAO Global Plan Initiatives: GPI-1, GPI-6, GPI-7,GPI-9, GPI-11, GPI-12, GPI-14, GPI-16
SESAR Key Performance Areas: Efficiency, Flexibility, Predictability, Safety, and Security
FAA Solution Sets: TBO, HD, Flex Term, RWI

Surveillance Information Services

Surveillance Information Services: Integrates surveillance information from all air and ground sources:

- Ground-to-Ground
- Air-to-Ground
- Air-to-Air

Using net-centric data distribution, this combined data provides a complete picture that can be processed and used for various operational displays

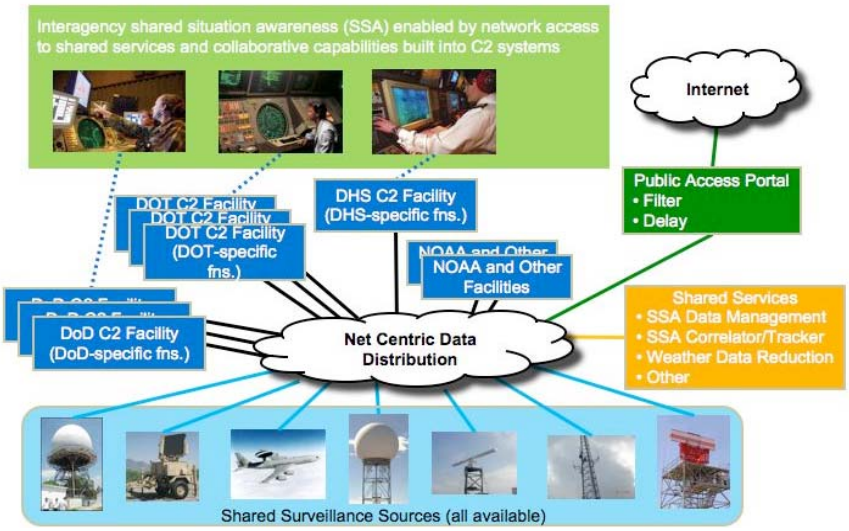
Cooperative surveillance: Self-reporting of position/intent data by aircraft or vehicle to other aircraft, vehicles, and ground-based systems

Non-cooperative surveillance: Detection through sensors regardless of self-reporting capabilities from the target

Today, air traffic surveillance is collected piecemeal, combining cooperative independent secondary surveillance Air Traffic Control Radar Beacon Systems and Non-Cooperative Active Surveillance (primary short- and long-range radars). Surveillance information can vary among facilities depending upon operational needs and geographic location.

NextGen Surveillance Information services will improve the ability to detect, identify, and monitor the movements of cooperative and non-cooperative targets.

What it Will Do: The Automated Dependent Surveillance Broadcast (ADS-B) system provides real-time position data of equipped aircraft to ground Air Traffic Management systems and to other equipped aircraft. This system will also potentially enable reduced delays and enhanced safety by using aircraft broadcasted positions, derived from satellite-based navigation systems or other suitable position determining systems, and advanced cockpit avionics and air traffic service automation systems.



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SESAR Key Performance Areas: Efficiency, Flexibility, Predictability, Safety, and Security
FAA Solution Sets: TBO, HD, Flex Term, RWI

ICAO Global Plan Initiatives:

- Flexible use of airspace (GPI-1)
- Air traffic flow management (GPI-6)
- Dynamic and flexible Air Traffic route management (GPI-7)
- Situational Awareness (GIP-9)
- RNP and RNAV SIDs and STARs (GPI-11)
- Functional integration of ground systems with airborne systems (GPI-12)
- Runway Operations (GPI-14)
- Decision support systems and alerting systems (GPI-16)

Benefits:

Efficiency: Reduced separation standards in certain types of airspace

Flexibility: Adaptive flexible spacing and sequencing of aircraft on the ground and in the air. Also flexible availability of surveillance information to support distributed decision making and collaboration

Predictability: Improved four-Dimensional Trajectory (4-DT) information and flight path conformance monitoring

Security and Safety: Comprehensive tracking of aircraft and ground vehicles to improve security, safety and operational effectiveness

In addition, NextGen Surveillance Information Services will include precise and timely information on potentially hazardous weather phenomena. Available data will help to improve short-term forecasts of dynamic weather phenomena and to detect potentially hazardous weather as it occurs.

Improved cockpit display avionics and broadcast positional data will provide detailed traffic situational awareness to the flight deck and to controllers. If authorized by the controller, aircraft that are properly equipped with displays, avionics and crew training will be able to perform self-separation from other equipped aircraft using established procedures. Leveraging the capabilities of ADS-B (ground and aircraft systems components) and Cockpit Display of Traffic Information will enable enhanced visual operations so as to maintain Visual Meteorological Conditions procedure arrival rates during Instrument Meteorological Conditions.

Global Harmonization: Improved surveillance services must be harmonized internationally so operations will be conducted and managed consistently, both in airspace where the U.S. provides air traffic services, as well as non-U.S. serviced airspace. To achieve this will require bi-lateral and multilateral discussions with other nations and organizations globally on topics such as standardization of equipment and data services needed for surveillance functions. The Airborne Surveillance Requirements Focus Group for the United States/Europe and ICAO is working on requirements for equipage and procedures to assure the consistent application of separation, sequencing and other operational procedures.

Integration and Interoperability: Surveillance Information Services will require:

- The standardization of equipment for precise and timely surveillance, navigation and weather information that is distributed and shared over a secure integrated network.
- International cooperative agreements for implementing processes and procedures of self separation standards.

ICAO Global Plan Initiatives: GPI-1, GPI-6, GPI-7, GPI-10, GPI-11, GPI-12
SESAR Key Performance Areas: Safety, Cost Effectiveness, Capacity, Efficiency, Flexibility, Predictability
FAA Solution Sets: TBO, HD, Flex Term, RWI

Trajectory and Performance Based Operations

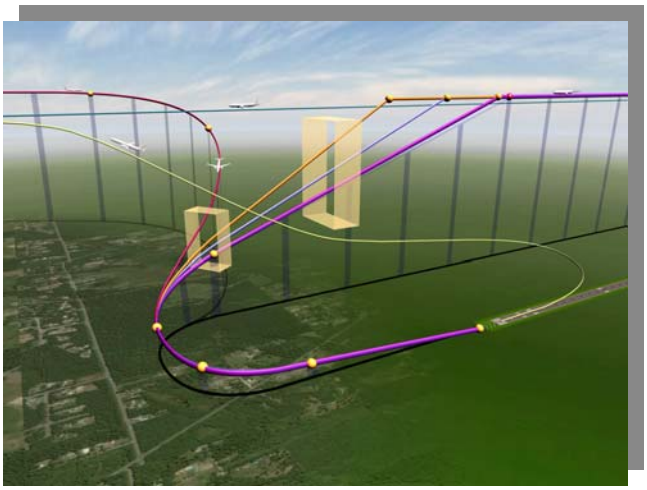
Trajectory Based Operations (TBO): Permit precise management of aircraft's current and future positions to improve efficiency and throughput, and facilitate separation assurance through close-ended 4DTs.

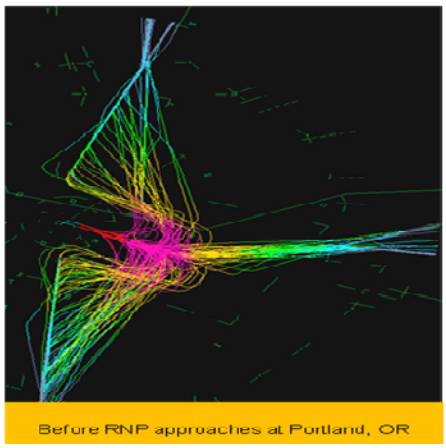
Performance Based Operations (PBO): Leverage an aircraft's performance characteristics to enhance airspace management and support high density operations.

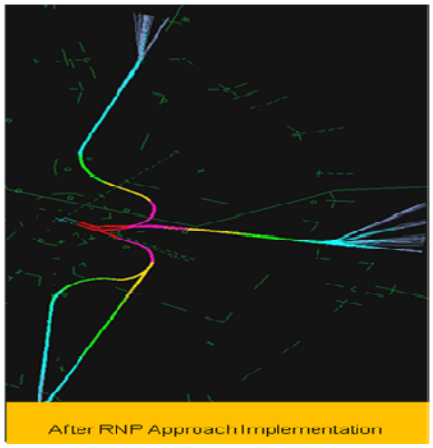
Four-Dimensional Trajectories (4DTs): Describe an aircraft path in space and time: the "centerline" of a path plus the position uncertainty, using waypoints to identify specific steps along the path.

Managing air traffic in highly dense and complex airspace in today's environment is constrained to rules-based operations that evolved over time using a network of ground-based navigation aids. Reliance on ground-based systems also constrains design of airspace and navigation routes.

NextGen will provide varying levels of service and operating flexibility depending on the performance capability of the aircraft. Advancements in aircraft capabilities will support the transition from rules-based operations to performance-based operations.







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Next Generation Air Transportation System
Joint Planning and Development Office

ICAO Global Plan Initiatives: GPI-1, GPI-6, GPI-7, GPI-10, GPI-11, GPI-12
SESAR Key Performance Areas: Safety, Cost Effectiveness, Capacity, Efficiency, Flexibility, Predictability
FAA Solution Sets: TBO, HD, Flex Term, RWI

ICAO Global Plan Initiatives:

- Flexible use of airspace (GPI-1)
- Air traffic flow management (GPI-6)
- Dynamic and flexible Air Traffic route management (GPI-7)
- Terminal Area Design and Management (GPI-10)
- RNP and RNAV SIDs and STARs (GPI-11)
- Functional integration of ground systems with airborne systems (GPI-12)

Benefits:

Safety: TBO equipment continuously checks for problems or spacing conflicts independent of traffic volume or complexity, providing information about a predicted problem until it is resolved.

Capacity & Efficiency: TBO and PBO enable the reduction of separation standards; they support the ability to perform delegated separation and low-visibility approach procedures.

Cost Effectiveness: Service tiers will be provided so that users can make the appropriate investments in equipment to access the level of service that will best meet their needs.

Flexibility: Highly capable aircraft will have greater operating flexibility.

What it Will Do: Trajectory-based (TBO) and performance-based operations (PBO) will transform several air traffic operations across all flight domains. Most noticeably, these enhanced operations will provide for: increased flight efficiencies by improving predictability; increased capacity by improving low-visibility approach/departure procedures, and in super-density terminals, improved efficiencies in the integrated management of arrivals, departures, and surface movements. En route, service providers will be able to pass responsibility for waypoint times-of-arrival to pilots of aircraft capable of meeting specified timing constraints. In terminal areas, under low-visibility approach procedures, VFR arrival rates can be maintained for longer periods, resulting in increased runway throughput. Increased flexibility can be achieved by modifying trajectories more easily when weather, environmental, defense, or security constraints impact an aircraft's plan.

TBO service levels will provide choices to users depending on their needs, required communication, navigation and surveillance performance, environmental performance criteria, or security parameters. Services will vary from area to area in terms of airspace and available airport runways, and they will vary as demand and system performance change as well. In this way, TBO services enable improved capacity management, while maintaining both predictability and flexibility of the ATM system.

Global Harmonization: Trajectory-based capabilities will need to be harmonized internationally in order to provide consistency. Consistent performance levels will help to harmonize global operations and create free-market opportunities for users and suppliers on a multi-national and/or global scale. This will involve a full range of bi-lateral and multilateral discussions with other nations and organizations globally.

Integration and Interoperability: Performance-based operations are dependent upon aircraft operators equipping their aircraft to interconnect and share information seamlessly and securely, for both air-to-air and air-to-ground communications. Global implementation of performance-based navigation systems will be necessary for seamless operations worldwide. Global harmonization encourages performance-based, global standards and enables services tailored to traveler and shipped.

ICAO Global Plan Initiatives: GPI-19
SESAR Key Performance Areas: KPA 04, KPA 10
FAA Solution Sets: RWI

Weather Information Services

NextGen Weather Information Services: Integrate with and support NextGen decision-oriented automation capabilities and human decision-making processes

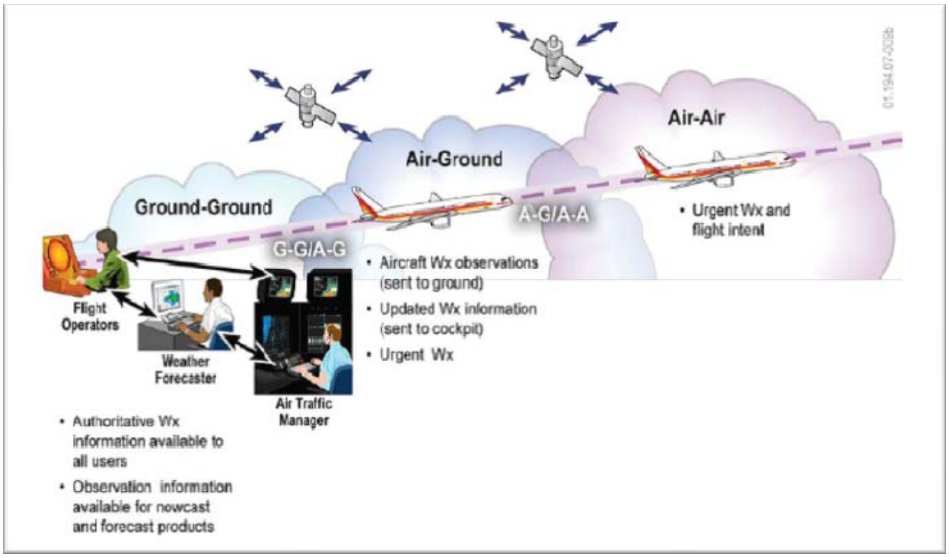
NextGen Network Enabled 'virtual' 4D Weather Cube: Provides comprehensive 4-dimensional aviation weather information that provides a Single Authoritative Source (SAS) of current and forecasted weather

Today, weather information is drawn from numerous competing or conflicting sources and is presented in different ways to various users. Users often independently develop their view of the weather creating inconsistent strategies and reactions to weather phenomena.

NextGen Weather Information Services will provide a common weather picture that can be integrated into automated and human air traffic management decision-making to seamlessly support enterprise-wide ATM operations. This serves to promote the safe, timely, and efficient operation of the air transportation system.

What it Will Do: Because all air navigation service providers, pilots, and operations centers will have access to the same weather data, collaborative decision making among air traffic management service providers and users will be enhanced.

Centrally managed weather information that is distributed to all stakeholders through the NextGen Network Enabled virtual 4D Weather Cube will ensure consistency and continuity in planning for common weather pictures. Within the 4D Weather Cube, weather observations and forecasts will be arbitrated and fused into a Single Authoritative Source (SAS) of weather information used in joint government/user decision-making processes.



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ICAO Global Plan Initiatives: GPI-19
SESAR Key Performance Areas: KPA 04, KPA 10
FAA Solution Sets: RWI

ICAO Global Plan Initiative: Meteorological Systems (GPI-19)

Benefits:

Safety: Hazardous weather information (e.g., icing turbulence, low-level wind shear) collected by aircraft is transmitted directly to nearby aircraft as well as to ground systems. Airspace structural changes are better customized in response to changing weather conditions, such as thunderstorms.

Efficiency: Weather information is tailored to the operational needs of different types of users, maintaining a consistent view of weather information. Weather information is fused for the first time as a single authoritative source. This reduces the need for stakeholders to manually gather, interpret, and integrate diverse and sometimes conflicting weather data.

The NextGen common weather picture will not be a stand-alone, separately displayed end-product, but integrated into NextGen decision-making processes (automated and human). Weather information, in the form of observed or forecasted meteorological variables (e.g., storm intensity, echo tops), will be translated into information that is directly relevant to NextGen users and service providers. This includes information such as the likelihood of a flight deviation, airspace permeability, and capacity.

Global Harmonization: The U.S. provides weather services beyond its physical borders, particularly for Oceanic and Gulf of Mexico regions. Non-U.S. carriers will need to be equipped to receive and integrate weather information into their flight management systems when flying in U.S. airspace. With universal sharing of weather information, countries can share weather data among other meteorological organizations around the globe.

Integration and Interoperability: In order to maximize NextGen Weather Information Services, aircraft will need to be capable of receiving and collecting digitized weather information. Data standards and procedures will need to be established to enable the dissemination of consolidated observations and forecast data as well as the collection and control of weather sensor data. Standardization of equipment, both on the ground and in the cockpit, will be needed to enable the sharing and fusing of precise and timely weather information over a secure integrated network.

Appendix A

ICAO Global Plan Initiatives

GPI Identifier	Description
GPI-1	Flexible Use of Airspace
GPI-2	Reduced Vertical Separation Minima
GPI-3	Harmonization of Level Systems
GPI-4	Alignment of Upper Airspace Classifications
GPI-5	RNAV and RNP (Performance-Based Navigation)
GPI-6	Air Traffic Flow Management
GPI-7	Dynamic and Flexible ATS Route Management
GPI-8	Collaborative Airspace Design and Management
GPI-9	Situational Awareness
GPI-10	Terminal Area Design and Management
GPI-11	RNP and RNAV SIDs and STARs
GPI-12	Functional Integration of Ground Systems with Airborne Systems
GPI-13	Aerodrome Design and Management
GPI-14	Runway Operations
GPI-15	Match IMC and VMC Operating Capacity
GPI-16	Decision Support Systems and Alerting Systems
GPI-17	Data Link Applications
GPI-18	Aeronautical Information
GPI-19	Meteorological Systems
GPI-20	WGS-84
GPI-21	Navigation Systems
GPI-22	Communications Infrastructure
GPI-23	Aeronautical Radio Spectrum

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Appendix B

SESAR Key Performance Areas

KPA Identifier	Description
KPA 01	Access and Equity
KPA 02	Capacity
KPA 03	Cost Effectiveness
KPA 04	Efficiency
KPA 05	Environment
KPA 06	Flexibility
KPA 07	Global Interoperability
KPA 08	Participation by the ATM Community
KPA 09	Predictability
KPA 10	Safety
KPA 11	Security

Appendix C

FAA NextGen Solution Sets

Solution Set Identifier	Solution Set Name
TBO	Initiate Trajectory-Based Operations
HD	Increase Arrival/Departures at High Density Airports
Flex Term	Increase Flexibility in the Terminal Environment
CATM	Improve Collaborative Air Traffic Management
RWI	Reduce Weather Impact
SSE	Increase Safety, Security, Environmental Performance
Facilities	Transform Facilities

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