NAV LEAN

Instrument Flight Procedures

FEDERAL AVIATION ADMINISTRATION

2010 REPORT

Navigation (NAV) Procedures Project Final Report

September 2010

Approved By:

Signature 9/30/10 Date

Henry P. Krakowski
Chief Operating Officer

Signature 9/30/10 Date

John J. Hickey
Deputy Associate Administrator for Aviation Safety
AVS-2

Submitted By:

Joe McCarthy (AJR-37)
Manager, Performance Based Navigation (PBN) Integration Group

Gary Powell (AFS-401)
Assistant Division Manager

Table of Contents

List of Figures

List of Tables

Executive Summary

In response to an RTCA Next Generation (NextGen) Mid-Term Implementation Task Force Report (TF-5) recommendation to identify and solve operational approval and certification issues that may impede adoption and acceleration of NextGen capabilities, the Federal Aviation Administration (FAA) initiated a cross-agency Navigation Procedures project to streamline policies and processes used to implement Instrument Flight Procedures (IFP) in the National Airspace System (NAS). This initiative, headed by Aviation Safety (AVS) and the Air Traffic Organization (ATO), used the "Lean Management Process" to identify waste and to develop a set of detailed recommendations to improve and streamline the processes used for developing and implementing IFPs.

The underlying motivation for Lean Management is to maximize customer value while minimizing or eliminating waste. It means creating more efficient and cost-effective value for customers while using fewer resources. To make this happen, an organization must shift its focus from optimizing separate technologies, assets, and vertical departments to optimizing the flow of products and services so that they flow horizontally across technologies, assets, and departments to customers. If an organization can minimize waste it can create a process that needs less human effort, less space, less capital, and less time to produce a product or service. Ultimately, an organization should strive to provide maximum value to its customers through an optimal process that has minimal waste.

For the Navigation Procedures project, six Working Groups were formed to review all activities involved in the development and implementation of IFPs, and to cooperatively develop recommendations to improve and streamline the process. Between March and May 2010, each Working Group member attended a 3-day NAV Lean Process workshop to receive interactive training on the Lean Process from FAA-qualified trainers. The training focused on identifying areas of low-value activity such as bottlenecks, over processing, delays, overproduction, and excess paperwork, all of which add little or no value to the final quality of the product. By the conclusion of the workshops, each Working Group had charted the current process for its particular area of concentration, and identified areas for improvement. The Working Groups met independently through June 2010 to refine their initial reports and to develop a comprehensive set of final recommendations. Working Group efforts culminated in a 3-day meeting of the Working Group and project leads to consolidate all recommendations into a single, unified set of recommendations that included estimated costs and timeframes for implementation, and identified an Office of Primary Responsibility (OPR) for each recommendation.

The current IFP development and implementation process is actually a bundle of interconnected, overlapping, and sometimes competing processes. No unique description exists for the current process; however, there is a core process for IFP implementation (request, design and development, approval, implementation, and maintenance) along with several other auxiliary processes (Safety Management System, Operations Approval and Certification, Environmental, and Criteria Development) that intersect with this core process to complete the full life cycle of an IFP. Close examination of the IFP life cycle by the Working Groups revealed a multiplicity of components and processes which have often evolved independently to meet requirements that

may or may not be related to IFPs. Those processes are then executed by numerous personnel with varied backgrounds, training, and expertise. The guidance that exists is somewhat fragmented and sometimes incomplete.

Creating the most effective and efficient process to complete a complex series of activities, such as those required to implement a new IFP, requires standardization, clearly articulated goals and milestones, and confidence that all participants are following the same set of rules. During their review, the Working Groups identified certain overarching issues with the current process and agreed that the following characteristics of the current process have a negative effect on the efficiency of the process.

- Having requests entering the system through multiple portals results in inconsistent processing. Often concepts, operational goals, anticipated benefits, and environmental and safety considerations do not receive the attention they should at this point, which later translates into rework and duplication of effort. Sometimes issues with IFPs that should have been identified early in the process are not discovered until they are ready to be, or have already been, implemented.
- There are inconsistencies in the interpretation of guidance. This inconsistency is sometimes the result of unclear, contradictory, or incomplete guidance. In other cases, it may result from a lack of training.
- The lack of an expedited process for “minor” revisions to existing IFPs wastes a significant amount of time and resources.
- Multiple data sources may result in data inconsistencies, limited availability to some users, and reworking of IFPs in development
- Incompatibility between tools which prevents the electronic transfer of data extends the time required to process IFPs and provides numerous opportunities for human error as data is repeatedly manually keyed into various systems throughout the process

The Working Groups collectively had 48 recommendations which were further refined during follow-on meetings and telecons and distilled to 21 recommendations, grouped under nine issues. The nine issues are listed below:

1. Minor amendments of IFPs result in added workload and delayed implementation.
2. The Terminal Area Route Generation, Evaluation, and Traffic Simulation (TARGETS) automation (used to design RNAV STARs) is not an approved AeroNav Services tool and cannot be used to electronically communicate with AeroNav Services software, leading to manual rework of STARs by AeroNav Services.
3. Databases used in IFP design are not standardized and are not available to all service providers.
4. Manual IFP data transfer creates human error and wasted time.

5. FAA guidance on preparation of Environmental Assessments (EA) does not address situations where the environment analysis is narrowly focused on only certain potential environmental impacts (“focused EA” approach).
6. Inconsistent interpretation of FAA environmental policy/guidance causing delays in developing and implementing IFPs.
7. No systems approach to IFP criteria development and implementation; competing agency initiatives impede criteria requirements definition; implementation aspects of criteria development are not currently addressed.
8. Inconsistent application of FAA SMS policy regarding the need to develop a Safety Risk Management Document (SRMD) or a Safety Risk Management Decision Memorandum (SRMDM) for every new or amended IFP causes delays.
9. Processing delays occur because there is no standardized process to accept input from all IFP proponents/stakeholders, to access, request, track, edit, store, and manage information throughout the IFP development process.

The recommendations touch on all of the major aspects of the IFP process, including policy, tools, data, and training. Assuming a full Environmental Impact Statement (EIS) is not required, it is estimated the full implementation of the 21 recommendations will reduce the time currently required to implement a new IFP by more than 40 percent.

Table 1 provides the list of recommendations, high-level cost categorization, estimated timeframe for implementation, and a candidate OPR.

Table 1. Working Group Recommendations

Issue	Rec Number	Recommendations	Cost	Time	OPR
1	**1**	Expedited processing for minor revisions of IFPs	$	Short	AFS-400
2	**2**	Approve TARGETS for electronic transfer	$$	Medium	AFS-400
	3	Direct to QA for STARS developed in TARGETS	$$	Medium	AFS-400/AJW-3
	4	Establish abbreviated STAR amendment process in FAA Orders	$$	Medium	AFS-400/AJW-3/AJR-37
3	**5**	Establish standardized databases with custodianship and data stewards	$$$	Medium	ATO/AVS/ARP
	6	Provide access to, and mandate use of, a single set of data for all IFP providers	$$$	Medium	ATO/AVS
4	**7**	Allow electronic transfer of data	$$$	Medium	ATO/AVS
	8	Standardize software and data formats	$$$	Medium	ATO/AVS
	9	Standardize data precision, resolution, and rounding values	$$$	Medium	AVS
5	**10**	Amend FAAO 1050.1E to provide guidance on focused approach to EAs and use of radar track data for noise analysis	$	Short	AJR-34/AEE/AGC
	11	Issue interim guidance for use of focused approach to EA	$	Short	AJR-34/AEE/AGC
	12	Enhance EA screening tools (more user friendly, efficient, comprehensive)	$	Short	AJR-34/AEE

Issue	Rec Number	Recommendations	Cost	Time	OPR
6	13	Standardize management and environmental specialist training	$	Short	AJR-34/AJR-37/AVS/AEE
	14	Modify FAAO 8260.19 to define responsible federal official for environmental work	$	Short	AJR-34/AJR-37/AVS/AEE
7	15	USIFPP as focal point for criteria changes and new requests	$	Short	AFS
8	16	Standardize SMS process for implementation of IFPs	$$	Short	AJS
	17	Interim guidance for SRM compliance for IFP development and implementation	$$	Short	AJS
9	18	Establish and implement a Web-based request and access portal for IFPs	$$$	Medium	ATO/AVS
	19	Amend FAA Order 8260.19 to define life cycle policy for IFP development	$$$	Medium	AVS
	20	Develop an outreach/communication plan to educate users on use of IFP portal	$$$	Medium	AFS/AJW/AJT/AJE
	21	Establish a Web-based Operations (Ops) Approval portal	$$$	Medium	AFS

Cost Symbols

$ – Internal Level
$$ – Service Director Level/VP
$$$ – Line of Business (LOB)

Timeframes

Short – by 2012
Medium – by2018

The next step in this effort will be developing a plan to implement the recommendations. Successful implementation of the future IFP process will be the result of rigorous planning, supported by the right mixture of skills, resources, and organization. Executive management support in particular will be critical to the success of this project. The implementation plan will describe how the recommendations will be developed, made operational, and transitioned into the IFP process. Thorough planning will ensure that resources and performance expectations are aligned to support the achievement of the plan. Essential elements of the implementation plan will include an overview of the target future IFP process, a brief description of the major tasks involved in the implementation, risks, assumptions, and dependencies, the overall resources needed to support the implementation effort, project organization and management structure, and schedule and performance criteria. As part of the implementation process, a tracking system to measure the effect of these recommendations on the procedure development and implementation timeline and effectiveness will be put in place.

Introduction

As the demand for Instrument Flight Procedures (IFP) has grown over the past decade and in order to meet the needs of the Next Generation (NextGen) Air Transportation System, the Federal Aviation Administration (FAA) has sought opportunities to streamline and optimize current processes. In response to an RTCA NextGen Mid-Term Implementation Task Force Report (TF-5) recommendation to identify and solve operational approval and certification issues that may impede adoption and acceleration of NextGen capabilities, the FAA initiated a cross-agency Navigation Procedures project to streamline all policies and processes used to implement IFPs. This initiative was headed by Aviation Safety (AVS) and the Air Traffic Organization (ATO). Using the "Lean Management Process," the Working Groups reviewed all processes used to request, prioritize, process, improve, and implement IFPs, and provided recommendations to maximize customer value and reduce waste in the development and delivery of all IFPs in the National Airspace System (NAS).

Background

IFPs encompass a diverse range of operations, from traditional Instrument Landing System (ILS) approaches to routes and procedures that are designed to capitalize on enhanced aircraft navigation capabilities, such as Area Navigation (RNAV) Standard Terminal Arrivals (STARs), RNAV Standard Instrument Departures (SIDs), and Required Navigation Performance (RNP) approaches. Routes and procedures based on RNAV or RNP requirements fall under the performance-based navigation (PBN) umbrella, and support the FAA's commitment to adopting a PBN system and its dedication to NextGen.

While the availability of such a wide range of IFPs has supported flight in instrument meteorological conditions (IMC) for users with different operational capabilities, there have been consequences as well. One such consequence is that the variety of IFP types has resulted in a variety of processes to develop and implement those IFPs. The activities required to design an ILS approach have been developed and used for many years, and have been thoroughly tested, are well known, and tend to follow a fairly linear path from conception to implementation. On the other hand, IFPs designed to accommodate aircraft with enhanced navigation capabilities are of a more recent construct, and the processes used to develop those IFPs are still evolving. The variations between the processes and the evolving nature of the PBN IFP development processes have too often resulted in inefficiencies manifesting in unplanned rework, miscommunication, and wasted time.

Lean Management

Methods continue to evolve in the business community for improving quality and production efficiency. Businesses have adopted Total Quality Management (TQM) and ISO standards for management as provided by the International Organization for Standardization. Six Sigma evolved from the manufacturing industry applying statistical methods to measure production defects. If the number of defects being produced follows a mathematical distribution such as a normal or bell curve, then sigma is a measure of the variation of the curve relative to the average, as illustrated in Figure 1.

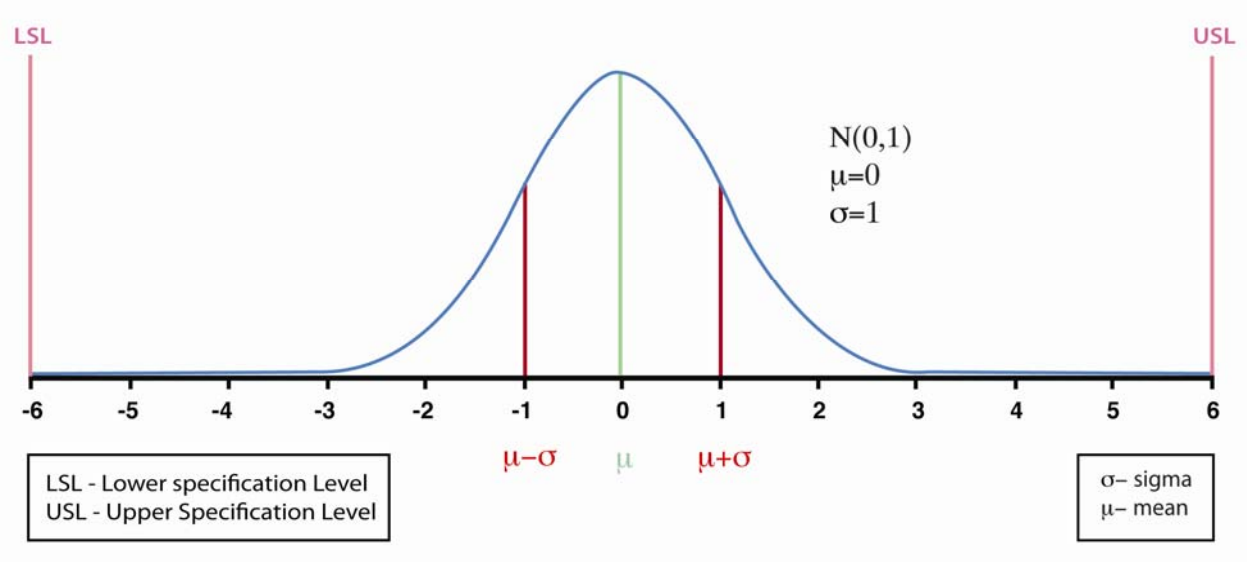


Figure 1. Deviation Chart Example

In the1920s, Walter Shewhart, the father of statistical quality control, showed that three sigma from the mean is the point where a process requires correction. Many measurement standards were developed, but credit for coining the term “Six Sigma” goes to a Motorola engineer named Bill Smith. In the 1980s, Motorola tested the idea of measuring quality in defects per thousands of opportunities, but the data did not provide enough granularity to identify the source of the defects. They proposed measuring defects per million opportunities. Using this new standard, Motorola developed the manufacturing methodology and implemented associated cultural changes to meet this new standard of quality. It’s only within the last ten years that principles of Six Sigma and Lean have been combined into what is today referred to as Lean Six Sigma.

Lean, Lean Thinking, and Lean Management have been around longer than the recorded history of the actual methods but started to become a known entity around 1893. At this time Frederick Winslow Taylor also known as the ‘father of scientific management” and one of the leaders of the efficiency movement began his time and motion studies. In 1913 Henry Ford studied and

adopted efficiency methods at his Highland Park, MI plant. To create flow production, a lean concept, he combined interchangeable parts with standard work.

The thought process of Lean is described in the book *The Machine that Changed the World*, New York: Free Press, 1990, by James P. Womack, Daniel Roos and Daniel T. Jones. The word 'Lean' was coined by James Womack to represent the combination of methods, tools and thinking that combined creates value-added work that benefits the process users and the end customer. Lean is based on a five-step process which identifies Value by mapping the value streams [Value-Stream Mapping] and creates the process Flow so that end users can effectively Pull from the upstream processes. As process Perfection is realized continuous improvement is pursued to repeat the cycle.

W. Edwards Deming's quality work greatly influenced the next generation of Lean Thinkers but today Lean is not just for manufacturing. Lean's applications in Finance, Information Technology, Administration Services and Government sectors are well documented [see Report's reference list for Lean web sites]. Ultimately, Lean is about creating the right process that produces the right results and to continuously focus on making it better.

The underlying motivation for Lean Management is to maximize customer value while minimizing or eliminating waste. There are seven categories of waste typically considered in lean management.

1. Transportation: Moving materials and output unnecessarily.
2. Inventory: Overproduction resulting in too much stock.
3. Motion: Inappropriate siting of teams or equipment.
4. Waiting: Equipment failure, for example, which causes delays.
5. Over processing: Performing unnecessary processing steps.
6. Overproduction: Producing more stock or producing it earlier than needed.
7. Defects: Dealing with rework.

Lean means creating more efficient and cost-effective value for customers while using fewer resources. A lean organization understands what is valuable to the customer and focuses its processes to continuously increase that value. Ultimately, a company or government organization should strive to provide maximum value to its customers through an optimal process that has minimal waste. To make this happen, an organization must shift its focus from optimizing separate technologies, assets, and vertical departments to optimizing the flow of products and services so that they flow horizontally across technologies, assets, and departments to customers (in more vernacular terms, eliminate stovepipes). If an organization can minimize waste it can create a process that requires less human effort, less space, less capital, and less time to produce a product or service.

To find waste in a process, Lean Process uses a Value Stream Map[1] to show the flow of process steps required to complete a product, service, or administrative function from order to delivery. This provides a visualization of the process being analyzed and also identifies the work, people, and communications involved. Furthermore, a Value Stream Map helps reveal areas for improvement or, in Lean terminology, wastes.

The Value Stream Map also allows for the use of simple metrics to determine how much impact waste can have on a process. Waste costs time and money. Furthermore, waste can negatively impact the quality of a product. Metrics used to evaluate how waste impacts a process include touch time (the time it takes to actually perform the work) and delay time (the time when a step is not yet complete, but is not being actively worked). Rework events, which can add major delays to a process, are also identified and measured. By identifying waste in a process, its impact can be measured and improvements can be shown in a Future State Map.

A Future State Map is the result of identifying waste in the Current State Value Stream Map and removing it. The idea is to streamline, improve, and standardize the process so that the process owner can provide a better quality product or service to the customer in less time.

Lean for Regulators[2]

NAV Lean Teams, composed of six Working Groups, were formed to review and make recommendations to improve and streamline the IFP process. The six Working Groups included the following areas of concentration.

- Process
- IFP Design
- Environmental and Airspace
- Database and Coding
- Standards and Criteria/Operational Approval
- Safety Management System (SMS)

The Working Group members were experts pulled from across the agency. The FAA project leads worked with the FAA senior leadership to identify the members and to balance cross-agency participation across the groups. The project leads leveraged agency experience with IFP streamlining through The MITRE Corporation, SAIC, and AMT. Each Working Group had a chairman, approximately ten working members, a NAV Lean facilitator, and a MITRE representative.

---

1 A Value Stream Map (also known as end-to-end system map) takes into account not only the activity of the product, but the management and information systems that support the basic process. This is especially helpful when working to reduce cycle time, because you gain insight into the decision-making flow in addition to the process flow. It is actually a Lean tool. The basic idea is to first map your process, then above it map the information flow that enables the process to occur.

2 The Lean for Regulators Process is contained in FAA Order 1100.1B.

Before the Working Groups met, terms of reference for each Working Group and a standardized format for reporting out their recommendations were drafted based on the NAV Lean Charter issued by AVS and ATO. In order for the Working Groups to produce recommendations that were well defined and actionable, the Working Group chairs were asked to plan for follow-on meetings to be sure the recommendations met this criteria and to report out the group findings. A standard format was used to make it easier to identify duplication and overlap. Integrators were identified who attended all the Working Group meetings held in Glen Burnie, Maryland. These individuals provided the continuity across the groups needed for the final integration.

Beginning in March 2010, each Working Group member attended a 3-day NAV Lean Process workshop to receive interactive training on the Lean Process from FAA-qualified trainers. The final workshop was concluded in May. During the workshops, participants learned to apply Lean Process methods that create and maximize value for the process user, the stakeholders, and the customer. The training focused on identifying areas of low-value activity such as bottlenecks, over processing, delays, overproduction, and excess paperwork, all of which add little or no value to the final quality of the product. By the conclusion of the workshop, each Working Group had charted the current process for its particular area of concentration, and identified areas for improvement. That effort was used as the starting point for the remainder of the group's effort. Each Working Group lead also developed an internal schedule for follow-on meetings to support the overall project schedule and goals.

The Working Groups continued to meet independently through June 2010 to refine their initial reports and to develop a comprehensive set of final recommendations for improving and streamlining the development and delivery of all IFPs. It is important to emphasize that each Working Group reached consensus before submitting their recommendations. Working Group efforts culminated in a 3-day meeting of the Working Group and project leads to consolidate all Working Group recommendations into a single, unified set of recommendations that included estimated costs and timeframes for implementation, and identified an Office of Primary Responsibility (OPR) for each recommendation.

Current IFP Process

The current IFP development and implementation process is actually a bundle of interconnected, overlapping, and sometimes competing processes. No unique description exists for the current process; however, there is a core process for IFP implementation (request, design and development, approval, implementation, and maintenance) along with several other auxiliary processes that intersect with this core process to complete the full life cycle of an IFP. Close examination of the IFP life cycle by the Working Groups revealed variations and contradictions within the policies that provide guidance to personnel engaged in IFP development and implementation leading to a process that is far from optimal, frequently generates rework, and on occasion results in the implementation of low- or no-benefit IFPs.

Core Processes

IFP design, development, and implementation are complex, multifaceted, and multi-organizational activities. As the FAA and industry have transitioned to performance-based procedures including RNAV and RNP navigation technologies, new requirements have emerged on several aspects of IFP activities such as the precision and quality of data, more collaboration and information sharing early in design and development to meet operational objectives, and automation tools to apply criteria, the application of which is no longer feasible by manual calculation.

An IFP requires enough detail to meet the needs of a pilot to navigate from point A to point B safely within the constraints of the airspace and its use. The IFP needs to be viable for air traffic control and operators, meet environmental restrictions, and provide benefits. This information is documented on a published chart. For PBN-capable aircraft, flight procedures must be specified with enough detail to load them into the navigation database. The Flight Management System (FMS) uses the representation of the flight procedure to predict the flight path of the aircraft and then to manage the flight when the aircraft is active. For the FMS to accomplish this, the flight procedures, longitudinal path, and lateral boundaries must be translated into a coding that the FMS planning function understands. This coding includes altitude and speed constraints which further define the planned vertical path for the aircraft. As a result, processes have emerged to address the complexities associated with an IFP in order for it to reach implementation for operational use in the NAS. A challenge for the current IFP process is to bring together all the requirements for implementing a procedure in a timely and efficient manner.

The IFP process begins with a request; however, it is not always clear where within the agency to take that request. Currently, there is no single office or entry point designated to receive all IFP requests. Some requests arrive at the PBN Integration Group for further processing. Some are submitted to a Flight Procedures Office (FPO). Other requests may be delivered to an Air Traffic Control (ATC) facility. There is also an FAA website for IFP requests. This lack of standardization for submitting, tracking, storing, and transferring IFP request information throughout the process results in frequent rework, potential human error, loss of data, and duplication of effort. It also makes the process appear opaque to stakeholders who often do not clearly understand their role in the IFP process which leads to further delays, complaints, and rework.

A request for an IFP can originate with the PBN Integration Group, an FAA field facility, airports, industry, or Congress. For example, Congress may direct implementing RNAV arrivals or departures at a specific airport to meet a specific need. An airport may require a new or revised procedure to address infrastructure changes, new runways, or equipment outages. An ATC facility may request a procedure to address efficiency needs or improve controller workload. An airline request could be driven by changes in their equipment, airport access, increased predictability, and reduced operating costs.

Procedure requests from each type of requestor enter the life cycle at different levels of maturity. Low-maturity requests may consist of little other than a very rudimentary description of the desired IFP. More complete requests might include some information concerning the proposed

IFP longitudinal and vertical paths, operational constraints, anticipated benefits, environmental considerations, and ongoing or completed coordination efforts. Historically, most IFP requests have entered into the system at a relatively low maturity state. An example of a high-maturity request that should move through the process quickly is a minor amendment to an existing IFP. Although expedited processing of minor changes would seem logical, there is no standardized fast track for these cases; therefore, even minor amendments may be subject to the same design and development life cycle as are new IFPs.

The beginning of the design and development stage of the life cycle is characterized by pre-work. In this pre-work state, concepts, operational goals, anticipated benefits, and environmental and safety considerations should be refined. However, at least partly due to the lack of a standardized process for submitting and for initial processing of IFP requests, too often much of the pre-work does not take place in a timely manner. This frequently results in rework, lost time, and failure to maximize potential benefits. Another challenge is that procedure design and development does not mean the same thing to all FAA and industry participants during the life cycle.

For the National Aeronautical Navigation Services Group (AeroNav Services), procedure development means that a procedure gets entered into their production cycle as represented by the National Airspace and Procedures Team (NAPT) list. The NAPT list represents a national prioritization of the production capacity of AeroNav Services for the implementation of public procedures. In the current process, IFPs on the NAPT list include arrival, departure, and approach procedures; en route procedures such as Q-Routes and T-Routes are also included. The NAPT list is updated twice monthly based on input from the Regional Airspace and Procedures Teams (RAPT). There are five RAPTs covering the NAS; each RAPT collects the procedure requests for the associated region and is chaired by the FPO for that region. The FPO coordinates the procedure demand with the National Flight Procedures Group (NFPG) located in Oklahoma City. Each region is allocated a nominal number of slots for each production cycle. Given the variation in demand across the NAS, the NPFG/NAPT negotiate among the different regions to reallocate slots for a given production cycle to meet demand and national priority.

The AeroNav Services production cycle for procedure development includes design, quality assurance, flight check, charting, publication, and maintenance. For the PBN Integration Group, which is responsible for supporting the implementation of PBN procedures in the NAS, procedure development means following the Five Phase process.[3] This process focuses a fair amount of energy on validating operational viability, issue mitigation, capturing a baseline of operations for benefits assessment, and application of upfront screening of flyability (including assessment in airline simulators), criteria, noise, and other constraint checks to aid with alternative assessment and to reduce rework in order to produce a high-quality design that will flow smoothly through the AeroNav Services production cycle and the environmental and SMS

[3] The Five Phase process provides a standardized process for developing and implementing performance-based navigation (PBN) routes and procedures, including Area Navigation (RNAV) and Required Navigation Performance (RNP) instrument approaches, departure procedures, arrival procedures, and routes. It is a refinement of the Guidelines for Implementing Terminal RNAV Procedures, and its use will be formalized in a new FAA order in the near future.

processes. The PBN Integration Group also performs a post-implementation analysis to assess whether the operational objectives were met and to identify lessons learned for incorporation into future PBN projects.

On the other hand, larger scale redesign projects are often characterized by their broader scope and complexity; they may consider multiple airports such as in the New York or Washington, DC areas, or a major airport such as Dallas-Fort Worth or Chicago O'Hare with one or more significant satellite airports. Airspace redesign examines the flows and their interdependencies in and out of major airports and the adjoining airspace which results in changes to sectors. Airspace design follows a process as outlined in the Airspace Handbook. Airspace design defines the sector structures needed to support en route structures such as jet routes, Q-routes, T-routes, and National Reference System (NRS) grid points, as well as terminal procedures that connect with the en route. In many cases, optimization of the procedures and route infrastructure does not require changing airspace constructs.

The airspace design process starts with problem identification, moves to alternatives assessment and selection, environmental assessment, and then to implementation. Implementation for airspace can touch on many things but also includes terminal flight procedures. These flight procedures eventually migrate to the NAPT list and become part of the AeroNav Services production cycle. If they are PBN procedures, they also intersect with the PBN Integration Group Five Phase process. Depending on the type of airspace changes and the level of environmental study required, the time from handoff of the airspace procedure designs to either the PBN Integration Group or AeroNav Services can range from less than a year to several years. Given the broader scopes of the Five Phase and Airspace Process (which are being integrated to support the demands of Metroplex airspace and procedures changes required for NextGen), procedures under development in these processes are not yet entered into the AeroNav Services production portal. Project management, status, and workflow information is not readily available. Procedure proponents and stakeholders find it confusing to navigate through and among these processes.

Ideas for advancing the state of the art provide another example of why procedures are developed. These ideas are brought forward by the PBN Integration Group and collaboratively through groups such as the Performance-Based Operations Aviation Rulemaking Committee (PARC), lead operator-airport partnerships, and NextGen demonstrations. Examples of each are RNP to ILS which is being actively worked by the PBN Integration Group and PARC, RNAV Visual Approaches with Radius-to-Fix (RF) legs[4] to the final approach segment advocated by the PBN Integration Group, Delta and Atlanta Terminal Radar Approach Control Facilities (TRACON), Seattle Greener Skies advocated by the PBN Integration Group, Boeing, Alaska Airlines, and Seattle TRACON, and Tailored Arrivals and 3D Path Arrival Management (PAM) sponsored by the NextGen and Operations Planning Service in the ATO.

All of these projects, as they mature, will translate into new procedures for incorporation into the NAS. During concept development, test or special procedures may be introduced as a stepping stone to identify operational issues, collect data, and clarify how to integrate new IFPs into

[4] This effort leverages the work done a few years ago pioneered by Continental Airlines using RNAV Visual Approach at Newark Liberty International Airport (EWR).

general NAS operations. Procedure development as described here is not a candidate for production development and does not fit well into the Five Phase process or the Airspace Design Process because these procedures are not ready for operational use. Special procedures, because they are not available for public use, are handled in a different manner. Since they often pose a challenge for Air Traffic, use of specials is limited. More of the life cycle costs of a special procedure are shouldered by the proponent which is most often an airline. All of the discussion so far has focused on domestic procedures. International procedures flown by U.S. carriers undergo yet a different process from domestic public and special procedures.

Auxiliary Processes

Other significant processes that intersect with the procedure development processes, but which are not as well integrated as they might be if the IFP process was better standardized, include SMS, Operations Approval and Certification, Environmental, and Criteria Development.

Safety Management System

SMS manifests itself differently for each of the IFP processes. For the AeroNav Services production development, SMS is addressed through an ISO 9000-compliant production process, workflow, automation improvements, and data management. The production process is monitored for defect control and workflow. For air traffic developed procedures, a Safety Risk Management Document (SRMD) is required for every new or amended IFP. That requirement has extended the time required to implement new IFPs, especially PBN-based IFPs.

Operations Approval and Certification

Operations Approval and Certification enters the picture as a fundamental requirement for operational use of a procedure. All IFPs require operational approval of airline equipment to fly the procedure. The operational approval consists of equipment, flight crew, process, and documentation certifications to ensure the operator is qualified to use the respective procedure. FAA Order 8900.1, Flight Standards Information Management System, Vol. 2, Air Operator, Air Agency Certification explains the five-step process for certification approval in great detail. Also embedded in the document is the reference to other guidance for the specific certifications. For example, the respective equipment, flight crew training, and other certification requirements are listed in the guidance material for the specific certification. An example of the additional guidance is AC 90-105 for RNP operations. Order 8900.1 also points to some flexibility that allows the local FAA inspector to streamline and approve some applications depending on the complexity of the certification. However, there are numerous duplications and required actions throughout the guidance that could be candidates for streamlining. For example, the 2009 RTCA TF-5 Report pointed to five areas of concern that identified improvements which could ease the approval process. Actual approval experiences were provided in which practical alternatives would alleviate effort for both the regulator and the applicant. In their discussion of the five concerns, TF-5 also noted that “The current processes appeared to pose a significant risk for implementation of NextGen capabilities entering the National Airspace System. If not rectified,

these concerns/issues could have far reaching implications as the FAA and industry attempt to accelerate NextGen implementation."

Environmental

The National Environmental Policy Act (NEPA) requires FAA to consider the potential environmental consequences of its proposed federal actions, such as implementation of IFPs. NEPA mandates a level of analysis and public disclosure of projected environmental impacts commensurate with their level of significance. FAA must complete the analysis and disclosure before the decision to implement the action.

Actions that the FAA has found, based on past experience with similar actions, do not individually or cumulatively have a significant effect on the human environment and for which there are no extraordinary circumstances are candidates for a categorical exclusion (CATEX) from further environmental impact analysis. For proposed IFPs that are overlays of existing procedures, or that would relocate the route of flight or altitude of aircraft that are above 3,000 feet above ground level (AGL), or that would not route aircraft over noise-sensitive areas, a CATEX typically applies.

Actions that do not qualify for a CATEX require an environmental assessment (EA) to determine if the action could produce significant environmental impacts. If the EA finds that there would be a significant impact, the FAA must prepare an environmental impact statement (EIS) before implementation of the action. NextGen IFPs that maximize benefits will likely fall into the EA, or possibly the EIS category.

Historically, a large number of IFPs have qualified for a CATEX; however, it is anticipated that in the future, NextGen activities including new RNP GPS approaches and departures will not qualify because of their unique routings and tracks. This has the potential to significantly increase the need for EAs and EISs for new IFPs. Additionally, in some instances a noise screening analysis may be required for those CATEX situations mentioned above to determine if extraordinary circumstances exist that would preclude the use of a CATEX. Consequently, if environmental reviews are not adequately integrated into the IFP planning process, delays may be experienced.

Criteria Development

Flight procedure criteria, developed and published by the Flight Procedure Standards Branch in Oklahoma City, provides the rules for safely constructing the nominal longitudinal and vertical path for departure, en route, arrival, approach, missed approach, and holding procedures. For terminal procedures used close to the airport (departure, arrival, approach, and missed approach), obstacle clearance surfaces are associated with a procedure and used to ensure that an aircraft flying the procedure will not encounter any obstacles. Aircraft performance and navigation infrastructure influence the detailed geometric shapes of the obstacle evaluation surfaces. When criteria are developed, not all possible combinations of the rules or operational applications can be considered. Clarification may be required or an unforeseen case may need to be addressed. When this situation arises, the authors of the criteria are brought into the loop to provide the clarification or fill the gap. When Air Traffic is exploring new operational concepts, new

procedures and airspace structures may be required. As new technology becomes available for communication, navigation, and surveillance in the various airborne and ground systems, new flight procedure criteria is also needed to support the design of future procedures. Collecting the requirements for new criteria and accurately understanding FAA/industry priorities are difficult. Priorities are often driven by triggers such as changes in the NAS, program office initiatives, changes in technical data which affect aircraft performance, or reaction to industry concerns/requests. These myriad proposed changes currently do not receive impartial consideration or proper vetting to see where they lie with respect to competing agency objectives and priorities caused by the lack of a clearinghouse to vet these issues. Furthermore, Implementation and Impact (I&I) concerns are not addressed in the planning stages of criteria development to determine whether appropriate resources exist to implement the change or whether there will be an impact (positive or negative) to existing NAS operations.

Data and Tools

A large variety of data are required for the design, development, and implementation of an IFP, and the data is entered into and manipulated by a number of tools. Much of the data used in the procedure development process is of a geospatial nature, such as specific locations and area depictions, while other data is more textual in nature (e.g., waypoint names). The list of data is extensive and varies with the process. For the AeroNav Services production process, the data includes navigation-related data such as Navigational Aids (NAVAIDS) and fixes that include names, coordinates, and whether they are used for more than one procedure type; airport data such as runway ends; sectional charts; man-made obstacles (permanent and temporary); terrain; altitude and speed constraints; and ARINC 424 coding. For the Five Phase and Airspace processes, additional data is required, including historical track data; environmental constraints; distance measuring equipment (DME)/DME coverage; radio coverage; airspace boundaries; and structures.

The data originates from a variety of sources including federal, state, local, and contracted organizations. Much of the data that is collected is consolidated into data repositories, such as the National Airspace System Resource (NASR), and is updated on predefined cycles, though some data remains resident and accessible through the originating organization and may or may not be updated on a periodic basis. Table 2 provides a summary of the primary data sources. The table also brings up questions about duplication of data, whether different data sources could be combined and whether there is adequate data stewardship.

Table 2. Data Sources

Organization	Database/Data File	Content	Obtained From
AeroNav Services/FAA	Digital Obstacle File (DOF)	Source of U.S. manmade obstacles	Download from AeroNav
AeroNav Services/FAA	AirNav	Developmental NAVAID data	Download from AeroNav
AeroNav Services/FAA	IFP	Operational navigation data, SIAP (Standard Instrument Approach Procedures), etc.	Integrated with applications (IPDS and TARGETS)
AeroNav Services/FAA	AVNIS	Operational navigation data	Website query, also integrated with applications (TARGETS)
NFDC/FAA	NASR	Operational navigation data	Subscription-based download, or via integrated applications (TARGETS)
AeroNav Services	NFD	ARINC 424 database of procedures	Subscription-based download, or via integrated applications (TARGETS)
NGA/DOD	DTED	Digital terrain	Download via NGA website
NASA	Shuttle Radar Topography Mission (SRTM)	Digital terrain	Download via NASA website
NGA/DOD	Digital Vertical Obstruction File (DVOF)	Source of domestic and international obstacle data	Not publicly available
NGA/DOD	Digital Aeronautical Flight Information File (DAFIF)	Domestic and international NAVAIDS and fixes	Not publicly available
NACO/FAA	Video maps, MVA charts, sectional charts	Airspace data and spot elevations	ASCII text file downloads available
Airports	Airports GIS (AGIS)	Airport and aeronautical data	AGIS website, apply for access. Capability is under development.
ATO AIM	OE/ AAA	Temporary manmade obstacles such as cell towers and cranes	OE /AAA website query, download spreadsheet files

Organization	Database/Data File	Content	Obtained From
Jeppesen/Lido/EAG	Navigation databases tailored for each FMS per airline	Procedure data	Commercially available data
Aeronautical Information Management (AIM)/FAA	ATX offload	Radar track data	Web query and track data download
NASA/ATAC	PDARS	Radar track data and runway assignment	Commercial software, contact info
AT Facilities/FAA	Standard Operating Procedures/Letters of Agreement	Delivery rates and Miles-in-Trail (MIT) restrictions	FAA site, requires login, MITRE Text Mining (RED)

Given that procedure development happens over an extended period of time, data refresh poses some challenges. For example, a new survey may have been completed for a NAVAID or an update made to a fix location. This updated information is not immediately available for use. First, it must get accepted and entered into the NASR database by NFDC. For example, a procedure that is going through the AeroNav Services production cycle may require a new fix to be added. This new fix information is entered into the development database and updated as needed during the different production phases. The operational database does not know about this new fix until it is provided to NFDC for publication in NASR. If this is revised fix location data, then all procedures that use this fix must be identified and updated to use the new information.

On a daily basis, the operational NASR database and the System Standards Integrated Services (AVNIS) developmental database are synchronized in the following manner: any operational updated data in NASR is passed to AVNIS; any developmental data that is ready to become operational is passed to NASR. NASR does not contain any obstacle data, so there is no synchronization of obstacle data. However, because AeroNav Services does procedure development for the Army and collaborates extensively with the Air Force, the AVNIS development obstacle data is synchronized with the Digital Obstacle File (DOF) data provided by the National Geospatial Intelligence Agency (NGA). Other procedure data such as NAVAIDs and fixes are also synchronized with the DAFIF. Information concerning the data itself (metadata) is often lacking, leaving no means of verifying the originator, accuracy, or currency of the information. This can lead to the unintentional use of inaccurate or inappropriate data.

Other data stewards for obstacle data are Airports (ARP) and the Aeronautical Information Management Obstruction Evaluation and Airport Airspace Analysis (AIM OE/AAA). The Office of Airports is in the process of populating the Airports Geographical Information System (GIS) which includes obstacles near the airport and airport data such as runway ends and elevation. The airport data is made available to NASR and AVNIS for operational use and for procedure development.

Obstacle surveys are conducted by airlines, AeroNav Services, airports, and FAA field facilities to reduce the vertical and horizontal uncertainty when it has a negative impact on key aspects of a procedure such as the decision altitude and missed approach path. This data is shared among the many procedure stakeholders. The precision and accuracy of the data is not uniform among the data consumers. This poses a challenge when new surveys are conducted to create awareness in the community and provide a means for collecting data with enough accuracy to meet the needs of all stakeholders.

Automated tools are an essential component in processing and managing data used in the design, development, and implementation of procedures. Unfortunately, most of the tools in use today were developed at different times, by different organizations, for unique purposes, and with little thought of interoperability with other tools. The result is a series of independent tools that cannot communicate electronically, so that data generated by one tool must be manually entered into subsequent systems, introducing significant opportunity for error. This manual rekeying of data occurs throughout the process.

Policy and Training

Individual and organizational roles and responsibilities associated with IFP development are outlined in a number of national and regional orders, policy documents, memoranda, guidelines, and checklists. These guidance materials are intended to reflect standardized process, written in a way so as to be clear, complete, and consistent. However, there are instances where the material is ambiguous, open to interpretation, or contradictory.

All participants in the IFP life cycle require some training and knowledge of various policies, tools, and data; however, the knowledge and experience levels of persons developing IFPs vary, particularly among PBN Working Group members. There is a core knowledge base that is routinely leveraged for IFP development. However, PBN Working Group members beyond this core group are frequently taken from their normal duties and asked to perform activities for which they have little or no practical experience and only minimal, ad hoc training. Those who are trained are not always provided with refresher training and long periods often pass before original training knowledge is applied. This lack of current or refresher training can lead to tasks being performed inefficiently or incorrectly, which may result in errors being found late in the process or missed altogether. Even though many participants are thoroughly trained and expert within their particular niches, they do not possess an understanding of other aspects of the IFP life cycle. Likewise, industry participants may have little or no training and little opportunity to gain insight into the IFP development process.

Summary

It must first be acknowledged that the current system, with all of its flaws and weaknesses, still produces safe IFPs. The issues are with efficiency and in achieving optimal results. The current IFP development life cycle is characterized by a multiplicity of components and processes which have often evolved independently to meet requirements that may or may not be related to IFPs. Those processes are then executed by numerous personnel with varied backgrounds, training, and expertise. The guidance that exists is somewhat fragmented and sometimes incomplete.

The complexity of attempting to diagram the current process was aptly demonstrated by the efforts of the six Working Groups. Each group was tasked with developing a Value Stream Map describing the current process, and each group came up with a Value Stream Map that was distinctly different from the other groups' maps in numerous and significant ways. However, there were also enough commonalities to allow the identification of certain overarching issues with the current process. The groups all agreed to varying degrees that the following characteristics of the current process have a negative effect on the efficiency of the process and may also make achieving optimal results harder than necessary.

- Having requests entering the system through multiple portals results in inconsistent processing. Often concepts, operational goals, anticipated benefits, and environmental and safety considerations do not receive the attention they should at this point, which later translates into rework and duplication of effort. Sometimes issues with IFPs that should have been identified early in the process are not discovered until they are ready to be, or have already been, implemented.
- There are inconsistencies in the interpretation of guidance. This inconsistency is sometimes the result of unclear, contradictory, or incomplete guidance. In other cases, it may result from a lack of initial and refresher training.
- The lack of an expedited process for "minor" revisions to existing IFPs wastes a significant amount of time and resources.
- Multiple data sources for the same data elements may result in data inconsistencies, limited availability to some users, and rework of IFPs in development.
- Incompatibility between tools which prevents the electronic transfer of data extends the time required to process IFPs and provides numerous opportunities for human error as data is repeatedly keyed manually into various systems throughout the process.

Figure 2 is a composite of the Working Groups' Value Stream Maps and illustrates the current process at a high level. A revised diagram illustrating the future or target IFP process is included in the next section.

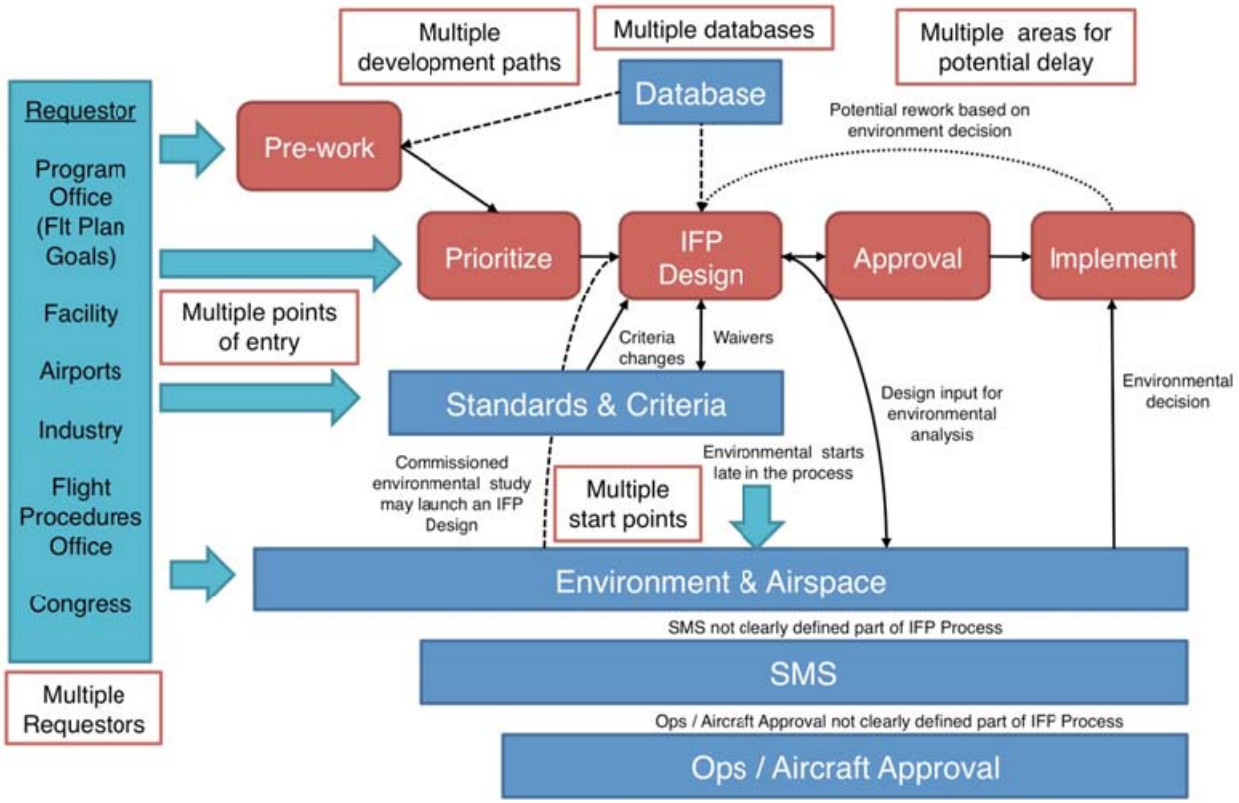


Figure 2. Current IFP Process

Future IFP Process

Creating the most effective and efficient process to complete a complex series of activities, such as those required to implement a new IFP, requires standardization, clearly articulated goals and milestones, and confidence that all participants are following the same set of rules.

In the future process the entire IFP life cycle will be documented in FAA Order 8260.19 to address all aspects of the IFP process in a single location. The IFP life cycle, as described in the order, will include a streamlined version of the current core process for IFP implementation (request, design and development, approval, implementation, and maintenance) and will also explain the intersection of auxiliary processes, such as SMS, environmental, and operational approval. The process will be better managed by having all IFP requests submitted through an authorized Web-based portal established as the entry point into a system for processing, tracking, and managing the IFP development life cycle. Access to the system will be controlled, but available to all interested users. Standards for the minimum information required to initiate an IFP request will be established.

The system will allow participants in the process to obtain up-to-date information concerning an IFP's status, exchange information with other system users, and will provide an archive function and audit trail. This system will also serve as a gateway to databases required for IFP design and development, applicable publications, and forms and templates. Use of this system will facilitate early screening of requests to ensure completeness and prioritization of requests, and will provide transparency for users. It will also promote and ensure that safety, airspace, operational approval, and environmental aspects are all considered early in the process. Use of this common portal will also facilitate the early recognition of potential requirements for new or modified criteria. Figure 3 illustrates the future process.

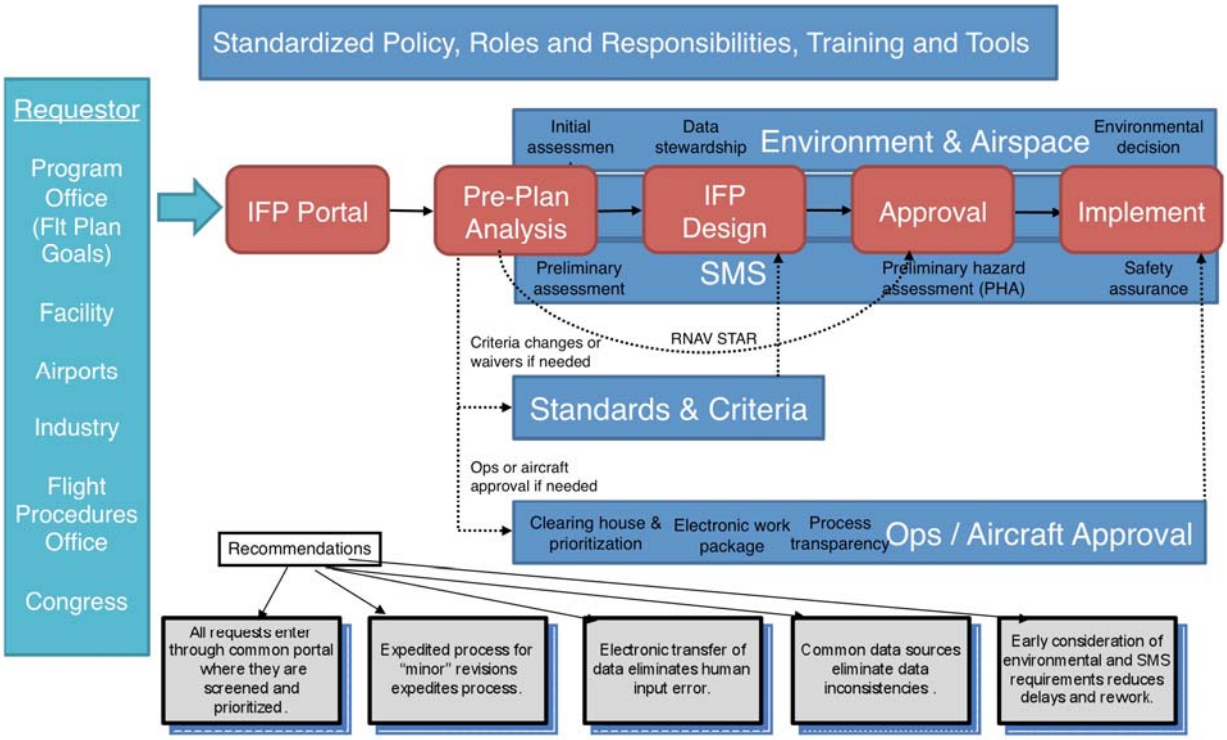


Figure 3. Future IFP Process

The future process will be flexible. It will be designed with a "fast track" path for minor amendments to existing IFPs and will also accommodate the movement of ATC-designed STARs directly to Quality Assurance, thereby eliminating much of the duplication of effort found in the current process.

Auxiliary processes, such as SMS, operational approval, environmental, and criteria development, will be modified to reduce the amount of time they add to the IFP process, but only to the extent that the modifications do not lessen their ability to achieve their primary responsibilities. The role of the United States Instrument Flight Procedures Panel (USIFPP), representing multiple FAA lines of business and external stakeholders, will be strengthened to improve coordination between parties responsible for criteria development and implementation. This will help to ensure that new criteria and operational approval guidance are developed and implemented in a structured process that reduces rework, and ensures compatibility between criteria effective dates and actual implementation dates.

Current process problems arising from multiple databases for the same data elements and the existence of inconsistent accuracy or precision values will be resolved. Databases housing the same type of data will be consolidated to ensure all parties are using the same and most current data. Mathematical precision and resolution standards, and rounding values for data used in IFP design, will be examined for completeness and accuracy. Software and data formats will also be standardized to allow auto population/extraction of data to produce, populate, and edit documents. The proper data steward for each data source will be clearly identified.

Opportunities for human error and time invested in the manual transfer of data between systems used in IFP development will also be significantly reduced or eliminated. Protocols and interfaces to allow tools to electronically exchange data will be developed and fielded. All process users, both internal and external to the FAA will be provided with ample notification and training, as needed, to ensure that they are adequately prepared to use the future IFP process.

Implementation of the future IFP process is expected to significantly reduce the average time required to implement IFPs and will enhance the operational adaptation of NextGen. Achieving this optimal future process and all of its benefits will require implementing all of the recommendations proposed in this report. However, incremental benefits may be realized as elements of the future process are implemented. A total of nine issues and 21 recommendations were developed by the NAV Lean Process Working Groups and were submitted to the project sponsors for approval. They are described in Appendix A.

Summary and Next Steps

The FAA has long sought to provide the best service possible to users, including implementing safe, efficient IFPs in the shortest time possible. As the number of PBN IFPs has increased, the need to streamline and improve the IFP process has taken on additional urgency. In response to that need, the FAA has undertaken a number of initiatives and has made some significant achievements. During 2003, AeroNav Services assessed their internal production processes and workflow. Out of this effort they reengineered their production system and identified automation requirements. In response to a 2004 RTCA suggestion that the FAA was not able to implement new IFPs fast enough to support a full transition to RNAV, the agency conducted an analysis that resulted in 12 recommendations designed to increase production capacity and reduce production time.

In its continuing quest to achieve the optimal IFP process, and in direct response to TF-5 recommendations, the FAA undertook the NAV Procedures project and has made a significant commitment of resources to ensure its success. By project completion, more than 100 people had devoted over 5,000 hours to analyzing the problem and developing the recommendations to streamline all IFP processes. An illustration of the Working Group organization and membership may be found in Appendix C.

As noted previously, over a 3-month period each Working Group met individually and each developed a set of recommendations for reducing waste in the IFP process. The Working Group leads subsequently met with the project leads in Washington, DC to refine the recommendations, eliminate duplications, and add explanatory material as needed. At the conclusion of that 3-day meeting, by combining similar recommendations and eliminating duplicates, the team had developed a spreadsheet containing 48 recommendations. Those 48 recommendations were further refined during follow-on meetings and telecons and distilled to the 21 recommendations, grouped under nine issues, included in this report. The recommendations touch on all of the major aspects of the IFP process, including policy, tools, data, and training. Assuming a full EIS is not required, it is estimated the full implementation of these recommendations will reduce the time currently required to implement a new IFP by more than 40 percent. Publication of this report will mark the end of this stage of the project: analysis and recommendations. Next steps will include developing an implementation plan, implementing the recommendations, monitoring post-implementation results, and maintenance.

Successful implementation of the future IFP process will be the result of rigorous planning, supported by the right mixture of skills, resources, and organization. Executive management support in particular will be critical to the success of this project. The implementation plan will describe how the recommendations will be initiated, made operational, and transitioned into the IFP process. Thorough planning will ensure that resources and performance expectations are aligned to support the achievement of the plan. Essential elements of the implementation plan will include an overview of the target future IFP process, a brief description of the major tasks involved in the implementation, risks, assumptions, and dependencies. It will also include the overall resources needed to support the implementation effort, project organization and management structure, schedule, and performance criteria. Additionally, a performance tracking

system to measure the effect of implementation on procedure development timelines and effectiveness will be necessary.

The major project tasks will evolve directly from the recommendations included in this paper and will have to be transitioned to measurable and tangible deliverables. Every deliverable will have a schedule and milestones, costs and budget, project priority, and a responsible manager supported by executive-level management.

The implementation plan will describe the project organization, management structure, areas of responsibility, and OPRs, and will identify resources to execute the plan. The plan will assign authority and accountability while defining performance expectations (i.e., who is going to manage the various deliverables, what they are responsible for, and to whom they report).

A systematic consideration of the practical aspects of the implementation will identify and consider risks, underlying assumptions, and dependencies at each stage of the project. All identified risks will require developing mitigations and/or alternate strategies. Resources include hardware, software, facilities, materials, funding, and personnel. They must be estimated and budgeted for early in the planning.

The project schedule should define and include the following:

- Project phases
- Deliverables associated with each phase
- Major activities for each deliverable
- Key milestones
- Dependencies

Reference List

RTCA, September 2009, *NextGen Mid-Term Implementation Task Force Rep*ort, Washington, D.C.

FAA, January 2010, *FAA Response to Recommendations of the RTCA NextGen Mid-Term Implementation Task Force*, Washington, D.C.

Lean Enterprise Institute. http://www.lean.org/

Lean Transformations Group. http://www.lean-transform.com/

FAA, August 2004, "Meeting Flight Plan Commitment: Implementing a Performance-based NAS, Recommendations for Streamlining Procedures," (briefing), Washington, D.C.

FAA, August 2010, "Navigation (NAV) Procedures Project NAV Lean Team Draft Recommendations," presented to: NAV Lean Project Leads," (briefing), Washington, D.C.

FAA, August 2010, "Navigation (NAV) Procedures Project NAV Lean Team Draft Recommendations," presented to: NAV Lean Steering Committee, (briefing), Washington, D.C.

FAA, August 2010, "Navigation (NAV) Procedures Project NAV Lean Team Draft Recommendations," presented to: NextGen Management Board, (briefing), Washington, D.C.

FAA, August 2006, *Air Traffic Safety Oversight*, Order 1100.161, Washington, D.C.

Womack, James P., Roos, Daniel, and Jones, Daniel T., 1990, *The Machine that Changed the World*, New York: Free Press

FAA, July 2009, *Flight Standards Service Organizational Handbook*, Order 1100.1, Washington, D.C.

Appendix A Issues and Recommendations

This appendix includes the final nine issues, 21 recommendations, and OPRs that were developed from the Working Groups' efforts. The issues are described along with some of the potential implementation considerations for each of the recommendations. Table 3 lists the 21 recommendations.

Table 3. Working Group Recommendations

Issue	Rec Number	Recommendations	Cost	Time	OPR
1	**1**	Expedited processing for minor revisions of IFPs	$	Short	AFS-400
2	**2**	Approve TARGETS for electronic transfer	$$	Medium	AFS-400
	3	Direct to QA for STARS developed in TARGETS	$$	Medium	AFS-400/AJW-3
	4	Establish abbreviated STAR amendment process in FAA Orders	$$	Medium	AFS-400/AJW-3/AJR-37
3	**5**	Establish standardized databases with custodianship and data stewards	$$$	Medium	ATO/AVS/ARP
	6	Provide access to, and mandate use of, a single set of data for all IFP providers	$$$	Medium	ATO/AVS
4	**7**	Allow electronic transfer of data	$$$	Medium	ATO/AVS
	8	Standardize software and data formats	$$$	Medium	ATO/AVS
	9	Standardize data precision, resolution, and rounding values	$$$	Medium	AVS
5	**10**	Amend FAAO 1050.1E to provide guidance on focused approach to EAs and use of radar track data for noise analysis	$	Short	AJR-34/AEE/AGC
	11	Issue interim guidance for use of focused approach to EA	$	Short	AJR-34/AEE/AGC
	12	Enhance EA screening tools (more user friendly, efficient, comprehensive)	$	Short	AJR-34/AEE

Issue	Rec Number	Recommendations	Cost	Time	OPR
6	**13**	Standardize management and environmental specialist training	$	Short	AJR-34/AJR-37/AVS/AEE
	14	Modify FAAO 8260.19 to define responsible federal official for environmental work	$	Short	AJR-34/AJR-37/AVS/AEE
7	**15**	USIFPP as focal point for criteria changes and new requests	$	Short	AFS
8	**16**	Standardize SMS process for implementation of IFPs	$$	Short	AJS
	17	Interim guidance for SRM compliance for IFP development and implementation	$$	Short	AJS
9	**18**	Establish and implement a Web-based request and access portal for IFPs	$$$	Medium	ATO/AVS
	19	Amend FAA Order 8260.19 to define life cycle policy for IFP development	$$$	Medium	AVS
	20	Develop an outreach/communication plan to educate users on use of IFP portal	$$$	Medium	AFS/AJW/AJT/AJE
	21	Establish a Web-based Operations (Ops) Approval portal	$$$	Medium	AFS

Cost Symbols

$ – Internal Level
$$ – Service Director Level/VP
$$$ – Line of Business (LOB)

Timeframes

Short – by 2012
Medium – by2018

Issue 1: Minor amendments of IFPs result in added workload and delayed implementation.

Requests for minor revisions to IFPs are required to follow the same process as requests for new procedures or major revisions to existing procedures. This results in delays to publication of minor revisions that may provide significant benefit. For example, if ATC requests a change to make a crossing altitude higher by 1,000 feet or to remove a speed restriction, instead of doing a quick assessment and a chart modification, the procedure is sent back through the entire process as if it were a new procedure. A change to the process to allow minor modifications to "fast track" will allow the procedures to be modified much sooner.

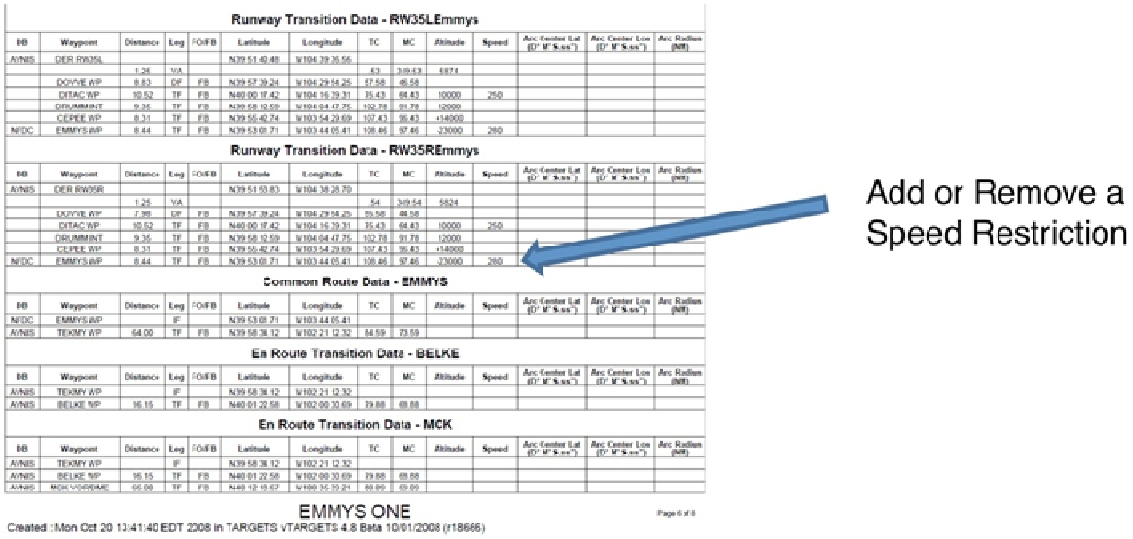


Figure 4. Route Data

Recommendation:

1. Identify conditions and amend Policy (FAA Orders 8260.19 and 8260.43) to allow expedited processing and clear definition of minor revisions to IFPs.

Implementing this recommendation will require a precise definition of "minor" revisions, designation of authority to designate revisions as minor, and a clear description of how such revisions are to be processed. There may be differences in which of the life cycle steps may be omitted for different minor revisions. For example, in the speed restriction change mentioned above it might be determined that only a tabletop examination of the change is needed before proceeding to charting, or a new flight inspection may be justified.

OPR: AFS-400

Issue 2: The Terminal Area Route Generation, Evaluation, and Traffic Simulation (TARGETS) automation (used to design RNAV STARs) is not an approved AeroNav Services tool and cannot be used to electronically communicate with AeroNav Services software, leading to manual rework of STARs by AeroNav Services.

Currently, Air Traffic is responsible for the development of all STARs covered under FAA Order 7100.9D and TARGETS is the primary tool used by Air Traffic for the STAR development. Once a STAR is developed from an Air Traffic perspective, it is passed to AeroNav Services (AJW) for development and implementation. There are several issues with this process. First, TARGETS is not an approved IFP design tool; therefore, AeroNav Services repeats the design of the procedure using their own tools. This is significant rework as STARs developed in TARGETS are mature when they are sent to AeroNav Services.

Second, TARGETS data cannot be directly imported into the AeroNav Services production system. AeroNav Services has a centralized database that all applications related to procedure production interface. Currently, the data for STARs are provided to AeroNav Services in a procedure package that contains the procedure data on the appropriate forms in a PDF file. A PDF file cannot be edited outside of TARGETS. AeroNav Services receives the PDF files and manually enters the data into its system. Even if TARGETS were approved, the issue of manual transfer of data necessitating rekeying of information into each subsequent system would remain. TARGETS would need to be modified so that it could electronically interface with AeroNav Services' database used for procedure production.

Recommendations:

2. Approve TARGETS-developed STAR output for electronic transfer of data to the AeroNav Services procedure production database.

OPR: AFS-400

3. Implement a "Direct to Quality Assurance" process for STARS when developed in TARGETS.

Once TARGETS is approved as an IFP design tool, STARs produced by TARGETS would be ready for AeroNav Services Quality Assurance (QA). QA would consist of verifying that the correct data sources were used and, if necessary, a flight inspection. There would be no need for AeroNav Services to rework the design calculations. This could be accomplished prior to, or in conjunction with, the development of an interface to allow TARGETS data to be electronically imported into the AeroNav Services system.

OPR: AJW-3/AFS-400

4. Establish process within FAA Orders 8260.19 and 7100.9 to allow abbreviated amendments for STARs.

This recommendation is similar to recommendation #1 to allow expedited processing and clear definition of minor revisions to IFPs. As STARs are historically an Air Traffic responsibility, this recommendation may be expedited and implemented alone.

OPR: AFS-400/AJW-3/AJR-37

Issue 3: Databases used in IFP design are not standardized and are not available to all service providers.

There are multiple databases containing the same data elements. Data for the same infrastructure is collected redundantly for multiple projects and input into multiple databases. This leads to different users accessing the same data elements from multiple sources. For example, obstruction data is available from AVNIS, DOF, DVOF, the National Geodetic Survey's Universal Data Delivery Format (UDDF), and the Federal Communication Commission's Antenna Structure Registration (ASR) program. These data sources are managed and maintained by different government agencies with different fundamental missions, data standards, and update cycles. Not all of these databases are available to all IFP service providers. For example, third party providers may not have access to the AVNIS, DVOF, or DAFIF databases, which are not publically available.

Recommendations:

5. Establish a standardized set of databases with custodianship and data stewards to maintain data integrity.

OPR: ATO/AVS/ARP

6. Provide access to, and mandate use of, a single set of data for all IFP service providers.

OPR: ATO/AVS

Issue 4: Manual IFP data transfer creates human error and wasted time.

The IFP development process relies heavily on human interface and does not efficiently use available and new technologies. The input and output of each phase of the process is a package of paper forms (e.g., PDF) containing data that must be manually entered into subsequent systems. Errors occur when data must be extracted from records/forms/datasheets and manually rekeyed into succeeding systems.

Figure 5. Manual Transfer of Data

There are also various levels of precision requirements for the same data elements. For example, data users often consider positions to be absolute. However, horizontal coordinates and elevations depend on the geodetic coordinate system (referred to as a "datum") in use at

the time the coordinates are measured or computed. It is often necessary to convert a position from one datum (e.g., North American Datum 1983) to another (e.g., World Geodetic Standard 1984) to facilitate different procedure types such as Global Navigation Satellite System (GNSS) approaches.

Furthermore, the required level of data precision depends on how or where the data will be applied. For example, many airborne aviation databases accept latitude and longitude specified to 0.01 seconds of arc. Existing enterprise databases, however, may store these values to 0.0001 seconds of arc. It is important that IFP design software correctly and consistently convert between different data formats and precisions to ensure that errors are not introduced.

Recommendations:

7. Develop, implement, and ensure standards to electronically communicate, transfer, and integrate data among tools.

This recommendation is an extension of Recommendation 2 which was confined to electronic transfer of TARGETS-generated STAR data. It expands the concept to consider all tools used in the IFP process. Automated tools are an essential component in processing and managing data used in the IFP process, and as such they should be capable of communicating electronically where there is a need for direct interface. However, that is not meant to imply that every tool must be capable of electronic interface with every other tool used during the process. For example, it would be beneficial for the RNAV PRO DME screening tool to be capable of electronic exchange of data with TARGETS. However, such an interface between RNAV PRO and AeroNav Services' Instrument Procedure Design System (IPDS) would likely not be needed. Implementing this recommendation should start by completing an inventory of all of the tools used throughout the process and then developing an architecture that identifies where electronic interface would be beneficial.

OPR: ATO/AVS

8. Standardize software and data formats that allow auto population/extraction of data to produce, populate, and edit documents that are accessible to all parties for review.

OPR: ATO/AVS

Figure 6. Electronic Transfer of Data

9. Standardize precision, resolution, and rounding values that are needed for each IFP application to alleviate disparity.

OPR: AVS

Issue 5: FAA guidance on preparation of Environmental Assessments (EA) does not address situations where the environmental analysis is narrowly focused on only certain potential environmental impacts ("focused EA" approach).

FAA policy guidance for complying with the requirements of NEPA (Order 1050.1) provides for consideration of potential impacts in 18 impact categories. However, implementation of an IFP may have potential effects only to one or a few impact categories. Therefore, policy guidance should be revised to allow only assessing impacts to the relevant impact categories, which may be only noise or air quality.

Additionally, Order 1050.1 language addressing categorical exclusions (CATEX) for new PBN IFPs that "use overlay of existing procedures" is not technically correct. The intent of the CATEX is to allow CATEXs for IFPS that overlay tracks from existing aircraft operations.

Furthermore, adequate screening tools are required so that potential environmental impacts can be identified early in the IFP development process. These tools are also needed to allow confirmation that a proposed IFP meets conditions for a CATEX with a limited expenditure of resources and time for analysis.

Recommendations:

10. Amend FAA Order 1050.1E to provide guidance to environmental specialists on using the focused environmental assessment (EA) approach and use of radar track data for noise analysis in lieu of an existing procedure.

Order 1050.1 is currently being revised by the Office of Environment and Energy and these changes should be included as part of the revision.

OPR: AJR-34/AEE/AGC

11. Issue interim operating guidance for FAA Order 1050.1E to enable the use of the focused EA approach for analyzing environmental impacts.

Implementing this recommendation will allow immediate use of the focused EA concept while Order 1050.1 is undergoing revision, which is expected to take until late 2011.

OPR: AJR-34/AEE/AGC

12. Enhance noise and air quality screening tools to make initial screening more efficient for FAA environmental specialists.

The TARGETS Noise plug-in provides capability for screening for noise impacts by invoking the Integrated Noise Model (INM). However, there is not a similar tool to screen for air quality/climate change impacts. The FAA is developing the Aviation Emissions Design Tool (AEDT), which contains fuel burn and air/noise emissions evaluation capability, to replace its current emissions models. AEDT will provide information to allow a better understanding of the trade-offs between climate change, air quality, and noise effects of changes in airspace and procedures. MITRE expects to begin a project in FY11 under AEE sponsorship to modify TARGETS software to use AEDT for emissions analyses. Once the TARGETS-AEDT connection is matured, air quality, climate change, and noise impacts can be screened as part of the procedure development process.

OPR: AJR-34/AEE

Issue 6: Inconsistent interpretation of FAA environmental policy/guidance causing delays in developing and implementing IFPs.

Currently, there is not a uniform application of available guidance by each of the ATO Service Center Operations Support Groups, AeroNav Services, and other Headquarters and field offices that are involved in environmental assessment of proposed IFPs. This is causing confusion among proponents of the procedures and rework as different requirements are levied by different organizations.

Recommendations:

13. Standardize management and environmental specialist training to ensure consistent compliance for all IFPs with FAA Order 1050.1E.

This will help to ensure the uniform application of environmental impact assessment requirements across all the organizations involved in IFP development and implementation.

OPR: AJR-34/AJR-37/AVS/AEE

14. Revise FAA Order 8260.19, Paragraph 207 and FAA Order 7400.2, Chapter 32 to clearly define the responsible federal official authorized to sign applicable environmental documents.

This will ensure that environmental impact assessments are approved at the appropriate level of management depending on the nature of the impacts.

OPR: AJR-34/AJR-37/AVS/AEE

Issue 7: No systems approach to IFP criteria development and implementation; competing agency initiatives impede criteria requirements definition; implementation aspects of criteria development are not currently addressed.

Today, criteria are developed or changed as a result of triggers such as changes in the NAS, program office initiatives, changes in technical data that affect aircraft performance, or reaction to industry concerns/requests. These myriad proposed changes brought on, at times, by competing LOB desires currently do not receive impartial consideration or proper vetting to see where they lie with respect to competing agency objectives and priorities caused by the lack of a clearinghouse to vet these issues. Furthermore, I&I concerns are not addressed in the planning stages of criteria development to determine whether appropriate resources exist to implement the change or whether impact (positive or negative) to NAS operations will result. For example, a criteria change that may affect tens of thousands of procedures that already exist must now be modified to conform to the new criteria. These required procedure modifications may exceed the capability of the service provider's limited resources or impose onerous time constraints for implementation.

A standardized criteria request process will help ensure that all necessary requirements and supporting data are captured and available at the beginning of criteria development. The role of the USIFPP, representing multiple FAA lines of business and external stakeholders, should be strengthened to improve coordination between parties responsible for criteria development and implementation. This will help to ensure that new criteria are developed and implemented in a structured process that reduces rework.

Recommendations:

15. The USIFPP will coordinate the following:

    - Establish standardized process for submitting and processing criteria requests, to include internal/external coordination and progress reporting.
    - Establish the USIFPP as the single FAA focal point for requests for new or revised TERPS criteria.
    - Ensure training, production capability, software updates, and Operations and Certification approval implementation issues are considered in the IFPP deliberation process.
    - Ensure criteria effective dates are compatible with the stakeholder's ability and commitment to implement the change.

OPR: AFS

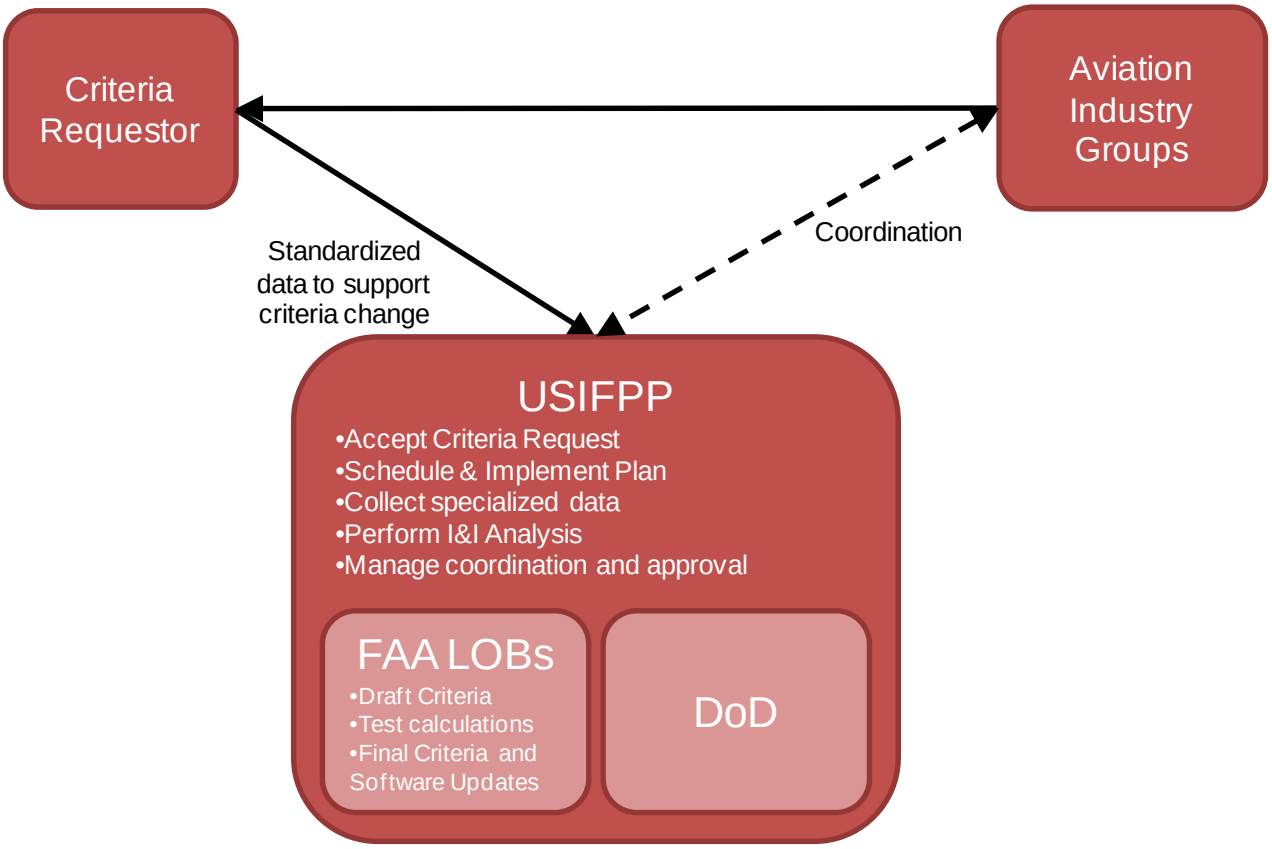


Figure 7. Standards Process with USIFPP in Central Role

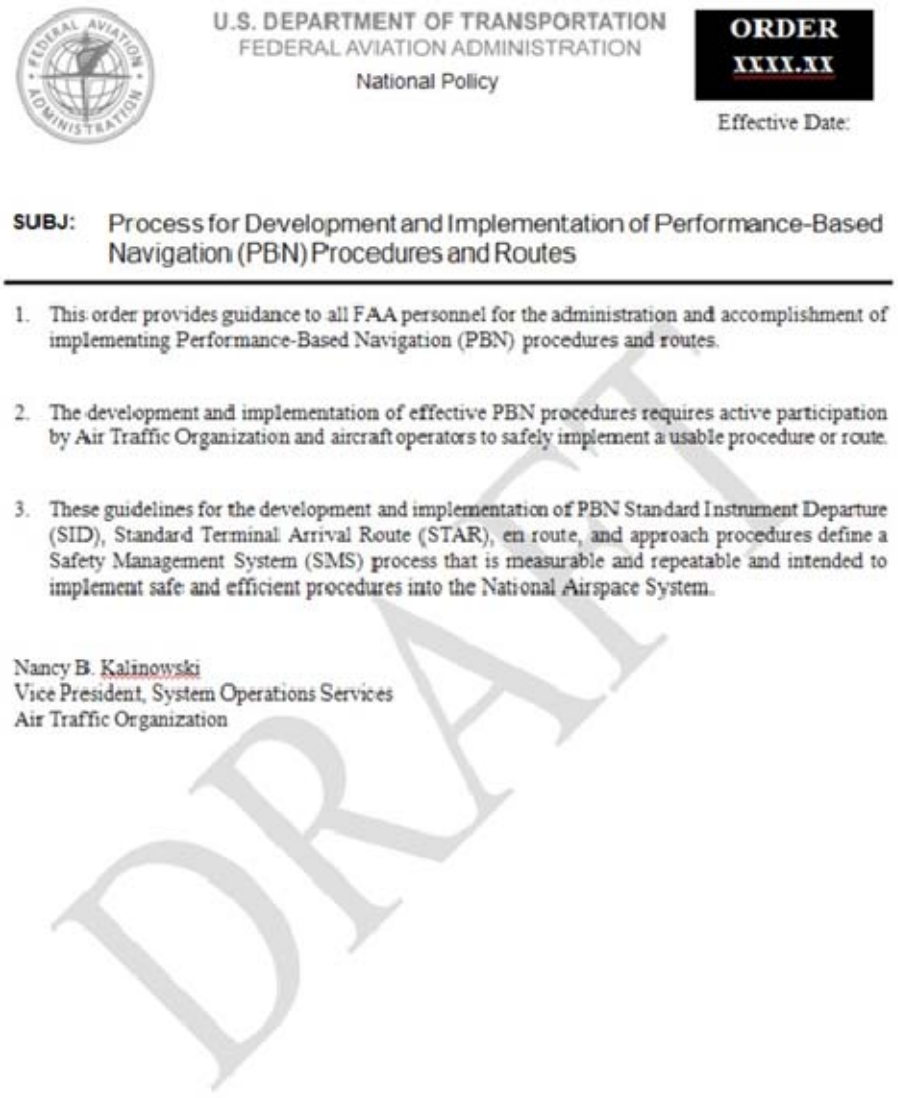
Issue 8: Inconsistent application of FAA SMS policy regarding the need to develop a Safety Risk Management Document (SRMD) or a Safety Risk Management Decision Memorandum (SRMDM) for every new or amended IFP causes delays.

Current guidance requires completion of a Safety Risk Management Document (SRMD) for each new or revised Air Traffic-developed IFP. Eliminating that requirement will reduce delay time for IFP implementation. Standardizing the process for development of IFPs in a manner which is compliant with SMS will also contribute to ensuring the highest level of safety for those IFPs.

Recommendations:

16. Publish a new FAA Order that addresses a standardized Safety Management System (SMS) process for implementation of IFPs within the NAS.

Implementing a standardized process for the development and implementation of IFPs that is evaluated and deemed to meet safety risk management compliance requirements will require two actions. First, the PBN Integration Group will finalize a draft of the Process for Development and Implementation of PBN Procedures. Second, an SRMD of the draft Order will be completed to ensure that the new process is SMS compliant. Once those actions are complete and the new order published, IFPs developed and implemented using the new process will be deemed SMS compliant and not require a separate SRMD.



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
National Policy

ORDER
XXXX.XX
Effective Date:

SUBJ: Process for Development and Implementation of Performance-Based Navigation (PBN) Procedures and Routes

1. This order provides guidance to all FAA personnel for the administration and accomplishment of implementing Performance-Based Navigation (PBN) procedures and routes.

2. The development and implementation of effective PBN procedures requires active participation by Air Traffic Organization and aircraft operators to safely implement a usable procedure or route.

3. These guidelines for the development and implementation of PBN Standard Instrument Departure (SID), Standard Terminal Arrival Route (STAR), en route, and approach procedures define a Safety Management System (SMS) process that is measurable and repeatable and intended to implement safe and efficient procedures into the National Airspace System.

Nancy B. Kalinowski
Vice President, System Operations Services
Air Traffic Organization

DRAFT

Figure 8. Revised Order

OPR: AJS

17. Interim safety guidance should be developed by the Office of Safety that addresses SRM compliance in reference to IFP development and implementation and distributed to all service providers.

Development of interim safety guidance to address IFPs developed prior to deployment of an SMS-compliant Process for Development and Implementation of PBN Procedures will serve as a bridge from the current to the future process.

OPR: AJS

Issue 9: Processing delays occur because there is no standardized process to accept input from all IFP proponents/stakeholders, to access, request, track, edit, store, and manage information throughout the IFP development process.

Currently, there is no standardized, transparent process to accept input from all (internal/external) IFP proponents/stakeholders. For example, requests can be made through the AeroNav Services website, the FPOs, Air Traffic Facilities, or the PBN Integration Group. This makes tracking requests, both for the developers and the proponents, a challenging task. Furthermore, IFP procedure requests generally lack consistency in thoroughness and detail. Some requests do not include an adequate level of information to fully evaluate the request before proceeding to the development phase. This lack of a standardized method to submit, track, store, and transfer information throughout the IFP development process often results in rework, the introduction of opportunities for human error, loss of data, and duplication of effort. Another result is that procedure development is often started without the involvement of environmental specialists, SMS experts, or an early estimation of benefits. The operations approval process faces many of the same transparency, tracking, and consistency challenges. Using a Web-based portal that is accessible to all interested parties would also provide users with a traceable history of requests, status, and actions.

In addition to developing and implementing a single portal, fully addressing these issues will require publishing a clear definition of the IFP life cycle, to include all related aspects of the process, in a single document. Finally, a comprehensive communication plan for all users, internal and external to the FAA, will have to be developed.

Recommendations:

18. Establish and implement a Web-based request and access portal as the mandatory entry point for all IFP requests and/or inquiries.

The portal will be the gateway into a Web-based system that will help standardize the IFP process and make it more transparent to users. Any authorized user (i.e., an individual or organization with a user ID and password) will have access to the system. There may be varying levels of permissions assigned to user IDs which will establish the limits of what a specific user may do or see through the system. Responsibility for managing the system will be determined prior to implementation. The portal will be the first stop for users who wish to submit a request for a new or revised IFP. The system will provide templates and specify

minimum required information for submissions. Requests will be processed and progress through the system according to business rules not yet finalized. The system will provide checkpoints for persons involved in IFP development and implementation to help ensure that all necessary activities are completed at the appropriate stage of the IFP development life cycle. Users will also be able to view IFPs in progress and communicate with other users via a system-provided messaging service. All actions and communications through the system will be archived and there will be an audit trail.

OPR: ATO/AVS

Figure 9. Web-Based Portal

19. Amend FAA Order (8260.19) to define the life cycle policy for IFP development to include the following:

- Environmental requirements
- SMS requirements
- Operations and Aircraft Approval requirements
- Criteria revisions

- Revisions as necessary by other LOBs such as Airports and Air Traffic
- Define “minor” amendments (i.e., changes to existing IFPs that are eligible for “fast tracking”)

As noted earlier in this paper, policy and guidance for IFP development are currently found in a number of national and regional orders, policy documents, memoranda, guidelines, and checklists. Furthermore, there is considerable disagreement on exactly how to describe the life cycle and about what the life cycle includes. Coordination of requirements with auxiliary processes, such as SMS, criteria development, operational approval, and environmental, are also not well defined. Clearly defining an IFP life cycle and formalizing it in FAA Order 8260.19 should eliminate confusion and therefore reduce the time required to develop and implement IFPs.

OPR: AVS

20. Develop an outreach/communication plan to educate users on the use of the portal.

Prior to actual implementation of the portal, user input, both internal and external to the FAA, should be solicited. Various FAA/industry working groups should be consulted. After all comments have been received and considered, a User Guide should be published, possibly in the form of an Advisory Circular.

OPR: AFS/AJW/AJT/AJE

21. Establish a Web-based Operations Approval entry portal and a Web-based work package to accommodate the needs of LOBs, including the following:

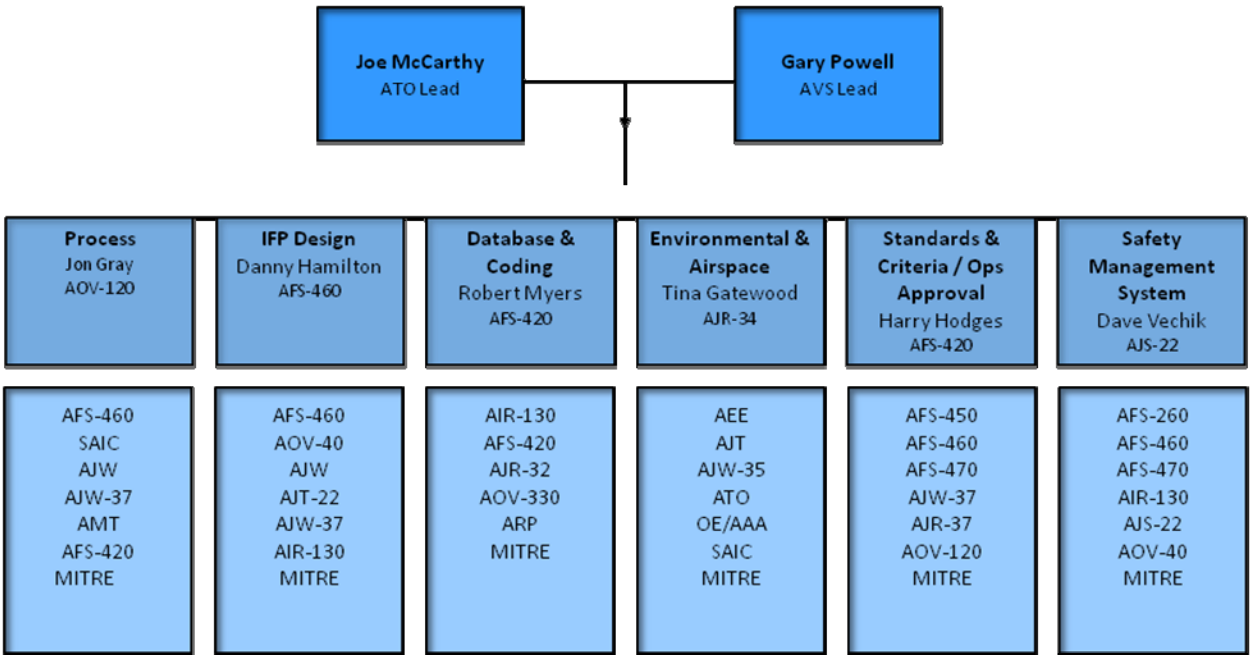
    - A task assignment feature that will allow appropriate levels of authority to assign projects.
    - A relational database for control and coordination of all documents.
    - Tracking, evaluation, scheduling, assignment, drafting, review, comment, and archiving of all documents.
    - Standard document templates, electronic conveyance, and electronic signatures such that individual inspectors (e.g., FSDO) will use the same requirements, documents, and processes. It is well known that the PBN experience level across FSDOs and Principal Operations Inspectors (POIs) varies significantly. As a result, the standardization brought to bear by the Web-based approval tool should be accompanied with a comprehensive PBN training program for FSDOs and POIs on the use of the Web-based tool and the underlying requirements for PBN approvals.
    - A checklist to assist the applicant in meeting the requirements for operational approval similar to that contained in the application guidance document entitled “RNP Special Aircrew and Aircraft Authorization Required (SAAAR) Application Process.”

- A capability to “bundle” approvals such as that for Reduced Vertical Separation Minima (RVSM), RNP 10, RNP 4, RNAV 2, RNAV1, RNP 0.3, and RNP Authorization Required (AR). Currently, the applicant is required to submit separate packages accompanied with duplicative pages from the Airplane Flight Manual (AFM), maintenance manuals, supplements, etc. This Web-based feature would allow the operator to submit a single package for multiple approvals when logical to do so and would reduce workload and duplication for both the regulator and applicant.
- A capability for international approvals. Although PBN is not yet fully harmonized internationally with respect to approval requirements, International Civil Aviation Organization (ICAO) and the member states appear to be working in that direction and the ICAO PBN Manual (Doc 9613) is aiding that effort. Continued work is required and an international working group may be required to fully harmonize the PBN approval process, but a Web-based process for international approvals with the appropriate information and resources would reduce workload on both the regulator and the applicant.
- A “fast-track” approval path for those aircraft that already have an aircraft-based approval (per AC 90-101 Appendix 2). This would be based on aircraft approvals already obtained by Original Equipment Manufacturers (OEMs) who have provided the requisite documentation.
- A tracking mechanism for applicants to monitor their respective application packages as they move through the approval process.
- An easily understood method to identify (and explain) submission components that are unsatisfactory or incomplete and accompanied with recommended solutions, and a user-friendly method for the applicant to revise the submission electronically. The subsequent revisions should be clearly identified as such to aid the regulator during the approval process.

OPR: AFS

Appendix B Working Group Organization

The NAV Lean Working Groups were staffed and organized as shown in the following chart.



Appendix C NAV Lean Charter

Federal Aviation Administration **Aviation Safety** **Air Traffic Organization**	**Number of pages: 6**	
Charter Title: **Navigation Project**		
Signature: **_____** **Richard L. Day, ATO** **_____** **John J. Hickey, AVS**	**Effective Date:**	**Revision: 0.3**

C.1 Purpose

The purpose of the Navigation Procedures (NAV) Project is to improve and streamline processes used for optimizing NAV air traffic procedures, to include the request, processing, approval and implementation of NAV procedures.

C.2 Scope

The scope of this NAV Project includes the review of applicable NAV processes, tools, and procedures related to standards, policies, development, approval, publication, and utilization of air traffic procedures. End-to-end processes are to be reviewed with the objective of establishing a single set of standard, repeatable processes used on a national level for development and implementation of all NAV procedures; (single national process avoids Safety Risk Management (SRM) for each procedure developed). A single national standard allows for quality control and quality assurance, along with a deviation and waiver process. The standard processes should address the development and implementation of criteria that leads to a request. Ground-based and space-based procedures are in-scope; Part-97, specials, SIDs, STARs, Q-routes, tailored arrivals, pre-established tailored arrivals, published and unpublished procedures are in-scope; reviewed and recommended changes to the appropriate safety target (10-9) are in-scope. Difficult process decisions can be referred to the Steering Committee through use of a “parking lot” designation. These “parking lot” items can and should be prioritized and assigned as specific tasks to be performed. The goal is to drive to a common process.

C.3 Membership

Membership comprises representatives from:

- Aviation Safety
  - Flight Standards Services (AFS)
  - Aircraft Certification Services (AIR)
  - Air Traffic Safety Oversight Service (AOV)
- Air Traffic Organization
  - Enterprise Operations (AJV)
  - Systems Operations (AJR)
  - Technical Operations (AJW)
  - Safety (AJS)
  - NextGen and Operations Planning (AJP)
- Aviation Policy, Planning and Environment
  - Environmental Policy (AEE)
- Airports
  - Airport Planning and Programming (APP)
- Support Contractors

The sponsors of this effort are the Senior Vice President of Operations (AJN) and the Deputy Associate Administrator for Aviation Safety (AVS-2); also referred to as the Charter Leads. Reporting to the sponsors is a Steering Committee (10 total members) including one member from each of the following organizations: Flight Standards Services (AFS), Aircraft Certification Services (AIR), Air Traffic Safety Oversight Service (AOV), Enterprise Operations (AJV), Systems Operations (AJR), Technical Operations (AJW), Safety (AJS), Airport Planning and Programming (APP), NextGen & Operations Planning (AJP), and Environmental Policy (AEE). Reporting to the Steering Committee will be a two Project Leads (one from ATO, one from AVS) responsible for day-to-day activities. Working Groups (multiple) are project-level, temporary duration, focused teams proposed by the Project Leads, and chartered by the Steering Committee.

C.4 Responsibilities

The responsibilities of the Sponsors (Charter Leads) include:

- Select and manage members of the Steering Committee;
- Brief the NextGen Management Board on this Project

The responsibilities of the Steering Committee include:

- Report progress to the Sponsors (Charter Leads)
- Provide guidance and direction to Project Leads and Working Groups
- Chair the monthly meetings
- Approve chartering of each Working Group

The responsibilities of the Project Leads include:

- Report progress to the Steering Committee
- Monitor the overall progress of each Working Group(s)
- Recommend creation and disbanding Working Group(s)

Working Group members, with the assistance of the support contractors will:

- Identify key stakeholders in the NAV process
- Execute the NAV study as planned, which includes:
  - Identification of the owners of the NAV process
  - Interview the NAV subject matter experts
  - Identification of key procedures required for NAV approval
  - Develop high-level process diagram
  - Determine value-added and low-value added processes
  - Perform value stream analysis
  - Recommend steps to optimize the NAV process
  - Provide bi-weekly status reports
  - Track action items
  - Maintain meeting records and notes

C.5 Schedule and Period of Performance

The NAV Steering Committee (including Charter Leads) will meet bi-weekly for approximately one hour at a predetermined time and place. Each NAV Working Group meets as required to accomplish the assigned task. Early successes are encouraged, and may be implemented with Steering Committee approval. A Program Plan is to be completed by March 2010; including planned outcomes, deliverables, and milestones. The Sponsors desire all lean process changes be approved for implementation by the end of FY10.

C.6 Work products

Major work products for the NAV Working Group would include:

- Administrative output
  - Meeting agendas, records and notes
  - Action item tracking database
  - Weekly status reports
  - Internal and external communication (out-reach) products
- Technical output
  - As-is process diagrams
  - Integrated process diagrams
  - List of value-added and low-value added steps
  - Recommendations for processes
  - Periodic progress report
  - International benchmarking of other service providers (Civil Air Navigation Services Organization [CANSO] members)

C.7 Metrics

Progress will be measured against the key performance indicators recommended by the Working Group(s), and approved by the Steering Committee.

C.8 Communication

Develop mechanism to communicate activities of work groups and stimulate interest in the changes taking place in processes and procedures. Summarize lessons learned that resulted from similar efforts. Organization Representatives: (as of 18 March, 2010)

Sponsors:

Organization	Name
AVS – Charter Lead	John Hickey
ATO – Charter Lead	Rick Day

Steering Committee:

Organization	Name
AFS	John McGraw
AIR	Dorenda Baker
AOV	Tony Ferrante
ATO (AJV)	Luis Ramirez
ATO (AJS)	Joseph Teixeira
ATO (AJR)	Nancy Kalinowski
ATO (AJW)	Teri Bristol
ARP	Benito DeLeon
AEP(AEE)	Carl Burleson
ATO (AJP)	John Maffei

Project Leads:

Organization	Name
AVS – Lead	Gary Powell
ATO – Lead	Joe McCarthy

Working Group: Process

Organization	Lead Name
AOV	Jon Gray

Working Group: IFP Design

Organization	Lead Name
AFS	Danny Hamilton

Working Group: Database/IFP Coding/FMS

Organization	Name
AFS-420	Robert Myers

Working Group: Airspace/Rulemaking/Environmental

Organization	Name
AJR	Tina Gatewood

Working Group: Standards/Criteria

Organization	Name
AFS	Harry Hodges

Working Group: Safety Management Systems/Ops Approval

Organization	Name
AJS	Dave Vechik

Note: Changes to organization representatives require Steering Committee approval.

Appendix D NAV Lean Program Plan (main body)

Navigation (NAV) Procedures Project

"NAV Lean Team"

Program Plan

April 8, 2010

Version 3.1

Approved By:

Signature Date

Rick Day
Senior Vice President of Operations
AJN-0

Signature Date

John Hickey
Deputy Associate Administrator for Aviation Safety
AVS-2

Signature Date

Submitted By:

Joe McCarthy
Manager, RNAV/RNP Group
AJR-37

Gary Powell
Deputy Assistant Division Manager
AFS-402

Background

In response to recommendations from the RTCA NextGen Mid-Term Implementation Task Force,[5] the Federal Aviation Administration (FAA) has initiated the Navigation (NAV) Procedures project. Using the "Lean Processes", the project will review and make recommendations to improve and streamline all processes used to request, prioritize, process, improve, and implement performance-based, conventional instrument flight procedures (IFP). The focus of the improvements is to create safe, repeatable, beneficial, and more efficient processes that comply with applicable regulations. The NAV Lean Team composed of six Working Groups (WG) and Facilitators, under the direction and guidance of the Project Leads, will review existing IFP processes along with supporting tools, and procedures using the Lean process to develop recommendations for changes. Project Leads will report recommendations to the Steering Committee/Sponsors for advisement and decision on implementation. Appendix A contains an organization chart outlining the relationships between the project participants.

Goal

By September 30, 2010, provide recommendations that will improve and streamline the development and delivery of all IFPs in the National Airspace System (NAS) to Aviation Safety (AVS) and the Air Traffic Organization (ATO) leadership. AVS/ATO leadership will assess and approve these recommendations for implementation in coordination with the Office of Airports (ARP) and Office of Policy, Planning and Environment (AEP) leadership.

Guiding Documents

- Program Plan (This document)
- Navigation Project Charter (Appendix B)
- Working Group Terms of Reference (TOR) (Appendix C)
- Working Group Report Format (Appendix D)

Roles and Responsibilities

The roles and responsibilities of the participants are listed below.

Sponsors

- Nominate, select, and manage members of the Steering Committee.
- Brief the NextGen Management Board on progress of the Project.
- Communicate importance of activity to participating FAA organizations.
- Approve Program Plan

[5] Federal Aviation Administration, *FAA Response to Recommendations of the RTCA NextGen Mid-Term Implementation Task Force*, January 2010, Washington, D.C.

Steering Committee

- Report progress to the Sponsors.
- Provide direction and guidance to Project Leads and Working Groups.
- Chair monthly meetings.
- Approve TORs of each Working Group.
- Approve the allocation of Working Group participation to ensure cross-organization representation.

Project Leads

- Recommend creation and disbanding of Working Groups.
- Monitor the overall progress of each Working Group.
- Communicate the goals, approach, and objectives to the Working Group Leads.
- Coordinate review of the recommendations with the Steering Committee.
- Report progress and recommendations to the Steering Committee.

Working Group Leads

- Develop a schedule of meetings after the initial Lean Training.
- Provide updates to the Project Leads as needed.
- Maintain documentation and track action items.
- Coordinate with other Working Group Leads and Facilitators to minimize duplication of scope and identify dependencies.
- Provide recommendations to the Project Leads.
- Provide input and assistance in the drafting of the final report.

Working Groups

- Attend NAV Lean Workshop Training and all subsequent meetings.
- Identify key stakeholders in the NAV process.
- Identify owners of the NAV process.
- Obtain relevant information from subject matter experts.
- Review existing NAV processes, tools, and procedures related to standards, policies, development, approval, publication, and use of instrument flight procedures.
- Develop process diagrams.
- Utilize “Lean” to streamline processes.

- Provide recommendations to optimize the applicable working group processes.
- Recommend performance metrics criteria.
- Follow format in Appendix D for reporting back to Project Leads.

Facilitators

- Attend Working Group meetings.
- Maintain awareness of each Working Group's activities, issues and progress.
- Maintain minutes, notes, and associated document at the discretion of the Working Group Lead.
- Assist Working Groups in achieving commonality in areas such as metrics, schedules, and reporting format.
- Review Working Group output in order to identify intersections or where multiple Working Groups' areas of responsibility overlap.
- Provide input and assistance in the drafting of the final report.

Integrators

- At the direction of the Project Leads, integrate input from the Working Groups to create unified and non-contradictory recommendations.
- Coordinate with Working Group Leads as required to identify areas of overlap and intersect, and address mitigation where necessary.
- Manage review of report with Project Leads, Facilitators, Working Group Leads, and Working Group members prior to delivery to the FAA Sponsors/Steering Committee.
- At the direction of the Project Leads, generate final report of recommendations for presentation to the Sponsors.

Lean Specialist

- Provide training to Working Groups at each group's initial Lean Workshop.
- Participate in working Group activities to share Lean Process expertise.

Action Plan

Statement of Work

The Working Groups will:

- Define the existing processes for development and delivery of IFPs.
- Conduct a Lean event on existing processes for development and delivery of IFPs.
- Identify a set of improved and streamlined processes to the existing IFP development processes through the use of the Lean Process Methodology.
- Develop a single, unified set of detailed recommendations required to implement the new process.
- Provide any on-the-spot changes the Working Group(s) determine important enough to implement prior to the project completion.
- Prepare an integrated report for Steering Committee/Sponsor approval. The report will include a full description of the legacy IFP processes, areas considered for improvement, and recommendations for action that will result in a more efficient IFP development process achieved via the Lean Process.

Detail

The NAV Lean Team composed of six Working Groups (WG) under the direction and guidance of the Project Leads will review and make recommendations to improve and streamline their respective processes. The focus of the improvements will be to create safe, repeatable, beneficial, and more efficient processes that comply with applicable regulations.

Each Working Group member will attend the NAV Lean Process workshop and all subsequent meetings as scheduled by the Group Lead. Each Working Group Lead will develop an internal schedule that supports the overall project schedule described later in this document. It is expected that two-to-four follow-on meetings may be necessary. Attendance is essential for working group success.

The NAV Lean Process workshop is the first meeting for each Working Group. During the workshop, the Working Group will receive interactive training on the Lean Process from FAA-qualified trainers. As part of the training, each Working Group will chart the current process for their particular area of concentration. This will include identifying areas of possible improvement. This effort will be used as the starting point for the group's effort. Working group members must approach their subject with an open mind. Prior constraints and hidden agendas are counterproductive. Thinking out of the box and disregarding financial or organizational barriers will enhance success of the group. The Working Groups will be the focal point for the preliminary analyses.

Project Leads will host a meeting on April 1 with all Working Group Leads to discuss the program plan and emphasize group cohesiveness. Although coordination and exchange of ideas between the Working Groups is encouraged, initially each Working Group will be

responsible for developing a set of recommendations for improvements in its area of responsibility as outlined in each Working Group's TOR. Integrators will ensure that the Project Leads are kept informed of progress and issues through regular updates. Per the Charter, "Difficult process decisions can be referred to the Steering Committee through use of a "parking lot" designation."

Following a review of all reports by the Working Group Leads and Facilitators, each Working Group will refine their first drafts to address contradictions and inconsistencies identified among the six reports. Extensive coordination between the Working Groups is expected during this period. The outcome will be a second and final set of Working Group reports. These reports will be provided to all Working Group Leads and Facilitators with copies to the Project Leads by July 28, 2010.

Final Product

The outcome of this project will be a report to the Steering Committee containing a single, unified set of detailed recommendations to improve and streamline processes used for developing and implementing instrument flight procedures. The report will include a description of the areas considered for improvement by the Working Groups and recommendations for action. The format outline for Working Group reports is contained in Appendix D. In developing recommendations, Working Groups should emphasize "quality" over "quantity." In order to be useful and viable, recommendations must be specific, actionable and measurable. However, recommendations for further consideration or more detailed analyses are appropriate. The recommendation must be clearly described and include examples of how the recommendation could be actionable, measurable, and beneficial.

The next action will be consolidation of the separate Working Group reports into a draft final report for delivery to the Project Leads by August 26, 2010. After all Project Lead comments have been addressed, the final report will be presented to the Steering Committee for approval and subsequent delivery to the Sponsors for approval.

Schedule

Process Group Initial Lean Workshop	March 9-11
All Terms of Reference (TOR) Complete	March 24
Project Plan Briefing to Sponsors	March 29
Project Lead Meeting w/WG Leads	April 1
IFP Design Group Initial Lean Workshop	April 6-8
WG Internal Schedules Published	April 7
Standards Group Initial Lean Workshop	April 13-15
Project Leads Update Steering Committee	April 19
Database/Coding Group Initial Lean Workshop	April 20-22
Airspace/Environmental Group Initial Lean Workshop	April 27-29
Project Leads Update Steering Committee	May 26
SMS Ops Approval Group Initial Lean Workshop	May 4-6
Project Leads Update Steering Committee	June 30
WG Leads /Facilitators Review and Comment on WG reports	June 24 – July 7
WG Final Reports	July 28
Project Leads Update Steering Committee	July 29
Project Leads Update Steering Committee	August 12
Deliver Final Report to Project Leads	August 26
Project Leads Brief Steering Committee on Recommendations	NLT Sept. 15
Deliver Final Report to Sponsors	NLT September 30

Appendix E Glossary

AAA	Airport Airspace Analysis
AEDT	Aviation Emissions Design Tool
AFM	Airplane Flight Manual
AFS	Flight Standards Services
AGL	Above Ground Level
AIM	Aeronautical Information Management
AIR	Aircraft Certification Services
AOV	Air Traffic Safety Oversight Service
APP	Airport Planning and Programming
AR	Authorization Required
ARP	Airports
ASR	Antenna Structure Registration
ATC	Air Traffic Control
ATO	Air Traffic Organization
AVS	Aviation Safety
CANSO	Civil Air Navigation Services Organization
CATEX	Categorical Exclusion
DME	Distance Measuring Equipment
DOF	Digital Obstacle File
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FMS	Flight Management System
FPO	Flight Procedures Office
GIS	Geographical Information System
GNSS	Global Navigation Satellite System
I&I	Implementation and Impact
ICAO	International Civil Aviation Organization

IFP	Instrument Flight Procedures
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INM	Integrated Noise Model
IPDS	Instrument Procedure Design System
NAPT	National Airspace and Procedures Team
NAS	National Airspace System
NASR	National Airspace System Resource
NAV	Navigation
NAVAID	Navigational Aid
NEPA	National Environmental Policy Act
NextGen	Next Generation
NFPG	National Flight Procedures Group
NGA	National Geospatial Intelligence Agency
NRS	National Reference System
OE	Obstruction Evaluation
OEM	Original Equipment Manufacturers
OPR	Office of Primary Responsibility
PAM	Path Arrival Management
PARC	Performance-Based Operations Aviation Rulemaking Committee
PBN	Performance-Based Navigation
POI	Principal Operations Inspectors
QA	Quality Assurance
RAPT	Regional Airspace and Procedures Team
RF	Radius-to-Fix
RNAV	Area Navigation
RNP	Required Navigation Performance
RVSM	Reduced Vertical Separation Minima
SAAAR	Special Aircrew and Aircraft Authorization Required
SID	Standard Instrument Departure

SMS	Safety Management System
SRM	Safety Risk Management
SRMD	Safety Risk Management Document
SRMDM	Safety Risk Management Decision Memorandum
STAR	Standard Terminal Arrival
TARGETS	Terminal Area Route Generation, Evaluation and Simulation
TF-5	Task Force-5
TQM	Total Quality Management
TRACON	Terminal Radar Approach Control Facility
UDDF	Universal Data Delivery Format
USIFPP	United States Instrument Flight Procedures Panel