U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

July 8, 2016

The Honorable John Thune
Chairman, Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

Please find the enclosed report in response to Section 609(a) of the FAA Modernization and Reform Act of 2012 that directs the Administrator to conduct a study of its training programs for air traffic controllers, including the Administrator's technical training strategy and improvement plan for air traffic controllers. The Act directed the Administrator to: (A) review the current training system for air traffic controllers, including the technical training strategy and improvement plan, (B) analyze the competencies required of air traffic controllers for successful performance in the current and future projected air traffic control environment, (C) analyze the competencies projected to be required of air traffic controllers as the Federal Aviation Administration transitions to the Next Generation Air Transportation System, (D) analyze various training approaches available to satisfy the air traffic controller competencies identified under subparagraphs (B) and (C), recommend improvements to the current training system for air traffic controllers, including the technical training strategy and improvement plan, and (F) the most cost-effective approach to provide training to air traffic controllers.

We have sent identical letters to Chairman Shuster, Senator Nelson, and Congressman DeFazio.

Sincerely,

Michael P. Huerta
Administrator

Enclosure

U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

July 8, 2016

The Honorable Bill Nelson
Committee on Commerce, Science
and Transportation
United States Senate
Washington, DC 20510

Dear Senator Nelson:

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We have sent identical letters to Chairmen Shuster and Thune and Congressman DeFazio.

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July 8, 2016

The Honorable Bill Shuster
Chairman, Committee on Transportation
and Infrastructure
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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U.S. Department
of Transportation

**Federal Aviation
Administration**

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

July 8, 2016

The Honorable Peter DeFazio
Committee on Transportation
and Infrastructure
House of Representatives
Washington, DC 20515

Dear Congressman DeFazio:

Please find the enclosed report in response to Section 609(a) of the FAA Modernization and Reform Act of 2012 that directs the Administrator to conduct a study of its training programs for air traffic controllers, including the Administrator's technical training strategy and improvement plan for air traffic controllers. The Act directed the Administrator to: (A) review the current training system for air traffic controllers, including the technical training strategy and improvement plan, (B) analyze the competencies required of air traffic controllers for successful performance in the current and future projected air traffic control environment, (C) analyze the competencies projected to be required of air traffic controllers as the Federal Aviation Administration transitions to the Next Generation Air Transportation System, (D) analyze various training approaches available to satisfy the air traffic controller competencies identified under subparagraphs (B) and (C), recommend improvements to the current training system for air traffic controllers, including the technical training strategy and improvement plan, and (F) the most cost-effective approach to provide training to air traffic controllers.

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Administrator

Enclosure

FAA
Safety and Technical Training

Assessment of the Adequacy of the National Training Programs for Air Traffic Controllers

Findings and Recommendations Report in Response to PL 112-15 Section 609 (a) of the FAA Modernization and Reform Act of 2012

Table of Contents

Executive Summary

Public Law 112–95 was enacted to amend Title 49, United States Code. It authorized appropriations for the Federal Aviation Administration (FAA) for fiscal years (FY) 2012 through 2015. Section 609 (a) of the law requires the FAA to provide a report on the Air Traffic Controller Specialists' (ATCS) training strategy and improvement plan. ATCS training is the responsibility of the Air Traffic Organization (ATO), Safety and Technical Training (AJI). AJI performed a review of ATCS training to produce this report.

ATCS Training

To assess the adequacy of ATCS training programs, AJI accomplished a number of program reviews. This included a review of the ATCS technical training curriculum, strategy, and the foundational elements for an improvement plan for ATCS training.

In 2011, AJI participated in the FAA Next Gen Air Transportation System (NextGen) Human Factors Office update to the 2007 ATCS Job Task Analysis (JTA), performed by the American Institutes for Research (AIR). In doing so, and by furthering curriculum architecture's activities, AJI gained better insight into the current ATCS training curriculum.

To understand the future environment, AJI commissioned a number of studies to analyze the effects of NextGen on ATCS job tasks and associated technical training requirements. The completion of these studies, and review of their outcomes, helped to develop a picture of the current training environment and potential impacts of NextGen. This further improved the connection among job task requirements, training objectives, and training outcomes.

As a result of this Reauthorization Act Section 609(a) study, AJI will focus on three recommendations that will continue current improvements, including:

- Improve tracking of recommendations to identify priorities proactively for ATCS training improvement;
- Improve coordination across the organizations responsible for training and training improvement initiatives; and
- Develop a comprehensive ATCS training strategy.

In addition, AJI is continuing operational efforts to improve training. Several new and ongoing efforts include:

- Establishing training standards;
- Establishing an evaluation program to evaluate quality of training on a rotational basis;
- Developing guides on media selection;
- Developing guides for Subject Matter Experts (SMEs) to understand the training design process;
- Updating and maintaining the curriculum architecture;
- Revamping new hire training;
- Undertaking cost planning to update ATCS training;
- Establishing baselines for areas exposed as weaknesses;
- Exporting Knowledge, Skills, Abilities, and Other attributes (KSAO) to the agency for working together in terms of hiring, etc.; and
- Conducting a Difficulty, Importance, and Frequency (DIF) Analysis to schedule refresher training and use the information to identify priorities for refresher training and course revisions and development.

AJI is now better prepared to respond to the changing technical training environment as new technologies like NextGen are introduced into the National Airspace System (NAS) by becoming more strategic about the content, development, delivery, and evaluation of ATCS training. AJI continues to use these insights to analyze training objectives, align training objectives to job tasks, modify and improve training content, improve prioritization of training, and identify overlapping or redundant training to improve efficiency and reduce cost.

1. Introduction

A critical element in supporting the FAA's mission to operate the safest, most efficient airspace system in the world is having well-trained ATCSs to manage air traffic movement at the nation's airports and in its airspace. The current authorization provides the FAA stable funding for the NAS, and requires it to streamline programs, create efficiencies, reduce waste, improve aviation safety and capacity, and for other purposes. Sections 224, 605, and 609 of Public Law 112-95 require the FAA to conduct a series of studies that focus on the technical training programs for ATCS and Airway Transportation Systems Specialists (ATSS).

Section 609 (a) states:

> SEC. 609. AIR TRAFFIC CONTROLLER TRAINING AND SCHEDULING.
>
> (a) TRAINING STRATEGY AND IMPROVEMENT PLAN.—The Administrator of the Federal Aviation Administration shall conduct a study to assess the adequacy of training programs for air traffic controllers, including the Administrator's technical training strategy and improvement plan for air traffic controllers.
>
> (1) CONTENTS.—The study shall include—
>
> (A) a review of the current training system for air traffic controllers, including the technical training strategy and improvement plan;
>
> (B) an analysis of the competencies required of air traffic controllers for successful performance in the current and future projected air traffic control environment;
>
> (C) an analysis of the competencies projected to be required of air traffic controllers as the Federal Aviation Administration transitions to the Next Generation Air Transportation System;
>
> (D) an analysis of various training approaches available to satisfy the air traffic controller competencies identified under subparagraphs (B) and (C);
>
> (E) recommendations to improve the current training system for air traffic controllers, including the technical training strategy and improvement plan.

This report is divided into sections according to Section 609 (a) requirements.

- **Section 1**: Introduction;
- **Section 2:** ATCS Training System: AJI Curriculum Architecture;
- **Section 3:** Analysis of Current and Future ATCS Requirements;
- **Section 4:** Analysis of NextGen impacts on the Future ATCS Environment;
- **Section 5:** Improvement Plan; and
- **Appendices**

Background

AJI continuously trains ATCSs to prepare them or improve their ability to manage air traffic movement. To maintain the safest, most efficient airspace system, AJI must assess whether its training programs address the procedures and knowledge that ATCSs must demonstrate in order to perform the job today and in the future. In addition to remaining dynamic, the training curriculum must be designed to train ATCSs ranging in experience from new hires seeking Certified Professional Controller (CPC) status for their air traffic control facilities to veteran CPCs learning new procedures. Training is highly specialized to the individual or position because it is tied to the ATCS' job tasks, knowledge, and skills needed to perform successfully within their air traffic control facility type.[1]

Overview of ATCS Training

The ATCS national training curriculum is delivered in part at the FAA Academy and then completed at local air traffic control facilities. FAA new hires, also known as "Developmentals," attend the FAA Academy in Oklahoma City, Oklahoma prior to reporting to one of the 315 FAA air traffic control facilities across the country. Developmentals hired from the general public must complete a 25-day Air Traffic Control Basics Course to gain an understanding of the fundamentals of air traffic control before entering one of three curriculum tracks. The curriculum tracks correspond to the three principal types of air traffic control facilities: Towers, Terminal Radar Approach Control (TRACON), or En Route. After successfully completing Academy training, Developmentals are assigned to air traffic control facilities where they receive site-specific training with the goal of obtaining CPC status.

The FAA uses four basic methods of training: classroom, Computer-Based Instruction (CBI) or Web-Based Training (WBT), simulation, and On-The-Job Training (OJT).[2]

- **Classroom:** Instructor-led training (ILT) designed to teach concepts and theories behind a particular job task, skill, or facility-specific position. Classroom training may be provided in-person by contractors or FAA employees certified to teach the subject matter and may "blend" courses delivered through a computer or online through the FAA electronic Learning Management System (eLMS);
- **CBI or WBT:** Interactive CBI or WBT can also teach concepts and theories and may include low-fidelity elements of simulation. Typically, CBI and WBT courses are fully self-directed (i.e., taken by Developmentals or CPCs without an instructor and completed at their own pace);
- **Simulation:** Training conducted in an environment that simulates air traffic operations, allowing Developmentals or CPCs to apply and demonstrate basic skills and knowledge while allowing the playback and feedback not possible under regular operations. The FAA categorizes simulation as low, medium, or high-fidelity based on the degree to which the simulation replicates factors (e.g., airplane capabilities and flight operating environments) in real-world air traffic scenarios; and
- **OJT:** Training conducted by a qualified On-The-Job Training Instructor (OJTI) who teaches Developmentals the principles of air traffic control through their direct experience in the work environment.

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[1] Taken together the job tasks, knowledge, and skills are the strongest representation of competencies. The FAA does not use the term competencies in training planning, and therefore, throughout this document the Study Team focuses on job tasks, knowledge, and skills required of ATCS.

[2] Source of definitions: Federal Aviation Administration. Order JO 3120.4M, *Air Traffic Technical Training*. 15 March 2011. http://www.faa.gov/documentLibrary/media/Order/3120percent204Mpercent20FINALpercent20withpercent20Signaturepercent20110311.pdf

Study Purpose and Scope

This report addresses the following:

- A review of the current training strategy for ATCS;
- An analysis of the job tasks, knowledge, and skills required of ATCS for successful performance;
- An analysis of ATCS job tasks, knowledge, and skills required for NextGen;
- An analysis of available training approaches to satisfy current and future job tasks, knowledge, and skills; and
- Recommendations to improve the training system, strategy, and improvement plan.

While AJI continuously assesses its ATCS training courses to improve them, efforts included as part of this study date back to the Job Task Analysis (JTA) completed in November 2007 as part of the establishment of curriculum architecture.

Study Approach

This section provides an overview of the approach that AJI used to collect data about the ATCS Training Program as well as current efforts underway to evolve the curriculum architecture and to implement a strategy for improving ATCS training. Through the literature review and analysis, AJI developed recommendations included in this report. Figure 1 illustrates the high-level methodology AJI employed to develop this report.

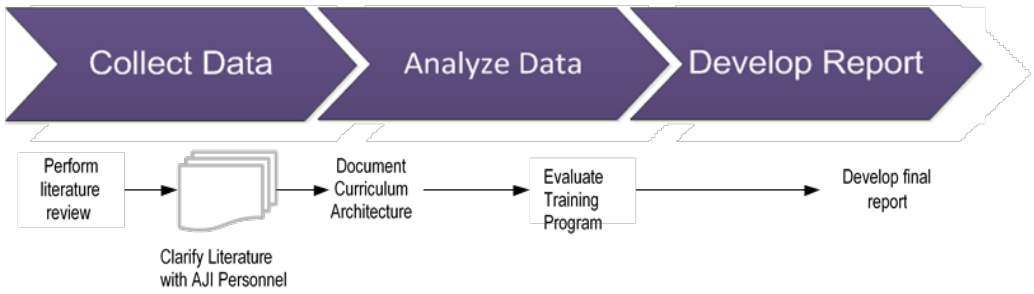


Figure 1. Study Approach

AJI reviewed a series of documents, spreadsheets, and processes to identify the history, present state, and future plans for ATCS technical training. A full list of materials reviewed by AJI can be found in Appendix A. AJI documented the findings and prepared recommendations for inclusion in this report.

Stakeholders

Stakeholders of this report include individuals and organizations impacted by the ATCS training curriculum. Table 1 highlights key stakeholders in the training process along with their functional roles.

Table 1. Stakeholders and Functional Roles

Acronym	Stakeholder	Functional Role in Air Traffic Controller Training
AJG	Management Services	FAA Air Traffic Organization (ATO) Division that oversees a number of ATO offices including Communications; Organizational Effectiveness; International; Comptroller, Planning and Business Services; Performance Analysis and Strategy; Workforce Services; Liaison and Coordination; Leadership and Professional Development; and Model Workforce and Diversity. AJG works with the FAA Academy, air traffic control facilities, and FAA Human Resources (AHR) to hire and place Developmentals at air traffic control facilities.
AJI	Safety and Technical Training	FAA ATO Division that designs, develops, updates, and maintains course curriculum to meet ATO training requirements, including course content, assessment tests, and evaluations; responds to and approves (or declines) course content change requests; responds to requests for information about FAA training.
AMA	FAA Academy	The FAA Academy provides technical and managerial training and development for the FAA workforce and the aviation community. Services provided by the Academy include: • Conducting air traffic controller training courses • Planning, maintaining, and managing the FAA's distance learning systems • Providing training program management and consultation services • Working with AHR, AJG, and air traffic control facilities to hire and place Developmentals in Academy training courses and air traffic control facility training
ATM	Air Traffic Manager	Individual responsible for the overall efficiency and effectiveness of the air traffic control facility training program. In contract flight service stations, Operations Manager is synonymous with ATM.
ATO	Air Traffic Organization	FAA Organization responsible for moving air traffic safely and efficiently; works with commercial and private aviation stakeholders and the military; provides guidance and support to employees— the 35,000 controllers, technicians, engineers, and support personnel whose daily efforts keep aircraft moving safely through the nation's skies; sets overall direction for air traffic controller training, including training requirements.
NATCA	National Air Traffic Controllers Association	Organization that represents over 20,000 controllers, engineers, and other safety-related professionals. NATCA represents the interests of its membership as well as the safety interests of the flying public. Controllers, designated as NATCA training representatives at their air traffic control facilities, work with management to develop the air traffic control facility-specific training plan.
Interagency Planning Office (ANG-I) (formerly Joint Planning and Development Office (JPDO))	Interagency Planning Office	Provides leadership in planning and developing NextGen. Coordinates NextGen initiatives, programs and policy development (including training efforts) across the various FAA lines of business and staff offices. The office also works with other U.S. federal and state government agencies, the FAA's international counterparts, and members of the aviation community to ensure harmonization of NextGen policies and procedures (including training efforts).
Service Centers	Service Centers	FAA Organizations whose roles are to provide shared services that promote standardization of processes, efficiency and effectiveness, and support the communication of new JOs or revisions to Jos Service Centers bring people together with similar expertise, allow sharing of ideas, and promote collaboration to improve processes, enhance communication, and the sharing of resources.

Acronym	Stakeholder	Functional Role in Air Traffic Controller Training
Training Managers	Training Managers	Individuals designated to manage air traffic control facility training programs and develop training schedules for Developmentals and CPCs-In Training (CPC-ITs). Training Managers also: 1) ensure that the air traffic control facility training program is planned, conducted, assessed, and revised on a continuous basis; 2) administer the training contract at the local level; 3) ensure local course materials, visual aids, and control scenarios are developed, properly labeled, and continually updated to ensure technical accuracy; 4) maintain training documentation; 5) plan and direct the training of personnel involved in the OJT/certification process. (Note: Not all air traffic control facilities have training managers; in the absence of a training manager, the ATM or training specialists undertake this role.)
Training Specialist	Training Specialist	Individuals who assist the Training Manager with air traffic control facility training delivery.
Training Teams	Training Teams	A team designated to facilitate the training of a Developmentals and CPC-ITs including OJT, performance evaluations, and monitoring training hours for trainee assigned to the Team. Training Teams are typically comprised of two OJTIs and one Front Line Manager (FLM) per trainee.

2. ATCS Training System: AJI Curriculum Architecture

ATO Curriculum Architecture for Current Training Courses

Section 609 (a) (1) (A) a review of the current training system for air traffic controllers, including the technical training strategy.

This section provides an overview of the documents developed by AJI to form curriculum architecture for ATCS training. It also explains the chronological progression of the development of this training system and the publication of reports that influenced its evolution. AJI continually works to improve the curriculum architecture for national training. The curriculum architecture is documented in workbooks described in further detail in this section.

AJI's curriculum architecture can be described as the framework for planning training for ATCS. It provides traceability between the ATC position's requirements, which are documented hierarchically as activities, sub-activities, and tasks, as well as the training curriculum comprised of courses and lessons. The curriculum architecture is a critical part of the training system, as it gathers previously scattered information on training courses into a single set of files and introduces elements of training evaluation and development that were previously omitted or underutilized. Some examples include assigning proficiency levels to courses and proposing new types of instructional media, learning devices, or methods to carry out training.

AJI uses a formal process for developing and evaluating training course content. AJI's centralized process for revising training increases the transparency and establishes the ability to track revisions made to the curriculum architecture and associated courses.

Job Task Analysis

In 2007, the FAA conducted a JTA for the purpose of developing performance standards for ATCSs at TRACON, Tower, and En Route air traffic control facilities. The JTA identified current and future work requirements. It also rated work tasks in terms of their difficulty to learn and their importance. Although the JTA was not performed to align training curriculum to job tasks or to determine needs for more training, it served as a hierarchical representation of the activities, sub-activities, and tasks that ATCSs were expected to perform as part of their duties at the time. It broke down expected job tasks based on the air traffic control facility types.

Table 2 shows that in 2007, the JTA contained 22 activities, 141 sub-activities, and 1,037 tasks. A significant portion of activities, sub-activities, and tasks were required in more than one air traffic control facility type and were double or triple counted.

Table 2. 2007 JTA for the Air Traffic Controller Position

Facility Type	Activities	Sub-Activities	Tasks
TRACON	7	42	328
Tower	8	54	406
En Route	7	45	303
Total	22	141	1,037

The 2007 JTA contained a listing of the KSAO associated with the ATCS position and a partial DIF analysis that rated sub-activities in the JTA according to a prescribed scale for their level of difficulty for learning and their importance. DIF analysis was not fully incorporated into the curriculum architecture, as the 2007 JTA initiative was not undertaken for the purpose of developing a training curriculum.

In 2011, the FAA NextGen Human Factors Office contracted with AIR to update the 2007 JTA. The Curriculum Architecture Report of Analysis and ATO Curriculum Structure (JTA Report) was published in June 2011. AIR reviewed 50 of the 264 ATCS courses offered at the time for multiple analytical purposes. Table 3 provides the report's main findings:

Table 3. JTA Report Approaches and Findings

Topic	Approach and Results
Air Traffic Proficiency Level Review	Aligned each course objective to a verb domain, according to Bloom's taxonomy, and then linked the verb domain to the proficiency level, according to definitions supplied by the ATO.3. Determined that 76 percent of the reviewed courses were taught at a novice or intermediate level followed by 24 percent at an advanced level and no courses at an expert level.
Air Traffic Media Selection Review	Examined the verb domain associated with the course objective and the current media used to teach the course. Determined the potential future media options for the course based on its assigned proficiency level and verb domain. The majority (93 percent) of reviewed courses was Instructor-Led Training (ILT) while the remainder combined the e- learning methodology with ILT. In recommending future media options, the FAA vendor considered "optimizing learning and balance development, delivery costs, audience size, audience location, and DIF Analysis ratings."
Air Traffic Objective Review	Key words in a course's objective(s), such as the verb domain or performance level, were compared to the content in the End-of-Lesson Test (EOLT) to determine the strength of the match. The purpose of the objective/assessment matches at the course level is to show the completeness of the courses and their EOLTs. Definitions applied to rate how well EOLTs corresponded to lesson objectives as either "Yes," "Partial," "None," "No EOLT," and "Missing." Review found that: • 46 percent of reviewed courses had EOLTs that matched their lesson objectives, • 24 percent had a partial match, • 24 percent had no EOLT, and • Six percent of courses had "Missing" rating meaning they did not contain lesson assessments or EOLTs.

In addition, the JTA Report recommended:

- carrying out a full DIF analysis to prioritize the delivery of refresher and recurrent training,

[3] Bloom's Taxonomy is a classification of learning objectives highly regarded in the education sector proposed in 1956 by a committee of educators chaired by Benjamin Bloom.

- endorsing the alignment of proficiency level ratings with job tasks and the integration of KSAO into the course analysis, and
- updating the JTA to document the duties of ATCS in specialized ATCS operations.

AIR found that Oceanic and Traffic Management Unit (TMU) curriculum, because of the different set of tasks, would likely require additional training courses. A summary table is included in Appendix B.

The report provided AJI with a valuable assessment of the courses reviewed and revealed the need for a comprehensive review of the current training curriculum.

Curriculum Model

AJI implemented recommendations from the 2011 JTA Report by completing the ATCS Curriculum Model in April 2012. The ATCS Curriculum Model is a spreadsheet-based analysis on the complete set of current courses in the training system for the ATCS position. The model shows the current media used to instruct versus the potential media that could be employed to improve the learning experience based on the assigned proficiency level. It also covered the course's assigned proficiency level and how well the EOLTs match lesson objective(s). More details on proficiency level can be found in Appendix C.

The Curriculum Model also contains metrics showing the distribution of current media hours by type (e.g., eLearning, ILT) along with a break out of potential media hours by type. Other metrics include the share of courses by proficiency level and the percent of courses by rating indicating the degree of match between EOLTs and lesson objectives. Finally, the model contains criteria definitions applied to classify the proficiency level and degree of match between EOLTs and lesson objectives. Table 4 recreates a table from the Curriculum Model showing the breakdown of ATCS training courses by assigned proficiency level.

Table 4. ATCS Training Courses by Proficiency Level

Proficiency Level	Scale Number	Courses	Proficiency Level Percent
Novice	1	119	49.4
Intermediate	2	68	28.2
Advanced	3	3	1.2
Expert	4	0	0
N/A[4]	N/A	51	21.2
Total		241	100

In addition to the Curriculum Model, AJI completed the “Sorting Tool” for Air Traffic Curriculum in July 2012. AJI describes it as a "traceability analysis" for individual courses, objectives, and lessons to job tasks.

Sorting Tool

Unlike the Curriculum Model, the Sorting Tool maps elements of the current training curriculum to the 2011 JTA and applies a rating scale to measure how well lessons in the current courses align to activities and sub-activities. Table 5 displays the rating scale AJI applies to measure the match between an activity or sub-activity to a lesson's objective.

[4] Courses that did not have documented objectives (51 or 21.2% of courses) could not be given a proficiency level so N/A was used

Table 5. Rating Scale for Match

Value/Color	Meaning	Range
3	Lesson links directly to the activity or sub-activity	76-100 percent match
2	Lesson supports the activity or sub-activity, but is not an exact match	51-75 percent match
1	Lesson is associated with the activity or sub-activity, but does not directly link/support	1-50 percent match

The Sorting Tool is also valuable for measuring the strength of the link between the training curriculum and the JTA. It shows the number of sub-activities receiving a "3," "2," or "1" rating to express the strength of the link between tasks and the lesson objective. This strength rating is based on word matching between the two elements. Table 6 illustrates this analysis.

For example, a total of 32 sub-activities had a "3," "2," or "1" rating with respect to how closely tasks aligned to the lesson objectives in Course 10603. The numbers of sub-activities addressed by the lessons total 1,048, so only three percent of sub-activities are being addressed by these lesson objectives for this course, but none of them were direct or strong links. This measure of percent of sub-activities matched is conducted at the lesson level and results are summed to present information by course.

Table 6. Strength of Link between the Training and JTA

Course	"3" Matches	"2" Matches	"1" Match	Total Matches	Total Possible Activity Matches per Objectives	Percent Matched
10603	0	15	17	32	1,048	3.05
12051	6	101	798	905	23,973	3.78
50019	199	110	548	857	9,694	8.84
50034	9	41	131	181	1,386	13.06

At the course level, 63.6 percent of objectives match an activity or sub-activity, and at the lesson level, 44 percent align. This discrepancy occurs because ATCS courses have been developed over many years as task after task was added to the curriculum. The curriculum was not designed as a whole from the beginning with a comprehensive, occupational JTA as the basis. The creation of the Sorting Tool and the Curriculum Model provided a baseline of the current training curriculum.

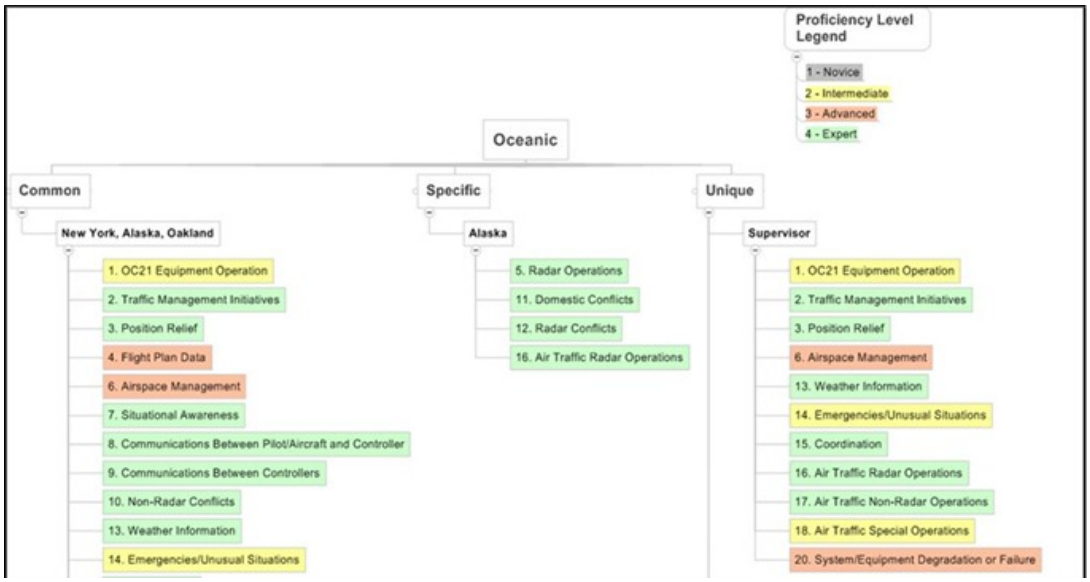
Curriculum Architecture for Future Training Courses

AJI sees value in streamlining its proposed training curriculum for the future. While analyzing current training courses, AJI concluded that many activities were covered in multiple trainings. The proposed curriculum for ATCS, excluding the Oceanic and TMU curriculum tracks, consists of 75 courses, as opposed to the 239 courses documented in the Sorting Tool. The introduction of modules, which groups together related lessons, totals 649 lessons as opposed to the current total of 1,687 lessons.

AJI continues to develop curriculum architecture for the proposed future state of training. The deliverables for proposed curriculum were developed in this order during 2012-2013:

- *TMU Curriculum Map Workbook* (May 2012);
- *Oceanic Curriculum Map Workbook* (May 2012);
- *Job Task Analysis Workbook* (August 2012);
- *Curriculum Map PDF* (March 2013); and
- *ATCS Course Analysis & Design* (April 2013)

The *TMU Curriculum Map Workbook* and *Oceanic Curriculum Map Workbook* are the first of the proposed training curriculum. AJI included many features recommended in the JTA Report: DIF Analysis, proficiency ratings, refresher course scores, and a rationale for the suggested instructional method. AJI introduced curriculum streams whereby the sequence in which ATCS should take courses, and their progressively higher proficiency levels, are mapped. Sequences are defined at the course level and the module level. Figure 2 shows the curriculum stream for teaching Oceanic courses and the associated proficiency level.



AJI developed an alignment of job tasks against course material, DIF ratings, and proficiency level assignments in the Job Task Analysis Workbook to serve as the foundation for the proposed curriculum. In March 2013, AJI completed the Curriculum Map describing the proposed streamlining of curriculum tracks for En Route, Tower, and TRACON ATCS. The maps provide AJI a visual method to interpret hierarchical representation of the proposed training curricula that is not immediately recognizable in workbooks. AJI then developed the ATCS KSAO to align activities, sub-activities, and tasks in the 2011 JTA. Figure 3 shows the mapping of the JTA hierarchy to the KSAO.

Figure 3. JTA mapped to KSAOs

The ATCS Course Analysis & Design is an analysis of the proposed training curriculum for ATCS, excluding the Oceanic and TMU. This analysis:

- Aligns a hierarchy of elements in the proposed courses, from the course to the topic level, to the 2011 JTA using a color-coded hierarchy;
- Applies a full DIF analysis to prioritize course delivery and suggest instructional media; and
- Classifies two proficiency scales to every job task based on the performance level versus knowledge level required to perform it. For example, training may require someone to perform a task at the Advanced level, but only level “C” knowledge is needed with “A” being highest.

In developing the proposed future training curriculum, AJI is identifying and reviewing courses that need to be taken by all ATCS, as well as identifying redundant course materials.

3. Analysis of Current and Future ATCS

Section 609 (a) (1) (B) an analysis of the competencies required of air traffic controllers for successful performance in the current and future projected air traffic control environment.

Taken together, the job tasks, knowledge, and skills are the strongest representation of competencies. AJI does not use the term “competencies” in training, rather AJI focuses on job tasks, knowledge, and skills required of ATCS.

Current: Job Tasks

Job tasks are described in the JTA, a hierarchical representation of activities associated with the ATCS position. Activities are divided into sub-activities, tasks, sub-tasks, steps, and elements. There is a JTA hierarchy for each air traffic control facility type based on differences in ATCS duties. It employs four colors to differentiate levels within a hierarchy that provide increasingly detailed descriptions of the ATCS’ duties. Table 7 illustrates the JTA hierarchy with the ATCS activity "Maintain non-radar separation requirements."

Table 7. Sample JTA Hierarchy ("Maintain non-radar separation requirements")

Alpha-Numeric ID	JTA Level	Task Statement
A8	Activity	Maintain non-radar separation requirements
SA23	Sub-Activity	Establish non-radar separation requirements
T69	Task	Determine non-radar separation requirements
ST204	Sub-Task	Record flight information on a flight progress strip
ST205	Sub-Task	Calculate position using information on the flight progress strip
T70	Task	Identify potential or actual conflicts during non-radar separation
SA24	Sub-Activity	Apply non-radar separation requirements
T72	Task	Determine potential control actions during non-radar separation
T74	Task	Prioritize control actions during non-radar separation
T76	Task	Issue control actions during non-radar separation
T77	Task	Receive pilot report of completed control instruction

The JTA is a large, comprehensive listing of 75 activities, 200 sub-activities, 653 tasks, 1,674 sub-tasks, 219 steps, and 24 elements. However, the number of discrete activities, sub-activities and tasks is not actually this high. The list includes an entry for each method/stage of training delivery. For example, activity "A26 - Maintain situational awareness at the position" is counted three times depending on

whether the activity's training is taught at the Academy, in an air traffic control facility classroom, or as OJT. The list also includes entries for tasks performed at each air traffic control facility type. ATCSs at all three types of air traffic control facilities are expected to perform 23 of the 28 JTA activities and must perform the sub-activities, tasks, sub-tasks, steps, and elements associated with an activity.

Current: Knowledge and Skills

As described above, AIR developed the ATCS KSAO and aligned it with activities, sub-activities, and tasks in the 2011 JTA. Color-coded cells indicate how the knowledge is employed. For training purposes, AJI focuses on knowledge and skills that can be taught. If a Developmental is brought into the ATCS Training Program, AJI assumes that they have the abilities and other personal characteristics required to succeed in the ATCS position. Abilities and other personal characteristics are “inherent traits” that should be considered during hiring.

Table 8 shows the knowledge table that lists 27 knowledge categories for the ATCS position. Each form of knowledge may have many sub-areas. For example, the knowledge category K2 (General Air Traffic Structure) is comprised of eight sub-areas.

Table 8. Knowledge Categories

No.	Knowledge	No.	Knowledge
K1	Federal Aviation Administration	K15	Airspace
K2	General Air Traffic Structure	K16	Flight Plan Data
K3	Professional ATCS Requirements	K17	Air Traffic Management Procedures
K4	Aviation Science	K18	Facility-Specific Characteristics
K5	Human Factors in Aviation	K19	Facility Tools and Equipment
K6	Geography	K20	ATC Communication Processes
K7	Navigation	K21	Concept of Separation
K8	Basic Weather Concepts	K22	Providing ATC Services
K9	Surveillance Systems Architecture	K23	Additional ATC Services
K10	Communication Systems Architecture	K24	Approach / Arrival Operations
K11	Aircraft Characteristics and Features	K25	Departure Operations
K12	Aircraft Operations	K26	Special Operations
K13	General Airport Characteristics	K27	Emergency and Unusual Situations
K14	Aeronautical Publications and ATC Procedures and Directives		

In ATCS KSAO, there are 59 skills classified under the following 12 groups:

- Air Traffic Management
- Communication
- Conflicts
- Emergencies
- Information Management
- Math and Science
- Situation Awareness
- Task Management
- Teamwork
- Time Sharing
- Tools and Equipment
- Weather

Table 9 shows an example of the alignment between some of the skill groups (Communication, Time Sharing, and Information Management) and defined skills as found in the ATCS KSAO.

Table 9. Skills Organization

No.	Skill Group	Skill Label	Skill Definition
Sk1	Communication	Oral Communication	Skill at verbally communicating properly formatted clearances, instructions, and other air traffic information clearly and concisely in English using the appropriate tone.
Sk2	Communication	Written Communication	Skill at recording control actions completely and accurately by writing on flight strips, scratch pads, and other forms.
Sk3	Communication	Active Listening	Skill at attending to what others are saying during air traffic communications, taking time to understand the information being relayed, and asking questions to clarify if necessary.

No.	Skill Group	Skill Label	Skill Definition
Sk4	Time Sharing	Task Switching	Skill at shifting rapidly between tasks during periods of high workload.
Sk5	Time Sharing	Attention Switching	Skill at shifting rapidly between auditory and visual sources to obtain information needed.
Sk6	Time Sharing	Interruption Recovery	Skill at maintaining situation awareness and returning quickly to work tasks after being interrupted.
Sk7	Information Management	Information Location	Skill at finding and cross-referencing information in air traffic control sources.
Sk8	Information Management	Decoding	Skill at interpreting air traffic related symbols, acronyms, abbreviations, and other truncated data such as data blocks.
Sk9	Information Management	Encoding	Skill at converting air traffic information into codes, symbols, and abbreviations for use in managing air traffic.

Table 10 shows how components of the "Knowledge and Skills" tables are mapped to tasks in the JTA. In the example, the task of receiving initial radio communication from the pilot is associated with the required knowledge K6.4: Types of Altitude References (AGL, MSL) and the skill Sk45: Conflict Resolution Strategy Implementation.

Table 10. Knowledge and Skills Mapping to JTA

Scalar Number	Statement	A/SA/T /ST/S/E	Knowledge	Skill	Skill Definition
A5	Manage communication	Activity			
A5.1	Perform radio communication	Sub-Activity			
A5.1.1	Receive initial radio communication from pilot	Task	K6.4 Types of Altitude References (AGL, MSL)	Sk45, Conflict Resolution Strategy Implementation	Skill at implementing conflict resolution strategies in a timely and effective manner.

Note: Frequently, tasks are mapped to more than one knowledge and skill; however, this example is limited to due to space constraints.

Job Tasks in the Future

The number and type of JTA activities have expanded in number and detail between the JTA in the Curriculum Model and the Course Analysis & Design as shown in Table 11.

Table 11. Comparison of JTAs (Curriculum Model vs. Course Analysis & Design)

Curriculum Model (JTA Activities)		Course Analysis & Design (JTA Activities)	
A1	Establish Situational Awareness	A1	Support a safety culture
A2	Manage Communications	A2	Establish teamwork and professional standards
A3	Manage Flight Plan Data	A3	Adhere to airspace structure fundamentals
A4	Manage Air Traffic	A4	Manage flight plan data
A5	Resolve Conflicts	A5	Manage communication
A6	Manage Traffic Flows and Sequences	A6	Evaluate weather conditions
A7	Transfer of Radar Identification	A7	Manage emergencies and unusual situations
A8	Assess the Impact of Weather	A8	Maintain non-radar separation requirements
A9	Manage Airspace	A9	Manage airborne departures (Tower only)
A10	Manage Resources	A10	Operate automation equipment
A11	Respond to Emergencies and Unusual Situations	A11	Maintain situational awareness of the equipment and airport Information
		A12	Manage airport changes (Tower only)
		A13	Establish radar identification
		A14	Transfer radar identification
		A15	Assemble clearances
		A16	Maintain separation requirements
		A17	Manage departures (Tower only)

Curriculum Model (JTA Activities)		Course Analysis & Design (JTA Activities)	
		A18	Manage departure and arrival flows
		A19	Adhere to Traffic Management Initiatives (TMI)
		A20	Manage flight path deviations and aircraft nonconformance
		A21	Respond to movement area violations (Tower only)
		A22	Manage Visual Flight Rules (VFR) flight processes
		A23	Manage Special Activity Airspace (SAA) procedures
		A24	Manage special operation procedures
		A25	Manage airspace configurations
		A26	Maintain situational awareness at the position
		A27	Respond to system/equipment degradation/failure
		A28	Manage air traffic controller resources

Performance and Knowledge Proficiency in the Future

For the proposed curriculum in the *Course Analysis & Design*, AJI uses "roadmaps" that show how trainees should progress. Courses and their sub-elements are rated using two proficiency scales for every job task based on the performance level versus the knowledge level required to perform it. As Developmentals progress through training, they are expected to perform at increasingly higher proficiency levels. As shown previously in Table 4, performance proficiency levels range from Beginner (level 1) to Expert (level 4). The knowledge proficiency levels include (a) can identify and name parts, tools and facts about the task; (b) can determine step-by-step procedures for doing the task; (c) can identify why and when the task must be done and why each step is needed; and (d) can evaluate conditions and make proper decisions about the subject.

Table 12 shows the progression of training and the proficiency level that a trainee should attain for non-radar separation after completing each stage of training. A newly hired Developmental must attain a proficiency level of 2b or “Intermediate” during their Academy training. All Developmentals entering facility training should have attained proficiency level 2b so that the facility knows the base-level of knowledge. Developmentals should attain the proficiency level of 3c or “Advanced” in facility classroom and simulation, and 4d or “Expert” through OJT. The curriculum track is organized so that through this progression of training, Developmentals attain 4d proficiency, which is the required proficiency for CPC certification.

Table 12. Proficiency Schedule

A8. Maintain non-radar separation requirements (Course: Non-radar Separation Requirements)							
Location	Difficulty to Learn	Difficulty to Perform	Importance	Frequency	Academy	Facility	OJT
Academy	5	5	5	3	2b		
Facility	5	5	5	3		3c	
OJT	5	5	5	3			4d

The Course Analysis & Design lists, for each task, the proficiency that a Developmental must attain before he or she can move to the next level of training.

4. Analysis of NextGen Impacts on the Future ATCS Environment

Section 609 (a) (1) (C) an analysis of the competencies projected to be required of air traffic controllers as the Federal Aviation Administration transitions to the Next Generation Air Transportation System.

This section provides a brief overview of NextGen and studies conducted to identify ATCS job requirements in the future NextGen environment. AJI notes that the ATCS environment is continuously evolving, and that NextGen is one of the drivers for change. To respond to Section 609 (a) requirements, AJI focused on changes to ATCS job tasks and required

training as a result of NextGen implementation. This section also summarizes activities to assess various training approaches to satisfy the future requirements.

NextGen's Impact on the ATCS Job

Other FAA lines of business conducted or commissioned several studies to assess the effects of NextGen on the ATCS job. This section describes activities to identify and describe the requirements of ATCS as the FAA transitions to NextGen.

Training Gap Analysis White Paper (09/2011) and Strategic Training Needs Analysis (08/2012)

AIR developed a vision of what ATCS job tasks could be in 2018 in their white paper entitled "Training Gap Analysis." The paper identified changes in job tasks and KSAOs. This document outlined the gap between the existing training curriculum and the future of ATCS job tasks. It was formulated as a guide for the FAA on modifying the training and pre-employment selection process. Building on the outcomes of the "Training Gap Analysis" white paper, AIR completed a Strategic Training Needs Analysis (STNA) in which they determined the effect of those drivers on the ATCS job tasks in the future. These findings led them to make recommendations on training ATCSs for NextGen.

AIR found that NextGen will have a disproportionate impact by specific air traffic control facility type and air traffic control facility level. Towers will be most affected, then TRACON and En Route. Larger air traffic control facilities will be more affected, while the smaller air traffic control facilities will experience less change. The drivers planned to be implemented by 2018 are specified in Table 13.

Table 13. Tower, TRACON, and En Route NextGen Drivers for implementation by 2018

Tower	TRACON	En Route
1. 4-Dimensional Weather Data Cube (4-D Wx Data Cube) 2. Airport Surface Detection Equipment-Model X (ASDE-X) 3. Automatic Dependent Surveillance- Broadcast Out (ADS-B Out) 4. Data Communications (Data Comm) 5. Integrated Arrival, Departure, and Surface (IADS) 6. Terminal Automation Modernization and Replacement (TAMR) 7. Tower Flight Data Manager (TFDM) 8. Wake Turbulence Mitigation	1. 4-Dimensional Weather Data Cube (4-D Wx Data Cube) 2. Automatic Dependent Surveillance-Broadcast Out (ADS-B Out) 3. Integrated Arrival, Departure, and Surface 4. Optimized Profile Descents (OPDs) 5. Performance-Based Navigation (PBN) 6. Terminal Automation Modernization and Replacement, Phase 3 (TAMR 3) 7. Wake Turbulence Mitigation for Arrivals (WTMA)	1. 4-Dimensional Weather Data Cube (4-D Wx Data Cube) 2. Automatic Dependent Surveillance-Broadcast Out (ADS- B Out) 3. Data Communications (Data Comm) 4. Initial Tailored Arrivals (ITAs) 5. Performance-Based Navigation (PBN) 6. Time-Based Flow Management Program (TBFM)

In addition to affecting the ATCS job tasks, NextGen drivers will affect the KSAO as described in Table 14. The required knowledge and skills are the most important for training in NextGen implementation.

Table 14. Tower, TRACON, and En Route NextGen drivers that impact KSAO

ATCS Position	Tower	TRACON	En Route
Knowledge	ATCS Automation Interoperability	ATCS Automation Interoperability	ATCS Automation Interoperability
Skills	Service Delivery Orientation	Service Delivery Orientation	Service Delivery Orientation
Abilities			
Other Personal Characteristics	Technology Acceptance	Technology Acceptance	Technology Acceptance

The STNA included a three-step process: (1) Develop Training Plans, (2) Develop Training Requirements, and (3) Develop Resources Estimates as described below.

- **Develop training plans:** Using a prioritized list of knowledge and skills linked to job tasks, AIR developed training plans for ATCS in Tower, TRACON, and En Route air traffic control facilities that the FAA can use to develop NextGen training;
- **Develop training requirements:** AIR identified the training requirements for each NextGen driver and ATCS position at Tower, TRACON, and En Route air traffic control facilities. The FAA incorporated these into the curriculum architecture, as appropriate; and
- **Develop resource estimates:** AIR developed algorithms for resource estimates including cost and time, for each NextGen driver. These can be used to estimate the resources required to develop, implement, evaluate, and maintain ATCS training.

NextGen Capabilities with Implications for Air Traffic Controller Training (06/2012)

The MITRE Corporation studied NextGen capabilities that are expected to impact air traffic operations. MITRE's report identified NextGen implementation portfolios and corresponding capabilities that are expected to change ATCS procedures or tasks. The report also revealed which ATCS positions will be affected, specifications on whether each capability is automation or procedure-based, and the implementation timelines for each capability. The outcomes of this study have implications for the training of ATCS.

The MITRE report and the STNA convey that NextGen will have a substantial influence on the ATCS job. AJI reviewed the outcomes and recommendations of studies conducted to date. Significant training updates will be required to train all of the new ATCS job tasks, knowledge, and skills. These studies provides important data that can be applied to plans for future training.

Various Training Approaches Available to Satisfy Required ATCS Job Tasks, Knowledge, and Skills

As described above, the FAA conducted several studies to learn what will be required of ATCS as the FAA implements NextGen. The FAA also commissioned the following studies and developed work groups to learn what improvements should be made to ATCS training that would support the implementation of NextGen.

Section 609 (a) (1) (D) an analysis of various training approaches available to satisfy the air traffic controller competencies.

FAA Independent Review Panel (IRP) on the Selection, Assignment and Training of Air Traffic Control Specialists (09/2011)

The IRP reviewed a broad array of training topics including screening, hiring, air traffic control facility assignments, and content/delivery. The IRP produced a set of 49 recommendations on ATCS selection, assignment, and training. While not specific to NextGen, implementation of these recommendations will support improvement of the ATCS Training Program and to satisfy current and future ATCS training requirements.

Technologies, Delivery Methods, and Processes Needed to Facilitate Training for NextGen Capabilities: A Case Study (01/2013)

The MITRE Corporation examined the relationship between effective and efficient ATCS training and the successful implementation and operation of new ATCS capabilities. This examination correlated with four NextGen drivers that represent a wide range of training audiences including Developmentals and CPCs. The report identified training objectives and recommendations suitable for training processes, methods, and technologies for each NextGen capability.

For example, MITRE explored the Traffic Flow Management (TFM) Program driver and reported four automation-based capabilities in the TFM Program:[5]

- Extended metering (7);
- Arrival Interval Management (IM) using ground automation (9);
- En Route path stretching capability for delay absorption (9); and
- Airborne rerouting (8)

There are 12 knowledge-based training objectives that address all capabilities in the TFM Program. Using these training objectives, MITRE recommended the following training technologies for the TFM Program:

- Stand-alone capabilities (require no instructor involvement);
- Videos, blogs, message boards, and web conferencing;
- Automated training with performance feedback;
- Guided scenarios with speech technology;
- Skill-focused exercises; and
- Hands-on skill scenarios.

The report also recommended a high-level training evolution/improvement plan for NextGen. The plan is comprised of two components:

- Complete and comprehensive curricula that includes functional descriptions as well as operational concepts, recommended practices, and intended benefits of new capabilities; and
- Application of advanced training technology to the curriculum to support efficient delivery of training and effective learning.

DIF Analysis

AJI completed the DIF Analysis to recommend instructional approaches – either facilitated, self- paced, or a blend of both methods – to train the proposed curriculum. The instructional approach was determined based on the DIF score and then confirmed or modified by subject matter experts (SMEs). Generally, more complex, important, and frequent tasks are selected for facilitated methods. Types of facilitated courses include ILT or structured OJT. Self-paced instructional media would encompass eLearning courses or some forms of simulation.

Table 15 describes the recommended instructional mediums for the proposed curriculum, their distribution among the courses, and their distribution or share, by estimated minutes of training required.

[5] The number in parentheses represents the number of skill-based training objectives for each of the capabilities

Table 15. Instructional Media for Proposed Curriculum

Instructional Medium	Description	Courses	Minutes	Share
eLearning	Comprises all forms of electronically supported training.	10	6,102	6 percent
ILT	Courses delivered by one or several instructors and/or SMEs and can be in a traditional classroom setting. Instructors may be using white boards, PowerPoint, or other media.	13	6,922	6 percent
Structured OJT	Employee training at the place of work while he or she is doing the actual job.	25	34,754	32 percent
Blended	Combination of facilitated and self-paced courses.	18	22,163	21 percent
Coaching	Coaching is used with employees who already know the job and have proven themselves capable with possibly one or two areas where the employee needs strengthening. It is more ad hoc in nature, with the intervention based on observation of the employee's performance. The manager or a fellow employee can provide coaching. It can be done by the manager or a fellow employee.	5	3,594	3 percent
Part-Task Training (PTT)	Equipment training provided through the physical mock-up of specific elements of the real equipment.	18	13,256	12 percent
Simulation	A place where the student can demonstrate principles that applies to the real world, not just simulation.	18	20,474	19 percent
Total		107	107,263	100 percent

AJI Working Groups

AJI sponsors operational teams that are conducting analyses in anticipation of NextGen, including:

- An AJI team that continues to evaluate how NextGen will change the air traffic work environment and what competencies will be required for the future workforce. AJI is incorporating what it learns from this evolving and ongoing process into training programs as new systems are implemented; and
- An AJI team that continues to evaluate and review the IRP recommendations for ongoing implementation.

Summary

AJI found that there are several previous and ongoing efforts to assess the future ATCS job tasks, and to identify the best approaches for training ATCS. The FAA is actively reviewing and implementing the IRP recommendations. AJI is challenged to track and coordinate activities across the different reports and stakeholders. Coordination is essential to ensure that implementation of NextGen capabilities and training activities happen in the right sequence. The FAA's offices should continue to coordinate with each other and other key stakeholders to make sure they are leveraging activities and resources. The FAA recommends a systematic approach for tracking and evaluating the recommendations, as well as documenting roles and responsibilities.

5. Recommendations

Section 609 (a) (1) (E) recommendations to improve the current training system for air traffic controllers, including the technical training strategy and improvement plan.

AJI must continue to improve and evolve the ATCS Training Program to ensure that ATCSs are trained to be successful. AJI has not produced a documented improvement plan for the ATCS Training Program, but has made significant efforts to assess the training program and develop recommendations for improvement, as described in the previous sections. AJI developed recommendations that, when implemented, will help AJI to continue down the current improvement trajectory. AJI focused on high-level recommendations that could be applied across the

organization. AJI is continuing operational efforts to improve training. AJI shared that there are several new and ongoing efforts, including the following:

- Establish training standards;
- Establish an evaluation program to evaluate quality of training on a rotational basis;
- Develop guides on media selection;
- Develop guides for SMEs to understand training design process;
- Update and maintain the curriculum architecture;
- Revamp new hire training;
- Undertake cost planning to update ATCS training;
- Establish baselines for areas exposed as weaknesses;
- Export KSAO to the agency for working together in terms of hiring, etc.; and
- Conduct a DIF Analysis to schedule refresher training – take the information to identify priorities for refresher training and course revisions and development.

Taken together, all of these activities are expected to improve the training program in the short-term and to support the training of ATCSs and Developmentals for the implementation of NextGen capabilities. In addition, based on findings from the Section 609(a) Report, AJI will:

- Improve tracking of recommendations to identify priorities proactively for ATCS training improvement; and
- Improve coordination across the organizations responsible for training and training improvement initiatives; and
- Develop a comprehensive ATCS training strategy.

Improve Tracking of Recommendations

The FAA and AJI have made a significant investment in evaluating NextGen and the required evolution of training. Through completion of these activities, the FAA and AJI have received a significant number of recommendations from internal and external parties. This review identified that AJI should assess the recommendations proposed by previous analysis; document their consideration of the recommendations; and identify whether the recommendation is a priority for implementation.

When AJI decides a recommendation should be implemented, they should assign a task lead, develop an implementation plan, and track progress of the implementation.

Improve Coordination

AJI is just one of several organizations involved in managing the impacts of NextGen. Success entails coordination and collaboration among multiple organizations in commissioning studies, gathering recommendations, planning and implementing initiatives for NextGen. To ensure consistency throughout the agency, AJI will continue to work at improving coordination with key stakeholders to promote the NextGen concepts into existing and future ATCS training programs.

Develop an ATCS Training Strategy

One of AJI's immediate next steps is to develop an ATCS Training Strategy. Using this report's findings, as well as the current JTA and DIF Analysis, the STNA, and prior case studies including NextGen studies, AJI will develop a training strategy that incorporates the aforementioned training improvements and supports implementation of recommendations identified as short and long term priorities. In addition, AJI will incorporate recommendations and implement initiatives (e.g., adopting better metrics) that address the Government Accountability Office (GAO) and Office of Inspector General (OIG) concerns.

Summary

AJI's review to address the requirements of Section 609 (a) revealed AJI's progress in improving training planning. In 2011, AJI contracted with AIR to update the 2007 JTA. In doing so, and by furthering the curriculum architecture activities, AJI gained better insight into the current training curriculum. In addition, to understand the future environment, AJI commissioned a number of studies to understand the effects of NextGen on the ATCS job and associated technical training requirements. Through the completion of these studies, and a review of their outcomes, AJI has a well-developed picture of the current training environment and the potential effects of NextGen. As a result, AJI can better understand the connections between job task requirements, training objectives, and training outcomes. AJI will be able to respond to the changing environment more effectively in years to come. AJI can now apply these insights strategically by prioritizing training development and identifying redundant training to improve efficiency and reduce costs.

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Appendix A. Materials Reviewed as Part of This Study

Date of Publication	Title	Relevance to 609 (a) Report
6/20/2011	Curriculum Architecture Report of Analysis and ATO Curriculum Structure	Identifies deficiencies in the 2007 JTA for ATCS position with respect to applying it to develop training curriculum. Provides analysis on current and future instructional media options and the recommended proficiency level for training courses.
9/22/2011	FAA Independent Review Panel on the Selection, Assignment and Training of Air Traffic Control Specialists	Reports find that the Academy does not provide new controller candidates with sufficient instruction in the fundamental air traffic control knowledge and skills necessary to become certified controllers.
9/30/2011	Training Gap Analysis (White Paper)	Identifies many of the competencies projected to be required of air traffic controllers due to NextGen by 2018. Explains NextGen technologies expected to be in place and how they may automate certain procedures for ATCS.
2012	TMU Curriculum Map 2012 Final	Describes the audience for each course, JTA list, DIF, proficiency, refresher rating, suggested delivery method and curriculum sequence.
1/11/2012	609 (b) Review and Evaluation of Air Traffic Controller Training at the FAA Academy	Addresses need to review the current training system for ATCS, including the technical training strategy and improvement plan.
1/12/2012	DOT OIG Report on FAA ATCS Staffing and Training	Finds that air traffic control facilities critical to moving air traffic safely and efficiently through the NAS have a higher percentage of their controllers in training and a higher attrition rate for trainees because the complexity of their airspace makes it harder to certify.
4/9/2012	Air Traffic Curriculum Model V1	Analyzes current courses being taught. Includes analysis of current proficiency levels, course media, and alignment between end of lesson tests and course objectives.
5/24/2012	Oceanic Curriculum Map Workbook V1.5	Describes the audience for each course, JTA list, DIF, proficiency, refresher rating, suggested delivery method, and curriculum sequence.
6/1/2012	MITRE NextGen Capabilities with Implications for ATCS Training	Describes NextGen capabilities that are expected to have an operational impact on air traffic controllers and, consequently, will require new or modifications to existing training.
8/3/2012	ATCS Sorting Tool V2	Analyzes all available current ATCS courses. Filterable spreadsheet that identifies alignment between job tasks and existing course materials with the strength of that alignment.
8/17/2012	Tech Ops Sorting Tool Final	Analyzes all available current Tech Ops courses. Filterable spreadsheet that identifies alignment between job tasks and existing course materials along with the strength of that alignment.
8/31/2012	AIR Strategic Training Needs Assessment: NextGen 2018	Describes the five-step process used to develop the NextGen 2018 Training Plans for ATCS in all three job options. Provides overview of the purpose of developing training requirements; including the foundation of the estimates and general assumptions about the scope of work, NextGen drivers, and the training process.
9/11/2012	Curriculum Architecture (CA) Findings Briefing	Provides overview of the elements that make up the Curriculum Architecture and how it improves the development of ATCS training.
10/24/2012	Tech Ops Curriculum Model v1	Analyzes current courses, including proficiency levels, course media, and alignment between end of lesson tests and course objectives.
1/1/2013	MITRE Technologies, Delivery Methods, and Processes Needed to Facilitate Training for NextGen Capabilities: A Case Study	Examines the relationship between improved training, and the successful implementation and operation of new ATCS capabilities. Purpose is to define and illustrate the relationship between effective and efficient ATCS training and the successful implementation and operation of new ATCS capabilities.
3/28/2013	ATCS KSAO V1.2	Documents the KSAO needed to perform tasks as part of the ATCS daily job routine that was obtained from the NextGen 2018 ATCS Knowledge Crosswalk. The workbook drills down into activities, tasks, and subtasks to associate KSAO and identify training foci.

Date of Publication	Title	Relevance to 609 (a) Report
4/5/2013	FAA ATCS Course Analysis Design V 01.4	Compiles broad information for designing the ATCS training curriculum including job task analyses, proficiency and DIF criteria and instructional strategies.
4/12/2013	Section 224 Review and Evaluation of Training Performance at FAA Air Traffic Control Facilities/Report (DRAFT)	Explores training performance at the level of the individual ATCS facility. Identifies high performing, average, and underperforming facilities based on pass/fail rates and their trainees' rates for meeting FAA Time to Certify (TTC) targets set by FAA headquarters by facility level.
4/30/2013	609 (b) Review and Evaluation of Air Traffic Controller Training at FAA Air Traffic Control Facilities/Facilities Report DRAFT (for Review)	Examines how roles, responsibilities, and processes for training are communicated, documented, and shared throughout the FAA and how facilities determine how many Developmentals each facility can accommodate annually.

Appendix B. JTA Recommendations

Training Element	Recommendation
DIF Analysis	Capture ratings for all three ratings of the DIF Analysis to determine the need for refresher and recurrent training.
Proficiency Levels for Job Tasks	Apply proficiency scale and definitions to job tasks, in addition to course objectives, and have them influence how much time to spend training for a task and the potential instructional media.
KSAO mapping	Concluded that abilities and other attributes may be pre-hire considerations, but that knowledge and skills should be addressed by training.
TMU & Oceanic	Capture two major work areas that were not part of the original JTA: TMU and Oceanic.

Appendix C. Proficiency Level

The proficiency level applies two different proficiency scales to rate each element of the JTA hierarchy. One proficiency scale is based on the proficiency level needed to perform the task (Performance) and the other is based on the level of demonstrated understanding of the reason for performing the task in a particular sequence and the ability to troubleshoot (Knowledge). As illustrated in Table C-1 and Table C-2, the Performance scale runs from one to four and the Knowledge scale from a to d with each successively higher rating corresponding to higher demonstration of task mastery.

Table C - 1. Performance Proficiency Scale

Task Performance Level	Scale Value	Definition
	1	Novice - Can do simple parts of the task. Needs to be told or shown how to do most of the task. Experience gained through classroom and/or experimental scenarios or as a trainee on-the-job.
	2	Intermediate - Can successfully complete the task as requested. Expert help required from time to time on the most difficult tasks. Performs with assistance.
	3	Advanced - Can perform all actions without assistance and has full mastery of assigned task. Can consistently explain in detail task completion process. Does all parts of the task. Efficiently performs task with aids.
	4	Expert - Can do the complete task quickly and accurately. Provides guidance, troubleshoots, and answers questions related to field expertise. Can tell or show others how to do the task.

Table C - 2. Knowledge Proficiency Scale

Task Knowledge Level	Scale Value	Definition
	a	Can identify and name parts, tools, and simple facts about the task.
	b	Can determine step-by-step procedures for doing the task.
	c	Can identify why and when the task must be done, and why each step is needed.
	d	Can evaluate conditions and make proper decisions about the subject.