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History of the Air Traffic Collegiate Training Initiative (AT-CTI) Program 1991-2016

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16. Abstract

In the 1989 FAA Flight Plan for Training, the Federal Aviation Administration (FAA) proposed testing the concept of off-loading some portion of air traffic control specialist (ATCS) training onto colleges and universities. This was the genesis of the program that became known as the Air Traffic Collegiate Training Initiative (AT-CTI). Beginning in 1989, the FAA entered into partnerships with selected post-secondary educational institutions to conduct some portion of ATCS technical training. The program grew from an original five institutions to a total of 36 participating colleges and universities by 2012.

The report describes the initiation and growth of the AT-CTI program from its beginnings in 1989 through 2016 across 5 time periods: Before 1991; 1991-1996; 1997-2006; 2007-2012; and 2013-2016. Internal and external events impacting the AT-CTI program in each time period are described. The goal of the report is to provide a factual history of the program as a first step towards an overall summative program evaluation.

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Introduction

In 1991, the U.S. Federal Aviation Administration (FAA) formed partnerships with five post-secondary educational institutions to provide initial training of air traffic control specialists (ATCSs). The program grew over the next two decades to include as many as 36 participating colleges and universities under the banner of the Air Traffic Collegiate Training Initiative (AT-CTI). The purpose of this report is to develop a history of the AT-CTI program.

Other authors have described the inception and development of the AT-CTI program. Schattenberg (2000) provided a summary overview of controller occupational qualifications, aptitude testing, and initial training along with a list of educational institutions participating in the FAA AT-CTI program at that time. Ruiz and Ruiz (2003) traced the history of three collegiate aviation education programs: the Air Traffic Cooperative Education Program, the Airway Science Curriculum Demonstration Program, and the AT-CTI program. Ruiz and Ruiz noted a lack of a single source of information for the inception and development of each program and attempted to fill that gap. But their history only went through 2003. Ruiz (2007) provided a description of the AT-CTI program development through 2006. Pavel (2012) described the AT-CTI program inception and expansion through 2012. He also provided some detail about the evolution of the ATCS selection process over the years. Coyne (2014) focused specifically on the AT-CTI program history from inception through early 2014. This report builds on and extends these previous reports by drawing on, wherever possible, primary sources such as internal FAA program-related documents to provide a comprehensive history of the AT-CTI program from inception through 2016.

The report is organized into six major sections. First, a brief overview of the ATCS occupation is presented, including recruitment, selection, and training. The second section describes the ideas and events through 1990 that led to creation of the AT-CTI program. The third section focuses on the formal demonstration program that was conducted from 1991 through 1996. The fourth major section of the report focuses on program expansion and institutionalization from 1997 through 2006. The fifth section describes the continued expansion of the program from 2007 through 2012. The report concludes with a description of events in 2013 through 2016 that impacted the AT-CTI program.

The Air Traffic Control Specialist (ATCS) occupation

The ATCS (or air traffic controller or, most simply, controller) occupation is the single largest and most visible occupational group in the FAA. Controllers are responsible for ensuring the safe, efficient, and orderly flow of air traffic in what is known as the U.S. National Airspace System (NAS). For an overview of the structure and function of the NAS, the day-to-day work of air traffic controllers, and the types of facilities in which they work, see resources such as the Controller Workforce Plan (FAA, 2017) and the FAA website (for example, "Follow A Flight Across America" at (https://www.faa.gov/air_traffic/flight_across_america/), and Nolan (2010), a standard academic reference on air traffic control. Briefly, there are about 14,500 non-supervisory air traffic controllers working in 315 air traffic control facilities (FAA, 2017, p. 10 & 13). There are two broad classes of facilities: terminal and en route. Terminal facilities provide air traffic control services at and around airports. En route facilities, commonly known as "centers," provide air traffic control services to aircraft generally at higher altitudes en route from one airport to another. The facility type determines the "option" in which a controller trains and works in accordance with the ATCS technical training order (FAA, 2015, p. 4-1). Controllers in the terminal option train for and work in terminal facilities (e.g., airport traffic control towers

[ATCTs] and terminal radar approach control [TRACONs] facilities), while controllers in the en route option train for and work in centers (e.g., air route traffic control centers [ARTCCs]).

ATCS recruitment begins with the opening of a vacancy announcement against which interested persons may apply. Generally, the FAA recruits from two primary sources: persons with prior air traffic control (ATC) experience such as former military controllers, and persons without such actual ATC job experience. The discussion from this point will be restricted to persons without prior qualifying ATC experience.

To be hired as an entry-level trainee in the ATCS occupation (e.g., "ATCS trainee"), an applicant without prior ATC-specific experience must meet certain minimum requirements. The current requirements for persons without prior qualifying ATCS job experience, as listed on the FAA public website ((https://www.faa.gov/jobs/career_fields/aviation_careers/) and ATCS job announcements are:

- Be a United States citizen;
- Be age 30 or under (on the closing date of the application period);
- Pass a medical examination;
- Pass a security investigation;
- Pass the FAA air traffic pre-employment tests;
- Speak English clearly enough to be understood over communications equipment; and
- Have three years of progressively responsible work experience, or a Bachelor's degree, or a combination of post-secondary education and work experience that totals three years.

Provided a person meets these requirements, he or she might be considered for employment by the FAA as an ATCS trainee. The methods for making actual selections are beyond the scope of this historical review, but suffice it to say that selections into the ATCS occupation are made in accordance with all relevant FAA and federal policies, regulations, and laws.

ATCS hiring has waxed and waned over the decades. For example, the FAA hired 27,925 new controllers between 1981 and 1992 (Figure 1) in the wake of the 1981 Professional Air Traffic Controller Organization (PATCO) strike. About 15,000 of those new controllers successfully completed Academy and facility training process by 1995 (see Broach, 1998, 2005). Hiring then declined through the mid- and late-1990s, only to increase in the mid-2000s as the controllers hired after the strike reached retirement age (FAA, 2016a). FAA expects to lose 11,225 controllers to retirements and other reasons over the ten-year period of 2017-2026 (FAA, 2017, p. 39). Over that same 10-year span, FAA projects hiring 10,869 new controllers (p. 42). Projected and actual hiring from 2006 through 2026, based on the published annual air traffic controller workforce plans, are illustrated in (Figure 2). ATCS hiring peaked in 2008 at 2,196 persons, declined in 2013 to 554 due to the effects of federal budget sequestration, and then recovered to 1,680 in 2016. The FAA projects hiring 1,781 new controllers in 2017 and 1,701 in 2018. The majority of hires since 2005 have had no prior ATC experience and were hired as entry-level ATCS trainees.

Figure 1: ATCS hiring by fiscal year, 1981-1992

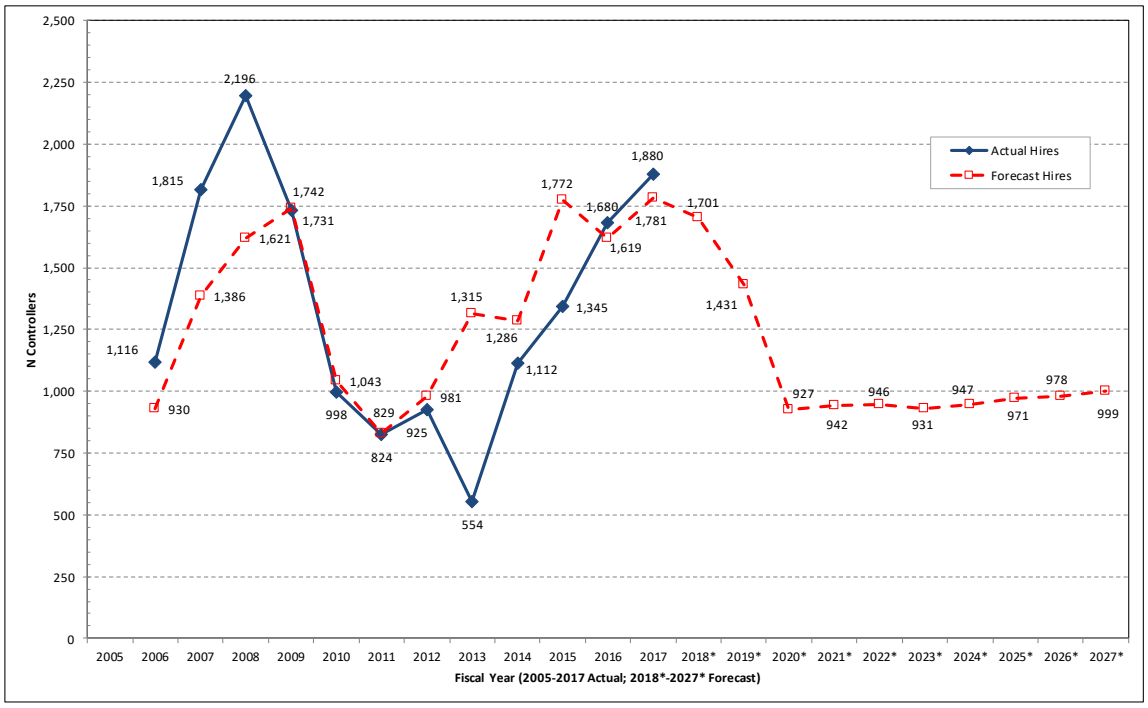

Figure 2: ATCS projected and actual hiring by fiscal year, 2006-2026

Once hired, ATCS trainees embark on a rigorous, extensive, and expensive training program. The training program for ATCS trainees begins with initial training at the FAA Academy. The length of the Academy training courses for ATCS trainees has varied over time, ranging from just 9 weeks from 1985 through 1992 to as long as 17 weeks in 2016 for trainees in the en route option. Regardless of the length of training in different time periods, the structure of Academy training has always included two major components: classroom instruction in ATC knowledge, rules and procedures; and hands-on practice and application in ATC simulations ranging from low to high fidelity. ATCS trainees who succeed at the FAA Academy enter training at a FAA ATC facility; this phase of training is often labeled as facility or field training. Academy graduates are also promoted from "trainee" to "developmental" status and pay.

Facility training for ATCS developmentals has always been much longer than Academy training and is measured in months (or years) rather than weeks. Facility training averages about 18 to 36 months, depending on facility type and level (Manning, 1998; Air Traffic Organization Technical Training Directorate, 2016). Facility training includes classroom, simulator, and on-the-job training (OJT) (FAA, 2015). OJT is conducted on position with live traffic under the close supervision of a more senior, fully qualified controller serving as an OJT-Instructor. Success in facility training culminates in designation as a Certified Professional Controller (CPC). Failure to progress satisfactorily in training can lead to termination, transfer to a lower level ATC facility or transfer to a non-ATC position within the facility (FAA, 2013). Thus, there are losses at each stage of training. The success and loss rates in ATCS training at the FAA Academy and in the field have varied substantially over the years, as shown in Figure 3.

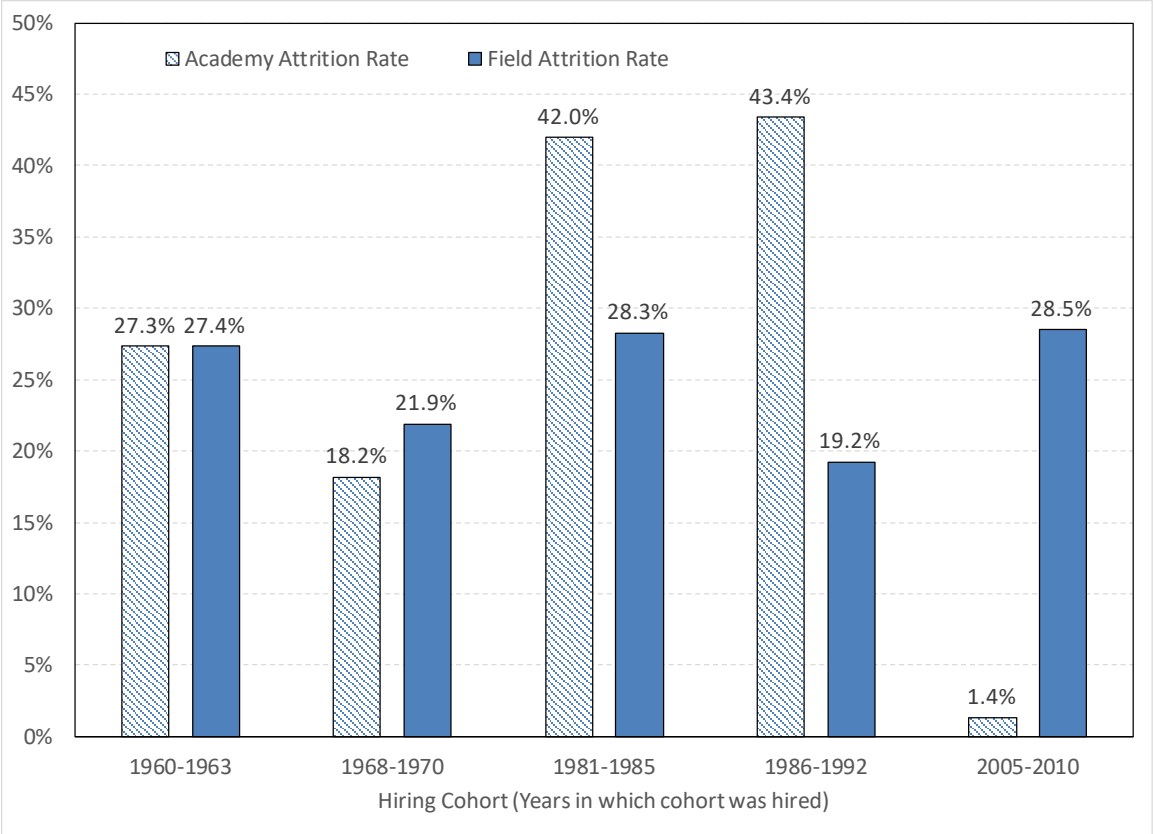

Figure 3: Historical FAA Academy and field training loss rates (Source: Broach, 2017)

Losses in ATCS training have long been a concern for both the agency and its overseers. As early as 1960, the field training attrition rate was characterized as a "serious problem" (Davis, Kerle, Silvestro, & Wallace, 1960). Similar concerns were noted in the 1970 report of the Air Traffic Controller Career Committee (Corson, Bernhard, Catterson, Fleming, Lewis, Mitchell, & Ruttenberg, 1970). High field attrition rates caught the attention of the U.S. Congress in 1975, resulting in a hearing and Congressional recommendations on how to reduce such losses (*Selection and Training of FAA Air Traffic Controllers*, 1975). Training attrition rates were a significant concern all through the 1980s as the FAA rebuilt the controller workforce following the 1981 PATCO strike (U.S. General Accounting Office (GAO), 1986, 1987). For example, the GAO testified in 1986 that the attrition rate at the FAA Academy and in facility training was about double what had been originally projected (GAO, 1986, p. 10-11). Subsequent testimony and audits during the 1980s repeated the GAO concerns about ATCS training and the impact of loss rates on achieving target staffing levels at field facilities (GAO, 1987, 1988, 1989a, b). Attrition, which occurs for a variety of reasons, in ATCS training is expected and planned for even today. For example, the annual ATCS workforce plan provides an estimate of expected losses at both the FAA Academy and in facility training based on historical loss rates (FAA, 2017, p. 37-38).

Program Antecedents through 1990

Several ideas emerged against this historical backdrop to help mitigate training attrition. One idea was to capitalize on changes in the technology of training. For example, the Human Resources Research Organization (Alexandria, VA) was contracted by the FAA to conduct an independent analysis of the ATCS training system from the perspectives of cognitive and instructional psychology. The study authors developed several short- and long-term

recommendations ranging from a straightforward review of the training curriculum to development of specialized part- and whole-task ATC simulations with intelligent tutoring capabilities (Means, et al., 1988).

Another idea that gained ground in the 1980s was to expand the pipeline by using the capabilities of the nation's colleges and universities to train new air traffic controllers. The idea of using the nation's colleges and universities for the training of FAA air traffic controllers was raised as early as 1983 in the aftermath of the 1981 PATCO strike (Odegard, 1983). By the mid- and late-1980s, aviation academicians were strongly advocating for using the nation's universities and colleges for training controllers (Armstrong, 1986; *FAA Training Programs,* 1989).

This attention and focus on controller training coalesced in the form of the FAA *Flight Plan for Training* (FAA, 1989). The *Flight Plan for Training* pointed to anticipated growth in air traffic operations and technological change as key drivers for FAA training processes. The *Flight Plan for Training* also identified issues and concerns regarding FAA training processes. With respect to ATCS training specifically, the *Flight Plan for Training* concluded that "Training, especially for air traffic control, has been overly focused on screening out failures rather than on improving the skills of trainees to meet FAA standards" (p. 4). The *Flight Plan for Training* set a future goal for training: "Optimize the tradeoff between who is hired and what training must be provided – selectively shift the burden of training to organizations outside the agency" (p. 7). In pursuit of that specific goal, the plan called for forging a new relationship with institutions of higher education (p. 8). The anticipated result of such a relationship was "skilled applicants who come to the FAA prepared to pass the required tests and screens" (p. 8). This new relationship between FAA and post-secondary educational institutions would "…permit off-loading of training to pre-hire and will establish liaisons that keep the FAA abreast of the latest in curriculum design and advanced training technologies" (p. 12). These goals were addressed in a specific initiative entitled "Pre-Hire ATC Training" (p. 28). The initiative was described as follows:

> "Pre-hire training at the college and university level will provide an economical new source of highly qualified and motivated Air Traffic Control Specialists. To test this concept, a trial Air Traffic Control (ATC) training program will be conducted. A university-based pilot program in which one hundred students will earn undergraduate degrees and receive the equivalent of the FAA Academy's developmental training will be initiated in 1989. If hired by the agency, these students will enter the FAA training system at an advanced level. The agency will expand this program to other universities and colleges if the experimental program is successful." (FAA, 1989, p. 28)

It appears that identification and selection of post-secondary educational institutions to participate in the initiative began shortly after the publication of the *Flight Plan for Training*. For example, the U.S. Congress earmarked $3.4M for the establishment of the Minnesota Mid-America Aviation Resource Consortium (MARC) ATCS training program in the FY1990 appropriations for the FAA (*Department of Transportation and Related Agencies Appropriations Act, 1990*). The FAA entered into a $5M contract with Hampton University in May 1990 for development of a prototype program for air traffic control training. The Community College of Beaver County, Pennsylvania (CCBC-PA), reached an agreement with the FAA in August 1990 to conduct a five-year prototype ATCS training program.

Pre-Hire Air Traffic Control Demonstration Program, 1991-1996

By 1991, five institutions had entered into agreements with the FAA for the training of air traffic controllers. The five educational institutions were:

- Minnesota Air Traffic Control Training Center (MnATCTC), Eden Prairie, MN (also known as the MARC program);
- Hampton University (HU), Hampton, VA;
- Community College of Beaver County (CCBC-PA), Monaca, PA;
- University of North Dakota (UND), Grand Forks ND; and
- University of Alaska, Anchorage (UAA), Anchorage, AK.

Congress earmarked an additional $3.25M for the MnATCTC in the *Department of Transportation and Related Agencies Appropriations Act, 1991*.

1991 Order

With five institutions selected for the demonstration program, FAA then developed an order to govern the demonstration. The "Pre-Hire Air Traffic Control Demonstration Program" (FAA order 3120.26) was published on January 16, 1991. The objective of the Pre-Hire Air Traffic Control Demonstration Program ("ATC Demonstration Program") was

> "…to determine if post-secondary educational institutions can develop and validate an innovative selection process and training curriculum that encompasses the knowledge, skills, and abilities required of the air traffic control occupational field (terminal and en route options) under the current air traffic control operation and forthcoming advanced automation system. Institutions must also be able to develop a valid method of assessing the competency of all who complete the training." (FAA, 1991, p. 1)

The program had a five-year time limit. No specific termination criteria or expiration date for the demonstration program was set forth in the order[1]. The order did, however, establish criteria for selection of additional institutions into the program and defined FAA organizational responsibilities for program management. Under FAA order 3120.26, overall oversight and management of the ATC Demonstration Program was vested in the FAA Office of Training and Higher Education (AHT), a component of FAA Human Resources Management (AHR) organization in 1991. FAA Training Program Management Officers (TPMOs) in FAA regional offices served as liaisons among the participating educational institutions and the regional air traffic divisions in which the schools were located. The order also established criteria for selection of post-secondary educational institutions into the demonstration program in the future. According to the order, program selection criteria included faculty and facility resources to develop air traffic control curriculum, methodology to prepare students for air traffic control responsibilities, "strategy to aggressively recruit minorities and females" (p. 3), a commitment to student selection and screening in accordance with Title IX of the Civil Rights Act of 1964, a history of institutional graduates who have become ATCSs, and a "willingness to allow FAA to evaluate the total program."

The order clearly stated that "The hiring of graduates of these programs will be governed by FAA's recruitment needs for the ATC occupation; FAA will not guarantee employment of graduates" (p. 3). Moreover, other language in the order regarding the hiring and placement of graduates was permissive rather than mandatory. For example, the order provided that "FAA may hire the graduates of these programs who meet all of the qualifications for entering the ATC occupation and may, at its discretion, place some or all of the graduates from any given program directly into a field facility…" (p. 3). In other words, there was no guarantee of FAA employment for program graduates.

The ATC Demonstration Program became known as the AT-CTI program soon after the publication of the order (the term we will use from this point forward).

As the AT-CTI program was developing in 1991, the FAA was taking steps to overhaul the ATCS recruitment, selection, and training processes, driven by the perceived high failure rate

at the FAA Academy in the initial training course known as the Nonradar Screen (see Della Rocco, 1998). The Air Traffic Training Workgroup (1991) developed a proposed training plan. In particular, their plan called out the focus on continued screening of ATCS trainees instead of training which, as a consequence, did not prepare students sufficiently for field training. The Air Traffic Training Workgroup also pointed out that the "pass-fail" philosophy at the FAA Academy did not promote an environment where students could succeed in training (p. 5). The workgroup proposed the development of an ATC training curriculum that (a) taught the knowledge and skills required to enter field training, and (b) was based on "train-to-mastery" methods. The Air Traffic Training Workgroup proposed a new "Air Traffic Control Training Model" (Figure 4), with "Collegiate Initiatives" (e.g., AT-CTI) as one of three recruitment sources.

1992 Changes to ATCS Recruitment, Selection, and Training

Major changes to controller recruitment, selection, and training processes were initiated by the FAA in 1992. First, the FAA reduced the pace of hiring new ATCS trainees in 1992 (Figure 1). By 1992, the ATCS workforce was sufficiently recovered from the effects of the 1981 strike (see Broach, 1998, 2005) and the need for hiring large numbers of new controllers ended. Second, reflecting that recovery, the FAA ended the FAA Academy Nonradar Screen program. Third, the FAA undertook two programs to overhaul the controller selection process. In 1991, the FAA began validation of a new, prototype computerized test battery that became known as the ATCS Pre-Training Screen (ATCS-PTS; Broach & Brecht-Clark, 1994) to replace the now-closed Nonradar Screen

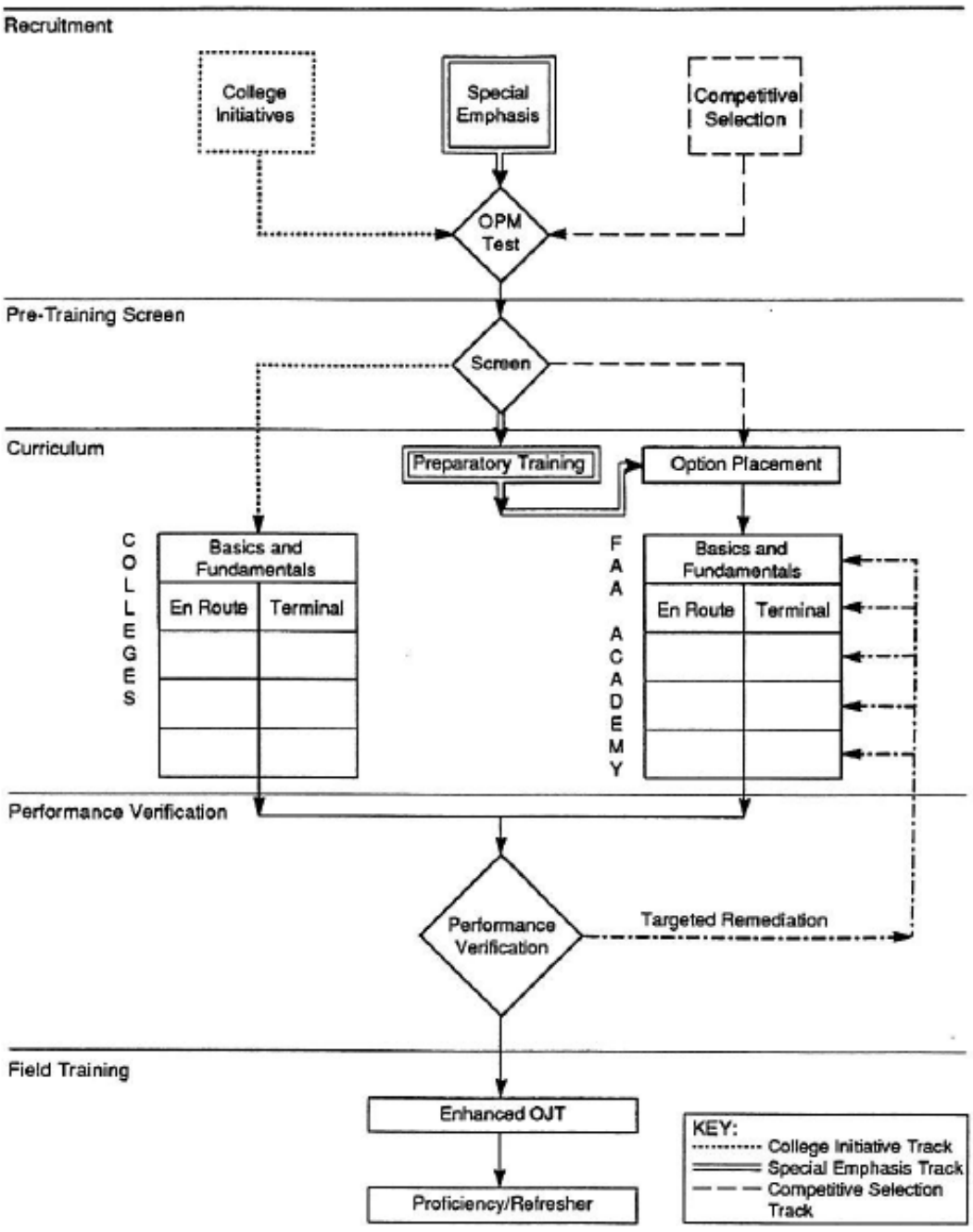

Figure 4: ATC "Multi-Path" training model

program. The new 5-day test battery was implemented in late 1992. At about the same time, the FAA issued a request for proposals for the development of a new ATCS aptitude test battery to replace the written test battery in use since 1981. Fourth, the FAA began implementing the vision of the Air Traffic Training Workgroup at the FAA Academy.

As of 1992, the FAA had hired 99 graduates from either CCBC-PA or MnATCTC under the AT-CTI program. As the average time to complete field training was about two years in terminal and three years in en route facilities, insufficient time had passed for any of those graduates to have completed facility training. The U.S. Congress provided astatutory basis for the AT-CTI program under Public Law 102-388 (*Department of Transportation and Related Agencies Appropriations Act, 1993*):

> "SEC. 362. COLLEGIATE TRAINING INITIATIVE.— (a) The Administrator of the Federal Aviation Administration may hereafter continue the Collegiate Training Initiative program, by entering into new agreements, and by maintaining existing agreements, with post-secondary educational institutions, as defined by the Administrator, whereby such institutions prepare students for the position of air traffic controller with the Department of Transportation, as defined in section 2109 of title 5, United States Code.
>
> (b) The Administrator may establish standards for the entry of institutions into such program and for their continued participation in it.
>
> (c) The Administrator may appoint persons who have successfully completed a course of training in such program to the position of air traffic controller noncompetitively in the excepted service, as defined in section 2103, of title 5, United States Code. Persons so appointed shall serve at the pleasure of the Administrator, subject to section 7511, of title 5, United States Code (pertaining to adverse actions). However, an appointment under this subsection may be converted from one in the excepted service to a career conditional or career appointment in the competitive civil service, as defined in section 2102, of title 5, United States Code, when the incumbent achieves full performance level air traffic controller status, as determined by the Administrator. The authority conferred by this subsection to make new appointments in the excepted service shall expire at the end of five years from the date of enactment of this Act, except that the Administrator may determine to extend such authority for one or more successive one-year periods thereafter."[2]

No fiscal year 1992 funds were provided to the MnATCTC program by the *Department of Transportation and Related Agencies Appropriations Act, 1992*.

1993 Events

An additional 66 AT-CTI graduates (5 from CCBC-PA and 61 from MnATCTC) were hired in 1993. The Congress also provided an additional $2.0M to the MnATCTC program in the appropriations act for fiscal year 1993 (*Department of Transportation and Related Agencies Appropriations Act, 1993*), bringing the total federal funding for that program up to $8.65M.

1994 Legislation and Hiring Procedures

In 1994, the Congress codified the legal authority for the AT-CTI program by amending Section 44506 of Title 49 of the United States Code (49 U.S.C. § 44506) with Public Law 103-272 (*To revise, codify, and enact without substantive change certain general and permanent laws, related to transportation, …*, July 5, 1994):

> "(c) Collegiate Training Initiative.—
>
> (1) The Administrator of the Federal Aviation Administration may maintain the Collegiate Training Initiative program by making new agreements and

> continuing existing agreements with institutions of higher education (as defined by the Administrator) under which the institutions prepare students for the position of air traffic controller with the Department of Transportation (as defined in section 2109 of title 5). The Administrator may establish standards for the entry of institutions into the program and for their continued participation.
> (2)
>
> > (A) The Administrator of the Federal Aviation Administration may appoint an individual who has successfully completed a course of training in a program described in paragraph (1) of this subsection to the position of air traffic controller noncompetitively in the excepted service (as defined in section 2103 of title 5). An individual appointed under this paragraph serves at the pleasure of the Administrator, subject to section 7511 of title 5. However, an appointment under this paragraph may be converted from one in the excepted service to a career conditional or career appointment in the competitive civil service (as defined in section 2102 of title 5) when the individual achieves full performance level air traffic controller status, as decided by the Administrator.
> > (B) The authority under subparagraph (A) of this paragraph to make appointments in the excepted service expires on October 6, 1997, except that the Administrator of the Federal Aviation Administration may extend the authority for one or more successive one-year periods."

The statutory language vested discretionary authority in the Administrator to continue existing agreements and to enter into new agreements with educational institutions for the training of air traffic controllers. This discretionary authority would expire in 1997 unless extended by the Administrator on an annual basis.

At the same time, the FAA issued the first Standard Operating Procedure (SOP) for the processing and referral of AT-CTI graduates for employment consideration (Manager, Human Resources Staffing Policy Division, 1994). The SOP provided that the written U.S. Office of Personnel Management (OPM) aptitude test battery "…may be administered at any time after the student is within 7 months of graduation from the program." This allowed AT-CTI students to apply with the FAA before graduation, with the written aptitude test scores good for up to three years. The SOP also allowed prospective graduates to begin the medical and security clearance process within six months of graduation. This policy was subsequently modified in December 1994 (Director of Human Resources Services for Air Traffic, 1994) in view of the dramatic decrease in the pace of controller hiring. Prospective graduates were completing the medical and security clearances only to languish on the CTI list for extended periods of time. But both the medical and security clearances were valid for just 6 months from date of completion. Therefore, medical and security clearances expired for many graduates as they waited to be hired. The medical and security clearance process had to be re-initiated for these graduates once they were under active consideration, imposing significant additional expenses on the FAA. The revised SOP deferred the medical examination and security investigation until such time as Air Traffic proposed hiring AT-CTI graduates. The pre-employment clearance process, therefore, was initiated once a job offer was made to an AT-CTI graduate. Once the graduate cleared the pre-employment process and was hired, the graduate was placed directly into a field facility in this time period (1991-1994), bypassing the entire FAA Academy initial training.

1995 Evaluation and Personnel Reform

In 1995, the FAA Headquarters Air Traffic Program Management organization conducted an internal evaluation of the AT-CTI program. The *Air Traffic Review of the Collegiate Training Initiative* (FAA, 1995) was based on a survey of facility management and

CTI graduates employed by the FAA as controllers. The purposes of the evaluation were to (a) determine how well college-based ATC training prepared students for FAA facility on-the-job training, (b) provide feedback to the AT-CTI institutions about persons hired and their progress in training, and (c) provide feedback to FAA Air Traffic to use in establishing national AT-CTI training requirements.

Surveys were distributed to 262 AT-CTI graduates and 71 facility Assistant Managers for Training (AMTs). Just 104 (40%) of the AT-CTI graduates completed the survey. Of the 104 AT-CTI graduates responding, just over half (56 or 54%) were graduates of the MnATCTC program and 36 (35%) were graduates from the CCBC-PA program. AT-CTI graduates, overall, indicated feeling well prepared for facility training, although specific deficiencies by school were noted by the graduates (for example, lack of non-radar training). Just 35 (49%) of the 71 facility AMTs completed their version of the survey. Overall, participating AMTs felt that AT-CTI graduates had the basic knowledge and skills to enter facility training. The AMTs also indicated that the AT-CTI graduates had "… positive attitudes, good communication skills, are hard-working, and are receptive to facility training" (FAA, 1995, p. 10).

In addition to the evaluation of the AT-CTI program, the FAA continued the overhaul of ATCS recruitment, selection, and training that began in 1991. There were three events, in particular, that were relevant to the evolution of the AT-CTI program in the mid-1990s. First, the FAA stopped using the ATCS Pre-Training Screen computerized test battery in the wake of a legal challenge to the test battery in early 1995. However, the FAA re-focused on and invested in the development and validation of a new computerized aptitude test that became known as the Air Traffic Selection and Training (AT-SAT) test battery (Ramos, Heil, & Manning, 2001a, b). Second, the Air Traffic Training Workgroup continued developing and refining the "Multi-Path Model" for hiring and training of controllers. The AT-CTI program was identified in the "Multi-Path Model" as one of four recruitment sources. Those four sources were (a) reinstatements (of former FAA controllers), (b) prior military controllers, (c) AT-CTI graduates, and (d) the general public without prior ATC education or experience. Finally, the U.S. Congress provided the FAA with legal authority to develop its own acquisition and personnel management systems (*Federal Aviation Reauthorization Act of 1996*, codified at 49 U.S.C. § 40122). Congress exempted the FAA from many of the requirements of Title 5 of the U.S. Code (the title governing the civil service). This provided the FAA with greater flexibility in recruitment and selection.

1996 CAMI Evaluation

By 1996, a total of 488 persons had graduated from the five participating institutions in the AT-CTI program. FAA employed 316 (65%) of those graduates, and 7 (1%) graduates had declined employment offers. Numerically, the MnATCTC program was the largest source, with 207 graduates by 1996, with 193 (94% of graduates) employed by the FAA as controllers. The Minnesota program also received another Congressional earmark for $250,000 in the FY1996 FAA appropriations bill (*Department of Transportation and Related Agencies Appropriations, 1996*). CCBC-PA had 152 graduates by 1996, but just 73 (48% of graduates) were employed by the FAA as controllers. UND had 75 graduates from the ATC program at that point, but just 7 (9% of graduates) were employed by the FAA. HU had 31 graduates, all of whom were employed by the FAA as of 1996. Finally, UAA had 23 graduates, with 12 (52% of graduates) employed by the FAA as controllers as of 1996. It is important to note that at this point in time, AT-CTI graduates bypassed the FAA Academy entirely and were placed directly into field facilities as developmental controllers.

The 1991 "Pre-Hire ATC Demonstration Program" order tasked the FAA's Civil Aeromedical Institute (CAMI, now the Civil Aerospace Medical Institute) with conducting formative and summative evaluations of the demonstration program. Formative evaluation

focuses on how a program is implemented operationally, including how a program is structured and managed; summative evaluation focuses on program outcomes, impact, and utility (Rossi, Lipsey & Freeman, 2004). CAMI initiated a formative evaluation in 1995 by awarding a contract to the Human Resources Research Organization, Alexandria, VA. The formative evaluation was published in 1996 by the Office of Aviation Medicine as a technical report titled "*A Formative Evaluation of the Collegiate Training Initiative – Air Traffic Control Specialist (CTI-ATCS) Program*" (Morrison, Fotohui, & Broach, 1996). Overall, that formative evaluation concluded that the programs at the five educational institutions appeared to be functioning well. They were making innovations in recruitment, selection (into their programs), and training that might benefit the FAA. However, the evaluation also noted that improvements in communications and program management were needed. The report also noted that the most serious problem facing the AT-CTI program was the reduction in demand for new entry level controllers. With the recovery of the ATCS workforce, the supply of AT-CTI graduates exceeded the FAA's need for new controllers, and graduates faced significant delays in hiring (Morrison, et al., p. 42).

In parallel, the re-design of the FAA's ATCS hiring and training processes continued, culminating in decisions to (a) formally implement the "Multi-Path Model" for ATCS training developed by the Air Traffic Training Workgroup, (b) transfer oversight and management of the AT-CTI program from Human Resources Management to Air Traffic, and (c) expand the AT-CTI program. Under the Multi-Path Model, graduates from AT-CTI institutions (except MnATCTC graduates) bypassed basic air traffic training and entered the FAA Academy at a more advanced stage of "skills-building" training. MnATCTC graduates continued to be placed directly into field facilities. Program management shifted from Human Resources Management (AHR) to the Air Traffic Training Requirements Program. That Air Traffic office developed a draft solicitation in December 1996 with the intention of distributing it to potential academic participants in January 1997.

AT-CTI Program Expansion and Institutionalization, 1997-2006

1997 Expansion

The Director of Air Traffic approved the program expansion on January 27, 1997 (Sweers, 1997). To be eligible for consideration, an institution of higher education had to meet the following criteria:

- Be an accredited degree granting, not for profit, 2 or 4-year post-secondary educational institution;
- Offer a non-engineering aviation degree;
- Have a viable aviation program demonstrated by at least 25 graduates per year in non-engineering aviation majors over the last five years; and
- Located within 100 miles of New York City or 200 miles of Washington, DC, Atlanta, GA, Dallas, TX, Cleveland, OH, Chicago, IL, San Francisco, CA, or Los Angeles, CA, or anywhere in Puerto Rico, Florida or Alaska.

The deadline for schools to apply was set as March 31, 1997. Final selection was to be completed by August 1997. Not more than 18 schools were to be selected in this expansion. At a minimum, schools were required to teach specific elements of the FAA Academy's initial qualifications training curriculum. These teaching objectives were defined in a January 1997 document titled *FAA Air Traffic Control's Collegiate Training Initiative Behavioral (Teaching) Objectives for Academic Standards* (FAA, 1997a). The FAA identified 34 potentially eligible schools for inclusion in the AT-CTI program. It appears, from available documents, that 14 schools submitted applications. Applications were evaluated on the following criteria (weights assigned to each criterion in parentheses; FAA, 1997b):

- Effectiveness, comprehensiveness, and appropriateness of the proposed approach to ensure acceptable coverage of the teaching objectives listed in the statement of work (25%).
- Extent and effectiveness of integration of the team training concept into the existing curriculum (10%).
- Relevant expertise of the faculty (10%).
- Student enrollment and cultural diversity in the aviation department, or aviation courses if there is no department (10%).
- Demonstrated expertise in teaching relevant aviation courses and effectiveness of the current program as shown through an ongoing assessment process (10%).
- Procedures in place to share expertise and resources with related programs (5%).
- Active relationships, provision, agreements that have been established with the aviation industry to include: cooperative education programs, intern programs, adjunct faculty, etc. (10%).
- Existence of an active Aviation Industry Advisory Board (5%).
- Air traffic control (ATC) simulation laboratory (5%).
- Availability of a flight simulation laboratory which includes ATC simulation capability (5%).
- Availability of a demonstrated plan for maintaining faculty currency in the curriculum on ATC procedures, methodology, etc. (5%).

Ten schools were initially selected for this expansion, but one declined, leaving nine schools. The FAA announced its selections on October 6, 1997 (FAA, 1997c; Table 1):

- Vaughn College of Aeronautics, Flushing NY;
- Daniel Webster College, Nashua, NH;
- Dowling College, Oakdale, NY;
- Embry-Riddle Aeronautical University, Daytona Beach, FL;
- Inter American University of Puerto Rico, San Juan, PR;
- Miami-Dade Community College, Miami, FL;
- Middle Tennessee State University, Murfreesboro, TN;
- Mount San Antonio College, Walnut, CA; and
- Purdue University, West Lafayette, IN.

The FAA press release announcing these selections noted that the nine new schools joined four other colleges that had been participating in the AT-CTI program for five years (FAA, 1997c). The press release did not include the MnATCTC program under the AT-CTI umbrella. Since MnATCTC was a funded program and all other AT-CTI schools were unfunded, it was decided to manage the Minnesota program as a FAA contract subject to procurement rules and regulations. This was reflected in subsequent Congressional language accompanying the FY1998 FAA appropriations bill in which the FAA was directed to "continue the current contractual relationship with MARC, as prescribed by law" (*Department of Transportation and Related Agencies Appropriations Bill, 1998*). Therefore, because of this change (to a contractual relationship), the MnATCTC program was not counted or reported under the AT-CTI program umbrella from 1998 forward.

The FAA hosted a 3-day national meeting for the nine new and four old schools in Oklahoma City in late October 1997 to provide information to the schools about the new training model being implemented by the FAA and revised policies and procedures for employment and placement. For example, the FAA began using "on-the-spot" hiring authority which allowed individuals who had successfully completed the ATC program at an approved AT-CTI institution to be appointed as an ATCS (FAA, 1997d). Of particular note, under this policy, AT-CTI

graduates had to achieve a “qualifying” score of at least 70 on the aptitude test in use at the time but were not rated or rank-ordered on

Table 1: AT-CTI schools by year of entry into the program[a]

Year	School	City	State
1991	Community College of Beaver County	Monaca	PA
	Hampton University	Hampton	VA
	University of Alaska Anchorage	Anchorage	AK
	University of North Dakota	Fargo	ND
1997	Daniel Webster College	Nashua	NH
	Dowling College	Shirley	NY
	Embry-Riddle Aeronautical University	Daytona Beach	FL
	InterAmerican University	San Juan	PR
	Miami-Dade College	Miami	FL
	Middle Tennessee State University	Murfreesboro	TN
	Mount San Antonio College	Walnut	CA
	Purdue University	West Lafayette	IN
	Vaughn College of Aeronautics & Technology	Oakdale	NY
2005	Minneapolis Community & Technical College[b]	Minneapolis	MN
2007	Arizona State University	Mesa	AZ
	Community College of Baltimore County	Baltimore	MD
	Florida State College at Jacksonville	Jacksonville	FL
	Green River Community College	Auburn	WA
	Kent State University	Kent	OH
	Lewis University	Romeoville	IL
	Metropolitan State University of Denver	Denver	CO
	Middle Georgia State University	Macon	GA
	University of Oklahoma	Norman	OK
2008	Aims Community College	Greeley	CO
	Broward Community College	Pembroke Pines	FL
	Eastern New Mexico University	Roswell	NM
	Embry-Riddle Aeronautical University	Prescott	AZ
	Jacksonville University	Jacksonville	FL
	LeTourneau University	Longview	TX
	Saint Cloud State University	Saint Cloud	MN
	Tulsa Community College	Tulsa	OK
2009	Florida Institute of Technology	Melbourne	FL
	Hesston College	Hesston	KS
	Sacramento City College	Sacramento	CA
	Texas State Technical College	Waco	TX
	Western Michigan University	Battle Creek	MI

Notes: [a]Several schools have changed their names since admission into the AT-CTI program; the current school name is used for convenience and consistency.
[b]MCTC petitioned separately in 2005 for admission to the AT-CTI program after taking over the MnATCTC program when the FAA-MARC contract ended.

the basis of that score. In addition, AT-CTI program graduates would now be required to attend the FAA Academy beginning in the fall of 1997 rather than being placed directly into field facilities. Finally, the schools were notified that the FAA intended to implement the Air Traffic Selection and Training (AT-SAT) computerized test battery to replace the older written aptitude test battery then in use.

It is important to note that expansion of the AT-CTI program in 1997 occurred during a time when the pace of controller hiring had slowed significantly. As shown in Figure 1, FAA hired an average of about 2,200 new controllers per year in 1985 through 1991. By the mid- to late-1990s, the FAA was hiring at less than half that rate. For example, just 650 ATCS trainees were hired in 1997, compared to 808 in 1998 and 313 in 1999, based on archival data maintained by CAMI. The majority of controllers were in their mid- to late-30s and projected retirements were not expected to increase until after 2000, peaking in the 2015-2017 period (Schroeder, Broach, & Farmer, 1998).

1998-2004 Events

Following the 1997 expansion, the AT-CTI program appeared to settle into a steady-state under the direction of Air Traffic. Revised procedures for the processing and referral of AT-CTI graduates for employment consideration were promulgated (Sprague, 1999). The pace of hiring remained relatively slow from 1999 through 2004 (just 9 new controllers were hired in 2004, for example, based on archival records). Much of management's attention to the program focused on hiring procedures and eligibility criteria (for example, Morgan, 2000). During this period, FAA began operational use of the computerized AT-SAT test battery in 2002 in place of the 1981-vintage written aptitude test battery (see King, Manning, & Drechsler, 2007). Relatively few persons were tested with AT-SAT initially. For example, just 196 persons took AT-SAT in 2002, based on archival AT-SAT examination data maintained by CAMI.

Despite the slower pace of hiring, watchdog organizations such as the U.S. Department of Transportation Office of the Inspector General (DOT OIG; 2004a, b), the Government Accountability Office (formerly the Government Accounting Office) (GAO, 2002, 2004), and the Congress began to give greater attention to the impending wave of controller retirements during this period. On December 13, 2003, the Congress passed the "*Vision 100--Century of Aviation Reauthorization Act*" which required the FAA to develop and report to the Congress a controller workforce plan. In response, the FAA convened a national cross-functional workgroup to develop such a plan. The first edition of "*A Plan for the Future: The Federal Aviation Administration's 10-year Strategy for the Air Traffic Control Workforce*" was published by FAA in December 2004.

In addition, Congressional funding for the MnATCTC program ended in 2004 and the contractual relationship with the FAA ended. The program subsequently suspended operations in 2004. Finally, the FAA hosted an AT-CTI conference in 2003 at the FAA Academy to share information about the controller hiring process, FAA plans, and changes in occupational training with the network of AT-CTI schools.

2005 External Reviews and Recommendations

The Minneapolis Community and Technical College (MCTC) system took over operations of the former MnATCTC program and petitioned for admission to the AT-CTI program in 2005 (FAA, 2006). As with the other participating institutions, the MCTC did not receive any FAA funding for its ATCS training program. Therefore, the MCTC was counted as an AT-CTI program starting in 2005.

ATCS staffing continued to be a concern in this time period. For example, the FAA Research, Engineering and Development Advisory Committee (REDAC) raised its concerns

about staffing the future ATC system in 2005. The REDAC, established by the Aviation Safety Research Act of 1988 (Public Law 100-591), provides advice and recommendations to the FAA Administrator on all aspects of the FAA's research programs. In a September 2005 REDAC meeting, the Subcommittee on Human Factors provided a briefing on workforce development and made several recommendations regarding the AT-CTI Program. Those recommendations included moving training to a system of performance-based metrics, providing clear guidance to AT-CTI schools for the advanced placement of their students in FAA Academy training, and exploring the possibility of an increase in the amount of training that AT-CTI schools can provide.

The DOT OIG was also concerned about ATCS staffing and training. In a December of 2005 report, *FAA Has Opportunities to Reduce Academy Training and Costs by Increasing Educational Requirements for Newly Hired Air Traffic Controllers*, the DOT OIG recommended that FAA review specific courses taught for new controller training at the FAA Academy to see if those courses were already or could be taught in the future by colleges and universities. After that review the FAA could then determine if that course material could be discontinued at the FAA Academy and made a prerequisite for employment consideration. The DOT OIG also recommended that the FAA report the results of those determinations to the Office of Management and Budget (OMB) in the ATCS workforce plan. The FAA concurred with each of those final recommendations from the DOT OIG.

2006 Training and Evaluation

As of 2006, the ATCS training program was governed by FAA order 3120.4L, *Air Traffic Technical Training* (FAA, 2005). En route training consisted of four stages (see Appendix 4, FAA, 2005). Stage I training was conducted at the FAA Academy and consisted of two courses. The first Academy course for trainees assigned to the en route option was En Route Air Traffic Basics (course number 50143). Air Traffic Basics was 25 days long with four major blocks of classroom-based instruction. Instruction was delivered through lecture with limited hands-on practice and demonstrations in the classroom. Trainees were evaluated using standardized written tests and a final written comprehensive test. No simulation-based performance assessments were conducted in Air Traffic Basics. The second Academy course for en route trainees was En Route Initial Training (course number 50144). The Initial Training course was 57 days long. Instruction was delivered through lecture and, more importantly, in hands-on simulations of en route traffic. Trainees were evaluated on their performance in high-fidelity simulations on a pass/fail basis. Unsatisfactory performance in the graded simulations could result in termination. AT-CTI graduates assigned to the en route option bypassed Air Traffic Basics (course 50143) and entered the FAA Academy in En Route Initial Training (course 50144).

Stage II through IV of en route training were conducted at the ARTCC to which the trainee was assigned after successfully completing Stage I training at the FAA Academy. Stage II consisted of Assistant Controller Training (course 55053) with a focus on processing flight plan data. Stage III consisted of Nonradar/Radar-Associate Controller Training (course 55054) and prepared the developmental to work on position as the Radar Associate, assisting the Radar Controller. Stage III included classroom, simulation, and on-the-job training. Stage IV training at the ARTCC consisted of Radar Controller Training (course 55055). This was the final stage of training, preparing the developmental to work on position as the Radar Controller. The training included classroom, high-fidelity simulation, and on-the-job training on position. If successful in this stage of training, the developmental became a Certified Professional Controller (CPC). Whereas en route Stage I training required 82 instructional days (about 4 months), Stages II through IV at the facility required about 33 to 36 months to complete.

Terminal training consisted of up to seven stages (see Appendix 6, FAA, 2005). As with en route training, Stage I training was conducted at the FAA Academy. Terminal Stage I training at the FAA Academy consisted of two courses. The first course at the FAA Academy was Terminal Air Traffic Basics (course 50043). This was the same Air Traffic Basics class as taught in en route option, just with a terminal course number. The second course at the FAA Academy was Tower Initial Qualifications (course 50046). It provided job-related knowledge and skill-oriented training consisting of classroom instruction, practice using technologies such as low fidelity tabletop models of an airport, medium-fidelity interactive PC-based systems, and high-fidelity terminal simulation of the airport environment. If successful in terminal Stage I training, the trainee was promoted to developmental status.

The developmental then reported to a field ATCT for training in Stages II through VII. Training in the terminal option is based on the working positions in the facility: Flight Data (Stage II); Clearance Delivery (Stage III); Ground Control (Stage IV); and Local Control/Cab Coordinator (Stage V). Some facilities also required instruction in nonradar terminal procedures (Stage VI). Terminal facilities providing radar services also required training in terminal radar control (Stage VII). The learning objectives for each stage of training are described in Appendix 6 of the technical training order. All stages of facility training included a mix of classroom training, some simulation, and most importantly, on-the-job training. If successful in facility training, the developmental became a Certified Professional Controller. Whereas Stage I training at the FAA Academy required 62 instructional days (about 12 weeks or 3 months), terminal field training (Stages II through VII, depending on facility requirements) required about 18 months at lower-level ATCT cab-only terminals to 24-28 months for intermediate level “up-down” terminals (e.g., ATCT with co-located TRACON) to as long as 33-36 months at high-level terminals. However, most FAA Academy graduates in the terminal option were assigned to low- and mid-level terminals in 2006.

The training sequence is illustrated in Figure 5. A key point in the figure is that persons with different backgrounds could enter the training sequence at different points. Specifically, former controllers (usually from the military) could bypass Stage I training at the FAA Academy entirely and enter training directly at the field facility (Stage II training). In contrast, AT-CTI graduates could bypass Air Traffic Basics (en route course

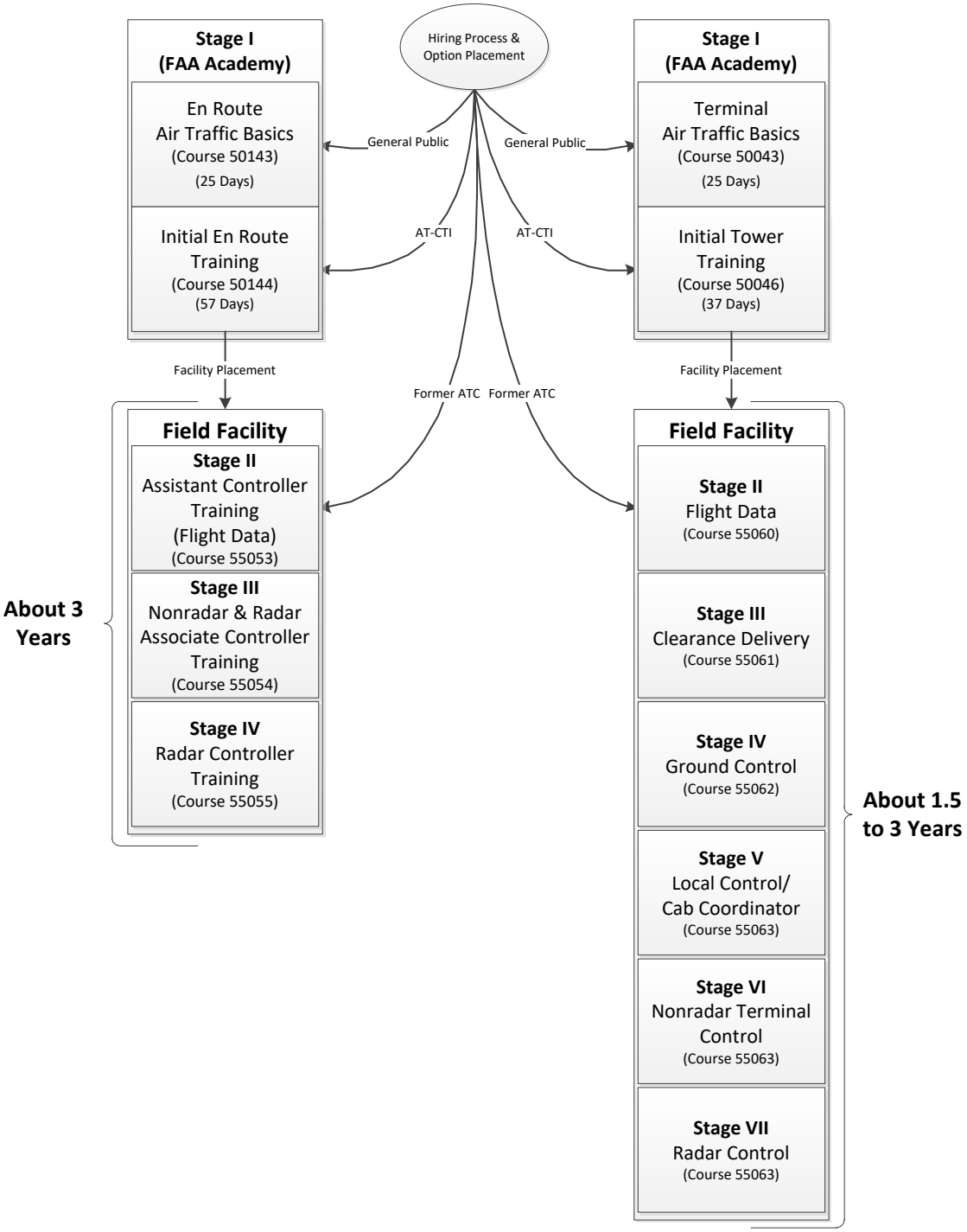

Figure 5: ATCS training sequence (2006)

50143 or terminal course 50043). However, they still were required to attend the FAA Academy initial qualifications training (en route course 50144 or terminal course 50046).

Upon successful completion of the option-specific initial qualifications training, AT-CTI graduates then entered facility training. Finally, persons without prior qualifying ATC experience and without AT-CTI training (e.g., "General Public" hires) were required to complete both Stage I courses at the FAA Academy. The academic institutions participating in the AT-CTI program in 2006 were required to teach, at a minimum, the equivalent of the Air Traffic Basics courses (50143 and 50043).

In 2006, the FAA undertook an internal evaluation of the AT-CTI program to ensure that the program met current and future business needs of the FAA (FAA, 2006). Three business needs were identified:

- Support, to the greatest extent possible, the FAA's hiring plan as expressed in *A Plan for the Future 2006-2015: The Federal Aviation Administration's 10-Year Strategy for the Air Traffic Workforce* (2006) by providing a sufficient number of high quality employee candidates.
- Reduce the cost of air traffic control training by increasing the amount of training completed by employee candidates prior to being hired by the FAA.
- Ensure AT-CTI students have mastered the prerequisite training required to enter and successfully complete the FAA ATC training program.

The evaluation had five overall goals:

- Goal 1: Determine if the overall structure and management of the AT-CTI Program was adequate to achieve program goals.
- Goal 2: Determine the extent to which AT-CTI graduates were prepared to bypass the Air Traffic Basics course at the FAA Academy.
- Goal 3: Collect and analyze data to respond to the recommendations made by the DOT OIG.
- Goal 4: Collect and analyze data to respond to the recommendations made by the REDAC.
- Goal 5: Develop recommendations for the future of the AT-CTI Program.

The evaluation goals were addressed through AT-CTI and FAA stakeholder surveys as well as interviews of FAA Academy instructors and AT-CTI students. AT-CTI test scores on the FAA Academy pre-test and attrition at the FAA Academy were also reviewed. AT-CTI student performance in Performance Verification was also reviewed. Performance Verification was conducted by Air Traffic at the end of FAA Academy initial qualifications training to evaluate trainee knowledge and skills. Essentially, it was a final exam for FAA Academy air traffic students. However, the 2006 AT-CTI program evaluation did not investigate field training outcomes for AT-CTI graduates.

A general summary statement of the findings from the 2006 evaluation indicated that "The AT-CTI schools and the FAA stakeholders responsible for administering the program believe that the AT-CTI Program is an effective recruitment tool for quality applicants who possess a broad base of aviation knowledge." (FAA, 2006, p. 5-1). The evaluation team recommended continuing and expanding the AT-CTI program to other higher education institutions. There were several recommendations provided to address the goals of the evaluation. Some specific goal-related observations were:

- Structure and management of the overall AT-CTI program needed improvement with regard to instructional quality control across AT-CTI programs at individual schools.

- AT-CTI students needed better information about the FAA hiring process and their access to and status within that process.
- Student academic disparity across AT-CTI schools upon entry into the FAA Academy needed to be addressed.
- A systematic review of AT-CTI Programs with regard to the resources needed to provide and possibly offset some existing FAA Academy instructional courses should be conducted.
- The development and implementation of performance based evaluative metrics and standards should be initiated and implemented.

Second AT-CTI program expansion 2007-2012

2007 Expansion

In 2005, the DOT OIG suggested that the pool for AT-CTI colleges could be expanded to include colleges and universities currently offering aviation programs. The FAA's 2006 evaluation also suggested expansion of the AT-CTI program to include additional schools. In 2007, the ATO Director of Technical Training and Development described AT-CTI as "a high potential program that can help FAA achieve its aggressive hiring goals and reduce Academy training costs" (Trinka, 2007). A "controlled expansion" was proposed for 2007. According to the briefing, the goals of the expansion were:

- "Increasing the number of schools and the level of participation by school,
- Increasing not only the number of qualified ATCS candidates, but also their diversity, and
- Enhancing both the quality and proficiency of the ATCS candidates." (Trinka, 2007)

The proposal projected a substantial increase in the number of CTI graduates from 650 in FY 2008 to 1,200 in FY2009 to 2,500 in FY2010 with expansion of the number of participating institutions from 14 in FY2007 to 50 by FY2010. In comparison, the 2007 controller workforce plan, published at about the same time (FAA, 2007d) projected 1,368 hires in FY2008, 1,514 in FY2009, and 1,610 in FY2010. In other words, the proposal projected that expansion of the AT-CTI program would result in more graduates than FAA hiring requirements by FY2010 (2,500 graduates versus 1,610 new hires in FY2010).

A key feature of the proposed expansion was to be an independent, third-party (e.g., contractor) assessment of schools participating in and seeking to join the AT-CTI program. Of particular note in this expansion was the close consideration of the ability of the prospective AT-CTI schools to deliver the required training in terms of curriculum structure, instructional capabilities and delivery, simulation, and institutional support. Implementation of this AT-CTI evaluation model (for assessing schools) was projected to cost $1.88 million by the ATO Director of Technical Training and Development, with an additional cost of $450K for continuing FAA "technical support" (Trinka, 2007).

The FAA entered into a contract in 2007 with JJA Consultants (Fairfax, VA) to develop guidance and materials for the evaluation of existing and prospective collegiate ATC training programs. The consultant delivered the *Air Traffic Collegiate Training Initiative Operational Guidelines and Management Oversight Package* (FAA, 2007a) and *Air Traffic –Collegiate Training Initiative Application Appeal Process* (FAA, 2007b). These documents described the processes and criteria for initial and annual evaluations of the AT-CTI programs offered by the participating educational institutions and how an appeal to those evaluations could be handled. The *Air Traffic Collegiate Training Initiative (AT-CTI) Institution Participation Guidelines* (FAA, 2007c) provided a general overview for the AT-CTI participating schools. The evaluation

framework developed by JJA Consultants in these documents applies only to the ATCS training programs offered by post-secondary educational institutions seeking to join and participating in the AT-CTI program. They do *not* provide guidance for evaluating the overall AT-CTI program from an FAA perspective.

For post-secondary education institutions desiring to join the AT-CTI program, the 2007 process began with submission of an application package in response to a solicitation. To be eligible for consideration, a school had to (a) be an accredited, degree-granting, not-for-profit two- or four-year post-secondary educational institution, (b) offer a non-engineering aviation degree, (c) have at least an average of 25 graduates per year in aviation majors over the previous five years, and (d) have a "willingness to complete the certification process and adhere to the [AT-CTI] program participation requirements" (FAA, 2007c, p. 1-2). If the applying school met these minimum criteria, then the detailed application was reviewed relative to five major components: 1) *Organizational Foundation and Resources*, 2) *Organizational Credibility*, 3) *Curriculum and Facilities*, 4) *Student Performance*, and 5) *Organizational Performance*. Within each major component, there were four weighted factors. Applications were scored on the factors; those scores were then summed to compute an overall school evaluation score on a 1,000-point metric. The component-by-factor scoring matrix is reproduced in Table 2.

Each factor had two or more sub-factors which were essentially information elements that were required in the application package. For example, consider Factor 3.1 (*Curriculum & Programs*), worth up to 100 points. The sub-factors included information items such as a description of the overall curriculum to be offered, program content, and curriculum design, maintenance, and improvement. The initial evaluation was entirely paper-based at this point. The next step in the evaluation process was site visits by the FAA evaluators. Site visits included interviews with selected school leadership, faculty, staff, students and stakeholders, classroom and laboratory visits, campus tours, and on-site review of curricula and equipment. The evaluation team then reconvened in a closed door session to finalize the school's scores on the relevant components and factors. This final score was then used by FAA decision-makers to accept or reject the school's application for participation in the AT-CTI program. Schools earning at least 350 points (out of 470) on Components 1, 2, and 3 received approval for provisional entry into the FAA AT-CTI program.

Table 2: 2007 AT-CTI school application evaluation model

Organizational Foundation & Resources		Organization Credibility		Curriculum & Facilities		Student Performance		Organization Performance	
Factor	Points	Factor	Points	Factor	Points	Factor	Points	Factor	Points
1.1 Leadership	20	2.1 Accreditation	15	3.1 Curriculum & Programs	100	4.1 Graduate Trends	60	5.1 Cooperation & Responsiveness	20
1.2 Goals, Objectives, & Program Alignment	30	2.2 Student Selection Process	10	3.2 Facilities & Equipment	60	4.2 Stakeholder Input on Performance	70	5.2 Data Submission & Reporting Quality	40
1.3 Scope of Participation & Location	25	2.3 External Relations	10	3.3 Student Assessment & Testing	80	4.3 Academic Readiness Trends	130	5.3 Continuous Performance Improvement Initiatives	50
1.4 Resources, Student Support, & Capacity	25	2.4 Outreach & Recruitment	15	3.4 Aviation Program Instructors, Staff, & Management	80	4.4 Academic Achievement Trends	120	5.4 Contributions to AT-CTI	40

Schools participating in the AT-CTI program were required to re-certify annually by submitting a full evaluation package encompassing all components (1 through 5). A minimum score of 350 on components 1 through 3 (out of 470) and 425 on components 4 and 5 (out of 530), for a total score of at least 775 (out of 1,000), was required to successfully re-certify. Schools provisionally accepted in the previous year could advance to full certification in subsequent years through this process. According to a presentation at the October 2007 FAA/AT-CTI conference in San Jose, California, 14 schools already participating in the AT-CTI program and 19 new schools submitted evaluation packages. All 14 "legacy" schools were re-certified and nine new schools were provisionally accepted into the FAA AT-CTI program, bringing the total to 23 schools. The nine new schools added in the 2007 expansion (Table 1) were:

- Arizona State University, Mesa, AZ;
- Community College of Baltimore County, Baltimore, MD;
- Florida State College at Jacksonville, Jacksonville, FL;
- Green River Community College, Auburn, WA;
- Kent State University, Kent, OH;
- Lewis University, Romeoville, IL;
- Metropolitan State University of Denver, Denver, CO;
- Middle Georgia State University, Cochran, GA; and
- University of Oklahoma, Norman, OK.

The pace of ATCS hiring by the FAA picked up considerably in 2007 in the wake of a surge in retirements from the controller workforce (Sniffen, 2007). Moreover, the FAA shifted from issuing "local vacancy announcements" for specific facilities to national, centralized announcements for three primary applicant sources: (a) former military controllers eligible for appointment under the Veteran's Recruitment Appointment (VRA) authority, (b) AT-CTI program graduates eligible for appointment under 49 U.S.C. § 44506(c), and (c) the general public eligible for appointment under the agency's general hiring authority. As before, there was no guarantee of employment for AT-CTI students. Former air traffic controllers were not required to take the computerized AT-SAT aptitude test battery. However, AT-SAT was required for AT-CTI students and the general public.

2008 and 2009 Evaluations and Expansions

The program expansions for 2008 and 2009 proceeded under the same rationale and goals as the 2007 expansion. Based on input from the contract evaluator, some changes were made to the original school evaluation scoring mechanism. The total number of accumulated points was reduced, the *Student Performance* and *Organizational Performance* components were combined, and several sub-factors were removed. The information concerning this school evaluation process for 2008 was presented in the FAA/AT-CTI conference in September, 2008 in Herndon, Virginia. Eighteen schools submitted applications in the 2008 cycle; just eight were selected. The eight colleges or universities selected in the 2008 expansion (see Table 1) were

- Aims Community College, Greeley, CO,
- Broward College, Pembroke Pines, FL,
- Eastern New Mexico University, Roswell, NM,
- Embry Riddle Aeronautical University, Prescott, AZ,
- Jacksonville University, Jacksonville, FL,
- Le Tourneau University, Longview, TX,
- Saint Cloud State University, Saint Cloud, MN, and
- Tulsa Community College, Tulsa, OK.

Another evaluation cycle was executed in 2009 (SERCO/JJA Consultants Inc., 2009). As in 2008, additional changes were made to the school evaluation criteria. Information concerning this process was presented by FAA at the September 2009 FAA/AT-CTI conference in Wichita, Kansas. According to the SERCO/JJA Consultants report delivered in October 2009, four schools already in the FAA AT-CTI program were "on probation." Twenty-one educational institutions submitted new applications for inclusion in the AT-CTI program in that evaluation cycle. One application was "disqualified as it was an entirely virtual, on-line program for which the FAA had no evaluation criteria or methods" and another was disqualified as not meeting the minimum requirements (SERCO/JJA Consultants, 2009, p. 7). Out of the 19 remaining applicants, just five additional colleges or universities were selected to participate in the AT-CTI program. The schools selected in the 2009 expansion (see Table 1) were

- Florida Institute of Technology, Melbourne, FL,
- Hesston College, Hesston, KS,
- Sacramento City College, Sacramento, CA,
- Texas State Technical College, Waco, TX, and
- Western Michigan University, Battle Creek, MI.

2010 Evaluation Cycle

The evaluation cycle in 2010 focused on schools that were already in the FAA AT-CTI program; no solicitation for new schools was issued. The evaluation process was explained at the 2010 FAA/AT-CTI conference (St. Paul, Minnesota), as well as AT-SAT testing, Air Traffic Basics testing, and FAA expectations of colleges and universities participating in the AT-CTI program. Fourteen participating schools were required to submit packages for evaluation, including the four schools "on probation" in the 2009 cycle (FAA, 2010). These four schools were removed from probation on the basis of the 2010 evaluation and restored to "full certification" status. Of the other 10 schools evaluated, seven were fully certified and retained in the program. However, three schools were placed "on probation" for two years based on the 2010 evaluation. Overall, 36 colleges and universities were participating in the AT-CTI program at this point.

2011 Independent Review Panel

In April 2011, an Independent Review Panel (IRP) was convened at the direction of the FAA Administrator to develop recommendations on air traffic controller selection, assignment, and training in the wake of widely publicized incidents involving controllers sleeping on the job (*FAA Announces review panel, management shuffle*, April 29, 2011). The panel visited several ATC facilities, AT-CTI schools, and the FAA Academy. The IRP made several recommendations relevant to the AT-CTI program in a final report delivered in November 2011 (Barr, Brady, Koleszar, New, & Pounds, 2011). The IRP proposed an alternative ATCS selection process modeled on the U.S. Air Force Pilot Candidate Selection Method. A key feature of the IRP proposal was to award rating points to ATCS applicants based on which AT-CTI school an applicant had attended. The IRP assumed that the "quality and thoroughness of a candidate's undergraduate education … is quite likely the strongest predictor of success in training" (Barr, et al., p. 13). The IRP proposed rank-ordering AT-CTI schools in four categories or levels based on institutional capabilities and ATC program characteristics, with an increasing number of rating points associated with each level (Table 3). While not stated explicitly, presumably applicants who had not attended an AT-CTI program would earn zero points on this factor in the rating and ranking of ATCS job applicants. The IRP also recommended that "The FAA needs to review its hiring practices for controller candidates and take advantage of the AT-CTI system it has created" (p. 18). The IRP justified this recommendation on the basis of an anecdote in which a facility trainer reportedly asked the agency "not to send me any more public hires" (p. 16). The IRP also

recommended that the agency track new controllers from selection through achievement of CPC status and to share AT-CTI graduate training performance data with the source institutions. The IRP also made several recommendations regarding aptitude testing in the selection process, training at the FAA Academy, placement by option, OJT Instructor training, and the field training process.

Table 3: IRP-proposed AT-CTI program levels

AT-CTI Level	Program Characteristics	Points
Level 1	Those institutions that teach only Air Traffic Basics including aircraft identification and performance	10
Level 2	Those institutions that teach Air Traffic Basics and the theory of at least one option with no supporting lab(s)	20
Level 3	Those institutions that teach Air Traffic Basics and at least one option with supporting lab(s)	30
Level 4	Those institutions that teach Air Traffic Basics and all options (Tower, Terminal Radar, En Route, and Non-Radar) with supporting labs for each option	40

However, by 2013, as often happens with external reviews of federal programs, the record of implementation of those recommendations is mixed. For example, the proposal to rate and rank ATCS job applicants on the basis of which school they attended was never implemented because it does not speak to the qualifications, skills, or abilities required to succeed as an air traffic controller. But, as a counter-example, FAA/AT-CTI conferences, as suggested by the IRP, were held in Indianapolis, Indiana in 2011 and Murfreesboro, Tennessee in 2012. Seven of the nine presentations at the 1-day 2011 conference were from educators and focused on "best practices" in instruction and student recruitment (consistent with the IRP recommendation for sharing "best practices"). Two presentations, both by FAA representatives, focused on factors influencing success at the FAA Academy and in field training.

ATCS Hiring through 2012

The pace of ATCS hiring increased from 2007 through 2012 as retirements from the ATCS workforce increased. Overall, FAA hired 8,489 new controllers, according to the annual controller workforce plans (see Figure 1). ATCS hiring peaked in 2008 at 2,196 and then slowed to 925 in 2012.

AT-CTI Program 2013-2016

As of 2013, the AT-CTI program included 36 post-secondary educational institutions, including the MCTC. However, ATCS hiring slowed even further in 2013 to just 554, due to the effects of sequestration on the FAA budget. Altogether, the network of AT-CTI schools could produce at least several hundred new graduates per year, resulting in a large pool of AT-CTI graduates available to FAA for employment. As of the end of 2013, the schools had provided the names of 16,741 persons (cumulatively) to the FAA. Of those 16,741 persons, 10,100 had actually graduated from an approved program between 1992 and 2013. Of those 10,100 graduates, the schools recommended the vast majority (10,069) for employment with the FAA over that same time period.

Of the 10,069 who graduated and were recommended for employment by AT-CTI schools between 1992 and 2013, about three-quarters (7,592) passed AT-SAT and were eligible for employment by the FAA under the Administrator's discretionary AT-CTI appointing authority. Overall, available records indicate that FAA hired 4,397 AT-CTI-qualified applicants between 1992 and 2013. In other words, just 44% of graduates and 58% of *qualified* graduates (e.g., graduated, recommended, and tested) were hired by the FAA.

Barrier Analysis 2013

As part of the FAA's continuing commitment to equal opportunity in employment, the agency undertook an in-depth review of its hiring processes for the ATCS occupation in 2012. This effort, conducted in accordance with guidance from the Equal Employment Opportunity Commission (EEOC, 2003), sought to identify procedures and policies that acted as "barriers" to the achievement of equal employment opportunity goals. Two such analyses were conducted, with final reports delivered to FAA in 2013 (APT Metrics, Inc., 2013; Outtz & Hanges, 2013). Several concerns about the ATCS hiring process were highlighted in the reports, including determination of applicant qualifications and aptitude testing.

Changes to ATCS Hiring Process

In response to the barrier analyses and other reviews (see DOT OIG, 2017), FAA undertook a redesign of its controller hiring process in two phases, with an interim process to be implemented in 2014 while a longer-term solution was developed for the 2016 timeframe. Key features of the interim process were the use of a single "all sources" vacancy announcement and introduction of a validated biographical assessment as part of the application process. A biographical assessment ("biodata") typically include items about past events and behaviors reflecting personality attributes, attitudes, experiences, interests, skills and abilities validated as predictors of overall performance for a given occupation (Stokes, Mumford, & Owens, 1994). All applicants were required to take AT-SAT in the interim 2014 process.

The decision to implement this interim process in 2014 had consequences for the AT-CTI program. Specifically, to ensure all applicants were assessed using the same tools, all previous applicants were asked to reapply under the new hiring process. This decision was announced by FAA to the AT-CTI educational institutions in a telephone conference call on January 8, 2014.

It is important to note that the AT-CTI program was not abolished or suspended by the FAA by this change in the ATCS hiring process. Indeed, the FAA's Assistant Administrator for Human Resource Management re-affirmed FAA's commitment to the AT-CTI program in a letter to what appears to be an unsuccessful applicant (Brady & McGuirk, 2014):

> "AT-CTI programs are an essential component of the FAA's multi-faceted program to ensure a predictable supply of highly skilled air traffic controllers in the years to come. … FAA will continue to work with CTI schools to encourage interest in employment opportunities in the aviation industry generally and with the FAA, specifically."

However, the change was not well received by the participating educational institutions. For example, there was some negative press in both national and local outlets (for examples, see Carey, 2014; Glas, 2014; Smith, 2015). Enrollments in ATC programs also reportedly declined at several schools (Ruud, 2016; Smith, 2015). The change also received Congressional attention. For example, a bill titled *Air Traffic Controller Hiring Improvement Act of 2016* (H.R. 5292) was introduced (but not passed) in the House of Representatives in May 2015 (*Curbelo introduces bill to address FAA shortage of air traffic controllers*, 2016). In June 2016, the House Aviation Subcommittee held hearings on ATCS hiring, staffing, and training plans (*A review of the Federal Aviation Administration's air traffic controller hiring, staffing, and training plan*, June 15, 2016). Ultimately, legislators mandated specific ATCS hiring procedures in the *FAA*

Extension, Safety, and Security Act of 2016 (Public Law 114-190, July 15, 2016). First, the law provided that "…the Administrator shall give preferential consideration to qualified individuals maintaining 52 consecutive weeks of air traffic control experience involving the full-time active separation of air traffic after receipt of an air traffic certification or air traffic control facility rating within 5 years of application…" (49 U.S.C. § 44506(f)(1)(A)). FAA Human Resource Policy Manual (HRPM) Policy Bulletin #90 (FAA, 2016b) defined "preferential consideration" as the "…process whereby the FAA, based on its annual hiring targets, refers experienced applicants as defined by 49 USC § 44506(f)(1)(A) for appointment, before considering entry-level applicants" (p. 3). Second, "entry-level applicants" without prior ATC experience are grouped by the law into two categories or "pools." "Pool 1" is defined by the law as qualified veterans (without 52-weeks of ATC experience) and AT-CTI program graduates. "Pool 2" is defined as all other applicants not meeting the criteria for prior experience or Pool 1. The law requires the agency to make approximately equal (within 10%) referrals from Pool 1 (veterans, AT-CTI graduates) and Pool 2 (all other applicants).

The FAA took steps in 2017 to begin rebuilding relationships with the AT-CTI schools in the wake of the 2014-2016 changes to the ATCS hiring process. This history of the AT-CTI program is one element in that process, by ensuring that there is a common baseline of knowledge about the program's antecedents and evolution over time. Given this history of the program, the natural next question is "So, after 25 years in existence, just what has the AT-CTI program accomplished for the FAA?" Answering that seemingly simple question will be the focus of the AT-CTI summative evaluation report.

Footnotes

[1]FAA order 3120.26 is listed as "Cancelled" in the on-line FAA orders and notices system, but no date of cancellation is provided (see (https://employees.faa.gov/tools_resources/orders_notices/index.cfm/go/document.information/documentID/7665)

[2]Several terms are used in this quote with which readers without federal human resources management might not be familiar such as "appointment," "noncompetitively," and "excepted service." Explanations of these terms are provided by the U.S. Office of Personnel Management. See for examples, (https://www.usajobs.gov/Help/working-in-government/appointments/) and (https://www.opm.gov/policy-data-oversight/hiring-information/competitive-hiring/#url=Types-of-Appointments)

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