Testimony of

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Before the House Transportation Committee

Subcommittee on Aviation

Wednesday, March 18, 2009

ATC Modernization and NextGen: Near-Term Achievable Goals

Introduction

The National Air Traffic Controllers Association (NATCA) is the exclusive representative of over 15,000 air traffic controllers serving the Federal Aviation Administration (FAA), the Department of Defense and the private sector. In addition, NATCA represents approximately 1,200 FAA engineers, 600 traffic management coordinators, 500 aircraft certification professionals, agency operational support staff, regional personnel from FAA's logistics, budget, finance and computer specialist divisions, and agency occupational health specialists, nurses and medical program specialists. NATCA's mission is to preserve, promote and improve the safety of air travel within the United States, and to serve as an advocate for air traffic controllers and other aviation safety professionals. NATCA has a long history of supporting new aviation technology, modernizing and enhancing our nation's air traffic control system, and working to ensure that we are prepared to meet the growing demand for aviation services.

NATCA's Recommendations

NATCA remains, as ever, completely committed to the safety and efficiency of the National Airspace System (NAS). New technology has the potential to improve safety, expand capacity, and increase efficiency of the NAS. Therefore, we support the FAA's willingness to undertake the large scale and long-term research, development and modernization project that it has labeled The Next Generation Air Transportation System (NextGen). There are however, several outstanding shortcomings with the FAA's methodology and plans that need to be addressed at this early stage of the process.

1. **The FAA must collaborate meaningfully with stakeholders** – The inclusion of NATCA is critical to the success of NextGen and all projects relating to modernization, technology and procedures. As recently as February 11th of this year, the Government Accountability Office and the Inspector General of the Transportation Department have both testified before this Committee that controller involvement prevents cost overruns and implementation delays. NATCA must be included in all stages, from inception to implementation.
2. **NowGen must not be neglected as we prepare for NextGen** – The current air traffic control system has fallen into disrepair. Both the human infrastructure, including staffing levels of air traffic controllers, inspectors, engineers, and other aviation safety professionals, and physical infrastructure, such as poorly-maintained and deteriorating air traffic control facilities, need attention in the near term.
3. **Human factors must be addressed** – Several of NextGen's proposals raise serious concerns regarding human factors, including the increased complexity and safety risk inherent in a best equipped, best served policy. These issues must be addressed during the development stages in order to avoid delays, cost overruns, and safety failures.
4. **Safety requires redundancy** – NATCA is concerned that the system being proposed by the FAA, which is centralized and lacking a viable backup, is unacceptably vulnerable to attack or natural disaster. Human intervention must not be the first and only layer of redundancy. The FAA must build redundancy into the system in order to ensure that in the event of an attack, natural disaster, or technological failure, safety is not compromised.

Collaboration is Critical

The participation of NATCA throughout all stages of NextGen's development and implementation is critical to the success of this project. NATCA's members are frontline workers who are able to provide vital insight to help the team identify and address human-interface issues and other concerns. Doing so

on the front-end rather than during implementation will save the agency time, taxpayer money and resources while avoiding potential damage to the integrity of the air traffic control system. Because NATCA's members have an intimate understanding of frontline air traffic control, they are uniquely qualified to provide insight into the needs of the system, the utility of the FAA's proposed technology, and the usability of the products included under the NextGen umbrella.

The FAA's go-it-alone strategy has come under criticism by this Committee and throughout the aviation industry. Last month, the FAA announced that it has committed to launching a NextGen Implementation Panel, through the RTCA Inc. (formerly the Radio Technical Commission for Aeronautics). Despite this gesture, to date we have received no indication from the FAA that the Agency has any intention of meaningfully collaborating with NATCA.

During the late 1990s and into the early part of this decade, the FAA completed more than 7,100 projects to install and integrate new facilities, systems, and equipment into the NAS, as well as more than 10,000 hardware and software upgrades. During this time, NATCA had representatives on over 70 modernization and procedure development projects[1] through the Controller Liaison Program. This program allowed controllers to provide crucial insight and guidance for the development and implementation of some of the most effective technological and procedural advancements including: Advanced Technologies and Oceanic Procedures (ATOP), Display System Replacement (DSR), User Request Evaluation Tool (URET), Voice Switching Control System (VSCS), Domestic Reduced Vertical Separation Minimum (DRVSM), and Standard Terminal Automation Replacement System (STARS). Despite its success, the Liaison Program was terminated in 2003. Throughout the rest of the Bush Administration, the FAA resisted any meaningful input from NATCA – to the detriment of the NAS.

The labor-management environment that developed during the Bush administration continues to make meaningful collaboration nearly impossible. The contempt with which all levels of Agency management has treated and continues to treat the air traffic controller workforce makes it clear that the agency does not value the professionalism of NATCA's members. It is our hope that after the imposed work rules are addressed by the Obama Administration and NATCA and the FAA reach a mutually-accepted collective bargaining agreement, we can again return to an era of cooperation and collaboration that will best serve the needs of the FAA, air traffic controllers, stakeholders, and the flying public.

NowGen: Human Infrastructure

While NATCA believes that NextGen may hold some promising plans and technology for the future of air traffic control, we are concerned that the Agency's focus on NextGen comes at the expense of the current air traffic control system, or NowGen. There are some very pressing problems facing the air traffic control system of today that can be addressed using available technology and infrastructure.

Air traffic control facilities across the nation are severely understaffed as a result of the wave of retirements and resignations following the agency's unilateral imposition of work and pay rules on the air traffic controller workforce. Rampant fatigue in the workforce is undermining safety across the system as those controllers that remain are required to work excessive amounts of overtime, have fewer opportunities for rest on and off the shift, and are often required to do a job designed for two to four controllers when Radar Associate positions are eliminated and positions are combined. The FAA's

[1] National Air Traffic Controllers Association, *2002 Air Traffic Modernization Tools.*

recent hiring efforts intended to combat the staffing problem have resulted in an unsafe ratio of trainees, a training backlog, and an overreliance on developmentals, or trainees, to work live traffic.

Over 46,000 years of experience has been lost since the imposed work rules.[2] Along with that experience, vital institutional knowledge and qualified instructors have been sacrificed over the past two and a half years. The FAA must make addressing the workforce issue its top priority; returning to the bargaining table to reach a legitimate and mutually-acceptable collective bargaining agreement would go a long way towards stabilizing today's air traffic controller workforce and setting a solid foundation for the training and development of the air traffic controller workforce of tomorrow.

NowGen: Physical Infrastructure

In addition to the deterioration of the human infrastructure, the FAA must contend with the deterioration of the physical infrastructure. According to a recent report by the Department of Transportation Inspector General, fifty-nine percent of FAA facilities are beyond their 30-year design life, while all 23 En Route centers are over 40 years old. Several air traffic control facilities including Detroit Metropolitan Airport Tower and TRACON (DTW), O'Hare International Airport Tower (ORD), Kansas City Tower/TRACON (MCI), Miami ARTCC (ZMA), and Memphis ARTCC (ZME) have reported problems with mold contamination. At DTW inspectors have confirmed the presence of stachybotrys, a toxic form of mold believed to be a contributory factor in health problems experienced by controllers at the facility, including cases of occupational asthma as well as seven cancer diagnoses during the past six years.

The FAA has also fallen behind in the installation of vital runway incursion prevention technology. Airport Surface Detection Equipment-Model X (ASDE-X) is a developed and proven surface radar system that has been used to great effect where it has been installed. Unfortunately, the FAA has allowed this demonstrated technology to take a back seat to NextGen and is on track to miss its delivery benchmarks. While the FAA estimated that ASDE-X would be deployed at the 35 busiest airports by the end of 2010, to date they have installed only 13 of the 35 (having taken four years to install the first 11)[3], and many of those that have been installed are still experiencing serious implementation glitches.

The FAA must make the maintenance and appropriate equipage of existing air traffic control facilities a priority. Air traffic controllers must be provided with safe and secure facilities and up-to-date equipment so that they can continue to maintain the safest and most efficient air traffic control system in the world.

Potential Advantages of NextGen Technology and Systems

NATCA believes that there is great potential in Automatic Dependent Surveillance – Broadcast (ADS-B). As the FAA has stated, satellite-based technology is capable of providing a more accurate depiction of aircraft location and eliminating the lag time of traditional radar scans. This degree of precision can help ensure greater safety and efficiency by allowing air traffic controllers the ability to make better-

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[2] Calculation assumes 25 years experience for every retiree. Twenty-five years of services is the minimum for retirement eligibility for most air traffic controllers.

[3] Dillingham, Gerald, *Aviation Safety:FAA Has Increased Efforts to Address Runway Incursions* Government Accountability Office Testimony before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives September 25, 2008

informed decisions regarding aircraft movements. If aircraft were equipped with ADS-B displays, pilots would have additional tools with which to process and understand their location and flying conditions, allowing pilots to maintain greater situational awareness, particularly during periods of poor visibility.

This capability will give controllers greater flexibility and provide predictability to the users. For example, controllers will be able to more frequently instruct pilots to proceed to the airport visually, utilizing the ADS-B in weather currently requiring instrument flight rules (IFR). A visual approach, which is granted at the discretion of air traffic controllers, requires pilots to utilize a simple "see and avoid" method of separation, allowing then to follow more closely than instrument guided approach standards permit. With current technology, controllers may only grant visual approaches during good weather and when visibility is unobstructed, as pilots must safely see the runway, ground, surrounding terrain, and other aircraft in the vicinity. With ADS-B displays, pilots would be able to artificially "see" other aircraft even during inclement whether, giving controllers greater flexibility to use these less complex and more efficient approach rules, increasing the arrival rates regardless of the weather. There would no longer be a need to reduce arrival rates during IFR weather. The users could more accurately predict scheduling, reduce delays, and increase capacity.

Concerns over NextGen

Based on the public documents that the FAA has made available on NextGen, NATCA has several outstanding concerns that we believe the FAA must address comprehensively before it can begin the roll-out of any major NextGen technology or policy changes. As previously stated, we believe that these and other issues can be most effectively addressed in a collaborative environment, and we sincerely hope that NATCA can be a part of developing the solutions to the problems facing the current air traffic control system and plan for the future system. Below are the concerns NATCA believes must be addressed immediately, which will be discussed in greater depth in the sections that follow.

1. The FAA must retain a back-up system: Redundancy is the essential element of any safety operation. The FAA's published plans contain no viable backup should the satellite fail due to natural or criminal activity. Limited frequency availability further complicates this situation.
2. Safe and viable plan for equipage: The success of NextGen is dependent on the equipage of thousands of aircraft with new technology, an expensive undertaking that would be a major financial strain on airlines, general aviation and business aviation, particularly in the current economic climate. The FAA has tried to address this by instituting a new "best equipped, best served" policy for air traffic control. This policy has serious implications for safety, as it adds an untenable level of complexity to air traffic control operations. If the FAA wishes to incentivize equipage, it must do so in a way that does not compromise safety.
3. Full consideration of human factors: Many of the proposed changes to the air traffic control system place significant demands on the people who make the system work. The usability of the technology and the accompanying procedures must be a priority.
4. Research before rulemaking: Many of the plans and promises made in the FAA's NextGen documents are based on assumptions about technology that has yet to be developed. While the ideas are a good basis for research and development projects, it is misleading for the FAA to describe its plans for operations as if the required technology were already available.

Redundancy: The Need for a Viable Back-Up System

While we believe ADS-B has tremendous potential and is capable of providing precise, accurate, and instantaneous information on aircraft positions to air traffic controllers, it is particularly vulnerable due to its single-site source. ADS-B is satellite-based technology, with information broadcasting from a single source satellite orbiting the earth. While this allows it to be more precise than the current ground-based radar, the singularity of its source makes it vulnerable to natural disasters and criminal or terrorist acts. If the satellite were to cease functioning for any reason, the entire US air traffic control system would be crippled.

The current ground-based radar system gathers its information from numerous radar sights located throughout the country. If one radar sight were to fail, another site could act as a back up. For example, if a terminal radar site were to fail, Center Radar, or CENRAP, from the nearest en route radar site would be able to provide the relevant data. In most cases when this occurs, FAA separation requirements are increased from three miles to five miles, but safety is maintained and service is uninterrupted.

Until redundancy can be incorporated into the new technology, the easiest option for creating the system redundancy necessary to maintain the safety of the NAS is to maintain the existing ground radar coverage as a back-up for the ADS-B system. However, due to financial considerations, the Agency wants to decommission many of the current radar sites, which would result in an incomplete backup system with gaps in coverage.

Further complicating this is the issue of frequency congestion. ADS-B transmits its information in the same frequency spectrum as the current radar systems, TCASS, ASDE-X and other critical aviation safety technology. There are simply not enough frequencies available to transmit all of the necessary information. According to a briefing before the Aviation Rulemaking Committee (ARC) on February 24, 2009, the FAA would have to decommission all existing radar sites and reduce TCASS surveillance to 60 percent in order to safely utilize ADS-B[4]. This further limitation of the available redundancy makes the NAS more vulnerable to failure and puts the safety of the flying public at risk.

Before ADS-B is implemented, the FAA must develop a safe and viable means of providing a back-up system. Redundancy and workable back-up systems are vital to the safety of the NAS, and must not be discounted in the fervor to introduce new technology.

Equipage: A Major Hurdle in Tough Economic Times

In order to utilize the technology and procedures that create the foundation of NextGen, aircraft must be equipped with new technology. For general and business aviation, the process of equipage may be cost-prohibitive. Encouraging voluntary compliance for these fliers may prove to be a fruitless effort, and mandatory equipage may cripple the general aviation industry beyond repair. One NATCA member and private pilot echoed the sentiments of many when he said, "I'll stop flying before I spend $35,000 on new equipment for my $50,000 plane." Particularly during these difficult economic times, when private pilots are struggling to pay for regular maintenance and fuel costs, the added expense will be cost prohibitive to most.

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[4] Capezzuto, Vincent, *Surveillance and Broadcast Services: Aviation Rulemaking Committee Briefing*, Federal Aviation Administration, Februay 24, 2009.

For the commercial airline industry, moving forward with NextGen means undergoing the expensive process of retrofitting a fleet of aircraft, a major challenge for airlines struggling to continue operations despite the economic downturn. Early equipage difficulties may be exacerbated by the FAA's history of changing technological requirements and delaying or abandoning modernization efforts. American Airlines, for example, retrofitted its fleet to install the Controller Pilot Data Link Communication system (CPDLC) only to see the FAA abandoned its efforts in 2004, leaving the airline to foot the bill for technology it would never use.

Airlines may be reluctant to equip their fleets until they can see a clear operational or economic benefit and until the FAA has demonstrated a firm commitment to a particular set of equipage standards. NextGen will be delayed until the FAA is able to effectively address the legitimate concern of airlines and aircraft owners and convince them that the technology is a good investment.

"Best Equipped, Best Served": Implications on Human Factors

In an attempt to create artificial economic incentives for early equipage, the FAA has announced that it will implement a policy that would "provide 'best-equipped, best-served' priority in the NAS to early adopters." This has serious implications for safe and efficient operations and for the workload and complexity for air traffic controllers.

Currently, air traffic controllers provide service on a first-come, first-serve basis. Air traffic controllers instruct aircraft to merge onto airways or disburse to their destinations in the order which comes most naturally, the order in which they arrive. Giving priority to particular aircraft would require complex maneuvering on the part of air traffic controllers, who would have to vector aircraft around one another in order to give preferential treatment. This is an unnecessary level of complexity introduced into the already complex air traffic control environment. As with any additional complexity, it brings with it an increased risk in terms of both safety and delays.

Air traffic controllers are also taught to maximize the efficiency of the NAS to the maximum extent practicable without sacrificing safety. This often means granting requests from pilots to proceed directly to particular navigation points of reference, VORs, rather than continuing along the prescribed route. Currently, this is done whenever air traffic and whether conditions permit. As there is no way to increase the use of these on-the-fly improvements to efficiency, the only way to provide incentives is to instruct controllers to avoid giving direct routes to aircraft without the new equipment. This means decreasing the overall efficiency of the NAS, and increasing flight delays for unequipped aircraft.

Lastly, differential treatment from air traffic control based on level of equipage requires the controller to know the level of equipage. This would mean an additional piece of information in an already-cluttered data-block. According to a Civil Aerospace Medical Institute (CAMI) study, the quantity of information in the display has a direct relationship to the time it takes for a controller to scan that display. Similarly, when a display is cluttered with information, it takes additional time to scan and parse out the relevant data.[5] Therefore, adding this additional information to the data blocks will increase the complexity of air traffic control even before one accounts for the preferential maneuvering.

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[5] Xing, Jing, *Information Complexity in Air Traffic Control Displays* Civil Aerospace Medical Institute, Federal Aviation Administration. September 2007.

Human Factors Considerations for "Trajectory Management"

The FAA's NextGen plans include increased automation and eventual self-separation of aircraft, resulting in a shift in the "traditional responsibilities and practices of pilots/controllers." Under the proposed system, air traffic control would shift to what the FAA is euphemistically referring to as "Trajectory Management." Essentially, air traffic controllers would discontinue active air traffic control and shift instead to air traffic monitoring and route management. This could have serious implications for the safety of the NAS.

Studies have shown that "when acting as a monitor of an automated system, people are frequently slow in detecting that a problem has occurred that necessitates their intervention. Once detected, additional time is also needed to determine the state of the system and sufficiently understand what is happening in order to be able to act in an appropriate manner. The extra time associated with performing these steps can be critical, prohibiting performance of the very activity the human is present to handle."[6] Safe air traffic control depends on the ability to quickly assess situations and make split second decisions.

Training and experience would also be a serious issue in this scenario. After this changeover of duties is completed it won't be long before the system is staffed entirely by individuals with no active air traffic control experience or on the job training. Even those who might remain in the profession and remember active air traffic control would quickly fall out of practice. Currently, controllers and managers who are working off the floor are required to work positions for 16 hours to maintain currency. Maintaining this level of currency would be impossible should automated separation become the standard. This too, would make it difficult for air traffic monitors to safely perform air traffic control functions should automated separation fail.

Research Before Rulemaking

At this stage of NextGen's progress, it is difficult to talk about near-term benefits of the system. Although this Committee is justified in looking for short-term improvements to help alleviate delays and improve capacity of the NAS, NextGen may not be the best place to look. Right now, NextGen is little more than a very ambitious research and development project. While the technology being developed may eventually produce great benefit to the system, it is misleading for the FAA to speak of plans as if the technology already existed.

For example, On January 29th of this year, the FAA published a PowerPoint presentation entitled "Delivering NextGen: Trajectory Based Operations," This document included statements such as "ANSP uses scheduling tools and trajectory based operations to assure a smooth flow of traffic and increase the efficient use of airspace,"[7] implying the availability of 4-D scheduling tools (three traditional directions plus time) that are, in fact, still in the early stages of developments. It is still unknown when these scheduling tools will be fully developed or even how they will function, yet the FAA continues to publish descriptions of how flight paths will be changed and how the new procedures will look.

To create and outline the procedures at this early stage of the development process is both disingenuous and irresponsible. The FAA is misleading its stakeholders into thinking the process is already further

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[6] Parasuraman, R and Mustapha Mouloua, *Automation and Human Performance: Theory and Applications.* Lawrence Erlbaum Associates, 1996.

[7] Federal Aviation Administration, *Delivering NextGen: Trajectory Based Operations"* January 29, 2009, pg 4.

along than it actually is. It is also spending time, money and manpower developing procedures and plans when it is unknown precisely how the necessary tools will function. This means that FAA is either developing broad and non-specific procedures, which are largely useless except as a public relations tool, or they are developing specific procedures which will likely need to be rebuilt once the technology is available.

Conclusion

In NextGen, the FAA has undertaken a large-scale and long-term research and development project to overhaul the technological infrastructure of the air traffic control system. This ambitious undertaking has serious implications for the future of the National Airspace System and should therefore include the meaningful participation of all NAS stakeholders.

NATCA supports the FAA's modernization efforts and is eager to be a part of the team developing and planning the technology that will bring us into the next generation of air traffic control. We look forward to working with the FAA to help them address the serious outstanding issues including human factors, equipage, and redundancy concerns. It is essential for us to be included as partners in this ongoing modernization effort.