INTRODUCING COMPETITION INTO THE DEVELOPMENT AND DEPLOYMENT OF THE NEXT GENERATION AIR TRAFFIC SYSTEM

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Executive Summary

As a result of the efforts of the U.S. Government's Joint Planning and Development Office (JPDO),[2] there is consensus within the aviation community in the United States on the necessary capabilities of a modernized air traffic control system. The architecture and features of the "Next Generation Air Transportation System," ("NextGen") [3] have been explained by the JPDO in a variety of technical papers that describe a satellite-based system of communications, navigation and surveillance services[4] for airspace users. A more perplexing problem, however, has been identifying the right role for the federal government – in particular, the Federal Aviation Administration – in the evolution to NextGen from the current legacy environment of ground-based radar technology and analog radio communications. To date, the debate has been set up as a binary choice between pursuing governance reforms of the FAA, on the one hand, and corporatizing or privatizing ATC functions through the creation of an Air Navigation Service Provider (ANSP), as other countries have done, on the other.

The Federal Aviation Act suggests a third and better choice may be available. It is an alternative that seemingly was intended all along but was obscured by historic events and policy choices occurring over time. Among the broad array of powers held by the

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[2] The JPDO was created in 2003 by President Bush and Congress under VISION 100 – Century of Aviation Reauthorization Act (P.L. 108-176). JPDO is responsible for managing a public/private partnership to bring NextGen online by 2025. The JPDO is the central organization that coordinates the specialized efforts of the Departments of Transportation, Defense, Homeland Security, Commerce, FAA, NASA, and the White House Office of Science and Technology Policy.

[3] Integrated Work Plan For The Next Generation Air Transportation System, JPDO, February 15, 2008, http://www.jpdo.gov/iwp/IWP_Version_02_Master_w-o_appendix.pdf

[4] This paper uses the terms "CNS Services" to include air traffic control functions.

Administrator of the FAA are the authorities to certificate 'air navigation facilities'[5] and to inspect, classify, and rate such facilities. [6] While the FAA is statutorily-designated as the final arbiter in setting standards for air navigation facilities, there has never been a legislative command that the government also hold a monopoly over their development, construction, and operation. The current system – in which the federal government has acted as the predominant owner and operator of air navigation facilities – was a matter of choice, not design. Indeed, the statutes and legislative history suggest that Congress had originally intended for air navigation facilities to be regulated and inspected by the government in an approach consistent with the FAA's oversight of airlines, aerospace manufacturers, and repair stations.

Based on existing statutory authority, this paper outlines and discusses the legal underpinnings for a third approach to modernizing the air traffic system – one that relies on competition and market-driven innovation to produce NextGen just as they have revolutionized telecommunications across America and the world generally. Our discussion is divided into four parts: In Part One, we review the basic technical concepts underlying Next Gen. We show how NextGen is really a network of distributed participants or, to quote former NASA executive Bruce Holmes, a "technological commons," as opposed to a static system of controls than can be managed centrally. In Part Two, we discuss the statutory bases for the current system and the Administrator's unused regulatory authority concerning air navigation facilities that could support Next Gen. In Part Three, we describe an overarching strategy whereby the federal government would, wherever appropriate, *enable the private sector* to provide next-generation air transportation technologies and services. We contrast this strategy with both governance "reform" of the FAA and the creation of an ANSP monopoly to replace the FAA. In Part Four, we discuss issues relating to transition from the current state. Our vision is not for a one-time fix but for a "continuous improvement" mandate that allows today's completely centralized system to evolve into a true network; we advocate policies on development and funding that would incentivize this to occur by balancing the need for market-based growth and government stimulus/oversight.

[5] 'Air Navigation Facility' "means a facility used, available for use, or designed for use, in aid of air navigation, including (A) a landing area; (B) a light; (C) apparatus or equipment for distributing weather information, signaling, radio-directional finding, or radio or other electromagnetic communication; and (D) another structure or mechanism for guiding or controlling flight in the air or the landing and takeoff of aircraft." 49 U.S.C. § 40102(a)(4)

[6] 49 U.S.C. § 44708

Part One: A Primer on NextGen Concepts

In order to determine the optimal method for modernizing the nation's air traffic system, it is first helpful briefly to lay out the objectives of NextGen.

Overall, the aim of NextGen is to increase significantly the safety, capacity, efficiency, environmental compatibility, and security of air transportation operations and, by doing so, allow for the continued growth of the U.S. economy. These benefits can be achieved through a combination of new procedures and advances in the technology deployed to manage passenger, air cargo, and air traffic operations in a radically different way than occurs today. Importantly, the end-state is a distributed network – that in some respects resembles a large telecommunications network or the Internet – in which each aircraft will comprise a 'node' in the networked architecture, broadcasting and receiving information and acting as relay stations for other nodes in the system. Peer-to-peer communication and automation would very gradually alter many coordination functions traditionally performed by air traffic controllers at centralized facilities.

The JPDO has identified eight key capabilities that are part and parcel of these goals:

1. *Network-Enabled Information Access*: Today, information access is often compartmentalized with pilots, controllers, and other groups each able to see only discrete parts of the overall situational picture at any given time. Network-enabled information access will allow for the creation of a usable, real-time overall situational picture for pilots, controllers and others by integrating information from the networked universe of sources. This enables greater and more optimal distribution of decision-making responsibility and improves the speed, efficiency, and quality of decisions and decision-making.

2. *Performance-Based Services*: Regulations and procedural requirements are described in performance terms rather than prescribed in terms of specific technology or equipment. This concept is akin to the minimum speed requirements to use the interstate highways. Service providers can use service tiers to create guarantees for different performance levels so that users can make the appropriate tradeoffs between investments and level of service desired to best suit their needs. For instance, the FAA and other air traffic control authorities already give preferential routings to aircraft operating in oceanic airspace if they can meet certain standards of navigation precision. This has created an incentive for airlines to invest in precision navigation

equipment to save fuel and time while boosting airspace capacity in these areas.

3. *Weather Assimilated into Decision-making:* Weather plays a significant role in the efficiency of the air traffic system. Recognizing this, NextGen will offer better weather information that is directly integrated into automation to allow decision-makers to take into account the uncertainties of weather and better understand weather effects. Applying weather probability information and tailoring weather data to individual user needs significantly increases the effective use of weather information and minimizes adverse effects of weather on operations.

4. *Layered Adaptive Security:* Currently, many of the security measures employed in aviation are overlaid upon an older and incongruous infrastructure with well-known results. The security system envisioned for NextGen is constructed of "layers of defense" (including techniques, tools, sensors, processes, information, etc.) that are integrated into the infrastructure and that help reduce the overall risk of a threat reaching its objective while minimally affecting efficient operations. Layered, adaptive security adjusts the deployment of security assets in response to the changing profile of risks; responses to anomalies and incidents are proportional to the assessed risk of involved individuals or cargo.

5. *Broad-Area Precision Navigation:* The disadvantage of ground-based navigational aids (besides the high cost of installation and maintenance) is that flight routes must be constructed in relation to these aids. The result is that the routes used are often not the shortest distance between two points. In NextGen, as satellite navigation is increasingly used, navigation services are provided where and when needed, in accordance with demand and safety considerations, to enable reliable aircraft operations in nearly all conditions.

6. *Aircraft Trajectory-Based Operations:* The basis of all operations in the national airspace system will be an aircraft's expected flight profile and its expected departure and arrival times. Many newer transport aircraft already are capable of four-dimensional trajectory flight management, in which the crew inputs a geographic point, altitude, and time and the aircraft will essentially fly itself to arrive at that point and altitude at the precise point in time. NextGen will rely on four-dimensional trajectories to manage air traffic

across the board, ensuring that, to a much greater extent than today, airspace resources are allocated to match known demand.

7. *Equivalent Visual Operations:* Currently, airport capacity can be dramatically reduced if visibility and cloud ceilings fall below certain minimums. NextGen envisions improved information availability that allows aircraft to efficiently conduct operations in all visibility conditions. For aircraft, these capabilities, in combination with broad-area precision navigation, enables increased accessibility, both on the airport surface and during arrival and departure operations, leading to more predictable and efficient operations.

8. *Super-Density Operations:* New procedures will improve airport surface movements, reduce spacing and separation requirements, and better manage overall flows in and out of busy metropolitan airspace to provide maximum use of the highest demand airports. Airport terminals also maximize efficiency of egress and ingress, matching passenger and cargo flow to airside while maintaining safety and security levels.

NextGen obviously has significant implications for the FAA as an air navigation service provider. Air traffic management is re-oriented from centralized ATC control towards pilot-centric, self-executing rules and procedures through networked automation systems, and is much more flexible than today's system. By requiring greater levels of CNS performance (mainly tied to aircraft capability), so as to eventually allow reduced separation between aircraft, NextGen substantially increases airspace capacity.[7] The role of the FAA moves from tactical provision of air traffic control to strategic management of the network traffic flows, as well as the regulatory oversight of privately owned and operated infrastructure.

In NextGen, airspace boundaries will no longer be tied to FAA facilities as they are today; distinctions would be based on complexity of airspace and required aircraft capabilities, and boundaries could easily be changed based on demand and other considerations. Fundamental to this change is the notion of four-dimensional trajectory-based airspace (described above) which would utilize specific operational requirements to maximize capacity. "Classic" airspace would be available to aircraft that lack the appropriate equipment for trajectory-based operations, acting as an incentive to those operators to

[7] For example, if aircraft can fly very accurate routes taking advantage of Required Navigation Procedures (RNP), with very accurate ADS-B surveillance, and can accept priority trajectory data messages, then separation between aircraft can be reduced.

re-equip. At busy terminals, "super density terminal operations" would be possible when demand requires it; operations by low-capability aircraft would not be permitted or would be restricted, in order to maximize capacity for high-capability aircraft. [8]

Part Two: Federal Aviation Laws and the Provision of Air Traffic Services

Historical Background

The earliest form of air navigation infrastructure can be traced to 1919 when the United States Postal Service began using bonfires to facilitate navigation at night. Postal Service pilots found their way with the help of fires lit by Postal Service staff, farmers, and the public.[9] By 1923, the Postal Service worked to complete a transcontinental airway of beacons spaced 15 to 25 miles apart, each with enough brightness to be seen for 40 miles in clear weather. Within a few years the Postal Service implemented a ground-to-air radiotelephone system that could communicate with airmail aircraft at distances up to 150 miles.[10]

The Postal Service limited its participation to airmail operations, and private industry was reluctant to invest in an unexplored, unproven industry. The uncertain investment environment facing the private sector precipitated in the government's initial foray as an air navigation service provider. The sixty-ninth Congress explained the factors necessitating government involvement:

> One of the principal conditions standing in the way of progress and acting in restraint of the more rapid investment of private capital in the field of air transport is the excessive burden placed upon private capital if it is to be required to pioneer in the development of flying equipment best suited to air transport and at the same time supply all the collateral requirements including airways and air navigation facilities, especially as such facilities are, by their very nature, open to the use of all, and no

[8] Other JPDO concepts include staffed virtual towers and automated virtual towers. Staffed virtual towers would provide air navigation service provider services from a facility that is not physically at the airport. These virtual towers would provide service to more airports than the FAA serves today, with reduced infrastructure costs and increased staff productivity. Automated virtual towers would improve services to lower density airports, many of which do not currently receive air traffic control services, by providing sequencing and basic airport information without air navigation service provider personnel.

[9] Roger Mola, The Evolution of Airway Lights and Electronic Navigation Aids, http://www.centennialofflight.gov/essay/Government_Role/navigation/POL13.htm.

[10] Id.

> proprietary rights can be retained by the parties undertaking the original investment and the expense of maintenance.[11]

These conditions culminated in the enactment of the Air Commerce Act of 1926 which charged the Department of Commerce with advancing the aviation industry. In fulfilling its duty, the Department of Commerce assumed the Postal Service's role of building and operating lighted airways. In addition, aeronautical communications were improved, and radio beacons were introduced as an effective aid to navigation.[12]

The volume of commercial air transportation increased dramatically by 1934. In an effort to clarify the government's oversight role, the aeronautics branch within the Department of Commerce adopted a distinct title, the Bureau of Air Commerce. The Bureau encouraged the private establishment of air traffic control along airways in an effort to distribute some of the burdens associated with overseeing larger volumes of traffic. A not-for-profit firm, ARINC, created the first air traffic control centers with funding from participating airlines.[13] Early control centers in Chicago, Cleveland, and Newark controlled traffic within a 50-mile radius of the respective locality, and each airline contributed to the cost of the air traffic control operations in proportion to airport use.[14] However, ARINC and the airlines were relieved of the burden of maintaining the air traffic control facilities after only a few years. In 1937, the Department of Commerce assumed the burden of operating these once privately owned facilities and asserted federal responsibility to ensure a "uniform centralized system of air traffic control."[15] It is worth noting that the Commerce Department's assumptions of the Postal Service and then ARINC's operations were *policy* decisions and were not compelled by law.

The Federal Aviation Act of 1958 and its Origins

The advances in and evolution of aviation technology may be characterized as a series of fits and starts. The government's oversight of aviation followed a similar path for much of the 20th century, and by the 1950s, the result was a patchwork of agencies with overlapping and even conflicting missions. This lack of coordination predictably resulted in problems one of which drew the attention of Congress:

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[11] S. Rep. No. 69-2, at 6 (1925).
[12] A Brief History of the Federal Aviation Administration, http://www.faa.gov/about/history/brief_history/ (last visited July 10, 2006).
[13] Robert W. Poole, Air Traffic Control: The Private Sector Option, Backgrounder 216, Oct. 5, 1982, at 9.
[14] Id.
[15] Glen A. Gilbert, Historical Development of the Air Traffic Control System, IEEE Transactions on Communications, Vol. COM-21, No. 5, May 1973.

> One of the chief results of this type of "coordination" was the now famous TACAN-VOR/DME fiasco which involved the expenditure of millions of dollars for the planning and development of a military air-navigation system that was essentially incompatible with the system being developed by civil authorities. As a direct result of these circumstances, the bleak fact is that our airways-control system is largely inadequate for present civil and military needs.[16]
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> The TACAN controversy, no doubt, contributed to delay in the development and installation of a short-range air navigation system to meet the needs of jet-age aviation.[17]

The first step towards centralizing some of the dispersed responsibility was the creation of the Airways Modernization Board.[18] The Board, armed with statutory authority, was created to promote efficiency and to expedite the research and development needed to handle the expanding air traffic in the jet age.[19] The Board's duties were to "develop, modify, test, and evaluate systems, procedures, facilities, and devices, as well as define the performance characteristics thereof, to meet the needs for safe and efficient navigation and traffic control of all civil and military aviation."[20]

Edward P. Curtis, a special assistant to the President for aviation facilities planning, provided the impetus for the legislation creating the Board when he produced an interim report[21] recommending the creation of a board that would commence the long-range improvement of air traffic systems.[22] Curtis further suggested the Airways Modernization Board hold full responsibility for developing and consolidating the requirements for future systems needed to provide the necessary communications, navigational aids, and control to accommodate future air traffic control.[23] While the report focuses on the Board's role in advancement of aviation navigation and control, Curtis "recognized that the selection of future systems and method of control of air traffic is a public action in the broadest

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[16] S. Rep. No. 85-1811 at 7 (1958).
[17] H.R. Rep. No. 85-2360 at 5 (1958).
[18] Airways Modernization Act, Pub. L. No. 85-133, § 2, 71 Stat. 349 (1957).
[19] H.R. Rep. No. 85- 836, at 2 (1957).
[20] Id. at 1.
[21] President's Message to Congress Transmitting an Interim Report Prepared by the Special Assistant for Aviation Facilities Planning, H.R. Doc. 150 (Aug. 11, 1957).
[22] Id. at 4.
[23] Id. at 3.

sense."[24] The Board was expected to seek advice from aircraft operators and the engineering talents of the manufacturing industry:

> It is intended that this Board will specify new systems which will best serve the needs of all air navigation and traffic control to the interested military and civil agencies. *It is not intended that the Board will have the authority to develop or procure the final ground or airborne equipments to be used in operations*.[25]

Until the passage of the Airways Modernization Act, the laws were silent on the question of unified development of air navigation facilities.[26] The Act centralized one aspect of aviation regulation, but the Board was only established to serve as an interim body.[27] Gaps remained in other areas, and it is fair to say that proper development planning was often stifled by subordination to other interests or neutralized in the process of coordination.[28] Even as the Board engaged in functions with long-term effects such as testing, evaluation, and selection of air navigation facilities, Curtis anticipated further organizational changes into which the function of the Board would logically fit.[29]

A watershed event that seems to have drawn and cemented the federal government into the role of monopolist over air traffic services occurred in 1956 when two passenger airplanes collided over the Grand Canyon killing 128 passengers. In that era, aircraft were separated using 'procedures' similar to those used to separate trains sharing a single track and pilots were expected to 'see-and-avoid' each other. The public outcry for action that followed is oft-cited as the impetus behind the creation of the FAA and led to much greater direct federal involvement in aviation infrastructure. The anticipated change arrived in 1958 with the passage of the Federal Aviation Act, which created the Federal Aviation Agency.[30] The Act created a larger agency charged with full responsibility for the advancement and promotion of civil aeronautics. The functions of the Airways Modernization Board were incorporated into the mission of the new agency, giving the Administrator plenary authority in matters of air traffic rules and operation of air

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[24] Id.
[25] President's Message to Congress Transmitting an Interim Report Prepared by the Special Assistant for Aviation Facilities Planning, H.R. Doc. 150, at 4 (Aug. 11, 1957) (emphasis added).
[26] S. Rep. No. 85-1811, at 14 (1958).
[27] President's Message to Congress Transmitting an Interim Report Prepared by the Special Assistant for Aviation Facilities Planning, H.R. Doc. 150, at 4 (Aug. 11, 1957).
[28] Id.
[29] Id.
[30] Federal Aviation Act, Pub. L. No. 85-726, 72 Stat. 731 (1958).

navigation facilities.[31] In transferring the standard-setting functions of the Board to the newly-created FAA, the record reveals no Congressional desire for the government to begin developing and procuring the 'final ground or airborne equipments.'

Prior to the enactment of the Act, the responsibility for air traffic control, navigation facilities, and development of aviation infrastructure was scattered among various military and civilian agencies; seventy-five interagency groups worked on one phase or another of aviation policy or planning.[32]

The Agency's Authority and Obligations with respect to Air Navigation Facilities

The statutes are notably permissive in the area of 'air navigation facilities.' Generally speaking, the Congress uses the verbs 'may' and 'shall' to differentiate between a grant of discretion and a legislative command. Two examples of relevant statutory language are below:

> The Administrator of the Federal Aviation Administration ***may***- (A) acquire, establish, improve, operate, and maintain air navigation facilities; and (B) provide facilities and personnel to regulate and protect air traffic.[33]

While this language opened the door for a federally-owned and operated infrastructure, it did not command it. Further, the language of the statute implicitly suggests that non-federal entities may create and operate air navigation facilities:

> The Administrator of the Federal Aviation Administration ***may*** inspect, classify, and rate an air navigation facility available for the use of civil aircraft on the suitability of the facility for that use.[34]

Such authority likely would not have been included if Congress had assumed that each and every air navigation facility were to be owned and operated directly by the federal government. The language above along with the existence of an air navigation facility certificate among a list of certificates issued to private persons in the statute strongly implies that Congress did not seek a federal monopoly of air navigation facilities.[35]

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[31] Id. at 15.
[32] S. Rep. No. 85-1811, at 6 (1958).
[33] 49 U.S.C. § 44502(a) (1) (2003).
[34] 49 U.S.C. § 44708 (2003) (emphasis added).
[35] 49 U.S.C. § 44702 (2003) (emphasis added).

In contrast to the permissive language cited above, the legislative command is clear in the examples below:

> Promoting Safety. - The Administrator of the Federal Aviation Administration ***shall*** promote safe flight of civil aircraft in air commerce ***by prescribing*** - (1) ***minimum standards*** required in the interest of safety for appliances and for the design, material, construction, quality of work, and performance of aircraft, aircraft engines, and propellers; (2) ***regulations and minimum standards*** in the interest of safety for –(A) inspecting, servicing, and overhauling aircraft, aircraft engines, propellers, and appliances; (B) equipment and facilities for, and the timing and manner of, the inspecting, servicing, and overhauling; and (C) a qualified private person, instead of an officer or employee of the Administration, to examine and report on the inspecting, servicing, and overhauling; (3) ***regulations*** required in the interest of safety for the reserve supply of aircraft, aircraft engines, propellers, appliances, and aircraft fuel and oil, including the reserve supply of fuel and oil carried in flight; (4) ***regulations*** in the interest of safety for the maximum hours or periods of service of airmen and other employees of air carriers; and (5) ***regulations and minimum standards*** for other practices, methods, and procedure the Administrator finds necessary for safety in air commerce and national security.[36]

Another statute containing a legislative command lends further credence to the notion that the executive branch was to serve as a regulator rather than operator of air navigation facilities:

> The Secretary of Transportation ***shall prescribe regulations*** on standards for installing navigational aids, including airport control towers. For each type of facility, the regulations shall consider at a minimum traffic density (number of aircraft operations without consideration of aircraft size), terrain and other obstacles to navigation, weather characteristics, passengers served, and potential aircraft operating efficiencies.[37]

The parallel between the preceding two legislative commands illustrates that Congress envisioned a national airspace system in which the private parties would not only build and operate airplanes but also install and presumably operate air navigation facilities.

[36] 49 U.S.C. § 44702(a) (emphasis added).
[37] 49 U.S.C. § 44719 (emphasis added).

Part Three: Comparing the Management Options

In the face of widespread acknowledgment that the traditional U.S. government approach to modernization of the national airspace system probably won't succeed (or at least not rapidly enough to realize the benefits of all the NextGen technologies),[38] policy makers to date have been asked to choose between two approaches: reform the FAA, or spin off air traffic control to a corporate entity and privatize its functions. As described below, there also is a third approach available – which is to facilitate competition among private sector firms over the provision of CNS services directly to airspace users as already happens, with great success and safety, in the rest of the aviation system.

To see how this third approach could be used in combination with elements of the first two, it is useful to examine the options in more detail.

Fundamental FAA Reform

As suggested, the first policy option is to leave air traffic control as an entirely federal government function but to eliminate the roadblocks to effective management and modernization through fundamental and durable reforms of the agency. Under this approach, new legislation would remedy the FAA's inability to engage in long-term capital planning, lessen political interference in agency investment and spending decisions

[38] This recognition is not new. In 1997 the National Civil Aviation Review Commission (NCARC), warned of exactly what is now happening:

> There are dark storm clouds on the horizon….. The present process by which the air traffic control system . . . is financed and managed will not meet the future needs of the national economy and the traveling public. … The FAA has both large capital requirements and large day-to-day operating needs. The FAA is unique for a government agency in that it provides around-the-clock, 365-days-a-year air traffic control services — a linchpin of our nation's economic well-being. However, the FAA is funded and budgeted like other government agencies, most of which do not have this type of operating responsibility. Being subject to the increasingly stringent federal budgetary spending caps, the agency is placed in the unsustainable position of having to forego capital development programs in order to keep the day-to-day operations adequately staffed. . . . Unless the budgeting and funding picture is dramatically altered so that aviation revenues can be directly linked to the programs they ostensibly support, rising operating expenses will outstrip the FAA's ability to make capital investments in air traffic control and airports. When faced with limited resources, operating and maintaining the present system prevails over the need to modernize.
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> See http://www.faa.gov/NCARC/reports/pepele.htm, at Part I (Introduction).

through earmarks and otherwise, and wean the aviation trust fund from its over-reliance on passenger ticket taxes and aviation fuel taxes. In some sense, this policy option represents a natural and logical outgrowth of prior attempts to reform the FAA, including the 1996 reauthorization proposal that created the Air Traffic Organization with its own chief operating officer and gave the FAA a pay for performance system, as well as greater independence in its acquisition and personnel systems. This organizational change has yielded tangible and substantial benefits.[39] The aim under this approach is to complete the reform effort initiated ten years ago.

Reforms would include the following:

- ✓ *Establish a system of user fees that links airspace system costs and revenues*. One fundamental reform would be to establish fees for the use of air traffic control services and CNS infrastructure that are based on the FAA's cost-accounting data associated with specific functions. For example, under the Bush Administration's 2006 FAA reauthorization proposal, turbine commercial flights would have primarily paid user fees; general aviation and all piston-powered flights would have primarily paid fuel taxes; and the General Fund would have financed the costs of Flight Service Stations, low activity air traffic control towers, and services provided to public users. The AIP program would have been funded via a set of simplified excise taxes, consisting of a flat, universal AIP fuel tax for domestic turbine commercial and all GA flights and an international passenger head tax for international commercial passenger flights. The Administration also proposed modest user fees to cover the costs of some activities in the areas of equipment certification and registration.

- ✓ *Set up a mechanism that ensures stakeholders a greater say in spending decisions*. Over the years reform advocates have pushed for a new FAA governance board to be

[39] The savings experienced from creation of the ATO over its first several years appear to be significant. For example, the Flight Service Station competitive sourcing, completed in October 2005, was estimated to save $1.7 billion over 10 years. An ATO project/program review resulted in the restructuring of 10 projects and termination of a further 3 programs that is expected to result in $460 million lifecycle savings. The ATO consolidated from nine service areas nationally to just three which should yield $360 to $460 million in savings over 10 years. The ATO also rationalized navigation infrastructure by eliminating 100 navigation aids and 400 navigation procedures based on obsolescing 'non-directional beacons.' In terms of labor cost management, ATO flattened its structure by eliminating 5 layers of management and reducing non-safety personnel by 15%. Along with other measures, labor cost per flight declined by 1.5% in FY 2005. These changes have also generated direct economic benefit for users. A new set of procedures based on Area Navigation (RNAV) in the Atlanta area save air carriers $39 million annually. A reduction in vertical spacing in U.S. domestic airspace is estimated to save airlines $5 billion through 2016. Finally, a new air traffic control route evaluation tool will reduce flight times and should reduce fuel costs by $450 million.

comprised of user representatives and/or other interested parties, perhaps appointed by the President, who would be given a significant role in the decisions of the agency and, therefore, exercise discipline over the FAA in terms of cost-control and capital investments. Under these proposals, board approval would typically be required for the establishment of user fees, including annual adjustments; major capital infrastructure decisions; requests for debt financing of modernization projects; the agency's strategic plan; and adoption of ATO's operational and performance metrics. The Board would also review and provide advice on FAA's safety programs, budget, and cost accounting system. However, the safety and policy responsibilities and decision-making authority of the FAA would be retained by the FAA Administrator with user input for these areas in a solely advisory capacity.

- ✓ *Give the FAA long-term spending authority.* Under various proposals user fees would be credited to a separate account established in the Treasury and available immediately to pay for air traffic control and related services. The amounts would remain available until exhausted and spending would not require any further congressional action. This sort of "permanent appropriations" status is critical not only to maintaining the link between revenues and costs but also to reducing year-by-year funding uncertainties, heretofore the most significant impediment to ongoing modernization. Fees could also include agreed-upon contributions to a reserve fund that FAA would use to minimize the need for increases in fee rates that might otherwise be required to avoid funding shortfalls attributable to unanticipated reductions in aviation activity or emergency requirements.

- ✓ *Provide access to private capital*. Any high-tech organization is at a huge disadvantage if it must finance on a pay-as-you-go basis. Borrowing is a necessity for capital-intensive enterprises, especially during major technology transitions. In light of this need, prior reform proposals have included authority for long-term borrowing from private capital markets. Because borrowing authority is typically used in the public sector to finance activities that are expected to generate a dedicated revenue stream, this is a good fit for a cost-based funding structure and the FAA's need for a capital-intensive transition program.

- ✓ *Realign and Consolidate Aviation Facilities and Services.* An obstacle to reform of the FAA has been that members of Congress have been reluctant to give up ATC facilities in their districts even though it is also widely agreed that the FAA has far too many air traffic control centers and terminal radar approach control (TRACON) locations. Using

the concept of Department of Defense's Base Realignment and Closure ("BRAC") process as a model, prior proposals have included a specific, mandatory process by which the agency would realign and consolidate its services and facilities, thus cutting capital, operating, maintenance, and administrative costs on an agency-wide basis. This BRAC-like authority, it is said, would provide a critical tool which the FAA could use to achieve a scaled-down overhead, maximizing the efficient operation of the agency without reducing safety.

'Privatization' or spin-off

The second policy option, tried in several countries, is to separate the air traffic control CNS infrastructure and human resources from the government air navigation service provider and spin them off – to a single corporate entity, independent agency or joint venture of some sort, fully or partly privatized. The truest form of this approach would emulate what the British government did with NATS – i.e., transferring all assets and employees from the government to a for-profit, private entity with shareholders and a fully independent board of directors. Another variant is to spin-off the assets and employees to a not-for-profit private corporation. This is the Canadian model (NavCanada). A final variant is to retain the assets and employees within the government but to set up a separate government corporation, or otherwise independent entity (the French model), and allow it to contract freely, make capital spending decisions with limited Congressional oversight, charge user fees, and borrow money. This was essentially the Clinton Administration 1994 USATS proposal.

The most critical step involved in all of these efforts is that the resulting entity enjoys *financial autonomy in its governance arrangements*, according to a 2006 report on commercialization of air navigation service providers by Glen McDougall of mbs Ottawa, Inc.[40] That is, they are able to assess and collect fees directly from users, borrow money, and spend on capital projects like a private corporation rather than a bureaucracy. The proponents of commercialization argue that it speeds up modernization efforts, improves service quality, reduces costs, and affords financial stability – all with the same or better level of safety. According to the McDougall study, preliminary evidence supports these beliefs. Notably, all of these attributes are also part of the DOT's initial proposal for reform of the FAA, described above.

[40] McDougall, "ATC Commercialization Policy: Has It Been Effective?," with the cooperation of George Mason University, Syracuse University and McGill University, January 2006.

The McDougall study uses the term 'commercialization' to describe the full spectrum of enterprise models in which varying degrees of market forces are allowed to permeate into organizations that are fundamentally governmental in nature.[41] In contrast, for analytic purposes, our notion of "privatization" for the United States is more narrow and specific. Rather than merely establishing distance between the government and the air traffic service provider, privatization presupposes a divestiture of the entire system, with all physical assets and human resources, to a single private firm – a monopoly – that would presumably seek to generate profits. Unlike several of the countries studied by McDougall's team, the government does not control or manage the air traffic service provider and would act only as disinterested regulator.

An approach such as that taken in the UK or Canada plainly has some merit – for specific CNS functions. Indeed, the FAA has already used the competitive sourcing process (under OMB Circular A-76) to achieve a substantial cost savings in the operation of flight service stations, which are now operated by a single private firm. But quite apart from the enormous political hurdles to any *broad scale* "privatization," we do not advocate it as an across-the-board solution in the United States market for several reasons:

- ✓ To begin with, these approaches replace a government monopoly supplier with a private one. While it is likely that the resulting private provider will be somewhat more efficient than the FAA,[42] a monopoly over air traffic services and all related CNS services stays intact – with all the usual negative implications for efficiency, cost, and innovation within the system. Whether one is considering the former AT&T or the U.S. Postal Service, service monopolies generally do not innovate or spend on disruptive technologies that reduce their costs, change their business model or lower their prices – but are instead focused on justifying high prices to consumers. By simply transferring the existing system to private hands, we could thus miss out on or postpone an opportunity for positive systemic transformation that an ongoing competitive marketplace provides and that are inherent in the difference between legacy and NextGen technologies and services.

[41] As described above, the French gave a government agency the authority to levy charges and to access capital markets, and the Canadians created a not-for-profit corporation without shareholders. In other countries in which a separate legal entity was created, the ownership often rests in government hands to varying degrees.

[42] The FAA's success in lowering its labor costs – among other things, through a 30% reduction in new hire wages for air traffic controllers – will enable the agency to be more productive.

- ✓ A corporate air navigation service provider set up by government is still not free of bureaucracy. Key technical and economic decisions would still be subject to an administrative process – these proposals generally involve some form of regulated rate setting in which users can appeal the result to the federal government – and thus would not be fully controlled by the marketplace. Even a semi-privatized entity could easily be held hostage to political machinations – the best example of which is Amtrak. Given European tendencies to view the role of government quite expansively and to advocate government involvement in the private sector, their embrace of ATC 'corporatization' tends, if anything, to suggest that the United States may need a different solution.

- ✓ Lessons from other countries are of limited value also because the United States market for aviation is significantly more diverse, complex and larger than those of countries that have opted for single-firm privatization. Our market is characterized by a huge general and business aviation industry that uses thousands of airports and represents more than 26 percent of flight operations. This industry will be growing much faster than the commercial airline business, given the introduction over the next several years of a large new fleet of thousands of very light jets. In all other countries, general aviation and business aviation are afterthoughts. As a result, the solution adopted elsewhere – where there is essentially only one constituent, the airlines, may not work here. Moreover, it appears that "privatization" in Europe is enjoying success partly because it has created not one but several firms competing for business in the larger market for Single European Sky. Thus, the equivalent outcome in the United States would be to engender competition within our borders among different providers, which is implicit in the third management approach.

- ✓ The spin-off of a huge, legacy, $9 billion per year technology enterprise with all of its assets from the U.S. government would be a protracted undertaking. This is driven by the complexity of the transaction: Certain functions must be retained with the incumbent, as well as associated employees. A new entity must secure IP rights to continue to use the technologies, clear real estate title, environmental indemnities, employee undertakings (to retain key management), and so on. The new corporation will need to consolidate and lay off employees, generating employment claims and high severance costs, and will face substantial retiree liabilities.[43] Even in the private

[43] The FAA's Air Traffic Organization has very substantial liabilities for pensions and retiree medical benefits. Some of these liabilities are not carried today by the FAA (but are assumed by other parts of government). Transferring those liabilities to the new corporation could require a level of capitalization that is much higher than today, leading in turn to higher user fees.

sector – where the company conducting the spin off has every incentive to accomplish it as quickly and inexpensively as possible – such a process normally takes a matter of several years to complete. One can imagine it taking much longer within the federal government.

Competition for CNS services

The first two policy options assume the presence of a single service provider in the national airspace system, either part of the government or privately held. But either approach would arguably make the most sense as a *comprehensive* solution to our modernization problem only if the following related assumptions were true: 1) That the provision of all CNS services (including but not limited to air traffic control) and equipment represents a natural monopoly, *i.e.,* an inherently single business enterprise. 2) That CNS services are thus at their core different from the remainder of aviation (air transportation, aircraft and parts manufacturing, and airport management) as well as all of telecommunications, *i.e.,* they cannot safely, reliably and efficiently be provided in a competitive marketplace. 3) That centralized control over the design, procurement, and deployment of the CNS infrastructure facilities will produce greater benefits to aviation than distributed and local authority.

Given the fundamental operational changes heralded by NextGen – the very creation of a more flexible network that replaces today's command-and-control system – we do not believe these assumptions are valid going forward. To begin with, the near-monopoly currently held by the federal government over CNS services is largely the confluence of decades old policy decisions and other historical factors. No inherent or otherwise discernible economic logic necessitates a monopoly structure, despite the obvious need for coordination to ensure safety and efficiency and centralized standard setting to ensure interoperability.[44] It is notable that even after the FAA was created in the charged atmosphere of recrimination following a mid-air collision, the Congress gave the FAA authority to *certificate* "air navigation facilities" along with aircraft, airmen, and air carriers. This strongly implies that Congress expected that there could be multiple operators of such facilities among the public.

The alleged tradeoff between competition and safety is a false one. The United States has the most competitive airline industry – and the safest. Competing firms design, build,

[44] Prior to the creation of the existing air traffic control system, navigation facilities were not centrally-owned. Indeed, the very first navigation aids in the United States were bonfires lit by farmers and others to guide pilots at night.

and repair the aircraft used by the airlines. The last seven years have seen one of the safest periods in U.S. aviation history, yet during this very same period competition was so intense that most of the largest carriers filed for and operated under bankruptcy protection with no detrimental effect on safety. While careful coordination of air traffic is absolutely essential, there is no identifiable attribute unique to CNS services that should prevent market forces from playing an important role in this area of aviation as they have in every other area. In fact, allowing market forces to assume their traditional role would be consistent with what Congress had intended back in 1958, as discussed earlier.

As stated above, there is a clear need for a centralized standard setting function. This provides system interoperability that ensures safety and also generates positive 'network' effects for aviation stakeholders allowing comparably equipped aircraft to be operated almost anywhere in the world. However, the specified levels of performance necessary for aviation safety may be achieved using a variety of approaches, and therein lies the role for innovation and competition. A clear analog can be found in the evolution of the mobile phone industry and the internet. The very visible innovations in these areas are the result of *private sector* ingenuity spurred forward by the profit motive. It is hard, if not impossible, to imagine that the same degree of progress would have occurred had the procurement, design, and deployment of these technologies been centrally controlled by the federal government or any single entity.

As we shift from a ground-based centralized system to a satellite-based distributed network, we believe competition can and must play a much greater role in the development of the network than it has traditionally played in the development of the current ATC system. Industry, not government, is the primary source and driver of technical innovation across the economy, and CNS services should be no exception. The JPDO can define the desired *attributes* of NextGen but ultimately only the marketplace can produce the desired outcome. For the same reason, we eschew the approach now in vogue in most countries across Europe, where state-sanctioned corporate monopolies have been substituted for public ones. The proper role for the federal government is to allow industry gradually to assume responsibility for modernizing the CNS infrastructure – just as today the private sector, and not the federal government, is principally responsible for the public infrastructure underlying critical industries such as telecommunications, banking and health care.

Under this approach, CNS services would be regulated as another type of safety critical aviation service, such as flight operations, manufacturing, or maintenance, repair and overhaul services. The FAA would certify CNS equipment and services, set performance

operational criteria, and devise standards to ensure interoperability, among other functions. But responsibility for related infrastructure could fall to those who are providing the service in question, allowing state and local airport authorities to play a much greater role. Competing CNS providers and users would transact directly to determine the types, level, and price of CNS services within a sphere defined by FAA safety regulation or system requirements or some combination thereof.

As discussed earlier, this approach is fully consistent with the FAA's current statutory authority and the Administrator could implement this third option either by contract or regulation. The FAA's procurement authority allows the agency to enter into a broad range of "transactions" with private firms and could be used to set up a licensing regime for certain services. Licensees would become responsible for creating the infrastructure and supplying CNS services within that region. In this regime, the FAA's role would be principally to establish minimum standards for performance and protocols for interoperability to ensure safety and efficiency across the national airspace system. Incentives could be created by limiting the number of competing license holders responsible for large regions. This approach has a historical precedent in the United States in the development of the mobile phone market.

Another avenue would be to use the agency's dormant statutory authority through rulemaking to certify air navigation facilities throughout the United States.[45] These facilities could then be broadly authorized to provide CNS services to users subject to safety and efficiency regulations with the same general import and effect as the licensing conditions described above. The obvious precedent for this approach is the FAA's management of the rest of the aviation system, *i.e.*, air transportation, aircraft manufacturing and service, and airport management. This structure has obviously worked well given the agency's safety track record. As an additional measure, the agency could consider allowing local airport authorities to establish such facilities within existing financing mechanisms.

[45] Along the same lines, the FAA could use its exemption authority to permit – on a pilot basis or otherwise – commercial service providers to contract with operators and/or airports in certain regions of the country to provide them with foundational NextGen services. This approach would enable airports and operators in those regions to contract for services that would ordinarily be provided by the FAA but, due to resource constraints, were not being made available. For example, air taxi operators may require the development and implementation of instrument approach procedures; they could be permitted to work directly with local airports and private service providers to develop the procedures themselves. The procedures would still have to meet the agency's exacting standards for safety but would not necessarily have to be developed and tested by the FAA. Notably, the governments of Canada and Australia have taken steps to this end and have licensed a U.S.-based firm to develop instrument approach procedures in their respective airspace.

Part Four: Transition to A New Approach

NextGen consists of a multiplicity of networked services. Some of these services may well be inherently governmental and require centralized federal control (*e.g.,* 24/7 surveillance of air traffic for homeland security purposes). Some suggest a single-source provider in that allowing competing systems to develop may undermine NextGen goals (*e.g.*, the JPDO envisions that safety will be improved if all aircraft operators have simultaneous access to an authoritative and consistent source of weather information). Some are already being provided privately (*e.g.,* aeronautical data services) and suggest a fully competitive marketplace subject to regulation like the rest of the aviation system.

Because NextGen is not a single function but a series of new services for airspace users, it is a mistake to conclude that any one of the management options alone provides the right solution for the national airspace system in its entirety. Instead, we believe the optimal outcome for airspace users (and their end customers, the traveling public) will lie in combining the benefits of all three management options. That is, we can leave some aspects of air traffic services fully federalized while we reform the FAA and allow it the flexibility to operate more efficiently; outsource a limited number of other functions to a single commercial entity; and enable competition over the remainder of services through a regulatory regime that also provides robust incentives for the private sector to enter the market.

The initial step of our suggested approach is to organize the basic CNS services comprising the NextGen system by deciding which model for providing each of them (competition, privatization or federal) will work best. We believe this will vary with the services themselves, depending how closely they are related to core governmental functions (such as homeland security) and whether they require a central provider. In general, services would fall into one of three 'buckets': "NextGen services" which would largely be provided by the private sector directly to users under a licensing, regulation and certification regime overseen by the FAA; "interim and integration services," which would become a joint responsibility of the federal government and airport authorities; and "legacy services" which would remain the primary responsibility of the FAA, funded through a combination of user fees and general fund contributions.

If we take this approach, the role of the federal government in designing, owning and operating the air traffic infrastructure would be steadily reduced to core functions (ranging from surveillance of aircraft for homeland security purposes to overall

management of the air traffic network). The FAA would be reoriented toward a more customary regulatory model – the same one that has proved highly effective in the rest of aviation, where federal oversight of airlines, aircraft manufacturers, airports and others has produced by far the safest and most reliable air transportation network in the world. The private sector would in turn take on *direct* responsibility for providing most new navigation and communications services to aviation users, but on a competitive basis wherever practicable while subject to federal requirements and standards. Local authorities – already responsible for modernizing runways, terminals, and other ground-side capital equipment at the 5261 public use airports in the country – would gain a similar degree of autonomy over the CNS infrastructure at their airports so as to improve service to their customers.

NextGen Services

This category would include those new services that are based on very different technologies than those of the existing CNS infrastructure. An example of this would be ADS-B, or Automatic Dependent Surveillance Broadcast—a satellite-based technology that allows pilots in the cockpit and air traffic controllers on the ground to "see" aircraft traffic with much more precision than has been possible before, making flying safer and allowing more efficient use of our airspace. ADS-B is a foundational technology in the NextGen initiative. Other examples might include the provision of digital air-ground data communications.

Because the federal government does not today provide these services or own or operate the associated infrastructure, we believe that the management of these services should be heavily oriented toward the private sector and that incentives should be in place to encourage their direct provision on a competitive basis from private firms to aviation customers. The federal government would fulfill the oversight and development role as originally anticipated by Congress in 1958, regulating these services for safety and efficiency and seeding new technologies through R&D grants. The FAA would exercise its dormant authority to certify air navigation facilities, particularly where needed to facilitate new business models such as on-demand air taxi services.

Interim and Integration Services

This category would consist of services required for the cost-effective transition from the current system of ground-based navigation aids to the anticipated satellite-based system. These services would include integration functions to ensure the continuous operation of the ATC system at its existing (or improved) levels of safety and reliability. Two examples

of such services would be the deployment of Airport Surface Detection Equipment, Model X, or ASDE-X, a runway-safety tool that enables air traffic controllers to detect potential runway conflicts by providing detailed coverage of movement on runways and taxiways;[46] and Airport Surveillance Model-11 (ASR-11), a new air traffic control radar.[47]

Here, we would anticipate a significantly expanded local role over the evolving CNS infrastructure. Many of the NextGen technologies will not only improve safety but also increase the efficiency and dependability of aircraft operations – and hence lower operational costs (including fuel burn) and increase passenger throughput at airports. Thus, airport operators and their customers already have a natural incentive to speed up modernization of the CNS infrastructure. Particularly as air traffic management begins to incorporate surface operations (gate to gate air traffic management), this need will become more apparent, as most ground-side facilities are already owned and operated by airports and not the FAA. Federal funding from the AIP program or from passenger facility charges, could be freed to incentivize (but not require) airport sponsors to assume the CNS infrastructure burden at their locations while modernizing the facilities so as to allow their customers (that is, aircraft operators) to take advantage of NextGen navigation.

Legacy Services

These are primarily core federal functions – for example, maintenance of primary radar and surveillance of non-cooperative traffic – many of which will be related to homeland defense and security. These services could also include, however, those commercial functions that, for important policy reasons, the government has decided to subsidize

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[46] By collecting data from a variety of sources, ASDE-X is able to track vehicles and aircraft on airport surfaces and obtain identification information from aircraft transponders. The data that ASDE-X uses comes from a surface-movement radar located on the air traffic control tower or remote tower, multilateration sensors, ADS-B (Automatic Dependent Surveillance-Broadcast) sensors, the terminal automation system, and from aircraft transponders. By fusing the data from these sources, ASDE-X is able to determine the position and identification of aircraft and vehicles on the airport surfaces, as well as of aircraft flying within 5 miles of the airport. Controllers in the tower see this information presented as a color display of aircraft and vehicle positions overlaid on a map of the airport's runways/taxiways and approach corridors. The system essentially creates a continuously updated map of all airport-surface operations that controllers can use to spot potential collisions.

[47] As part of the current national airspace system modernization effort, FAA and DOD are deploying ASR-11 models to replace the aging ASR-7 and ASR-8 radars currently in the field. These new radars will be deployed at over 100 airports and military bases throughout the United States. In addition to providing aircraft surveillance, the ASR-11 is also required to provide an accurate six level depiction of weather intensity.

with contributions from the general fund. Included in this category would be the shrinking pool of traditional air traffic control services, *i.e.,* the continued tactical separation by air traffic controllers of aircraft not equipped for NextGen navigation services under our existing program of federal and contract towers. Flight information services for non-business GA could also be included in this category.

The current air traffic control system will by necessity exist side by side with the NextGen system for many years to come – just as today's landline phone system coexists with the cell phone network. Thus, to provide these core services in the most cost-effective way, the FAA will need long-term legislative authority to allow it to operate more like the capital-intensive, technology-centric business it is. This means the ability to assess user fees, undertake long-term capital commitments, and make the difficult but necessary decisions to consolidate facilities.

Conclusion

NextGen represents a comprehensive re-engineering of today's air traffic system. But the challenge here goes well beyond a mere technological one. The shift from a system dependent upon a high degree of centralization to one that is networked and more decentralized will also require that aviation stakeholders, including the government, reassess their roles and responsibilities in light of changed realities. This transformation in governance is no less fundamental than the switch from ground-based radar to satellite navigation.

Only an integrated approach that blends elements of the three policy options described in this paper – reform of the FAA, commercialization, and competition subject to federal oversight and regulation – will provide the granularity in policy making needed to bring NextGen to fruition. In particular, the introduction of market forces to the provision of communication, navigation and surveillance services is essential to restoring innovation to an arena that has for too long been a *de facto* federal monopoly. This approach has worked well in the rest of the aviation system and is consistent with the U.S. experience in other parts of the economy.