Nearly seven years downwind of the 9-11 shock that temporarily interrupted the steady upward climb of air traffic, the projected growth numbers across the next couple of decades are staggering. New low-cost and regional carriers are fueling the current uptake, and the skies are expected to become further congested with the advent of very light jets (VLJ) and unmanned aerial vehicles deployed by urban police and other homeland security agencies.

The airways circling US urban centers are already saturated to the point that the Federal Aviation Administration recently felt compelled to restrict the number of peak-time flights into and out of the New York City area’s three major airports. Indeed, three-quarters of all air traffic in the States is concentrated in about 1% of the nation’s 3,400 airports. And of the 35 busiest airfields, eight will need additional capacity by 2025 (Atlanta, Las Vegas, Los Angeles, New York, Philadelphia, Phoenix, San Diego, and San Francisco) – even after planned improvements are completed – according to the FAA’s recent “Capacity Needs in the National Airspace System” report.

The increasing congestion also threatens safety. Purdue University professor of aviation technology, Michael Nolan, believes: “The real problem is not with the controllers but with the constant battle between capacity of the system and increased demand.”

He says that with the number of passengers growing about 5% a year, new misfires, delays, and airport congestion will continue until the system is overhauled. The professor cites no new airports constructed in the last two decades, and new proposals prompting neighbor concerns about noise and pollution, not to mention cost.

“The demand for aviation services will continue to rise in the long run. Over the next few years, international markets will grow twice as fast as domestic markets,” acting FAA administrator, Robert Sturgell, told the Forecast Conference in March. “We see a definite change in the regional carrier industry with a trend to more, larger RJs that have over 50 seats. And, there’s still a big tailwind for corporate aviation.

“All of this activity has implications for various airports. From an operations standpoint we predict that on average, every year, from now until 2025, we’re going to add the equivalent of JFK, LaGuardia and Newark combined into the system. That means an already congested airspace has got to be able to accommodate that many more ops per year. When you say things like that, the cynics will tell you immediately that the sky is falling. That’s not the case, because we can meet the demand if we transform the way we do business.”

“Absent modernization,” he warned, “the consequences will be a total system collapse.”

**Mega-Billion NextGen**

The FAA’s intended airspace transformation is referred to as “NextGen,” short-hand for Next Generation Air Transportation System. And, great news, the Joint Planning and Development Office (JPDO), which is coordinating the NextGen efforts of the departments of Transportation, Defense, Homeland Security, Commerce, NASA, the White House Office of Science and Technology Policy, and the FAA – passed a major milestone earlier this year: they published their “first-ever acronym list” of over 1,000 terms. An integrated work plan baseline and “aviation equipment road map” are promised by September.

The Aerospace Industries Association is leading the budget request to increase spending for NextGen ($688m for fiscal 2009 alone), which is not surprising since the AIA president and CEO is former FAA administrator Marion Blakey.
NextGen - Transforming The Way We Do Business In The Skies

It will take nearly two decades and $60bn in satellite-based technologies to keep up with airspace demands around congested hubs in the US. Rick Adams looks at the NextGen proposed by FAA, as well as near-term air traffic training needs.

The entire NextGen system includes 18 programs and is officially expected to cost up to $22bn.

The National Air Traffic Controllers Association and others offer a contrary opinion. "We believe Congress should call for an immediate, comprehensive evaluation of NextGen before additional funds to implement it are expended." NATCA president Patrick Forrey told the Aero Club. Forrey cited an independent industry analysis estimate that NextGen's software development alone could cost more than $50bn.

Also battling NextGen is a coalition of aviation enthusiasts, local airports, and small businesses from rural communities calling itself the Alliance for Aviation Across America. They allege that proposed user fees for funding the airspace system amount to corporate welfare for airlines.

The FAA views the NextGen initiative as the path to a "more flexible, resilient, scalable, adaptive, and highly automated system able to meet up to two to three times current air travel demand."

The JPDO has outlined "eight key capabilities," which it deems necessary for NextGen:
- Network-Enabled Information Access
- Performance-Based Operations and Services, which to the FAA includes such capabilities as area navigation (RNAV) and required navigation performance (RNP) specifications. "Once the required performance level is established, the aircraft's own capability determines whether it can safely achieve the specified performance and qualify for the operation."
- (Real time) Weather-Assimilated Decision-Making
- Layered Adaptive Security (rather than being bound to an inflexible "one-size-fits-all" approach)
- Broad-Area Precision Navigation - i.e., "pilots will have the ability to define their desired flight paths based on their own objectives." Aircraft Trajectory-Based Operations - "Each aircraft will both transmit and receive precise positioning information, telling it where and when it and others will cross key points along its path."
- Equivalent Visual Operations, the ability to know where other planes are without having to physically see each other.
- Supercapacity and Separation Operations to "maximize the amount of traffic through both the busiest airports and airspace... (such as) reduced spacing and separation standards."

One critical component, ADS-B, could fundamentally alter the current relationship between flight crews and ground controllers, putting more "free flight" decision-making in the hands of pilots and potentially redefining controllers to the role of more monitors rather than active participants. ADS-B (automatic dependent surveillance broadcast) is a satellite-based system that allows aircraft to broadcast their position to others. The FAA estimates it will cost $12bn to retrofit all US aircraft and air traffic control facilities with the new system.

An ADS-B equipped aircraft uses global positioning system (GPS) signals to determine its position and broadcasts data on its identity, position, speed, and heading to other aircraft and ground stations within 150 miles. By seeing surrounding traffic with far greater accuracy than the current 30-second radar delay, pilots will have greater flexibility to fly more directly between two points.

Last year the FAA awarded a three-phase ADS-B contract to a team led by ITT, which includes AT&T, Thales North America, WSI, and PriceWaterhouse-Coopers. For the first three years ADS-B will be rolled out in the Gulf of Mexico region, Philadelphia, Louisville, and Juneau. The first option covers 2010 to 2012, including nationwide deployment by 2013, with the second option running through 2022. If all options are exercised the contract could be worth $1bn. Once GPS tracking becomes the norm, says John Kefalos, director of business development and air traffic control programs for ITT, the NextGen system should "provide the potential for a very significant increase in capacity."

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A factor was AT&T’s existing telecommunication infrastructure; ADS-B equipment will be installed on AT&T’s cell phone towers. “They have an extensive network of towers, which provides almost a built-in infrastructure,” says FAA spokesman Paul Takemoto.

Another element of NextGen is SWIM, or “system wide information management,” equivalent to a dedicated Internet for airspace users that will give operators access to airspace activity and weather condition information.

NATCA’s Forney laments, “Controllers were supposed to be using GPS-based navigation systems by 1997. In 2007 we are still using ground-based radar throughout the system.”

Given the FAA’s “history of management and acquisition problems that contributed to cost growth, schedule slippages and performance shortfalls,” the General Accounting Office’s Gerald L. Dillingham says NextGen is on its list of “high risk” programs.

**Training Now**

Forget the future conundrum, suggests Gary Pearson, vice president of advanced programs for ATC training developer Adacel. “Unfortunately the problem is right now for controllers.”

There are cries aplenty of a controller shortage, the seeds of which were sown when President Ronald Reagan “broke” the controllers union in 1981 by firing more than 12,000 of them for staging an illegal strike. Since many of today’s controllers entered service shortly thereafter, many of those are now retiring en masse.

There are frequent union allegations of short staff levels at ATC centers, of controllers working “forced overtime,” and a training backlog, because those qualified to conduct training are also needed to manage air traffic. The current career path is sometimes described as “sitting around for months, waiting to get involved in training.” There is said to be no spare capacity nor consoles, “lots of people sitting around . . . very expensive.”

Sturgell said the FAA “exceeded” its staffing targets for 2007, hiring more than 1,900 controllers to bring its total ranks.
to nearly 15,000. “Controller hiring, training, and staffing is a major priority and we are on track to meet future needs.”

Last year, over 800 controllers retired, and the agency anticipates that number will increase every year through 2012.

To address ATC training needs, Sturgell announced in December a $48m contract for Orlando-based Adacel to deliver new air traffic tower simulators to 18 locations around the country, plus the FAA Academy in Oklahoma City. The FAA has been using prototype tower simulators in four locations since 2006.

Initial deliveries are destined for Los Angeles, Atlanta, Dallas/Fort Worth, Washington, D.C., Oakland, and New York’s JFK, as well as six systems to the Academy.

The tower simulation system includes a large 3D visual depiction of the airfield and the area around the airport, and can be adjusted to reflect varying weather conditions and times of day. “The simulator is capable of 360-degree wraparound views,” according to Pearson, replicating windows of an actual airport tower where the student is being trained to work.

The simulator provides synthetic voice response to allow the student to receive audio inputs from pilots, as they would in the tower. At the same time, advanced speech recognition algorithms interpret the student’s commands and translate them into actual aircraft movements depicted on the screen of the airfield layout.

The design of the device enables the instructor to define “how busy or difficult they want the scenario to be – heavy, moderate, or light traffic… a mix of civil and military.” Indeed, the system can create “more traffic than a controller will ever face,” literally hundreds of aircraft and other moving entities such as ground vehicles.

“We’re heading down a path of aircraft becoming smarter and smarter”, by which the “intelligent” computer-generated aircraft in the simulator are capable of “contextually based autonomous decisions.”

Pearson says early anecdotal evidence suggests that training time can be cut between 30% and 50% using the simulators. The built in intelligence also reduces the number of people needed to operate the simulator “to one – and that could be the student.”

Adacel’s ATC tower simulation experience spans the globe with customers in Australia, Brazil, Canada, Hungary, and Italy, for example. And Pearson says the Americans are not alone in their future airspace dilemma. India and China are driving the greatest demand, yet have “arguably less than satisfactory technology to deal with the increase.” In Africa, there is “next to no ATC” for north and south routes and “a whole host of infrastructure issues.”

The company’s technology must also accommodate differences in regional policies, such as taxi command (in Europe, verbal permission from ATC is required to cross runways; in the US, aircraft do not stop unless specifically told to do so).

One of Adacel’s competitors, BAE Systems, recently delivered a single student, two pseudo pilot Modular Airspace Synthetic Environment (MASE) to Air Traffic Services at Coventry airport to assist in training its controllers in approach radar control, as well as procedural control. Coventry air traffic services manager David Smillie states “The MAPE simulator is going to help enormously with initial, continuation and training in unusual circumstances. It is very impressive in its accuracy of our real system.”

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