FROM 'SHRIMP BOATS'

As U.S. federal ATC celebrates its 75th anniversary, ALPA focuses on

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Their handlers called them "shrimp boats," which they resembled in shape but did not represent. Pushed by men with long wooden sticks like miniature polo mallets, the little "boats" moved slowly across a table map, standing in for airliners that the men tracked based on position reports radioed by pilots.

That's how air traffic control began in the United States during the 1930s—airline employees in three airway traffic control centers (Chicago, Cleveland, and Newark) tracking, but not separating, aircraft like DC-2s, DC-3s, and Ford Trimotors.

Last month, the FAA marked the 75th anniversary of federal air traffic control, which began on July 6, 1936, when the Bureau of Commerce took over the operation of the three centers and their 15 employees.

How much has changed in these 75 years!

Navigation has jumped by leaps and bounds (in reliability, accuracy, and ease of use) from pilotage and dead reckoning to bonfires and beacons to the A-N (aural-null) ranges to NDBs, VORs, and VORTACs, to RNAV, INS/IRUs, and GPS. Celestial navigation for flights over oceans, deserts, jungles, and the poles gave way to Omega, Loran-C, and other long-range or global nav systems—all now made obsolete by the Global Navigation Satellite System (GNSS) receivers, using the GPS, GLONASS, Galileo, or Beidou system.

FAA

Earl Ward (left) organized the original Newark airway traffic control center. Here, he tracks a flight as R.A. Eccles watches. The markers representing aircraft were moved across the map as flights progressed. First developed by controller J.V. Tighe, these markers came to be known as "shrimp boats."

Surveillance and separation, over much of the earth's land surface and coasts, have evolved from the "they should have landed by now" of St. Exupery's pioneering airmail days and nights to pilot inflight position reports and, in a major leap in the 1950s, to primary (skin reflection) and secondary (transponder-based) ATC surveillance radar. And now, Automatic Dependent Surveillance Broadcast (ADS-B), again based on GNSS.

Communications have evolved from flag and light signals to telegraph vacuum tube sets requiring an onboard operator to today's satellite-based systems allowing a mere phone call to anywhere in the world. Future communications systems will use a combination of datalink communications for messages such as controller-pilot data-link communications (CPDLC) and voice capabilities allowing for direct pilot-to-controller contact in non-VHF areas.

Traffic management has evolved from visual to an instrument-based regulatory system resulting in control zones and several classes of airspace. Traffic management historically has been based on providing "first-come, first-served" traffic services. Once an operator has invested in the new technologies, the service change is proposed as "best-equipped, best-served."

ALPA Board of Directors Priority: ATC System Modernization

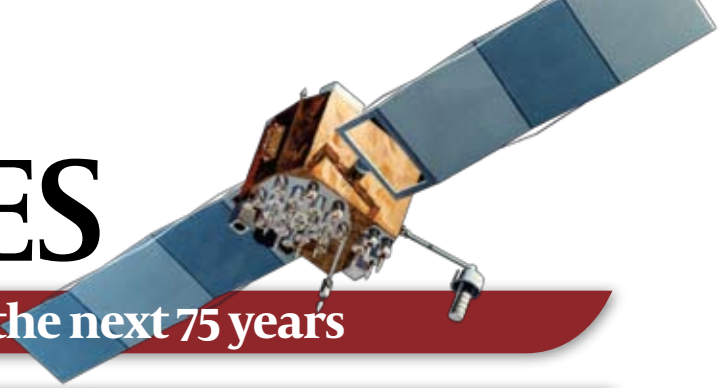
During ALPA's 2008 Board of Directors (BOD) meeting, Delegate Committee 3 (Safety/Security/Flight Time-Duty Time) set ATC system modernization as one of the union's top three long-term safety priorities having the potential to dramatically change the airline industry and improve ALPA members' livelihoods.

The BOD members discussed the fact that airline pilots currently fly in an antiquated system that is based on technology developed during the 1950s and 1960s, yet they fly fourth- and fifth-generation aircraft. Determining the problem isn't the issue—fixing it is.

The cost associated with upgrading and improving the U.S. ATC system is about $40 billion. Committee delegates agreed that improving the U.S. airspace system requires all industry partners, including government and airline management, to look at system and airplane upgrades in a new way. Congress needs to understand that a solid commitment to ongoing federal funding is going to be required. This is not a project that can be terminated before completion. Airline managements will also need to understand that they must cover some of the cost as they will eventually benefit from improved efficiency and capacity.

TO SATELLITES

completing a robust foundation for the next 75 years



ALPA Reps at the Table

Fulfilling policy made by ALPA's line pilot governing bodies (see "ALPA ATS Policies: By the Book," page 20), the union's representatives continue to be deeply involved in directing the course of NextGen implementation:

- ALPA's president, Capt. Lee Moak, is a member of the NGATS Institute Management Council (IMC) and also serves on the IMC Executive Committee. The NGATS Institute is the industry counterpart to the Joint Development Program Office (JPDO), which is made up of eight federal government groups that are involved in helping to shape NextGen.
- Moak also sits on the FAA NextGen Advisory Committee (NAC). RTCA, Inc., a private, not-for-profit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management (CS/ATM) system issues, administers the NAC. RTCA functions as a Federal Advisory Committee. The FAA uses RTCA recommendations as the basis for policy, program, and regulatory decisions; the private sector uses them for development, investment, and other business decisions.
- Keith Hagy, director of ALPA's Engineering and Air Safety Department, represents ALPA's interests on the RTCA Policy Board. Chris Baum, a manager in the Department, serves on the RTCA Program Management Committee.
- ALPA line pilot safety representatives and Engineering & Air Safety Department staff participate in a number of government/industry committees and forums that are working to develop standards, procedures, policies, and guidelines for NextGen implementation.

NextGen: A work in progress

Today, 75 years after the Bureau of Commerce federalized the "shrimp boats," the FAA and aviation stakeholders are deeply involved together in implementing this enormous and vitally important overhaul of the U.S. national airspace system (NAS). NextGen has been billed as the biggest U.S. transportation infrastructure project since the Eisenhower administration created the interstate highway system.

The forecast demands for aviation services globally require a better and smarter method of managing the use of the airspace system—from the gate to enroute flight and back to the gate. The challenge is building a new system within an existing system that operates 24/7, 365 days a year. You just can't shut down the airspace for a week of two, make the changes, and turn it back on.

The NextGen program is not only the combination of the aforementioned technologies, but also the optimization of each of their abilities combined in a process known as air traffic management (ATM). A well-designed ATM capability allows the air and ground components to function smoothly by synchronizing with each other, when expected, as required, and as efficiently as demanded. Airline pilots will not see but will be directly affected by these management processes. The result will be a requirement for more precise flying by all users, enabled by the proper technology, training, and regulation changes. NextGen Implementation Plan (NGIP) 2011, published annually by the FAA, highlights programs and projects time lines and can be found at www.faa.gov/nextgen.

The total NextGen vision for now through the year 2030 includes a vast number of changes, including to airport surface operations, aviation security, environmental aspects, energy, metroplex operations, unmanned aircraft systems operations, improved weather information services, on-demand NAS information, and their underlying technology changes. For most of the technology components, one of the fundamental elements of NextGen is the movement from ground-based to satellite-based navigation via GNSS, communications via datacomm, and surveillance via ADS-B. A key focus of these applications is the ability to share information, such as improved situation displays. With cockpit displays of traffic information (CDTIs), pilots will have the same picture of air traffic as controllers have and better situational awareness.

NextGen: vs. NowGen

Many new airliners are being delivered with operating ADS-B systems installed. Air traffic controllers can then use ADS-B to separate suitably equipped aircraft in areas within ADS-B coverage, resulting in pilots' receiving better surveillance services such as proceeding direct to a down-track fix and better ability to deviate from course for weather. These sites include Houston Center (providing coverage to the Gulf of Mexico), the Louisville TRACON, Philadelphia, Alaska, and South Florida. The FAA expects to complete the U.S. ground infrastructure by 2013 and to have the system fully operational by 2020.

Industry and government teams including the Air Line Pilots Association, Int'l, are working in metroplex areas to implement airspace, technologies, and procedural changes in the short term. ALPA is working in NORCAL, SOCAL, and other locations, providing pilot expertise and helping to get it right the first time.

ALPA ATS Policies: By the Book

Listed below are some, but not all, of the ALPA policies on air traffic control that are contained in the Engineering & Air Safety section of ALPA's *Administrative Manual*:

- ALPA supports the development and implementation of an ATC system using space-based systems for navigation, communications, and surveillance.
- ALPA supports a concept of national airspace system (NAS) architecture based on a jointly developed industry/government operational requirements document. ALPA also supports the allocation of resources by the administration and Congress in a manner that supports rapid modernization of the NAS.
- ALPA strongly endorses its continuous participation in the planning of future ATC systems.
- ALPA recommends frequent meetings with high-level FAA ATC representatives.
- ALPA supports the ATC system concept that includes a high degree of redundancy.
- ALPA supports the implementation of a flexible ATC system.
- ALPA endorses the development of cockpit displays of traffic information (CDTI).
- ALPA shall not endorse any cockpit traffic display that has not been properly tested, evaluated, and certified by the FAA, with the concurrence of ALPA for not only the collision avoidance function, but also for any extension of TCAS technology.
- ALPA supports equipping all airliners operated in accordance with the ALPA One Level of Safety policy with a system equivalent to at least TCAS II standards. The system should not be connected to the flight controls, but only provide maneuver commands for the pilot, unless a certified system can be shown to significantly increase the operational safety of TCAS resolution advisory maneuvers. Air traffic separation standards should not be based on this type of "last resort" collision avoidance system.

To view ALPA's *Administrative Manual*, visit the members-only site of www.alpa.org. Click on e-library in the toolbar, and in the left-hand menu click on Administration. Then click on Administrative Manual and go to the Engineering & Air Safety section.

The FAA is implementing hundreds of RNP approaches annually over the next several years. Some of these are overlays of existing approaches, and others optimize the flight path for terrain obstacles, noise areas, and other factors. RNP departures are being designed and implemented with an eventual goal to stitch the route segments together from takeoff to touchdown.

ALPA is actively participating in NextGen as an industry partner for planning and implementation. Capt. Lee Moak, ALPA's president, currently sits on the RTCA NextGen Advisory Committee (NAC), the high-level industry-government body that helps form the strategic "big picture" of NextGen. As ALPA's NextGen Project Team lead, I sit on the NAC Subcommittee, which is focused on the tactical implementation of many of the segments of the NGIP, based on NAC guidance. Many ALPA pilots participate in FAA Advisory Rulemaking Committees (ARCs), RTCA Technical Special Committees, and airport-level working groups, making sure that the pilot perspective is taken into account.

Yet much remains to be done.

NextGen: Sounds great—What's the holdup?

First, though implementing NextGen (and doing it right the first time) is hugely important for maintaining and improving safety, efficiency, and capacity while reducing aviation's environmental effects, it's not a free lunch and has costs—directly and indirectly. While it has benefits for all the participants, it also has risks of not delivering the promised benefits and possibly making things worse. It's a new system, after all.

"Roger, radar contact…"

During the 1930s, scientists in several countries developed primary surveillance radar (i.e., radar that detects the direction and distance to distant metal objects) that was used secretly in WW II. Primary surveillance radar brought about huge changes in civilian aviation when U.S. controllers began using it to separate aircraft during the 1950s. Enroute centers started using the first air route surveillance radar in 1956 when the first ATC computer was installed at Indianapolis Center. A year later, the ATC radar beacon system (i.e., secondary surveillance radar, which interrogates aircraft transponders) came along.

Second, as mentioned above, NextGen is very much a work in progress. The first tier of applications will focus on replacing current operations with new technology, procedures, and airspace changes. For example, ADS-B *per se* is pretty straightforward—i.e., the aircraft or ground vehicle reports its GPS position with precision not available from earlier technology. Various users see the data for different purposes. The much bigger question is, What do we do with the data? New technologies and applications will require a review and amendment to procedures; and regarding certain applications, the "concept of operations" hasn't even been decided yet.

ADS-B's improved accuracy of location should permit (at least in theory) reduced separation between aircraft, but what about wake turbulence? When will rigorous testing be conducted to answer a long list of questions about wakes? Will new

ALPA Contributions to ATC and National Airspace System Safety

The Association's active engagement with the FAA, Transport Canada, international organizations, local ATC facilities, manufacturers, airline managements, and other aviation stakeholders during the past 75 years has led to many improvements, large and small, in ATC and the airspace system. Here are just a few highlights:

- The traffic alert and collision avoidance system (TCAS), which ALPA activists sought since the 1950s, has greatly increased pilots' awareness of other air traffic and virtually eliminated midair collisions involving airliners.
- Safe introduction of airspace system changes such as reduced vertical separation minima (RVSM) in international and domestic airspace came about because ALPA representatives inserted line pilots' perspective and concerns into the process.
- RNAV and RNP procedures to improve airspace system capacity, efficiency, and safety reflect many years of careful attention and input from a number of ALPA pilot safety activists.
- Being able to talk directly to an air route traffic control center (ARTCC) is possible because ALPA pushed for it; in the early days, pilots had to obtain enroute clearance changes via their airline dispatcher.
- Visual descent points (VDPs) for nonprecision approaches were the brainchild of ALPA, which got them onto nav charts.

Two Unforgettable Augusts

30 YEARS AGO: On Aug. 1, 1981, the Professional Air Traffic Controllers Organization (PATCO) went on strike. President Ronald Reagan fired the striking controllers, setting the tone for a nationwide tougher stance against labor unions by their enemies.

In the weak U.S. economy of the time, U.S. airlines used the PATCO strike to cut flight frequencies in half virtually overnight, furloughing many ALPA members. The return to the pre-strike number of operations in the U.S. ATC system took a few years.

PATCO is long gone, but some of the controllers' issues, including fatiguing schedules and controller errors, are still very much in the news today.

25 YEARS AGO: On Aug. 31, 1986, an AeroMexico DC-9, Flight 498, collided with a single-engine Piper Archer over Cerritos, Calif., a suburb in the Los Angeles basin. A total of 82 people (including 15 on the ground) died.

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The Cerritos midair collision was the final straw that led the Congress to order the FAA to mandate traffic alert and collision avoidance (TCAS) II equipment on U.S. airliners. ALPA had been pushing for a collision avoidance system on airliners since the 1956 collision of a United DC-7 and a TWA Lockheed Super Constellation over the Grand Canyon.

tools need to be developed in the cockpit and on the ground to safely permit reduced separation? New procedures may require changes in training, and these should be based on accurate and meaningful human factors studies.

Another example is trajectory-based operations (TBO), a more complicated application that ultimately may require the use of ADS-B, datacomm, and GNSS technologies. The air traffic control system must synchronize trajectories, adding in a time component resulting in an application called 4DTrad.

Sounds simple, as long as you're flying the only airplane in the sky. But add in other airplanes, longer distances, weather, and other factors, and you get the future of the NAS for better or worse. Add in aviation security, ground infrastructure, performance requirements, and global operations and harmonization while building all this change together, and "complex" is an understatement.

Third, the big sticking points regarding NextGen implementation are the cost and who will pay for it. This multi-billion-dollar, multi-year program requires a reliable funding stream over a period of several years. The government and industry haven't provided this yet. FAA Administrator Randy Babbitt has been urging airlines to pony up and make the investment to equip their fleets with NextGen technologies, insisting that the early bird will get the worm.

Airline managements, however, are skeptical; for one thing, they've been burned before. The Miami trials in 2000 (controller-pilot data-link communications, or CPDLC) are an excellent example: Several years ago, a few U.S. airlines made significant investments at the FAA's request to participate in CPDLC operational trials, which ended when budget cuts led the agency to pull the plug on a working program.

Several trial programs with adequate funding, such as the DataComm Implementation Team (DCIT), are looking for first adopters to develop these technologies with final announcements expected soon. JetBlue Airlines recently received funding to equip some of its fleet with ADS-B.

Lest you think this is all a waste of time and resources, consider these success stories: ALPA pilots flying north of the

FAA, NATCA Agree on Steps To Ease Controller Fatigue

On July 1, the FAA and the National Air Traffic Controllers Association (NATCA) announced agreement on recommendations developed by a joint FAA-NATCA working group to mitigate controller fatigue. The working group was established under the 2009 collective bargaining agreement between the FAA and NATCA.

The recent agreement on fatigue countermeasures reinforces existing FAA policy that prohibits controllers from sleeping on duty. The agency will continue to provide controllers with breaks on the midnight shift, based on staffing and workload. While on breaks, controllers are expected to be available for recall at all times.

The FAA and NATCA also agreed that all controllers must report for work well rested and mentally alert and that the controller has the responsibility to notify his or her supervisor if he or she is too tired to work. Controllers can now request to take vacation or sick leave if they are too fatigued to work air traffic.

Earlier this year, after a series of highly publicized events involving controllers working alone on the midnight shift, the FAA eliminated single-staffing on that shift and adjusted work schedules to give controllers at least nine hours off (versus eight hours previously) between shifts. Controllers also now will be allowed to listen to the radio and read "appropriate printed material" while on duty between 10 p.m. and 6 a.m. "as traffic permits," the FAA said.

The agency has agreed to develop policies that will encourage controllers to seek medical help for sleep apnea, which currently is medically disqualifying for controllers. The FAA said it will work "to develop a process for most air traffic controllers with sleep apnea to regain their medical qualification once they receive proper medical treatment."

Additionally, the FAA will develop a fatigue risk management system for air traffic operations by January 2012. The agency also is designing a comprehensive fatigue awareness and education training program for employees.

FAA ATC Today

- The current workforce of more than 15,000 FAA air traffic controllers handles about 50,000 flights per day—51 million airline, general aviation, and military operations in 2010.
- In 2010, 149.6 million passengers flew on U.S. domestic and international flights.
- More than 6,000 technical operations specialists maintain the equipment in the U.S. national airspace system, which includes 131 federal stand-alone airport traffic control towers, 246 contract towers, 132 towers/terminal radar approach control (TRACON) facilities, 29 stand-alone TRACONs, 21 air route traffic control centers, two center radar approach control facilities, the FAA Air Traffic Control System Command Center, and 41,000 installations that house radars and other air traffic equipment.

border are today participating in ADS-B-mandated operations in the Hudson Bay area. Alaska and the Anchorage FIR are using ADS-B for surveillance in nonradar areas. Airlines operating at New York's JFK use a private ADS-B-derived system called AEROBAHN to help manage their ground and ramp operations. New York Oceanic provides CPDLC services for clearances and ATC directives.

Some point out that the first to equip will, by the time the entire industry is equipped, have the oldest installed equipment; the last to equip likely will enjoy the benefits of design upgrades and perhaps even lower costs resulting from economies of scale. Thus no one wants to go first in a big way. Closer to home—Do you want part of your earnings to go toward this investment through your employer or through your taxes?

Finally, there's the economic argument regarding what the true benefits are and who will benefit. The big return for airplane operators, for example, will come with ADS-B *In* (aircraft receiving ADS-B information and applications), not ADS-B *Out* (aircraft broadcasting position). The FAA has mandated that airlines must be ADS-B *Out* equipped by 2020, which will result in reduced need and cost to operate the radar network. But airlines will have little direct benefit. Conversely, every participating aircraft will have to be equipped for *In* to work (at least as far as surveillance, CDTI, and related applications are concerned).

To get real benefits for investing in new technologies and application, they must actually be able to be used. And that leads to the discussions under way regarding the possibility of changing another fundamental paradigm of the ATC system: "first come, first served" giving way to "best equipped, best served." That already has been the case to a certain extent for a long time—i.e., certain aircraft equipment and, sometimes, specific pilot training are required to gain access to particular airspace and procedures—for example, precision runway monitor approaches.

In June, Administrator Babbitt, in a speech to the RTCA Annual Symposium, noted, "We [the FAA] have asked the NextGen Advisory Committee [on which ALPA's president, Capt. Lee Moak, sits] to look at the issue of equipage and come back to us in the fall with a consensus proposal….We're open to all ideas. These are tough economic times, [but] we need to balance our fiscal restraints with the need for equipage."

For the future of the airline profession, ALPA maintains that *pilots* must be a central focus of all these changes. Ultimately, it's the flight crews who must make the flying piece of the system work. For decades, ALPA has helped keep the NAS working through the professionalism of its pilots and with the help of experienced controllers. And that's what's going to make NextGen work.