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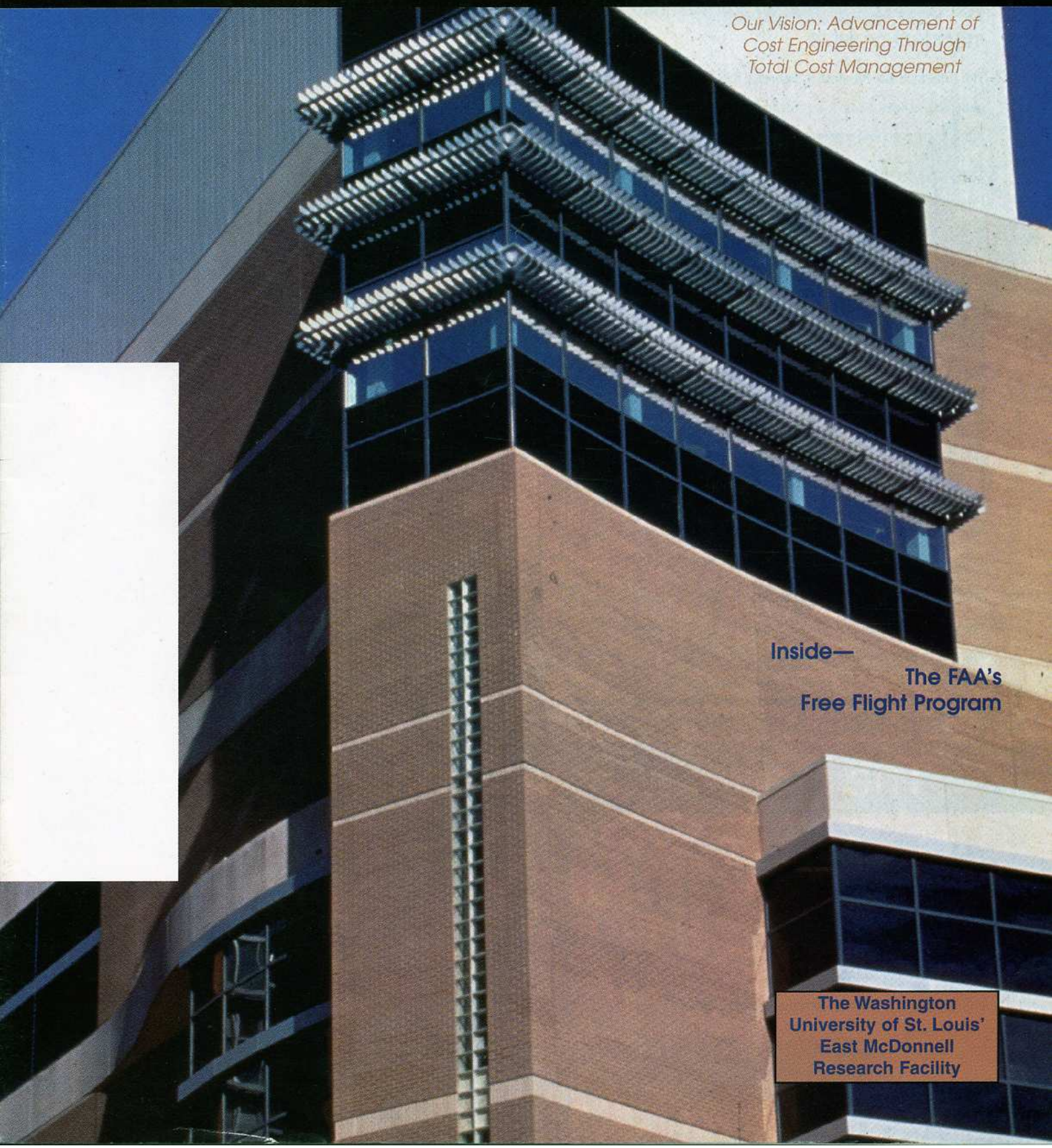

Our Vision: Advancement of Cost Engineering Through Total Cost Management

Inside—
The FAA's Free Flight Program

The Washington University of St. Louis' East McDonnell Research Facility

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On the Cover: The Washington University of St. Louis' East McDonnell Research Facility, St. Louis, MO, USA. Photo courtesy of Sverdrup Facilities, Inc.

Free Flight:

Keeping Up With Changing Times

Sarwar A. Samad, CCE

The US Federal Aviation Administration (FAA) plays a crucial role in the growth of commercial aviation. The FAA's primary mission is safety—it sets standards for aircraft and people working in the aviation field, and also performs safety inspections of airplanes. Due to the fact that the US is a recognized world leader in aviation, the FAA plays a very important role in the international aviation arena. Indeed, the FAA's safety and regulatory responsibilities extend to every corner of the world where air carriers operate. Consequently, the FAA works closely with the International Civil Aviation Organization to establish global safety standards.

Analysts tell us that the flow of new orders for commercial transports will take an upturn at the beginning of the new century. They predict very high levels of jetliner sales in the next decade. Just as cars use highways to travel from place to place, airplanes use airways to travel from city to city and from continent to continent. More cars mean more roads; more airplanes mean more highways in the sky, which translates into more aviation activities. The continuing growth in aircraft operations, the diversity of these operations, the number and size of aircraft, and the sophistication of both domestic and international aircraft, have all placed tremendous pressure on the FAA to respond to these challenges. To meet them, the FAA and the aviation industry have initiated a plan called Free Flight. To achieve Free Flight, the FAA, with the help of the aviation community, has taken the first step by initiating the Flight 2000 Program.

What is Flight 2000? It is a very important experiment. "For us," says David B. Tuttle, the director and chief engineer for Flight 2000, "to move toward Free Flight and modernize the system by a 2005, 2006 time frame . . . we need to have a first step, we need to do a limited implementation, and that's what we get from Flight 2000 [1]." Actually, Flight 2000 is an experiment to test and to evaluate, with actual aircraft, advanced communications, navigation satellites, automatic dependent surveillance broadcasts, weather processors, and air traffic management capabilities for Free Flight. This experiment, which includes approximately 2,000 aircraft, all well-equipped with advanced avionics, will start on September 30, 2000, in Alaska, Hawaii, and Oakland, CA (the actual locations and schedule may change). Each location has a specific role in testing and evaluation. For instance, Hawaii will provide intercity travel and services to pilots. Alaska will provide a wide range of weather conditions and will be the communications clearinghouse for separation and flight information services. The Oakland Air Route Traffic Control Center will provide oceanic airspace and data communications services to domestic [US] airspace.

Many benefits will result from the Flight 2000 experiment. It will provide "the user community with the flexibility to better manage its operations . . . more efficient routes . . . reduce user operating costs . . . and allow the user's aircraft to reach its destination at the prescribed time [3]." So, "from Alaskan bush planes and Hawaiian tourist aircraft to the most sophisticated airline traversing the vast Pacific tracks, Flight 2000 will show the way to the next level of a safe, modern, efficient, and globally-harmonized aviation system well into the new millennium [3]." Ultimately, Flight 2000's goal is to supply a solid plan for enhancing the US National Aviation System (NAS) and achieving the final goal: Free Flight.

What exactly is Free Flight? Just what it says—a pilot can fly his or her aircraft with minimal directions from an air traffic controller. Under the current National Aviation System/ATC, controllers usually tell pilots when they can take off, what altitudes and routes they can fly, and what speed adjustments can be made to ensure the flow of traffic. A pilot may request specific routes and can even decline a clearance, but the responsibility for control always rests with the air traffic controller, and the responsibility for compliance is with the pilot. Although this system is usually safe and works well, it has many disadvantages. For example, many airplanes have to change direction and are forced to go to an unwanted destination, not to ensure safety, but because the ATC system has inflexibilities that require that kind of instruction. However, the concept of Free Flight reverses the roles of air traffic controller and pilot. Indeed, the pilot will be solely responsible for navigation. He or she will be free to fly the route that is most efficient, while the air traffic controller monitors that flight and provides directions only when a safety conflict arises or equipment fails. Free Flight will enable both the pilot and air traffic controller to choose "the safest and most efficient routes, speeds, and altitudes in real time [4]." The pilot will be able to know his or her position and where potential air traffic is; the air traffic controller also will be able to predict where air traffic jams are likely to happen and can recommend or issue the right instructions to ease the flow of traffic, especially at high-traffic airports and in congested airspace. Free Flight should save billions of dollars each year in the cost of flying from one destination to another and in time savings.

One might ask if Free Flight is really needed. The answer, of course, is yes. We need the program because of the rapid changes in technological, economical, and competitive forces. According to the FAA, "the annual air traffic rate is expected to grow by 3 to 5 percent for at least the next 15 years, and the current airspace architecture and management will not be able to efficiently handle this increase. Implementation of Free Flight, which offers benefits in system safety, capacity, and efficiency, is key to advancing aviation by accommodating the nation's [US] growing airspace needs [3]."

Besides the fact that Free Flight will reduce the cost of flying, pilots will feel safer when they realize that with a Global Navigation Satellite System (GNSS) in place, coupled with digital communications and computer technology, they also will have the ability to enhance flight safety and will have more control over operational decisions, from preflight planning to destination parking. According to the FAA, Free Flight will provide "more efficient routes," and "will reduce user operating costs." Furthermore, it "will allow the user's aircraft to reach its destination at the prescribed time . . . and [result in] reductions in fuel burn" [3]. This leads us to the final and the most important question: How does Free Flight work?

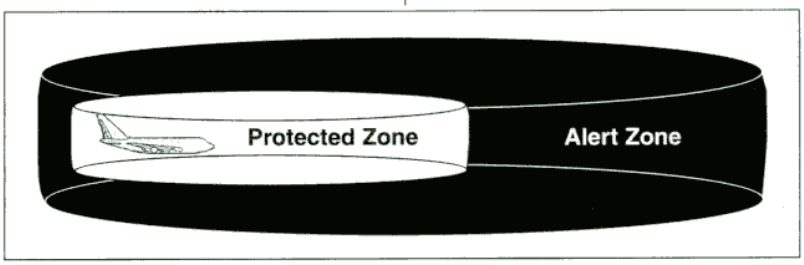

Figure 1–Airborne Free Flight (Courtesy of the FAA)

To make Free Flight a reality, a number of procedural and technical hurdles need to be cleared. The first problem is to change the National Aviation System (NAS) from a centralized air controlling system between pilots and air traffic controllers into a system of air traffic managers, by allowing pilots to have more flexibility in selecting their own efficient and economical routes. One of the most important concerns is how Free Flight will fundamentally change the way airplanes are separated. This is a serious concern; however, the FAA came up with a solution. The solution is

> based on two airspace zones, protected and alert, the sizes of which are based on the aircraft's speed, performance characteristics, and communications, navigation, and surveillance equipment. The protected zone, the one closest to the aircraft, can never meet the protected zone of another aircraft. The alert zone extends well beyond the protected zone, and aircraft can maneuver freely until alert zones touch. If alert zones do touch, a controller may provide one or both pilots with course corrections or restrictions to ensure separation [3].

Figure 1 depicts the two airspace zones. This concept of two airspace zones can work if certain considerations are met.

One of these considerations is that the Global Positioning System (GPS) must work well enough to be able to pinpoint accurately the position of each aircraft at all times. Any deficiency in the ability of the GPS to supply the accurate position would result in a disaster. The second consideration is that the digital data that link the workstation in the cockpit of an aircraft and air traffic controllers must relate directly the aircraft's position continuously and reliably, and at the same time, "must be able to receive warnings and corrective instructions equally quickly and reliably [2]."

Realistically speaking, there will be limits to Free Flight. Air traffic will still be air traffic, and air traffic controllers will still have to issue instructions from time to time. Air traffic controllers thus will still have a crucial role. Having said that, the bulk of their responsibilities will be focused on monitoring traffic, predicting and anticipating collisions, and issuing instructions. Certainly, it will be an improvement over the present system. The beauty of Free Flight is that pilots will be able to fly their airplanes without any restrictions.

It is imaginable that within a decade, a pilot will be able to fly his or her airplane without any restrictions, or possibly even that his or her airplane will be able to find its own way from one destination to another. Just as the concepts of Very High Frequency Omnidirectional Range (VOR) and Distance Measuring Equipment (DME) seemed to take all of the worry out of navigation and radar took most of the uncertainty out of air traffic control, Free Flight will be able to ensure safety and routinely fly an airplane from one destination to another. It will be as if it were just as normal for pilots to fly as is it for birds to fly.

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This article was written based on available information. The opinions given in this article are based on the author's research and are not the official position of the FAA. The approach and methodology may change due to program and funding restraints that may affect various phases of the program.◆