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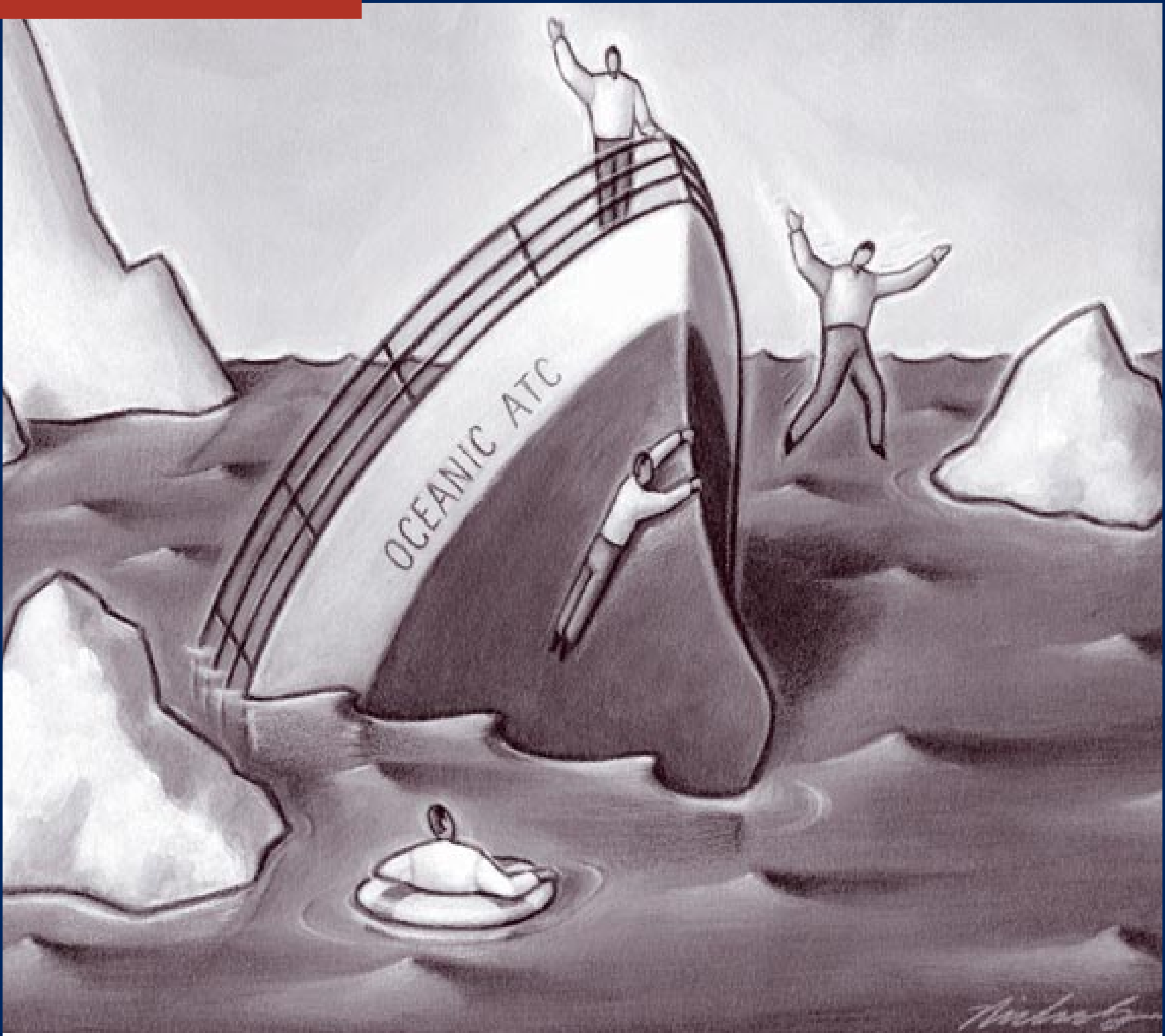

Provocative Issues Facing THE NATIONAL AIR TRAFFIC CONTROLLERS ASSOCIATION

OCEANIC MODERNIZATION

DEFINITIONS:

Oceanic air traffic control

Flights over water typically lasting anywhere from 2 to 10 hours without benefit of ground radar over vast geographic areas, requiring use of high frequency radios, relayed from the pilot to controllers through a third party. The Federal Aviation Administration identified Anchorage, Oakland and New York Centers as oceanic air traffic control facilities slated for modernization.

Offshore air traffic control

Controllers in perimeter facilities where aircraft fly over the ocean in their assigned airspace for relatively short periods of time. They also work in a non-radar environment in smaller, more localized areas typically within 250 miles of land.

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At 39,000 feet above the Pacific Ocean, our world view differs drastically from our perspective while driving an automobile at 60 miles an hour on an expressway. Traveling 500 miles per hour on a comfortable commercial airplane, headset on, a recent movie underway, laptop and phone within reach, with food or libation only a flight attendant away, we see ourselves hours from exotic sights, aromas, new adventures and enriching experiences. Occasionally, we glance out a window. Curiously we sense the earth's endless curvature is simultaneously distant and underneath us. We are among the fortunate millions of globe trotters, taking advantage of convenient, accessible, fast travel options only dreamed about decades earlier. Because we are on the cusp of the 21st century, we feel confident our lofty trip will be expeditious and monitored by the best human and technological resources available.

As we fly, two pilots view the world in hues of blue – both sky and sea. They constantly validate how the aircraft is performing, as well as the navigational instruments that confirm they're on the right track. When they reach the next reporting point, they'll fill in the blanks: Their call sign, altitude, position, time and estimate when they'll next describe their whereabouts. This goes on until pilots prepare for descent, many hours away.

Controllers, too, stand vigil over our plane's progress. When we took off from San Francisco Airport headed for Tokyo, we were handled as any of the hundreds of other departing aircraft. We ascended to 10,000 feet, then gradually climbed higher and higher. At 35,000 feet and 50 miles out over the sea, we were handed off to a specially trained ocean air traffic controller. She has been waiting for us for at least 30 minutes, anticipating our arrival in her sector – that vast airspace for which she's responsible.

In preparation, she has checked the reports of all other aircraft in her sector to resolve possible conflicts with our flight. She has no radar to watch us, so everything she does is based upon updates provided by our pilot, forming a picture in her mind, even though she cannot see us.

She has no radar observing us, indicating whether we're headed into a quickly developing storm or aiming for other aircraft. She has no way to communicate directly with the pilot. She has no satellite sending accurate, timely information about our whereabouts to her display screen. Instead, she is reading information from a computer printer generated miles away from a third party who has had radio contact with the pilot. The printout tells the controller where the pilot is, the plane's altitude and when it will be at the next "fix." She copies this information by hand on flight strips describing our flight plan (speed, altitude, air speed, location, destination). With the tools of her trade – a pencil, ruler, grease pen and plastic overlay of the Pacific Ocean – she writes down our position. There, we remain until the pilot communicates at the next predetermined intersection, or fix. The only movement we make until then is in the head of our controller who mentally monitors our course, as well as that of any other aircraft in her sector.

On this flight, our pilot will report as many as 15 to 25 times – depending on conditions – during our 11-hour flight.

Passengers nap as this speeding metal cylinder pierces the night air, all but blind to air traffic controllers in Oakland Center. When our jet leaves U.S. airspace, it is worked by oceanic controllers at Tokyo Center for two more hours before entering radar coverage.

SAN JUAN CENTER

San Juan Center's oceanic airspace spans approximately 200,000 square miles.

FACTOIDS

- Ninety-five percent of all San Juan Center air traffic takes some form of oceanic route.
- Seventy-five percent of the oceanic traffic is non-radar.
- Twenty percent of non-radar traffic is to or from the deep ocean.
- Sixty percent of the oceanic traffic is generated from foreign facilities, such as Dominican Republic, Curacao, Venezuela and Trinidad.
- Twenty-five percent of the oceanic traffic is generated from Miami and New York Centers; 10 percent originates from San Juan.

EQUIPMENT

Equipment is considered substandard by controllers (D-side, communications, planned view display). As a result of negotiations to improve communications with foreign facilities from the Greater Antilles and Miami, San Juan Center will switch to a multicultural voice communications system known as MEVA, a French acronym. The East Caribbean Group, known as ECAR, is negotiating a similar program for the Lesser Antilles.

Changes for Aeronautical Radio Inc. are slowly becoming a reality with computerized position reports from aircraft instead of teletype.

A plotting board to show locations of aircraft is archaic. Rulers used in measuring distance and trajectory of aircraft are made locally by cutting the legend from each of two charts, then pasting them on a flexible Plexiglas looking material.

FOREIGN FACILITIES

Nearby foreign oceanic facilities operating under International Civil Aviation Organization procedures surround the center, which is unable to expeditiously handle flights because of the absence of radar. As a result and to ensure safety, San Juan controllers separate aircraft entering foreign airspace either by distance or time earlier than otherwise necessary– causing air traffic delays.

BACKGROUND

At the beginning of the 1990s, visionaries mapped out their view of international air travel for millions of U.S. travelers 20 years later. Sketching the quagmire of problems plaguing oceanic aviation was not nearly as difficult as the subsequent task of transforming an image of reliable, efficient, safe flight into reality.

In 1992, the Federal Aviation Administration published its outlook for oceanic air traffic management in 2010. On paper, it was completely overhauled, with satellites for navigation, communication and surveillance dominating human input. The skies were almost completely open for pilot determination of routes from one nation's coastline to another's. The plan shows aircraft computers "talking" directly to each other, eliminating the checks and balances of ground controllers except when planes violate minimum separation standards. Then, a high resolution, graphical situation display aids in resolving any potential collision.

The FAA's plan did not take into consideration the amount of time to develop even simple improvements to the existing system – especially since technological improvements to a 24-hour, 7-day-a-week operation is like changing tires on a car careening on a highway at 80 miles an hour. It ignored how minor evolution in equipment could affect controllers or pilots. It disregarded agency cost overruns on a myriad of expensive projects that would eat into oceanic air traffic control projections. It rejected the FAA's long history of mismanagement, over-promising and missed deliveries of other ambitious plans for improvement.

U.S. OCEANIC AIR TRAFFIC CONTROL

The FAA is responsible for air traffic services to aircraft flying over large areas of the Atlantic, Pacific and Arctic Oceans. New York and Oakland Centers are responsible for airspace under the oceanic program; Anchorage provides en route – including radar – and oceanic functions for all of Alaskan airspace.

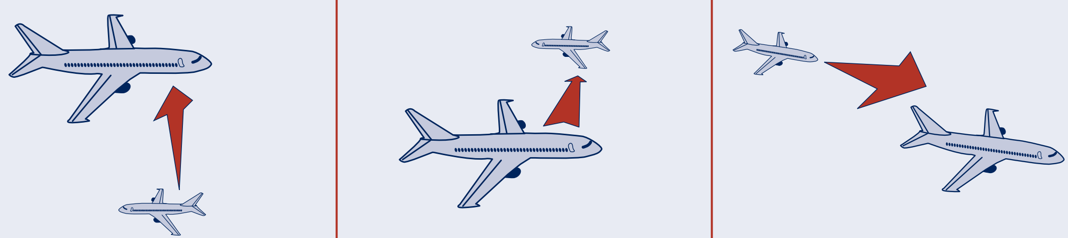
The centerpiece of U.S. ocean air traffic control is the Oceanic Display and Planning System, deployed in Oakland and New York Centers in 1989 and 1992, respectively. ODAPS is a single mainframe computer that uses its own software in quaint, obsolete Jovial language.

Often in theory but only sometimes in actuality, 45 minutes to an hour before an aircraft enters ocean airspace, ODAPS generates the first of several eight-inch flight strips with information about speed, altitude, winds and the plane's path. At this point, the flight plan is assessed by the controller for potential conflicts. If a problem exists with other traffic, changes are made to the aircraft's route while it is still within radar coverage and before its entry into oceanic airspace.

No direct voice communications take place between the pilot and controllers once the airplane is in ocean airspace. Communications between oceanic aircraft and Aeronautical Radio Inc., (ARINC) a third party located off the premises, are via HF radio. Information from ARINC personnel is forwarded to ODAPS and air traffic control printers, where it is copied by hand onto flight strips that update the aircraft's progress. ODAPS revises its original flight plan and sends new data to a telecommunications processor, a text-based screen, and an interim situation display (ISD) graphically depicts ODAPS revisions on a 20-inch by 20-inch Sony monitor at the controller's work station.

These progress reports are made at approximately each 10 degrees longitude, and no later than every hour and 20 minutes. If a position report is more than 10 minutes overdue, controllers must "find" the aircraft to ensure proper separation from other objects or to determine whether a more aggressive search and rescue operation is required. Each reporting position – also called a fix or way-point – requires one flight progress strip on the controller's flight strip bay. By the time any given aircraft

Oceanic Aicaft Separation



	Vertical	Lateral	Longitudinal
1998	2,000 feet apart	100 nautical miles	15 minutes in trail (about 120 miles)
After Modernization	1,000 feet apart	30 nautical miles	30 miles in trail

lands, consecutive strips representing every report can equal up to seven feet in length.

Instead of ODAPS, Anchorage Center uses the offshore computer system (OCS) to process flight data information in the same way as its domestic operations. The information is then updated manually via flight progress strips from VHF and HF position reports. The OCS gives the facility some ocean data link capability.

Additionally, all three oceanic centers use the Dynamic Ocean Tracking System, an automated planning tool that projects aircraft movement to identify airspace competition and availability and provides controllers and pilots with efficient routes. They take advantage of favorable wind and temperature conditions. Controllers manually verify DOTS-generated tracks are separated in accordance with standards.

A majority of oceanic air traffic uses invisible highways in the sky: Flexible and permanent tracks. Unlike paved roads, temporary tracks alter from day to day because of upper wind changes. Unlike domestic flights, they are not related to ground-based navigational aids. These flex-tracks are generated in high density areas after computers determine fuel efficient routes and, because they are associated with dynamic jet streams, commercial airlines on long overseas flights benefit most by simply hitching a ride on these winds. Published, permanent tracks represent the most direct course between two points or are due to logistical limitations presented by creating adaptable itineraries.

During peak times, a large amount of traffic must be funneled into a small set of oceanic routes. As in any rush hour, a bottleneck occurs. As a result, traffic leaving coastal airports may be delayed, rerouted to a parallel track, or given less-preferred altitudes to accommodate these large flows.

Oceanic air travel is hampered by obsolescence: No direct communications between pilots and controllers, archaic equipment and processes, too few controllers, and a rigid track system. Seventy percent of the controller's workload is manually processing position reports, called "scribe work."

Because of limitations of the present oceanic system, commercial airlines are unable to achieve maximum fuel efficiency, minimum travel times, preferred takeoff times, and flight paths free of severe turbulence. All of these add up to wasted time and money – both passed onto passengers blithely unaware. Estimates are these drawbacks will only intensify as air traffic could increase as much as 50 percent in the next decade in the North Atlantic and 100 percent in the Pacific during the same period.

As more and more aircraft compete for the same airspace, the work load of controllers increases. Concurrently, the fuel efficiency of oceanic flights declines because many flights are no longer able to consistently fly the altitude profiles and routes required for maximum capability. In addition, the lack of visual representation of aircraft positions over the ocean limits the ability to plan the efficient flow of air traffic.

Improved automation and communications capabilities on the ground – with corresponding communications, navigation and surveillance of oceanic aircraft – goes to the heart of oceanic modernization.

If FAA's goal for modernization came to fruition, in practical terms, advancements would mean aircraft could fly closer to one another while over seas – from 100 nautical miles apart today to approximately 50 nautical miles longitudinal and 50 nautical miles lateral to, eventually, 30 nautical miles, respectively. Vertical separation will be reduced from 2,000 feet to 1,000 feet between 29,000 and 41,000 feet. More aircraft will be allowed to fly preferred routes, improving airspace efficiency for project growth in ocean travel.

ANCHORAGE CENTER

Anchorage Center Oceanic Airspace consist of air traffic service routes from Oakland, Calif., and Vancouver, Canada. These tracks feed the North Pacific Tracks (NOPAC), which borders two Russian centers, Tokyo and Oakland. NOPAC routes consist of five composite tracks with 50 miles between each. Altitudes on these tracks alternate with the northern most one using odd cardinal altitudes, i.e. 31,000 feet, 33,000 feet, etc. The next track to the south uses even cardinal altitudes, 32,000 feet, 34,000 feet, and so on. Three are westbound; two are eastbound only.

Both Oakland and Anchorage Centers are negotiating with the Federal Aviation Administration to reduce minimum separation for aircraft flying laterally – from 100 to 50 nautical miles. This change is anticipated in 1998. Peak traffic times are 2 and 6 p.m. with most traffic destined for airports in the Orient. Flights originate at other cities, such as New York City, Detroit, Newark, Atlanta, Minneapolis and Washington, D.C. West Coast departures from Southern California to Vancouver also transition to the NOPAC with all flights merging on the northern two tracks. The next peak is from 4 to 10 a.m. when all these flights return to U.S. destinations. Many stop over to refuel in Anchorage.

Anchorage International has become the largest cargo hub in the world. United Parcel Service and Federal Express have set up extensive package sorting facilities and flight operations centers in Anchorage to service their Far East operations. These flights have become known as the "box haulers." With continued opening of the Russian airspace, many carriers are flying on newly established fee-for-service Russian tracks, creating a complicated mix of metric and standard altitudes in some Anchorage oceanic airspace. Flying time from the eastern United States to several Chinese airports may be reduced by as much as one hour and 20 minutes by using these new tracks.

Additional oceanic airspace extends from the state's northern coast to the North Pole. This area borders with Edmonton and Myshmidta Control, a Russian center. Flights from the Orient destined for Europe may use Alaskan airports as refueling stops before proceeding over the Pole.

Currently, 55 controllers – 50 active in NATCA – work the West specialty, which consists of Anchorage's oceanic and several domestic sectors.

A contract, signed September 1995 with the Hughes Aircraft Co., was to implement the advanced oceanic automation system through a series of five incremental equipment replacements and functional enhancements. These "builds" were to bring measurable benefits to controllers at minimum risk and reasonable costs. Because of reduced funding support and significant unanticipated costs to the project, the contract has been continually narrowed in scope. Once described in terms of Build 1, Build 2 and so forth until Build 5, the U.S. oceanic modernization program is, in 1998, down to a partial Build 1 or, as commonly referred to, Build 1 early drop. Hughes later merged with Raytheon, which took over this contract.

A summary of builds – as of mid-1998 – follows.

Build 0

Build 0 updates ODAPS by altering procedures that allow New York Center to use an interim conflict probe for reduced vertical separation between aircraft. Oakland – which already uses this tool – would also benefit from the changes. However, New York and Oakland controllers report the conflict probe is not reliable.

Build 1 early drop

A limited multi-sector oceanic data link comprises this partial build. It allows properly equipped aircraft to communicate without HF radio and provides an interface for data transfer with foreign facilities.

Full Build 1

This phase delivers complete multi-sector oceanic data link, including Automatic Dependence Surveillance and enhanced inter-facility data communications when aircraft transfer from one airspace to another. A revised timetable plotted completion in Fall 1999, but now it has been delayed until at least Spring 2000.

Oceanic data link provides direct pilot to controller communications and ADS will increase airspace capacity by reducing the distance between aircraft. Since both data link and ADS require expensive, specialized equipment on board planes, only equipped aircraft will benefit from modified separation standards. More importantly, air traffic controllers have been disregarded in the equation; the FAA has not addressed the increased workload associated with ADS and modified separation standards when developing a long term program that brings increased air traffic into an expanding airspace and ensuring safe, orderly flows.

Build 1.5

Capabilities contained in this scaled down Build 2 include two controller access to the workstation, allowing more efficient distribution of work load. A replica workstation for simulated training, and technology reducing unnecessary data while adding now-unavailable information about aircraft are part of Build 1.5.

Funding for a mainframe computer inherent to the success of oceanic modernization – originally slated for Build 2 – has not been allocated, jeopardizing even incremental success.

The reality is that Build 1 in its entirety or even Build 1.5 will not occur in the 20th century because money to correct software codes in agency computers prior to 2000 will be diverted from oceanic modernization, and also due to cost overruns on Build 1 early drop, and several budget cuts.

Build 2

The greatest advantage to controllers in Build 2 is – was – replacement of the antiquated and unreliable ODAPS, particularly the flight data processor at Oakland and New York Centers, and the offshore computer system at Anchorage Center. ODAPS, written in ancient Jovial, has suffered numerous unscheduled outages, as well as corrupted data displayed to oceanic controllers. If not noticed by the trained eye of an experienced controller, this kind of incident could lead to a disaster.

Dynamic sector boundaries in Build 2 would offer additional flexibility by accommodating changes in the traffic loading of oceanic routes, allowing more balanced disbursement of controllers' workloads. Unfortunately, future plans for this safety enhancement have been scrapped.

Controllers have voiced the need for

Oceanic System Evolution – The Original Plan

Current System	Transition System	Future System
	Oceanic Automation System	Advanced Oceanic Automation System

1993	1994	1995	1996	1997	1998	1999	2000

- Nov 1993 ODAPS (Oakland and New York)
- Jan 1994 Offshore Computer System Upgrade (Anchorage)
- Nov 1994 Telecommunications Processor (Oakland)
- Jan 1995 Interim Situation Display (Oakland)
- Apr 1995 Initial Ocean Data Link – Pre-Build 1 (1 Sector / Oakland)
- Sep 1996 – Build 2
- Sep 1997 – Build 3
- Sep 1998 – Build 3
- Sep 1999 – Build 5

DELAYS plague oceanic air traffic control modernization. A limited ocean data link may become operation in the summer, 1998, with ODL at all three oceanic facilities installed by 1999. Builds 2 through 5 have been canceled. This graphic depicts the program's evolution as envisioned by planners in 1993.

Original Oceanic "Builds" To Modernization – Mostly Unfunded

Months After Contract Award

CA	12	24	36	48	60	72	84	96

Initial Conditions

- Oakland and New York Centers are operating telecommunications processors, interim situation displays, and interim conflict probe
- Ocean data link prototype is operating
- IBM Series/1 processors decommissioning will be underway

Build ONE

- Option – Implementation of ODL at all three oceanic facilities

Build TWO

- Research may precede development of facilities and equipment
- Implement flight data processor replacement
- Peform analysis for early implementation of a communications processor to replace Anchorage offshore computer system
- Provide remote maintenance monitoring
- Provide capability to dynamically alter ATC sector boundaries
- Migrate all independent mainframe computer into one funtional network
- Option – replace the Honolulu mainframe computer

Build THREE

- Develop and implement advanced conflict probe
- Develop and implement enhanced situation display
- Develop and implement electronic flight data
- Develop and implement aeronautical telecommunications network
- Develop full Automatic Dependence Surveillance capabilities

Build FOUR

- Integrate domestic traffic management into oceanic funtions
- Develop oceanic weather products
- Develop advanced productivity tools for the controller

Build FIVE

- Complete all builds, tasks, studies, and finalize all documentation
- Transfer custody of all contract hardware, software equipment, licenses, and documentation to the FAA

ON PAPER, oceanic modernization appeared very real in 1993. The above graphic summarizes key accomplishments during each of the five oceanic "builds."

1994 Vision

assistance during peak traffic periods. Two controller access, enabling a second person to come into an oceanic sector should have come prior to multi-sector ocean data link's installation. A workstation accommodating multiple controllers is not funded.

Build 3

A primitive conflict probe that visually alerts controllers when two airplanes fly too close to one another is operational on a trial basis at Oakland Center. Frequently, it signals false readings, which unnecessarily demands time and attention from controllers who turn to erroneous emergencies. If Build 3 were completed, a more advanced device would presumably eliminate today's problems.

An enhanced situation display would also provide more reliable and additional information to men and women working oceanic sectors. ADS, also associated with Build 3, would pipe data into the enhanced situation display, providing controllers with a detailed "street map in the sky" so they could visualize where aircraft were.

Electronic strips would eliminate the need to write data by hand and scrap the bulky seven-foot flight strip bay. At this stage, oceanic air traffic control would no longer be termed "manual." However, Build 3 is dead.

Build 4

This phase would have concentrated on other positions not directly involved separating aircraft: air traffic management – integrating them into the new, automated environment.

Build 5

Tying up loose ends, including transferring all hardware, software, licenses and other documentation from the contractor to the FAA were goals of this administrative phase.

MIAMI CENTER

Miami Center's 500,000 square mile oceanic airspace in 1997 accounted for 436,538 operations. Its unique location makes it the oceanic transition point from North America and Europe to the Caribbean, Central and South America and back.

NATCA controllers operate with 11 oceanic sectors which interact with six foreign facilities (Havana, Freeport, Bahamas, Turks and Cacaos Islands, Haiti, Santo Domingo). Each of these countries has distinct operational procedures with only the Bahamas, Havana and Santa Domingo having radar. At times, due to poor phone service and internal foreign government issues, controllers must coordinate all flight information between two centers via pilot relays or teletype.

Language barriers between adjacent centers and difficulty in understanding pilots increases the work load on controllers. NATCA actively participates in inviting foreign flight crews to visit Miami Center as part of a program initiated by Scott Voight, NATCA member at Fort Worth Center.

NATCA is pressing for upgrade programs, such as a Caribbean voice circuit program and Bahamas modernization plan which calls for improved radio and radar coverage in most of Miami's oceanic airspace. The center also supports global positioning system as a primary source of navigational capability, but does not support dismantling of the current ground-based radio beacons or VHF omni-directional range antennae.

Miami Center controllers work with four adjacent Federal Aviation Administration facilities: New York, San Juan, Jacksonville and Houston. All display a superior level of professionalism from their many years of experience, training and personal goals to provide air passengers with the highest level of safety.

NEW YORK CENTER

New York Center comprises 3,257,000 square miles overlying major portions of the North Atlantic Ocean and Caribbean Sea. International airspace extends on an east-west axis from the East Coast of the United States to 40 degrees west longitude and on a north-south axis from 18 to 45 degrees north latitude.

Air traffic is exchanged directly with nine adjacent control centers: Washington, Boston, Jacksonville, Miami, San Juan (Puerto Rico), Santa Maria (Azores), Piarco (Port of Spain), Gander (Newfoundland, Canada), and Moncton (New Brunswick, Canada). Control of the airspace is divided into seven non-radar sectors, five radar sectors (three coastal transition and two overhead Bermuda) and one aircraft movement information service sector.

The western portion of the international airspace consists of an extensive system of fixed routes connecting the United States, Bermuda, Canada and the Caribbean Islands. The eastern, or North Atlantic, section contains few fixed routes - most embody random and flexible tracks.

International traffic management applications are orchestrated by special planner positions. Oceanic operations comprise a major segment of the air traffic control services provided by the New York Center and constitute significant portions of the most complex and dynamic elements endemic to the facility environment.

Original Contractor Estimates For Five "Builds"

Build 1	$4,484,212
Build 2	$18,763,132
Build 3	$10,861,413
Build 4	$8,115,584
Build 5	$2,828,136
Total	**$45,052,477**

1998 Estimates

Build 1	$48,000,000 +
Build 1.5	$38,000,000

FAA representatives cite varying reasons for discrepancies in costs. Most popular are:

1) Extreme difficulty making Build 1 run using ODAPS as the flight data processor.

2) Requirements for Build 1 were not defined when the contract was awarded.

3) The contractor is too high priced.

Three elements of technology – **communications, navigation and surveillance,** commonly referred to as CNS – provide a transition to a modernized oceanic air traffic control system. Communications can equate to data link; navigation to the Global Positioning System; and surveillance to ADS and ADS-B (see below).

Data link, a computerized link between the aircraft and ground, is intended to provide unspoken communication between pilots and controllers to limit frequency overload. It has been in development for over 20 years, but has only recently been recognized for its worth in air traffic control . One real value of data link is the capability for the plane to automatically tell controllers about itself, answering questions that routinely take up much of a controller's time.

Ocean data link will consist of two functional areas: air-to-ground and ground-to-ground data communications with supporting automation for air traffic control – as well as provide ground-to-ground data communications for oceanic track data coordination. Its enhanced software package will reside on the telecommunications processor hardware (IBM RISC 6000 class workstations), along with a 19-inch monitor, keyboard and a mouse-like apparatus called a track ball.

It will provide automatic way-point or "fixed" position reports, freeing pilots of this duty; direct pilot to controller communications through VHF radios and satellites.

Possible benefits to controllers include faster, more accurate communications; aircraft error detection for when an aircraft is off course; message preparation aids – the fixed messages that may be activated with the push of a button; information from messages can be easily matched with other data provided by pilot reports; and computer human interface enhancements provide more facts much faster to controllers. Airlines will appreciate reduced separation standards, earlier in trail climbs, more flexible routes and antiquated HF radio will no longer be a pilot's primary means of communications.

Controller to pilot data link will offer near real time direct communication between aircraft and air traffic control – a vast improvement over today.

One of eight ocean sectors at Oakland Center has an operational prototype ocean data link used as a primary means of communications in that sector. Most controllers do not like working with this equipment; it adds to their work load.

The Global Positioning System provides instant position information to a special receiver. It offers a more precise positioning than the present ground-based radar system, and it can work in a variety of ways for pilots and controllers – from take off to landing. But, it has holes in its coverage. Since satellites were not placed in the heavens solely to support a navigation system, there are areas where effectiveness is spotty at best. Most satellites were placed to observe politically sensitive or meteorologically active regions; hence, huge holes exist within domestic airspace. GPS is on board aircraft.

Automatic Dependence Surveillance is an aircraft-center generated means of position identification. It has been described as pseudo-radar that goes from the plane to the ground. Information from it could be used by the controller to locate aircraft and/or surface vehicles in areas not covered by radar. Its first air traffic use will be in the ocean, although domestic companies such as New York City's transit service utilize a version of ADS as it maps out in real time where its buses are at any given minute.

Equipment must be upgraded to allow advances in communications, navigation and surveillance.

ODAPS, the current flight data processor at Oakland and New York Centers, runs off the IBM 4381. The FAA initially committed to Build 1, using ODAPS as a platform for subsequent modernization. Anchorage – which does not operate with ODAPS – was to benefit from oceanic replacements during Build 2.

An **oceanic flight data processor with advanced conflict probe** was to replace ODAPS in Build 2. It was to have a modern language as well as an open architecture for easy modifications and capability of operating with multiple systems.

A **conflict probe** that alerts controllers when planes fly too close to each other is being tested at Oakland. Originally scheduled for delivery with ODAPS in the early eighties, this defective tool has required multiple adjustments, and is not in 1998 certified for use to determine aircraft conflicts. After over a year's examination still contains numerous, notable flaws and limitations.

The **telecommunications processor,** a terminal connected through a local area network to an ODAPS mainframe, has replaced flight data input/output equipment at Oakland and New York Centers. It provides controllers with color screens, and allows controllers to scroll old messages (air-to-ground, system, ground-to-ground) for verification.

The **interim situation display,** a 20-inch Sony monitor, replaced the plan view display at New York and Oakland Centers. It depicts computer generated simulation of oceanic traffic. It also has a limited ability to update the data base and produce lists in scaleable windows.

Enhanced situation display was to replace ISD (above) with more sophisticated visual tools to help controllers plot or separate aircraft, and eliminate Plexiglas boards. Electronic strips would take controllers out of the manual environment which today takes up so much time.

A **flight strip bay and adjoining printer** are available at all three oceanic centers. The flight strip bay is an M-1 console, a large steel rack where dozens of stacked strips are required for each sector. A nearby dot matrix printer – nicknamed the ARINC printer – receives information about a pilot's position through reports from Aeronautical Radio Inc.

A **data communications console** was to replace both the flight strip bay and adjoining printer, but it is no longer in the pipeline for timely development.

HOUSTON CENTER

Houston Center's Gulf of Mexico airspace encompasses approximately 109,000 square miles, and is operated under international non-radar separation standards – 15 minutes or altitude. Over 50 percent of the airspace has no radar and 40 percent is without radio coverage. All clearances on major routes, such as Miami to points on the Yucatan Peninsula, are relayed through a third party, Aeronautical Radio Inc. Offshore separation standards are identical to those in Houston Center's domestic, non-radar environment.

This airspace has approximately 56,000 operations annually. It is controlled by the same 60 specialists who staff the five domestic radar and two Gulf sectors.

Offshore helicopters are a unique facet of Houston Center's ocean air traffic control. With gas and oil exploration, over 70 percent of the world's helicopter operations are contained with this airspace.

During bad weather when helicopter operators cannot fly direct to their rigs under "see and be seen" rules, air traffic control services using instrument flight rules require 20 miles or 10 minutes between aircraft at the same altitude, because the offshore airspace has no radar. At an estimated cost of $16,000 per hour for delays, the restrictive airspace is very unappealing.

TRAINING

Specialized training is required for oceanic air traffic, regardless of controllers' previous experience, because this simulated environment differs from any other. After simulation, they apprentice under the tutelage of a more experienced oceanic controller with live traffic.

Training for domestic air traffic control often takes three years, while oceanic instruction may take four or five years. Veterans complain trainees coming out of today's classes require lengthy supervision in an already understaffed environment because they are not prepared for real life demands of oceanic air traffic control.

As modernization progresses, training will change from today's paper-based, teacher-lecture format to computer-based instruction. Raytheon has been asked to devise an education plan addressing competency and skill levels, as well as quality control. Failure to solve these problems could stall use on sophisticated equipment and advanced technology being introduced into the system.

GLOBAL SNAPSHOT

Other countries, while often handling smaller areas of ocean space, nevertheless, have advanced air traffic control systems when compared to the United States. One oceanic Oakland Center sector uses an early version of controller to pilot data link communications, but Automatic Dependent Surveillance is not anticipated until after the turn of the century.

In many nations, controllers have been integral to the planning of automated oceanic programs. As a result, mid-development modifications and cost overruns have not occurred, as they have in the United States where controllers have not, until recently, been consulted.

Japan

The Japanese government is in the process of conducting trials of its controller to pilot data link communications and Automatic Dependent Surveillance systems, a preliminary step to planned implementation in late 1998. These two technologies will provide Japanese controllers with a more accurate view of where aircraft in flight over seas are, better ensuring safety.

Australia

Due to a lack of radar and VHF radio transmitters, the remote interior regions of Australia are, for purposes of air traffic control, handled the same as its ocean airspace. Australia is planning on making ADS available in 60 of these remote sectors, which will provide controllers with improved ability to track flights.

United Kingdom

In the Shandwick Oceanic Control Center, the UK has implemented a system that differs entirely from the one planned by the United States. Controllers do not use strips at all, instead they rely on two PC styled computer screens per sector. One monitor holds all the position and communications reports, often with many lines of data scrolled above or below the viewable area. The second monitor comes into play only after a conflict probe detects a potential loss of separation and, then, specific information about those two planes is captured for resolution. This contrasts from the current U.S. practice of using strips to permit controllers to maintain the "big picture" of what traffic situations are developing in their airspace.

If its system crashes – for instance, the conflict probe goes down and cannot function – UK controllers resort to manual flight strips and a non-automated environment, which requires approximately 25 minutes.

Tahiti

Airspace in this exotic Pacific Ocean island is run by France. It already has controller to pilot data link communications and ADS.

New Zealand

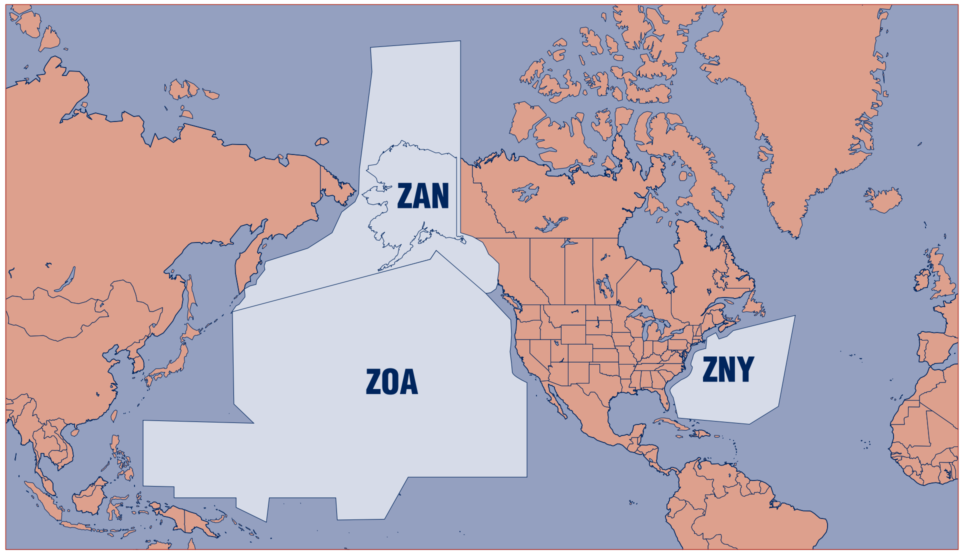
New Zealand controllers have an interim oceanic system that includes some ADS and controller to pilot data link communications capabilities. The full oceanic control system – scheduled for implementation in late 1998 – will build on these initial capabilities and improve the tools controllers use. At that time, an oceanic situation display monitor showing controllers the position of aircraft as reported by ADS will be available. Controllers actively participated in the research, development, manufacturing and implementation phases.

Canada

Unlike the previously mentioned countries, the oceanic airspace controlled by Canada is in the Atlantic Ocean and contains the heavily used routes between North America and Europe. Canada plans to implement a robust data link capability by late 1999; it will incorporate controller to pilot data link communications and ADS over the aeronautical telecommunications network.

These advances represent modifications to its current system, rather than a sweeping overhaul originally planned through implementation of a Canadian Advanced Air Traffic System, which did not progress quickly enough to meet the country's timetable. Rather than wait, Canada decided to replace specific equipment in incremental stages. The FAA is considering CAATS and, if it proves acceptable, Canada may also turn to it for oceanic air traffic.

Today's Oceanic System



ZAN = Anchorage Center
ZOA = Oakland Center
ZNY = New York Center

The U.S. oceanic system is located at three air route traffic control centers: Anchorage, Alaska; Oakland, California; and Ronkonkoma, New York. It's characterized by manual operations, large separations between aircraft, and cumbersome communications through offsite, third parties. Oceanic air traffic control monitors hourly position reports as airplanes report in at defined way-points or "fixes" on a track system that functions much as an invisible highway in the sky. The system cannot easily accommodate more efficient routes or flight changes.

FUNDING ISSUES

Performance Based Organization

See related sidebar describing key components of a quasi private organization – one recommendation for oceanic air traffic control, as well as for most current FAA functions.

User Fees

Congress has been leaning toward the notion of fee-for-use payments in a variety of industries, aviation not excluded. Guidance from the Office of Management and Budget for fiscal year 1998 states: "Oceanic automation is to be fully user fee funded (in FY98), along with oceanic operations as a separate cost center in the FAA."

A variety of user fee proposals abound in Congress. No consensus in the aviation industry has been reached about which one is fair to airlines, general aviation, recreational pilots, or other commercial and individual enterprises.

Two alternatives for oceanic user fees often surface. One is very similar to overflight user fees, which occurs when a commercial aircraft flies into another country's airspace. Already, an airplane pays user fees to Canada, for example, when it utilizes the country's services, controllers, equipment and technology. This is an easy solution because neither direct involvement of airlines nor organizational change is required.

A second method feeds into the performance based organization concept. Policy decisions, including those about user fees, would be made by a board of directors with representation from FAA and airspace users. Proponents say this option would immediately fund oceanic air traffic control services.

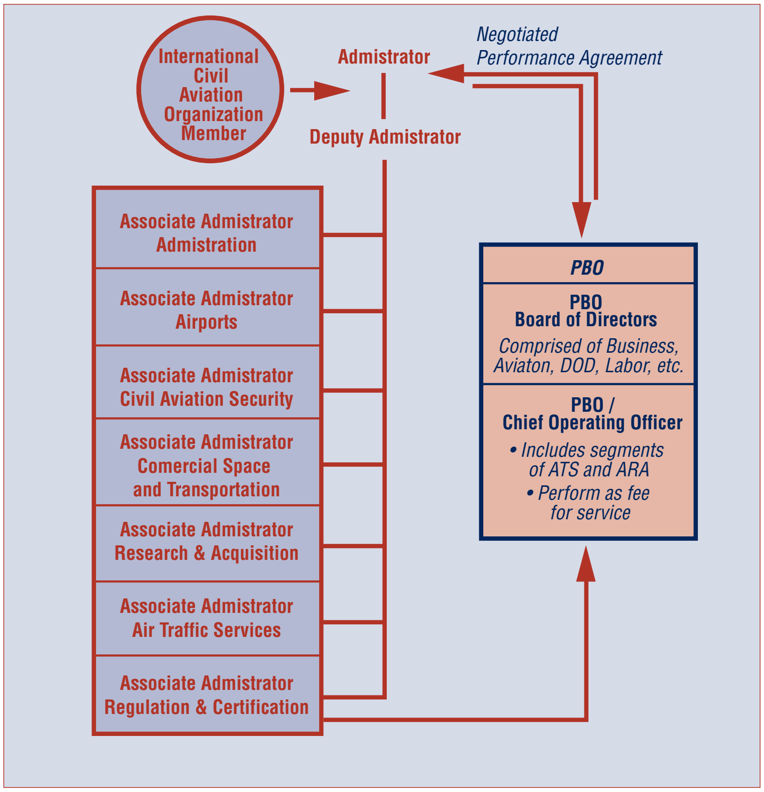
At least 59 countries have commercialized their air traffic services to some degree, including Australia, Germany, Ireland, New Zealand, Portugal, South Africa and Switzerland. Nav Canada, a non profit private company owned by airlines, privatized all Canadian air traffic services in November 1996 after purchasing the government's assets for $1.5 billion. It is run by a chief executive officer who reports to a board of directors.

PRIVATIZATION

Farming out air traffic control functions to a business-oriented company that would take over day-to-day operations is another oft-cited answer to cost questions. The precedent has been set with contracting out of lower level facilities.

Experience has proved air traffic controllers in contracted out facilities earn less than their counterparts in the federal government, do not receive multi-year training and work on inferior equipment. Savings accrued from these measures are reasons bottom line oriented policy makers gravitate to privatization.

PBO and FAA Relationship



A board of directors would be composed of the FAA administrator and six public interest members with no direct pecuniary ties to the aviation industry but whom are generally knowledgeable of best business and management practices. Parties with a direct interest in the organization's operations will have their views heard, particularly the airspace users (effectively the stockholders of the organization if user fees are implemented) and labor. This role could be performed by a steering committee.

U.S. Oceanic Air Traffic Control Performance Based Organization Proposed By National Civil Aviation Review Commission

When the National Civil Aviation Review Commission completed its 1997 review of Federal Aviation Administration funding, a performance based organization (PBO) was among recommendations. Prior to complete overhaul of FAA into such an operation, the commission proposed a transitional first step: Oceanic air traffic control, because it provides a segment of operations large enough to include all business divisions. As envisioned, the oceanic PBO would be self-contained, responsible for providing oceanic air traffic services, and assets separated from domestic operations. Initially, existing facilities and equipment would be utilized.

Plans are being developed to implement PBO principles for the entire agency.

Oceanic ATC Mission

To provide safe, efficient and cost effective air traffic management services in U.S. oceanic airspace in response to the changing needs of system users and rapidly expanding international commerce.

Organizational Vision

The performance-based U.S. oceanic ATC organization will be the worldwide provider of choice for safe air traffic management. It will allow for collaborative decision making in planning, investments and operations; facilitating the transition to a free flight environment.

Potential for cost and system performance improvements

The NCARC recommendation assumes new technology – controller to pilot data link and Automatic Dependent Surveillance – will be delivered over the next two years and could be used to measure the PBO's success. Other savings would accrue to airlines and other users, as well as the organization itself: Reducing separation standards, increasing the availability of more efficient tracks, electronic flight strips, and more strategic traffic management techniques and control by exception, rather than continuous monitoring and tactical control.

Personnel

The NCARC draft proposal describes a system emphasizing performance incentives and flexible management procedures. Its features include an ability to easily hire, promote, demote and terminate employees for performance or other reasons, such as over or under staffing. A study to develop a labor/management arrangement supporting performance measurement and incentives would address a workable advocate system for individual controllers, link salaries to availability of labor and market rates, and consider the possibility of contracting out the operational workforce. While FAA reform of 1996 could be a starting point, a broader industry perspective not bound by traditional U.S. government policies are suggested in the commission's document.

U.S. oceanic airspace is vast – almost beyond comprehension – as it spans from the Philippine Islands near Guam to the Bering Straits in the North Pacific to the Tropics near the Fiji Islands to halfway across the Atlantic Ocean.

Fortunately, air traffic over the ocean is characterized by tremendous separations, especially when compared to the standard five miles apart over land. While the distance drastically minimizes the chance of mid-air collisions or near misses, it also causes delays and they, eventually, cost money. If airlines could feed jets into oceanic airspace at a faster rate and maintain at least the current level of safety, then the entire aviation community – from airlines to pilots and controllers to passengers would benefit.

For years, it has been obvious the United States is falling behind many other developed nations, technologically, in air traffic control services. Requirements of modern aviation travel have long outpaced the FAA's ability to provide reliable, functional service. Problems in the oceanic air traffic control are no mystery. They are similar to those shared by domestic controllers except, many people observe, worse: Inadequate numbers of trained staff, inferior equipment, poor training, lack of follow through on modernization plans, and over reliance on a "big sky theory." It is a big sky, after all. What are the chances of two airplanes colliding?

In its own uncanny way, as soon as the FAA focused on complex issues beneath oceanic deficiencies and devised a plan of action, it almost immediately began to chip away at its own solutions. As this booklet proves, the agency realizes the ocean needs attention. Yet, it is not a high priority. Mistakes from the past overtake intentions to modernize. Exhibit A: an emergency Y2K software upgrade that will cost millions but also allow computers to read dates when the calendar turns the page from Dec. 31, 1999 to Jan. 1, 2000. Specifically earmarking money for oceanic air traffic control would eliminate the siphoning off of funds for other programs.

With each passing year, solutions not of our own making become more viable. Not long ago, it would be unthinkable to rely on Japan for control of a vast portion of the Pacific Ocean, as it would be to turn over the Atlantic Ocean to Canada. Both countries are more technologically advanced than the United States. NATCA strenuously opposes these moves because – even with unpredictable equipment – our airlines, pilots, controllers, engineers, technicians and their support personnel are the best in the business.

The U.S. oceanic controller's primary tools to separate aircraft include his or her No. 2 lead and grease pencils, tissue and a Plexiglas plotting board. In these days of high technology, hourly position reports handwritten on paper flight strips look like "something out of the Flintstones," as a congressional representative once observed after visiting New York Center. The FAA must come up with a new approach that takes the place of manually handling flight position reports. This process represents 70 percent of the controller's work load and is at the heart of what limits U.S. oceanic air traffic control today.

In the early 1990s, the FAA initiated a program known as the oceanic automation system – the first step in a long term modernization program for three U.S. centers. Its goal was to develop and deploy interim replacement at Oakland and New York Air Route Traffic Control Centers' oceanic airspace. Even after these early improvements, controllers are left using grease pencils, tissue and plotting boards.

The continuing evolution of improvements was to occur through a series of builds, described earlier in this booklet. Build 2 – the heart of a contract awarded to Hughes Aircraft – was to provide controllers the necessary infrastructure upon which other options could be added. Today, it has been scaled back to nothing. Under this scenario, U.S. oceanic modernization may stop at the Dark Ages, rather than at the 21st century.

The goals of Build 1 are aimed squarely at benefiting the participating commercial aviation community. Ocean data link and ADS support reduction of separation standards on the few aircraft – an estimate five percent – with equipment on board. Even as more jets become armed with the expensive equipment, controllers will not likely be able to accommodate the planned capacity increase without a sound infrastructure replacement.

One of the most important pieces originally planned for Build 2 is the dismantling of the antiquated ODAPS flight data processor at Oakland and New York Centers and the offshore computer system at Anchorage. Both are hopelessly outdated and rapidly becoming unsupportable. Numerous outages over the years make it among the most unreliable systems in air traffic control. Yet, the FAA wants to add Build 1 software enhancements onto the unstable ODAPS platform, which will lead to slower processing and a flurry of additional outages. One of the few things in Build 1 that could give controllers flexibility, dynamic sector boundaries, has been lost due to cost overruns and excesses. Gone also is two controller access, and ocean data link is in jeopardy.

The real benefit to controllers in terms of work load reduction would have come in Build 3. This build would have finally eliminated the cumbersome manual tracking process, allowing real capacity increases.

NATCA strongly supports the original strategy of automating our stone age oceanic system. Replacing the existing infrastructure in 2005 to 2008, today's time frame for both domestic and ocean modernization, is not an option because of burgeoning increases in air traffic. Builds 2 and 3– or an acceptable, timely alternative – must be funded so controllers can help airlines and pilots take advantage of potential savings in time and costs resulting from their own technological advances. NATCA will not sit by while partially funded substitutes are placed in the field because FAA is desperate to make public claims about delivery of non-benefitting products.

FAA needs to take a close look at oceanic air traffic control systems in other countries, such as New Zealand and Canada

Regardless of improvements, the FAA must involve air traffic controllers, engineers, technicians and other personnel actively engaged in modernization in the early design and development stages. Otherwise, contractors will continue to develop unusable systems because of poor guidance about what is needed, why and how equipment must – in a real workplace with actual users – work.

Taxpayers turn to the federal government for certain core functions – among them, safety. This, not coincidentally, is the FAA's first responsibility – a role most employees take very seriously. NATCA has a vested interest in FAA's future, including its financing and structure. To cut costs, a variety of ideas have surfaced; chief among them are contracting out, privatization and a performance based organization. Any theory must be fully, openly debated by all parties: General aviation, airlines, employees and their unions, government and passengers.

NATCA is categorically against privatizing the agency itself. (See NATCA publication, *Privatization*, Volume 2, Number 2, Spring 1997).* A performance based organization may appear desirable as a technological solution on paper, but the FAA should have learned by now that effective change is a far cry more than scripting utopian solutions. NATCA has opposed a PBO since its initial introduction in the 1980s, because eventually the bottom line will rule decision-making. Casualties will be reductions in the workforce, more decrepit equipment, lower salaries for increased work loads – all translating to sacrificed safety.

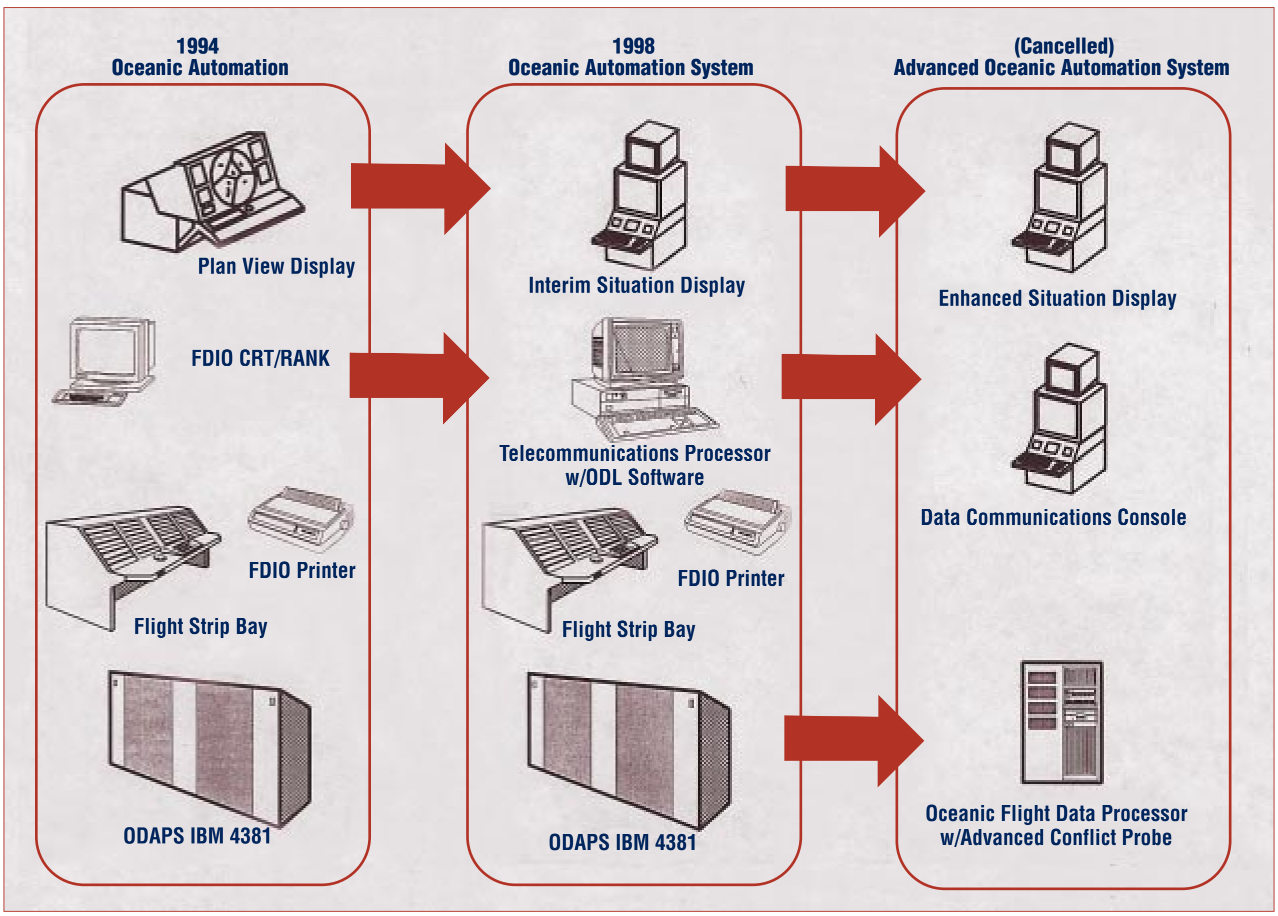
In almost every approach addressing the FAA's structure and financing, user fees are the kernel from which discussion starts. Oceanic user fees, as proposed in the past, will empower airlines to dictate future automation upgrades, which – from a safety perspective – may be potentially dangerous. If implemented, questions will be raised, such as how willing are airlines to spend money on ground-based infrastructure replacement? The participating airlines will dictate the actions of the FAA and its investments. Additionally, NATCA is concerned oceanic user fees will lead to outright privatization of U.S. oceanic airspace or contracting air traffic control services to other countries, for instance, Japan and Canada.

A modicum of imagination reveals where that would lead. Nations abroad would serve their interests first, institute fees for service without regard for U.S. considerations, and make truthful claims about their rise in stature – perhaps as the world's most sophisticated oceanic aviation providers.

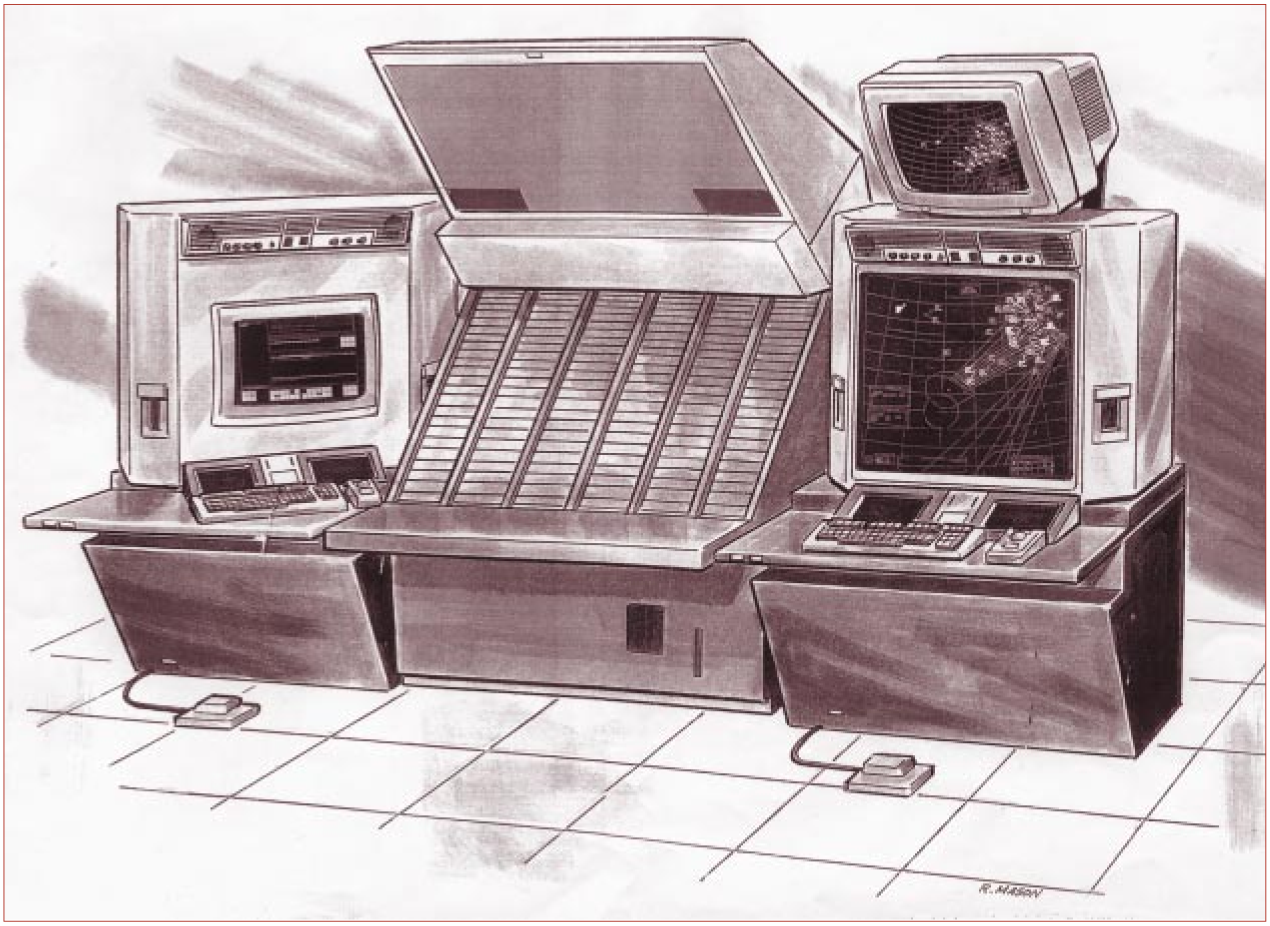
Solutions are complex, but not insurmountable. The United States must lead an international forum – perhaps through the International Federation of Air Traffic Control Associations – that focuses on the FAA maintaining its leadership in aviation.

* *Privatization*, available at **www.natca.org**
– click on News Center, Publications, Quarterly Reports.

U.S. OCEANIC MODERNIZATION PLAN



THE CONTROLLERS WORK STATION evolves if the U.S. oceanic modernization program progresses to its end state, currently not funded or planned.



R.MASON

OCEANIC CONTROLLER WORKSTATION at Oakland Center. The left console depicts ocean data link and a telecommunications monitor; the center portion represents a seven-foot flight strip bay; the right shows the Interim Situation Display. Currently, only one person may operate this equipment. Two controller access would allow more efficient operations of expanding airspace and increasing ocean aircraft. All separation and tracking is done on the strip bays. The other devices on the right and left only provide communications and decision support. The center piece is the heart of the operation.

OAKLAND CENTER

Oakland Center provides air traffic control services over 18.9 million square miles of the Pacific Ocean, equating to roughly 10 percent of the Earth's surface and, by far, the largest single piece of airspace in the world.

It is responsible for several major corridors, crossing eight time zones and the international date line. They include heavily traveled routes between North America and Asia, North America and the Hawaiian Islands, the Hawaiian Islands and Asia, North America and Australia/New Zealand, the Hawaiian Islands and Australia/New Zealand, and an increasingly active corridor between Australia/New Zealand and Asia. Additionally, Oakland is responsible for flights in and out of numerous Pacific islands, including Midway, Wake, Truk, Yap and Guam. The center routinely works with 12 foreign air traffic control facilities, only two claim English as their primary language, creating unique coordination challenges for Oakland oceanic controllers.

The airspace is divided into two areas of specialization: the North Pacific and South Pacific. It involves about 70 full time controllers in a true round the clock operation. They typically work about 520 aircraft per day, each spending anywhere from 40 minutes to 10 hours flying through the airspace.

Despite the international attention that comes with being the largest provider of oceanic air traffic control services in the world, Oakland is plagued by out of date equipment and a cumbersome manual method of tracking and separating aircraft which has changed little since the 1950s. Even with these handicaps, controllers maintain a professionalism and pride in what they do, and are committed to making Oakland oceanic the safest and most efficient operation in the world.

"When dawn broke, there were 30 of us on the raft, knee deep in the icy water and afraid to move for fear we'd capsize it. The hours that elapsed before we were picked up were the longest and most terrible that I have ever spent."

COLONEL ARCHIBALD GRACIE

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