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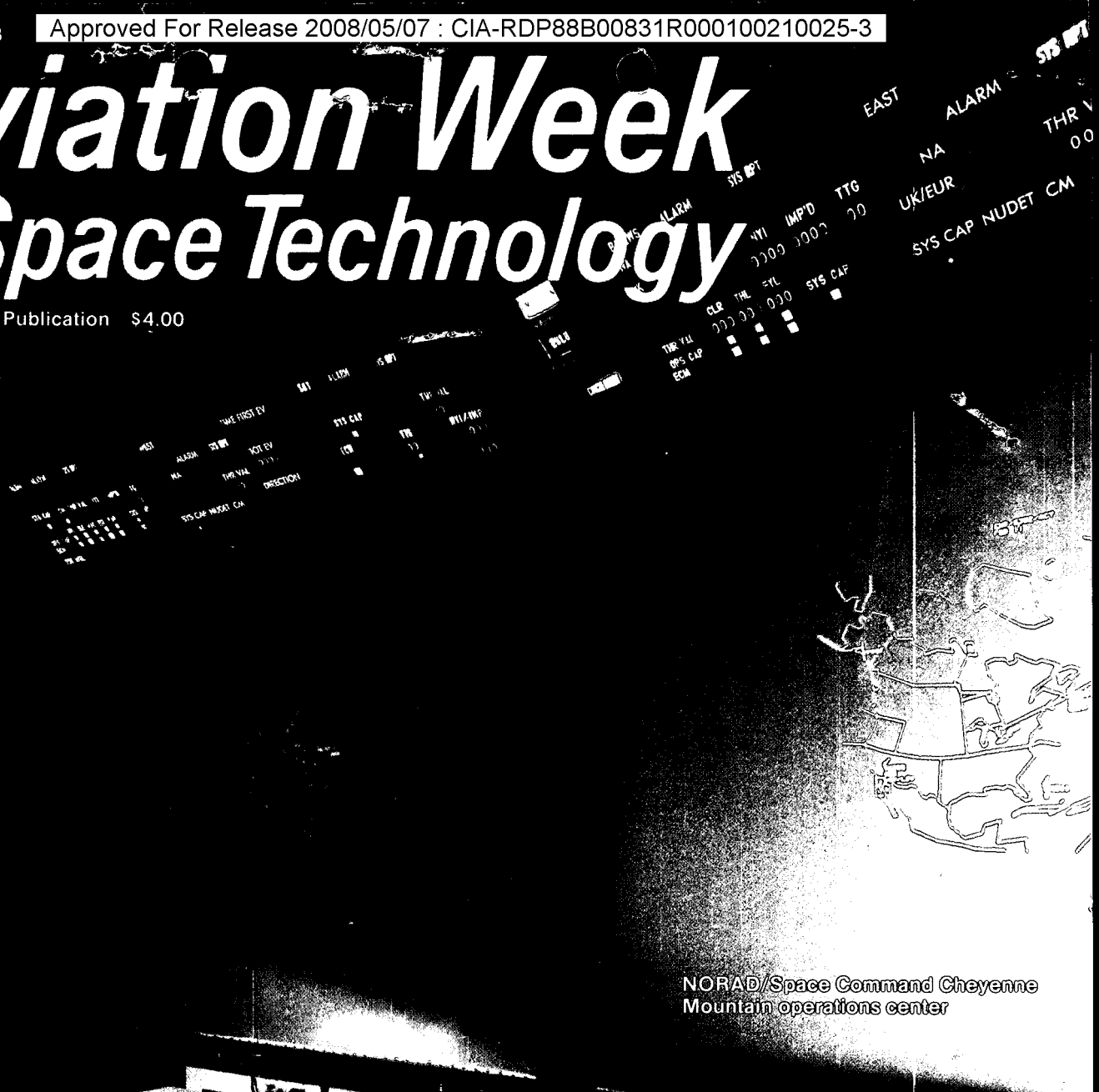
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March 28, 1983

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Aviation Week & Space Technology

A McGraw-Hill Publication \$4.00



NORAD/Space Command Cheyenne Mountain operations center

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Aerospace Calendar

- Apr. 4-8**—SPIE's Technical Symposium East '83 and Instrument Exhibit, International Society for Optical Engineering, Hyatt Regency Crystal City Hotel, Arlington, Va.
- Apr. 5-7**—1983 International Reliability Physics Symposium, Hyatt Regency Phoenix, Phoenix, Ariz. Sponsors: IEEE Reliability and Electron Devices Societies.
- Apr. 5-8**—Intermag '83, 21st International Magnetics Conference, Franklin Plaza Hotel, Philadelphia, Pa. Sponsor: IEEE Magnetics Society.
- Apr. 11-12**—International Operators Seminar, National Business Aircraft Assn., Crystal City Marriott, Arlington, Va.
- Apr. 10-14**—National News Conference, Aviation Space Writers Assn., Stouffer's National

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- Apr. 11-13**—Air Cargo '83, European Exhibition and Conference, RAI Halls and Congress Center, Amsterdam, the Netherlands.
- Apr. 11-13**—Southeastcon '83, IEEE Southeastern Conference, Sheraton Twin Towers Convention Center, Orlando, Fla.
- Apr. 12-14**—28th National Symposium and Exhibition, Society for the Advancement of Material and Process Engineering, Disneyland Hotel, Anaheim, Calif. Theme: Materials and Processes—Continuing Innovations.
- Apr. 12-15**—SAE Business Aircraft Meeting and Exposition, Century 21, Wichita, Kan. Contact: Jim Brahney, (412) 776-4841, ext. 257.
- Apr. 12-15**—AIRMEC '83, Third International Aircraft Maintenance Engineering Exhibit and Conference, Dusseldorf, West Germany.
- Apr. 15-16**—13th Mini-Symposium, Society of Experimental Test Pilots, San Diego Hilton, San Diego, Calif.
- Apr. 15-20**—38th Annual Conference, International Federation of Air Line Pilots' Assns., Dublin, Ireland.
- Apr. 17-19**—28th Annual Flight Safety Foundation Corporate Aviation Safety Seminar, Fairmont Hotel, New Orleans, La.
- Apr. 17-19**—Joint Western-Mountain Region EW Technical Symposium, Assn. of Old Crows, Hilton Palacio del Rio, San Antonio, Tex. Contact: P. K. Weir, (512) 494-9336.
- Apr. 18-20**—National Medevac Helicopter Conference, Crystal City, Va. Cosponsors: Helicopter Assn. International, Maryland Institute for Emergency Medical Services Sys-

tems. For information: Susan Danker or Richard Saker, (202) 466-2420.

- Apr. 18-20**—Industry/FAA Regional Air Carrier Symposium, North Park Inn, Dallas, Tex. Contact: Max Young, (817) 877-2088
- Apr. 18-21**—29th Annual Technical Meeting and Equipment Exposition, Institute of Environmental Sciences, Marriott Hotel, Los Angeles, Calif. Theme: Environmental Technology—A Key to Product Acceptability.
- Apr. 18-21**—13th International Symposium on Industrial Robots and Robots 7 Conference and Exposition, Conrad Hilton Hotel and McCormick Place, Chicago, Ill. Theme: Robotics—The Emerging Challenge. Sponsors: Robotics International/Society of Manufacturing Engineers; Robot Institute of America.
- Apr. 18-22**—1983 SPIE International Technical Conference/Europe, International Conference Center, Geneva, Switzerland. Sponsor: International Society for Optical Engineering.
- Apr. 19-21**—National Symposium on the DoD FY '84 Research and Development Program, Electronic Industries Assn., Hyatt Regency Crystal City, Arlington, Va. Contact: Frank A. Mitchell, (202) 457-4944.
- Apr. 20**—Spring Symposium, Huntsville Chapter of National Contract Management Assn., Hotel Hilton, Huntsville, Ala. Title: Professional Integrity in Contracting. Contact: William S. Taylor, (205) 876-1233.
- Apr. 20-22**—Symposium on Computer-Aided Geometry Modeling, Hampton, Va. Contact: John Shoosmith, (804) 827-3466. □

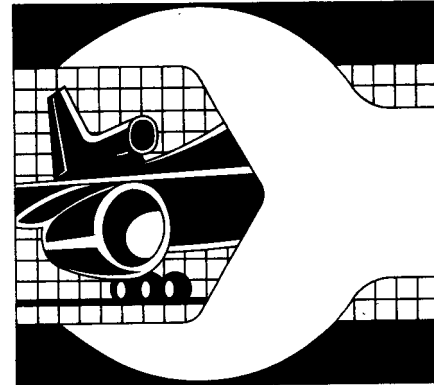
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March 28, 1983

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145,721 copies of this issue printed**Cover**

Command post for North American Aerospace Defense Command/Space Command buried in Cheyenne Mountain, Colo., has Soviet missile warning attack data boards near the ceiling. Soviet Salyut 7 space station ground track is on the left screen while a North American projection is at right. The facility recently was renovated with new Raytheon consoles and Hughes liquid crystal display boards. USAF photo by TSgt. Wesley G. Anderson.

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Opportunities Lost

With Congress threatening to trim his defense budget drastically and military spending and nuclear weapons at the focus of an economic and moral controversy, President Ronald Reagan went on national television last week with his case for the affirmative.

Most of his speech, in the best traditions of Reagan earnestness and sincerity, went over ground that is fundamental to drafting of a U. S. defense budget but which has been ploughed before. His comparisons of U. S. and Soviet relative strength were sobering, as always, but did not really get to the heart of why he is asking for double digit increases in defense for Fiscal 1984 as opposed to 5% or 6% or 7% as some have proposed. In trying to simplify the technical and budgetary complexities for a broad audience, the President faced a formidable task, and a lot had to be lost in the process.

His one new element, a commitment to push the technology for a defense against nuclear weapons, is a significant shift in concept, but the President did not get into much in the way of specifics before the television cameras. The commitment is symbolic, in the sense that his space policy two years ago was symbolic. There is nothing like a development program for a new antiballistic missile system in the mill. What is in the mill is a Phase 1 program to select a technology path to pursue, under direction of the Secretary of Defense. In effect, it is a management initiative to put some top-level direction and priority among the \$1 billion in research efforts now under way as the Army's ballistic missile defense work or the Defense Advanced Projects Agency's laser and particle-beam programs.

The President's use of reconnaissance photographs to document his description of Soviet tentacles reaching into the Western Hemisphere was a good idea whose time should have come a long time ago. When the house lights dimmed and the spotlight hit the center of the stage, the sad fact is that the veteran trouper had left his most convincing props in the closet.

Not the Best Evidence

His documentary evidence was not the latest or the best he could have produced in the way of aircraft or space imagery. It dealt with the Caribbean and Central America, where reconnaissance photography has already been used in public briefings to support the Administration's case there for the rising threat.

As important as Soviet listening post and force proximity are in the political wars, it is a sideshow in U. S./Soviet strategic superiority jockeying. It has little bearing on nuclear weapons and the rationale for U. S. development and deployment of a new land-based intercontinental missile, the MX, or the B-1B bomber, the submarine-launched Trident ballistic mis-

sile, or deployment of cruise missiles and Pershing 2s in Europe.

The Defense Dept. pulled its punches in the same way in the just-released second edition of its booklet, *Soviet Military Power*. Its contents are arresting, even though much is repeated from the first edition. It includes a drawing of the new Soviet bomber Blackjack. Another drawing sketches, in a general way, the deployment of three Soviet mobile SS-20 ballistic missiles in a forest. Still another shows a Kiev-class carrier in a Japanese-built floating drydock.

Critics' Attack

Critics of the Administration's Defense budgeting were hardly open-minded about the presentation. They simply turned around to attack the Defense Dept. for using taxpayer money to try to sell that same taxpayer on higher military spending. In their own small way, the drawings, with a sales brochure flavor, aided and abetted the hypercritical reaction of the skeptics whose opposition the Administration will have to overcome to preserve its program. The hard photography is there to add the last inch of verification. Yet the spook mentality of the Administration keeps it locked in the safe to satisfy the bureaucracy while it increasingly risks losing the more important contest in Congress and in the public arena. The same mentality cost the President the initiative in his television speech.

Even worse, in the book's comparison drawing of the U. S. space shuttle in planform with new Soviet space vehicles, the planform of the Soviet counterpart to the shuttle was depicted with a delta wing instead of the double delta it actually has. Another drawing, of the Soviet antisatellite spacecraft, was even less accurate technically. This is harmless and perhaps even justified fakery, but in the intensely unbelieving context of the battle over the defense budget and its necessity to meet the Soviet threat, any loss of credibility ought to be avoided. Microscopic flaws will be turned into catastrophic cracks in the structure.

Yet one more example of missed opportunity was that of the National Capital Section of the American Institute of Astronautics and Aeronautics and its classified briefing on the Soviet threat. The rationale was that only if the meeting was classified as secret could a meaningful briefing be given to the section, whose sessions are normally open to all. As a result, only about half the section's members could come to the meeting.

The Administration is using the same logic in telling the public about the Soviet threat. As a result it is preaching more fervently to a smaller choir, and the defense consensus that existed when the Administration took office is slowly, but surely, drifting apart.

—William H. Gregory

Who's Where

Anthony M. Corrado named vice president of operations for Litton Industries' Amecom Div., College Park, Md.; formerly, he was vice president of Hazeltine Corp.'s Industrial Products Div.

Robert W. Truxell has joined General Dynamics Corp. as vice president and general manager of the Land Systems Div., Detroit, Mich., and also has been elected a corporate vice president. Truxell was corporate vice president and general manager of the Truck and Bus Manufacturing Div. of General Motors, prior to his recent retirement.

John E. Heaney elected vice president of corporate communications, a newly created position, of Fairchild Industries, Inc., Germantown, Md.

John F. Fedak Jr. appointed vice president of engineering and system operations for Ford Aerospace Satellite Services Corp., Washington, D. C.; Fedak was assistant vice president and transmission engineer for Western Union, responsible for engineering of satellite and terrestrial communications systems.

Douglas Aircraft Co., Long Beach, Calif., division of McDonnell Douglas Corp., has named the following as marketing directors for commercial aircraft activities: **William C. Messer**, Northern Europe; **David E. Moore**, Middle East; **James B. Mackenzie**, North Pacific-Asia region; **Robert J. Olivas**, South Pacific-Asia region; **John J. McHale**, Canada and U. S.

W. John Denson appointed executive vice president of Lockheed Space Operations Co., Titusville, Fla.; he was program manager of Lockheed's Shuttle Avionics Integration Laboratory activities in Houston, Tex. **H. Bard Allison** named executive director of the C-5/C-141 programs at Lockheed-Georgia Co., Marietta, Ga.; **Carroll Dallas** succeeds Allison as director of engineering. Also: **James A. Neilson** appointed director of the C-5B program, and **C. P. Settlemyer** appointed director of the C-5A program. **R. A. Meadows** succeeds Settlemyer as the C-141 program director.

Raymond P. LeCann elected vice president of Europe/Middle East region for Grumman International, Inc., a subsidiary of Grumman Corp., based in Paris.

James M. Burns named program marketing director-Data Link 700 system for Collins Air Transport, Cedar Rapids, Iowa, a division of Rockwell International Corp., and **George A. Coble** named technical director for Data Link.

Honors and Elections

Frederick R. Einsidler, president and chief executive officer of Butler International, Inc., has been elected president of the Wings Club, New York, N. Y., succeeding **Harry B. Combs**, vice chairman of Gates Learjet Corp. Einsidler is vice chairman and chief executive officer of Butler Aviation International and chairman and chief executive officer of Butler Service Group, and of International Transport.

Robert J. Schliekelmann, head of Fokker's Technological Center, has received the annual **Certificate of Honor Award** from the Society for the Advancement of Material and Process Engineering for his contributions to advances in nondestructive testing of metal bonding and for work in composite components in aerospace.

Industry Observer

Soviet heavy space shuttle orbiter sighted by U. S. reconnaissance spacecraft closely resembles the double delta winged NASA orbiter and not the sharply swept wing configuration presented by Defense Secretary Caspar Weinberger's report on Soviet military power (AW&ST Mar. 14, p. 257). The main engines for the Soviet heavy shuttle will be mounted on the vehicle's external tank, not in the orbiter tail as in the U. S. design. All of the Soviet heavy shuttle's engines are expected to be liquid fueled, with none of the engines reusable since both the strap-on boosters and external tank are expendable.

Update program for the French navy/Dassault-Breguet Alize maritime patrol/antisubmarine warfare aircraft will be completed this year. The turboprop-powered aircraft is being fitted with Thomson-CSF's Iguane radar to improve its search capabilities and enhance its ability to locate small targets and semisubmerged submarines (AW&ST Sept. 1, 1980, p. 223). French navy Alizes are operated from land bases and from France's two aircraft carriers (AW&ST Oct. 13, 1980, p. 67).

Westland Helicopters plans to test-fire several Rockwell International Hellfire antitank missiles from a Lynx helicopter later this year. The helicopter is a company-owned demonstrator with civil registration that is being used in the development of the Lynx 3 helicopter gunship (AW&ST Aug. 2, 1982, p. 21; July 12, 1982, p. 56). Hellfire will be one of three antiarmor weapons offered with the Lynx 3, in addition to the Hughes TOW and Euromissile HOT.

U. S. Air Force in Europe is recommending that in-shelter refueling systems be made the NATO-wide standard. Such a system uses a buried pipeline loop to each shelter to replace trucks refueling combat aircraft, reducing exposure to attack and dependence on an aging truck fleet. A prototype system is in operation in four shelters at Spandahlem AB, Germany.

Japan is planning to purchase from the U. S. a \$17.5-million block of replacement parts for the McDonnell Douglas/Mitsubishi Nike-J surface-to-air missile. That nation's Air Self-Defense Force has received notification from the U. S. Army that orders received this year will be filled in 1985, and no requests will be accepted after 1986. The Japanese service predicts the replacement parts will keep its six Nike-J groups in service for 10 more years.

Naval Training Equipment Center is expected to move from the Naval Training Center in Orlando either to the Herndon Airport or to the Central Florida Research Park, a 1,400-acre facility affiliated with the University of Central Florida. Orange County has offered to give the Navy 40 acres of research park land if it locates at the park. A decision is expected before summer.

U. S. Air Force will handle qualification for the Norwegian air force of the Kongsberg Vaapenfabrikk Penguin Mk. 3 antishipping missile on a General Dynamics F-16 at Edwards AFB, Calif., starting Apr. 1, and at Eglin AFB, Fla., next month. The Norwegian government will compensate the U. S. for test costs.

International Trade Commission is studying the effects of increasing application of robotics in aircraft production on product competitiveness in domestic and international markets. Industry contributions to the study are due Aug. 12.

Washington Roundup

Missile Defense

President Ronald Reagan's call for a research and development effort in directed energy and other ballistic missile defense technologies is identical to one by Presidential Science Adviser George A. Keyworth in 1981 for a national task force to coordinate laser research (AW&ST July 27, 1981, p. 26). White House officials said the new effort, which will take several months and has no new funding at the moment, will be conducted on a multiagency level to "define" the directed energy program for lasers, microwave devices, particle beams and projectiles. Keyworth said in 1981 that the Reagan Administration must bring in various parties and perspectives to a national task force effort. Directed-energy weapons programs, Keyworth said at the time, are excessively diverse, lack desirable cross communications between programs and are too oriented toward systems development at the expense of basic research.

Shuttle Cost Pact

U. S. Air Force and National Aeronautics and Space Administration have negotiated a \$13.8-million increase to the price Defense Dept. will pay for the use of shuttle on dedicated military space flights. **The previous USAF dedicated shuttle flight price was \$16 million in Fiscal 1975 dollars and the new charge will be \$29.8 million.** Under the new formula going into effect after 1985, Defense Dept. will pay the same price for a shuttle launch as commercial users for equivalent service, excluding manpower charges that will be traded between NASA and USAF.

Final request for proposals in the Air Force's program to lease more than 120 corporate type aircraft for operational support missions will have few changes from the draft request (AW&ST Feb. 28, p. 16). However, a snag was introduced into the program to replace the Rockwell International CT-39 by Senate Appropriations defense subcommittee chairman Sen. Ted Stevens (R.-Alaska). Stevens is concerned over leasing costs and wants to delay the RFP for more details.

Defense Sharing

Israeli Defense Minister Moshe Arens, lately Israel's ambassador to the United States, has moved quickly to eliminate one trouble spot left by Ariel Sharon—**sharing with the U. S. Israeli techniques used against Soviet missiles in the Bekaa Valley.** This followed shortly after Arens huddled with Defense Secretary Caspar Weinberger (AW&ST Feb. 21, p. 13). Weinberger last week sent to Congress a notification of a proposal to sell Israel 200 Raytheon/Ford Aerospace AIM-9L air-to-air missiles. Meetings on technology transfer problems involving the Israel Aircraft Industries Lavi fighter also have started in the Pentagon.

The President's Commission on Strategic Forces tentatively has decided to recommend deploying 100 MX intercontinental missiles in reinforced Minuteman silos and building a small, 30,000-lb. single-warhead ICBM with mobile capability (AW&ST Jan. 31, p. 15). The Commission has written a draft report that will contain no radical proposals, a senior Administration official said. It also will recommend no change in strategic aircraft programs, the official said, "sticking with the whole package of B-1, Stealth and so on."

Three-Star Critic

U. S. arms negotiator Ambassador Edward L. Rowney may have retired as an Army three-star general, but his memos in his new diplomatic role are undiplomatically crusty. In a "talking points" memo to Kenneth Adelman, the much embattled presidential nominee to head State Dept.'s Arms Control and Disarmament Agency, Rowney said: "ACDA needs serious redirection—is drifting, . . . the personnel system has degenerated . . . ACDA needlessly top-heavy—extra deputy directors in bureaus, deadwood near the top . . . ACDA could get hopelessly embroiled in Soviet compliance issues, detracting from active negotiations President wants . . . ACDA an ill-managed agency with many dubious expenditures and wrong personnel."

As for people, Rowney was equally blunt such as "fire or send back to State many of the problems"; or "the Cadillac of the bureaus"; or "knowledgeable, smart but never produces on requests or promises"; or "questionable, nit-picker"; or "smart, fast, left-leaning, watch him carefully"; or "the best, want him as my permanent [job title deleted] in Geneva." Not even the secretaries escaped ("incompetent, lazy . . ."). Rowney suggested using the State secretarial pool.

—Washington Staff

NASA Sets Medical Privacy Rule

New policy would prevent disclosure of symptoms shown by astronauts unless they alter conduct of the mission

By Craig Covault

Washington—The National Aeronautics and Space Administration is instituting a new astronaut medical privacy policy under which symptoms such as motion sickness will not be disclosed publicly unless they force changes in mission milestones or objectives. The policy will be effective with shuttle Mission 6.

In the event symptoms, such as motion sickness caused by adaption to zero-g, do affect the mission plan and are disclosed, NASA will not discuss the symptoms in detail so as to retain some medical privacy for the crewman involved.

Following detailed public discussion of the motion sickness symptoms experienced by two Mission 5 astronauts last November, NASA legal personnel questioned whether the agency had violated the Federal Privacy Act by such discussion of crew symptoms (AW&ST Dec. 6, 1982, p. 27).

No formal judgment was made whether the Mission 5 motion sickness discussions violated the act, but the new policy has been written to fulfill Federal Privacy Act provisions in the future.

Mission Planning

NASA believes any crew symptoms such as vomiting, headaches or a feeling of malaise that occur but are not severe enough to alter mission planning should remain private on grounds of medical ethics and the Privacy Act. Symptoms that do result in changes to mission performance, however, can be covered by the Freedom of Information Act and will be summarized by NASA management.

The names of crewmen whose symptoms are involved in mission planning changes will probably be discussed.

The plan is for NASA to treat the occurrence of symptoms not affecting mission operations as scientific data that will be totaled and made public every five or six flights as statistical information.

The new medical privacy policy was carried in the Federal Register, and NASA encountered no opposition to it following its publication, according to Dr. Arnauld Nicogossian, chief of Medical Operations for NASA's Life Sciences Div.

Dr. Sam L. Pool, chief of the Medical Sciences Div. of Johnson Space Center, said, "Clearly the way the new standard was written and published, it says those matters which do not affect the mission are private unless there is a fairly high probability that whatever we saw would affect the flight."

The detailed public discussion of motion sickness symptoms has angered many astronauts, who believe if they become motion sick their chances for future crew assignments are reduced, even though most symptoms experienced by shuttle crews have not seriously reduced crew performance.

Detailed public discussion of symptoms during Mission 5 also caused concern among U. S. Air Force reconnaissance satellite managers, who feared symptoms could affect crew performance in deploying reconnaissance spacecraft during the first orbit after launch from Vandenberg AFB, Calif. That quick deployment option, if ever exercised, would avoid the orbiter's overflight of the Soviet Union prior to landing after one orbit.

NASA management had to explain to USAF managers that motion sickness normally does not affect crewmen that early in flight and, when it does occur, is mild in most cases.

One privacy policy option raised by Johnson Space Center but later rejected would have assigned essentially a single descriptive term to increasingly severe symptoms. A crewman having such symptoms would have been characterized as falling under a particular class of symp-

tom, but no specific details would have been given out other than those explaining in general the type of symptoms that could be present under each class.

In addition to the new policy, NASA has decided not to schedule private medical conferences in the flight plan. The crews in space or the flight control team will now use a private medical conference only if one side or the other requests it.

If a crewman is experiencing mild symptoms related to zero-g adaptation that are not affecting performance, the astronaut need not discuss them with the ground over the air-to-ground loop and can wait to discuss them with medical personnel after the mission ends. NASA also will stress use of physicians being carried on some flights for medical research purposes. Medical doctors in the astronaut office have joked for some time the way to do away with private medical conferences on the air-to-ground loop is to fly more doctors in space.

Hands-On Research

Physicians assigned to flights, as is the case on Missions 6-8, have been selected for hands-on research, but NASA is now stressing their value for offering on-the-spot medical advice as a space-based house call.

Following the public discussion of the Mission 5 crew symptoms, Mission 6 commander Paul J. Weitz and other members of his crew said they did not want their medical condition in flight discussed publicly. NASA physicians agree from a medical ethics standpoint this should be the case, but they also recognize the mission performance aspects of the issue. "I hope what we have now will satisfy the requirement for privacy and the need for knowledge on crew condition," Pool said.

NASA recently received Reagan Administration approval to initiate a five-year, \$51.4-million program to research space motion sickness factors, now characterized as "space adaptation syndrome" by the agency. NASA received \$2 million in its Fiscal 1984 budget request to initiate the effort (AW&ST Dec. 13, 1982, p. 16).

"A solution to this problem is essential," NASA told Office of Management and Budget in seeking the \$51.4-million program. "The effort will be constructed with goals and milestones leading to implementation in the late 1980s of definitive techniques that will mitigate the effects of space motion sickness."

A more focused in-flight research program for such studies will begin with Missions 7 and 8, to which mission specialist astronaut physicians recently were added.

Mission 6 next week also carries simple

Satcom 3 Debris

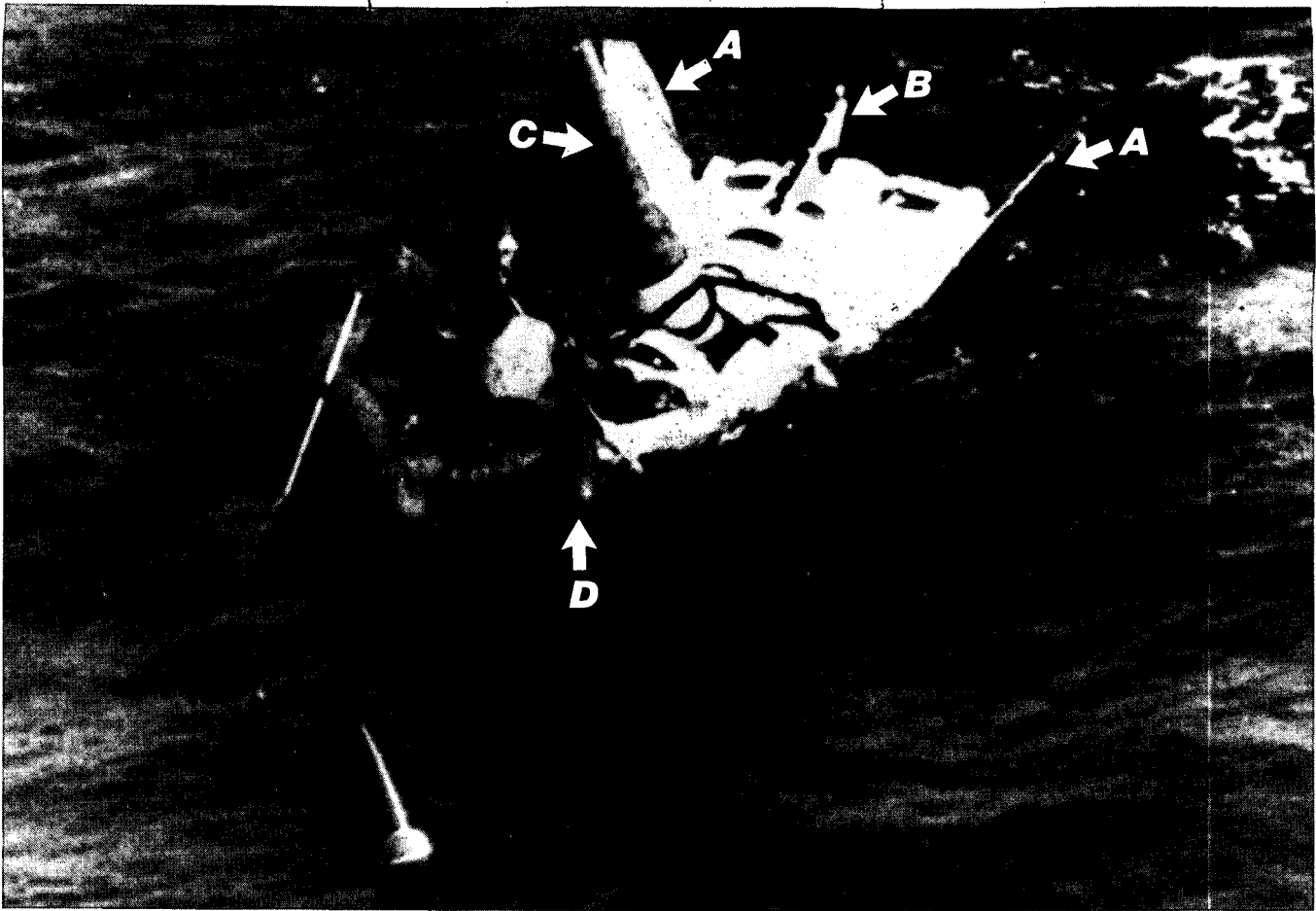
Colorado Springs, Colo.—U. S. Air Force Space Command's ground-based electro-optical deep space surveillance system (GEODSS) station at Socorro, N. M., has found debris in deep space that may be the RCA Satcom 3 lost during apogee kick motor firing Dec. 10, 1979.

The spacecraft's loss has been attributed to a likely apogee kick motor explosion or other apogee motor malfunction (AW&ST Dec. 17, 1979, p. 23).

The GEODSS debris discovery data were passed to the MIT Lincoln Laboratory's Millstone Hill deep space tracking center, Westford, Mass., for correlation, and it was able to acquire the debris via radar.

Space Command managers have not yet been able to confirm that the debris is from Satcom 3, but they believe that is the most likely explanation.

Following loss of Satcom 3, RCA's insurance brokers, Marsh & McLennan, secured a \$77-million settlement from aerospace insurance underwriters. Discovery of the debris will not affect the settlement.



Soviets Recover Spaceplane in Indian Ocean

Soviet winged spacecraft designed as a subscale version of a future manned spaceplane floats in the Indian Ocean Mar. 15 as two Russians in a raft assist in recovery operations. The vehicle has lifting body/blended wing characteristics with the wings (A) slanted sharply upward. A small vertical stabilizer (B) rises from the aft mid fuselage. A large cone (C) about 8 ft. tall rises from the forward fuselage. This cone is reported to be a recovery aid to assist Soviet forces in locating the spacecraft, which rides low in the water following a parachute landing. The brightly polished nose cap (D) could be a Q-ball that sensed dynamic pressure as the vehicle flew a wingborne reentry. The vehicle is identical to a similar spacecraft launched June 3, 1982 (AW&ST June 21, 1982, p. 16). Both vehicles were launched from

Kapustin Yar on SL-8 boosters derived from the SS-5 intermediate-range ballistic missile. Also during both tests the 2,000-lb. spacecraft flew 1.5 Earth revolutions before using a retrorocket system to achieve a reentry into an Indian Ocean recovery area about 300 naut. mi. south of the Cocos Islands. The photograph was taken by the crew of a Royal Australian Air Force aircraft shadowing the seven-ship Soviet recovery fleet. In the spaceplane's larger manned configuration, the vehicle is expected to be launched on an expendable booster for space station resupply or quick response manned military missions. The spaceplane development is different from Soviet development of a heavy space shuttle vehicle similar to the U. S. space shuttle (AW&ST Mar. 14, p. 255). (Wide World)

experiments, some carried earlier on Mission 5, to research the body's adaptation to zero-g and to study factors associated with multiple crewman living in the orbit for several days.

Activities to be carried out in space next week include:

- **Predictive test validation**—The results of ground-based tests to help determine motion sickness susceptibility will be compared with each crewman's reaction once in zero-g.

- **Head and eye motion studies**—One crewman will wear electrodes to record eye movements during both launch and reentry to acquire data on some nervous system responses occurring immediately at the onset of zero-g and their dissipation during reentry into the gravity field.

- **Head and eye tracking tasks**—Electrodes will be used to record how the eyes track a small ball suspended from the head. The objective is to see how zero-g shifts the threshold of such capability by each subject.

- **Body fluid shift**—Photography of the faces of the crew in orbit will be compared with those made on Earth to assess the amount of extra fluid moving to the upper portion of the body. The fluid shift tends to make the face puffy in zero-g conditions.

- **Near vision studies**—Eye tests to read fine print up close will help assess how much the fluid shift may affect vision.

- **Hearing tests**—Crewmen wearing a headset will indicate when they can hear tones at different frequencies so this can

be compared with similar tests made on earth when zero-gravity was not a factor.

- **Cardiovascular deconditioning countermeasures**—Four hours prior to reentry, each crewman will consume liquids and salts in order to reestablish a more Earth-like cardiovascular chemical condition. The human body typically expels about 10% of bodily water after several hours in zero-g.

In addition to these life sciences tests, a medical restraint system that could secure a person on whom cardiopulmonary resuscitation had to be performed in zero-g will be demonstrated.

Noise measurements and cabin atmosphere samples also will be taken to obtain baselines on the new orbiter Challenger in flight. □

Shuttle Payloads to Be Protected on Pad

By Edward H. Kolcum

Kennedy Space Center—National Aeronautics and Space Administration has devised a new set of procedures and hardware modifications designed to keep shuttle payloads clean while they are on the launch pad to prevent a recurrence of the contamination of the Mission 6 payload that caused a delay in its launch.

Some of the corrective actions have been taken, and several hardware modifications will be made after the next flight is launched, which is scheduled for 1:30 p. m. EST Apr. 4. The launch will be preceded by a 93-hr. countdown with an additional 26 hr. 30 min. of built-in holds.

The Tracking and Data Relay Satellite System (TDRSS) payload for this mission has been vacuumed and brushed to the

same level of cleanliness it had before it was dusted with contamination during a storm Feb. 27-28, according to John Lovelace of NASA's Goddard Space Flight Center. Lovelace is TDRSS mission-integration manager.

Alfred D. O'Hara, director of launch and landing operations, said he feels comfortable with the Apr. 4 launch date. The schedule will enable most workmen here to be given a holiday Easter Sunday because a 24-hr. 10-min. hold will go into effect at midnight Saturday, Apr. 2.

James A. Kelley, chairman of the shuttle countdown working group, said that because of the brief launch window, only one launch attempt can be made each day. He and Robert B. Sieck, shuttle chief en-

gineer, said the vehicle could be recycled for a daily launch, but if the launch does not take place by Apr. 6, a delay of about three days would result.

"The inertial upper stage would become the driver at that point," Sieck said. It would be necessary to reopen the payload bay doors to recharge the battery in the Boeing IUS and realign the inertial measurement unit in this stage.

Countdown Changes

Kelley said these are the other changes in the coming countdown from the one used for the fifth shuttle mission that was launched Nov. 11 (AW&ST Nov. 15, 1982, p. 18):

- **Launch window.** The window was open 40 min. for Mission 5 and will be open 17 min. 30 sec. for Mission 6 if it is launched Apr. 4. It increases by about 6 sec. daily after that date. Astronaut USAF Maj. Ronald J. Graybe will go to Dakar, Senegal, to fly approaches at the runway there to assess lighting conditions after sunset. Dakar is the transatlantic abort site, and a determination will be made if visibility is such that the window could remain open longer so that a landing could be made there after sunset. Kelley said the formal countdown will not include a longer window opening, but a decision on extending it could be made on launch day, if necessary. O'Hara said there is a possibility that the window could be extended by as much as 15 min.

- **Hold duration.** It was decided to combine and extend all but the terminal count holds to reduce the size of the station-keeping crew on Easter Sunday.

- **Payload bay doors.** They were closed prior to the call to stations, which signifies the start of the launch countdown, in Mission 5. They will remain open until after cargo closeout in Mission 6 because it is necessary to have access to the TDRSS battery to apply a trickle charge until about 83 hr. before launch.

- **Liquid oxygen hold time after drain back** has been increased to 10 min. from 6 min. and is an operation that is performed after replenishment has stabilized. The increase was made after evaluating the flight mission margin. There was concern before Mission 5 over the temperature of the liquid oxygen because of the removal of the anti-geyser line in the external tank (AW&ST Nov. 1, 1982, p. 19). However, Sieck said the concern now is more over the proper propellant mixture and determining the minimum excess hydrogen that will be carried. Kelley said that between 1,000 and 1,100 lb. of liquid oxygen is drained back each minute.

Administration Plans Boost in Aid to Greece

Washington—The Reagan Administration last week changed its position on military aid to Greece, saying it would allocate an additional \$220 million in guaranteed loans to the Greek government if the two nations reach "a satisfactory agreement" in current negotiations on preserving U. S. military bases in Greece.

In its original Fiscal 1984 foreign military aid request, the Administration recommended no Greek aid increase above the Fiscal 1983 level of \$280 million in Foreign Military Sales (FMS) guaranteed loans. At the same time, the President proposed sizable aid increases to Turkey, rekindling congressional concerns about the long-standing conflict between Greece and Turkey over Turkish occupation of the island of Cyprus (AW&ST Mar. 21, p. 86).

Members of Congress feared the Administration's actions might be interpreted by Greek leaders as a political insult and might prompt them to break off military base talks begun last October. The Senate Foreign Relations Committee's ranking member, Sen. Claiborne Pell (D.-R. I.), criticized the Administration for imprudent timing and bad judgment.

In a letter last week to congressional leaders, the State Dept. said the aid boost to Greece would be allocated "only after the United States has achieved a satisfactory agreement with Greece in the current negotiations with respect to access to and use of military facilities in that country by United States forces.

"To make this intention clear to all parties," the letter continued, the Administration wants the condition made a requirement of law. To that end, the State Dept. set forth amendment language stating that the extra aid could be made available "only if the President certifies and reports to Congress" that a base agreement is achieved.

According to the Defense Dept., Greece's planned military purchases include:

- Attack helicopters.
- Combat and maritime patrol aircraft.
- Portable and guided missile systems.
- Tank and armored personnel carrier conversion kits and antitank weapons.
- Land and sea communications and radar equipment.

A House Foreign Affairs Committee staff aide said last week the committee probably will draft a two-year foreign aid bill this year, as it tried to do two years ago over Administration objections. "This time the Administration is a little more prepared for it and I think reconciled to it," she said. Congress failed to adopt a foreign aid bill for Fiscal 1983 and funded the program through a catch-all continuing resolution.

The aide enumerated several advantages to a two-year bill. It permits more continuity in foreign policy and easier planning, she said.

"Frankly, members would rather take a foreign aid bill to the floor in a nonelection year," she said, because the program is traditionally politically unpopular. Annual foreign aid bills are time consuming. "There's some feeling that we could do our oversight better if we weren't so caught up in marking up the foreign aid bill for the first half of every year."

- IUS hold time, which was not a consideration in Mission 5, is 13 min. after the redundant inertial measurement unit is put into its flight mode at T-5 min. 30 sec.

The final countdown documentation was completed Mar. 23 when it was decided to include an extra hour of hold in the terminal countdown. This period, which begins at 1:10 a. m. Apr. 4, will have 2 hr. 20 min. of holds.

Edwin C. Johnson, Jr., O'Hara's technical assistant, said NASA and its contractors have developed these near-term anticontamination corrective actions:

- Holes around seals at the orbiter and payload changeout room interface and around doors have been closed.

- Access has been restricted to the payload ground handling mechanism levels above the spacecraft.

- A cover was installed under the platform above the spacecraft.

- The payload changeout room was wiped down and vacuumed.

- A daily cleaning routine was established in the payload changeout room.

- Tacky mats were installed at highly traveled locations.

- Workmen must wear booties.

- The most aft orbiter bulkhead will be used as a control area and monitor to measure contamination in the payload bay.

- White room rules are reinforced by newly posted signs.

- Hypergol spill fan switches, which were inadvertently activated pouring outside air into the payload changeout room, have been modified. Alarms and lights will be installed to detect activation of these fans.

- A debris shield has been installed be-

German Pilot Training

Training program for West German pilots at Luke AFB, Ariz., under the mutual defense assistance agreement with the Federal Republic of Germany, has been concluded after more than 25 years of operation.

German air force and navy pilots have been trained in German-owned Lockheed F-104 Starfighters for the past 19 years of the program, with peak activity during 1968 when the training activities included a fleet of more than 100 F-104s. The Starfighters were maintained under contract by civilian employees of Lockheed Aircraft Service Co.

The company's services included flight-line activities, airframe inspections and repair, avionics maintenance and update, and engine inspection and replacement.

Nearly 2,000 pilots, instructor pilots, fighter weapons instructors and advanced fighter pilots have been trained in the program during its F-104 operations.

Comsat Nomination

Washington—Shareholders of Communications Satellite Corp. will elect Joseph V. Charyk chairman of the board and chief executive officer of the corporation at its annual meeting May 20.

John D. Harper, Comsat's current chairman, nominated Charyk at the corporation's Mar. 18 board meeting. He will retire as chairman following the annual meeting. Irving Goldstein will succeed Charyk as president.

Goldstein now is executive vice president of Comsat and formerly was president of Satellite Television Corp., Comsat's satellite direct-broadcast subsidiary. Harper will remain a member of the Comsat board.

tween the spacecraft and orbiter during use of a work platform for payload bay cleaning.

- The upper payload changeout room seal for the orbiter window can no longer be moved until payload bay doors are shut.

- Technicians and other operational personnel have been sensitized to the contamination problem.

Johnson said the initial sample from the TDRSS indicated that the contamination consisted primarily of hydrated silica, typical of the products from the white thermal protection system tile and Ludox tile densification material.

Particle Sources

Among the possible sources are material from tile repair work in the forward reaction control system area directly above the payload changeout room. Particles also could come from under the payload bay liner from orbiter processing facility tile work when a fuel cell was replaced.

A third potential source was tiles along the side of the orbiter that came in contact with the payload changeout room side door seals.

Other types of contamination found, Johnson said, were metal chips, mostly aluminum and some steel, salt, sand, rust, man-made fibers, steel weld beads, zinc-rich paint and titanium-rich spheres of acrylic spray paint.

Johnson said that prior to the TDRSS cleaning, the orbiter radiators were wiped and contamination did not include hydrated silica. Substances found were calcium-rich particles, sand, a talc-like substance, zinc-rich paint, steel weld beads and aluminum-rich corrosion products, which was residue from previous solid rocket motor firings.

Factors that contributed to the TDRSS contamination problem, Johnson said, included the long duration of the spacecraft in the payload changeout room, severe

weather, the seal between the payload changeout room and orbiter, lack of daily cleaning, heavy traffic, activation of the hypergol spill fans and inadequate sensitivity to clean room operations.

Johnson said that after Mission 6 is launched, Kennedy plans a number of modifications that will insure payloads are clean. Among these modifications are the evaluation of payload debris shields—blankets or covers—that will be used on the pad. Other changes in hardware or procedures are:

- The payload changeout room door seal pressure will be increased and the seal design will be analyzed. Winds during the February storm reached a peak velocity of 57 kt., and the orbiter moved an estimated 9 in., allowing the contaminants to penetrate the seal between the payload bay and changeout room.

- The forward reaction control system room will be protected from weather.

- Paint chip producing surfaces and particle traps will be eliminated.

- Room static pressure will be increased.

- Covers will be installed under all extendable platforms.

- A cleanliness management system will go into effect. It will include laser particle counters for remote readout in the launch control center.

- Pad flow time and payload stay time in the payload changeout room will be decreased.

- A contamination control plan will be developed to see how the facility is maintained and verified clean. It will provide the user with cleanliness-level data. □

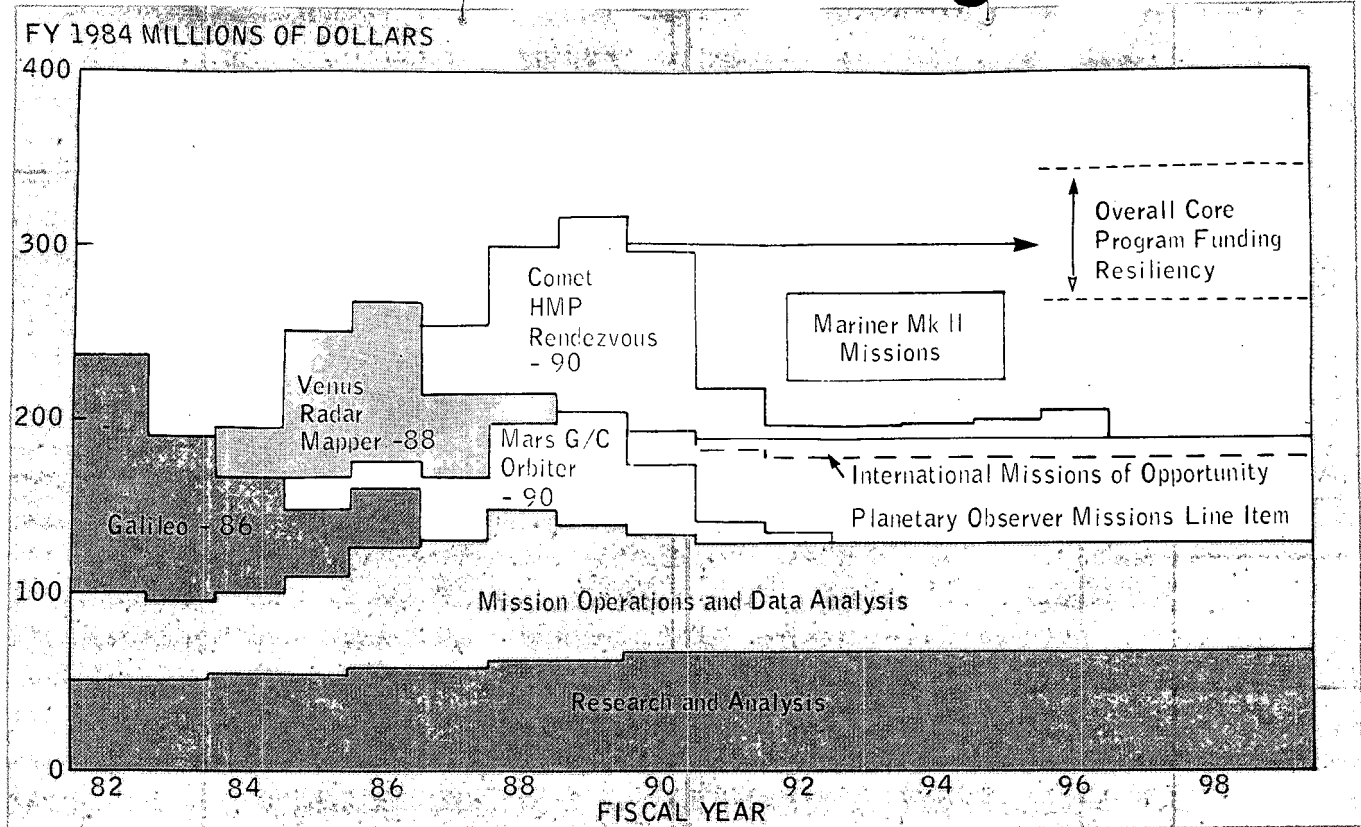
AW&ST Telephones

Washington—New telephone numbers assigned to the Washington Bureau of AVIATION WEEK & SPACE TECHNOLOGY will become effective Monday, Mar. 28, replacing the present (202) 624-7575 main number and individual editor extensions.

New main number is (202) 463-1770. Individual extensions are preceded by (202) 463 and are assigned as follows:

William H. Gregory, editor-in-chief, 1776; Herbert J. Coleman, managing editor-bureaus, 1775; Philip J. Klass, senior avionics editor, 1786; Clarence A. Robinson, Jr., senior military editor, 1787; James Ott, transport editor, 1781; Eugene Kozicharow, transport editor, 1785; J. Michael Hoeflerlin, military editor, 1789; Craig Covault, space technology editor, 1782; David M. North, business flying editor, 1784; J. Woods Hansen, news editor, 1779; Jay C. Lowndes, engineering editor, 1783; Alton K. Marsh, congressional editor, 1780; Paul Mann, congressional editor, 1788.

Telex number remains RCA International 248437.



Solar System Exploration Committee's recommended planetary science program strategy would utilize low-cost spacecraft at \$300-million annual funding level to attain a stabilized series of missions, rather than the abrupt peaks and valleys of previous funding, as illustrated above.

Farsighted Planning Urged For Study of Solar System

By Erwin J. Bulban

Houston—Current satellite technology could accommodate a large segment of scientific exploration requirements at relatively low cost, easing budget pressures on National Aeronautics and Space Administration, according to David Morrison, chairman of the Solar System Exploration Committee.

The committee was formed by NASA in 1980 with a panel of personnel from U. S. universities, NASA centers and several aerospace companies to devise a new approach to implementation of a 20-year space science program.

Morrison described a "core program" for a long-term mission strategy for solar system exploration, aimed at identifying an affordable approach, to a lunar and planetary science conference here at NASA's Johnson Space Center.

This core planetary exploration program has been studied by NASA, briefed to members of Congress and received favorable response, Morrison said.

He said previous approaches to planetary science space programs have demonstrated that because of the multiple

objectives they sought to achieve on each mission, they pushed the technical state of the art and became too expensive, straining NASA's ability to obtain funding.

As a result, planetary science programs have suffered heavily from "peaks and valleys funding," resulting in erratic space exploration that has frustrated NASA and the science community, he said.

The study by the Solar System Exploration Committee has recommended an approach cognizant of the agency's funding problems and aimed at providing stability to planetary missions.

"We must break our goals into smaller pieces that are more efficient to operate," Morrison said. "Let's try to focus science on particular objectives and not do everything at once. There are some things we know how to do well—flybys, orbiters, entry probes. With shuttle and the Centaur upper stage we have a fine vehicle, so let's exploit them and not worry about new technology."

To translate this philosophy into missions, the Solar System Exploration Committee has developed a core program

utilizing "planetary observers," which would entail a series of missions using derivatives of existing Earth orbital spacecraft. This program could sustain a series of high-priority science missions at a sustained level of about \$300 million annually in 1984 dollars, the committee estimates.

The group is proposing a series of relatively inexpensive missions using this technology:

- **Mars orbiter**, using a derivative of a commercial Earth satellite, placed in low circular polar orbit to carry out two primary mission objectives—map the surface composition of the planet with infrared, gamma ray and X-ray instruments, and study the Mars climate, in particular the exchange of volatiles, primarily water and carbon dioxide between the polar caps. Launch date would be in 1990, with anticipated operation to 1993.

- **Comet rendezvous**, using a so-called Mariner Mk. 2 spacecraft to match orbits with a short-period comet and do a detailed study of the nucleus and, by continuing to fly along with it on its way to and beyond the Sun, continuing to study its evolution. The spacecraft would return with plasmated dust samples.

- **Titan flyby with probe** to follow up Voyager discoveries. One of the most exciting Voyager discoveries was the complexity of the Titan atmosphere, dominated by nitrogen, with organic processes taking place that are believed to be an

analog of the prebiotic state of Earth, Morrison said.

Other planetary observer missions considered in the committee's recommendations to NASA include first visits to near-Earth asteroids and initial characterization of main belt asteroids.

The missions would include several flybys of varied types and detailed orbital studies of two large asteroids, in-depth exploration of the Jovian and Saturnian systems of satellites, rings and magnetospheres to permit comparative studies, probes to do direct analyses of the atmospheres of Jupiter, Saturn and Uranus and a flyby of Uranus, its rings and satellites, according to the committee.

Global mapping of the lunar geochemistry, including a search for polar reservoirs of ice, also would be included in this series, which could be accomplished by the year 2000 under a core program, the committee said.

For observation of the outer planets, some comets and asteroids, it would be necessary to build specialized spacecraft, but the philosophy would be to utilize a modular approach, emphasize simplified, lightweight construction and ground support systems readily configured to meet new mission requirements.

These would be the task of the Mariner Mk. 2 spacecraft, which would implement the recommended initial series of missions utilizing modified Earth orbital configurations. Jet Propulsion Laboratory is conducting pre-Phase A studies of the simplified modular spacecraft, Morrison said.

The committee's recommendations include the Venus radar mapper spacecraft, included in NASA's Fiscal 1984 budget as a new start, as a high-priority project in the core program.

The committee's support of the Venus radar mapper was a key factor in NASA's decision to include it as a new start in its

Navy Evaluating French Transmitters

Paris—U. S. Navy is considering purchase of French-built infrared transmitter/receiver units for use in alignment of inertial navigation systems on carrier-based aircraft prior to launch.

A Navy decision on trial acquisition and test of Telemir infrared units from France's Societe Anonyme de Telecommunications (SAT) could be made during the first half of the year.

Grumman Aerospace Corp. would team with SAT to handle repackaging of the French company's off-the-shelf equipment for the Navy application. This work would be coordinated through Grumman's Great River Operations in New York state.

The equipment would be used in a Navy test and evaluation program. Successful operation of the Telemir could lead to a Navy purchase of systems for its carrier-based aircraft that are equipped with the service's Carrier Aircraft Inertial Navigation System. These include the McDonnell Douglas F/A-18, Grumman F-14 and Grumman E-6.

Telemir would perform the functions now done by the Navy's electromagnetic inertial navigation alignment systems on board the carriers. The alignment process is carried out to update positioning information in the aircraft's computer before takeoff.

An advantage of Telemir is its ability to limit coverage area to the carrier's immediate vicinity. This makes it difficult for hostile receivers to detect the data transmissions and locate the vessel. Signals from the Navy's current transmitters can be detected over the horizon.

The Telemir receiver is a small device resembling an anticollision light. It contains an optical head that receives the infrared optical carrier from one of several Telemir transmitters positioned on the vessel. The alignment data are transmitted in encoded form over noncoherent directional infrared channels.

Telemir has been operational on French navy aircraft carriers since 1978. The receivers are carried by Dassault-Breguet Super Etendard fighters, which are assigned nuclear and conventional attack duties in the French navy.

Complete coverage of the deck area on French carriers is provided by four Telemir transmitters. U. S. carriers are larger than French vessels, and additional transmitters are expected to be required to provide total deck coverage.

Fiscal 1984 budget, according to Dr. Geoffrey A. Briggs, deputy director, Earth and Planetary Div., NASA headquarters. Briggs also is executive director of the Solar System Exploration Committee.

"The science community, through the Solar System Exploration Committee, has put together the planetary exploration priorities in a very clear way and has made the whole program credible to NASA, whereas a few years ago there was doubt

that the community had thought through its priorities and considered NASA budget constraints," the space agency official said.

The agency has given high priority to developing a series of low-cost planetary missions, utilizing simple modular spacecraft, which will require some technology development toward the end of the decade, he said.

Another issue the space agency will have to consider in the next year is a proposal to take a modified version of the Galileo mission spacecraft and send it to Saturn as an orbiter with a probe, Briggs said.

NASA has come to the conclusion that the agency cannot undertake this program in the near term because the cost would preclude the beginning of other high-priority missions.

There is an opportunity to take care of the Galileo program, and the Solar System Exploration Committee has recommended that NASA maintain such an option.

This would involve acquiring more spare parts for the Galileo orbiter and building another orbiter, but not a probe. The agency is attempting to collaborate with European partners on such a project, whereby they would build the probe, Briggs said.

NASA plans to include such a project in its next budget, he said. □

Test Clears New Shuttle Solid Motor for Use

Washington—Morton Thiokol, Inc., space shuttle high-performance solid rocket motor successfully completed a qualification firing at Wasatch, Utah, Mar. 21, clearing the design for use starting on shuttle Mission 8. An additional 3,000 lb. of shuttle payload can be carried with the increased performance of the motor.

A key aspect of the test was the ability of Morton Thiokol to predict precisely the motor's burn rate prior to the test, an issue in planning individual shuttle ascent trajectories. The company predicted the motor fired Mar. 21 would have a burn rate of 0.368 in./sec., and early test data show the actual burn rate was precisely as predicted.

Greater motor performance was achieved by increasing the length of the nozzle exit cone by 10 in., which in turn increased nozzle diameter by 4 in. Other factors increasing performance were use of additional iron oxide in the propellant compared with standard motors, increasing propellant surface available for burning by removal of inhibitor material and slightly increasing propellant load as a result of thinner case walls used in the lightweight cases for the high-performance motor. Nozzle throat diameter at the nozzle/motor interface also was slightly less than the standard motor.

Total motor impulse achieved was 298.4 million lb.-sec. with a specific impulse of 268 sec. compared with standard shuttle motors that provide 294 million lb.-sec. of total impulse and 265.5 sec. of specific impulse.



Boeing Converts Former Airline 707-320 Transport to Tanker

Former Trans World Airlines Boeing 707-320, converted by Boeing Military Airplane Co., Wichita, Kan., to a tanker, is shown during initial flight tests to evaluate centerline hose and drogue refueling system. It is being fitted with wingtip-mounted hose and drogue pods for three-point refueling. This is a company-funded program to evaluate the

world market for conversion of surplus 707-320 transports to military tanker-transport (AW&ST Dec. 13, 1982, p. 87). This demonstrator, which has been given a red, white and blue paint scheme following initial flights, will be displayed at the Paris air show May 26-June 5 and subsequently will be demonstrated on a sales tour.

NASA/Ames Plans 18-Leg Trip To Fly QSRA to Paris Air Show

Moffett Field, Calif.—An 18-leg, 5,218-naut.-mi. flight by a two-man crew will be necessary to get the National Aeronautics and Space Administration's quiet short-haul research aircraft (QSRA) to the 1983 Paris air show for display.

Officials at NASA's Ames Research Center here, where the four-engine QSRA is based, are seeking a Lockheed C-130 transport that could serve as a companion aircraft—the only obstacle remaining to the research vehicle's Paris appearance.

"We are getting the spares packaged and ready to go," an Ames official said. "We are working at this end as if we are going." In other preparations, the aircraft is being flown through various air show routines, and modifications aimed at improving its cruise performance for the flight to Paris are being tested.

Officials here, who have scoured the nation for an available C-130, said they are 90-95% certain the research aircraft will make it to the show.

They believe its appearance there represents a turnabout in the thinking of NASA headquarters officials that began with the display of the Bell/NASA/Army XV-15 tilt-rotor research aircraft at the Paris show in 1981 (AW&ST June 15, 1981, p. 19).

Prior to that, NASA management believed NASA aircraft are "strictly research aircraft; keep them in our own backyard," an Ames official said. Largely due to the efforts of the late John Cochran, then QSRA program manager, NASA's management changed its thinking for the 1981 show, but decided it could afford to send only one aircraft, and the XV-15 was chosen, he said.

Boeing Will Not Display 757, 767 at Paris

Boeing Co. will not display its new aircraft at the 1983 Paris air show, leaving the European Airbus Industrie consortium's presence unchallenged by any U.S. large commercial air transport manufacturer despite the intense competition in the marketplace (AW&ST Mar. 21, p. 31).

The only Boeing aircraft at the show will be a 707-320C that the Boeing Military Airplane Co. has modified as a demonstrator for a tanker/transport conversion (see photo above) the company is attempting to sell (AW&ST Dec. 13, 1982, p. 87). It will be on static display only.

Boeing's decision against displaying its new 757 and 767 transports will prevent a repeat of the confrontation with the Airbus A310 that took place at the Farnborough air show last fall (AW&ST Sept. 13, 1982, p. 19). At that event, potential customers were given their first opportunity for what amounted to a side-by-side comparison of the A310 and the 767, which were head-to-head competitors in sales contests throughout the world.

Boeing Commercial Airplane Co. officials cited budget pressures for the decision and because each of the new transports have been demonstrated extensively to potential customers on lengthy tours throughout the world.

Boeing Commercial Airplane Co. does not plan even to be represented in the exhibition hall.

However, Boeing Commercial Airplane Co. officials will be present at the corporate chalet, prepared to outline the company's response if Airbus chooses the show as a forum to announce a go-ahead on the A320 150-passenger transport.

McDonnell Douglas has elected not to participate in the show, as has Lockheed, which has withdrawn from the commercial air transport market (AW&ST Oct. 18, 1982, p. 20).

Boeing Aerospace will concentrate on pushing the E-3A airborne warning and control system aircraft, which it is trying to sell to France, and the modular experimental platform for science and applications, a cooperative program with Europe's Ariespace.

In view of the boost the XV-15 has given to the joint services' advanced vertical lift aircraft (JVX) program, NASA management "finds it hard to ignore" that sending the XV-15 to Paris "was the best thing they could have done," he said. This new attitude was demonstrated when NASA headquarters this time initiated the plan to send the QSRA to Paris.

Ames officials had wanted to send the aircraft to the 1979 show, and plans had proceeded to the point where transportation on aircraft carriers had been arranged when NASA headquarters changed its mind, he said. Transportation by carrier also had been explored for the 1983 show, but the scheduling could not be arranged.

The QSRA is a de Havilland of Canada C-8A Buffalo that was modified by Boeing to serve as a NASA research aircraft for demonstration of advanced high-lift technology (AW&ST Sept. 8, 1982, p. 44). It is powered by four shoulder-mounted 7,500-lb.-thrust Lycoming YF102 engines and utilizes the upper surface blowing (USB) concept to achieve high lift.

The flight to Paris, which will roughly follow the Great Circle route, is well within the aircraft's capability, according to Ames' QSRA group leader, Dennis W. Riddle. "The longest stage length is 390 naut. mi., which we can achieve with plenty of reserves," he said.

The QSRA is expected to cruise at 170 kt. TAS and will require a total flight time from Ames to Paris' Le Bourget of 30.8 hr. This might be improved if current flight tests show that no unfavorable characteristics result from temporary removal of the outboard leading edge slat, which is fixed in the down position, Riddle said.

The aircraft, which has accumulated about 400 flight hours, will be flown by Robert C. Innis and James L. Martin.

The route will take it from Moffett Field to Reno, Nev., Boise, Idaho, Great Falls, Mont., and into Canada to Moose Jaw air base. From there, it would proceed to The Pas, Churchill, Rankin Inlet, Coral Harbor, Frobisher and Cape Dyer before leaving Canada for Sondrestrom and Kulusuk Island, Greenland. The next stops are Keflavik and Hornafjordur, Iceland, Vagar in the Faeroe Islands and Glasgow, Scotland. From there it will fly to Mildenhall AFB in the U. K., where it will be prepared for the show, and then flown to Le Bourget.

The longest leg—390 naut. mi.—is Vagar to Glasgow, and the longest overwater segment—385 naut. mi.—is between Kulusuk Island and Keflavik.

The C-130, carrying ground support personnel, spares and equipment, is expected to cruise at 260 kt. It will fly ahead of the QSRA, supplying weather information and landing ahead of the research aircraft to prepare for its arrival and ready it for the next leg.

B-1B Flight Tests Begin at Edwards

Edwards AFB, Calif.—USAF/Rockwell International B-1B flight test program began here last week when the second B-1A prototype, modified with several B-1B design changes, completed a 3-hr. 20-min. test mission.

Among the B-1B features incorporated in the prototype aircraft were a modified flight control system, spoilers near the aircraft's new composite bomb bay doors and fixed-geometry engine air inlets. The flight was devoted to systems functional checks, handling qualities evaluations, vibration and acoustic measurements of the forward bomb bay and a simulated aerial refueling.

Several test points were deleted and the flight was shortened from a planned 4-hr. mission when an engine caution light illuminated early in the mission, indicating possible high vibration levels on the No. 1 engine. As a precaution, the thrust on that engine was reduced to idle and left there for the remainder of the flight. Post-flight investigations determined the cause to be a loose wiring connection on a vibration sensor.

The forward bomb bay doors were opened during the flight to measure vibration levels in the bay. New guillotine-type spoilers forward of the bomb bays are expected to improve the interior acoustic vibration levels at high-subsonic, low-altitude flight conditions.

Aircraft handling qualities following flight control system modifications were checked during "dry" refueling contacts with a USAF/Boeing KC-135 aerial tanker and were found good, according to Lt. Col. Leroy B. Schroeder, B-1B combined test force director and copilot for the initial test flight. The evaluations included 15- and 30-deg. banks while connected to the tanker refueling boom.

T. D. Benefield, senior engineering test pilot for Rockwell International's North American Aircraft Operations, piloted the aircraft, and James A. Leasure, Rockwell flight test engineer, served as the third crewmember.

The aircraft is scheduled to fly its next test flight in about two weeks, to continue handling qualities evaluations.

Primary function of this aircraft will be to perform handling qualities investigations, conduct weapons carriage and separation tests, and examine several airframe flutter points. Weapon tests will include drops of Mk. 82 high-drag conventional bombs, Mk. 86 maritime warfare versions of the Mk. 82, B-61 and B-83 nuclear bombs and the short-range attack missile (SRAM).

Drop tests of these weapons are expected to begin within the next three months.

Target departure date is May 6, but this could slip a day or two. The show is scheduled to run May 26 through June 5.

Although the QSRA is a NASA display, Boeing is assisting, Riddle said. Boeing officials are helping with coordination in Paris, and the QSRA will be parked next to the Boeing 707-320C tanker/transport demonstration aircraft, al-

lowing NASA personnel to utilize Boeing support facilities. In addition, Boeing will pay the QSRA show entry fee.

The QSRA has performed flying routines on only two occasions and never has participated in a major air show. Ames officials are putting together a 6-min. flying demonstration "that has the best visual impact," Riddle said. □

Europeans Form New Satellite Organization

Paris—Europe has agreed on a multinational management organization as the framework for a European weather satellite network, called Eumetsat. It will be responsible for overseeing the space- and ground-based elements of the satellite system during a 12-year program.

Plans are being made for procurement of three new meteorological satellites and one complete set of spares. The spacecraft will be improved versions of the Meteosat satellites built by a European consortium, headed by France's Aerospatiale, and orbited in 1977 and 1981.

The two satellites now in orbit are managed by the European Space Agency under its pre-operational Meteosat program. ESA will perform similar duties for the three new satellites.

Cost of the European weather satellite program is estimated at \$400 million. Launch of the three new Meteosats is planned for May, 1987; August, 1988, and November, 1990, on Ariane launchers.

Agreement on Eumetsat as the framework for a satellite network was reached during an intergovernmental conference held last week. The meeting was attended by delegations of ESA's 11 member states plus Austria, Finland, Greece, Norway, Portugal and Turkey.

Air Force Receives First Lockheed TR-1B

Los Angeles—Initial two-place trainer version of the USAF/Lockheed TR-1 high-altitude battlefield reconnaissance aircraft—designated TR-1B—has been delivered to the Air Force by Lockheed-California Co.

The Air Force plans to purchase a total of 35 TR-1 aircraft, including the two trainers, which will be based with the 9th Strategic Reconnaissance Wing at Beale AFB, Calif. The second trainer is scheduled for delivery in May.

The TR-1 is built on production tooling used for the U-2R, although its primary mission will be providing reconnaissance information to tactical commanders. Two of the aircraft have been deployed to RAF Alconbury, England.

The TR-1 has a second cockpit for an instructor pilot located in an elevated position in a payload section designated the Q-bay, just aft of the standard single-place cockpit. Both versions of the TR-1 aircraft have a Pratt & Whitney J75-P-13B engine, which provides a range in excess of 3,000 mi.

Sensors in the aircraft's interchangeable nose, instrument wing pods and mission bay hatches enable the TR-1 to provide all-weather, day or night surveillance in support of U. S. and allied ground and air forces, according to Air Force officials.

Lockheed is evaluating use of composite materials on some TR-1 parts. Lockheed officials said testing using composite elevators

appears promising, and composite elevator structures could be introduced into the program, possibly 10 aircraft into the production run—with Air Force concurrence and funding for additional tooling. Weight savings through use of composites would be about 25% for each part, according to officials, and the reduced weight would result in added range and altitude capabilities for the aircraft.

Lockheed also is evaluating composite material for use on TR-1 speed brakes, flaps and ailerons.

The trainer aircraft delivered this month is the sixth TR-1 to be built. The first TR-1, delivered to the Air Force in September, 1981, made a total of 2,980 landings and accumulated about 1,186 hr. of operation through February of this year. The 35th TR-1 is scheduled to be delivered to the Air Force in 1989 at the current rate of production.

Average TR-1 unit flyaway cost is about \$17.1 million, according to Air Force officials.

Lockheed also built a single ER-2 Earth resources aircraft, which has the same airframe and engine as the TR-1, for the National Aeronautics and Space Administration. The ER-2 was delivered to NASA's Ames Research Center in June, 1981.

The TR-1 and ER-2 airframe is about 40% larger than the initial U-2 built by Lockheed during the 1950s.

Inert MX in Canister Falls at Pad

Los Angeles—A canister containing an inert MX missile designed to evaluate missile processing systems at Vandenberg AFB, Calif., was dropped at the MX test pad while attached to its launch support stand and hit the ground, according to Air Force officials.

Program officials last week were assessing possible damage to the canister and pathfinder missile, which were moved from the test pad area to the MX missile assembly building at the base. An investigation team was formed to determine the cause of the Mar. 16 incident.

The missile is transported inside its cylindrical canister in a horizontal position to the test pad area, where the base of the

canister is attached to a pivoting launch support stand. The missile and canister, which extend horizontally from the stand without supporting structural members underneath the canister, are raised to a near-vertical position by the pivoting stand in preparation for launch.

The pathfinder missile and its protective canister were being lowered from a near-vertical to horizontal position when a structural failure in the support stand resulted in the canister's falling beyond the horizontal position and striking the ground, according to Air Force officials. No injuries to personnel were reported.

Air Force officials last week said the possible impact on preparations for the

planned MX flight test series at Vandenberg had not been determined. Program officials were attempting to evaluate the extent of possible damage to the missile and canister and determine the cause of the accident.

The launch support stand had been used previously to raise and lower a structure designed to simulate the weight of a missile and canister at the site.

The pathfinder missile was being lowered to a horizontal position on Mar. 16 due to bad weather when the incident occurred.

The pathfinder is equipped with MX electrical interfaces so it can go through various stage processing and prelaunch activities to check ground support systems. The pathfinder process at Vandenberg is considered an important aspect of the missile program because the inert stages are processed through all MX prelaunch activities ranging from receipt of the stages and components at the base to delivery of the integrated missile to the pad.

The checkout process enables program officials to verify handling procedures and systems prior to the processing of a flight vehicle. Technical problems encountered last year during the pathfinder process occurred during integrated testing when missile and ground systems were connected for the first time, officials said (AW&ST Dec. 13, 1982, p. 22).

The Vandenberg test pad and MX launch support stand were intended for use during the initial launches of the planned flight test series, with later test flights being conducted from a launch area representative of the basing mode for the missile system. □

Protesters Arrested at Vandenberg AFB

Los Angeles—Authorities arrested or detained more than 700 protesters at Vandenberg AFB, Calif., through the middle of last week in the second demonstration at the sprawling southern California base during the past two months.

The key thrust of the latest demonstration was at the base's main gate on Mar. 21-22, although six protesters were detained outside a perimeter fence at Vandenberg's MX missile assembly building.

Air Force officials said the six were monitored by helicopters while on the 100,000-acre base until they reached an area in which they could easily be taken into custody. They did not penetrate the perimeter fence of the missile assembly facility, the officials added.

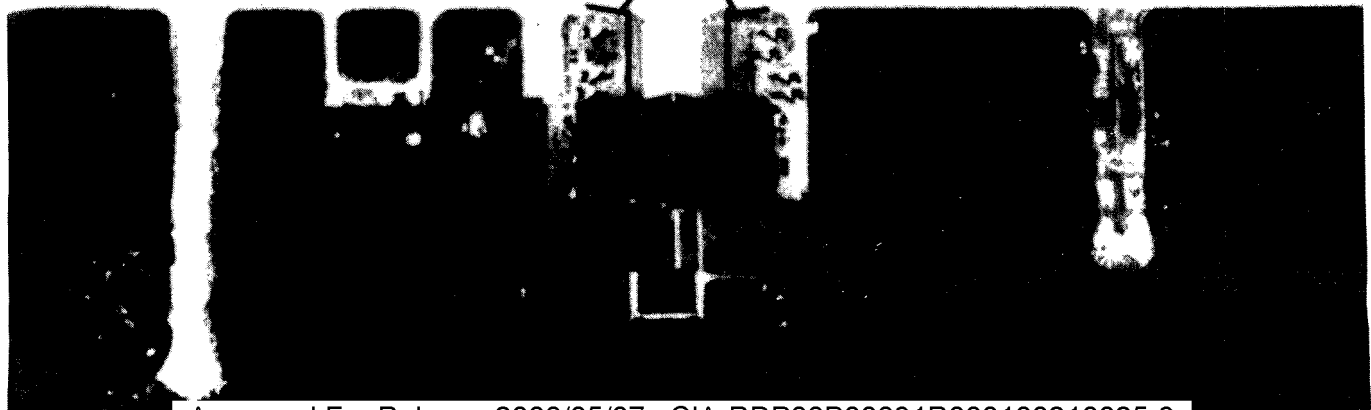
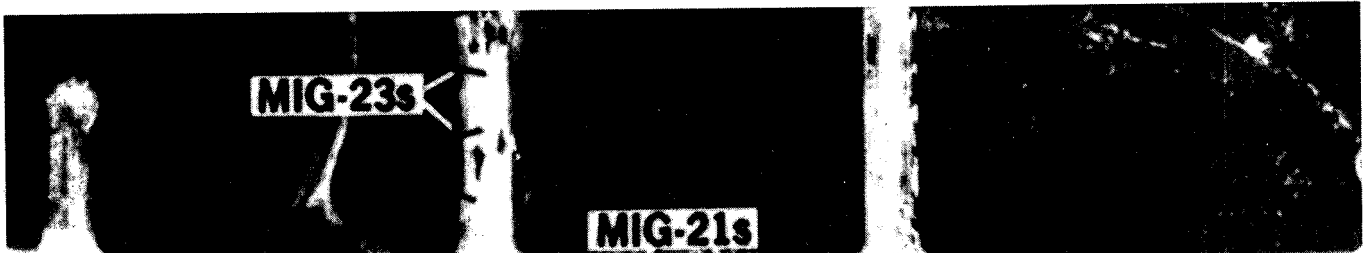
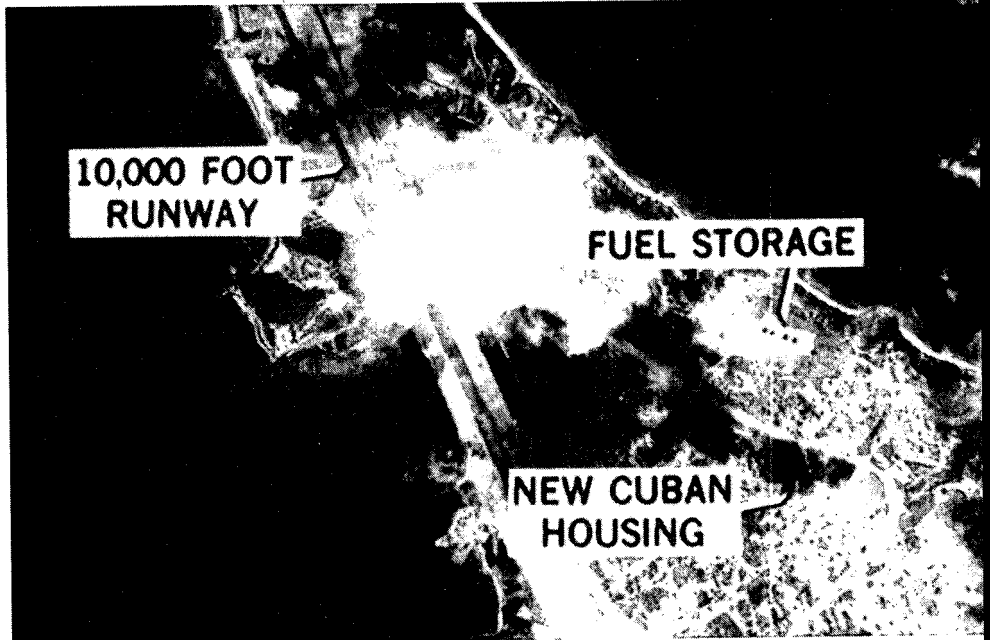
During a similar demonstration at the base Jan. 23-24, more than 200 persons were detained or arrested. A group of 27 protesters penetrated the north portion of the base and moved to within one mile of a Minuteman ICBM test launch facility. Both demonstrations were staged primarily by antinuclear weapons protesters.

Vandenberg, located about 150 mi. northwest of Los Angeles, is the site for the proposed MX intercontinental ballistic missile system flight test series.



Soviets Extending Power in Caribbean

Aerial photographs taken by Lockheed SR-71s and declassified by President Reagan show Soviet military power influence in the Caribbean Basin and Central America. A Soviet intelligence collection facility in Lourdes, Cuba, is manned by 1,500 Soviet technicians and includes a satellite ground station for communications with Moscow (above). Reagan said it has grown 60% in the last decade. A military airport shows MiG-23 aircraft in western Cuba (below). The President said two Soviet antisubmarine aircraft, not identified, began operating from the airport this month. A third photograph (right) shows construction, with Soviet financing and backing, of a 10,000-ft. runway in Grenada. The President also showed photographs of Soviet/Cuban activities in Nicaragua, published last year in AVIATION WEEK & SPACE TECHNOLOGY (Mar. 15, 1982, p. 23). (Wide World)



Shuttle Biological Unit Cleared For Mission After Inspection

Washington—McDonnell Douglas has given its shuttle Mission 6 biological separation unit approval for flight following disassembly and inspection of the system in the orbiter Challenger because of concern that lengthy launch delays may have allowed growth of harmful fungus or bacteria in the device.

McDonnell Douglas technicians will begin electrophoresis-system activation this week to support the Apr. 4, 1:30 p. m. EST Mission 6 liftoff. The technicians will also begin tests of processor fluids important to manufacture of unique medicines in zero-g.

National Aeronautics and Space Administration safety managers also have been assessing the effect of the delay on the batteries used to activate the U. S. Air Force Academy and Japanese Getaway Special payloads on

Mission 6. The delays have reduced battery power in payload initiation units to only 25% of charge, a level expected to be strong enough to turn the payloads on but not necessarily strong enough to turn them off once activated.

The batteries inside the USAF and Japanese Getaway special payloads are considered operational for flight; it is the orbiter batteries that initiate the payloads that are being assessed. The analysis is centering on whether any flight safety problems would arise if the payloads were activated but could not be shut down with the weak batteries.

If launch were to slip beyond Apr. 18, battery power would drop to a point where it is possible activation commands would not be strong enough to start the payloads. Kennedy

Space Center personnel earlier replaced the battery in the Japanese snow-making Getaway special, but the capability of this internal battery would also reach a critical level if launch were delayed into mid-April.

McDonnell Douglas personnel are scheduled to load their large middeck electrophoresis system with the highly distilled water buffer solution about Mar. 31. Electrophoresis unit objectives for Mission 6 are to assess the processing of biological material under higher electrical field strengths, enabling a greater purity in the separated material. This is a critical factor in the manufacture of new medicines in zero-g.

During shuttle Mission 4, the processing unit demonstrated that it could provide 500 times the output volume in zero-g that is possible on Earth.

Use of the new orbiter Challenger for the second flight of the system has allowed a water-cooling loop to be installed around the electrophoresis system, enabling it to reject

Rivalries Intensify For NATO Air Defense Radar Contracts

Addlestone, England—Competition for more than 30 additional long-range air defense radar units for the North Atlantic Treaty Organization over the next six to eight years is under way with four of the competitors having already won one large order each. Twenty radar units have been sold so far.

Plessey Radar's selection as prime contractor for six AR320 air defense radars for the British Ministry of Defense offset the selection of the Hughes radar for the Norwegian air defense sector of the NATO air defense network and earlier selections of General Electric and Marconi radar for other buys (AW&ST Jan. 10, p. 107).

Since portions of the competition have involved the four companies that won an order each as well as Thomson-CSF of France, the next segment—the so-called southern tier of Italy, Greece and Turkey—may be the most highly contested. Up to seven radar units are to be purchased, and the winner may gain an advantage in future NATO competitions by virtue of a large production base.

Request for proposals for the southern tier radars is expected to be issued by midsummer, which should permit the final contract to be awarded in early 1984.

Beyond that competition is one for air defense radars in Portugal and possibly for additional radar units in Germany and Norway. Recent NATO air defense radar competitions have had these results:

- General Electric was selected to provide two S-band radars for Britain under NATO auspices.

- Marconi was chosen to provide six Martello radar units for Britain, of which three were selected under the NATO infrastructure competition rules and three more were purchased by Britain directly.

- Hughes was winner in the NATO competition for three air defense radars for Norway. Additional units are required, and there may be a follow-on competition at a later date.

- Hughes also was selected to provide four radar units for West Germany. This was a national buy, not one conducted under NATO auspices. There may be a

NATO competition for Germany at a later time.

- Plessey Radar and ITT Gilfillan's joint AR320 radar was selected in a NATO competition for Britain. NATO funded purchase of three and the British Defense Ministry purchased three more for a total of six.

The forthcoming southern tier competition will give the winner a significant edge in pursuing further segments of the NATO air defense reequipment program. Estimates indicate that 30-40 new long-range air defense radars are likely to be purchased by NATO and member nations between now and the early 1990s.

There also are sales possibilities outside the alliance. In Europe, likely purchasers are seen as Sweden and Switzerland, both

House Panel Given Defense Plan For Funding Research

Washington—An alternative to a House committee plan to control more closely defense contractors' expenses for independent research and development, bid and proposal, has been offered to Congress by Richard D. DeLauer, under secretary of Defense for research and engineering.

Early reactions from members of the House Appropriations defense subcommittee show the alternative may be an acceptable substitute to the subcommittee's plan announced last year to force these expenses to appear in the Defense budget as a separate line item beginning in Fiscal 1985.

The expenses cover independent research, directed as a company sees fit, and the cost of preparing bids and proposals to the gov-

ernment. If they were to appear as a line item, Hughes Aircraft Co. Chief Executive Allen E. Puckett warned the subcommittee last week, the word independent would disappear from the term. Companies would lose control of which research to perform.

Puckett appeared on behalf of members of the Aerospace Industries Assn., the Electronic Industries Assn., the National Security Industrial Assn. and the American Electronics Assn.

The defense subcommittee said last year there is no visibility and accountability of independent research and development, bid and proposal. The total cost is unknown. It is an expense that can be charged against government contracts that the Defense Contract Audit Agency is not allowed to audit. "I see it

more heat and operate at higher power levels, officials said.

On Mission 4 the highest power level possible was 10 v./cm., but on Challenger the rate will be 25 v./cm., a level expected to be used once commercial biological processing is begun.

The high power level should create a more precise separation of the biological materials fed into the buffer liquid. Six sample trays will be processed.

McDonnell Douglas will process three trays of proprietary biological material that are candidates for use as medicines once commercial space processing begins. The company also will process an albumin protein sample as a standard against which the commercial materials will be compared.

Two NASA Marshall Space Flight Center hemoglobin samples also will be processed to provide NASA data on the continuous-flow electrophoresis process under its joint venture agreement with McDonnell Douglas.

of which have extensive, advanced air defense systems, and possibly Austria. The Austrians do not have a major air defense capability but are believed to need a degraded system for neutrality enforcement in the late 1980s and early 1990s.

Yugoslavia also is a possible customer, but political considerations may prevent the country from obtaining a Western military unit. In the most recent NATO competition, the radar selected was based on both British and U. S. technology.

The AR320 radar combines the receiver, signal processing equipment, software, displays, communications and simulator from the Plessey Radar AR-3D with the planar array antenna and high-power, wide-band transmitter of the ITT Gilfillan Series 320 radar. □

as the most important issue currently before us," DeLauer told the subcommittee, chaired by Rep. Joseph P. Addabbo (D.-N. Y.).

"It is not appropriate for IR&D, where industry pursues those areas which they deem most important for their competitive position in future markets. Nor is it suitable for B&P, which is a cost incurred by contractors when competing for Defense Dept. work," DeLauer said.

The subcommittee directed last year that not more than \$2.1 billion of the Fiscal 1983 Defense budget authority be obligated or spent to pay independent research and development and bid and proposal costs. DeLauer said that requirement by the subcommittee is not relevant to the way the Defense Dept. does business.

"In order to more directly address the concerns of the committee and what I believe to be your intent relative to advance visibility and control of IR&D and B&P costs," he said,

News Digest

General Electric Co. Aircraft Engine Business Group has delivered to the Army the first production T700-GE-701 turboshaft engine for the AH-64A Apache attack helicopter. The uprated version of the T700 develops 10% more power than the T700-GE-700 used in the Army/Sikorsky UH-60A Blackhawk utility helicopter.

Racal Recorders, Ltd., Southampton, England, will deliver \$3 million worth of multichannel recorders to the British Royal Air Force. The equipment will be used to log ground/air communications.

British Defense Ministry has ordered four British Aerospace 125 Series 700 aircraft for government communications flights. The aircraft will be based at Royal Air Force Northolt. Contract includes retrofit of six earlier Rolls-Royce Viper-powered 125s with Garrett TFE731-3 turboprops.

Air Florida will introduce a twice-weekly service between Miami and Madrid, Zurich and Frankfurt on May 4, and on May 6, a weekly flight between Miami and Dusseldorf. Routes will be operated by McDonnell Douglas DC-10 aircraft, and on the London-Frankfurt sector by British Aerospace BAC 111s operated by British Island Airways.

Flight testing of the Pratt & Whitney PW2037 engine on the No. 1 Boeing 747 passed the halfway point last week with 25 hr. of a planned 39-hr. program and five of eight flights completed by Mar. 23 (AW&ST Jan. 17, p. 29). Testing of the powerplant, which is scheduled to power some Boeing 757 transports starting in October, 1984, was being conducted on

Collier Trophy

Washington—T. A. Wilson, chairman of the Boeing Co., has been awarded the National Aeronautic Assn. Collier Trophy.

The award, to be presented at a May 14 dinner at the Sheraton Washington Hotel, cites Wilson "for private development of the Boeing 757 and Boeing 767 advanced technology jet transports, with the support of the Federal Aviation Administration, industry and the airlines."

The Collier Trophy is awarded annually for the greatest achievement in aeronautics or astronautics in America, demonstrated by actual use in the previous year.

the Boeing-owned 747 out of Seattle's Boeing Field.

Modified Soviet planetary spacecraft carrying a mixed Soviet-French ultraviolet spectroscopy payload was launched from the Soviet Union on Mar. 23. The Astron spacecraft was placed into an orbit of 200,000 × 2,000 km. (124,200 × 1,242 mi.) inclined 51.5 deg. Astron is a Soviet Venera-class satellite that is modified for use in Earth orbital missions. Venera-class spacecraft previously have been used for Soviet missions to Venus. The payload carried by the Astron includes a Soviet telescope and French spectrometer (AW&ST Aug. 9, 1982, p. 58). Observations with the spacecraft are expected to be conducted during a period of eight months to one year.

Gates Learjet plans to raise the price of its Series 30 and 50 corporate aircraft by as much as 19% Oct. 1 due to increased cost of vendor-supplied components, including engines, and escalating labor costs. Series 25D prices will not rise. □

"I have established total ceiling amounts for the services for our 1983 advance agreements. Based on what I consider to be reasonable assumptions regarding the economy and the commercial business mix, these ceilings will result in less than \$2.1 billion allocated to DOD contracts.

"In order to give proper consideration to our inability to control economic factors which influence the annual Defense Dept. allocation of IR&D and B&P, I request that the Fiscal 1984 Appropriations Act provide some degree of flexibility with regard to the 1983 ceiling. I do not make this request in order to get relief from my responsibility to strictly manage and control IR&D and B&P costs, but simply to recognize the uncertainties inherent in the economy."

It will be several weeks before the subcommittee takes action on DeLauer's proposal.

Ultimately Congress must regard these costs as a legitimate part of doing business,

rather than an item that is purchased, DeLauer told the subcommittee. He listed several advances that have resulted from such outlays:

- Aircraft engine improvements. It is expected that by 1990 the thrust-to-weight ratio will increase from 8:1 to 10:1 and that specific fuel consumption will decrease another 10%.
- Submarine navigation system.
- Portable secure military communications.
- Manned multiple aircraft air-combat simulator, which will allow 12 pilots to fly simultaneously in simulated air combat.
- Lasers, including the world's first ruby laser.
- Advanced composites.
- Factory of the future, utilizing new technology that will help in production of cheap composite structures for current and future aircraft.

Air Transport

Carrier Traffic Continues Climb

February results show gains of 13% for majors and 30% or more for three regionals in spite of storm problems

Washington—U. S. airline traffic continued its rebound through February, rising 13% over the same month a year ago for 11 majors and 30% or higher for at least three regional carriers.

The increase came in spite of last month's storms that canceled flights for several days along the East Coast (AW&ST Feb. 21, p. 26).

Capacity for the 11 majors rose 4% over a year ago, and load factor climbed from an average of 56% last year to 60%.

Traffic for the month rose under the stimulus of discount fares and various promotions, which reduced the average revenue per passenger mile from last year's levels, according to airline officials.

North Atlantic operations by Trans World Airlines and Pan American World Airways were affected by the weather cancellations and lower demand.

Trans World reduced capacity in inter-

national services by 7.6% and revenue passenger miles dropped by 0.6%. Pan American's capacity in the Atlantic was down 13.7% and revenue passenger miles were down 15.8%.

In U. S. domestic markets, Pan American's scheduled revenue passenger miles increased 5%, capacity was down 6.9% and load factor was up to 62.8%.

In other international services, Pan American recorded a 13.5% increase in Latin American traffic and a 5.3% increase in Pacific traffic.

Highest load factor among majors reporting was recorded by American Airlines. American had a 67.8% system-wide load factor, 68.3% in domestic services.

Western Airlines recorded a 24% growth in revenue passenger miles, followed by Delta Air Lines with 20%, American at 18.8%, Trans World at 17.4%, Republic at 16%, Northwest at 14.9%, USAir at 13.8% and United at 11.4%.

Trans World said its traffic was stimulated by its Kids Fly Free promotion, plus the \$99 discount fares still available in certain markets.

Eastern Airlines' traffic rose 8.7%. "There is some obvious stirring in the national economy, which is generating air traffic," Russell L. Ray Jr., senior vice president-marketing, said.

Eastern's operations were disrupted severely by the mid-February snows.

Nationals and regionals recording high rates of traffic growth for February:

Southwest Airlines, up 37.1% in revenue passenger miles; Piedmont Airlines, up 32%; Midway Airlines, up 30%, and Frontier Airlines, up 23.1%.

Muse Air Corp.'s 32.5 million revenue passenger miles were up 275% over a year ago.

People Express' 197.1 million revenue passenger miles were up 114%.

Individual carrier reports of primarily scheduled service include:

- **American**—2.554 billion revenue passenger miles, up 18.8%; 3.768 billion available seat miles, up 3.7%; a 67.8% load factor, up from 59.2%.

- **Continental**—830.4 million revenue passenger miles, up 5%; 1.38 billion available seat miles, down 2.2%; a 60% load factor, up from 55.8%.

- **Delta**—2.218 billion revenue passenger miles, up 20%; 3.662 billion available seat miles, up 4.1%; a 61% load factor, up from 53%.

- **Eastern**—2.22 billion revenue passenger miles, up 8.7%; 3.58 billion available seat miles, up 4%; a 62% load factor, up from 59.3%.

- **Northwest**—1.064 billion revenue passenger miles, up 14.9%; 2.031 billion available seat miles, up 15.9%; a 52.4% load factor, down from 52.9%.

- **Pan American**—1.904 billion system revenue passenger miles, up 0.2%; 3.351 billion system available seat miles, down 2.4%; a 55.9% load factor, up from 54.7%.

- **Republic**—779.4 million revenue passenger miles, up 16%; 1.358 billion available seat miles, up 5.8%; a 57% load factor, up from 52%.

- **Trans World**—1.623 billion revenue miles, up 17.4%; 2.608 billion available seat miles, down 3.1%; a 62.2% load factor, up from 51.3%.

- **USAir**—465.3 million revenue passenger miles, up 13.8%; 860 million available seat miles, up 9.3%; a 54.1% load factor, up from 52%.

- **United**—2.9 billion revenue passenger miles, up 11.4%; 4.74 billion available seat miles, up 2.3%; a 61.9% load factor, up from 57.6%.

- **Western**—752 million revenue passenger miles, up 24%; 1.27 billion available seat miles, up 33%; a 58.9% load factor, down from 63%.

- **Southwest**—254.6 million revenue passenger miles, up 37.1%; 443 million available seat miles, up 30.9%; a 57.4%

Eastern Strike Averted

Washington—A strike against Eastern Airlines was averted Mar. 24 after the carrier offered a three-year contract with a 21% pay increase this year to District Lodge 100, International Assn. of Machinists and Aerospace Workers.

Dwain C. Andrews, Eastern's vice president for labor relations, said the contract represented "a compromise" by the airline and the union. But carrier officials said Eastern made no substantial gains in work rules.

"We are completely satisfied," Charles Bryan, District Lodge 100 president, said. "The contract contains all the elements of positive labor relations." Bryan said he would recommend highly the ratification of the contract, which may take place Apr. 7 or 8.

Airline and union leaders praised the work of Robert Harris, chairman of the National Mediation Board, who directed the mediation effort last week after the union rejected by a 72.4% margin an Eastern proposal for a three-year contract calling for 32.2% in pay raises and an improved pension and medical and dental plans (AW&ST Mar. 21, p. 29).

Eastern said the three-year contract offered the same 32% pay increase except that the majority of the increase would go into effect this year, including retroactive pay to Jan. 1, 1983. The contract would expire Dec. 31, 1984.

TWA Employee Suit

A Trans World Airlines employee since 1947 has filed a class action suit against the airline, charging that she was denied an opportunity to compete for the position of director of customer services programs and was not selected because of her sex or her age.

The suit, filed in U. S. District Court, Southern District of New York, asked for \$1 million in damages for Rosemary T. Aurichio, 56, manager of customer relations at the airline. She charged the airline management created the new position and named Bahir Browsh to the post on Jan. 9, 1981, without announcing the job's availability according to carrier rules of employment.

The Equal Employment Opportunity Commission, New York City, gave notice to the plaintiff of her right to sue but has taken no other action in the case she brought to the commission.

Air Florida Continues Debt Restructuring

Washington—Air Florida is continuing to restructure its existing debt arrangements and to tailor equipment to its route structure by cutting back on the number of aircraft it operates, according to Donald Lloyd-Jones, president and chief executive officer.

Lloyd-Jones said the airline is attempting to dispose of its more expensive leased aircraft and replace them with lower cost aircraft to trim operating expenses.

He added that the carrier also is conducting debt talks with InterFirst Bank Dallas, N. A., Air Florida's principal bank lender and the holder of the security interest in most of Air Florida's assets.

Proposals under discussion include deferrals of payments of interest and principal and the release by InterFirst of a second lien on four Boeing 737-200 aircraft owned by the airline.

Air Florida is discussing a proposal to sell or lease the four aircraft with other airlines, together with sale of a large number of authorized but unissued Air Florida shares for cash, Lloyd-Jones said.

The sold aircraft would continue to be secured by the Federal Aviation Administration and holders of certain FAA-guaranteed indebtedness.

The Air Florida official said the guaranteed indebtedness would in effect be assumed by any new user of the aircraft, although Air Florida would remain secondarily liable.

The proposed deal requires the consent of the Federal Aviation Administration as well as the holders of the guaranteed indebtedness.

Air Florida has returned to InterFirst a 737-200 that the bank originally leased to the airline. The termination agreement calls for about \$3.3 million to be added to Air Florida's debt to InterFirst, ending Air Florida's obligations under the financing lease.

Air Florida also has returned a second 737-200 to another lessor, terminating the lease, although the airline will be required to make payments on rental arrears.

The airline will realize a gain on disposal of approximately \$1.1 million in the first quarter of 1983 as a result of the termination of the capital lease.

A third 737-200 was returned to its lessor recently, following Air Florida's default on a semiannual rent payment in January. The airline estimates a gain on disposal of about \$900,000 in the first quarter of 1983 as a result of the return of the aircraft and termination of the lease.

Lloyd-Jones said Air Florida expects to replace the 737 aircraft with less expensive aircraft, including other 737-200s.

A McDonnell Douglas DC-10-30, which was used on the airline's Miami-London route, was returned to its lessor with Air Florida agreeing to pay a negotiated termination penalty. The lessor has, in turn, agreed to pay for maintenance reserves and other credits to others who owed maintenance charges for the aircraft, Lloyd-Jones said.

The DC-10-30 has been substituted with a Boeing 707 on the Miami-London route.

Air Florida plans to return to using a DC-10-30 this month on the route under an operating lease arrangement.

load factor, up from a level of 54.88%.

- **Muse Air Corp.**—32.5 million revenue passenger miles, up 275%; 88.32 million available seat miles, up 273%; a 36.8% load factor, up from 36.6%.

- **Frontier**—307.3 million revenue passenger miles, up 23.1%; 467.7 million available seat miles, up 5.5%; a 65.7% load factor; up from 56.3%.

- **Midway**—44.6 million revenue passenger miles, up 30%; 105.8 million available seat miles, up 44.1%; a 42.2% load factor, down from 46.8%.

- **Piedmont**—309.7 million revenue passenger miles, up 32.3%; 632.4 million available seat miles, up 34.9%; a 48.97% load factor, down from 49.94%.

- **People Express**—197.1 million revenue passenger miles, up 104.8%; 257.5 million available seat miles, up 56%; a 76.5% load factor, up from 56%.

- **Air Florida**—110.8 million revenue passenger miles, down 43%; 177 million available seat miles, down 47%; a 62.6% load factor, up from 57.9%.

- **New York Air**—39 million revenue passenger miles, down 23%; 72.4 million available seat miles, down 31.3%; a 53.9% load factor, up from 51.2%.

- **Jet America**—35 million revenue passenger miles, up 87%; 63.1 million available seat miles, up 66%; a 55.4% load factor, up from 49.4%.

- **Scheduled Skyways**—3.3 million revenue passenger miles, up from a level of 10.1%; 7.43 million available seat miles, up 9.5%. □

Swissair Planning to Maintain Two-Class Passenger Service

Swissair has decided to maintain its existing two-class passenger service structure but will adopt a new policy to improve the treatment of its full-fare paying passengers.

The decision was made after Swissair reevaluated its current first-class/economy service structure against the three-class arrangements offered by some competing

airlines. Its decision to retain a two-class service structure reflects Swissair's belief that three-class systems generally do not provide tailored responses to fluctuating demands in individual tariff categories.

The new policy for improved handling of full-fare passengers will begin this summer.

Preferential check-in facilities for these passengers will be included at the first-class counters of airports at most of Swissair's destinations.

Full-fare travelers will receive special boarding cards that enable them to to board the aircraft ahead of other passengers.

They also will receive a certain degree of preferential treatment once on board the aircraft, according to Swissair.

Swissair recorded a net profit of \$19.2 million in 1982, of which \$16.5 million came from the sale of aircraft and spares.

The Swiss flag carrier's results last year enabled it to pay a dividend of \$12.50 per share.

Swissair is projecting marginal improvements in its operating results for 1983. The year's traffic may be higher than initial expectations, however.

The 1982 net profit of \$19.2 million is down from a net of \$27.15 million the year before. □

Continental Stock Offering

Los Angeles—Continental Airlines has requested authorization from the Securities and Exchange Commission to issue an initial public stock offering of two million units.

An estimated \$40 million in equity capital generated by the sale of the units would be used for "general corporate purposes," according to Continental.

The units will be offered for sale at \$20 each. Each unit will include one share of common and one share of convertible preferred stock.

The airline's 20 million common shares are now held by Texas Air Corp., which bought Continental in 1982 (AW&ST Nov. 15, 1982 p. 34). After the public offering, Texas Air Corp. will hold about a 91% interest in Continental.

More Carriers Adopt Mileage-Based Fares

Washington—More U.S. major airlines and a regional carrier, Frontier Airlines, joined other majors last week in returning to a pre-deregulation, mileage-based system to set airline coach fares effective Apr. 2.

Eastern Airlines' mileage-based plan will reduce fares in about half its markets (AW&ST Mar. 21, p. 29). Its Air-Shuttle fares will remain at the same levels, and special discounts to Florida will remain. One-way Super Coach fares will be offered at 75% of the economy level.

USAir was preparing a mileage-based cost taper that it said will eliminate some anomalies in the mileage-based plan first offered by American Airlines, a carrier official said.

Under American's plan, a 249-mi. flight, based on 53 cents/mi., would cost \$131.97, while a 251-mi. flight, based on 34 cents/mi., would cost \$85.34, a differential that USAir pricing officials wanted to address.

American's fare plan, however, will not change, according to that carrier.

Northwest Airlines said it was adopting a fare simplification program that would reduce fares to four basic types, first-class, coach, Super Coach and Super Saver, effective Apr. 15, which was one step in the American fare plan.

Frontier's matching of a simplified fare system and a pricing-by-distance system was a significant step, airline officials said, because competition between majors and regionals is expected to be more keen this year.

Frontier's plan will go into effect Apr. 15 with three basic fare

levels, coach, an unrestricted discount and a restricted discount. Coach rates will be priced in 10 mileage brackets, starting at 34 cents/mi. for flights of 251-500 mi. and decreasing to 15 cents/mi. for flights more than 2,500 mi., similar to American's plan.

The carrier's discount plans, both of which will be capacity controlled, are:

- A new unrestricted discount offering savings of 25% off coach rates in all markets.

- A restricted Super Saver replacing Frontier's current Super Saver on Apr. 2, cutting coach rates by 30-57% depending on distance.

As in many other deep discounts offered by carriers in their new plans, restrictions are stronger and include purchase of round-trip tickets at least seven days before departure and return flights beginning 7-14 days after arrival at the destination.

Military and children's fare discounts will remain, as they are planned to remain in other carriers' fare programs.

Delta Air Lines will apply the mileage formula systemwide except in a small part of its system, estimated to be less than 25%, where special discounts will remain in effect because of competing low fare levels, a Delta official said.

Delta's first-class fares will continue to be 120% of coach fares.

Piedmont Airlines officials said they continue to study American's mileage-based fare plans, but no changes were expected in the immediate future. Piedmont's fares already have been simplified, an official said.

People Express Agrees to Buy Braniff 727s, Lease 747-200

Newark—People Express last week reached an agreement with Braniff Airways to acquire 20 Boeing 727-200 aircraft and lease one Boeing 747-200, which would almost double the fleet size of the low-fare, high-frequency airline.

The Newark International Airport-based airline also recently signed a letter of intent with McDonnell Douglas Corp. to purchase eight used 727-200s and has an option on an additional nine 727-200s to meet its future aircraft needs. The agreement with McDonnell Douglas can be terminated without penalty before Mar. 29 (AW&ST Mar. 7, p. 29).

People Express officials said the airline is studying both aircraft-acquisition deals and is not precluding one over the other. The final decision on which agreement to put into effect will depend on several factors, including the status of the Braniff aircraft as part of the airline's bankruptcy proceedings.

The new entrant, which started operations in 1981, has a fleet of 21 Boeing 737-100s and 737-200s and is scheduled to take delivery of an additional 737-200 in May.

The officials said the sales agreement between Braniff and People Express calls for a purchase price of \$4 million for each 727-200.

The agreement for both the sale of the 727-200s and the lease of the 747-200 is subject to the approval of the bankruptcy court having jurisdiction over Braniff, government approval of the application of People Express to provide nonstop Newark-London service which was granted last week and other conditions.

The agreement calls for Braniff to deliver the 727-200s to People Express between November, 1983, and March, 1985, with the airline having the right to accelerate delivery of six of the aircraft for the summer of 1983.

The 747-200 aircraft lease is for a peri-

od of five years expiring September, 1988, and gives People Express the right to terminate the lease at the end of one year.

People Express agreed to pay a lease rate of \$50,000 a month from delivery through September, 1983, and \$250,000 monthly for the balance of the lease term for the 747.

The airline also agreed to purchase from Braniff a Boeing 727-200 simulator, certain ground equipment, technical assistance and flight training in connection with the start-up of 727 and 747 operations.

The airline originally signed a letter of intent with McDonnell Douglas for the purchase of eight 727-200s that McDonnell Douglas is acquiring from Alitalia Airlines with an option on nine additional 727-200s, contingent on the aircraft manufacturer purchasing them from Alitalia.

Braniff chairman Howard D. Putnam said the agreement calls for Braniff to provide certain continuing maintenance services for the 727 aircraft to People Express at Braniff's Love Field maintenance facility.

"We are extremely pleased with the completion of this transaction with People Express," the chairman of the bankrupt airline said. "The sale of the aircraft, when combined with the continuing maintenance and training services, provides a significant step in the resolution of Braniff's bankruptcy and the development of continuing businesses for our reorganization." □

Midway DC-9 Lease

Midway Airlines has signed an agreement with McDonnell Douglas Corp. to lease two DC-9-80s for 13.5 years with options to buy and including spare parts and one spare Pratt & Whitney JT8D engine.

When the aircraft are delivered in the third quarter of this year, Midway will sell three DC-9-31s to the manufacturer. The lease and the sale of aircraft will keep Midway's capacity at the same level.

Midway's fleet includes nine DC-9-15s and eight DC-9-31s, including the three to be sold.

Airline Antitrust Actions Increase at Justice Dept.

By James Ott

Washington—Antitrust activities of the Justice Dept., including investigations and cases involving airlines, have increased in the last year and reflect a more rapid flow of information on antitrust matters reaching the department, Elliott M. Seiden, chief, transportation section, Antitrust Div., said last week.

Investigations and cases are started "when information comes to our attention" and have resulted in an observable increase in activity, Seiden said, but do not represent a change of policy or a new direction in antitrust prosecution at the agency.

Antitrust priorities continue to be investigation and prosecution of cases involving price-fixing and agreements among companies to divide up the marketplace. Such activities restrict the market from operating freely and cause consumer harm, he said.

The priorities have been emphasized in recent actions, including:

- Justice Dept. civil case against American Airlines and its president and chief executive, Robert L. Crandall, who is charged with attempting to persuade Howard Putnam, president and chief executive officer, Braniff International Airways, to engage in illegal monopoly practices and a joint 20% increase in fares on competitive routes (AW&ST Feb. 28, p. 32).

- A Justice Dept. review of allegations by Braniff, which had filed for reorganization under the bankruptcy act, that American had engaged in "dirty tricks" by manipulating Braniff's schedules in American's Sabre computerized reservations system. This agency review follows a grand jury investigation into the charges at Ft. Worth, which ended with no indictments.

- An agency investigation into pricing practices in the transatlantic market, growing out of a suit filed by Laker Airways (AW&ST Dec. 13, 1982, p. 51), which has dissolved in bankruptcy. U. S. and foreign carriers believe a grand jury will be impaneled shortly in that investigation.

- A grand jury investigation in Atlanta into an aspect of courier service. Airlines, however, are secondary in that investigation, which has been under way for more than a year.

- An investigation, initiated by Congress, into airline computerized reservations systems, a joint effort under way by the Civil Aeronautics Board and the Justice Dept.

Airline lawyers said the Justice Dept. may be stretching the interpretation of Section 2 of the Sherman Antitrust Act in its case against American Airlines. Even if the carrier's alleged attempt is proved, prices in that market were not fixed and would not constitute a violation, the lawyers said.

The Justice Dept. has said cases under Section 2 are rare because of the reluctance of parties, who may be involved in an attempt to establish a monopoly, to disclose that attempt to the government.

James A. Calderwood, an antitrust attorney with Grove, Jaskiewicz, Gilliam and Cobert of Washington, D. C., said, however, that the Justice Dept. case against American should be of concern because the issue could go beyond price-fixing if there is "any attempt to exclude from the market by manipulation of the reservations system."

Investigation into computerized reservations systems is interesting from a legal standpoint, Calderwood said, because in "no other situation are there opportunities for one or two companies in an industry to control something that's so vital to others in that industry."

Calderwood said if the Justice Dept. would file and win a case against airlines,

establishing prima facie evidence and proving illegal manipulation of reservations systems, other airlines would have a comparatively easy case to prove and many private civil cases could be expected.

Private civil antitrust cases have been increasing since the advent of deregulation of airlines and other transportation modes in the U. S., Calderwood said. He estimated that 2,000 antitrust cases are on file in U. S. courts, 100 of them by the Justice Dept.

Since deregulation, the Civil Aeronautics Board and the Interstate Commerce Commission no longer serve as arbiters of antitrust problems between carriers. "Companies facing antitrust problems are going to the antitrust laws, which are broadly written," Calderwood said.

The precepts that have been established in the body of common antitrust law, developed from thousands of case decisions since the 1890 Sherman act, are being applied to transportation cases, he said.

Loss of an antitrust suit can be severe, as much as three times actual damages and a jail sentence. The heavy consequence of loss is the primary reason for nolo contendere pleas in which a defendant does not plead guilty but subjects himself or his company to conviction.

In these cases, damages at three times the actual damages can be avoided.

Calderwood said airlines and other transportation companies should be wary of the rules of reason provision, one of the broadly written provisions in antitrust law. If a certain practice can be shown to be unreasonably uncompetitive, airlines

Pan Am Signs Contracts With Five Unions

Washington—Pan American World Airways has signed labor contracts with five of its largest unions, extending a wage package agreement negotiated in the fall of 1981 and the spring of 1982.

The latest agreement was accepted recently by the Flight Engineers International Assn., representing 859 flight engineers at Pan American.

Other unions that have ratified the new wage contracts are the Air Line Pilots Assn., the Air Transport Div. of the Transport Workers Union, the International Brotherhood of Teamsters and the Independent Union of Flight Attendants.

The contracts cover the period Jan. 1, 1983, to Dec. 31, 1984, and extend wage reduction agreements negotiated when the last contract expired. The agreements call for restoration of 5% of 10% reduction taken from employees in previous contracts and insures that an additional 5% will be restored in 1984.

The agreement includes a provision that the various union members will receive additional pay increases calculated on airline profits.

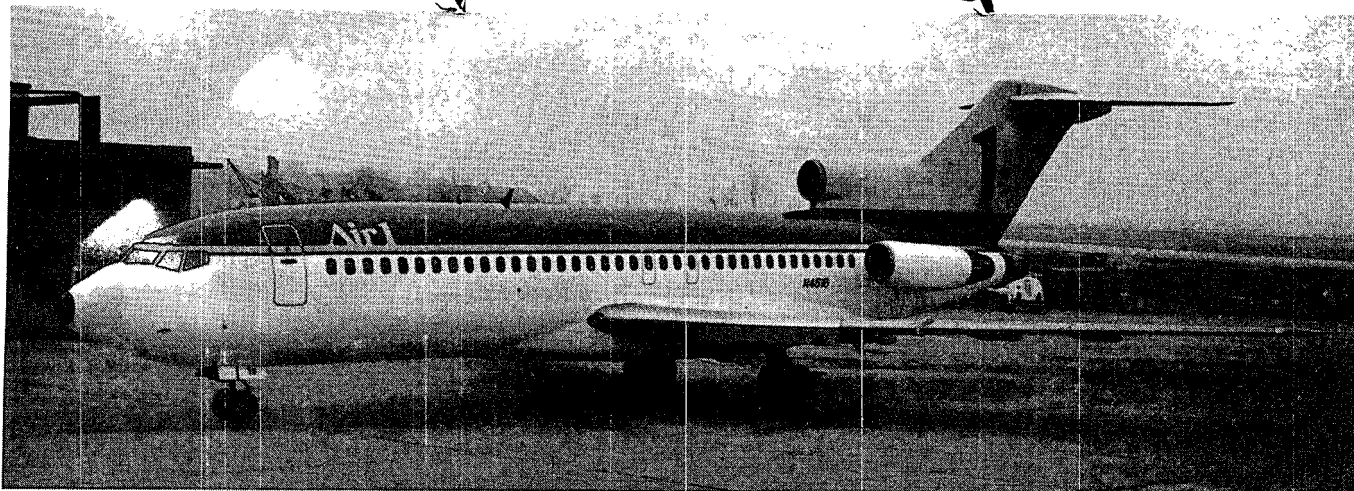
USAir flight attendants, represented by the Assn. of Flight Attendants, AFL-CIO, also recently reached agreement with the airline. The new 17-month contract will run from Apr. 1, 1983, through Aug. 31, 1984.

The Assn. of Flight Attendants said the contract raises wages of the 1,680 flight attendants to "among the highest in the industry."

The contract calls for wage increases of 9.27% spread out over 17 months.

AFA President Linda A. Puchala said eight other carriers will conduct negotiations with its AFA flight attendants this year. "AFA-USAir negotiations are proof that agreements can be reached in direct bargaining without elongated mediation and the confrontation of a cooling off period."

AFA represents about 21,000 flight attendants on 14 carriers.



New St. Louis-Based Airline Will Begin Service Apr. 1

Boeing 727-100 of Air 1, the new St. Louis-based airline, is shown. The airline will start scheduled operations Apr. 1 using aircraft fitted with 80 seats. The carrier will provide first-class service at coach fares (AW&ST Mar. 21, p. 34).

engaging in that practice could be prosecuted successfully, he added.

James E. Landry, senior vice president and general counsel with the Air Transport Assn., said greater antitrust activity was anticipated as airlines are more exposed to antitrust law under deregulation.

The Airline Deregulation Act provides for CAB powers to grant immunity to parties of an agreement, he noted, and those powers would transfer to the Justice Dept. after the CAB closes under the law.

Landry said the ATA, congressional aviation subcommittees, the CAB and the Transportation Dept. have supported a change in the law to transfer that power to the Transportation Dept.

Landry said much has been written on the roles of associations in matters that could involve antitrust. "But it is the general perception and consensus that a trade association is a meeting ground for competitors and therefore there is antitrust sensitivity," he added.

ATA lawyers spend "a fair amount of time monitoring activities to stay out of troubled waters," he added.

Airline lawyers generally are concerned with two categories of antitrust law, one dealing with agreements among carriers, the other with capacity and price agreements.

He said airlines have been particularly careful to avoid capacity and price agreements even before airline deregulation. The CAB, he said, never has conferred antitrust immunity on a rate or capacity agreement in the U.S.

If there is a question about an agreement covering other aspects of airline operations, airlines are still free to seek immunity from the Board, he added.

The Board denied antitrust immunity to a proposal by the association to permit initial discussions on a spare parts inventory (AW&ST Feb. 21, p. 32). Landry, how-

ever, has interpreted the Board's comments to mean that it required a more detailed explanation for the proposal.

Landry anticipates that airlines will seek immunity for the talks because they consider a parts inventory to be an efficient and effective solution to rising costs of aircraft parts.

A larger, more complex question, Landry said, arises over the airlines' use of a scheduling committee to work out landing slot arrangements at high-density airports, including Washington's National Airport, which is operated by the Federal Aviation Administration.

The Board has granted immunity to scheduling committee activities since the strike by the Professional Air Traffic Controllers Organization in August, 1981. As the ATC system returns to normal, the Board is "trying to get airlines to come up with something different," Susan B. Jollie, the CAB's associate general counsel for antitrust and litigation, said.

The CAB has asked airlines to propose a solution in case the airline scheduling committee reaches an impasse, "and the committee is trying to work that out," he said.

The CAB foresees a "significant amount" of work ahead to follow the congressional mandate to review periodically airline agreements covering a variety of airline operations. "We're going to do it," Jollie said. "A review is consistent with deregulation and the obligation to keep our house in order for a transfer later."

The antitrust investigation at Atlanta into an aspect of courier service has resulted in subpoenas, according to Donald A. Kinkaid, chief, Antitrust Div. field office.

Kinkaid said a grand jury has been looking into time-critical transportation of nonvaluable items, which he defined as canceled checks or computer print-outs

connected with banking activities. Kinkaid said airlines were secondary in the investigation, and it was not clear how carriers were involved in the case.

The joint investigation of computerized reservations systems, primarily American's Sabre and United Airlines' Apollo systems, is focusing on lease costs and conditions of a lease that may inhibit competition, charges for cohosts and whether charges discriminate against other airlines or are designed to inhibit competition, and display of schedules and fares of cohort airlines and other carriers and whether there is discrimination against either classes of carriers (AW&ST Jan. 10, p. 26).

Frontier Airlines has charged that United Airlines was unfair and uncompetitive in the use of its system at Denver (AW&ST Feb. 7, p. 31).

Justice Dept.'s earlier position on a common automated reservations system, first advocated by the Air Transport Assn., Air Traffic Conference and 11 airlines in 1969, was negative.

The agency said the computer operation by ATAR Computer System, Inc., "calls for a collective boycott of ATAR's competitors and presents ATAR with a monopoly of this market. A monopoly of airline reservations systems would substantially restrain trade in connection with air transportation and other lines of commerce. Competition among airlines in developing better reservation systems would be precluded. The ability of travel agents to choose among reservation service equipment and reservation service sellers would be ended. All suppliers of equipment used for reservation services but one would be foreclosed from this market. All operators of reservation service systems but one would be foreclosed from the market. An agreement with these effects would contravene Sections 1 and 2 of the Sherman Act." □

Shortlines

Air Florida has rescinded 80 of 104 furlough notices to flight attendants as traffic prospects to Europe have improved. The carrier will add two McDonnell Douglas DC-10s to the fleet for new European service in early May (AW&ST Mar. 21, p. 28). Furloughs went into effect for 24 attendants and 36 pilots on Mar. 13.

Continental Airlines will increase its gates at Stapleton Airport, Denver, from 14 to 24. Six gates are being acquired from **Western Airlines** and four others will be included in new facilities at the airport.

Frontier Airlines will suspend temporarily its flights between the U. S. and the Mexican cities of Ixtapa, Guadalajara and Manzanillo, effective May 1. The carrier said the three markets had shown low demand. Service will continue to Mazatlan and Puerto Vallarta from Denver via Albuquerque, N. M., and El Paso, Tex.

Midway Airlines will return to two-tier peak and off-peak pricing on Apr. 1 and will revise its schedule with a temporary suspension of flights to Tampa on Apr. 18, reduction of service to Omaha from three to two flights a day and the addition of one round trip per day from Chicago to Minneapolis/St. Paul and to Columbus, Ohio, on Apr. 24.

Ozark Air Lines has started two round trips a day between St. Louis and Charlotte, S. C., via Louisville. Afternoon non-stops to Cleveland, Louisville and New Orleans have been added, with evening return trips from Cleveland and Louisville and a morning return from New Orleans.

Pan American World Airways will add a daily flight from Kansas City on Apr. 24 that will connect with Cincinnati and JFK International, New York, where service to 26 international destinations is available.

Swissair scheduled replacement of McDonnell Douglas DC-10-30s with Boeing 747s on its Chicago-Boston-Zurich service on Mar. 27.

Trans World Airlines will resume daily one-stop service to Vienna under a service agreement with **Austrian Airlines**, effective Apr. 24. Trans World will operate Boeing 747s from New York to Frankfurt, and Austrian will operate McDonnell Douglas DC-9-80s from there to Vienna as TWA Flight 740.

United Airlines will add three daily round-trip flights between LaGuardia and O'Hare airports on Apr. 24, increasing its seats in the O'Hare-New York market to 3,908 daily, which includes five trips to Newark and three to JFK International.

Airline Observer

Greater head-to-head competition between U.S. majors and regionals is expected this year. New twin-engine, short-haul aircraft are entering the fleets of American Airlines, Delta Air Lines and Trans World Airlines and will be put into service in selective markets that feed hubs and long-haul flights. In turn, regional airlines are expected to enter selected long-haul markets.

Lufthansa German Airlines is scheduled to put into service six of 25 Airbus Industrie A310 short-to-medium-haul transports this year, starting in April. Plans call for the A310, configured with 18 first-class and 193 economy-class seats, to be used on routes from Frankfurt to London, Vienna, Paris, Madrid, Athens, Istanbul and Cairo. The airline estimates that operations with a two-man cockpit crew instead of a three-man crew will save about \$240,000 annually for each aircraft. Lufthansa will receive its final A310 in 1990.

U.S. airlines are offering special SuperSaver fares with no minimum stay restrictions to persons who qualify to attend conventions. Information on fares and special services are included in convention brochures. Those who qualify must give a code number to identify themselves with the airlines. American Airlines has established a Meeting Services Desk and a toll-free telephone number, where passengers may reserve a seat, obtain tickets, select a seat and order a meal. Republic Airlines offers 30% off regular coach fare levels, or lower fares if available, as does American.

Japan's Ministry of Transport is looking favorably at the application by Japan Cargo Airlines to provide cargo service between Japan and the U.S., but approval is being withheld until the market improves. The ministry foresees steady growth in both mid- and long-term forecasts. Japan Air Lines opposes the application and was joined recently by the Federation of Labor of Japan. The labor group, representing employees of subcontractor companies of Japan Air Lines' cargo service, said another cargo carrier in the market would generate excessive competition and cause an employment crisis. The cargo airline was formed in 1978 by All Nippon Airways and four shipping firms. Initial service would link Tokyo, San Francisco and New York.

The U.S. has issued 2 million machine-readable passports and is introducing automatic readers as an experiment at O'Hare International Airport, Chicago. Automated equipment has been installed at London's Heathrow and Gatwick airports and at the Dover, England, Harbor, and it is linked to a central computer. Ten nations in the European Economic Community are planning to produce uniform passports under International Civil Aviation Organization specifications by Jan. 1, 1985.

Massachusetts Port Authority is attempting to get Congress to make Boston's Logan International Airport a foreign trade zone as part of a \$200-million Bird Islands Flats development program that includes construction of a new \$130-million Massachusetts Technology Center and a \$70-million air cargo complex. Foreign trade zones are created by Congress to stimulate international trade by exempting products entering the jurisdiction from import duties, excise taxes and bonding costs.

Frontier Airlines will begin offering free ground transportation between Denver's Stapleton Airport and hotels in Boulder and in Fort Collins, Colo., on May 1 in its own fleet of eight 19-passenger vans. A total of 150 round trips a week are timed with Frontier's connecting banks of flight departures and arrivals.

NTSB Cites Wind Shear In New Orleans Accident

By Eugene Kozicharow

Washington—National Transportation Safety Board last week recommended that the Federal Aviation Administration improve its airport weather and wind shear alert systems after an investigation determined the probable cause of the Pan American World Airways Boeing 727-235 crash at New Orleans International Airport on July 9, 1982, was a wind shear caused by a microburst (AW&ST July 19, 1982, p. 32).

The safety board said the aircraft encountered the wind shear during liftoff and initial climb on its scheduled flight to Las Vegas. The downdraft and decreasing headwind led to the crash that killed 145 persons on the aircraft, including seven crewmembers and a nonrevenue passenger in the cockpit jump seat. Eight persons on the ground also were killed (AW&ST Sept. 20, 1982, p. 30).

Limited Technology

Contributing to the crash, which occurred 29 sec. after start of the takeoff roll, was the "limited capability" of existing airport wind shear detection technology to "provide definitive guidance for controllers and pilots for use in avoiding low-level wind shear encounters," the board ruled.

The board said the decision of the 727-235 captain to take off was "reasonable" given the weather information he had received and found that the copilot, who was flying the aircraft, "would have had difficulty" recognizing the effects of the wind shear and reacting in time before the aircraft's descent could have been stopped.

The safety board incorporated 14 safety recommendations in its report, including:

- Improvement of airport wind shear alert systems.
- Better information requirements for pilots' takeoff decisions.
- Improved wind shear pilot training.
- Expedited development of airborne wind shear detection equipment.
- Further research into the effects of heavy rain on aircraft performance.

The NTSB investigation found that the New Orleans wind shear alert system did not detect the shear that the Pan American flight encountered until after it had begun its takeoff.

An air traffic controller's advisory, which was based on the shear, was broadcast to another aircraft 2 sec. after the Pan American 727-235 had already struck trees after its takeoff.

A sensor of the New Orleans low-level

wind shear alert system west of the approach end of Runway 10 had been vandalized and was inoperative when the New Orleans system was commissioned in December, 1979, and on the day of the accident, the Board's investigation found.

The New Orleans alert system was one of 58 then operational in the U. S. Its sensors and computers provided controllers with airport sector wind velocities and directions to relay to pilots. But the board said the information would have been "more meaningful" to pilots if it were presented as headwind, tailwind or cross-wind shear vectors for the runway being used.

Existing systems' computers could be modified to provide the specific information, according to the board.

It added that recent work with airborne wind shear detection systems has demonstrated that the systems can "improve pilot performance in wind shear."

However, the systems are limited in their ability to predict wind shear soon enough. "Programs must be pressed to develop airborne and ground systems with greater lead time predictive capabilities," the board said.

The NTSB investigation determined

Wind Shear Study

Washington—Federal Aviation Administration last week awarded a \$275,000 contract to the National Academy of Sciences to conduct a three-month study of low-level wind shear and its effect on aircraft.

The contract calls for the establishment of a joint committee composed of two panels that will study low-level wind variables and aircraft performance and operations.

The low-level wind shear panel will review current techniques used to determine and track wind shear and will recommend a series of changes to improve the FAA's ability in predicting the weather phenomenon.

The aircraft performance panel will review the vulnerability of aircraft operating in wind shear conditions and recommend changes when necessary in operational procedures.

The study was mandated by Congress last year after the crash of the Pan American World Airways Boeing 727-235 aircraft July 9, 1982, at New Orleans International Airport.

that Pan American Flight 759 lifted off at 4:08:40 p. m. from Runway 10, climbed to an altitude of 100-150 ft. above ground and then began to descend. The aircraft struck three trees 2,376 ft. beyond the departure end of the runway in a slightly left-wing-low attitude. The impact point in the trees was 50 ft. above ground level. The time at impact was 4:09:01 p. m.

The aircraft then struck a second group of trees about 300 ft. farther east in a 6-deg. left bank. The 727-235 continued to roll into a vertical left bank and struck the ground, left wing tip first. The impact swath ended 4,610 ft. from the departure end of the runway and 400 ft. to the left of its extended centerline.

The impact, explosion and post-crash fire destroyed the aircraft and six houses. Five other houses were severely damaged.

The investigation found that special weather observation at the airport recorded an overcast at 4,100 ft., with visibility of 2 mi. Heavy rain showers, haze and winds gusting to 20 kt. were reported.

The National Weather Service radar was showing weather cells over and beyond the departure end of the runway when the aircraft took off. Three wind shear advisories radioed by air traffic control shortly before takeoff had been received by the flight crew, including one in response to their request for wind information. The takeoff was made in increasingly heavy rain, but there was no thunder or lightning before or during liftoff.

Decreasing Headwind

Between the time of the liftoff and the time the aircraft reached the treeline, the aircraft experienced a decreasing headwind shear of about 38 kt. and a 7 fps. downdraft at 100 ft. above ground level. "The wind shear was caused by diverging flow from a microburst which occurred on the New Orleans International Airport," the safety board concluded.

The 38-kt. wind shear decreased the airspeed of the aircraft by about 18 kt.

The safety board estimated that the copilot had about 6 sec. to react to the wind shear, raise the aircraft's nose and add all available engine power to prevent descending into the trees. An 18-kt. acceleration and leveling of the aircraft in the last 5-6 sec. before the initial tree impact indicated that the copilot "had probably reacted and was applying corrective action," the board said.

The copilot's correction of the 727-235's settling toward the ground "equalled the response which could be expected under the prevailing conditions," the board said.

"It appeared that all that was occurring at the time was rain showers," the safety board added. "Company [Pan American] directives did not preclude the captain from taking off in these circumstances." □

THE KIOWA AEROSCOUT MAST-MOUNTED SIGHT LETS THE ARMY HIDE AND GO SEEK.

Army OH-58D Aeroscote crews will soon see without being seen, day or night, through weather or battlefield smoke or haze, thanks to the Mast-Mounted Sight from McDonnell Douglas. And they will see better than they ever could before.

New precision optics and aiming systems are "soft-mounted" to minimize jitter and vibration on images viewed in the cockpit. The optics will increase stand-off capability, see more targets and remarkably improve control and distribution of fire.

Best of all, the sensors are mounted above the rotor to let the OH-58D Aeroscote remain behind tree and ridge lines. Only a steerable, ball-shaped housing over the optical systems is exposed to hostile eyes.

The new sight is the result of research started in 1975. In the years since, the stabilization system has passed more than 300 hours of Army laboratory tests and 100 hours of Army evaluation flying.

The sensors chosen for the Bell Helicopter Aeroscote include telescopic TV and FLIR thermal imaging systems.

The Mast-Mounted Sight is now being readied for full-scale production as part of the Army Helicopter Improvement Program, and for other projects requiring sensor installations in high vibration environments.

Turn the page to see an enemy's eye view of an Aeroscote crew.



MCDONNELL DOUGLAS

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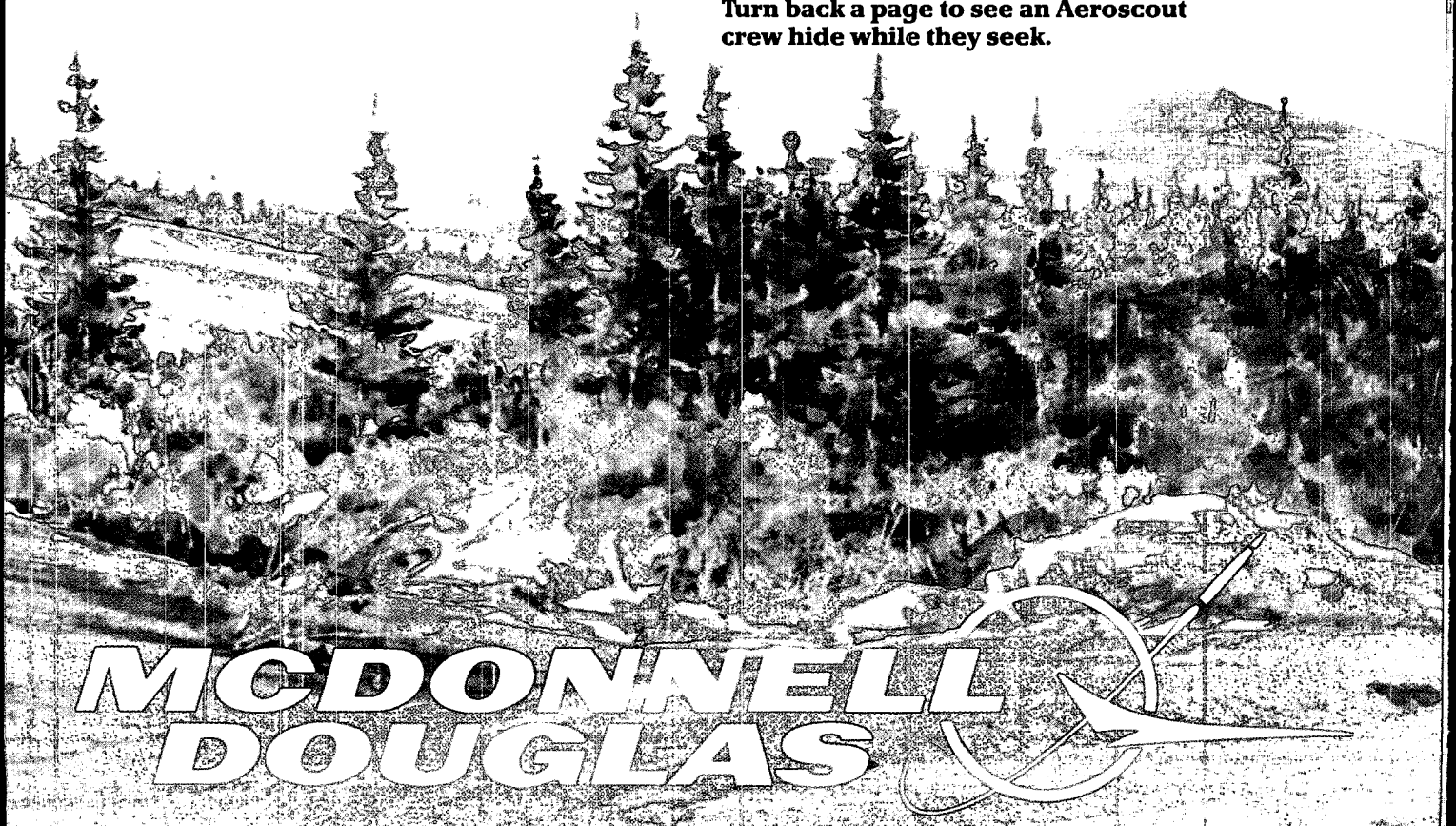
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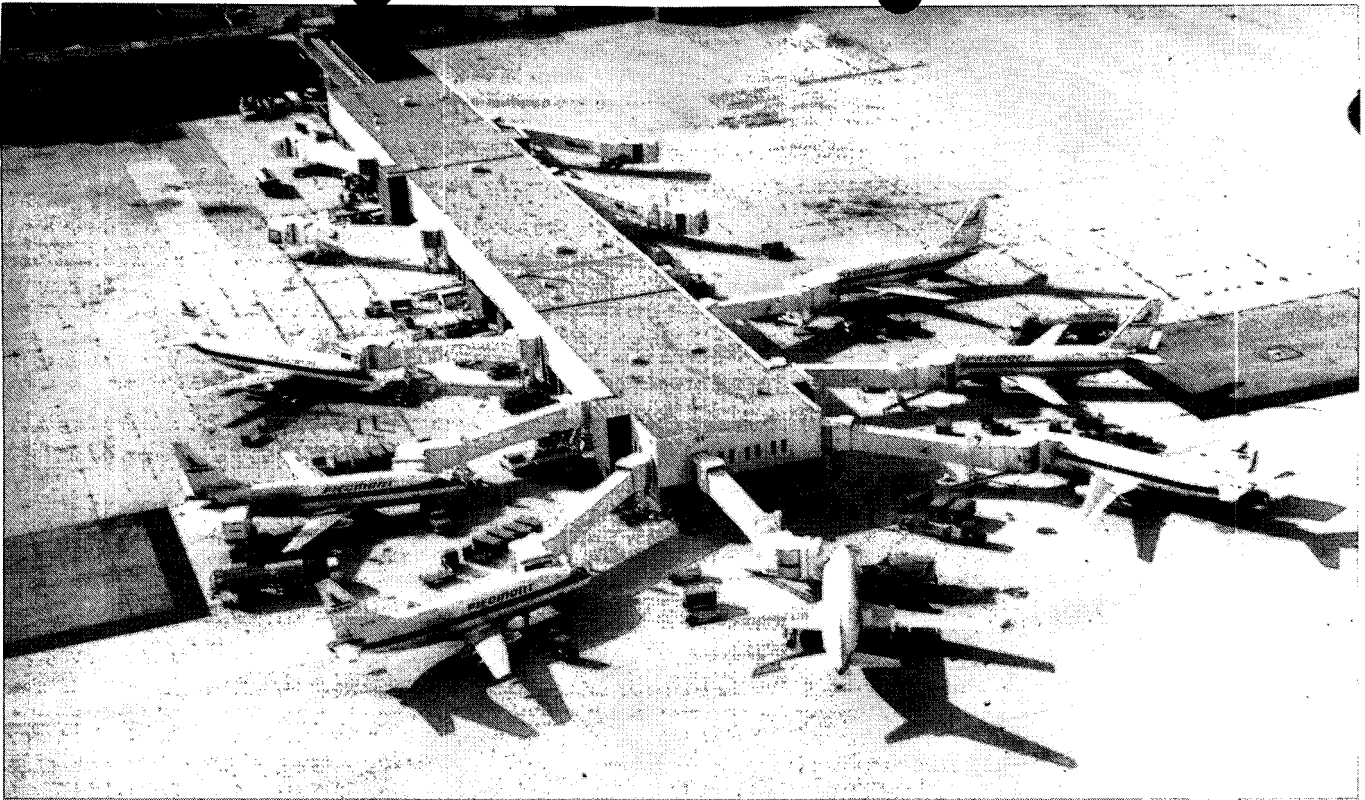
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Turn back a page to see an Aeroscout crew hide while they seek.



MCDONNELL DOUGLAS



Piedmont Airlines' hub at Dayton International Airport is an example of a connecting bank in operation. The hub serves eight Middle West markets and connects them with East Coast and Florida markets and Dallas/Ft. Worth.

Piedmont Expanding Hubs To Baltimore/Washington

By James Ott

Winston-Salem, N. C.—Piedmont Airlines is bringing its regional hub-and-spoke philosophy, which emphasizes service to markets deregulation left out, to Baltimore/Washington International Airport, setting the stage for an expanded route system that will link its three hubs.

Baltimore operations should account for much of the 18% capacity gain expected by the end of the year. Nine Boeing 737-200s and six Boeing 727-200s are coming into the fleet in 1983. William F. Howard, president and chief operating officer, said the aircraft may not be sufficient to meet expansion demands. He is reviewing aircraft buys with that in mind.

Starting in August, Piedmont plans four connecting banks of seven flights each at Baltimore. The plan calls for 12 flights in each bank by the end of the year.

The State of Maryland, the airport operator, is financing a \$21-million, 12-gate complex for Piedmont and is negotiating with the carrier on a quantity discount on landing fees.

From Baltimore, Piedmont will be able to make deeper penetration of Middle Atlantic and northeastern U. S. regions—

and eastern Canada if the Canadian government permits.

The carrier is preparing a new schedule for the Baltimore hub that should be ready 30-60 days before the August start-up. Details are not complete at this time, but these elements have emerged:

- Piedmont will link its hubs at Charlotte, N. C., and Dayton, Ohio, with the new hub at Baltimore to provide connecting services to cities served by each hub.

- Service to Canada from Baltimore is in Piedmont's plans, but U. S. and Canadian bilateral discussions have not resolved the issue.

- The Middle Atlantic region offers some potential for short-haul service, and there are a number of underserved cities in New York state that could connect with the new hub.

Howard said the expansion is transforming Piedmont "from a local service carrier to a major regional airline." But the carrier's operating philosophy will not change. "We are providing air transportation for medium-size cities," he said. "We are finding underserved cities and serving them with small jets."

Howard calls Piedmont's strategy unconventional, because the carrier has deliberately bypassed large, traditional hubs and focused service on underserved communities. Many such communities are immune from competition since, standing alone, they do not generate sufficient traffic to warrant regular jet service.

Piedmont has applied its hub-and-spoke system to medium-size markets that in many cases lost service since passage of the Airline Deregulation Act. Larger airlines withdrew from many losing and marginally profitable routes in the post-deregulation period and focused more on high-density longer hauls between their own hubs.

While many U. S. carriers have incurred losses in this period, Piedmont has thrived, and much credit is given to the carrier's route and pricing strategies.

Operating profits rose from \$7 million in 1978 to \$21.3 million in 1979, \$28.6 million in 1980, \$57.2 million in 1981, and declined to \$23.8 million in 1982 under the influence of discount fare wars.

The carrier's first hub at Charlotte will have grown by next month to 122 departures a day, and its hub at Dayton, opened in 1982, is advancing toward 100,000 available seat miles each month.

Piedmont's hub operation, characterized by tight scheduling of flights and quick turnaround of aircraft, enables the carrier to provide a multitude of destinations to passengers who may be boarding at the end of any of its routes. The carrier

NTSB Chief Warns on Pace In Restoring ATC Capacities

Washington—National Transportation Safety Board Chairman Jim Burnett has warned that the Federal Aviation Administration pace for reestablishing the nation's air traffic control system in the aftermath of the 1981 air traffic controllers strike may be too quick and could lead to accidents.

Burnett said the FAA should consider slowing down its push to lift all flight restrictions to prestrike levels in April. While the national airspace system is safe, he said, problems could surface if traffic levels rise too fast.

He said the FAA's first priority in returning the system to safety levels before the strike should be to get air traffic control supervisors away from filling in for controllers and back into strictly supervisory roles to provide back-up and support for newly trained controllers.

A second priority for the FAA would be to cut back on long hours for controllers and get them to work normal 40-hr. weeks, according to Burnett.

The NTSB official said, "We're not saying the sky is falling," but traffic levels should be raised to match the pace of controllers' skills.

The FAA said earlier this year it was lifting air traffic control restrictions on airline and general aviation traffic in most parts of the country by the fall.

FAA Administrator J. Lynn Helms said the air traffic control system is handling slightly more than 90% of the traffic levels registered before the August, 1981, strike and is expected to return to 100% by April (AW&ST Feb. 7, p. 35).

Burnett told the House Public Works and

Transportation aviation subcommittee recently that dealings with the FAA have become "tougher" in the last several years. "There are some signs the FAA is not being as responsive to recommendations as it used to be," he said.

In contrast with 1981, when the FAA adopted 93% of NTSB recommendations, the FAA only adopted 73% last year, he said, adding that the FAA also has been slow in responding to the Board about whether it accepts or rejects recommendations.

"For example, the FAA has delayed a final decision on the Board-recommended changes in the operational procedures used by Boeing 737 flightcrews," he said. "The agency has advised the Board that any action on this recommendation must await completion of further wind tunnel tests on the Boeing 737. We intend to keep pressing on these recommendations and several others, all of which the Board considers important."

Burnett said the FAA also was dragging its

has restricted the schedule for a connecting bank of flights at its hubs to 30-40-min. in order to allow passengers to change aircraft and avoid a lengthy ground delay. An advantage for a passenger in a Piedmont hub is that all aircraft are parked at the Piedmont complex. Only a short walk is required to board another aircraft.

From the airline's standpoint, the concentration of flights at a particular time serves the carrier's need to build up traffic flow. The traffic is, in effect, funneled from other markets through the hub, which allows the carrier to serve markets that the hub cities alone could not serve.

Howard uses the example of Charlotte-Dallas/Ft. Worth, one of Piedmont's first successful long-haul routes from the Charlotte hub.

"Everyone thought we would lose, but the feed from other cities built the traffic flow at Charlotte and now we have four nonstops a day," he said.

The pattern of connecting flights at each hub allows passengers involved in the hub-and-spoke system to depart in the morning and return at night from nearly all points on the carrier's system, Howard said.

Expanding the hub-and-spoke concept, particularly in a recessionary economy, had elements of a risk, Howard said, but Piedmont's strong financial position enabled it to take advantage of other airlines' reversals.

The carrier was in a position to purchase facilities, take over leases and trade airport slots from carriers that were ready to do business.

Over the last 15-18 months Piedmont has added new facilities at Dallas/Ft. Worth, Boston, Charlotte, Raleigh-Durham, Greensboro, Miami, Orlando, Tampa, Dayton, Denver and Houston largely with internally generated funds.

J. Leonard Martin, vice president, passenger services, said Piedmont favors the

long-term lease for airport properties. At the medium-size airports where Piedmont serves, long-term leases are required because the airports have "no way to raise capital to expand. They need the carriers' backing," he said.

Piedmont sought and obtained "risk-sharing" by operators at Dayton and Baltimore and continues to negotiate for a quantity discount on landing fees.

Dayton airport expanded its northeast concourse, added a deck level and produced the 11-gate complex with 11 loading bridges. Approximately 450,000 sq. ft. of ramp space was added.

The \$12-million Dayton project was financed through general obligation bonds issued by the city, and airport revenue bonds.

Piedmont will increase its gates at this complex from seven to nine Apr. 24.

The landing fees issue remains unresolved, according to J. R. Wood, director of aviation for the City of Dayton.

Piedmont has proposed that the quantity discount go into effect when daily landings exceed the highest level so far achieved by a carrier to avoid complications with carrier contracts.

Wood said the proposal, still being discussed, is stymied because the airport has found "no legal way to do it."

Piedmont's presence at Dayton has increased operations after enplanements declined by 17% in the aftermath of deregulation, the strike by air traffic controllers and, lately, recent offering of deeply discounted fares by People Express at Columbus, Ohio.

Since Piedmont's arrival at Dayton, airline seats offered by carriers have risen 48% over 1980, and operations are "back up to where they ought to be," he said.

The Baltimore hub will be bigger than

Reengined DC-3 Aircraft Ordered

Los Angeles—First production United States Aircraft Corp./Douglas DC-3 aircraft equipped with Pratt & Whitney of Canada PT6A-45R turboprop engines has been ordered by a U. S. regional operator for combined passenger and cargo revenue service.

The purchase agreement also includes an option to lease or purchase the company's demonstrator aircraft.

The initial production aircraft—to be delivered in July—will accommodate 18 passengers in a forward passenger compartment and palletized cargo in the aft two-thirds of the cabin.

Supplemental 800-gal. fuel tanks will be installed in the outer wing panels, doubling the aircraft's standard 800-gal. fuel capacity.

A DC-3 fitted with the turboprop engines has completed 102 hr. of flight testing since last August (AW&ST Aug. 2, 1982, p. 32; May 31, 1982, p. 23). It is expected to receive a Federal Aviation Administration supplemental type certificate this spring.

Formerly based at Van Nuys Airport, United States Aircraft recently moved to larger facilities at nearby Burbank Airport.

heels on an NTSB recommendation to install digital flight data recorders on all aircraft to monitor new avionics and equipment systems. The new data recorders would measure and monitor 11 parameters compared with only five for current flight recorders.

He said the U. S. was falling behind many European nations in aircraft accident investigative techniques because of slowness in adopting new technological tools such as digital recorders.

Lack of the digital recorders in all commercial aircraft is "undermining" safety efforts in the U. S., Burnett claimed.

Burnett said a series of budget cuts in recent years had restricted NTSB activities because of a lack of manpower. "Like other agencies, the board has taken its share of budget cuts," he said. "In view of our unusually small size, these cuts went beyond any fat that we may have had and cut right into our muscle."

The NTSB had 401 employees in February,

1980, according to Burnett. By October, 1982, the board was down to only 292 employees—a reduction in staffing of 27%.

"While the Board managed to continue its priority investigations during this period, it was not done without sacrifice," he said. "We were forced to issue less reports, less recommendations, and delay the initiation of a follow-up study of the air traffic control system since the Professional Air Traffic Controllers Organization strike."

The cutback in personnel led to delays in issuing reports, which climbed from 8.6 months in 1981 to 20.7 months.

He said the Board is asking Congress to approve a three-year reauthorization request that would authorize the Board \$22.6 million in Fiscal 1984, climb to \$24.5 million in Fiscal 1985 and culminate with an authorization of \$26.1 million in Fiscal 1986.

The reauthorization would permit the NTSB to hire an additional 31 persons in Fiscal 1984, including 22 more technical experts.

ers at this stage must "balance fuel savings against ownership costs," he added.

Piedmont has discussed the Boeing 737-200, now priced at \$16 million, he said, and has looked into the Boeing 737-300 and 400, priced at \$28-30 million.

"The price for the derivatives troubles us, particularly at current interest rates," he said.

Piedmont is careful about its pricing levels when in competition with other carriers and also when discounts at certain markets begin to have an effect on other markets.

The carrier in early March reduced fares from Wilmington, N. C., to levels charged at Raleigh/Durham. Fare levels had been lower at Raleigh/Durham, which attracted passengers who drove from Wilmington and other Carolinas towns to get the lower fares.

Piedmont has common-rated fares at other points as well.

Howard said Piedmont at first opposed deregulation and altered its position to pro-deregulation largely because officials believed there was little that could be done against the deregulation tide:

"Deregulation can work, though it has been traumatic for many airlines," Howard said. "We have four years of deregulation and four years of deregulation pricing, but only in a downside economy. When the economy turns, there will be a better chance for improved yield. Load factors will go up and much of the urge to use discounts will diminish." □

the Dayton hub. There will be one more gate in the complex.

Piedmont cites the Baltimore/Washington area's population of 5.2 million as an asset. Traffic at Baltimore/Washington International airport increased 20% in 1982 over 1981. Airport officials anticipate a positive impact from Piedmont's presence.

"We have a fair number of short-haul markets that are poorly served," T. James Truby, state aviation administrator, said.

Piedmont's traffic also may increase because of the airport's international connections and the proximity of the Washington suburbs in Maryland to the airport, Truby added.

Piedmont expects to hire 140-150 new pilots in 1983 and at least 35-40 pilots in 1984 even if no new aircraft are purchased.

The carrier has hired 100 pilots who came from Braniff International Airways, which filed for bankruptcy in 1982, and 30 other former Braniff pilots are now in Piedmont classes. Average age of new pilots is 40-41 years, with 11,000-12,000 flying hours.

Howard is pleased with the performance of the Boeing 727-200s that the carrier has acquired from Delta Air Lines. Piedmont paid \$4.7 million each for 11 aircraft, which were modified by Delta. The carrier invested \$700,000 in new equipment for each aircraft, representing a unit total cost of \$5.2 million.

"Call them gas-guzzlers if you will," Howard said, but the \$5.2-million investment when compared with the cost of new aircraft, is spent wisely as long as fuel prices remain stable, he said.

Piedmont's Boeing 727-200s are equipped with digital avionics, color radar and new interiors in a 164-seat configura-

tion. The aircraft will remain economically feasible for Piedmont as long as fuel remains below \$1.60/gal., Howard said.

"I won't say we won't buy new technology aircraft," the president said, "The 757 is not that much bigger than the 727, and the difference in passenger appeal is essentially zero."

Howard said senior vice presidents for finance like the new-generation aircraft because they offer lower fuel costs. Carri-

World Shifts to One Class in Scheduled Service

Washington—World Airways is eliminating its first-class and business sections and focusing on one-class scheduled service at competitive fares that offers a wider scope of coach amenities than before.

The one-class service, called Ultra Service, is one step in a 1983 operating plan, formulated by World management after consultations with an employee Forward Look Committee.

The carrier plan involves expansion to include nonstop Baltimore-Frankfurt service four days a week starting Apr. 21 and Oakland-Newark-Baltimore service daily that will connect with Frankfurt flights, and a new market in the fall.

W. P. Jamieson, vice president, marketing and sales, said the operating plan calls for economic recovery of the carrier by mid-1983.

The carrier is seeking yield improvement but will remain competitive in price and service, he said.

World has identified its market as "the leisure passenger, VFR—Visiting Friends and Relatives—the young and old, and the cost-conscious businessman," Jamieson said.

Other classes of service, such as Executive 1 for businessmen, were profitable only in the fall season, he said. These classes have been eliminated to provide improved coach service, he added.

World is reconfiguring five McDonnell Douglas DC-10s used in scheduled service to carry 350 passengers at 34-in. and in some cases 35-in. pitch seats.

New cabin interiors with increased carry-on baggage room are being installed.

Other amenities include one-stop airport check-in, choice of three entrees, theme cocktails, free wine, hot towels, baby change facilities, inflight electronic games for children and films on the destination of the aircraft.

Jamieson said 100 furloughed flight attendants and cockpit crews worked without pay for a period to promote World's new services with travel agents. Their efforts were a factor in the carrier's meeting its January and February goals in its 1983 profit plan, the vice president said.

FAA Cancels VOR Weather Program

By Philip J. Klass

Washington—Federal Aviation Administration has canceled a planned demonstration of a technique to transmit ground weather radar imagery to general aviation aircraft via VOR stations, delaying the operational availability of such service by at least 10 years.

The technique was first demonstrated in Ohio, and a more extensive demonstration-evaluation had been planned for this summer (AW&ST Nov. 16, 1981, p. 89).

FAA Administrator J. Lynn Helms terminated the program despite a recent report submitted to him by general aviation and business aircraft operators that recommended efforts to alert pilots more promptly to severe storms.

Data Feed

In the canceled demonstration, storm data from U. S. Weather Service ground radar would have been fed to several VOR stations, probably in the Washington, D. C., area, and broadcast over the little-used voice channel, together with surface weather observations from airports in the region.

Aircraft equipped with a small cockpit printer-adapter connected to the output of the aircraft's VOR receiver would print out a replica of the weather radar imagery showing both severity and location of storms.

The pilot can select several different display scale factors ranging from 30 × 30 naut. mi. to 256 × 256 naut. mi. Or the pilot can print out surface weather data.

Cost analyses performed earlier by general aviation avionics companies indicated that the airborne equipment needed to provide the new service could be priced at around \$2,000 in production quantities.

Mitre Corp., which developed the experimental hardware used in the demonstration in Ohio, recently informed the FAA that it had enough funds in its existing contract to build a dozen units that could be employed in the planned demonstration and sought agency approval to do so.

The necessary modems required to modify three VOR stations to broadcast the weather radar imagery also were available, having been built for the Ohio demonstration.

Mitre recently demonstrated a functionally similar terminal that could be used by fixed-base operators to provide pilots with television-type display and a print-out of weather radar imagery and surface observations.

The Mitre terminal, which uses a commercially available Osborne personal computer and a small printer, would cost about \$2,000, according to James P. Kelley, Mitre project engineer.

Kelley said a pilot with a personal computer in his home also could program it to perform the necessary processing of weather radar imagery obtained over conventional telephone lines.

Helms' decision to terminate the program was based on a "lack of support from the operational side of the house," one FAA official said.

"They felt that such a display might lure general aviation pilots into entering areas that appeared to have less precipitation echo than others," the official said.

He said the FAA eventually plans to transmit ground weather radar data to aircraft cockpits via its Mode-S data link, if requested by a pilot whose aircraft is appropriately equipped.

He acknowledged that because of the limited amount of data that can be transmitted to an aircraft via the Mode-S data link during a single scan of the ground interrogator beam, it would be necessary to transmit only the contours of severe weather areas to provide the information in a timely manner.

The FAA expects to be able to obtain such severe-weather contours from its central weather processor when that system becomes operational "in the late 1980s" the official said.

However, Mode-S surveillance and data link coverage down to 6,000 ft. altitude over the continental U. S. is not expected to be achieved before the year 2000, according to the present FAA schedule, the official said.

Nationwide Coverage

Those who favor the VOR-broadcast technique for ground weather radar claim the FAA could have nationwide coverage before 1990, and that user equipment could be on the market several years before that date.

In response to the FAA view that the new service might have an adverse effect on general aviation safety, proponents point to the results of limited tests conducted by Ohio University's Avionics Engineering Center during the summer of 1982.

In a report on those tests, published this past December, Richard H. McFarland said the cockpit weather dissemination system "was found capable of providing radar reflectivity patterns which were used by pilots to adjust their flight paths and thus avoid turbulent areas.

"The synoptic view available from the radar located in Columbus, Ohio, gave the pilots a perspective that is not even available from on-board weather radar," McFarland continued. "This was found to be a significant advantage in maximizing the efficiency of the flights and minimizing the discomfort to the crews and passengers."

McFarland added that while the tests had emphasized general aviation-type operations, "the results are directly applicable to commercial and military operations."

Of the 16 pilots who participated in the test, McFarland said, "some were very enthusiastic."

"At the very least, the respondents felt it offered a useful service. . . there were no negative responses from participants concerning the appropriateness of such a device for improving safety of flight," McFarland continued. □

Northwest Shows Profit, Republic a Loss

Northwest Airlines recorded an \$8.375-million operating loss and a \$5.019-million net profit for 1982, while Republic Airlines recorded a \$37.223-million operating profit for the year but a net loss of \$39.8-million due in part to \$100.7 million in interest expense.

The carriers' financial reports increase the net losses for nine U. S. majors to \$588 million for the year (AW&ST Feb. 14, p. 29).

Comparison of reports of individual carriers by year and by fourth quarter are as follows:

■ **Northwest**—\$1.877-billion revenues, up 1.3%; \$1.885-billion expenses, up 1.8%. Loss on interest expense, \$7.216 million; gain from disposal of property, \$12.425 million, and gain from other income, \$3.854 million. For the fourth quarter, \$473-million revenues, up 8.2%; \$487.9-million expenses, up 8.7%; \$14.93-million operating loss and a \$2.57-million net loss.

■ **Republic**—\$1.530-billion revenues, up 1%; \$1.493-billion expenses, up 4%. Interest expense, less capitalized interest, \$100.7 million, down from \$108.36 million in 1981, and total expenses of \$1.570 billion, up from \$1.494 billion in 1981. For the fourth quarter, \$348.5-million revenues, up 2%; \$378.8-million expenses, up 4%; \$30.28-million operating loss and a \$27.32-million net loss.

Aeronautical Engineering

PW4000 Uses JT9D, New Technology

By Keith F. Mordoff

East Hartford, Conn.—Development of the Pratt & Whitney PW4000 family of turbofan engines is based on experience gained from the JT9D series of engines, technologies developed from the PW2037 program and new design improvements to provide a series of new technology engines in the 48,000-60,000-lb.-thrust class.

Many detailed component changes were necessary to achieve PW4000 engine economy, maintainability and performance gains over the JT9D large turbofan engines. The PW4000 is designed for new versions of the Boeing 747 and 767, for Airbus Industrie A300-600 and A310 aircraft, and for retrofit on current JT9D-7R4 powered aircraft (AW&ST Dec. 13, 1982, p. 24).

Pratt & Whitney management has determined that the demand for large commercial engines is the strongest segment of the market and wanted a new technology engine to meet the anticipated need. Managers estimate 8,000-10,000 transport aircraft will be ordered over the next 20

years and that 60% will be wide-body aircraft requiring large turbofan engines.

Design of the PW4000 began more than a year before the program's announcement last December. Pratt & Whitney engineers were given a clean sheet of paper from the start of engine design, according to Karl M. Thomas, senior vice president, Commercial Products Div.

"The PW4000 started with ideas from the energy efficient engine [E³] program that were put into practice on the PW2037 and refined for the PW4000," he said.

The design group decided early that a new design and not an improved JT9D-7R4 was needed to provide an engine with the desired fuel economy and thrust improvements.

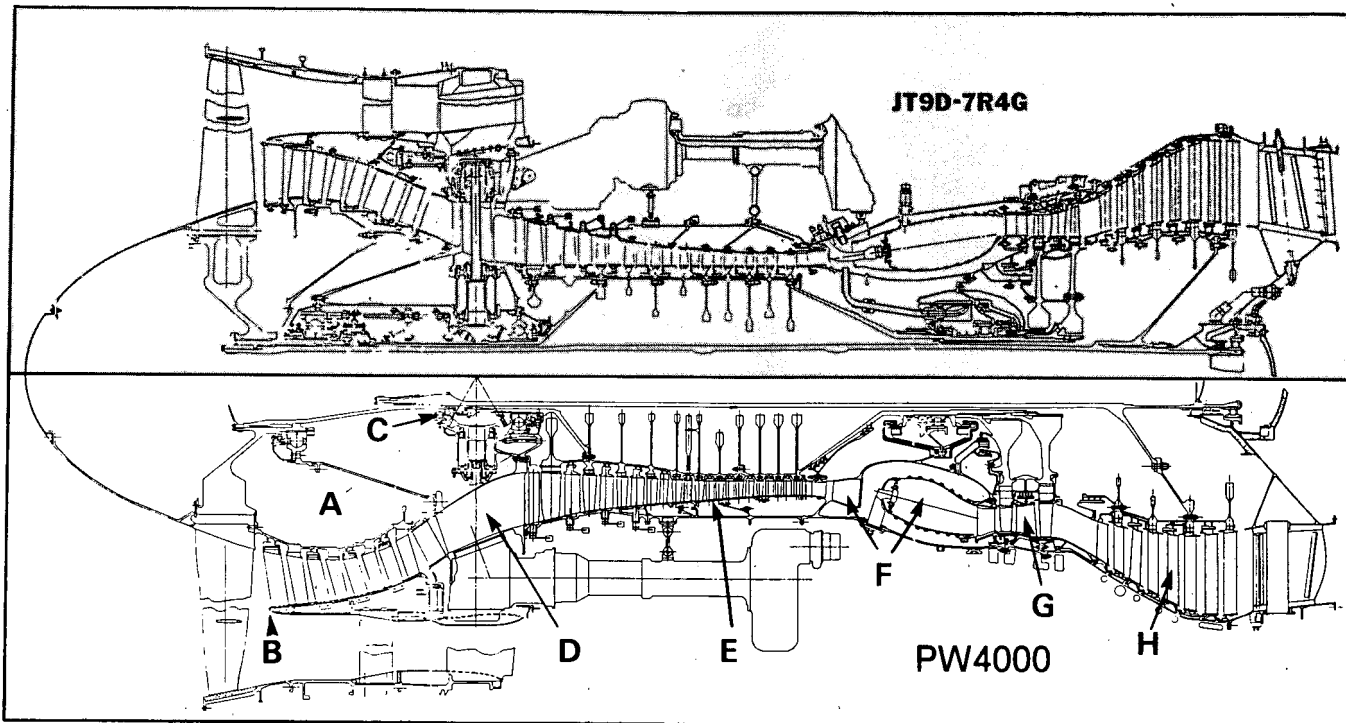
"The JT9D could have been made to reach 60,000 lb. of thrust, but we needed increased engine life, reliability and lower operating costs. With all of the changes needed to accomplish this, we decided we might as well make a new engine," Wil-

liam Robertson, vice president, JT9D and PW4000 series for Pratt & Whitney, said.

Improvements in the PW4000 were designed to increase fuel efficiency, reduce maintenance and lower ownership costs over the JT9D-7R4. Fuel efficiency was improved by increasing engine rotational speed by 27%, doubling engine stiffness, improving compressor aerodynamics, reducing turbine cooling by 26% and using an electronic engine control.

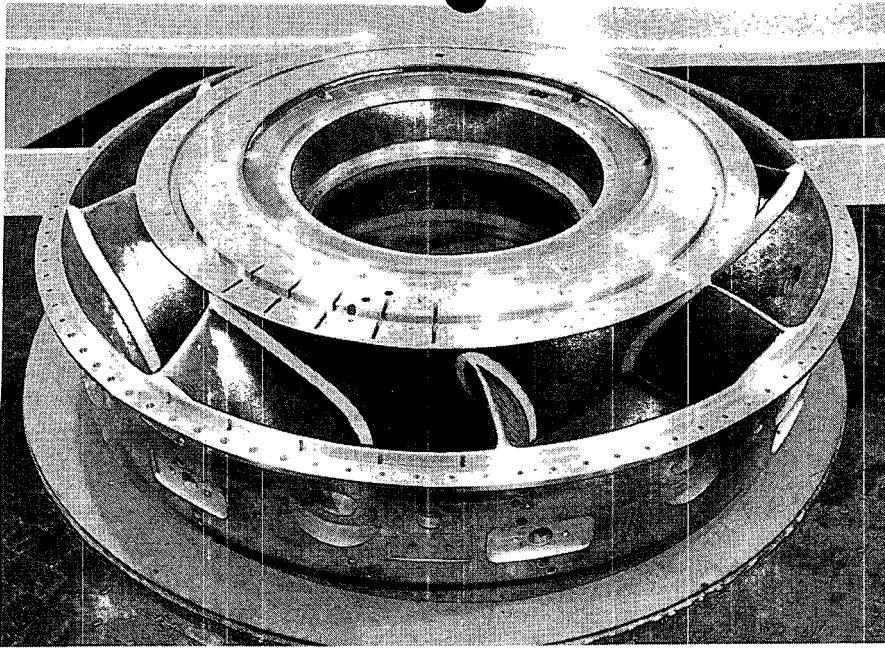
Pratt & Whitney expects maintenance requirements to be reduced 25% in an engine with half as many parts as the JT9D. Fewer parts and larger castings used in the engine cases and diffuser section also will reduce the engine's assembly time, Robertson said.

Pratt & Whitney designed the PW4000 to fit existing JT9D-7R4 installations to further reduce costs. To meet this requirement, the engine has the same fan case diameter, overall length and mounting points as the JT9D-7R4. This commonality reduces costs by minimizing engine



Cross sections of the Pratt & Whitney PW4000 turbofan engine (bottom half) and the latest version of the JT9D-7R4G (top half, tinted) are compared. The PW4000 has the same dimensions and attach points as the JT9D to allow use with common installations and support equipment. Simplified construction reduces the number of parts and stiffens the structure in the fan and low-pressure compressor support drum (A). The core and bypass air splitter (B) is moved back to reduce particle ingestion. An additional bearing (C) stiffens

the front of the engine. Intermediate case (D) is strengthened also to stiffen the engine and improve the gearbox mounting. High-pressure compressor improvements (E) include fewer parts, improved airfoils, higher rotor speed and Thermatic rotor expansion system. One-piece cast diffuser, improved fuel nozzle and a ring-rolled burner reduce parts in the diffuser/burner section (F). High-pressure turbine blades (G) have improved aerodynamics and require less cooling air. Low-pressure turbine blades (H) incorporate a new design.



Prototype intermediate case for the Pratt & Whitney PW4000 powerplant shows the wide vanes used to separate and stiffen the low- and high-pressure compressor sections of the engine. A one-piece casting of the production intermediate case will replace the welded construction technique of the prototype case. Compressor blades and other components are being assembled for the first high-pressure compressor rig tests, scheduled to begin in July.

inventories and allows the use of common handling equipment, test cells and nacelles, according to Jim Bruner, PW4000 engineering manager.

"Our objective also is to phase out the JT9D with the PW4000. We perceive 1988 or 1989 as the time for JT9D-7R4 production halt, with spares continuing in production," he said.

Detailed improvements over the JT9D-7R4 are incorporated throughout the engine beginning with the fan section. The front fan was redesigned to reduce the number of blades from 40 to 38. The increased stiffness of the engine case compared with the JT9D allows a tighter fan tip clearance with the fan case rub strip. The bypass area behind the fan also was designed to increase the flowpath convergence to reduce the aerodynamic losses across the case vanes, Bruner said.

The low-pressure compressor section incorporates second-generation controlled diffusion airfoils, reducing the number of airfoils in this section by 9%. The new controlled diffusion airfoils are similar to those used in the PW2037, but they include changes defined by PW2037 testing and better computer design modeling, Bruner said.

The controlled diffusion airfoils have thicker leading and trailing edges than standard airfoils that increase the blade's resistance to particulate erosion and permit them to operate at higher Mach numbers without blade efficiency loss (AW&ST Jan. 25, 1982, p. 48).

Pratt & Whitney also redesigned the low-pressure compressor section to reduce

the amount of dirt particles ingested into the engine.

The air splitter separating bypass and core airflow is moved 1.2 in. farther back, compared with the JT9D, and the blades and stators located behind the splitter are swept back at an angle. The extra space allows more particles to pass outside the core, eliminating 12% of the dirt that enters the compressor on JT9D-7R4 engines.

Particles still entering the compressor can be removed by a bleed port behind the fourth row of low-pressure compressor blades. The 1-in. port catches dirt as it is thrown to the outside of the case wall by the compressor blades and is routed into the bypass airflow. The port eliminates another 8% of the ingested particles.

Pratt & Whitney's effort to increase the stiffness of the PW4000 over the JT9D is evident in the intermediate case area. The vanes separating the low-pressure from the high-pressure compressor were widened and extended as a solid strut to the outer casing. The low-pressure compressor drum is welded into a single piece to add more rigidity and allow tighter blade clearances.

An extra bearing, not present on the JT9D, was added to the section to stabilize and stiffen the front of the engine, Bruner said.

The bearing is located between the No. 1 and 2 bearings on JT9Ds.

"People were used to the numbering for the four bearing locations on the JT9D, so we decided to call the new one a 1.5 bearing to retain the same nomenclature. In other words, the No. 4 bearing location

on the JT9D still coincides with the same bearing on the PW4000."

Pratt & Whitney increased the rotor speed 27% over the JT9D-7R4 by decreasing the diameter of the high-pressure compressor and high-pressure turbine. The increase in rotor speed raised the pressure ratio by 10% and dropped the number of airfoils in the high-pressure compressor by 31%. The use of the second-generation controlled diffusion airfoils also decreased the number of airfoils needed in the compressor, Walter Stahl, PW4000 development engineer, said.

Simplified Case

The compressor section also is designed for stiffness by simplifying the case structure design and electron beam welding the rotors into a solid drum. This improves the gas path sealing and reduces the number of parts in the section, Stahl said.

Within the high-pressure compressor section is a new system to reduce blade clearances during different engine operating conditions. In the past, cool air has been used to shrink the outer compressor case during cruise to improve performance by allowing less air leakage. The new Thermatic rotor drum distributes hot air into the rotor cavity, forcing the blades to expand out toward the case wall seals. The increased stiffness of the engine also allows closer clearance tolerances during takeoff without blade end rubbing problems, Stahl said.

Air is taken from the ninth stage of the compressor and is passed into the rotor during takeoff to expand the rotor and tighten clearances. Hotter air from the fifteenth stage is used to retain the tight clearances when the ninth-stage air is cooler during cruise conditions. Development of hollow ninth-stage stators provided the engineers a way to pass the air from outside of the compressor case into the rotor cavity.

All of the compressor improvements reduce thrust specific fuel consumption by 3.4% from the JT9D-7R4, according to Pratt & Whitney.

Cascade Diffuser

The diffuser/burner section of the PW4000 borrows heavily from PW2037 design. A cascade diffuser supported by 24 struts distributes air to 24 fuel nozzles. The PW4000 burner uses a double pass liner similar to the PW2037, has 60% fewer parts and is 4 in. shorter than the JT9D-7R4 burner. A simplified fuel nozzle also cut 10-20% of the PW4000 burner parts compared with the PW2037 burner section design, Bruner said.

The high-pressure turbine section also gains from the higher rotational speed of the engine. The section contains 43% fewer airfoils and 55% fewer parts than the JT9D-7R4. The high-pressure turbine blades were designed using three-dimen-

sional computer modeling to improve airflow near the blade's base and improve their efficiency. The three-dimensional blades are more complex in shape and are configured to minimize aerodynamic end-wall losses due to clearance leakages (AW&ST June 28, 1982, p. 121).

Pratt & Whitney claims a 3.9% reduction in thrust specific fuel consumption from the diffuser/burner section and the high-pressure turbine section over the JT9D-7R4.

The three-dimensional airfoil design also is used in the blades and exhaust case vanes of the low-pressure turbine section. Pratt & Whitney claims a 1.0% reduction in thrust specific fuel consumption mainly from the improved airfoil design. The section uses 9% fewer airfoils than the JT9D-7R4.

All engine functions are controlled by a digital electronic engine control. The control monitors engine air requirements to the airframe, Thermatic rotor and turbine air control valve scheduling, fuel flow scheduling for idle and transient engine operations, high-pressure compressor vane positioning and oil cooler valve control. The electronic engine control also eliminates engine trimming after maintenance.

The PW4000 will be compatible with mechanical cockpit interfaces as well as the newer electronic cockpits. The engine

is designed to accept mechanical commands from a three-man cockpit and drive analog instrumentation in response. The engine also can accept electrical commands through the electronic engine control and respond back through digital data links when used with electronic cockpits, George Sevich, PW4000 development engineer, said.

Designing the engine to accept both types of control inputs did not force any compromises, since this capability was planned early in the engine's development, according to Sevich.

The decision to produce an all-new engine allowed manufacturing to be included in design integration and in risk versus benefit studies from the beginning of the program, Robert J. Piasecki, manufacturing manager for Pratt & Whitney, said.

"This early involvement in the program will allow us to build the development engine in the same manner as the production engine, basically using production tooling," he said.

Production of the PW4000 will take advantage of computer-aided design and computer-aided manufacturing, composite technology, ring rolling for the combustor liner and lasers for welding, hard facing, blade cooling hole drilling and marking, Piasecki said.

Engine production will be split between

factories in East Hartford, North Haven, Middletown and Southington, Conn., North Berwick, Maine, and the new facility in Columbus, Ga. (AW&ST Aug. 2, 1982, p. 86).

"We are working toward a modular concept with each factory shipping a complete module," Piasecki said. Final assembly of the engine will be done at Middletown.

The initial production PW4000s will be certified at 56,000 lb. of thrust with an overall 7% improvement in fuel consumption. Subsequent versions will be rated from 48,000-60,000 lb. of thrust with an additional 4% improvement in fuel consumption.

"Only modest changes in the high-pressure turbine configuration and electronic engine control are needed to cover the 48,000-60,000-lb.-thrust range," Bruner said. "We do not see any need to go above 60,000 lb. of thrust."

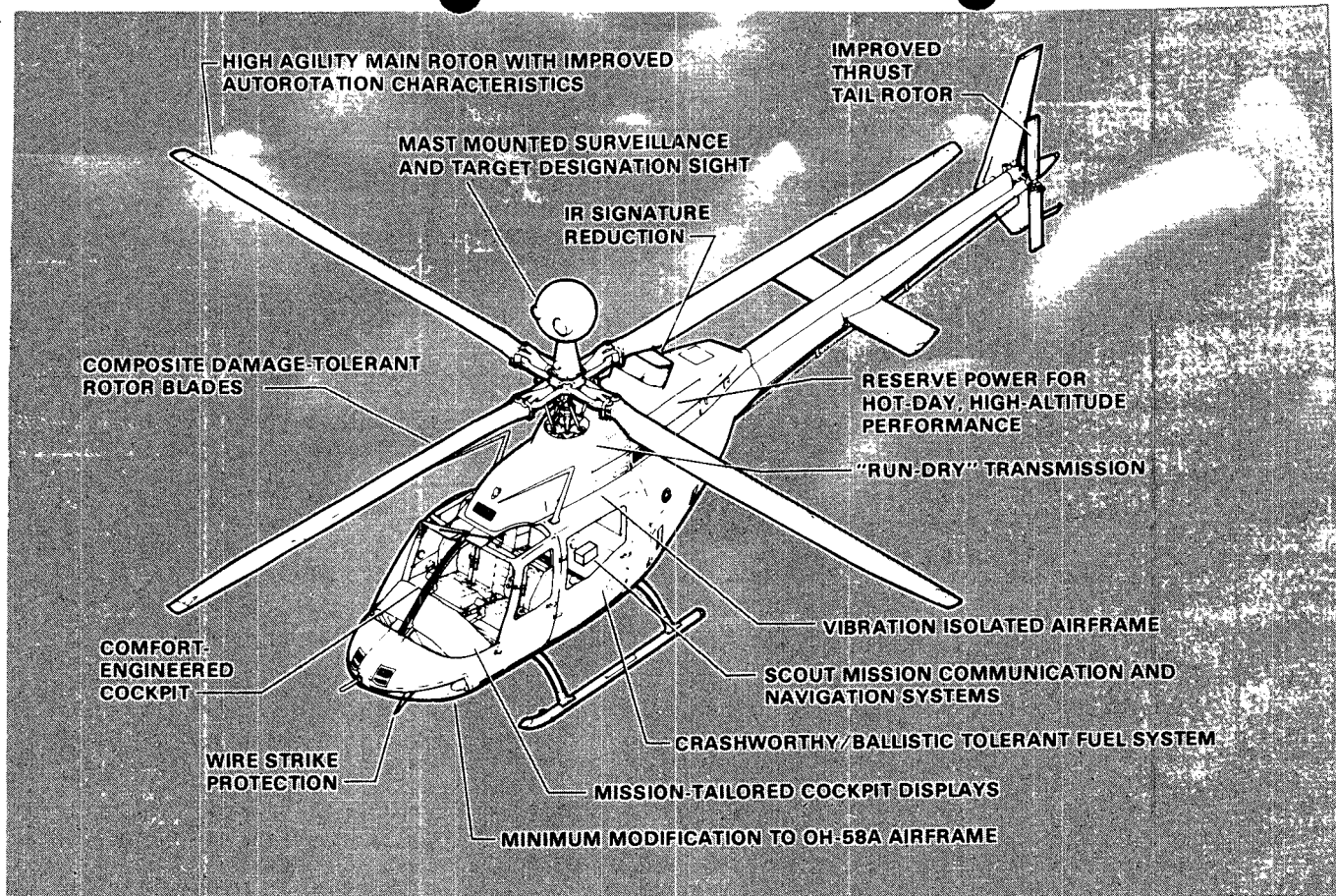
Pratt & Whitney plans to complete all design work by June and conduct high-pressure compressor rig tests from July through November. Low-pressure turbine rig tests are scheduled from March through November, 1984, with the first complete engine test to start in April, 1984. FAA certification of the PW4000 is scheduled for July, 1986, to support the first airline deliveries in 1987. □



Falcon D Tested as Electronic Countermeasures Trainer

Flight Systems/Dassault-Breguet Falcon 20D, configured as an electronic countermeasures training aircraft, is shown during a test flight over the California desert. The Flight Systems-initiated development is aimed at providing airborne electronic warfare and countermeasures training for U. S. and allied naval, ground and air forces under flight service contracts (AW&ST Feb. 14, p. 13; Oct. 11, 1982, p. 111). The leased Federal Express Falcon 20D carries programmable, computer-controlled communications and radar jamming equipment. External modifications include ultra and very high frequency radio antennas on the forward and aft lower fuselage for disruptive communications transmissions; D-, G-, I- and J-band radar electronic countermeasures antennas located in the nose radome, and aft-

coverage air-to-air radar jamming antennas in the canister-like radome mounted below the vertical stabilizer. An on-board Hewlett Packard 85 microcomputer tailors and controls transmissions of radar and communications electronic warfare signals produced by a company-designed wave function generator, emulating techniques and modes used by Soviet jammers. Following a brief test program, the aircraft will conduct countermeasures training for U. S. and Canadian military exercises scheduled for this summer, attempting to penetrate allied defense networks. Flight Systems plans to upgrade the Falcon's countermeasures capabilities to simulate coherent radar jammers that threaten U. S. Air Force/McDonnell Douglas F-15 and USAF/General Dynamics F-16 fighter aircraft.



Modifications being made to the Bell OH-58 in the Army's Helicopter Improvement Program include composite damage-tolerant rotor blades.

Helicopter Plan's Success Keyed to Control of Cost

By J. Michael Hoferlin

Washington—Cost control may be key to any Army success in completing its Helicopter Improvement Program (AHIP) to develop the Bell OH-58D Scout.

Program costs have gone in less than three years from an initial estimate of \$1.3 billion to \$2.7 billion with a drop in planned aircraft procurement from 720 to 578. Because aircraft capabilities have not been tested, the General Accounting Office believes additional cost increases can be anticipated.

Army officials said they have contained costs within the ceiling price by negotiating a fixed-price incentive contract for the full-scale engineering development phase of the program despite a rise in target costs of almost \$3.1 million during the first 13 months of the contract.

Ceiling price options for the first two production buys of 16 and 44 aircraft also were negotiated to control costs further, they said.

The OH-58D is intended to give the Army a reconnaissance and standoff tar-

get acquisition capability in daylight, night and adverse weather conditions. It will have a basic OH-58A airframe with modifications to include:

- A McDonnell Douglas/Northrop mast-mounted sight above the main rotor.
- A four-bladed glass fiber composite main rotor and composite main rotor hub.
- An upgraded drive system with a 435-hp. main transmission.
- An upgraded 110-hp. tail rotor drive system.
- Vibration isolation pylon mounting system.
- Two Allison 250-C30P 650-shp. type engines.
- Provisions for mounting a multipurpose lightweight missile system.
- Improved nap-of-the-earth flight characteristics and communications and navigation avionics.
- Survivability equipment, including a radar warning receiver and infrared suppressor.

Army doctrine calls for using the OH-

58Ds in conjunction with either Hughes AH-64 or Bell AH-1S attack helicopters. The OH-58Ds would seek out and target enemy vehicles and positions with mast-mounted laser designators. Attack helicopters then would destroy the targets. The Scout helicopters also would be able to "guide" certain missiles to their targets as well as designate targets for fixed-wing aircraft or artillery.

"This will be our first true scout helicopter," one Army officer said. "Most of the aircraft we have so far are really observation helicopters performing scout roles."

Unlike the others, he said, the OH-58D has improved communication and target acquisition capability plus the ability to meet performance requirements calling for hovering out of ground effect at 4,000 ft. on a 95F day. The aircraft's endurance is estimated at 2.4 hr.

Among uncertainties cited by the GAO report is development and testing of the mast-mounted sight, which incorporates sensors for automatic tracking, rangefinding and laser target designation.

The sight housing is to be 25 in. in diameter and mounted about 30 in. above the main rotor, giving the helicopter increased survivability by allowing it to hide behind terrain features while performing its mission. The sight will be used as a periscope to see and acquire targets with-

out the helicopter airframe being exposed to enemy radar or weapons.

The Army and GAO differ on financial and safety risks imposed by the sight.

The Army said basic sight components are "repackaged proved designs" and are low risk. The GAO cites the mechanical integration of components in the thermal, space and weight restrictions of the sphere as a "major risk contributor." GAO also cites a contractor analysis showing internal bearing isolators as having "inadequate fatigue life" by failing after only 200 hr. instead of the 4,500 hr. required by the Army.

Redesigned Material

Since that analysis, isolator material has been redesigned and changed to meet Army requirements, the GAO said. Integration of sights and airframes is to begin in July with operational flight testing scheduled for October.

Success in utilizing the sight depends largely upon a pilot's ability to hold a precise hover. According to a 1982 Army study, this hover creates a high pilot workload. As a result, the GAO recommends that an altitude hold and hover system be considered.

Requirements for a system have not been defined, but Bell officials have proposed one that would take inputs from the Doppler and attitude heading and reference systems and feed them to the existing stability control augmentation system to provide heading control. Provisions for altitude hold are not proposed. The radar altimeter is not part of the system.

A program official said that when the cockpit was designed attention was given to reducing crew workloads.

"If we find during any development or operational testing that we need that [altitude and hover system], we can go back and retrofit," he said. "It would take money but not that much time."

Missile Capability

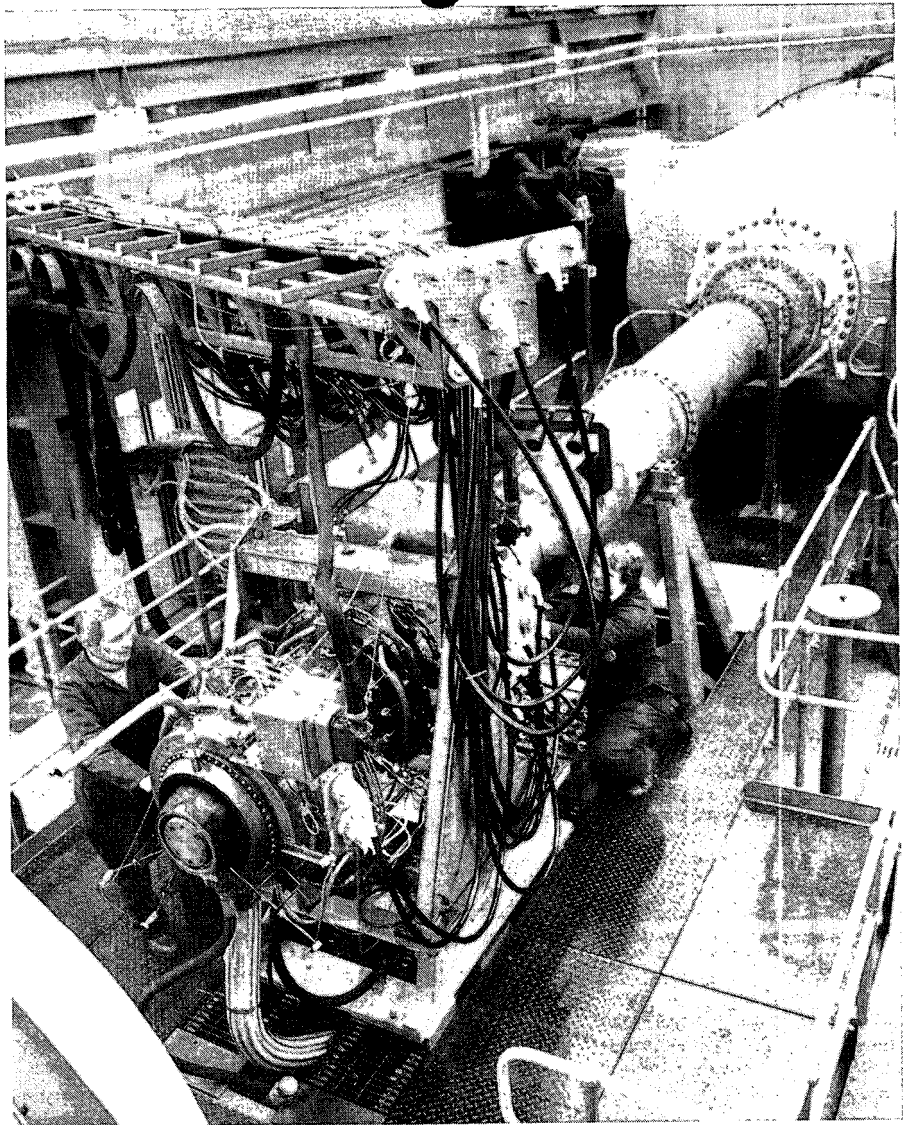
Army officials are interested in equipping the OH-58D with air-to-air missile capabilities in the future, although no funds have been requested. An estimated \$44 million would be needed to develop a weapon system using a lightweight version of General Dynamics' Stinger missile.

Inclusion of a Stinger package, officials believe, would greatly enhance survivability of both the scout and attack helicopters. Soviet Hind attack helicopters have air-to-air capabilities.

The Army determined that the 100-lb. infrared night vision system in the AH-64 is too heavy for the OH-58D. Therefore, night vision goggles are to be used by Scout pilots.

The GAO said current goggles are light amplification devices and require some ambient light to be effective.

This incompatibility of systems, it said,



Rolls-Royce Installs Engine Core Testbed

Technicians at Rolls-Royce, Ltd., Bristol, England, work on the core of a Turbo-Union RB. 199 turbofan during commissioning of a new test plant. The computer-controlled test facility can record up to 500 core parameters and simulate realistic entry-air conditions. X-ray imaging system permits engineers to observe behavior of internal components while the core is rotating.

could preclude certain joint night operations.

Army officials disagree. They said existing goggles are adequate.

Another area of disagreement between the Army and GAO concerns the Army's 1980 cost estimate of \$1.3 billion for 720 aircraft. The GAO considers this estimate "very significant."

Defense planners told GAO such estimates "should not be given too much credence" because they were made prior to the definition of the AHIP/Scout configuration and were for an aircraft with limited capability. That aircraft was to use existing engines, drive trains, avionics, rotor systems and minimum range sights.

Army officers said such an aircraft simply could not meet mission or performance requirements. Performance require-

ments and program definitions changed in July, 1980, to enable the OH-58D to operate in a nap-of-the-earth environment with full mission payloads in hot or cold weather.

Consequently, the engines and power trains were upgraded, and new main and tail rotors were required along with expanded testing. As a result, program costs increased about \$357 million.

In Fiscal 1981, the Army made configuration changes and extended the procurement program by two years, which increased cost to over \$2 billion. The aircraft to be purchased decreased from 720 to 578. By October, 1982, total estimated program costs were \$2.7 billion.

The GAO said cost growth has decreased since the Army "fully defined system requirements." □

CASA/Nurtanio CN-235 Aircraft Nears

By Jeffrey M. Lenorovitz

Seville, Spain—First of two CASA/Nurtanio CN-235 commuter transport flight prototype aircraft is in final assembly here as the Spanish/Indonesian cooperative program moves toward initial flight this October.

The aircraft manufactured at CASA's Seville-Tablada plant will be joined by a Nurtanio-built prototype in Indonesia for a 12-13-month flight test and certification program. This is expected to lead to start of CN-235 deliveries in late 1984.

CASA and Nurtanio also are building one additional preproduction airframe each for use in ground test activities. The Spanish unit will be used mainly for static testing and also may perform some fatigue work. The Indonesian airframe will be dedicated to fatigue tests.

The CN-235 is a program shared by the two companies on a 50-50 basis. They have formed an organization called Airtech Industries to act as the program's central management group.

Production tasks for the twin-engine turboprop transport will be divided between the two companies, and final assembly lines will be established in Spain and Indonesia.

Program plans call for combined production to reach eight CN-235s a month two and one-half years after first aircraft

delivery. Four units a month will be produced at CASA and four at Nurtanio facilities. The CN-235 project follows a separate effort in which Nurtanio is producing the CASA-designed C-212 transport under agreement with the Spanish company.

Nurtanio has assumed a greater role in the CN-235 because it is participating with CASA in design and development from program inception. This is part of an Indonesian plan to develop a complete design, development and production capability for its government-run aerospace industry (AW&ST Apr. 19, 1982, p. 68).

CASA officials said the overall CN-235 program remains on schedule. Simultaneous rollout ceremonies for the two flying prototype aircraft in Spain and Indonesia are targeted for late August or early September. The ceremonies will be held at CASA's Getafe plant near Madrid and Nurtanio's facility at Java's Bandung air force base.

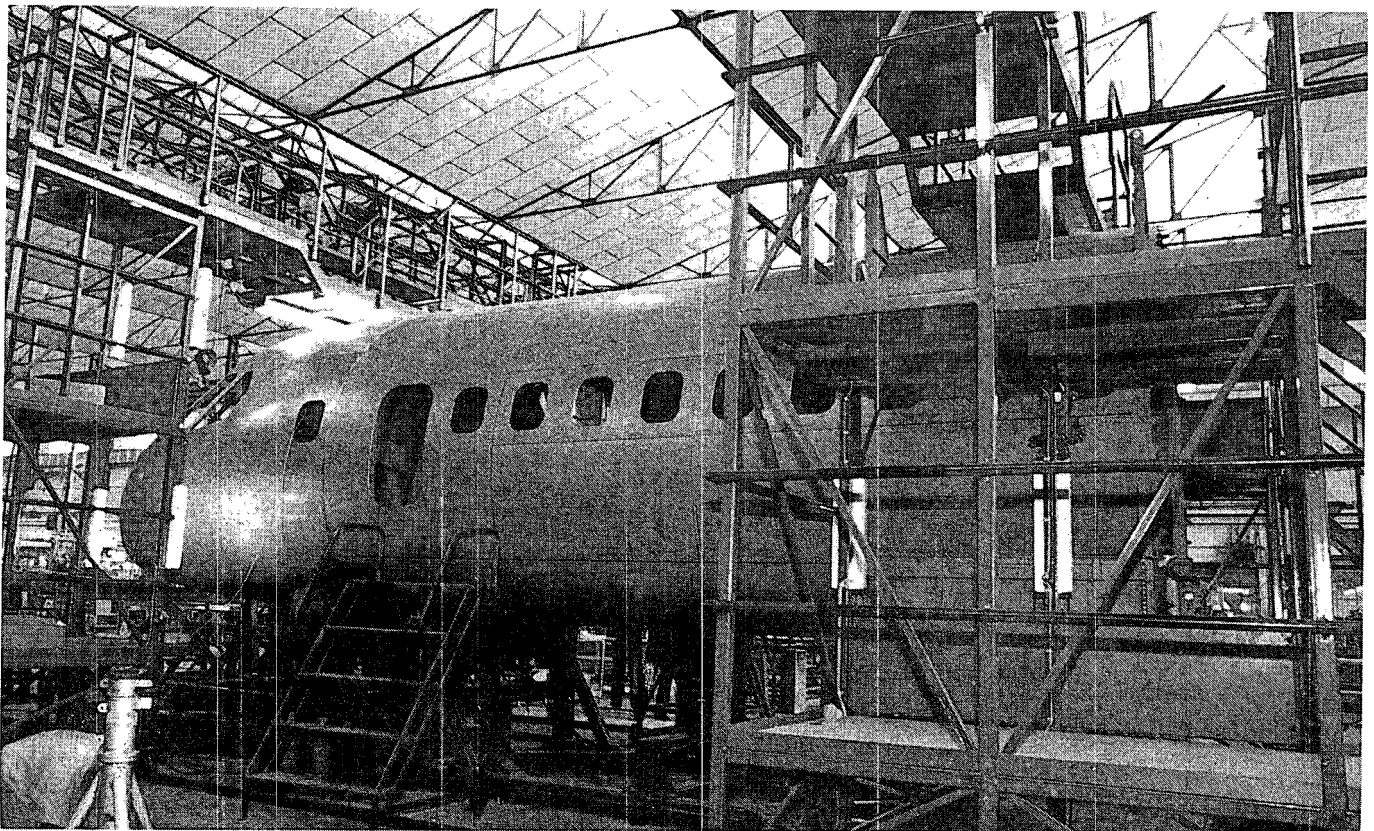
Nurtanio's portion of CN-235 development has had some delays, and the manufacturer is being supported by a concentrated CASA assistance program. A review was held recently to evaluate current program status in both Indonesia and Spain. The Nurtanio effort had fallen about two months behind at one point,

program officials said. Despite the delays, CASA management said the young Indonesian industry is demonstrating its ability to handle the new aircraft program and has shown technical competence.

Orders for the CN-235 stand at 104 firm and 18 options. The majority are booked with customers in the Spanish and Indonesian home markets. Sales price for a fully equipped 39-passenger version was set at approximately \$4.6 million in 1982. The 1983 price has not been set, but any increase is expected to be 10% or less from last year's level.

CASA officials said they have been satisfied with the number of orders booked to date, although sales efforts have been affected by the slowdown in worldwide commuter regional airline markets. The organization is working to establish an identity as a new-generation transport producer in key markets such as Europe and North America.

A CN-235 sales operation is being organized in the U. S. that will include establishment of an office in Washington, D. C. CASA exhibited a CN-235 mockup at the Regional Airlines Assn. meeting last December (AW&ST Dec. 13, 1982, p. 40). This was followed by a briefing in January for airline executives held at General Electric's aircraft engine business group fac-



Completion

tory in Lynn, Mass., where the CN-235's CT7-7 engine is assembled (AW&ST Feb. 14, p. 123).

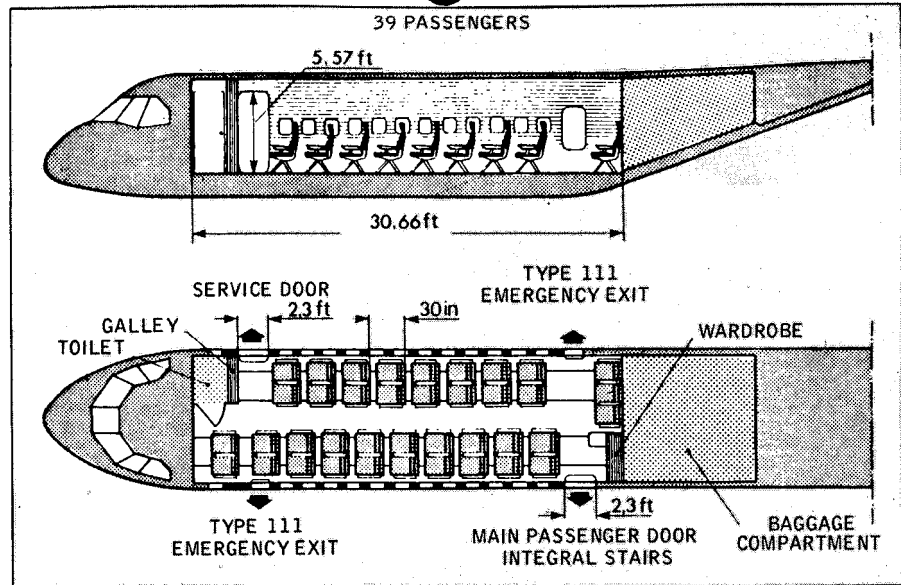
CASA is stressing that it already has a presence in the U. S. market through the sales of the company's C-212 transport, which is operated by six North American regional operators.

Flight test program for the CN-235 is expected to accumulate a total of about 1,000 flight hours on the Spanish and Indonesian prototypes. Flight time will be divided about equally between the two aircraft. The CN-235 will be certified to Federal Aviation Regulations Part 25 standards.

At least one CN-235 will be delivered by CASA to an airline customer in late 1984. This will be to Aviaco, a Spanish commuter carrier. Other deliveries will follow in the final weeks of 1984 or in early 1985.

No full-scale engineering mockup of the CN-235 is to be built by CASA or Nurtanio. An engineering mockup of the cockpit section will be developed to study avionics and wiring installation, and the CASA static test airframe also will handle some engineering mockup duties, according to program officials. A mockup of the engine nacelle also is being produced.

Fuselage of CASA's CN-235 flying pro-



Standard configuration for the CN-235 transport accommodates 39 passengers in seating with 30-in. pitch. The cabin is to be fitted with overhead luggage bins, and additional baggage can be placed in the compartment aft of the rear cabin bulkhead. CASA is developing a special luggage container to fit in the aircraft's rear baggage compartment.

totopype is being assembled at the Seville-Tablada plant and will be shipped north to Getafe, where the flight development activity will take place. Mating of the prototype's wings and empennage will be done in a new development/test hangar built at Getafe to support the CN-235 program.

The full-scale production effort will be centered at Seville. Assembly work will be

done at the Seville-Tablada plant, and components will be trucked to the nearby Seville-San Pablo facility for final assembly and flight acceptance.

Construction work on two new buildings has begun at Seville-San Pablo for the CN-235. One will house the final assembly line, and the other will be for aircraft painting. CASA currently has its C-212 assembly and flight acceptance activities at Seville-San Pablo.

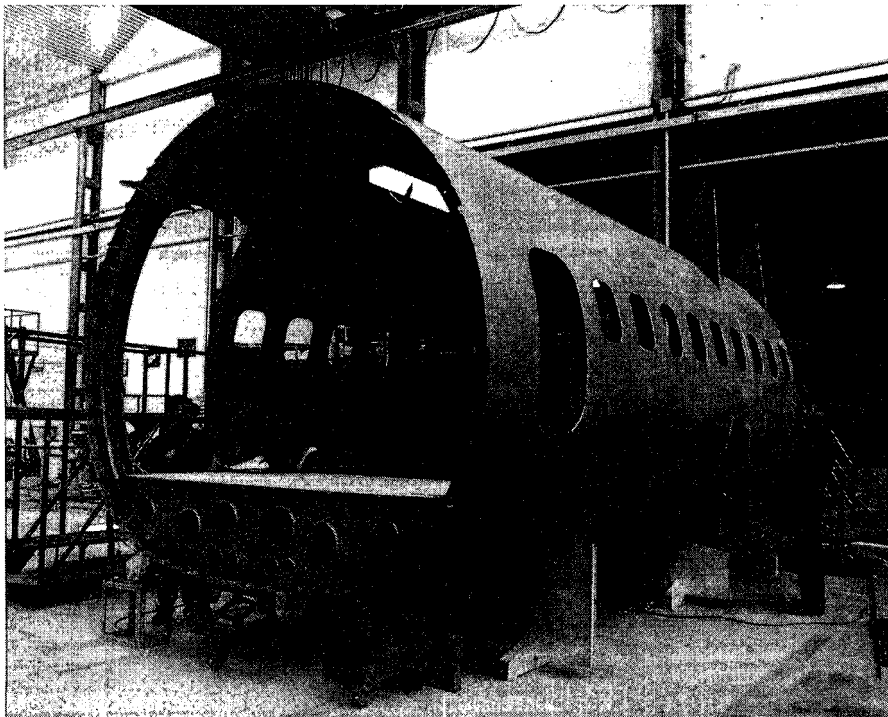
Basic flight and performance data for the CN-235 are being verified in the flight test program. Maximum ramp weight for the aircraft is estimated at 28,769 lb., and maximum takeoff weight is targeted at 28,659 lb. Maximum landing weight is set at 28,218 lb., and the estimated zero fuel weight maximum is 26,013 lb. Operating empty weight is 18,132 lb., and maximum payload weight in the passenger configuration is 7,881 lb.

Program officials said the initial airframes produced appear to be consistent with these weight projections.

Range with maximum payload is set at 430 naut. mi. This calculation is made at maximum cruising power at cruise altitude and with instrument flight rules fuel reserves. Maximum cruise speed is estimated at 245 kt.

The pressurization system is being designed at 3.6 psi., giving the aircraft a ceiling limit of 18,000 ft. The cabin will be pressurized to an equivalent altitude of 8,000 ft. Pressurization may be increased to 4-4.5 psi. based on the results of static testing, according to Pedro Martinez, CASA's CN-235 marketing manager.



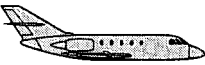

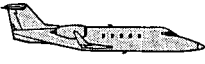

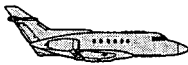

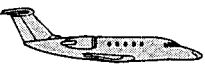

An important factor in the decision to set pressurization at 3.6 psi was the capability to retain the CN-235's large rear



Fuselage for the CASA/Nurtanio CN-235 turboprop transport takes shape at CASA's Seville plant (above). Two airframes are being built. One will be used for static testing; the second will become the Spanish flying prototype CN-235. Nose section (left) has been mated to the airframe. The outer wings, aft fuselage and tail section are being built by Nurtanio in Indonesia.

The small, economical business jet has served its historical purpose.

It led to the big, economical business jet.

	Cabin Width (Centerline)	Cubic Feet	Maximum Payload	Range (With NBAA/IFR Reserves and 5 Passengers)
 Challenger 600	 8 ft., 2 in.	1,150 ft.	7,830 lbs.	2,800 NM
 Falcon 200	 6 ft., 2 in.	700 ft.	4,130 lbs.	2,225 NM
 Learjet 55	 5 ft., 11 in.	400 ft.	2,470 lbs.	2,040 NM
 Hawker-Siddeley 125/700	 5 ft., 11 in.	604 ft.	2,050 lbs.	2,220 NM
 Citation III	 5 ft., 8 in.	438 ft.	2,072 lbs.	2,100 NM

at the centerline. Two feet wider than the Falcon 200. Two feet, three inches wider than the Learjet 55 and the Hawker-Siddeley 125/700. And two feet, six inches wider than the Citation III.

As for range, it is entirely arguable that the Challenger 600, with its 2,800 nautical mile NBAA/IFR range, is the only real transcontinental corporate jet in the lot, capable of making NY-LA non-stop with unflinching reliability. Not to mention a full passenger cabin.

Or fly New York to Detroit to St. Louis to Pittsburgh and back to New York without having to refuel, and with NBAA/IFR reserves in the tanks.

So, you can struggle along in a cramped, limited-range, limited-passenger aircraft that happens to look inexpensive to run.

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To find out more about the honestly transcontinental Canadair Challenger 600, just call Mr. James B. Taylor, President of Canadair Inc. His telephone number is (203) 226-1581.

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When you send executives across the country to negotiate a deal, or inspect a property, or handle an emergency, or otherwise conduct business on behalf of the stockholders, the purpose of sending them via privately owned and operated aircraft is obvious:

To move them with maximum speed and a minimum of physical and mental discomfort, so they can function better en route and, more importantly, once they arrive.

What has become equally obvious over the years is that the very aircraft they are sent in tend to defeat that purpose.

The cabins are too small, the engines are too small, the thinking is too small.

Conventional transcontinental corporate jets may be woefully inadequate, but not willfully so.

Most are simply hostage to the thinking and technology of the sixties, when the original versions of these aircraft were first designed and built.

Back then, you could not have

a big, comfortable passenger cabin without big, fuel-guzzling engines to go with it. You could not have decent transcontinental range without a mailing tube for a fuselage and a good, stiff wind at your back.

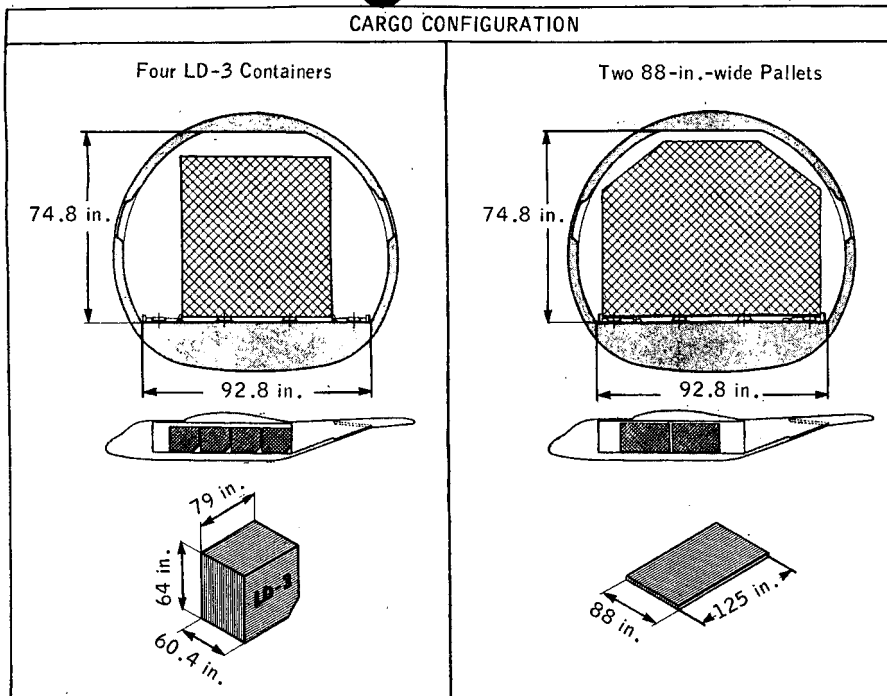
Since such shortcomings were literally designed into the aircraft of that period, there seems little sense in trying to overcome those shortcomings with what are essentially those same aircraft.

Particularly when you consider what modern technology has wrought in the interim.

The Canadair Challenger 600. Now you can operate a big transcontinental corporate jet for little more than the cost of a small transcontinental corporate jet.

The Canadair Challenger represents nothing less than a decade-and-a-half leap in technology. Resulting not just in an extremely economical aircraft, but one that contains a passenger cabin eight feet, two inches wide





All-cargo configuration of the CN-235 transport can carry four LD-3 containers or two 88 × 125-in. pallets. The aircraft's cabin interior length is 30 ft. 8 in.

cargo door. "The cargo door is an important feature for CN-235 operators, civil and military," Martinez said. "We wanted to make sure the door was part of the basic aircraft design without the weight penalties we might face with higher pressurization."

Martinez said average stage length for the CN-235 is estimated at 200-300 naut. mi., and operators wanting to optimize the aircraft's efficiency would not want to fly higher than 18,000 ft. in their normal operations.

CN-235 Suppliers

Seville, Spain—Following is a list of major suppliers for the Spanish/Indonesian CN-235 commuter transport program:

- General Electric CT-7-7 turboprop engines
- Hamilton Standard Propellers
- Hamilton Standard Air-conditioning
- Garrett Pressurization
- Collins Avionics package
- Fairchild Cockpit voice recorder/flight data recorder
- Telephonics Interphone/public address
- Lord Corp. Engine isolation system
- Teleflex Aerospace Powerplant control system
- Dowty Rotal Flap actuating system
- Messier-Hispano-Bugatti Landing gear
- Dunlop Brakes, antiskid, tires
- Kratos Engine indicators
- Revue Thommen Flight indicators
- Auxilec Starter generator
- Grimes Exterior lights

"Even if the average stage length for the aircraft grows after the CN-235 is in service for several years, the 18,000-ft. ceiling still is a good target for optimizing the aircraft's performance," he said.

The rear-door configuration is patterned from the design used on CASA's unpressurized C-212 transport. The door's bottom portion deploys downward from the CN-235 fuselage, providing a 119.7 × 92.5-in. ramp. The upper door segment activates upward inside the fuselage. This arrangement will enable the CN-235 to handle LD-3 containers and 88-in.-wide pallets.

Cabin interior length is 30 ft. 8 in., and volume is 1,478 cu. ft. Maximum cabin width is 8 ft. 10.2 in., and floor width is 7 ft. 9.1 in. Maximum cabin loading dimensions are for a width of 88 in. and a height of 52 in. In an all-cargo configuration the CN-235 can handle four LD-3 containers or two 88 × 125-in. pallets.

Standard configuration accommodates 39 passengers at 30-in. seat pitch. The majority of rows in this configuration are arranged 2-2 with a central aisle. A final row of three seats is positioned against the rear cabin bulkhead.

Standard CN-235 cockpit instrumentation will include four 5-in. cathode ray tube displays. The pilot and copilot's position will be fitted with two displays each. One will function as the ADI (attitude director indicator), and the other will be the HSI (horizontal situation indicator).

Basic avionics package is with Collins equipment. It includes the APS 65 autopilot that CASA hopes to certify for Category 2 landings on the CN-235. □

MONITOR MONITOR MONITOR MONITOR

- AC/DC voltage levels
- FREQUENCY drift
- PHASE angle shift, unbalance, loss, reversal

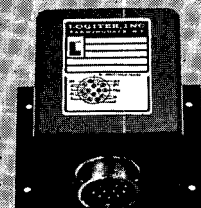


Boeing 757, 767 instrument panel

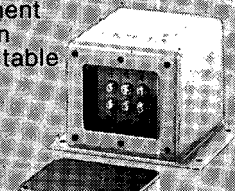


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IRAS Detecting Spectral Colors Of Elements in Distant Galaxies

London—Infrared telescope and other detection instrumentation on the Infrared Astronomical Satellite (IRAS), launched Jan. 26 from Vandenberg AFB, Calif., are demonstrating sufficiently high resolution to enable the satellite's radiation spectrometer to display radiation lines of individual elements clearly.

Spectrum lines of both sulphur and neon 3 have been observed in radiation from distant galaxies. One of the concerns of the science team was that the system's resolution would not permit individual traces of elements to be clearly detected.

"Spectrum lines of neon 3 are very sharp," Professor Dick Jennings, one of the resident astronomers at Rutherford Appleton Laboratories, Chilton, England, said.

Since it is known how much energy is required to produce neon 3, the gas's detection indicates the temperature of the star radiating it and the amount present in the star's makeup, he said.

Although the satellite has so far completed about 16% of its work in surveying the sky, the data have been analyzed only on a sample basis. Jet Propulsion Laboratory in Pasadena, Calif., is processing the data, and techniques are still being developed and tested there.

Science team members at Chilton indicated that to prevent costly delays through the use of incompletely developed processing techniques, data from a sample area of the sky was being used to refine the techniques before work on the rest of the data was begun.

At Chilton, the data acquisition process is being monitored to insure that each scan of the sky produces the required data, or to rescan an area quickly if the scan is in some way deficient. Several rescans may be necessary to obtain the data that would have been obtained in the original scan, Jennings said, since the movement of the satellite would require several passes to cover the same area covered by the first.

Also, some of the instrumentation in the spacecraft and on the ground is still being calibrated.

Mapping of the entire sky is expected to take slightly more than six months from the time the first mapping scans were made on Feb. 10 (AW&ST Feb. 28, pp. 21, 59).

Chopped photometric channel (CPC) instrumentation contained in the Dutch Additional Experiment (DAX) package, which also is carried on the IRAS, is producing infrared maps of approximately nine arc-minutes by nine arc-minutes, a greater spatial resolution than is possible with the survey instrumentation used to map the sky.

These maps are being made from observations centered on known astronomical objects, which permit the infrared map to be compared to photographs of the same area taken through an optical telescope.

Each of the observations being taken by the DAX is presented in two radiation bands—50 microns and 100 microns—to enable further comparison.

Initial observations were taken of galaxy NGC 891, which is located about 15 million light years from Earth, and of an area within

Space Technology

Center Set for Soviet Space Monitoring

By Craig Covault

Colorado Springs, Colo.—Space Command's Space Defense Operations Center buried within Cheyenne Mountain here is maturing to a point at which the facility can play a strategic warning role by monitoring Soviet space activities that may indicate possible hostile Soviet activities on Earth.

"The strategic warning value of space systems is a primary factor that we need to exploit," USAF Col. Gerald M. May, director of space operations for Space Command, said. "We need to better understand how this would fit into our decision-making process—make a determination of what we see and if we can, make a judgment on Soviet intent. We would then try to marry that with all of the indicators we see in the spectrum of activities we see worldwide.

"Space is not all that esoteric, it has tactical and terrestrial value," May said.

The Space Defense Operations Center (Spadoc) is a command post with computer consoles upon which can be displayed geographic and digital data on the ground track and condition of all spacecraft tracked by North American Aerospace Defense Command. Intelligence officers and their computer displays are also positioned in Spadoc, as is a status board

denoting the condition of virtually all U. S. defense and government civil spacecraft and key ground stations.

The objective is to have one point at which the status of all U. S. space assets and the intent of Soviet systems can be monitored and warnings issued to U. S. space operators if necessary (AW&ST Feb. 8, 1982, p. 21).

In order to have such interaction with the spacecraft operators, Space Defense Operations Center personnel have been negotiating interaction agreements on all U. S. government-operated spacecraft. Six agreements have been signed, five are close to being signed and 11 others are still in negotiation. One other planned agreement process has not yet begun, while two others have some differences that need to be worked out between Space Command and the operator before they can be implemented.

Space Defense officers said they have been limited by the amount of manpower assigned to working out these agreements and wish Space Command would place a higher priority on the work. The current number of signed agreements is only two more than last year at this time.

The agreements resulting from these negotiations result in procedures on how the

spacecraft operators and the Space Defense Operations Center personnel will exchange data on a day-to-day basis or in circumstances where a spacecraft malfunction or hostile act has occurred.

One recent example of this interaction occurred Nov. 25, 1982, when the GOES 4 geosynchronous orbit weather satellite operated by the National Earth Satellite Service had a serious imaging system malfunction (AW&ST Dec. 6, 1982 p. 26).

As soon as spacecraft ground controllers detected a problem on the spacecraft, positioned over the Pacific Ocean, they went into routine failure analysis procedures and informed the Space Defense Operations Center here about the problem. The timing of the failure in relation to the position at that time of low-altitude Soviet spacecraft or other Soviet platforms capable of carrying laser weapons systems was assessed to be sure no hostile act had caused the failure.

In reality it provided a good simulation of what would become a more important assessment in a time of international tension. Other spacecraft malfunctions have been reported and assessed in a similar manner.

Commercial spacecraft have not yet been included in the process for such in-

the Milky Way galaxy, centered on the constellation Perseus.

NGC 891 is a spiral galaxy but is viewed edge-on from Earth. Optical photographs show black clouds of gas absorbing the light emitted by the stars composing the galaxy.

The infrared observations, however, show that the black clouds are actually emitting infrared radiation. The clouds are believed to be molecular hydrogen that is being warmed by stellar radiation from the galaxy and is then emitting the energy absorbed in the infrared spectrum.

Observations of areas in Perseus have found several sources of infrared emissions not previously known.

These are thought to be from newly formed stars, which are believed to emit large amounts of infrared energy. The area surveyed is believed to be an area in which stars have recently formed and in which they may still be forming.

The IRAS science team believes the satellite may be able to discover stars that have escaped detection by radio astronomy, as well as provide data on the development and behavior of new stars.

teraction because the Defense Dept. has been unable to determine how commercial spacecraft would interact with the military in a crisis situation or how to provide spacecraft survivability measures to commercial spacecraft without a multimillion-dollar federal funding program.

The operational Soviet antisatellite system, using spacecraft launched on SL-11 boosters into co-orbital trajectories with target spacecraft, is a primary concern in the Space Defense Operations Center. Whenever such a mission is launched, even if it appears the Soviets are going after one of their own target spacecraft, the center here alerts all U. S. satellite operators with vehicles in orbits that could be reached by the Soviet Asat as it flies its mission.

In this same vein, the maneuvers of all Soviet spacecraft are called to the attention of Space Defense Operations Center personnel so the relative geometry of the Soviet spacecraft making the maneuver can be assessed against the positions of U. S. spacecraft. The Spadoc also will be the primary command center for U. S. antisatellite weapon operations using a Vought miniature vehicle launched on a McDonnell Douglas F-15.

The highest priority cross-monitoring of positions between Soviet and U. S. spacecraft is done for USAF imaging reconnaissance satellites on a day-to-day basis and with the space shuttle whenever a manned flight is in progress. It has been only within the last year that the management structure at NORAD and more recently Space Command has begun to realize the value of assessing Soviet space actions,

especially antisatellite activity, as a possible indicator of Soviet actions on Earth.

"The management structure was not familiar with operating under the occasion where you might have something happen to a U. S. satellite," one Space Command officer said. Now NORAD exercises simulating an escalation of conflict include actions against U. S. spacecraft as part of the simulations.

The importance of the Space Defense Operations Center in shuttle operations also has become apparent to Space Command officers now that the organization has been involved in five shuttle missions. The workload here increases significantly during a shuttle mission to maintain closer monitoring of possible accidental collision hazards with orbital debris and also to keep an eye on Soviet spacecraft or ground facilities that could pose a threat to the manned orbiter.

"Being totally dedicated to a four-orbiter fleet is a pretty slim amount of resources, and it is something that we have to protect and preserve," May said.

"Seeing the kinds of conjunctions that have occurred between space shuttle and other objects in space makes us realize just how fragile it is," he said. The closest such conjunction was a Soviet rocket body that passed within a few miles of the orbiter during shuttle Mission 4. As space traffic increases, Space Defense Operations Center personnel believe they will

take on more of a service role in addition to their space defense role.

"In order for us to keep everything separated in space, we are going to become the traffic cop," May said. "I don't see any other nation coming forward to do that so it will rest with us. New computational and surveillance capabilities are going to be required on our part to do it."

The increased demands on NORAD/Space Command space tracking and intelligence activities have resulted in a more conservative approach now.

"There was a time we thought we could do about anything when it came to tracking vehicles in space," he said. "As the years have gone by, we have become more familiar with the capabilities and limitations of our tracking network. We have become very conservative over the past few years to say maybe we are not as good as we used to think we were. Now we say, 'Let's be very careful about how we go about calculating satellite positions, let's be sure we know what we are talking about because we are going to be providing some very sensitive data and we are going to be asked to provide some very accurate parameters on the locations of vehicles in space.'

"We were very flamboyant when we got into the space business, but not any more. Now we know the Soviets have an antisatellite system that can cause a lot of damage and trouble." □

USAF Selects Shuttle Ice Deterrent

Los Angeles—Air Force has decided to use a ducted hot air system to deter ice buildup on the space shuttle external propellant tank when scheduled shuttle launch operations begin at Vandenberg AFB, Calif., in late 1985. The heated air probably will be provided by jet turbine engine exhaust, program officials said.

Air Force officials said icing on the large external tank could pose a problem at Vandenberg prior to shuttle launches because of weather conditions at the West Coast base, located about 140 mi. northwest of Los Angeles.

The heater system, as currently envisioned, could include two turbine engines located to the side of the launch pad, with engine exhaust ducts running up through the launch mount to direct the hot air on the bottom of the shuttle propellant tank. The planned system does pose some environmental concerns, however, due to the exhaust products that would be emitted during the approximately 5 hr. of engine operation before launch.

A solar heating system had been discussed earlier as a possible alternative to the presently planned unit.

Project officials also had considered an electrical system, but it was determined that it would use excessive power.

Recent heavy rainstorms along the Southern California coast have not affected construction activities at Vandenberg significantly, although there has been some erosion and runoff from a hill directly east of the shuttle launch pad area. Program officials said the runoff has not been a serious problem and that plans made previous to the recent storms called for stabilization of the hillside following completion of site construction.

The 7,000-ft. extension to the north end of the Vandenberg runway in preparation for space shuttle landings has been completed, while construction of the orbiter maintenance and checkout facility structure is scheduled to be completed in about two months. The payload preparation room is about 85% complete.

A large weather shelter designed to enclose the shuttle on the launch pad when combined with the mobile service tower will be constructed in a joint venture of Raymond Kaiser Engineers and the Kaiser Steel Corp. The \$34-million contract for the project was awarded by the Army Corps of Engineers.

General Electric Wins Fuel Antimisting Contract

Federal Aviation Administration's Technical Center has awarded a \$2-million contract to General Electric Aircraft Engine Business Group for the design, manufacture and testing of a prototype antimisting fuel degrader.

The modified high-speed centrifugal pump would operate ahead of the fuel pump in an aircraft fuel system to retard the action of polymer fuel additives that cause fuel droplets to form instead of a fine mist when fuel tanks are ruptured during a crash and airflow strikes the fuel.

Such additives have stopped the propagation of fire within clouds of fuel particles, but would be unsuitable for use in a gas turbine engine without a degradation of properties (AW&ST Mar. 23, 1981, p. 69).

Garrett AiResearch as subcontractor will build and bench-test five prototypes using the General Electric design.

Flight tests are scheduled for this year and early next on one engine of a Convair 880 to be provided, converted and flown by General Air Services, which is located in Miami, Fla.

The remaining four degraders will be installed on the center's Boeing 720 scheduled for a remotely piloted, full-scale crash test with antimisting fuel in mid-1984 at Edwards AFB, Calif. (AW&ST Aug. 3, 1981, p. 13).

Management

Bill Introduced to Relax Overseas Bribery Law

Washington—A bill to relax U. S. overseas bribery law and to make it part of an existing export control statute has been introduced in the House of Representatives by Rep. Daniel A. Mica (D.-Fla.), a member of the House Foreign Affairs subcommittee on international economic policy and trade.

Mica wants to revise the 1977 Foreign Corrupt Practices Act, which prohibits U. S. companies from paying foreign government officials to obtain or retain business, and to consider incorporating it in the Export Administration Act of 1979, which is now up for congressional renewal (AW&ST Mar. 7, p. 14). The export act empowers the President to control exports for national security and foreign policy reasons through licenses and trade sanctions.

The Reagan Administration has long sought an amended bribery law, agreeing with business officials that the existing law is poorly defined, difficult for business to understand and interpret, and a detriment to trade (AW&ST May 25, 1981, p. 22).

The Senate amended the legislation two years ago, largely in accordance with White House thinking, but the House never acted because Rep. Timothy E. Wirth (D.-Colo.) held the bill in the House Energy and Commerce subcommittee on telecommunications, consumer protection and finance, of which he is chairman (AW&ST June 14, 1982, p. 28; Nov. 30, 1981, p. 29).

Wirth opposed the Senate bill because he believes it as ambiguous as the Foreign Corrupt Practices Act in defining what constitutes a corrupt payment.

Sen. John Heinz (R.-Pa.) reintroduced the Senate bill last Feb. 3.

Mica's bill is similar to Heinz's but would take the Foreign Corrupt Practices Act "out of the hands of the Securities and Exchange Commission and would put it in the hands of the secretary of Commerce as the administering official and the enforcement agency," according to Roger Majak, who is staff director for the House Foreign Affairs subcommittee and who drafted the bill on Mica's behalf.

Combining the bribery law with the Export Administration Act would work well technically, Majak said, because the ex-

Northrop Executive Posts

Los Angeles—Roy P. Jackson, vice president and general manager of the Northrop Corp.'s Aircraft Div. since 1980, has been appointed to the corporate post of senior vice president-operations.

Joseph T. Gallagher, vice president-engineering in the Aircraft Div. since 1980, has been named vice president and general manager of the division, succeeding Jackson.

Stanley Ebner, vice president and manager of Northrop's Washington office since 1979, has been appointed senior vice president-government relations.

port statute regulates foreign trade practices in various areas "and of course that's exactly what's involved in the payments to foreign officials."

He said the export law furnished all the authority the secretary of Commerce would need to enforce bribery prohibitions, except "the authority for injunctive relief in the event there is an apparent violation in progress, and that we have given him in the proposed bill."

Energy Subcommittee

Majak disagreed that Mica's bill was intended as a tactical maneuver to spur Wirth's Energy subcommittee into action, but he volunteered that members of the Foreign Affairs subcommittee "obviously are aware that nothing has happened in the Energy and Commerce Committee for over two years, and they obviously are aware of the possibility that this proposal could become an alternative."

Majak said he had conferred with Wirth's subcommittee staff about Mica's bill and "they are obviously, I think, skeptical of it in a number of ways."

He attributed this in part to their concern that giving the Commerce Dept. enforcement authority for overseas bribery law would place the department in yet another conflict between promoting trade and restricting it.

Commerce Duties

This issue figures prominently in the debate over renewing the Export Administration Act, which expires Sept. 30. Some members of Congress now want to strip Commerce of its enforcement responsibilities for export controls, charging that the department's institutional bias for promoting trade weakens its enforcement capability.

This sentiment presumably would conflict with Mica's proposal to add to the department's enforcement functions.

Majak said Mica's bill would not delay reauthorization of the Export Administration Act.

It was introduced separately, he said, "and no decision has been made at this point as to whether we will or will not try to add it to the Export Administration Act renewal."

Majak also cautioned that it was not settled whether the subcommittee would act on Mica's bill, although he insisted it was a serious proposal. "It would work, it's ready to go, it's not just a discussion bill.

"I think we probably will do a hearing or two, fairly soon," he added.

In drafting the bill, Majak conferred with Commerce Dept. officials, but he said they had taken no formal position on it, nor would he expect them to. He said Heinz's staff was receptive to the proposal, but "their bill is still, I think, their preferred approach." □

NTSB Urges Fuel Tank, Procedure Changes

Washington—National Transportation Safety Board has made nine recommendations to the Federal Aviation Administration covering general aviation aircraft fuel tanks and fueling procedures, citing 396 accidents involving engine failures or malfunctions from 1975 to 1981 traced to water in the fuel.

The safety board's recommendations included two urgent and seven priority actions ranging from purging the fuel tanks of some Cessna Aircraft to installing wing fuel tank quick drains on some Piper aircraft. The recommendations to the FAA were prompted by recent tests of water contamination in general aviation aircraft fuel tanks.

A study of the accident records of older high-wing Piper aircraft and older and new high-wing Cessna aircraft with rubberized bladder-type fuel cells led to the recommendations. Also included in the study were the Piper Pawnee and the Cessna AgWagon

agricultural aircraft. The safety board found that engine stoppage in these aircraft traced to water in the fuel occurred most often during the takeoff and initial climb phase of flight.

In aircraft such as the Cessna 180, 182, 185, 206 and 207 that have flexible rubberized bladder-type fuel cells in their wings, water can be entrapped or dammed up within the cells because of irregular surfaces, wrinkles or ridges in the cells, the board said.

Older single-engine aircraft that did not have quick drains in the fuel tanks when manufactured should have them installed now, the NTSB said. Although Piper builds a wing fuel tank quick drain installation kit for these aircraft models, the safety board said that few aircraft operators have installed the kits. The safety board said tests conducted on the Piper's metal fuel tanks showed that water could still be in the fuel tank sumps even after the aircraft's belly drain and fuel strainer ceased to indicate any trace of water.

Business Flying

Challenger 601 Certificated by FAA

Washington—Canadair Challenger 601 received its Federal Aviation Administration certification, and deliveries of the aircraft, powered by General Electric CF34 turbofan engines, began earlier this month.

Federal Aviation Administration approval of the 19-passenger business flying aircraft was preceded by Canadian Transportation Dept. certification in late February. The aircraft, which is equipped with winglets, received its U. S. and Canadian approval within a year of its first flight on Apr. 10, 1982.

Canadair delivered the first production Challenger 601 to a completion center earlier this month, and expects to deliver two or three more during March.

A total of 28 Challenger 601s are scheduled to be delivered to completion centers in 1983. Deliveries of Canadair's Avco Lycoming ALF502L-powered Challenger 600s will drop from the 39 in 1982 to less than 10 in 1983.

The Canadian aircraft manufacturer, based in Montreal, holds approximately 50 orders for the Challenger 601. They are a combination of new orders, deposits switched from the canceled stretched Challenger E and other corporate operators choosing the Challenger 601 over the Challenger 600.

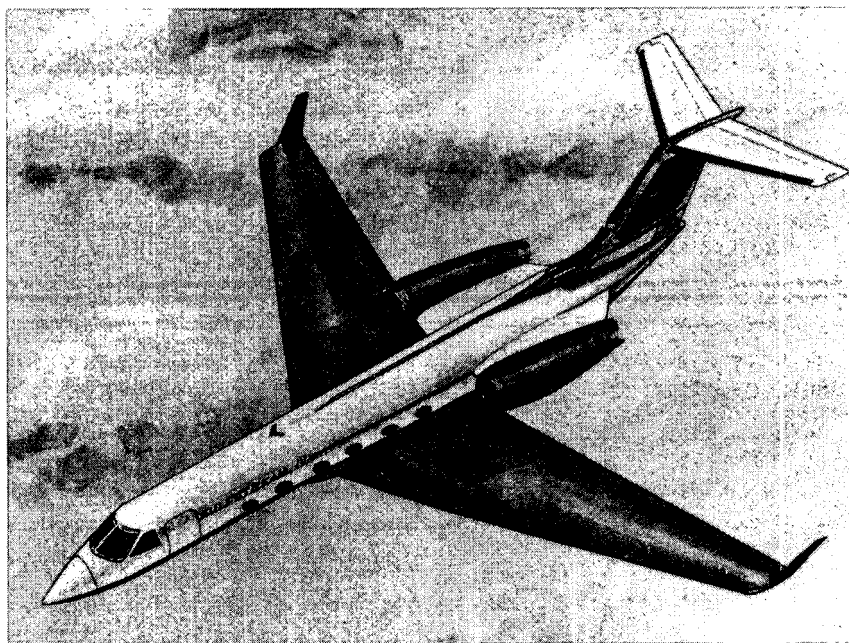
Canadair has delivered 75 Challenger 600s since deliveries began in 1980. At one time, Canadair held approximately 125 orders for the Challenger 600.

Performance goals for the Challenger 601, unlike the Challenger 600, were either met or exceeded by Canadair (AW&ST Sept. 22, 1980, p. 34). Range of the Challenger 601 with National Business Aircraft Assn. instrument flight fuel reserves

at long-range cruise is approximately 3,570 naut. mi. Canadair had guaranteed corporate operators that the IFR range of the 601 would be at least 3,500 naut. mi. while carrying five passengers.

The balanced field length of the 601 at its estimated 41,650-lb. maximum takeoff

weight had been calculated to be 5,100 ft. by Canadair. The 601 has been certificated to a higher takeoff gross weight of 42,100 lb., and the balanced field length at this increased weight is 5,125 ft. At the 41,650-lb. takeoff gross weight, the balanced field length would be 5,050 ft. □



Gulfstream 4 to Make Its First Flight in 1985

Gulfstream Aerospace's Gulfstream 4 will have an exterior configuration similar to the Gulfstream 3, except for a 2-ft. extension and the addition of a window on each side. The Gulfstream 4 will be powered by the Rolls-Royce Tay engine (AW&ST Mar. 21, p. 59), flat rated to 12,450 lb. of thrust at takeoff. Other changes from the Gulfstream 3 include a flat rear pressure bulkhead, avionics moved from the cabin to the rear baggage area and electronic flight instruments as standard equipment in the Gulfstream 4. First flight is planned for December, 1985, with production deliveries scheduled to begin in the last quarter of 1986.

Business, Utility Aircraft Shipments

January, 1983

Make & Model	No. of Units	Year to Date	Factory Billings	Make & Model	No. of Units	Year to Date	Factory Billings
Ayres				Gates Learjet			
600 Thrush.....	0	0		25D.....	0	0	
1200 Thrush.....	0	0		35A.....	0	0	
Turbo Thrush.....	2	2		36A.....	2	2	
Ayres Totals	2	2	\$517,000	55.....	0	0	
Beech				Gates Learjet Totals	2	2	\$9,911,000
77 Skipper.....	0	0		Gulfstream Aerospace			
C23 Sundowner.....	1	1		840 Commander.....	0	0	
C24R Sierra.....	0	0		900 Commander.....	0	0	
F33A/C Bonanza.....	1	1		980 Commander.....	0	0	
V35B Bonanza.....	2	2		1000 Commander.....	0	0	
36TC Bonanza.....	3	3		Gulfstream 3.....	2	2	
36 Bonanza.....	3	3		Gulfstream Aerospace Totals	2	2	\$19,700,000
76 Duchess.....	0	0		Lake Aircraft			
B55 Baron.....	0	0		200 EP.....	1	1	
E55 Baron.....	0	0		250 Renegade.....	0	0	
58 Baron.....	1	1		Lake Aircraft Totals	1	1	\$106,000
58TC Baron.....	0	0		Maule Aircraft			
58P Baron.....	2	2		M-5 235C.....	0	0	
B60 Duke.....	0	0		M-6 235.....	3	3	
C99.....	0	0		Maule Totals	3	3	\$158,058
F90 King Air.....	0	0		Mooney			
E90 King Air.....	0	0		201 M20J.....	8	8	
C90 King Air.....	1	1		231 M20K.....	4	4	
B100 King Air.....	0	0		Mooney Totals	12	12	N.A.
200 Super King Air.....	2	2		Piper			
Beech Totals	16	16	\$6,652,498	PA-18-150 Super Cub.....	0	0	
Cessna				PA-28-161 Warrior.....	12	12	
152.....	13	13		PA-28-181 Archer 2.....	8	8	
F152.....	2	2		PA-28-236 Dakota.....	2	2	
152 Aerobat.....	0	0		PA-32-301 Saratoga.....	3	3	
FRA 152.....	0	0		PA-32-301T Turbo Saratoga.....	1	1	
172 Skyhawk.....	10	10		PA-38-112 Tomahawk.....	6	6	
F172.....	0	0		T-35.....	0	0	
R172 Hawk XP.....	0	0		PA-28RT-201 Arrow 4.....	0	0	
F172 Hawk XP.....	0	0		PA-28RT-201T Turbo Arrow.....	3	3	
180 Skywagon.....	0	0		PA-32-301 Saratoga SP.....	1	1	
182 Skylane.....	4	4		PA-32R-301T Turbo Saratoga SP.....	1	1	
182 Turbo Skylane.....	1	1		PA-36-375 Brave.....	10	10	
185 Skywagon.....	3	3		PA-34-220T Seneca 3.....	10	10	
Stationair 6.....	7	7		PA-44-180 Seminole.....	0	0	
Turbo Stationair 6.....	8	8		PA-44-180T Turbo Seminole.....	0	0	
Stationair 8.....	2	2		Aerostar 602P.....	2	2	
Turbo Stationair 8.....	0	0		PA-31-310 Navajo.....	0	0	
172 Cutlass.....	2	2		PA-31-325 Navajo C/R.....	0	0	
172 Cutlass RG.....	4	4		PA-31-350 Chieftain.....	2	2	
R182 Skylane RG.....	3	3		PA-31T-500 Cheyenne 1.....	1	1	
TR182 Skylane RG.....	0	0		PA-31T-620 Cheyenne 2.....	6	6	
210 Centurion.....	1	1		PA-31T-620 Cheyenne 2XL.....	2	2	
Turbo 210 Centurion.....	4	4		PA-44-720 Cheyenne 3.....	0	0	
P210 Centurion.....	3	3		T-1020.....	0	0	
AgTruck.....	1	1		T-1040.....	1	1	
AgHusky.....	3	3		Piper Totals	71	71	\$14,911,000
303 Crusader.....	5	5		Schweizer AgCat B			
310.....	0	0			3	3	\$264,058
335.....	1	1		Totals (January, 1983)			
340.....	2	2			214	-	\$92,094,687
402.....	3	3		Totals (January, 1982)			
404 Titan.....	0	0			384	-	\$132,100,000
414A.....	1	1		Exports (January, 1983)			
421 Golden Eagle.....	2	2			59	-	\$34,800,000
425 Conquest 1.....	5	5		Exports (January, 1982)			
441 Conquest 2.....	3	3			92	-	\$39,700,000
Citation 1.....	2	2		Fairchild Aircraft			
Citation 2.....	5	5		SA-227AT Merlin 4C.....	0	0	
Citation 3.....	1	1		SA-227AC Metro 3.....	1	1	
Cessna Totals	101	101	\$37,960,357	Fairchild Aircraft Totals	1	1	\$1,914,716

N. A.—Not Available

Avionics

Systems Command Probes C³ Potential

By Kenneth J. Stein

Hanscom AFB, Mass.—Coordinated upgrade of U. S. strategic warning capabilities links a number of complementary command, control and communications (C³) programs under way at USAF's Electronic Systems Div. here, designed to modernize and extend existing systems and add some new ones.

"Our emphasis is on strategic C³ capabilities that can survive and endure," Lt. Gen. James W. Stansberry, ESD commander, told AVIATION WEEK & SPACE TECHNOLOGY. Developments focus on improved sensors, communications links, data processing capabilities and displays.

Strategic command, control and communications upgrades represent a major defense investment, with funding on the order of \$18 billion over the next few years, Stansberry said. About one-half of that is estimated to involve ESD programs.

Emphasis in C³ systems has changed from being product oriented to being mission area oriented, Stansberry said. A major element of its task is that Electronic Systems Div. must closely coordinate the interfaces of many programs that were started individually.

Reinforcing the emphasis on this coordinated approach, a general officer slot has been established at ESD to oversee strategic warning programs, Stansberry said. Brig. Gen. M. H. Alexander has been appointed deputy for strategic systems and Anthony Salvucci has been named assistant deputy.

"We're trying to achieve complementary directions in several air defense programs, taking a total architectural

approach to air defense systems," Salvucci said. "We're looking at the mission area as a whole, lumping missile, space and air defense roles together. We're now designing from the top down, changing the assets at lower levels to fit the total mission.

"In the C³ area, we are trying to become less sensitive to what tactics might be and look at possible enemy actions. Why should an enemy go after a missile if it is easier to knock out the transmission capability for sending orders?" Salvucci said.

"Therefore, we try for the best mix, planning on fixing potential 'holes' and prioritizing what is perceived as intent," Salvucci said.

Major landmarks in strategic upgrade efforts in progress at ESD include these programs:

- First of eight Region Operations Control Centers, a vital link in the U. S.-Canadian Joint Surveillance System, reached initial operational capability at Tyndall AFB, Fla., earlier this month. The air defense system, which displays digitized air traffic data derived from Federal Aviation Administration, USAF and joint-use radars, is a successor to the Semi-Automatic Ground Environment (SAGE) and Back-Up Interceptor Control (BUIC) installations of past years. The initial operations center accepts data from radars ranging from Texas and the Gulf of Mexico to Louisiana, Alabama, Florida, the Carolinas and most of Virginia. Prime contractor for the system, expected to be fully operational in 1984, is Hughes Aircraft, Fullerton, Calif., with a firm, fixed-price contract for \$156 million.

- Coverage of the over-the-horizon/backscatter (OTH-B) radar sites at Maine will be expanded and the sites extended under a contract with General Electric Co. (AW&ST Aug. 16, 1982, p. 68). ESD expects to have construction completed by this summer on a dedicated building to house the OTH-B operations center at Bangor International Airport. One modification to the test system will change receive antennas at Columbia Falls, Me., to monopole types, which are "better structurally in the wind and ice" of the Maine winter environment, according to Col. A. Lee Snyder, program manager.

- Missile Warning Bypass System, now undergoing testing, is designed to speed alert information from Pave Paws, Ballistic Missile Early Warning System and other sensors to the North American Aerospace Defense Command (NORAD) command post, even if main communications processors experience a failure. This direct linkup is being built, installed and tested by Ford Aerospace & Communications under a \$4.1-million contract. More basically, requests for proposals were released recently for design concepts for Computer System Segment Replacement at NORAD's underground command post. The plan is to "rewire" the entire processing complex at NORAD's underground command post with a new distributed architecture system employing arrays of microprocessors, possibly linked by fiber optics, to provide increased flexibility and better response time. A \$200-million multiyear program, expected also to replace processing and display and communications segments at "the heart of the mountain," marks the first basic change in the NORAD command post since its inception.

- Pave Paws warning system will be upgraded at the two initial sites, Otis AFB, Mass., and Beale AFB, Calif., with improved data processors and software and activation of some passive array elements (AW&ST Apr. 9, 1979, p. 60). The new southeastern site, at Robins AFB, Ga., largest of the four, will take on an additional functional task of deep space tracking in addition to its warning role, taking over the tracking functions of the FPS-85 phased array system at Eglin AFB, Fla. Both the Robins location and the southwestern installation near Goodfellow AFB, Tex., will use approximately one-third of the 1,300-1,700 sensors on the array face. The system at Robins also will have a more powerful computer in

Navy Plans Tests of Airborne EW Simulator

San Francisco—Naval Air Rework Facility, Alameda, Calif., expects to begin tests this fall of an airborne electronic warfare (EW) simulator/trainer housed in a modification of the reconnaissance version of the Douglas A-3 Sky Warrior.

The modified aircraft has been designated the ERA-3B.

One feature on the ERA-3B will be a 20-ft.-long radome beneath the fuselage, which will house high-power jamming antennas. The radomes are being developed and built by Boeing Military Airplane Co. at Boeing's Wichita, Kan., facility.

The broadband radomes embody technology that Boeing developed in antenna system installation programs for the USAF/Boeing B-52, independent research and development, and the design and production of quiet nacelles. The radome contract is valued at \$2.4 million. The first unit is to be delivered in early summer.

The ERA-3B payload includes active and passive electronic warfare equipment supplied by EM Systems of Sunnyvale, Calif., Hewlett-Packard Co., Lundy Electronics & Systems, Inc., Raytheon Co., Scientific Communications, Inc., of Garland, Tex., and Watkins-Johnson Co. Payload integration is being done by Naval Air Systems Command and Naval Electronic Systems Command.

view of its multiple role. Pave Paws upgrades extending to 1988-89 are expected to be funded at about \$250-300 million. A sole-source award to Raytheon Co., which developed and built the original system, is expected this summer.

■ Ground wave emergency network (GWEN) is a low-frequency system operating at 160-190 KHz. to provide emergency communications and to pass crucial national messages when other communications systems are "highly stressed" within an electromagnetic pulse environment. GWEN would be expected to maintain multiple signal paths across the U. S., providing flexible packetized communications from one node to the next. Two preliminary design contracts for an operational system have been awarded, \$5 million to Rockwell-Collins Communications Systems Div., Richardson, Tex., and \$4 million to RCA Government Communications Systems, Camden, N. J.

■ Ballistic Missile Early Warning System (BMEWS) upgrades encompass both radar system and data processing improvements. Missile impact predictor (MIP) data processing capabilities at all three BMEWS sites will be updated with Control Data Cyber 170-720 processors replacing the aging IBM 7090s. Development, test and engineering phase is near completion at the Clear, Alaska, operating site. Initial operational test and evaluation is planned at Thule, Greenland, followed by installation at Fylingdales Moor, England. For BMEWS basic radar upgrade at Thule, three companies are in source selection for a design-to-budget approach: Federal Electric Corp., Norden Systems and Raytheon. This represents a new approach to the Thule job—"What can we do for approximately \$80 million to upgrade the radar?" Stansberry said.

■ North Warning System, a replacement for the Distant Early Warning (DEW) line, will use a mix of "minimally attended" long-range radars and unattended short-range radars expected to reduce personnel required to operate and maintain the system. Replacement of aging DEW line radars across Alaska, Canada and Greenland is expected to trim annual operating costs by more than \$40 million. The 50 sites in the modified 3,000-mi. network will have an expanded mission, guarding against penetration by low-level air-to-surface missiles, as well as by manned aircraft. Requests for proposals are expected to be released soon.

■ Seek Igloo, a program to replace Alaskan air defense radars more than 20 years old with new, largely automated equipment, has reached a test phase in which a preproduction General Electric AN/FPS-117 radar is undergoing initial operational evaluation at King Salmon Air Force Station, Alaska. If a production decision follows, the FPS-117 will replace equipment at 12 additional coastal and

inland Alaskan sites. The FPS-117 is designed to provide range, position and height of targets out to 200 naut. mi. and up to 100,000 ft. Use of the minimally manned radars at all 13 Alaskan sites would be expected to save more than \$30 million annually, allowing USAF to reduce personnel at the sites from more than 900 to about 150.

■ WWMCCS (World-Wide Military Command/Control System) information system improvements, in which Electronic Systems Div. has been given responsibility for development and acquisition in a joint program conceived and designed by the Defense Communications Agency. Contracts for the overall upgrade program for WWMCCS, encompassing more than 30 sites world-wide, were at about the \$3-billion level during the past fiscal year and may climb to about \$5 billion in the next year or two, according to Stansberry.

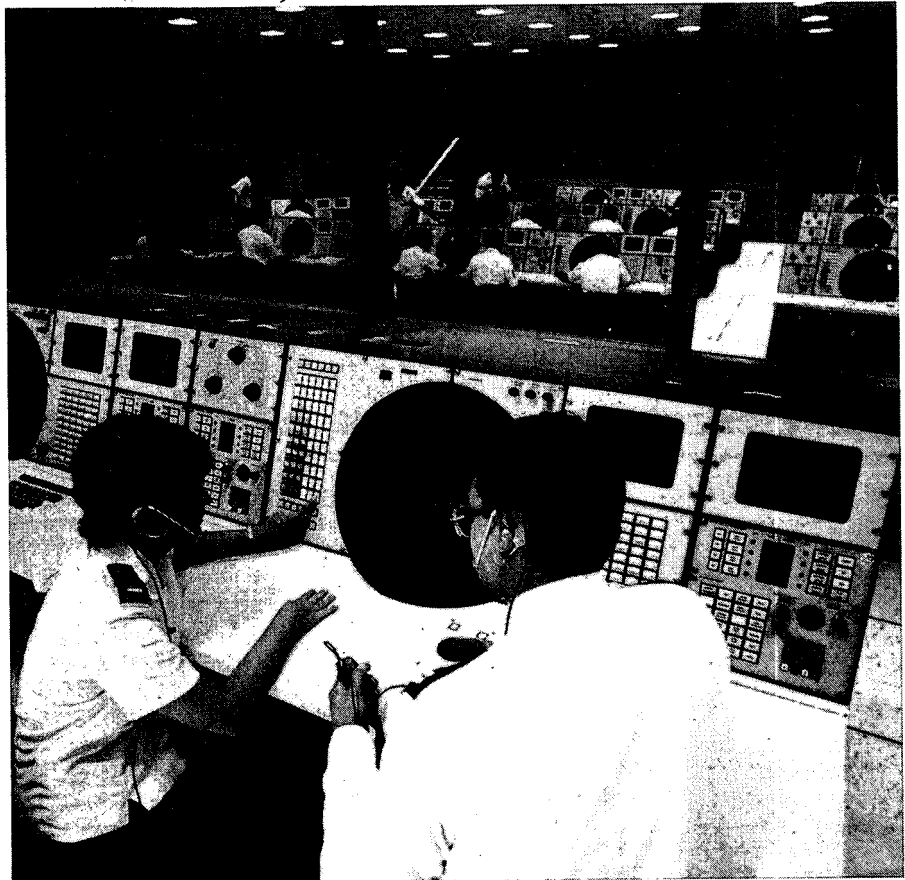
■ Providing USAF support of MEECN (minimum essential emergency communications network), ESD released two competitive validation phase contracts in January for a miniature airborne VLF/LF receive terminal for bomber aircraft. Awards of about \$13 million each went to Rockwell-Collins and Westinghouse Electric, with each to provide three sets of

evaluation hardware. A single contractor will be selected for full-scale development. Also in support of MEECN is development of frequency, time and spatial diversity receiving equipment both for ground sites and airborne command posts, and also a 100-kw. VLF/LF transmitter for USAF/Boeing EC-135 command post aircraft. Westinghouse won a competition for the transmitter, but subsequent flight tests were discontinued because of difficulty of interfacing the high-power transmitter with trailing-wire antennas. Westinghouse is studying transmitter/antenna combinations, and a decision on proceeding is expected later this year, Col. William Lewark, who heads the strategic communications systems directorate at ESD, said.

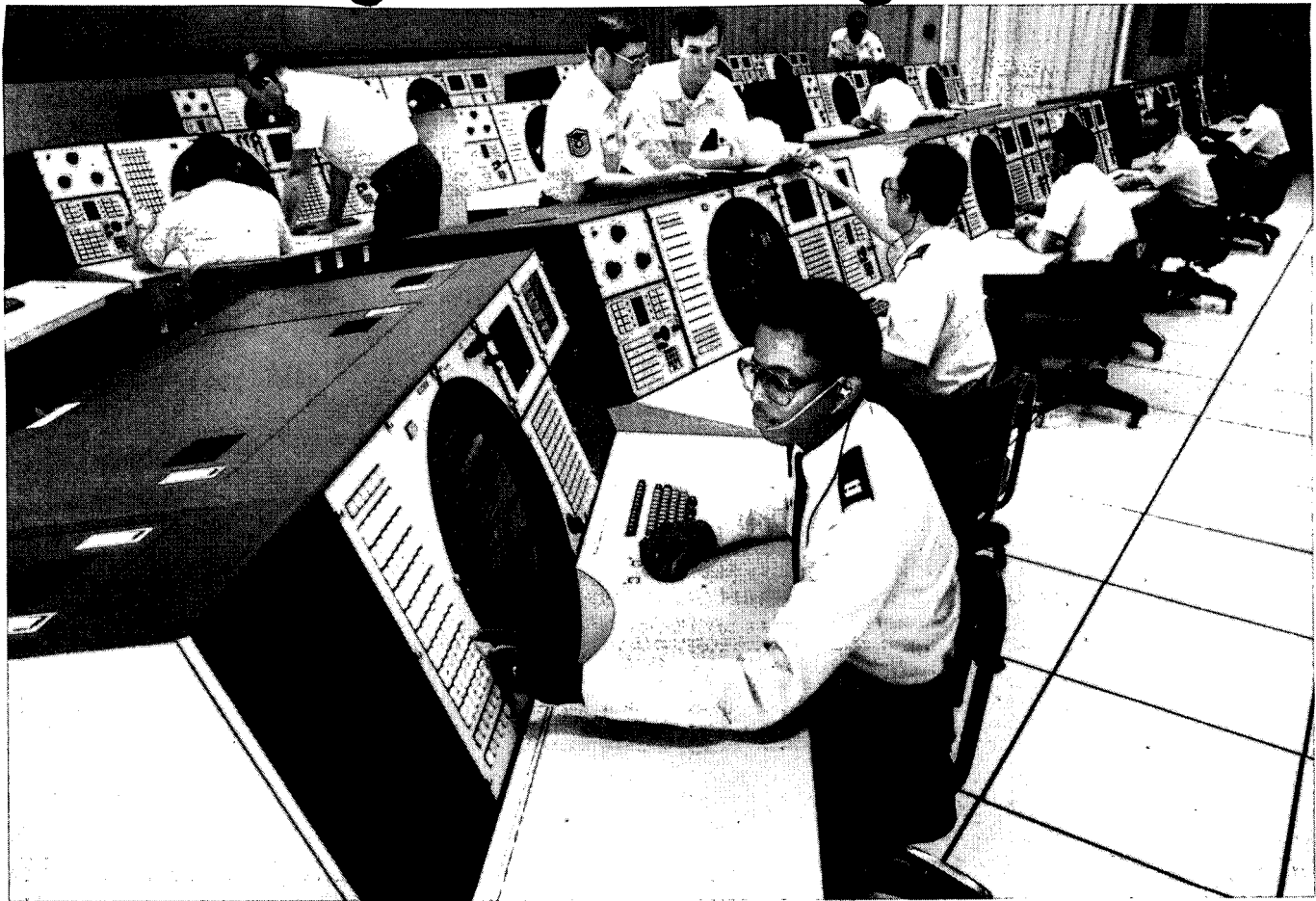
The new Region Operations Control Center at Tyndall AFB is one of eight planned facilities, according to Lt. Col. Gordon Drake, Joint Surveillance System program manager in ESD's North American Air Defense Systems Directorate.

Others locations include:

- Griffiss AFB, N. Y.
- McChord AFB, Wash.
- March AFB, Calif.
- Elmendorf AFB, Alaska.
- Wheeler AFB, Hawaii.
- North Bay, Ontario, Canada. Two



Joint Surveillance System replaces earlier technology of the Semi-Automatic Ground Environment (SAGE) and Back-Up Interceptor Control (BUIC) systems, reducing operating personnel by more than 6,000, with anticipated savings of \$100 million annually. Typical Region Operations Control Center will provide 18 radar scope positions. Hughes Aircraft is prime contractor for the control centers under a \$156-million firm fixed-price contract.



Region Operations Control Center (ROCC) for U. S.-Canadian Joint Surveillance System will provide command and control functions covering a geographical area measuring about 2,048 naut. mi. square. The Joint Surveillance System will integrate existing USAF

surveillance radars, Federal Aviation Administration air traffic control radar system and Canadian radars into a shared radar-data system. Four Region Operations Control Centers will be built in the Continental U. S., two in Canada and one each in Hawaii and Alaska.

centers will be located at this site, which will be turned over to Canadian Forces after acceptance.

When the new network is fully operational, it is expected to save \$100 million annually in operating costs, as older air defense systems and operations centers are closed down.

Designed as a peacetime air surveillance and control network, the Joint Surveillance System gathers information from USAF, FAA and some dual-use radar sites. Digitized data from the radars will be shared with the FAA, Drake said.

A typical center employs 18 display scopes in normal configuration and "does a lot of what SAGE did, but with nicer displays and clearer maps that can be used in normal room lighting," Drake said.

In implementing the Joint Surveillance System, modifications are being made to some existing radars, and height-finders are being added, Drake said.

In the Norad command post Computer System Segment Replacement, first of several update phases that will involve processing, display and communications capabilities, a new distributed architecture

concept employing microprocessors is expected to replace the present Honeywell 6000 central processors, according to Col. E. A. Mezzapelle, who heads ESD's missile warning systems directorate.

The processing program will replace "the heart of the mountain," Mezzapelle said, since all sensor information comes into the communications processors and out to other command posts. Systems Command is charged with development planning and insuring that the system being built will be as error-free as possible, Mezzapelle said.

This development planning responsibility will involve end-to-end tests of the new hardware.

A contract definition phase is anticipated late this year for a command post processing and display system designed to provide missile warning information at all command posts.

In the essential communications area, the Ground Wave Emergency Network is expected to provide low-frequency links that follow the Earth's surface, continuing to function through electromagnetic pulse conditions that could disrupt ionospheric characteristics, according to Lewark.

A nine-station unmanned GWEN network is being built in the Midwest to test the feasibility of the concept. The pilot program will link Strategic Air Command headquarters at Offutt AFB, Neb.; North American Aerospace Defense Command at Peterson AFB, Colo.; Buckley Air National Guard Base, Colo., and several other bases.

Initially stations will be located at Pueblo and Aurora, Colo.; Omaha and Ainsworth, Neb.; Manhattan and Colby, Kan.; Fayetteville, Ark.; Canton, Okla., and Clark, S. D.

Commercial radio towers will be used at Manhattan, Colby and Canton.

Standard GWEN towers will be about 300 ft. high with a suitable ground plane, nominally 1,000 ft. on a side, Lewark said.

The low-frequency system, operating at 160-190 KHz., will have some logic at each site and some antijam capability, Lewark said.

USAF also is looking anew at adaptive high-frequency radio, which had been discounted in the past because of operating difficulties in a disturbed ionosphere, Lewark said.

However, operation at extended fre-



New radar system at Tempelhof Central Airport, Berlin, will be housed in 53-ft.-dia. radome shown as it was installed atop a 233-ft. tower at the airport. The system will employ an enhanced version of the AN/FPS-117(V) radar developed for USAF's Seek Igloo program and an automation/display system with four-color controller consoles.

New Traffic Control System Being Built in Berlin

Hanscom AFB, Mass.—Enhanced version of the AN/FPS-117(V) air defense radar developed by General Electric Co. for USAF's Seek Igloo program will be used in conjunction with Sanders Associates four-color display consoles in a new traffic control system being built at Tempelhof Central Airport in Berlin.

The automated system will provide composite video displays of all radar data on Sanders color consoles similar to those employed in the U. S. Navy's Fleet Air Control and Surveillance Facilities (AW&ST Mar. 7, p. 65).

The new Berlin radar system will replace a much-modified FPS-67D radar, which is approaching end of life and is no longer supportable, according to Lt. Col. Gene Box, Berlin radar program manager at USAF's Electronic Systems Div. here.

The system, used to help control traffic in the air corridors that link Berlin with Western Europe, will employ new data processing equipment that will track aircraft and display current flight plans.

The FPS-117(V) antenna will be housed inside a 53-ft.-dia. radome atop a 233-ft. tower erected at Tempelhof.

Sanders Associates was awarded a \$24.3-million multiyear contract to install the new equipment at Tempelhof, with an expected operational date in late 1985.

quency ranges in the high end of the band and networking techniques promise more capabilities than had been realized in recent years, he said.

New modular radios under development are expected to be capable of monitoring multiple frequencies and analyzing

link qualities, accepting properly addressed messages on a number of usable frequencies.

Screen rooms also are being provided at principal Strategic Air Command command posts to provide EMP protection for key communications equipment. EMP

event detectors are designed to provide warning of pulse conditions.

In the sensor area, the radar upgrade at the Thule, Greenland, BMEWS site is fund-limited, and the three contractors in source selection have had to bid on a design-to-budget approach of approximately \$80 million, Mezzapelle said.

The 40-44-month program is targeted to have an upgrade in place in early 1987, Mezzapelle said. Thule, which monitors the "main channel" of approaching ICBMs, was built for one or two single-warhead type missiles, but with the development of extensive MIRV capabilities, the ability to track the first stage does not provide enough information, he said.

Radar Modernization

The approach at Thule is to modernize the radar and enable the system to better characterize an attack, Stansberry said.

The radar upgrade will complement the missile impact predictor system improvements, in which USAF hopes to see the new Control Data Cyber 170-720 processors in place at all three BMEWS sites by later this year.

In a third phase, USAF plans to develop the operational requirements for BMEWS Site 3, Fylingdales Moor, England, to improve both missile warning and space tracking capabilities, Mezzapelle said. The space role could become the primary one at Fylingdales. However, this portion of the development is relegated to future USAF budgets, perhaps 1986.

Cyber computers also figure in the planned upgrade of the Pave Paws radar sites at Otis AFB, Mass., and Beale AFB, Calif., Mezzapelle said. A more powerful Cyber model is planned for the new dual function site at Robins AFB, Ga. The total program for radar system growth and added data processing capability at the two original sites, plus the two new Pave Paws sites, is expected to extend through 1988-89.

In the Seek Igloo program, developmental hardware has now been through three test phases and is currently completing evaluation by the Alaskan Air Command, testing the radar remoted to King Salmon Air Force Station, Alaska, according to Charles Minor, test director.

The highly automated FPS-117 radar is expected to reduce personnel at each site from the present eight or ten ranging up to 25 to "up to three people at each of the sites for maintenance purposes," according to system specifications.

The test system has been operated in conjunction with USAF aircraft flying out of Elmendorf AFB and has been interfaced with both the new Region Operations Control Center and with FAA air traffic facilities.

The new North Warning system radars will also enable USAF to reduce on-site personnel and trim operating costs. The

North Warning concept calls for approximately 37 short-range unmanned radars and 13 long-range "minimally staffed" radars. The long-range sites will use Seek Igloo radars, according to Lt. Col. William Stinson, program manager.

A request for proposals for the remaining radars is expected to be issued soon.

Modernization of both processors and software that support the World-Wide Military Command/Control System is expected to enable the system to meet demands that outgrew its original 1960-vintage technology.

"The appetite of WWMCCS Information System users outgrew system capabilities and its software also is now considered relatively inefficient," Col. Thad Sandford, WWMCCS program manager at ESD, said.

The system, conceived in the early 1960s and installed in the field in the early 1970s, was built around Honeywell 6000 central processors. Because neither a sudden cutover nor a system shutdown is permissible, an evolutionary approach with local area networks is being undertaken, Sandford said.

WWMCCS is a joint program conceived and designed by the Defense Communications Agency, and the joint program manager, in Washington, reports to the joint chiefs of staff. ESD has been given the responsibility of development and acquisition of the system.

Hardware Competition

Expected procedure calls for modernization of the software first, followed by a hardware competition. ESD has the task of providing a modern replacement for the Honeywell 6000, which is no longer manufactured, Sandford said.

Plans call for an integration contractor and two hardware contractors. The hardware contractors will provide, respectively, joint mission hardware and user interfaces to the WWMCCS information system. Selection of an integration contractor is expected by late summer; a common user contractor selection is expected to follow about four months later, Sandford said.

ESD also has responsibility for modernization of the Space Defense Operations Center in Cheyenne Mountain, consolidating command, control, communications and intelligence capabilities for the space defense role.

A program to upgrade the operations center and space cataloging capabilities is just about at completion of definition of incremental acquisitions, according to Col. William F. H. Page, who heads the space defense systems directorate at ESD.

Ford Aerospace and Martin Marietta were awarded definition contracts of about \$3 million each, and ESD is now in the process of source selection for a development contractor, Page said. □

Filter Center

Lockheed-Georgia Co. and Singer's Link Flight Simulation Div. are forming a new joint company to build a \$12-million training facility equipped with a state-of-the-art flight simulator to provide initial and refresher flight training on both civil and military versions of Lockheed's C-130/L-100 Hercules aircraft. Under terms of the agreement, Link will build, install and maintain an advanced simulator system for the turboprop aircraft. Lockheed will acquire land near its plant at Marietta, Ga., construct the 15,000-sq.-ft. building, staff and manage the training facility and market its services. Construction is expected to begin in May.

Honeywell-developed dual-mode airborne missile warning system, employing a combination of pulse-Doppler radar and infrared sensors to detect missiles attacking an aircraft, will undergo flight test on a USAF/Lockheed C-130 at the Army's White Sands Missile Range, N. M. By combining two different types of sensors, USAF hopes to reduce false alarms and enhance missile detection. The advanced development system earlier was tested on the Sandia cable car facility near Albuquerque, N. M.

McDonnell Douglas Electronics Co. has acquired Polhemus Navigation Sciences from the Austin Co. for \$3 million and will operate the new acquisition at its present location in Essex Junction, Vt. Polhemus produces a helmet-mounted sighting system that uses electromagnetic sensors to determine pilot's line of sight.

Small, lightweight solid-state flight data recorder that will be developed for the USAF/General Dynamics F-16C/D could become a triservice standard for use on fighter, attack and trainer aircraft. This is the objective of an effort under way by USAF Aeronautical Systems Div.'s deputy for aeronautical equipment. General Dynamics will handle selection of a contractor to develop the flight recorder later this year.

Request for industry proposals for funded six-month studies on megawatt-level nuclear space power systems is scheduled to be issued around mid-April by NASA's Lewis Research Center, Ohio. The studies are to identify viable concepts, estimate their physical and operating characteristics and pinpoint critical technologies needed to develop promising concepts. Inquiries can be directed to R. J. Paginton: (216) 443-4000, Ext. 709.

Grumman Aerospace will develop Modular Automatic Test Equipment (MATE) for portions of the USAF/Martin Marietta Lantirn (low-altitude navigation targeting infrared for night) radar pod under a \$7-million award from Martin Marietta. Grumman projects a market potential of more than \$50 million if the Lantirn pods enter full-scale production.

Sperry Flight Systems will install an electronic flight instrument system (EFIS) in a Sikorsky S-76 demonstrator helicopter, using 5 x 5-in. cathode ray tube displays in the civil helicopter. A Sperry SPZ700 dual digital flight control system and Primus 800 ColoRadar will be certified with the EFIS installation.

New interface unit between Texas Instruments' TI 91 Remote Loran-C Navigator and Sperry Flight Systems' Data Nav 3 display system will enable integration of Loran-C navigation data with weather or groundmap radar information on a single CRT screen. The Loran-C unit supplies programmable waypoints, range and bearing to the next waypoint, estimated time en route, ground track angle and cross track data to the Data Nav 3, providing a continuous pictorial display of the aircraft track on any Sperry color radar indicator.



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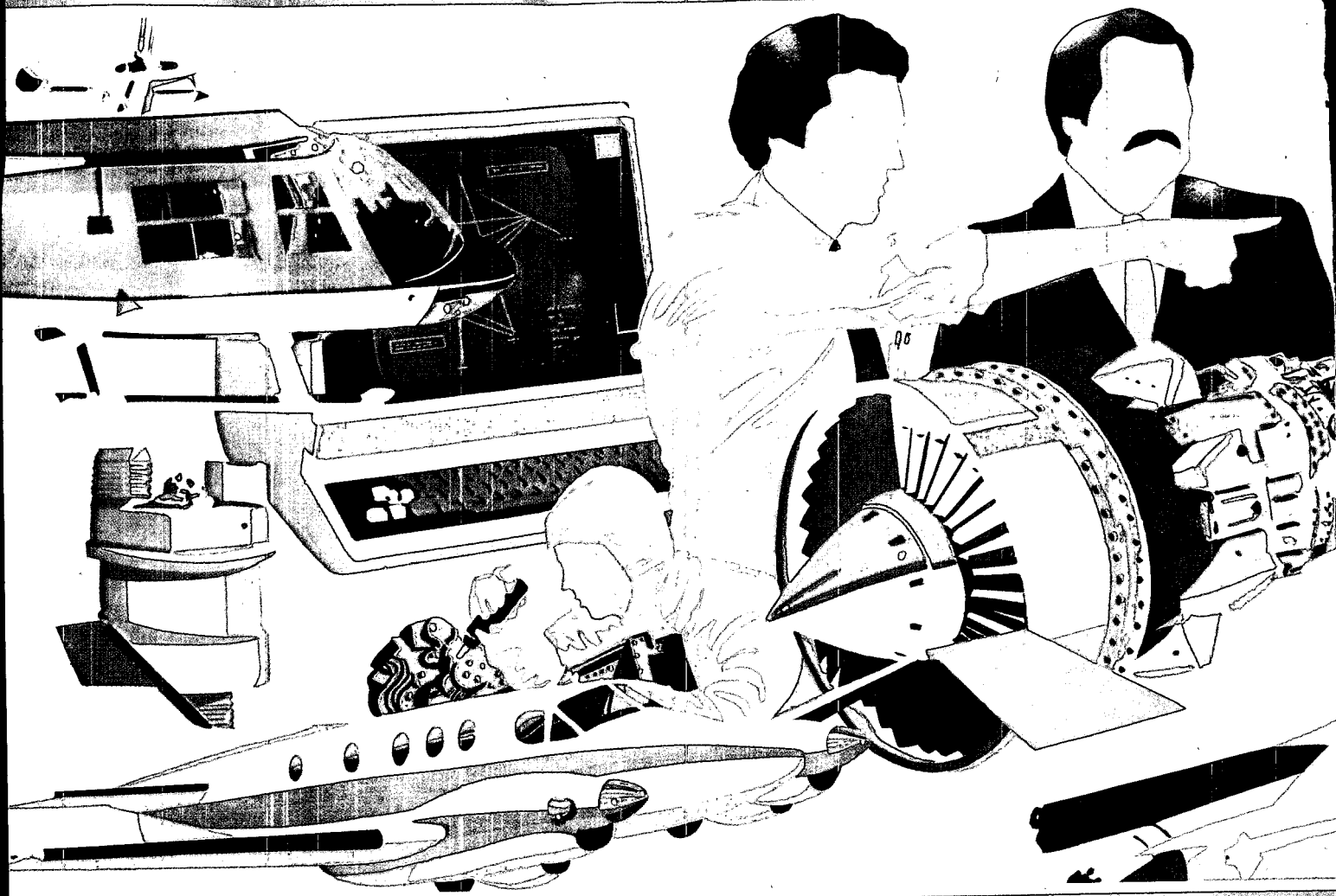
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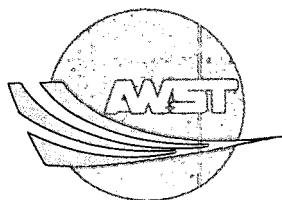
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Letters to the Editor

Wind Shear

The article by Keith F. Mordoff on methods to combat wind shear effects provides some very important information on how aircraft performance can be best optimized during an extreme microburst encounter (AW&ST Feb. 21, p. 40).

As aviators, we have apparently been obsessed more with loss of airspeed than flight path control. Furthermore, we have had little or no awareness of the effects that a critical change in angle of attack can have. Consequently, it should come as no surprise that the test aircraft was repeatedly forced into the ground when the elevator was used to lower the model's nose to gain airspeed in an attempted recovery.

The demonstration vividly illustrates that during extreme microburst conditions, reducing the pitch attitude to maintain or regain lost airspeed can result in a further, more critical reduction in angle of attack, a significant loss of altitude, a degradation in climb performance and ground impact. Under such conditions, IAS is an inferior and invalid parameter for adequately deciphering the aerodynamic picture. The indiscriminate chasing of IAS, without cross-reference to other instrumentation, can in itself kill.

During microburst flight, an aircraft normally experiences significant gains followed by losses of IAS and critical reductions in AOA. The combined reduction in IAS (dynamic pressure) and AOA (lift coefficient) will severely impair the aircraft's ability to generate lift and thereby sustain flight. Furthermore, a severe reduction in AOA toward negative values can occur. This can produce a temporary flight condition where a high-pressure area develops above the airfoil and a low-pressure area below. This reversal has the opposite effect of a positive lift producing wing.

Referencing this transitory flight regime of near zero or inverse generation of lift, wind shear effects can be explained as a function of lift generation and classical Newtonian dynamics. Simply stated, if the aircraft is not generating enough lift to support its weight, then it's not going anywhere but down. The resultant vector (of lift, weight, thrust and drag) will create an unbalanced force to accelerate the aircraft inertially with an increasing, downward vertical velocity in accordance with Newton's second law of motion. This is apparently what occurred in these tests and in several past catastrophes.

The alternate technique of using up elevator definitely supports the stick shaker recovery method originated by Paul Higgins of Boeing. I believe this to be the best procedure to date for transport-category aircraft that have no real means to read and fly precise AOA.

When inadvertently confronted with an extreme microburst encounter, performance can best be maximized by (1) applying maximum thrust and executing a missed approach while (2) simultaneously rotating to the AOA for maximum lift generation to discontinue or prevent a downward inertial velocity and once level flight or a positive rate of climb is achieved, then (3) fly out at the AOA for best angle of climb until a positive rate of climb is established and obstacles are cleared, and (4) then accelerate to the AOA for best rate of climb.

AVIATION WEEK & SPACE TECHNOLOGY welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, AVIATION WEEK & SPACE TECHNOLOGY, 1221 Avenue of the Americas, New York, N.Y. 10020. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names will be withheld. We reserve the right to edit letters.

The solution to the wind shear threat can be found in the precision control of the relative wind through AOA and the optimizing of all the physical forces of flight. This assumes, of course, that the given aerodynamic capability of the aircraft can exceed the physical forces of the given shear or microburst.

JOSEPH F. TOWERS
Lt. Cmdr., Naval Reserve
San Diego, Calif.

I was pleased to see your article on methods to combat effects of wind shear (Feb. 21, p. 40). Trans World Airlines and other airlines have implemented the wind shear/stall recovery technique advocated by the National Aeronautics and Space Administration workshop at the University of Tennessee you cited. We adopted this technique in 1979 after reviewing wind shear accidents and incidents.

This research and others tend to corroborate the optimum performance (maximum lift/drag) theory of recovery technique. Research on wind shear detection devices should make our airways safer.

Capt. WENDELL H. RONE
Flight Manager-Training
Trans World Airlines
Kansas City, Mo.

In the article on wind shear research, attention was drawn to the possibility that some shear situations may not be penetrated safely. If this is true, it is of the first importance to detect such situations; and this implies that all airports should have the needed equipment.

It seems equally important that this information be made available to air crews in a form that can be both understood and believed.

It is also important to consider the integrity of any method used to combat wind shear, especially with regard to the effects of errors in data sources. For example, the method of optically projecting a symbol at a fixed angle below the true horizon (to show directly the vertical offset from a desired approach path) is sensitive to inaccuracy in the attitude reference.

Experience has shown that a conventional gyro can be quite inadequate for this purpose because of deceleration error during the approach. An error of only one-third degree when the aircraft is at a height of 1,000 ft. results in an apparent vertical offset of about 120 ft. Other methods of dealing with wind shear need to be examined in the same manner.

So it appears necessary to deal with the problems of measuring a real-life shear, of communicating relevant information to air crews, and of surmounting effects of inaccurate data sources. Simulator experiments can be given due credence when the influence of these factors is allowed.

In conclusion, your wind shear article adds weight to a feeling that your space is well used in giving emphasis to research. Perhaps the time has come to include a section devoted to research in your table of contents. We need R&D to keep ahead.

J. M. NAISH
Los Altos, Calif.

CF6 Engine Oil

In the third paragraph of the article on the General Electric CF6 engine problem there is a statement that American Airlines "had switched its lubricating oil to that used by Delta before the difficulty was isolated" (AW&ST Jan. 31, p. 34). A true statement.

The penultimate paragraph of the article goes on to say that Delta, using Exxon 2380, has not observed the metal-chip problem. This is not true since Delta had removed two engines due to metal on the B sump chip detector, one on Jan. 27 and the other on Jan. 28. In addition to leaving out the above facts, which could leave some readers (including our customers of Mobil Jet Oil 2) with the wrong impression, AVIATION WEEK failed to report that American continued to remove engines due to metal on the chip detectors after having switched to Exxon 2380.

Delta, using Exxon 2380, had two removals due to metal on the B sump chip detector, one on Jan. 27 and the second on Jan. 28. Both removals were before the AVIATION WEEK publication date and should have been included in the interest of fairness and accurate reporting.

Omission of these facts could, by inference, cause your readers to conclude that Mobil Jet Oil 2 was at fault. This conclusion is not true, and General Electric's subsequent admissions of mechanical causes of the bearing failures attest to the problem being totally unrelated to the lubricant used.

I look forward to clarification of this matter in a future issue.

J. R. ESSER
USD Aviation & Government Sales
Mobil Oil Corp.
Fairfax, Va.

(Both Exxon 2380 and Mobil Jet Oil 2 can be used in the General Electric CF6-80 engine, according to the FAA. While no mention of the two Delta engines was made in the Jan. 31 story, the information was included in the next issue, AW&ST Feb. 7, p. 32—Ed.)

F-15C/D Budget Item

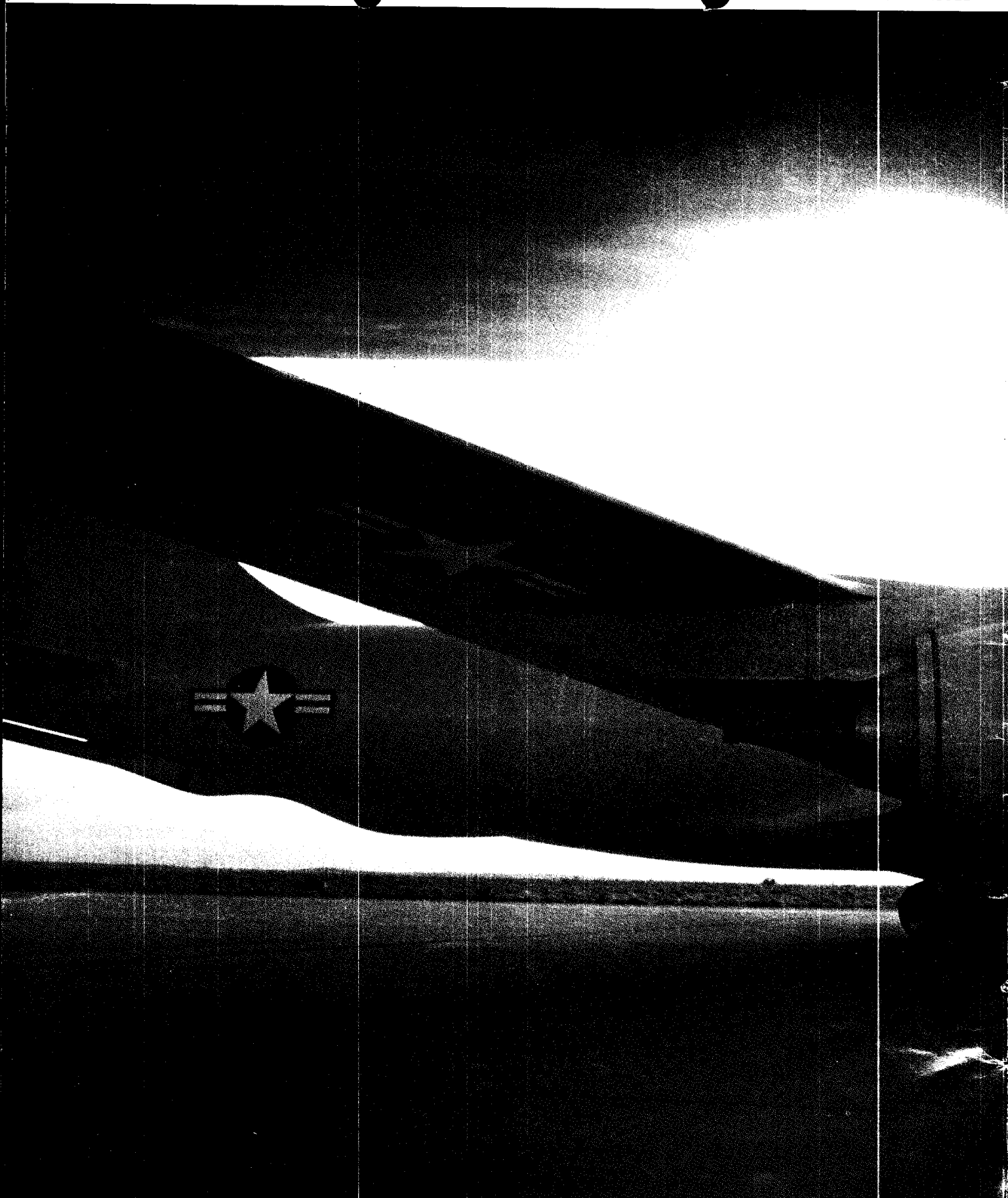
I was amazed to find the Air Force's F-15C/D aircraft missing from your box score listing of Fiscal 1984 major weapon systems spending detailed by military service (AW&ST Feb. 14, p. 92). Ditto for the EF-111A.

Did someone's finger slip while reviewing the Defense budget request, or are the programs really terminated?

DALE W. BRYANT
Softech, Inc.
Falls Church, Va.

(F-15C/D figures were inadvertently omitted from the Feb. 14 table. They appear in the Mar. 14 issue, p. 10. Defense Dept. did not request funding for the EF-111 in Fiscal 1984—Ed.)

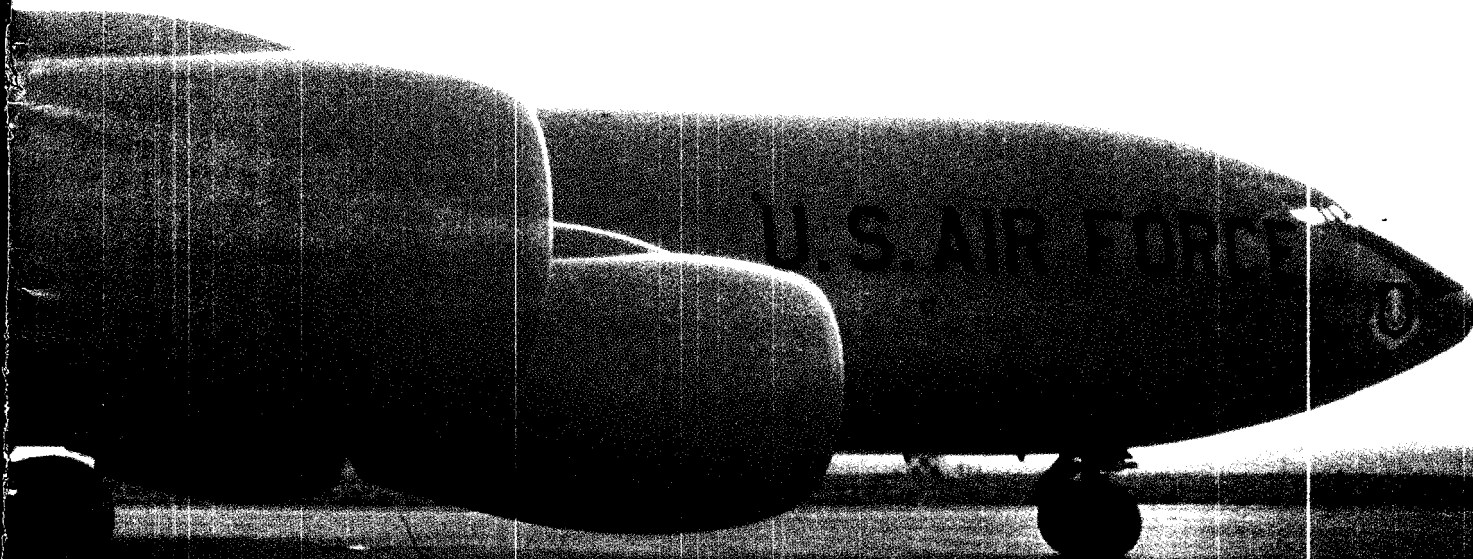
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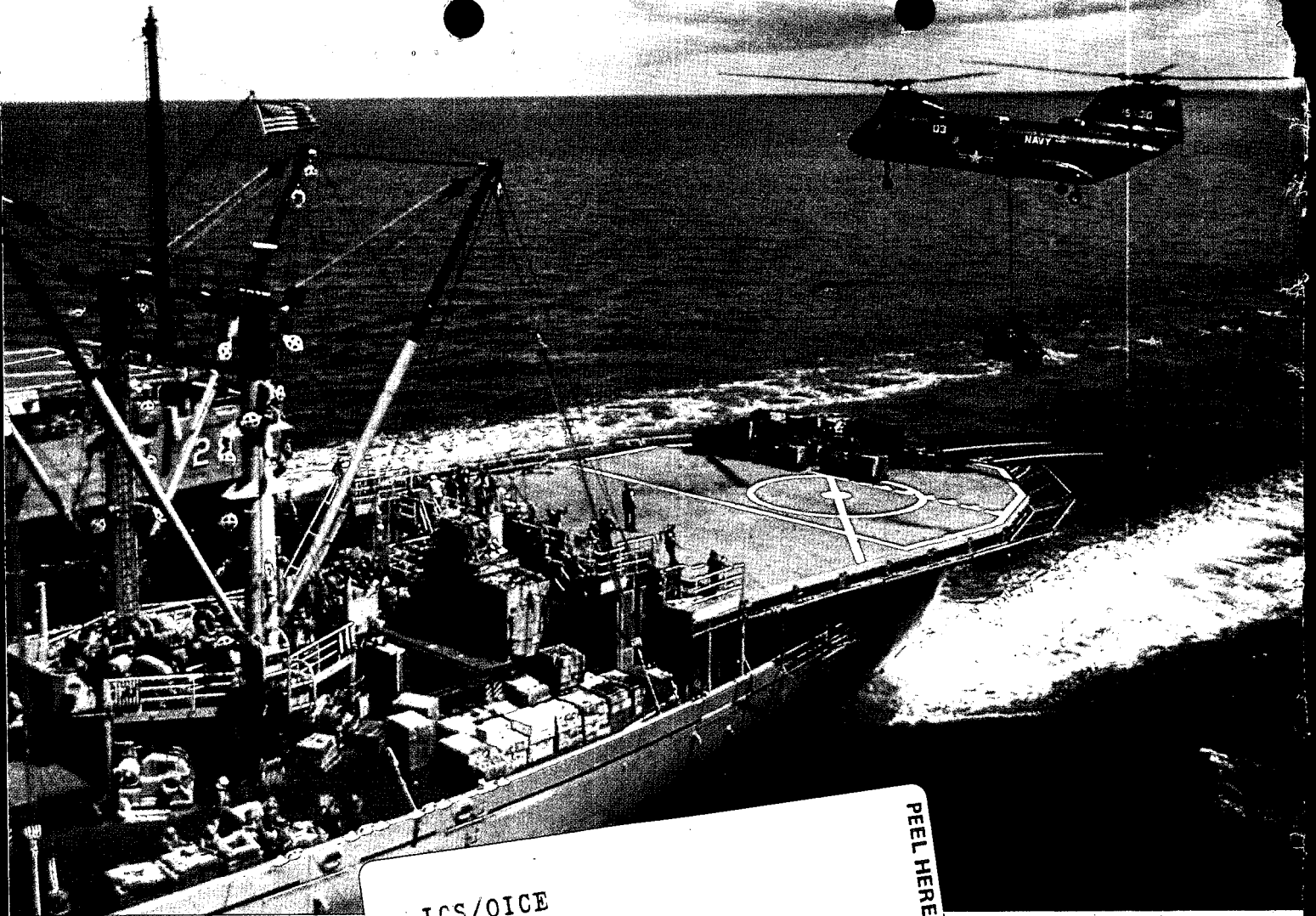
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