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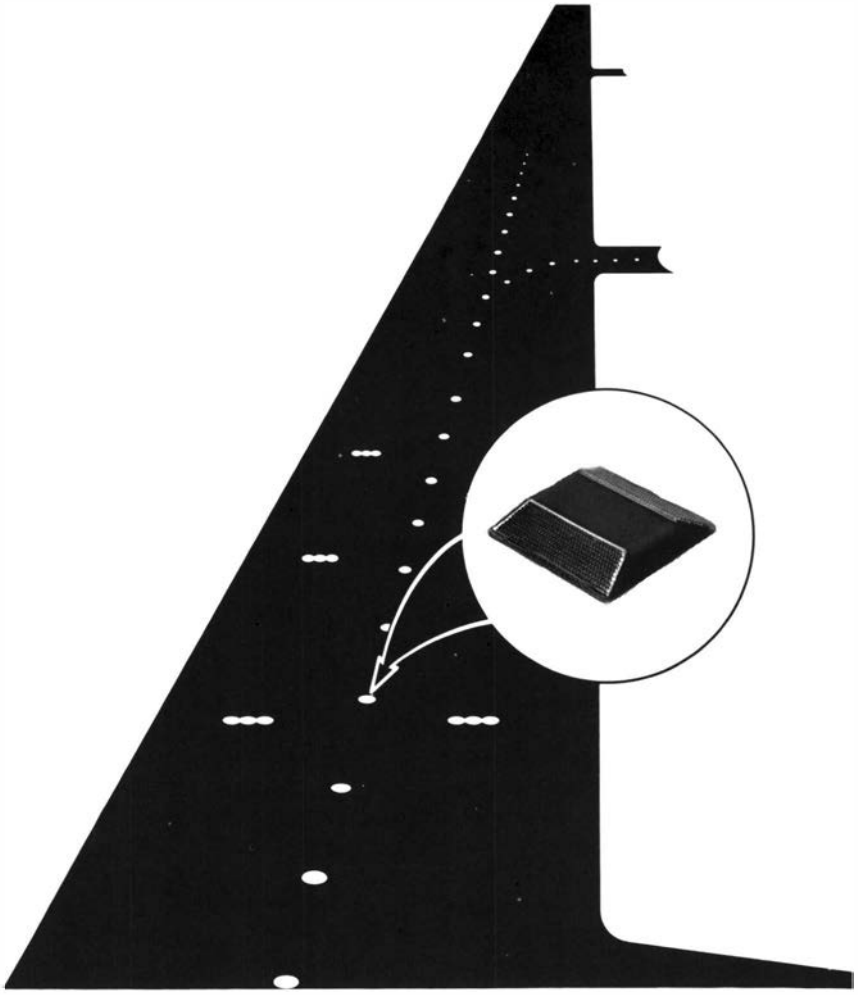

Research Highlights

Sometimes, simple is best. The FAA Technical Center is looking into whether retroreflective pavement markers—similiar to those used on many of the nation's highways—can be used to help pilots landing at small airports or even to supplement standard systems at large airports.

"When there is water on a runway," says Guy S. Brown, Airport Airside Branch, "painted markings are often ineffective due to the reflections of landing lights off the wet surface. We are hoping that retroreflectors, which return the light straight back to its source, will help."

The center is also looking at the markers as a means for pilots to locate exit taxiways, according to Larry Hackler of the same branch. Yellow and green reflectors have been installed on a Tech Center runway leading into the turnoffs to counter the "sea of blue" caused by all taxiway entrance and edge lights being blue.

The color coding for the runway reflectors is the same as for Category II ILSs.

Comments have been favorable, but performance has been dependent on the location and aiming of landing and taxi lights on aircraft.

Front Cover: **The controller's finger will speak to the computer differently in tomorrow's sector suite.** **See page 9.**

Back Cover: **Controllers in the tower at Love Field, Dallas Tex., silhouetted against a setting sun.** Wide World Photos

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By Gerald E. Lavey
Asst. chief of the Public & Employee Communications Div., he previously worked for the Federal Railroad Administration and DOT's Denver SecRep.

'Controllers Proficient, System Safe'

Flight Safety Foundation Audit Okays System Despite Problems

To fly or not to fly—that was the question in the minds of many people following the controllers' strike last summer. And philosophy had nothing to do with their query; it was safety they were concerned about.

The signals they were getting in that regard were mixed. Reports on flying safety in the first weeks after the Aug. 3 strike ranged from "better than ever" to "a disaster just waiting to happen."

On the one hand, FAA, from day one, kept insisting that the air traffic control system was safe. As the Administrator told a House subcommittee: "Despite the claims of others that the system is unsafe, all the evidence we have gathered indicates convincingly that the system is every bit as safe as it was before the strike. Airline management and the pilots who fly substantiate the safety of the system."

On the other hand, spokeman for PATCO and individual striking controllers were quoted almost daily in newspapers and on the evening news alleging far more near mid-air collision reports and operational errors than the FAA was willing to admit. And they predicted confidently that is was just a matter of time before a tragedy occurred and the air traffic control system collapsed.

Adding to the confusion was the fact that behind the safety claims, the public perceived a labor-managment struggle, with each side having an axe to grind and a vested interest in their respective versions of the safety story.

What made FAA's story hard to buy is that it seemed to fly in the face of fundamental logic. It just didn't make sense that 11,400 controllers could be sacked and the system get along okay without them. So, if the public didn't know who or what to believe, it was no wonder.

To help clear up the confusion and to find out if the system really was as safe as FAA was claiming it was, the Administrator decided to get an independent, outside opinion.

For that task, he picked the highly respected Flight Safety Foundation, an international, non-profit organization that had been in the business of promoting aviation safety since the end of World War II.

Under a $185,000, six-month contract, announced on Aug. 18, the foundation was charged by Helms "to evaluate safety conditions and report its findings to us."

It just didn't make sense that 11,400 controllers could be sacked and the system get along okay without them.

Interviewed at the organization's headquarters in Arlington, Va., just outside Washington, D.C., Flight Safety Foundation President John H. Enders said: "The Administrator really maintained hands off in this study. He told us to look at the present system and give him an appraisal of its strengths and weaknesses. He told us not to get into the labor issue, because a separate independent group was working on that, and not to be concerned with long-term rebuilding of the system, because that issue, too, was being handled separately. Other than that, though, he let us go our own way.

Enders became President of the Flight Safety Foundation in 1980 after spending most of his career with NASA, where he started out as a NACA rocket research engineer, flew as a NASA research test pilot and finished as NASA's headquarters manager of aircraft safety and operating problems research. He also served a four-and-a-half-year stint as a test pilot in the Air Force and later spent a year as technical advisor to FAA's Associate Administrator for Aviation Safety.

So, he was no newcomer to either aviation safety or the FAA. His biggest problem initially was not expertise but putting together a credible investigative team in two weeks. "We got some volunteers and some recommendations," he said, "and we carefully considered each one. The only ones we rejected out of hand were people currently working for FAA and striking controllers, in order to preserve objectivity."

Of the 16 individuals who eventuall made the team [see box], seven had

prior air traffic control experience. "Several of them were known to be outspokenly critical of FAA," said Enders, "and there wasn't a single one who could be called pro-FAA."

While Enders provided oversight for the project, Homer L. Mouden, vice president for technical affairs, was general manager, and E. Gene Lyman human factors expert, was the technical study director. Ed Wood of the foundation's staff, who retired from FAA in 1980 after 15 years with Flight Standards and the Office of General Aviation, was Lyman's technical assistant in the study.

In the course of its "safety audit," as Enders prefers to call it, the task force visited over 70 ATC facilities, interviewed approximately 500 controllers and supervisors and spent more than 500 hours observing controllers working traffic. The visits were made in two phases: a detailed inspection of all 70 facilities was done from Sept. 14 to Oct. 18, 1981, and about 50 percent of the sites were revisited from Nov. 16 through Dec. 11.

Task force members also evaluated ATC operations from the jumpseats of air carrier and corporate aircraft, interviewed pilots and other flight personnel and flew the system themselves to get a first-hand look.

After all of this, the task force concluded—to quote from the report presented to the Administrator on January 29 and released on February 5—that "On an overall basis, the present ATC system has an equivalent level of safety to the pre-strike system."

The investigators also found that "an overwhelming majority of pilots interviewed reported the ATC system better than before and a pleasure to fly."

On the subject of controller proficiency, the report states categorically that

"No evidence was found to support allegations of unqualified personnel controlling traffic" and added that "On the average, the present controller work force is judged to have equivalent proficiency when compared to the pre-strike staff."

These findings came as somewhat of a surprise to Enders and the task force members. Explained Enders: "We came to this task very skeptical, expecting to find major problems. We thought the task force was going to spend a lot of its time on near misses, equipment breakdowns, performance failures and the like. We found those problems minor to non-existent."

The foundation's report essentially confirmed the findings of a special investigation of the ATC system by the National Transportation Safety Board during August and September. During its investigation, the NTSB team visited 45 ATC facilities and interviewed 220 controllers and supervisors.

At the end of its probe, the safety board reported: "No basic ATC procedures were changed or compromised in order to keep the ATC system in operation, and the high level of ATC safety required is possible within the present system and will be possible as the system is rebuilt." The board, however, was concerned about fatigue and stress downstream and recommended that FAA establish a program to detect that problem.

Who's Who in the FSF Task Force

James R. Banks—ATC consultant for the USAF Air Defense Command, Scott AFB; past president, Air Traffic Control Association (ATCA).

Ricardo Cassell—CAA/FAA tower and center controller; former FAA research and development program manager.

John W. (Jack) Connolly—director of government affairs for Alden Electronics Co.; former special assistant to the administrator of National Oceanic & Atmospheric Administration (NOAA) on aviation weather services; coordinated establishment of forecaster services in ARTCCs.

Jack Doswell—professional pilot and instructor; former pilot with U.S. Special Air Mission; aviation users representative on ATC matters.

H. O. (Tad) Evans—director of General Motors Air Transport; former pilot with American Airlines and U.S. Army Air Corps.

Donald L. George—analyst with National Aeronautics and Space Administration (NASA); retired controller and team supervisor at Washington National Airport Tower.

Col. John T. (Tom) Halley—division chief, HQ, Air Force Inspection and Safety Center, Norton AFB; 5,000 hours in fighter aircraft.

W. S. (Mike) Hunter—retired CAA/FAA controller and manager; commercial pilot; co-founder of the Arizona Pilots Association; Aircraft Owners and Pilots Association (AOPA) representative on ATC matters; aviation safety consultant.

Lt. Col. Doyle W. Krauss—assistant director, Air Traffic Services, Tactical Air Command, Langley AFB; military pilot and controller experience in terminal and en route operations.

Louis M. McNair—B-727 captain for a major airline, Airline Pilots Association (ALPA) Air Safety Award for ATC and accident investigation; former member of FAA Air Traffic Procedures Advisory Committee.

Harry W. Orlady—retired B-747 captain for United Airlines; president of Orlady Associates, which deals with human and aeromedical aspects of aviation safety.

William Reynard—chief, Aviation Safety Reporting Office, NASA Ames Research Center; pilot; former director for Special Courses, AOPA Air Safety Foundation; VP for operations, National Aviation Trades Association.

Samuel P. Saint—retired captain, American Airlines; consultant to government and industry on aviation and ATC operational matters.

Harry Schmidt—principal, Aero Analysis; consultant on aviation management and planning; former engineering test pilot.

Austin Stephanoff—retired CAA/FAA controller and supervisor at the Cleveland ARTCC.

Tirey K. Vickers—director for ATC planning, Airways Engineering Corp.; former CAA/FAA controller and tower chief; editor of the *Journal of Air Traffic Control.*

Photo by Neal Callahan

If the Flight Safety Foundation team didn't find what it expected, it did find "excellent morale" but, at the same time, as Enders put it, "an overwhelming jitteryness among the working controllers that the strikers would be brought back, along with a return to a stressful work environment of uncooperativeness and harassment."

If that happended, many of the working controllers interviewed said they would "walk off the job," reports Enders.

That attitude softened somewhat by the time the task force made its second round of visits, he said, but the feelings were still strong.

Because of the safety implications of an uncooperative work environment, the foundation's report to the Administrator recommended that "the government should stand firm in refusing to bring back the striking controllers into the ATC system."

Enders took considerable heat on that when he testified, along with NTSB Chairman James Burnett, before the House Post Office and Civil Service Subcommittee on Investigations on Feb. 23.

Subcommittee Chairman William D. Ford charged that the foundation "clearly went beyond its stated purpose in the investigation." In fact, Rep. Ford said the report concentrates so much on the labor problems leading up to the strike and what would happen if strikers were allowed to return that he had the impression the foundation "had its mind made up before the investigation."

That's not the case, Enders insisted. "We did not concentrate on anything except safety in the workplace. There certainly was no preconception that the system was trouble-free—in fact, just the opposite—and we certainly didn't expect to find such strong, universal opposition among the working controllers to rehiring the strikers either."

Therefore, he said, even though the foundation had not intended to get into labor issues, "There was no way we could ignore those findings because we felt they had a definite bearing on aviation safety."

The investigators also had expected to find evidence of stress and fatigue among controllers, but they didn't find those either. The high morale, they suggested in the report, appears to have reduced factors leading to stress and fatigue. And, they noted, this high morale contrasted sharply with the pre-strike work environment described by the working controllers of "bickering, abusiveness and continual harassment of controllers and supervisors."

Rep. Ford said his staff found the same negative atmosphere in its visits to ATC facilities before the strike. But what surprised him, he said, is that his staff could find "no instance of where disruptive controllers were written up, sent home, reprimanded or otherwise disciplined."

That finding, which the foundation study confirmed, is a "strong indictment of government personnel management system procedures," Enders feels.

"I'm not trying to belittle the problems FAA management had," he

"On an overall basis, the present ATC system has an equivalent level of safety to the pre-strike system."

said. "The return of striking controllers in 1970, for example, must have caused as serious an erosion of management authority as anything imaginable."

Nonetheless, he said, "I don't think the agency should turn its head away and say it didn't happen. People can argue about the extent of the problem, but the fact is it existed."

Enders cited examples of reported "setups"—situations created by pro-strike controllers to produce operational errors or deviations in an effort to harass controllers unsympathetic to a strike. Reportedly, these occurred at "most major facilities from time to time before the strike," claims Enders, "and other lesser cases of harassment were a common occurrence at most facilities."

How could these cases of harassment have gone unchallenged by FAA management?

Enders said there was a strong feeling in the field that "the true state of affairs as they existed in the facilities before the strike never percolated to the top." As a result, team supervisors felt they were on their own and didn't have the top management support they needed to take action to stop the harassment. Moreover, they were intimidated by the union.

Some facility managers are now worried that "the bureaucracy will start to settle in now that the strike is over,"

and a similar atmosphere will be allowed to develop again, said Enders. If that is allowed to happen, he predicts, "FAA may have a repeat of this ATC problem down the road."

To keep that from happening, he said, a better mechanism must be established to follow up on problems and complaints from the facilities.

Among the recommendations to the FAA Administrator in the foundation's report is one that reads: "FAA should establish improved management controls, including a new look at controller-management relations, to assure that flight safety will not be compromised by the lack of proficiency and discipline." Immediately following that recommendation is one that states:"FAA should improve communications between all levels of field personnel and FAA headquarters."

"Those two management recommendations are key safety items, in my judgment, and should be considered as one," said Enders. "The present system has shown the importance of attitudes on safety, and attitudes depend on good management. If they are taken care of, many of the other things we're suggesting will fall into line."

"It may sound idealistic perhaps," he said, "but mutual understanding and trust are the cornerstone of this kind of communications." Generally, that atmosphere may be a bit shaky now, he claims. He said many controllers told the task force: "Don't ever mistake our reasons for staying on the job. We stayed because this is our business. We're professionals. We took an oath."

"I suppose some wanted to keep the paychecks coming, too,"added Enders, "but they wanted to make it very clear that their action should not be interpreted as any particular loyalty to FAA as an employer." ■

By John G. Leyden
Chief of the Public & Employee Communications Division, Office of Public Affairs, and a former reporter for the *Washington Star*.

Controllers Have Their Say

Opinions Valued in Design of Sector Suites

When FAA began developing a new work station for radar controllers, it decided to go to the source and ask the people who move the traffic what their preferences and priorities were.

Initial evaluations of alternative sector suite mockups by field and Washington-based controllers were conducted last December, and more are planned for later this year. The results will help define the requirements for work stations or "sector suites," as they are called.

Program manager Kenneth Gray said the ideal approach would be to bring in controllers from the field to evaluate sector-suite mockups in a laboratory environment but noted that staffing problems at ATC facilities around the country make this impractical.

Another alternative might be to load the mockups in a truck and take them around to both center and terminal facilities for on-site evaluations.

The sector suites are key elements in the agency's National Airspace System Plan for modernizing the en route and terminal ATC environment. The 20-year plan also calls for the replacement of the present ATC computer systems and the development of new computer programs, or software, that will accommodate the evolution to higher levels of automation.

The NAS Plan envisions that the sector suite would have three dynamic displays. One would be the traditional traffic or situation presentation similar to that now provided by the controller's plan view display. The second would be for the presentation of flight plan information and would eliminate the need for flight-progress strips. The third would be for flight planning purposes in connection with the implementation of advanced automation features.

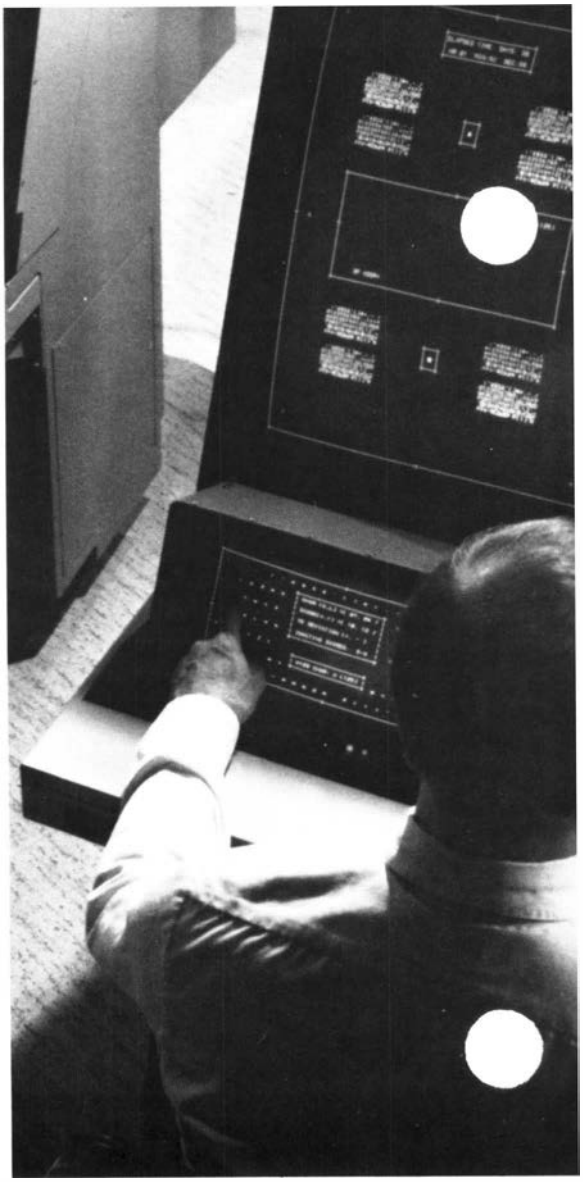
This arrangement, among other things, would provide a controller with insurance against the loss of his or her traffic display. With the touch of a button, the same presentation of radar data on one of the other displays could be called up immediately.

The sector suites also would incorporate their own processors to drive the displays and perform the same basic functions as the computer display channel in the en route system today. These processors would be interconnected and linked to the central computer by high-speed data lines, thus providing a back-up capability in the event of a failure in the main computer.

At this point, however, the sector suite still is in the mockup stage, with attention being given to the human engineering aspects of the design, Actually, three mockups were built to provide evaluators with a range of configurations, features and display presentations.

Ken Gray, who is with the Systems Research and Development Service's ATC Automation Division, noted that the mockups were constructed using a building block and modular principle.

Dr. Helen Hamilton, engineering research psychologist, and Frank Willett, both of the Tech Center's ATC Applications Branch, "operate" mockups of sector suites.



This permits features to be added or subtracted as required and will allow the same basic design to be adapted to both en route and terminal facilities.

In all, 27 controllers participated in the December evaluation, which was held in the air traffic control laboratories of the Mitre Corporation in the Washington suburb of McLean, Va. Sixteen of the controllers were from field facilities, 13 of whom were drawn from the nearby Washington Air Route Traffic Control Center, two from the Atlanta Center and one from Baltimore-Washington Airport. The remaining 11 came from Washington headquarters and included controllers with both terminal and en route experience.

In addition to evaluating the mockups, the 27 controllers had an opportunity to view other related experiments being conducted for FAA by Mitre, including the development of the Automated En Route Air Traffic Control (AERA) concept. This essentially is a software program that will permit the computer to assume increasing responsibility for traffic separation and routings in the future system.

The controller teams also had an opportunity to familiarize themselves with advanced computer input techniques that will be incorporated in the sector-suite design. Called "touch entry," it greatly simplifies the job of entering and updating information in the computer.

Using touch entry, for example, a controller might tap the assigned altitude for a particular aircraft as shown on either his traffic or flight data display. The touch would break a grid of invisible light beams and tell the computer that the controller wanted to enter a new altitude assignment. It would then serve up a "menu" of appropriate altitudes; the controller would touch the one he wanted; and the change would be made automatically.

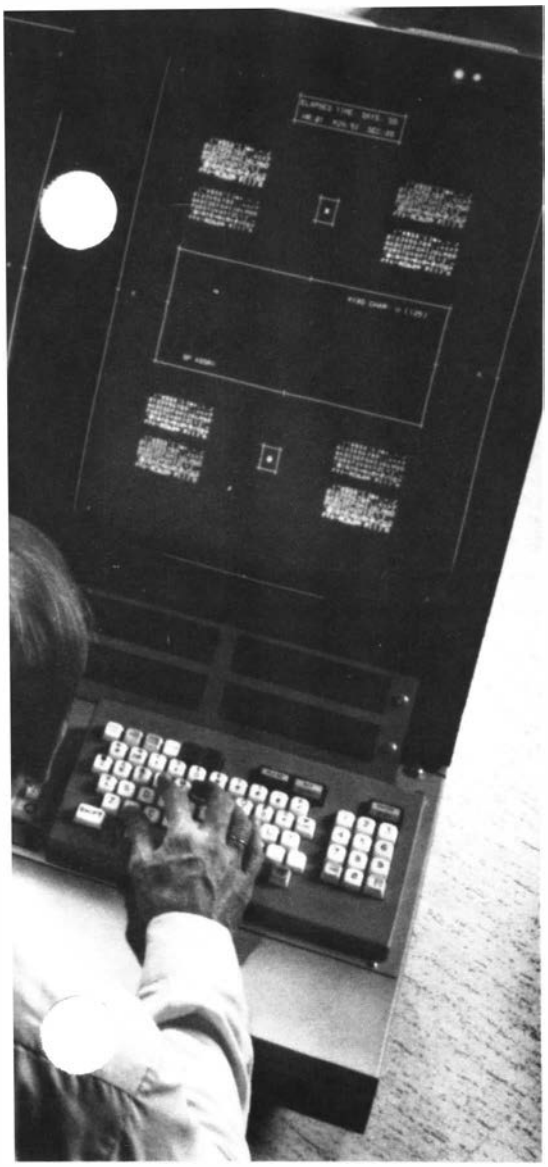
Gray pointed out that touch entry not only is faster and easier to use than the standard keyboard device but also offers far less opportunity for error. He noted that the system is almost self-teaching, since information is presented in a logical sequence and mistakes can be caught immediately.

For the evaluation itself, the controllers were divided into groups of two to four people and briefed on the information and tools that would be available to them in the future system. They then were given time at each mockup and asked to comment on the special characteristics of each.

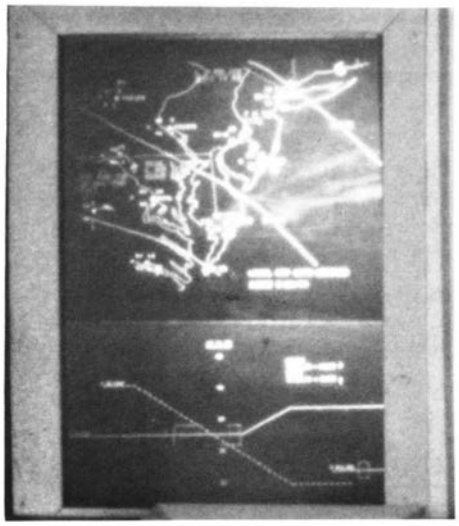
Dr. Helen Hamilton of the Technical Center's ATC Applications Branch, who coordinated and managed the evaluation phase, noted that the static nature of the mockups did somewhat limit the scope of the study. However, she added that the mockups did provide a three-dimensional vehicle at which you could sit controllers and get them thinking and talking about their roles in the future system.

A typical problem facing the evaluators concerned the size and shape of the mockup displays. All of the displays were rectangular in shape, but they were set in an upright position on two of the mockups and lengthwise on the third.

Controllers tended to split on their judgement of the two arrangements. The upright display was favored for north-south traffic flow and the lengthwise



ETABS (Electronic Tabular Display Subsystem) is being delivered by Sanders Associates, Nashua, N.H., to the Tech Center to be used as an engineering model. ETABS functions for flight data display and infrared touch entry will be integrated into the ATC sector suite.



The flight-planning screen might show horizontal and vertical profiles of aircraft, as above, to compare, say, conflicting flight plans.

ones for east-west routes. Suggestions were made that a large square display would satisfy both points of view.

Other comments concerned the presentation of data, the location of data entry devices, communications panels and other physical features, the application of the concept to both en route and terminal facilities and its usefulness for oceanic control and altitude reservation functions. A final report on the findings of the December evaluation is being prepared by Dr. Hamilton.

Ken Gray is recommending that a composite mockup be built to incorporate the improvements suggested by the first group of evaluators. It's this composite that he wants to take on the road in late summer to obtain a broad cross-section of controller views. If possible, he added, he would like to visit one center and two terminals in each region.

Gray noted that such a tour would benefit both the FAA and the controller workforce, since the agency would gain the benefit of their opinions and the controllers would feel, quite correctly, that they had a voice in shaping the future system.

FAA's National Airspace System Plan projects a need for some 2,500 sector suites at en route centers, hub terminal radar control facilities and tower cabs through the year 2000. It calls for production of the first unit in 1987 with deliveries to the field beginning later that same year. ■

People

Aeronautical Center

■ **Wesley H. Kraft,** unit chief in the Line Maintenance Section, Frankfurt, Germany, Flight Inspection Field Office.

■ **James W. Newman,** promotion to chief of the Training Methods and Operations Branch at the FAA Academy made permanent.

Alaskan Region

■ **Alvin D. Nowland,** chief of the Kotzebue Flight Service Station, from the Northway FSS.

Central Region

■ **Charles A. Sears,** chief of the Airspace & Procedures Section of the Operations, Procedures & Airspace Branch, Air Traffic Division, from the Operations Section.

■ **Harold M. Wolters,** team supervisor at the Offutt AFB RAPCON, Bellevue, Neb.

Eastern Region

■ **Mathew M. Calendar, Jr.,** data systems officer at the Baltimore-Washington Airport Tower, from the New York TRACON.

■ **Jesse G. Fodero,** team supervisor at the Buffalo, N.Y., Tower.

■ **Thomas E. Griffith,** chief of the Lewisburg, W. Va., Tower, from the Charleston, W. Va., Tower.

■ **John P. Mulligan,** team supervisor at the Farmingdale, N.Y., Tower, from the New York TRACON.

Great Lakes Region

■ **Joel W. Campbell,** watch supervisor in the Detroit, Mich., Airway Facilities Sector.

■ **Bruce A. Hiles,** chief of the Automation & Procedures Section of the Airspace and Procedures Branch, Air Traffic Division, from the Evaluation Branch.

■ **Wallace Hill,** team supervisor at the Cincinnati (Ohio) Lunken Tower, from the Dayton-Vandalia, Ohio, Tower.

■ **Michael D. Kopczynski,** chief of the La Crosse, Wis., FSS.

■ **Terence E. Miller,** team supervisor at the Moline, Ill., Tower, from the Chicago O'Hare Tower.

■ **Talmadge J. Morris, Jr.,** team supervisor at the South Bend, Ind., FSS.

■ **Donald R. Powell,** crew chief in the Indianapolis, Ind., ARTCC Airway Facilities Sector, promotion made permanent.

■ **Ronald C. Schlitter,** team supervisor at the Decatur, Ill., FSS.

■ **Jack R. Watkins,** crew chief in the Aurora, Ill., AF Sector.

■ **George D. Woods,** systems performance officer in the Cleveland, Ohio, ARTCC.

Northwest Mountain Region

■ **Edward M. Gass,** team supervisor at the Seattle-Tacoma, Wash., Tower, from the Boise, Idaho, Tower.

■ **Roger D. Ray,** team supervisor at the Eugene, Ore., Tower, from the Oakland, Calif., TRACON.

■ **Wallace W. Rose,** chief of the Broomfield, Colo., Tower, from the Operations, Procedures and Airspace Branch, Air Traffic Division.

Southern Region

■ **Edward S. Bayne,** chief of the Knoxville, Tenn., Downtown Tower, from the Knoxville Tower.

■ **Jimmy J. Downing,** team supervisor at the Nashville, Tenn., Tower, promotion made permanent.

■ **Charles W. Foster,** team supervisor at the Dothan, Ala., Tower, from the Jacksonville, Fla., Tower.

■ **Robert R. Johnson,** unit supervisor in the Wilmington, N.C., AF Sector Field Office of the Charleston, S.C., AF Sector, from the Electronic Engineering Branch, Airway Facilities Division.

■ **Roger A. Lahaise,** team supervisor at the West Columbia, S.C., Tower, from the Memphis Tenn., Tower.

■ **Clifford C. Monteau,** deputy chief of the Jacksonville, Fla., ARTCC, from the Operations Branch, Air Traffic Division.

■ **August T. Ruark,** team supervisor at the San Juan, Puerto Rico, International Flight Service Station, from the Atlanta Ga., FSS.

Southwest Region

■ **James G. Goertz,** data systems officer at the Houston, Tex., Intercontinental Tower, from the Automation Branch, Air Traffic Division.

■ **Donald D. King,** navaids/communications specialist in the Oklahoma city AF Sector, promotion made permanent.

■ **Donald C. Kozlowski,** team supervisor at the Albuquerque, N.M., FSS.

Technical Center

■ **Richard W. Cleary,** chief of the Program Branch of the Engineering Management Staff, promotion made permanent.

■ **Arthur D. Faram,** chief of the Enroute Field support Section of the National Automation Support Branch, promotion made permanent.

■ **Joseph S. Kowalewski, Jr.,** chief of the Terminal Production Section, National Program Maintenance Branch, ATC Automation Division.

■ **David L. McCracken,** chief of the Terminal Field Support Section, National Automation Support Branch.

■ **William G. Morris,** chief of the Terminal Baseline/Design Section, National Program Maintenance Branch, ATC Automation Division, from the Flight Service Station Section.

■ **Richard B. Shinpaugh,** chief of the Enroute Production Section, National Program Maintenance Branch, ATC Automation Division, from the En Route Procedures Branch, Air Traffic Service, Washington.

Washington Headquarters

■ **Carol V. J. Carmody,** chief of the Budget Reports Branch, Budget Review & Reports Staff, Office of the Budget.

■ **David E. Hodge,** chief of the En Route/Terminal Requirements Branch, Systems Programs Division, Air Traffic Service, from the Terminal systems Branch of the Automation Division.

Western-Pacific Region

■ **Sheryl D. Becker,** team supervisor at the Oxnard, Calif., Tower, from the Burbank, Calif., Tower.

■ **Henry W. Bolton,** chief of the Daggett, Calif., AF Sector Field Office, Lancaster, Calif., AF Sector.

■ **William A. Brown,** team supervisor at the Reid-Hillview Airport Tower in San Jose, Calif., from the San Jose Municipal Tower.

■ **George T. Feick II,** chief of the Tahoe Valley Tower in South Lake Tahoe, Calif., from the Reno, Nev., Tower.

■ **Dale L. Frehafer,** team supervisor at the Deer Valley Tower in Phoenix, Ariz., from the Las Vegas, Nev., Tower.

■ **Stuart A. Hayter,** chief of the Programs Section, Plans and Programs Branch, Air Traffic Division, from the Office of International Aviation, Washington.

■ **Kathryn E. Kuhlmann,** team supervisor at the Long Beach, Calif., Tower.

■ **Jerry D. Luce,** chief of the Airspace and Procedures Branch, Air Traffic Division, from the Operations, Procedures & Airspace Branch of the Pacific-Asia Region.

■ **William J. Newman,** team supervisor at the Reid-Hillview Tower in San Jose, Calif., from the San Jose Municipal Tower.

■ **Robert H. Perez,** maintenance mechanic foreman in the Finegayan, Guam, AF Sector.

By Fred Farrar
A public information specialist in the Office of Public Affairs, he is a former Washington correspondent for the *Chicago Tribune*.

Getting the Jump on a Job

Certification Team Looks Ahead to a Hybrid Aircraft

You'd think that the staff of the Helicopter Certification Directorate in the Southwest Region would be concerned with more pressing matters than whether oil will be discovered more than 400 miles from England's shores in the North Sea.

Ordinarily, you'd be right. But such a discovery could directly affect the directorate by dumping in its lap the prospect of having to certificate a hybrid type of aircraft that the FAA had never before certificated.

Instead of sitting around waiting and wondering, the directorate since late last year has been busy drawing up a cer tification basis for such an aircraft, so that it will be ready to go when and if a manufacturer decides to build one and apply for type certification.

The aircraft is the tilt rotor—a helicopter-airplane hybrid that combines the comparative fuel efficiency of the airplane with the vertical takeoff and landing capability of the helicopter. The most likely manufacturer is the Bell Helicopter Division of Textron, Inc., of Fort Worth, Tex.

Bell has one such aircraft now flying that it developed under the joint sponsorship of the National Aeronautics and Space Administration, the Army and the Navy. And it sees a bright future for a civil version, because the helicopter has

just about reached its technological limit and cannot be made more fuel efficient or faster.

This is where that oil drilling rig more than 400 miles from land in the North Sea comes in. If you want to fly that far and still have a vertical landing capability, a helicopter is not the answer.

Only one type of helicopter has a range of 400 miles. To go that far, it has to carry so much fuel that it could carry only eight passengers instead of the 40 it is designed to carry. And at a top speed of 130 knots, it would take more than three hours to make the trip.

The tilt rotor, on the other hand, cruises at twice the speed for twice the range on the same amount of fuel. It accomplishes this by taking off and landing in its helicopter mode and cruising in its airplane mode. How it does this is implied by its name. The rotors, large diameter propellers, and the engines that drive them tilt up for takeoff and landing and forward for cruise.

It is a convenient and logical arrangement. But it poses a host of certification problems that the FAA has never faced before. That is why the Helicopter Certification Directorate has, at Bell's request, started work on the job of drawing up the standards.

Bell made the request last December in a letter to C. R. (Tex) Melugin, director of the Southwest Region; since then, the directorate has had one person working full time on the project and three working part-time.

According to Wayne Barbini, an aerospace engineer in the directorate, the job is "essentially one of certificating one aircraft under two parts of the FARs.

Southwest Region Director C.R. Melugin, Jr., (left) discusses the characteristics of Bell Helicopter's XV-15 TiltRotor with experimental test pilot Dorman Cannon.

"Those are Part 25, which sets the standards for large transport airplanes, and Part 29, which sets the standards for transport helicopters."

Barbini says that there are four areas of special concern, which the directorate will be keeping in mind as it draws up the certification basis—structure, drive train, systems and flight testing.

"As far as the structure is concerned," Barbini says, "the aircraft is going to have to carry the loads peculiar to a helicopter during take off and landing, the loads typical of an airplane during cruise, and a whole new set of loads during transition.

"The drive train is also critical," Barbini said, "because the engines that drive the rotors are 'cross-shafted' so that if one engine fails the other can continue to drive both rotors. This is to prevent an asymmetrical thrust situation from developing, and we will want to make sure that the cross-shafting system is completely fail-safe."

He said that the systems that control what works and when are equally critical. "We want to be sure, for instance, that the system that controls the tilting of the rotors does what it is supposed to do. How would you land the thing if the rotors, which extend far below the landing gear when they are in the cruise position, won't tilt back up into the helicopter mode?"

"The flight testing is important," Barbini continued, "because we want to be sure that we have a stable aircraft with good handling characteristics."

And when all this is done, Barbini said, the FAA will have one more decision to make.

"Who can fly it? Will it be fixed wing pilots with helicopter ratings or helicopter pilots with fixed wing ratings?" ■

On the Track of the Crackle

Mobile Labs Find Intruders on FAA's Airwaves

Shortly after the strike of air traffic controllers began, a series of short bogus ATC transmissions were heard in air/ground communications—a serious breach of safety, a violation of the Federal Aviation Regulations and of the Federal Communications Commission regulations and a prosecutable offense.

The incidents brought out the FBI, the FCC and FAA's Radio Frequency Interference & Measurement (RFIM) vans. The Great Lakes calls it a Spectrum Characteristics Analysis and Measurement (SCAM) van. The Western-Pacific Region hangs the name Spectrum Analysis Antenna Pattern Plotting Interference Locator (SAIL) on its van. By any other name, it's just as effective a diagnostic and tracking tool.

If you still don't know what we're talking about, harken back to World War II movies in which the Nazis were tracking down a Resistance radio. The enemy used a truck that sported a loop antenna, which rotated ominously in the direction of the hero's *verboten* transmitter.

FAA equipment is more sophisticated now, and it needs to be. For one thing, there weren't radios all over occupied Europe—only the Germans were supposed to have them. For another, they were looking only for a radio, not first trying to determine what it is that they're looking for.

A spurious broadcast brings out the troops—the FAA and the FCC looking electronically and the FBI examining voiceprints and checking suspects. But FAA's primary job for these mobile electronics laboratories is to ensure the integrity of its radar, navaid and communications systems.

That integrity is threatened by a multitude of signal radiators, and the multitude is growing dramatically.

All of the FAA regions now have a frequency measurement van. According to Jerry Markey, chief of the Frequency Engineering Branch in headquarters, a van design was tested for standardization at first. It was decided, however, that beyond certain minimal equipment, each region should acquire its own van tailored to its individual needs. The Rocky Mountain Region, for example, had to get a van capable of climbing steep mountain roads.

The Great Lakes Region received the headquarters-developed test vehicle, a modified Dodge van that supports a rotating antenna mount. Inside is a spectrum analyzer, which provides a CRT display of a spectrum of frequencies or a single frequency under examination. Also in the racks are signal generators for duplicating a frequency so an interference pattern can be simulated, a field strength meter and a power density meter for measuring signal levels, an oscilloscope—another frequency CRT display, a digital counter and radiation hazard monitors, plus prosaic stuff like a snake bite kit and a pair of burgler alarms.

The latest addition is an automatic direction finder. Most vans also have walkie-talkie and CB equipment.

Smaller vans have become more practical as solid-state electronics has made the equipment ever more compact. David Lantzy, Airway Facilities communications specialist who operates the Great Lakes van, says the compactness permits him to function without assistance.

Radio interference is a problem, whether deliberate or inadvertent, because of the pervasiveness of radios. The FM radio band (88-108 MHz) is particularly troublesome because it abuts the ATC frequencies.

At Washington National Tower, electronics engineer George Sakai, headquarters Frequency Engineering Branch, working with Dick Crofford and Bill King of the Airway Facilities Sector there, traced a brief, recurring noise on controllers' headsets to an extremely popular rock-and-roll radio station. Even if it were feasible, there'd be the devil to pay if all employees as well as transients at the airport had to switch it off or tune to another station. The fix was to reduce the sensitivity of the FAA's receivers.

The causes of frequency interference are as diverse as the instruments of our technology. Excessively high power or improper shielding of industrial equipment are frequent sources of troublesome radiation. But the portent for other problem sources is growing—the proliferation of home computers, video games and video arcades and the continuing spread of cable television. If

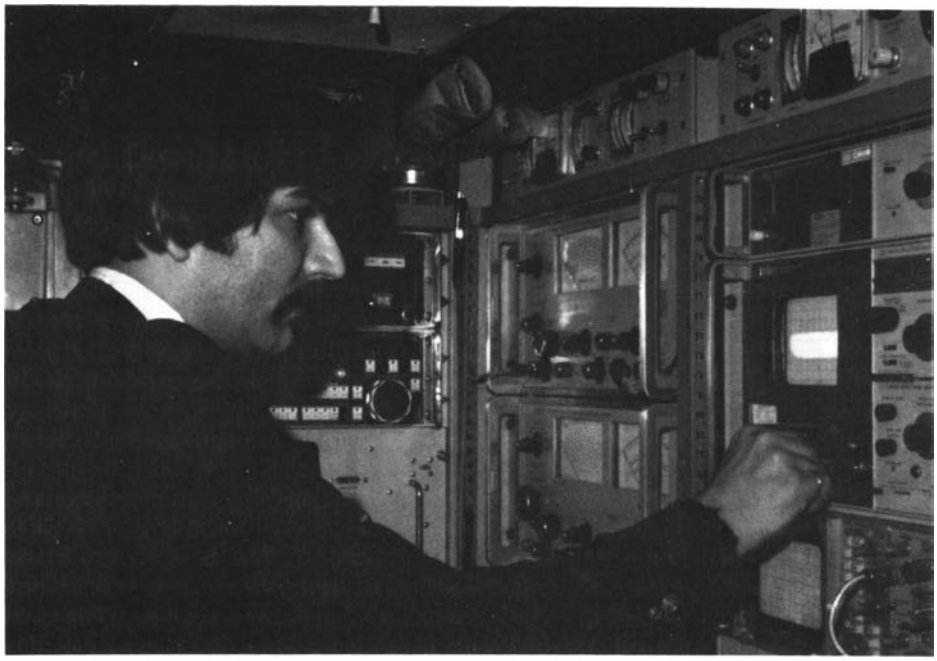
designed, installed and operated properly, the equipment poses no problems. However, the choice of locations may not be properly evaluated, equipment may break down and there may be unauthorized tampering with shielding.

Great Lakes' Lantzy had similar problems at both O'Hare Airport and Meigs Field in Chicago. The worse one was at Meigs because it was intermittent. "It took almost a year to track down this interference, which was an annoying crackle on the controllers' headsets, not a safety problem," Lantzy said.

Just as I thought I'd be able to zero in on the offender, a controller would start transmitting, and I'd have to wait for the noise to resume without the voice. After we installed a direction finder, we tracked it easily. In both cases, the offenders were thermoplastic welding machines in nearby factories."

Frequency interference at the Minneapolis ARTCC was easier to track; it was at the center itself, where toner powder in a photocopier had spread to electrical contacts in the machine.

At first, Reuben Michaelis, another electronics engineer in the Frequency Engineering Branch, had a difficult time determining why an instrument landing system at Andrews Air Force Base was malfunctioning. By frequency analysis and tracking with a van, he found the culprit to be a defectively shielded hand-held optical scanner from a cash register computer in a store that was more than 10 miles from Andrews but directly under that ILS's approach path.



David Lantzy, Great Lakes communications specialist, tunes in a frequency on his SCAM van's spectrum analyzer to check the accuracy of a navigational aid.

The RFIM van also is used in a preventive way to check radar antenna radiation patterns and navaids. Also, at times, it's used in conjunction with flight inspection work. If a flight inspection aircraft finds an interfering signal causing equipment inaccuracy, then the RFIM van is called in to locate the source.

Improperly tuned signals from our own equipment or commercial transmitters can create excessive harmonics—multiples of the fundamental frequency—or spurious signals that can affect other signals nearby, particularly on a shared antenna site.

When FAA determines that an outside agency is responsible for interfering with FAA communications or navaids and tracks down the offender, FAA then files a complaint with the offending government agency or the FCC for non-government organizations or private citizens to obtain corrective action.

Says branch chief Markey, "Our interference problems are manageable, and most people are cooperative when we point the finger at the offending equipment. While we try to work out accommodating solutions, we never permit a compromise of aviation safety. With the thousands of possibilities for radio interference, there's no end to the utility of RFIM vans in protecting the National Airspace System." ■

Contributing to this article were Marjorie Kriz, Great Lakes Public affairs specialist, and Len Samuels, editor of FAA WORLD.

Contributing to this article were Tom Schatterman, Great Lakes Region engineer; George Burlage, Southwest Region public affairs officer; and Barbara Abels, Western-Pacific Regic public affairs specialist.

Painless Cost-Cutting

Technicians Prove a Kilowatt Saved Is a Budget Dollar Earned

Sometimes the complaint "they can't see the forest for the trees" overlooks the fact that without the trees there'd be no forest.

In complying with the President's cost-cutting program, FAA technicians and engineers around the country have been taking new looks at the stands of power-consuming equipment and facilities in their charge to prune out waste. Actually, just in recognition of escalating energy costs, many projects were undertaken before the President's call.

Fred Conover, Airway Facilities Sector manager at the Albuquerque, N.M., ARTCC, decided to prod employees into focusing on the center's energy consumption, "My idea was to let the employees see the monthly electricity statement and help them understand power company billings, like peak-demand periods. There's no better way to give them an awareness of the cost of doing business," Conover explained.

The monthly bill was over $30,000 four years ago. The cost of electricity has more than doubled since then, but the center's bills have remained the same or even slightly lower. Use had been at the rate of 757,000 kilowatt-hours (kwh) per month; now it's 550,000 kwh.

Although the rate varies according to area and whether it's at peak-demand time or not, four cents per kilowatt-hour is the approximate commercial rate, which doesn't sound like much. For each saving idea or project, that rate translates into a few thousand dollars—not bad to individual pocketbooks, but still not much in the scheme of million-dollar and billion-dollar budgets. But add the projects together in one facility and multiply by facilities; pretty soon these individual trees have made a forest of significant savings.

In many facilities, it's frequently the environmental systems—heating, ventilating, air conditioning and humidity control—that are inefficiently used.

One of several projects undertaken by the Red Bluff, Calif., AF Sector Field Office, which is responsible for a long-range radar antenna, a beacon antenna, a common digitizer and a radar microwave link terminal and repeater, was to install an energy saver on its 20-ton air conditioning system. This involves the use of evaporators to pre-cool incoming air to the condensers. It improves efficiency and extends the life of the air conditioner's compressor.

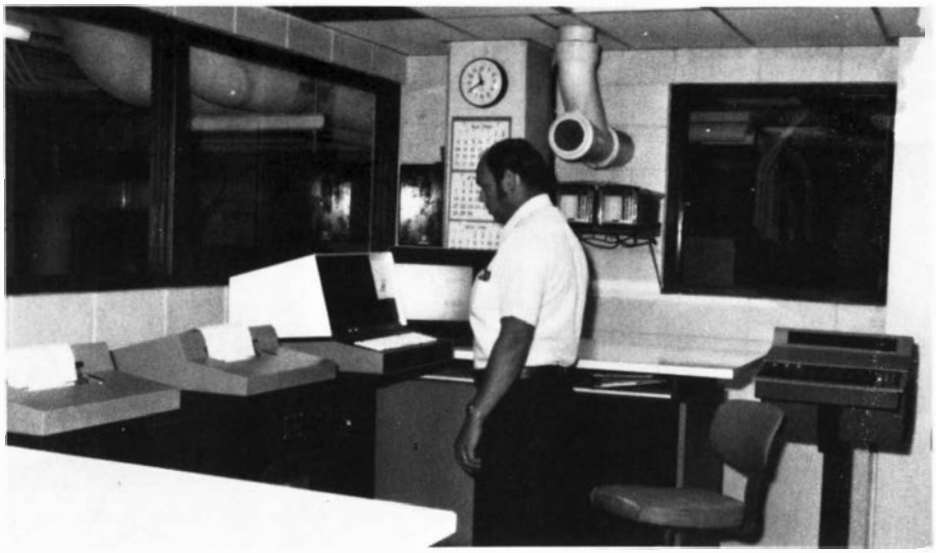
Red Bluff technicians also designed and installed an automatic building temperature control, which put 11 four-kilowatt space heaters our of business. The control system uses the heat generated by the radar equipment for heating the building during the winter and uses outside air when it's below 65 degrees to cool the facility in the warmer months.

These were among the efforts that brought the SFO a 30 percent reduction in electrical energy consumption and a conservation award from Pacific Gas & Electric Co. last fall. Overall, Red Bluff expects current yearly savings to be $12,000.

The Chicago ARTCC saved 2.2 million kwh and 13.6 million cubic feet of natural gas in a year. One means to this accomplishment was by shutting off one of two 200-ton air conditioners for most of the year and by raising thermostats and humidity limits in the administrative areas during warm weather and using outside air for cooling whei possible. The computer areas, particularly the central computer complex (CCC), are not subject to such economies, for the equipment is sensitive to even minor changes in its environment.

As a result of using only one air conditioner, associated cooling equipment could also be turned off. In addition, five air supply fans and eight other fans were shut off in the evening without adverse effect.

Analysis showed that 40 percent humidity could be maintained in the winter even with shutting off a 25-hp steam boiler committed to the purpose. ARTCC technicians replaced a 100-hp boiler delivering 4,200 cubic feet of heated air per minute with a 60-hp one that produced an adequate 2,500 cubic feet per minute. Hot water supply tem-



Harvey Burr, assistant chief of the Chicago ARTCC's environmental unit, checks status of the air conditioning system throughout the building with a computerized remote maintenance monitoring system.

peratures were lowered and the heat from the electronic equipment was tapped for space heating.

The Albuquerque ARTCC achieved comparable savings to that of Chicago. Technicians there installed 6,500-cubic-foot-per-minute evaporative coolers on the Power Conditioning System building, replacing a 30-ton refrigerated air-conditioning unit. The evaporative, or swamp, cooler units draw 7.8 amperes of current, compared to 83 amperes with the refrigerated units. This permitted the installation costs to be amortized within 90 days. Evaporative units are particularly good in dry areas like New Mexico.

Another fix was to retire a two-ton refrigerated air conditioner serving Weather Bureau equipment in favor of cool air re-routed from the center's main system. The $128 for coils, piping and valves saved about 22,000 kwh, or close to $1,000 a year.

The possibilities for savings on other equipment also have been scrutinized. Old concrete block or hard-board-paneled RCAG sites were due for remodeling in the Great Lakes Region. With solid-state electronics replacing vacuum-tube equipment at these air-ground communications facilities and generating less heat, less cooling and more heating was needed for the buildings. As a result, their heating efficiency was boosted by overlaying them with a two-inch foam exterior shell and aluminum siding and adding urethane foam covering for the roofs.

Electric heat was added just as a boost to the equipment heat supply. A window air conditioner with an ERR rating of 8.8 and a ventilating fan for outside air provided alternative cooling possibilities.

Older towers are also getting modernized and efficient heating and air conditioning systems and added insulation.

In addition to the nationwide program for installing more energy-efficient medium-intensity approach lighting systems (MALSR), Great Lakes has reduced 66 percent of the lamps on 13 runway approach lighting systems without compromising safety—a saving of more than $25,000 annually.

As most Federal employees have been aware for the last few years, office lighting has not been ignored in the search for savings. Lights in unused spaces or after hours are turned off, and alternate lamps have been removed.

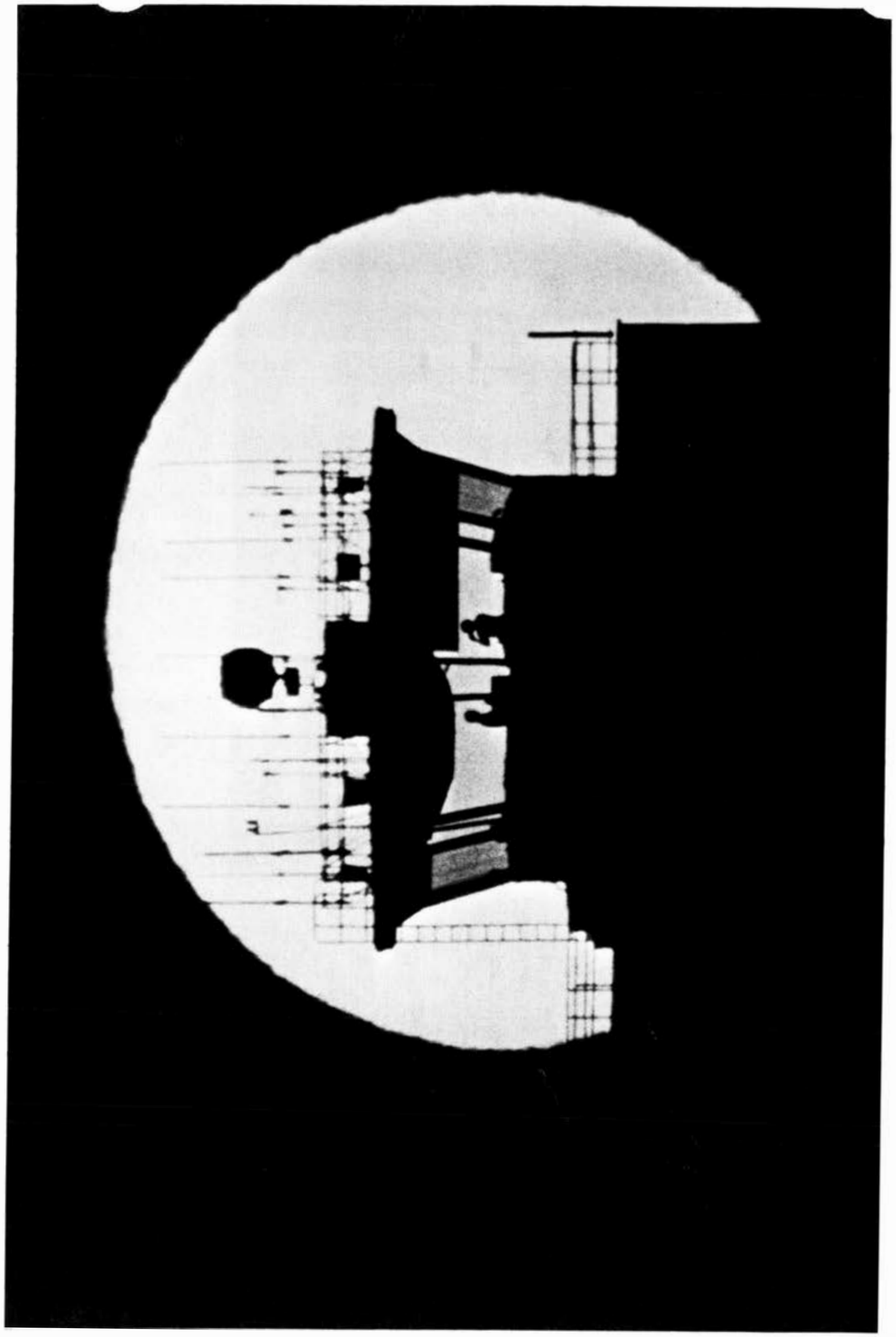
The Albuquerque Center, however, installed new circuit switches, which permitted 1,064 fluorescent tubes to be turned off remotely. Outside, 19,000-watt quartz-halogen lights were replaced with 1,200-watt low-sodium lighting units.

Even the ARTCC cafeteria's dishwasher came in for attention, its electric boost replaced with a steam-coil hot water heater. This eliminated the demand-power penalty and saved $4,000 a year. Another "small" saving was achieved when technicians evaluated the center's fire water pump. To stay at the ready, it turned itself on continually to compensate for variations in water pressure. But they found that water-line pressure was adequate without the pump, due to multiple-source routing. Saved: $9,500 a year.

At Red Bluff, the Radar Antenna and Transmitter Start circuit was modified so that if the main channel failed, it would turn on the standby radar channel. This contrasted with power going to both channels throughout the eight-hour period each day that the facility is unmanned. Reliability was not sacrificed for the $4,000 yearly savings in electrical costs, plus the lessened wear on the standby equipment.

Like most in Airway Facilities, SFO chief Harold Hotchkin had become alarmed at the rising utility costs, particularly when mated with lowering budgets. The answer was to conserve energy without adversely affecting the safety of the airspace or the employee environment.

As usual, Hotchkin noted, the technicians came through. ■



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