quickly fail if subjected to EMP. Mobile units also rely on radio links rather than the more vulnerable land lines that the military rents from American Telephone & Telegraph, the sole U.S. common carrier with which it does business. EMP hardening of the AT&T system is considered impossible because of its size.

Even with the new emphasis on airborne and mobile ground systems, underground command posts have not been abandoned. On the chance that they might not be the object of a direct nuclear hit but only incapacitated by power outages, a move is afoot to supply them with backup and specially hardened power systems. This is considered so important that the Senate Armed Services Committee has added $5 million to the Administration's fiscal 1982 budget request for "power upgrades at key C^3 facilities."

One way of increasing the reliability of the military's telephone lines is through redundancy, through the interconnection of a variety of commercial carriers into the military network. Among other things, this would give a technical heterogeneity that would increase the odds that at least one carrier might weather an EMP attack. (On a more mundane level, competitive procurement would also probably lower the Pentagon's telephone bill.) This is probably the simplest, most straightforward way to enhance the reliability of the military's ground-based network. In 1979 President Carter stressed this by issuing Presidential Directive 53, an unclassified order encouraging such "connectivity" with a variety of commercial carriers so that "forces can support flexible execution of retaliatory strikes during and after an enemy nuclear attack."

Despite the presidential pressure and the apparent advantages, the military still has not procured any lines from the growing horde of specialized common carriers in the United States. The Defense Communications Agency has formed a "working group" to study the issue, but outside vendors are discouraged. "We've talked to them," says Orville Wright, President of MCI Communications Inc., one of the new specialized carriers, "but the talk has been very small indeed. They seem to be light years away from making any kind of decision."

Some of the steps proposed by the Joint Chiefs to decrease the vulnerability of the military's communication links are major, some are modest. Whether they will add up to a secure network is the critical question. Many of the programs, if funded, will not produce new equipment until the 1990's, and, even then, the efficacy of the improvements could be firmly estabished only after the fact of a nuclear confrontation. Given the patchwork that now exists, the prospects are not all that encouraging. More, the numerous upgrades and the acquisition of new systems to stem the communications gap are continuously undercut by the technological creep that created the vulnerability to an EMP attack in the first place: the semiconductor revolution. The ubiquitous chips, microprocessors, and integrated circuits that have penetrated so many facets of military procurement will only become more numerous. Frost & Sullivan, a New York–based market forecasting firm that specializes in military electronics, estimates that the U.S. military will double its purchases of semiconductors between 1980 and 1985. Whether these delicate devices with their inability to handle surges in voltage can be protected in critical systems is a question perhaps more basic than whether big new systems can reduce vulnerability. In the meantime, the EMP threat looms ever larger as the electronics revolution moves forward.—WILLIAM J. BROAD

Airfield Alarms Astronomers

The Air Force wants to build a new airfield in Altar Valley, Arizona, only 9 miles away from Kitt Peak National Observatory, where there is the world's largest collection of telescopes. Officials at Kitt Peak and the observatory's sponsor, the National Science Foundation, are worried that a new airport, a source of both light and air pollution, could severely compromise operations.

The Air Force is waiting for the first draft of its environmental impact statement before making a final decision about the site. Meanwhile, Kitt Peak director Geoffrey Burbidge has been rounding up support from the Arizona congressional delegation and the governor's office in an attempt to convince the Air Force to rethink its plans. The Air Force wants to build a supplement to the Davis Monthan field near Tucson, and the quest has gained urgency since an Air Force plane went down on the campus of the University of Arizona 3 years ago.

Kitt Peak did not learn that Altar Valley was the site of choice for a new airfield until June, when reports appeared in the local press. The proposed new airfield, which is to be completed by spring 1983, would include a 10,000-foot runway and various buildings. Although the present plan is to operate the field only during the daytime, conduits for runway lights are included in the plan, and Burbidge has been unable to extract assurances from the Air Force that the strip will not operate at night.

Kitt Peak, which is home to a half-dozen university-owned telescopes as well as the federal ones, has 18 telescopes making observations around the clock. During the day optical telescopes make infrared observations, and solar observations are made with the world's largest solar telescope. Optical and infrared observations are made at night. Turbulence and particulate emissions from jets can interfere with infrared scanning of the atmosphere. Increases in particulate matter would jeopardize a long-term study monitoring atmospheric constituents that is being conducted by Battelle Institute.

The greatest potential threat to the observatory is that airport lights will interfere with nocturnal optical observations. Light pollution from the city of Tucson is kept under control by an ordinance that requires reflectors on street lamps to throw the light downward. The new airport would be one-sixth as far from the observatory as Tucson, and could cause almost 40 times as much light interference. Burbidge adds that the airfield's security lighting alone "would have the same effect as approximately 25 to 30 years of the projected growth of Tucson." The remaining useful life of Kitt Peak is estimated to be more than 50 years if the population of the area continues to grow at the present rate.

The Air Force has promised to give weight to the concerns of the observatory, which is preparing quantitative estimates of the effects of the proposed airstrip for inclusion in the environmental impact statement. The first draft is expected to be completed in October.—CONSTANCE HOLDEN

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