

those who walk over the terminals, it might give an unpleasant electric shock to a camper dragging an aluminum canoe or a farmer stepping onto a tractor hitched to a plow. The other recommendation is that the Navy should demonstrate a reliable procedure to detect and repair faults, such as a break in cable insulation where current could leak out into the ground and produce electric shocks in animals and people passing near the defect.

The committee evaluated numerous studies of more subtle biological effects of the extremely low frequency radiation (ELF) that the antenna would produce. Tests have included ELF effects on a wide variety of organisms and processes, such as slime mold cell division, flatworm regeneration and primate behavior. Many experiments that had reported significant effects were judged to lack proper controls and guards against researcher bias or could not be replicated by other scientists. The committee judged as incorrect a widely publicized 1971 study which indicated exposure to ELF radiation increases triglyceride levels in the blood. A more recent study by Navy researchers showed no such changes. "The committee's considered opinion is that such fields will not cause a significant and adverse biologic disturbance, except in the event of electric shock, which is of serious concern," the report concludes.

The committee does identify some possible biological effects of weak electric and magnetic fields, but they do not consider them hazardous. Fish in lakes within the grid would probably detect the electric fields, the report states. Such interference might affect their spatial orientation or detection of prey. The committee suggests that, in the absence of more definitive information, ground terminals be placed as far as possible from bodies of water.

Radar tracking of birds flying over the Wisconsin test facility (SN: 3/5/77, p. 153) indicates that the ELF magnetic field has a "real and measurable effect on some migrant birds." The report points out that constructing the grid near a major migratory flyway (such as in upper Michigan) would present more opportunities for potential harm to birds than building it away from major bird routes.

Before any antenna is constructed, the bird migration patterns in the area should be studied, so they can be compared with patterns during antenna operation, the committee states. Furthermore if Seafarer is constructed, research projects should take advantage of the opportunity to learn of the effects of weak ELF fields, knowledge also relevant to life under ordinary power lines and among electrical appliances. "Our concern relating to the possible biologic effects of weak ELF fields is that there should be a commitment to monitor biologic and ecologic systems and to acquire a better, indeed a complete, basic knowledge of the effects of electric and

magnetic fields on living organisms. If there is any single technological feature of our civilization which seems destined to remain with us for centuries to come, it is electricity," Hastings says. "We cannot afford to be without basic knowledge concerning its effects in biological systems."

If harmful biological effects are discovered after the antenna is installed and operating, will it be disconnected? H. Tyler Marcy, assistant secretary of the Navy (Research and Development) says yes. He told the first meeting of the NAS committee last year, "Let me go on record, if there are deleterious effects which are determined, that we will stop the transmission." □

Madagascar's mysterious meteorite

The confused tale of the meteorite (or meteorites) that did (or did not) fall to the east (or south, or northeast, or northwest) of the capital city of Madagascar, possibly creating (or not creating) a crater (or craters) up to 240 meters across, is finally beginning to straighten itself out—or is it?

U.S. researchers were in a brief tizzy last week at unconfirmed reports of two nearly simultaneous meteorite impacts on July 30 in the island republic, the larger of which was described in some early accounts as having created what would be the largest impact crater in modern history (SN: 8/6/77, p. 86). The giant crater was said to be near Fianarantsoa, about 400 kilometers south of the capital, and there were reported eyewitnesses to a "bluish light" in the sky shortly before the stated time of impact.

Now, the "giant crater" part of the story seems to have fallen into disrepute, although there apparently was a meteorite impact, preceded by a spectacular fireball. Robert S. Barrett, interim *charge d'affaires* at the U.S. Embassy there, cabled the State Department in Washington: "Report of impact near Fianarantsoa apparently due to the fact that there occurred a mild natural earth tremor in that area approximately 30 minutes after meteorite impact." Reports of the tremor by local residents were "apparently connected by radio news personnel with meteorite fall." The local broadcast "was apparently picked up by VOA [Voice of America], Radio France and Radio South Africa, the former two adding such details as the size of the crater . . . and specific locations." The local radio version was subsequently "corrected," and Madagascar government accounts thereafter downplayed or ignored that aspect of the story.

The fireball and some kind of impact, however, seem to have been real, although closer to the capital and in an easterly direction. An impact registered on the seismographs of the University of Madagascar observatory, but a team of

two seismologists and two geologists from the observatory had failed to find the meteorite by Aug. 9, after a week of searching with the aid of a Soviet-donated helicopter provided by the Malagasy army.

The observatory's acting director calculated that the object should amount to about 1 cubic meter, Barrett reports. Eyewitnesses near where observatory officials believe it fell described the fireball as "blinding," and much brighter than full daylight. Sharon Wells, an embassy secretary, saw the fireball and described it as about the size of a full moon, moving northeast by north, based on the direction of the road on which she was driving at the time.

But the puzzle won't go away. According to a cable from Barrett to the Smithsonian Institution's Scientific Event Alert Network, "Two detonations occurred nearly simultaneously several minutes after the fireball and are variously described as sounding like sonic booms, artillery shots, bomb explosions or quarrying detonations." Two? Wasn't one of them supposed to have been an earthquake several hundred kilometers away? Or did a quake, a fireball and two meteor fragments all beset Madagascar within barely half an hour?

Stay tuned to this station. □

Alcohol: A heart disease preventive?

Clinical observations have linked heart attacks with a rise in cholesterol in the blood. Still other investigations have associated heart disease with an increase in certain cholesterol-bearing lipoproteins in the blood, but not with others. Because alcohol is known to influence lipid metabolism and transport in the body, a team of researchers participating in the National Heart, Lung and Blood Institute's Cooperative Lipoprotein Phenotyping Study decided to see what effect moderate alcohol consumption has on both total blood cholesterol levels and on levels of specific cholesterol-bearing lipoproteins.

As reported in the July 23 LANCET, the researchers found only a slight correlation between moderate alcohol consumption and total blood cholesterol. Past studies have not linked heavy alcohol drinking with a rise in total blood cholesterol, either. Even more intriguing, the researchers were able to associate moderate drinking with high levels of high-density lipoproteins in the blood, those cholesterol-bearing molecules that have been linked with a resistance to heart disease, and with low levels of low-density lipoproteins, those cholesterol-carrying molecules that have been related to heart disease. "It was awfully surprising to us to find this," declares one of the principal investigators, Tavia Gordon of the NHLBI.

Thus, it looks as if moderate alcohol consumption does not increase total cholesterol levels in the blood and may even help protect against heart attacks by increasing lipoproteins that have been associated with heart disease resistance. However, more research must be conducted before one concludes that alcohol is a heart attack preventive, the researchers warn.

Five populations of nondrinkers and moderate drinkers (those who drank between 5 and 20 ounces of alcohol a week) were studied. They lived in San Francisco, Honolulu, Albany, N.Y., Framingham, Mass., and Evans County, Ga. Blood was drawn from the subjects and analyzed for total levels of cholesterol and for levels of high-density lipoproteins, low-density lipoproteins, very-low-density lipoproteins and triglycerides. Very-low-density lipoproteins, like the high-density and low-density ones, carry cholesterol in the blood. Triglycerides, in contrast, are like cholesterol—fats carried by lipoproteins. Whether very-low-density lipoproteins and triglycerides play any role in heart disease remains to be seen.

Results showed only a modest correlation between the amount of alcohol intake and raised total cholesterol in the blood, and even then, there were marked individual variations with some drinkers even having low total cholesterol values. What's more, alcohol consumption was associated with a high level of high-density lipoproteins and with a low level of low-density lipoproteins and with perhaps some elevation in the very-low-density lipoproteins and in the triglycerides. The greater the consumption of alcohol, the stronger this association. (Past studies have likewise failed to associate heavy drinking with raised total cholesterol levels. However, they have linked heavy drinking with elevated levels of triglycerides.)

These findings, then, suggest that moderate alcohol consumption does not increase total cholesterol in the blood, which is a major heart attack risk factor, and that it may even shift the lipoprotein balance in the blood so that there are more heart attack-preventing lipoproteins and few heart attack-risk lipoproteins. However, it is too early to endorse alcohol as a heart attack preventive, Gordon and his colleagues warn.

For one thing, alcohol carries medical risks of its own. For another, their study did not examine whether increasing or decreasing one's alcohol intake might alter the levels of cholesterol or of various cholesterol-bearing lipoproteins, and even more crucially, whether such alterations might in turn increase or decrease the risk of heart disease.

"Our study is only a start toward answering these questions," Gordon stresses. And as he and his colleagues conclude in the LANCET report, "These are challenging new findings which require considerable follow-up before they can be fully understood. . . ." □

Space colonies: One step closer

For the third consecutive summer, a multidisciplinary group of scientists met to elucidate what could become man's next "manifest destiny"—the human colonization of space. A major outcome of the six-week collaboration of over fifty persons is that principal architectural schemes derived during the previous two studies are now understood in greater detail.

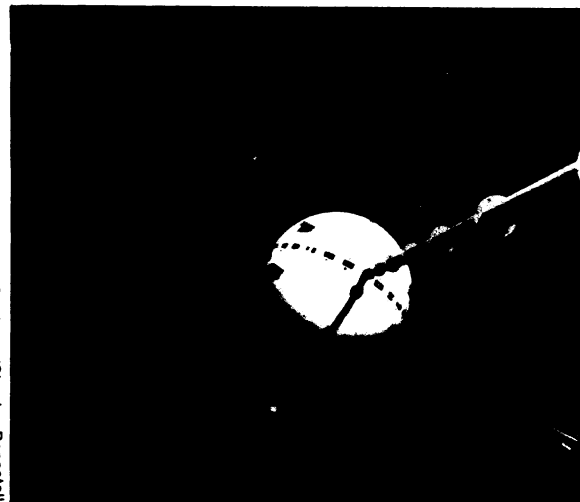
This summer's participants took further account of the U.S. Space Shuttle's foreseeable role. The shuttle itself, now undergoing preliminary flight tests, could ship material for the first habitat beginning in 1985, according to Princeton physicist Gerard K. O'Neill, chief initiator of contemporary interest in space colonization. By 1991 the first colony-manufactured, solar-power satellite could be finished and producing enough electricity for a city the size of Los Angeles. (This is strictly a technological forecast, of course, not an official timetable.)

An area of concentration by this summer's researchers, many of whom donated their time, was regenerative life-support systems. These differ critically from those routinely used in manned spaceflights, which rely on the one-time consumption of stored resources like oxygen, water and food. But for years-long colony habitation, the bulkiness of such an expendable environment would be prohibitively impractical.

As a first step toward developing an artificial, "closed" (self-replenishing) ecosystem, the scientists defined, then ordered according to relative importance, the associated research problems. An important aspect of any closed life-support mechanism is the conversion of carbon dioxide into usable oxygen and carbon. The former can be breathed and the latter can be synthesized, for instance, into protein and carbohydrate. Last year the Soviets successfully kept three people alive in a closed system for six months and illustrated many of the problems that still lack solution (SN: 11/13/76, p. 314).

The initial space habitat, orbiting about 400 kilometers above earth, may be a humble affair fashioned from the external tanks of several space shuttles. Each tank would house twenty-one persons on seven floors. And in accordance with psychologists' advice, each boarder would have a separate room, which he or she could decorate according to personal taste.

Working from this austere outpost, pioneering inhabitants would assemble in an orbit 50,000 kilometers above earth the first full-fledged colony, replete with luxurious, terrestrial-like landscapes and external, zero-gravity factories. The romance of this endeavor is reflected in names given to some popular colony de-



One idea: Mine asteroids for raw material.

signs, like "Island One" and the "Crystal Palace."

Because of the enormous energy required to haul any payload against the formidable resistance of earth's gravity, most construction material will be derived from nonterrestrial sources. The veteran scheme is to mine the moon and then launch the soil in fiberglass bundles toward a processing station 40,000 kilometers away (the so-called mass catcher). The lunar ore, chemically separated and processed, would then be shuttled from the catcher to the main colony for manufacturing purposes.

As presently conceived, a moon-mining operation involving about fifty people could excavate 600,000 tons of lunar soil per year, by late 1989. The soil modules, about two kilograms each, would be stuffed into a procession of buckets, gliding (via magnetic levitation) on a 4-kilometer-long track. Along it, the buckets would accelerate (at up to 1,000 "g's") by magnetic induction and "cough up" their contents into space—towards the mass catcher—just before they are slowed down and returned for another go-round.

An alternative plan, which received detailed analysis this summer, involves mining asteroids. One research group estimated that about 200,000 asteroids of one million tons or greater are generally approaching the earth. Of these, about 50 are close enough to cross the orbit of Mars and only about 6 have known compositions. It would take less than two years to reach one of these, using the pull of Venus's gravity to advantage. Needed before this idea is implemented, however, is a systematic survey of the heavens to locate the choicest asteroids.

The summer studies, sponsored by NASA at its Ames Research Center in Mountain View, Calif., have reached the limit of their usefulness, says O'Neill. It is now time for in-depth, dedicated analyses of the manifold aspects of this project, he says, and time for an end to "band-aid" funding. Several contracts lined up for this coming year add up to only a fraction of one million dollars. □