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What Our Spacemen Are Doing

an article

by ELLERY LANIER

Here it is—the article you've been waiting for! A dramatic, first-hand account of what is taking place in America's new spacecraft project plants by a writer who knows his Science and is brilliantly adept at communicating his enthusiasms on Earth-Satellite wave length.

IT COULD HAVE BEEN the deck of a giant inter-planetary liner en route to Mars. The spacious U-shaped conference room had a rather low ceiling from which continuous ceiling-to-floor windows wrapped themselves around the curve of the U looking out into empty space. At the head of a broad conference table that must have been at least twenty feet long, sat a sprinkling of the top brass and braid of America's space program.

George Sutton, outgoing president of the American Rocket Society presided. To his left sat Colonel Ralph Stapp who would be the new president in 1959. Other key men were grouped around the head of the table. There were General's stars and Colonel's eagles to spare. Seated around the rest of the table were a round score of newsmen. It was a scene straight out of a science-fiction classic—only the purple-headed Venusians were missing.

Outside the conference room, the hotel corridors were buzzing with the voices of five thousand men who had gathered for this historical meeting to further the conquest of outer space. There were secret gatherings behind doors guarded by the alert personnel of our armed forces, and on two floors of the building, a fantastic array of space-craft projects, exhibited with a sober attitude which said, "We mean business."

I have been a science-fiction fan for many years and am fully aware that the old adventure into the unknown stereotype has become completely mundane. But what I saw and heard at this meeting of the American Rocket Society, brought back the old thrill. I felt the kind of excitement that Ralph 124C and his successor Buck Rogers used to bring to me. I remembered how I hid my science-fiction books at school, so that I wouldn't be reprimanded for reading trash. And I remembered the thrill of looking through my homemade reflecting telescope and wondering whether in one hundred or a thousand years we would reach outer space.

There was one booklet I picked up in which William H. Dorrance of Convair, discussed in imaginative detail flights around our galaxy, which is 100,000 light years across. He described how a space ship travelling close to the speed of light would take 200,000 years to complete the voyage. And if, in accordance with the theory of Relativity, time passed very slowly for the space men, the solar system itself might be gone when they returned. Friends and relations as well as the whole human race would have vanished into oblivion, along with the Sun and the planets.

Another equally fascinating proposal would be to send an unmanned instrumented "space-time cap-



sule" on a million year voyage around the galaxy, to bring back surprises for future generations. The real heat of this story is that it was in connection with 'Business Implications of Future Space Flight Systems'.

Getting right down to science-fiction, Russel M. Kulsrud of Project Matterhorn at Princeton University presented a paper in which he dwelt at length on "The Microcosmic God". In this unforgettable story the scientist forces the little men that he has developed to perfect an invisible force field to throw up around his microcity and effectively isolate themselves from the missiles of an enemy.

Many other science-fiction authors have used invisible force-fields to protect their characters from attack by gigantic cosmic forces. But now according to Kulsrud, "This deflection of missiles and other concrete objects by invisible forces which until recently belonged only in the realm of fantasy is gradually coming to realization in the field of hydrodynamics."

This same force could be used to carry men to the stars. A rocket ship that is travelling close to the speed of light in interstellar space will scoop

up the rare hydrogen atoms by a magnetic funnel and use the high temperature of the speeding rocket to produce fusion reactions that will work like present ram-jet engines.

Well, all that was great fun to talk about. But then I got to an exhibit which really stopped me cold. It was a small-scale model of just such a propulsion system—and it was working! I spoke to Bernard Gorowitz, a heavysset young man, who stood next to a chunky glass-domed device that looked like an illustration out of one of the earliest science-fiction magazines. Gorowitz had helped to develop this marvel—it was called a Pulsed Plasma Accelerator—at the Space Vehicle Department of General Electric in Philadelphia.

Gorowitz switched on the current and energy stored under the device surged through to jump a spark gap between two huge thumb-like electrodes in a glass cylinder. A 'plasma' of ionized gas was hurled by a magnetic field through another glass tube. It looked like a swollen blow torch flame and when it hit a suspended target in the big glass dome, the target swung sharply away from the impact.

It really works. This whole Plasma field could

bring about the science-fiction dream of limitless power through nuclear fusion. A magnetic field can be made to act like a bottle to enclose the atoms being tapped for energy. The heat created is greater than any known material can withstand.

With a magnetic container it would be possible to control this temperature for useful purposes. In addition, the terrible radiation dangers associated with present atomic power plants could be eliminated. Another practical use for the force field would be to keep incoming spaceships from becoming incinerated in our atmosphere. A wall of fantastic, heat-resisting invisible shielding would protect the ship from burning up the way a bumper protects an automobile from impacts.

Near another exhibit of a liquid rocket engine, I was given a United States Army publication that featured "The Army in the Space Age". It contained an article by Brigadier General Earle F. Cook titled "The New Frontier". Among other data—such as the hazards of running into mile-wide chunks of interplanetary debris—General Cook described the new kind of conversation that would be needed when we started speaking to the planets by radiotelephone. Though the messages travelled as fast as lightning, there would be an awkward delay in conversation.

After saying, "Hello Mars, this is Earth calling," you would have to wait a few minutes until the answer made its way back to Earth. Even if both parties spoke at once they wouldn't interrupt each other because of the time factor. General Cook explained that television transmission to the planets would be even more difficult.

His suggested solution of the problem really flipped me with its tone of the very best in science-fiction—"What may be needed therefore is a wholly new concept of conveying mass data and pictures across space—perhaps a system with little or no relationship to our present electromagnetic usages".

On the lighter side, I came across an idea which leads straight into the realm of hitherto unexplored possibilities for sport and recreation in the space age. This is the 'Photon Sail', which will let the rocket men do some free sailing in small space ships, equipped with gigantic mirrored sails which will catch the photons streaming like a wind from the sun. They will become interplanetary yachtsmen.

All the fun of sailing would be combined with a lively measure of interplanetary competition. Whether it will be possible to tack directly into the sun's direction remains to be discovered, but even now it is possible to buy a toy sunsail in most stationery shops. These are glass bulbs containing a tiny spinner with four small square 'sails' painted black on one side and white on the other. The little sails whirl speedily when they are placed in the sunlight.

Near the entrance to the mezzanine exhibit, I came on another surprise. I hardly expected to see a miniature model of a spaceman shaving in a washroom. But there was, about ten inches tall, standing before a mirror over a washstand in the lower compartment of a beautifully made model of the Atlas Manned Space Station. The model space ship was about ten feet long and had open sides to reveal its inner workings. It was conceived by Krafft Ehrliche.

The plan is to put a real spaceship constructed from the model, into a permanent orbit about four hundred miles up, with a four-man crew. In the model ship, the man shaving stands in a washroom, the floor of which slopes toward the blunt end of the ship. Above the washroom there is a galley and recreation room, in which one spaceman is relaxing by throwing darts at a target. Above the galley there are sleeping quarters and higher still the control room where the pilot is seated before a wide console of electronic flight controls.

As planned at present, the crew will be rotated about once every two weeks, and later once a month. Once a year a cargo ship will deliver fresh supplies and equipment. It is claimed that this manned space ship could become a reality within five years.

Much of the dramatic quality of science fiction stories derives from Man's precarious predicament in the alien atmosphere of outer space, his adjustment, in brief, to the unknown. Our only real information about living conditions in outer space comes to us in the reports about Laika, Laska, and Benji.

If you don't know who Laska and Benji are, you should have heard the paper read by van der Wal and Young from the Space Technology Labs. in Los Angeles. Laska and Benji were two mice that were carried in the nose cones of long-range ballistic missiles. They successfully survived re-entry into our atmosphere from outer space. They went further into space than did Laika and they survived the tremendous heat and shock of coming back to earth. They landed in the Atlantic Ocean but the nose cones could not be found.

The project was known as Project MIA (Mouse-In-Able). A special small 'mouse house' was designed with an air-conditioning unit, a ventilating fan, an oxygen tank, water supply, and some food pellets and bits of potato for dessert. A fine wire was inserted under the skin of the mice to send out a radio impulse of their heartbeats through a telemetering device. They were set into a little cradle that could swing in such a way that it would get into a position of greatest resistance to the pull of gravity on take-off and later under the enormous deceleration of coming back to earth. A miniature saddle was fitted to the mice and attached to a rotating ring.

The mice could move but would be unable to chew through the wire that would be sending out their heartbeats. Laska, the female mouse was launched in an Able missile on July 9, 1958, and on July 23, the male mouse Benji followed her to outer space.

During her weightless period in space, the message from Laska indicated that her heart was beating normally. It is almost certain that she returned alive from outer space. She had lived through 45 minutes of weightlessness. The male mouse, Benji was even more resistant to the effects of the rocket take-off—the pressure, the noise, the vibrations and then the weightlessness, hardly daunted him.

Turning from mice to men, Colonel Robert L. Hullinghorst, of the U. S. Army, discussed the human problems of space flight. Man would be isolated in a new world with destruction possible at any moment. His daily habits would be changed

drastically—and a really strange possibility arises, "There is good evidence that man in the weightless state will require little or no sleep".

It is also expected that there will be a 'break through' phenomenon. On reaching a height exceeding 80,000 feet there is "a sudden mixture of elation and sorrow, a feeling that all contact with the world has been severed and you are now a definite part of the vastness of space".

This feeling is compared to the "raptures of the deep" which deep sea divers experience and which they have learned to handle effectively. It is a feeling of eerie unreality—almost like drifting in a dream. But it has a chemical origin with deep sea divers, for the nitrogen in their closed atmosphere acts like a narcotic.

When the break-through into space occurs spacemen will probably experience this unreality sense but its chemical cause can be handled effectively, once it is understood.

Another of the strange experiences which will be almost inevitable will be the challenge of believing your own eyes. All your other senses will contradict your sense of sight. The sense of balance, weight, and touch will have to be re-educated. Actions will be new and strange—the spatial equivalent of a man's getting his sea legs, only now he'll be getting his space body. The impulses of weight, gravity, and balance will be totally different. You will be able to lift huge weights easily and walk on the ceiling. Most important of all will be the new-type training of human reasoning power on which the success of the whole space venture will depend.

Lt. Col. Paul G. Yessler reported on Army studies into the way the human organism responds under varying conditions of stress. At the Walter Reed Army Medical Center studies were conducted covering all sorts of possibilities in space life. Enforced loss of sleep was one of the more interesting aspects of the problem. A group of fifty men—25 experimental and 25 as controls—were kept awake for 98 hours. It was discovered that performance of tasks does not decline in a gradual and consistent way with sleep loss; it is uneven and irregular.

There are brief mental blocks or lapses of awareness which keep increasing. Between these lapses of extreme drowsiness it is possible to do things well. A vigilance test was tried in which a series of carefully worked out stimuli were presented. Only one of these was a critical signal. Mistakes in reacting occurred when there was no signal or there was a failure to react when the signal appeared. Failure to catch the signal was the more frequent error. If an outside observer directed the experiment there were more mistakes than when the subject conducted the tests himself.

A psychiatrist interviewed the subjects to observe changes in speech, thought organization, and the sense of time. It was discovered that sleep loss does not necessarily produce higher irritability, especially when the subjects were handled "tenderly". Often they tried to deny their sleepiness and simply claimed they were fatigued. They tried to avoid work calling for attention and concentration. Finally the subjects experienced distortions of space perception, with the floor looking wavy, and objects

seeming to be of wrong sizes and other hallucinations.

A more direct study of this "first human in space" problem was made by Captain Willard R. Hawkins, USAF and George T. Hauty. At Randolph Air Force Base in Texas they have a Department of Astroecology. This word "Astroecology" is one that every science fiction buff should immediately fall in love with. Ecology refers to the total effects of an environment—food, climate, shelter and so forth. With the prefix "Astro" it refers to man living his life in relation to his environment among the stars.

The department of Astroecology has been experimenting with a space cabin called a Terrella or Little Earth, with an inside measure of 96 cubic feet. All the physical equipment for space flight are contained within the cabin. The pilot must maintain a sitting or a supine position and cannot stand up straight. All visual contact with the outside world is cut off.

In one simulated space flight the pilot was fed on baby food concentrates which were found to create resentment. An alternative experiment was tried. Over a week long flight test the future space-man was fed an exotic diet of lobster, Norwegian shrimp, quail eggs, and boned turkey. Results were excellent.

Over the long stretch of time, little things not ordinarily noticed, become very important. The hazardous storage of equipment and the control instruments themselves become very annoying. Music was tried but even favorite recordings become irritating after too many repetitions. Even whistling became difficult.

A strong need for contact with the outside world was felt by all the subjects. The continuous unchanging light needed to record the flight test added to the fatigue and irritability. It was found that skipping meals was very damaging to mental and physical functioning in general. The exotic food diet turned out to be the biggest booster of morale.

Once the spacemen experienced fatigue, they did not feel rested again through the entire trip. The worst aspect of the trip was the hour by hour monotony of the work. The most stimulating and motivating factor was found to be knowing something about the results of the adventure they were going through.

One future space-man was asked to add columns of figures for one hour each day. He was constantly trying to beat his previous day's record. On the sixth day of his flight he was working in the genius category.

Another discovery for improving the morale of space-men was to have "a place for everything and everything in its place", within the space craft. The seats will have to be completely adjustable to relieve muscular tensions as they arise and there will have to be a chance to shave, bathe, and put on clean underwear at intervals during the flight. The pressure suit has been found to be a deterrent and the cabin itself will have to be the pressure suit—allowing the spacemen to work in shirt sleeves. Special exercise equipment will have to be built into the cabin to fight the muscular fatigue and atrophy caused by long confinement.

A new space cabin of 380 cubic feet is now un-

der construction, designed to hold a two-man crew for 30 days. It will have more space than the present cabin and improved arrangement of equipment, the better to train our future "astronauts."

One of the most spectacular space craft models at the meeting was a saucer-shaped Martian Reconnaissance Vehicle. The saucer would measure 40 feet across and weigh 616 pounds. It would be assembled on—and launched from—one of our satellites some 400 miles up, and be driven to Mars by an ion accelerator, which gets its electrical energy from the sun through solar cells. While orbiting the planet Mars it would radio back information.

My early memories of science fiction in the days of Hugo Gernsback's *AMAZING STORIES* were revived by talk about the kinds of weapons that would be used in space warfare. There were references to cathode ray guns, neutron guns, ion guns, and all the classical equipment of the earlier science fiction writers. The battlefield itself is to be a vacuum with the fighters flying through space at fantastic speeds.

Attack decisions would have to be made in millionths of a second by automatic weapons. Even the

equations of Einstein, would enter into battle strategy. The aces of the space age would probably all have doctorates in science.

James M. Gavin delivered an historical speech, which was really an introduction to the entire space age. He compared the position of the space industry forty years ago. For science fiction enthusiasts the quote that Gavin made from one of Dr. Theodore von Karman's recent articles, holds particular interest and importance, since it points out how in a very real sense, the fantasy has been taken out of science-fiction. The big question is: where does science-fiction go from here?

I can think of no better way of ending this article than to quote Gavin's quote of von Karman at length: "It does not take a crystal ball to appreciate that major scientific discoveries will occur over the next twenty-five years. Whole new fields of science will open up as we investigate high energy fuels, ionic and electromagnetic rockets, plasma jets, and study the use of solar energy . . . Techniques, structures and materials as yet undreamed of will be found."