"Missile Away!"

THE NEW MEXICO-WEST TEXAS SECTION OF THE AMERICAN ROCKET SOCIETY

SPECIAL
SPACE TRAVEL
ISSUE

Vol. IV, No. 4
WINTER
1957

35c

"Missile Away!"

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SPECIAL SUPPLEMENT: (NM-WT Section members only)
Briefcase, courtesy General Electric Co.

STATEMENT OF EDITORIAL POLICY

The purpose of this magazine is to bring to scientist, engineer, specialist, technician, and layman a better understanding of the rocket and guided missile field with its present and future uses in war and peace. To this end, it is dedicated to publish material of common interest written in terms which are readily understood and illustrated with the finest efforts of the photographers and artists associated with this field.

EDITORIAL—(Cont'd)

The past four years have been understandably difficult for the ARS, whether it has been generally known or not. Membership has increased from about 1500 to 5000. New methods had to be put into force to cope with this. Funds had to be raised before much could be done for members in the way of genuine service. New policies had to be formed. New blood had to be infused into the organization to help cope with the increasing problems. At last, however, the dawn is beginning to break. The Society's finances are finally in good shape, and true expansion can follow.

Furthermore, there is little doubt in anyone's mind in the National organization that this is a *rocket* society, and that one of the primary applications of rocket power lies in travel beyond the earth's atmosphere.

Things aren't perfect yet by a long shot, but they are definitely improving in the ARS. We will continue to keep prodding on these little things, however. Strange as it may seem, there is little hostility topside in reaction to this prodding; the National Board and Officers frankly thanked the "rebels" in the ARS who kept continually jolting the "high seas" when they threatened to get in a rut.

But this is a time for kudoes, not brickbats. To all the officers and directors of past years who have fought without honor to improve the ARS, we tender our appreciation and our thanks for a good job. Thanks are long overdue to Jim Harford and Billie Slade for tackling a hard job and making the ARS solvent.

We've all come a long way, boys, whether we know it or not. We only wish we could find some way to pass on to all our NM-WT Section members the things we have seen and heard and felt.

The road is not so steep ahead, but the gradient is still there. There is much remaining to be improved upon or initiated. We have assured Bob Truax and his new Board that we are behind him 100%; we will give all the help we can. We only ask that we be called upon if needed and that we be kept informed. And, of course, we'll maintain the reputation of the NM-WT Section in being the most active and the most "rabble-rousing" of all the sections.

Such an attitude in a gorup is a healthy thing, and we have not been discouraged in it. However, lest someone think that we are generally against everything are ARS does, let us point out right here and now that it just isn't so. We *do* appreciate what has been done to advance the ARS.

There! We said it, and we're glad!

—G. H. S.

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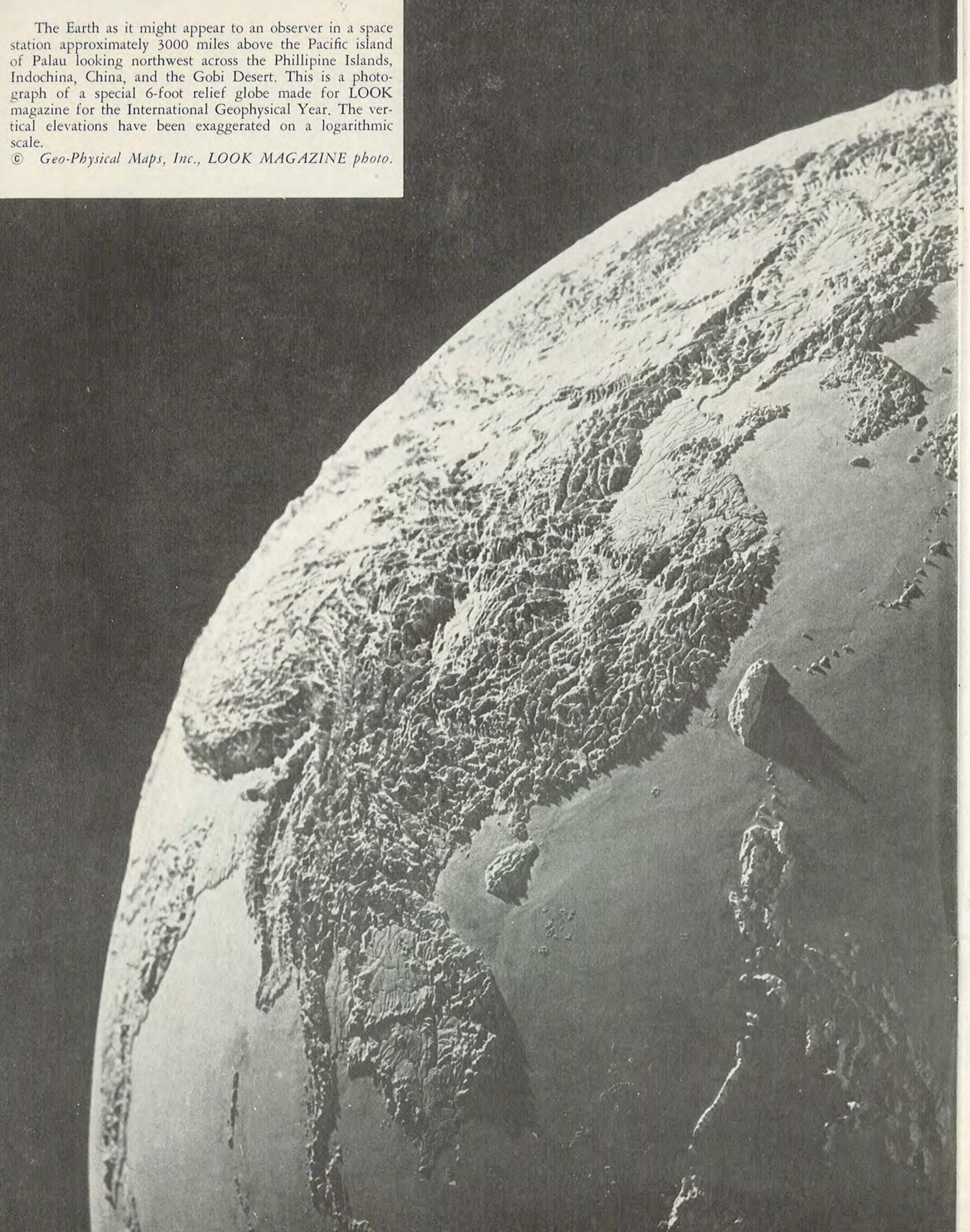
The Earth as it might appear to an observer in a space station approximately 3000 miles above the Pacific island of Palau looking northwest across the Phillipine Islands, Indochina, China, and the Gobi Desert. This is a photograph of a special 6-foot relief globe made for LOOK magazine for the International Geophysical Year. The vertical elevations have been exaggerated on a logarithmic scale.



In publishing a special issue devoted to astronautics, we deviate from the standard policy of this magazine of printing factual articles about the rockets and missiles of today. However, in jumping into the future to discuss space flight, we do not feel that we are entering the realm of science fiction or fantasy. Astronautics is coming. It may not be tomorrow, or next week, or next year. But it is coming.

Therefore, we feel that an issue devoted to astronautics is merely one concerned with foresight—looking ahead at the problems which may arise, considering the mechanics of travel between celestial bodies, and building practical propositions on a groundwork of both knowledge and theory.

Given time—less than most people think—we can and will accomplish flight through space beyond our atmosphere. In a sense, we have already achieved the beginning, taking our first groping steps with unmanned vehicles. Manned craft are next, and even they have already made the initial steps, climbing 125,000 feet high where less than 1% of the earth's atmosphere lies above.

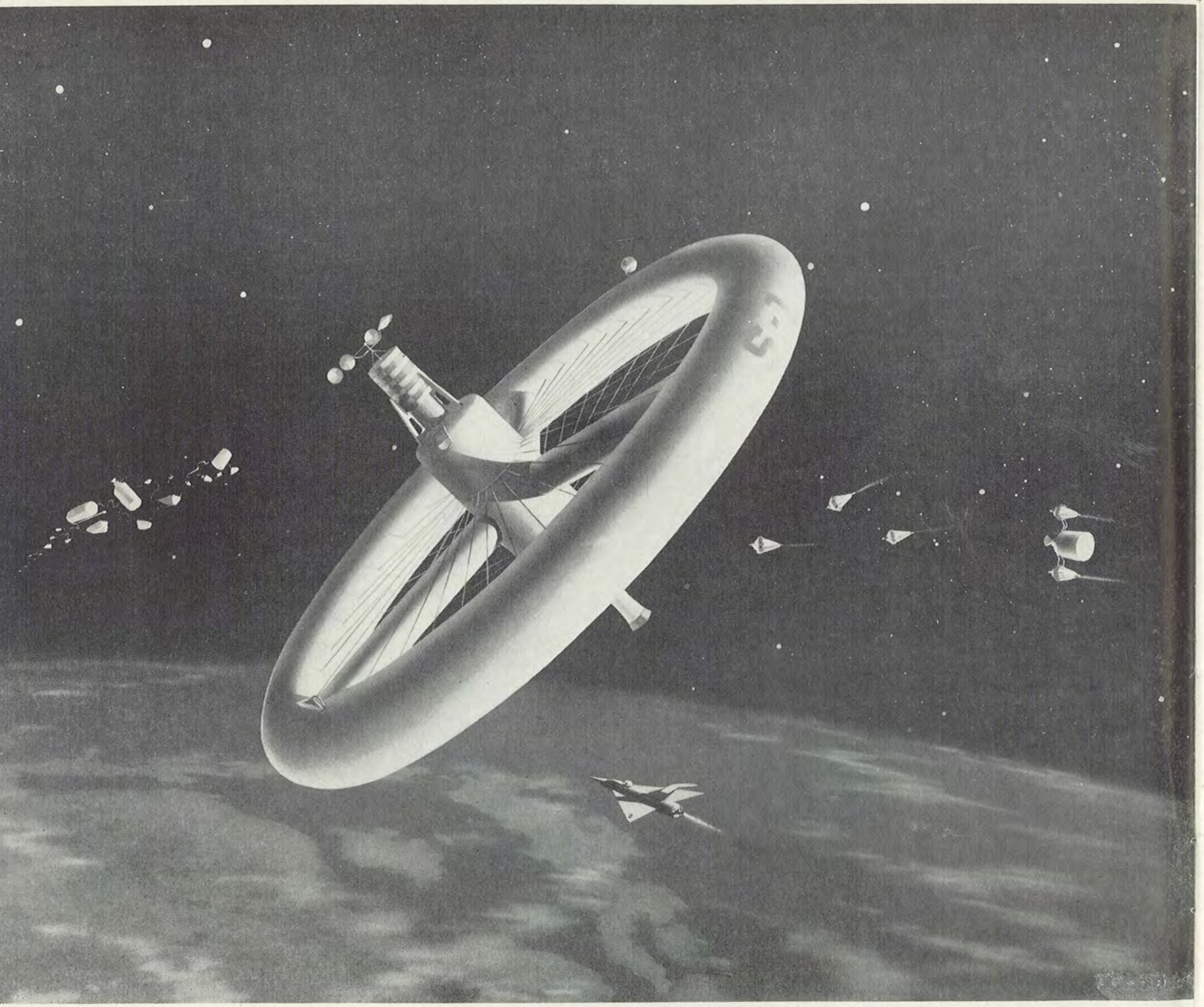
No mind-shattering technical or scientific break-through is needed. The task ahead is one of time-consuming, labor-consuming testing, refining, developing, and testing some more. Some of it will be maddening to the creative person, but the person glorying in details, in seemingly trifling minutae, it will be grand indeed.

There are tremendous steps whch must be taken and odds-on gambles which must be made. Risks there will be, but each will be carefully weighed and deliberated. Courage will always be necessary.

We are in an envious position. We are writing history, and we know it. And we cannot shrug it off. What we do will be recorded for prosperity, for the school children of tomorrow to read. Since we have this chance to determine what those history books of the future say, it behooves us as human beings to do the best job we can. History has its adjectives for the crepehangers, the prophets of doom, the anti-intellectuals, and the weak-hearted souls. Its pages are full of conjecture as to what might have happened if someone had grasped the chance which occurred.

Yes, space travel is no longer science fiction. Within our own generation, it can be fact.

THE MILITARY UTILITY OF A SPACE STATION



by
LEWIS J. STECHER, JR.
CDR, USN

While this article does not reflect the opinions of the military services, it is still significant. The true usefulness of space flight and satellites is not apparent on the surface. It is not a matter of what we can do with them, but what we will never be able to do without them!

Although this article is written by a member of the Armed Forces, it is entirely imaginative, written without the slightest bit of information as to whether or not our government has any serious plans to build manned satellites. One thing I feel certain about: whether or not such plans are being given serious consideration now, they will be.

Three major reasons for a manned satellite will be presented and examined here. The first reason, and the one perhaps most often presented, is that such a satellite would provide a magnificent launching platform for guided missiles and would, in fact, make its possessor automatically the supreme power in the world. This is palpable poppycock. Within the next few years, intercontinental ballistic missiles equipped with hydrogen warheads and accurate guidance systems will be able to reach and to destroy any spot on Earth. Located on Earth, large numbers of ICBM's can be provided and concealed so that enough would remain, even after a fully successful sneak attack, to provide for massive, indeed overwhelming, retaliation. A manned satellite, on the other hand, would be a single, highly visible basket full of atomic eggs. With its completely calculated trajectory, it would be an easy target for any enemy. It could not defend itself since it would be unable to provide an unlimited number of anti-missile missiles, even if these were entirely effective, to avoid being overwhelmed quickly. And, worst of all, the missiles to destroy the satellite would be launched from points on the Earth far beyond its horizon so that it would be nearly impossible to retaliate.

The second reason for a manned satellite is to provide a scout which could fly above potential enemy territory without violating boundaries and thereby providing provocation for war. A satellite with a suitable trajectory would be able to see and photograph the entire surface of the Earth at frequent intervals. It would be able to pin-point important targets for ground-based ICBM's, permitting the pre-setting of their guidance mechanisms with the precise information that will be required if their accuracy capabilities are to be used effectively. It would be able to search out the new installations for war, to detect troop movements, and in general to carry out President Eisenhower's aerial inspection plan without requiring the consent of other nations. Of course, if a war developed, the satellite would be shot down, but this has often been the fate of successful scouts and is an acceptable risk.

There is only one thing wrong with using a fixed manned satellite for this second purpose: there is a better way to do the job. A permanent satellite has a grave disadvantage in that its trajectory is known, and there is no way to find out what goes on when the satellite is below the horizon. With periodic inspections at known times, it increases the enemy's difficulties in concealing his movements and construction, but it does not necessarily prevent them.

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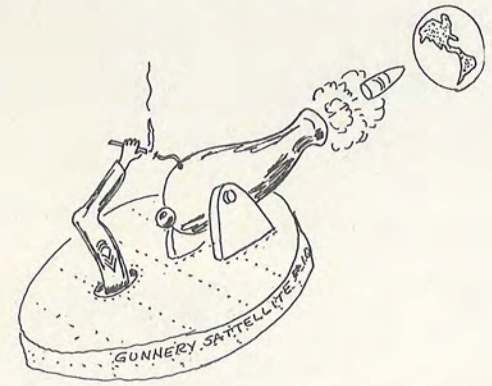

50-MISSION CRUSH

planets. These civilian advantages, ironically enough, can probably result only if the world situation remains tense enough for a long enough time to persuade the military to make a united effort for entirely military reasons.

It is entirely possible, then, that a permanent space satellite, or a group of them, may be circling the Earth within the next few years. It will certainly be technically feasible to construct them. Steps now being taken by the government, such as Project Vanguard, will help show the practicality of such a project.

Huge missiles of the intercontinental variety are already being designed and built. These missiles will be in themselves small space ships only a step away from manned vehicles. The military is therefore busy proving that the military will be able to provide the equipment and the skills needed to permit the construction of a space satellite. The reasons for building such a space satellite are compelling, and the pressures for building such a station will probably become enormous since a station will serve to help maintain peace, to reinforce the chances of making peace permanent, and to make that peaceful world a better place in which to live.

With solid reasons for carrying out the project, and with the technological ability to do so, it is to be hoped that a manned satellite will in fact be built.

What are we waiting for? Let's go!

INTER SERVICE RIVALRY

ABOUT THE AUTOR

Commander Lewis J. Stecher, Jr. graduated from the U. S. Naval Academy in 1941. He received his master's degree from M.I.T. in 1948. He has served in many capacities aboard ships of the U. S. Navy, and was executive and operations officer of the Naval Ordnance Missile Test Facility, White Sands Proving Ground, from 1953 until 1956. He is presently serving as Gunnery Officer aboard the USS *Canberra* (CAG-2), the Navy's second anti-aircraft guided missile cruiser.

L P R—(Cont'd)

These effects tend to compensate each other to some degree but with the net effect of decreasing the speed. Since the LPR is going slower and since the distance around is now greater, the period (time to go around once) has become longer. As we go to higher and higher orbits the speed continues to decrease and the period becomes longer. At an altitude of about 22,500 miles, the satellite takes 24 hours to complete one revolution as compared to the 2 hours close in. Twenty-four hours has a familiar sound. It is the too few hours there are in a day—just the time it takes for the earth to rotate once on its axis.

Although the earth's rotation does not effect the satellite orbit at all, to someone watching from the earth, there seems to be an effect. (see Harold Daw in "Missile Away!" Summer 1956). The earth rotates toward the east. If the satellite is launched to the east the earth's rotational speed can give an assist whereas for a westward launching (fig. 2) the extra speed would have to be made up by the launching vehicle. For this reason probably most of the early satellites will be launched to the east and therefore have an orbit with motion to the east. Returning to our

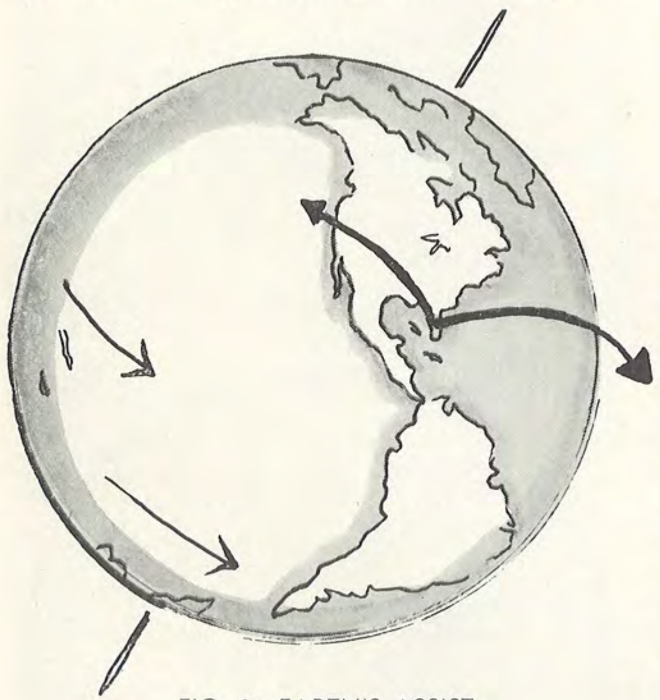

FIG. 2—EARTH'S ASSIST

equatorial orbit we see that as the LPR is going around once, the earth also rotates to the east. Thus an observer on the equator who is carried along by the earth sees the satellite come up in the west later than he expected—and the satellite period seems to him to be longer than we calculated above. As the period becomes longer, the satellite disappears more and more slowly behind the eastern horizon and rises later and later. Finally, at the 22,500 mile altitude (24-hour orbit) it takes the satellite just as long to go around once as it takes the earth. They keep right together. The man watching from the equator sees the satellite in one position in the sky all of the time.

Putting the satellite in even higher orbits increases the period to longer than 24 hours, and the earth now goes around faster than the satellite. The satellite now lags behind in the sky, sets in the west and rises in the east. The moon, a satellite at an altitude of about 238,000 miles, has a 27-day period.

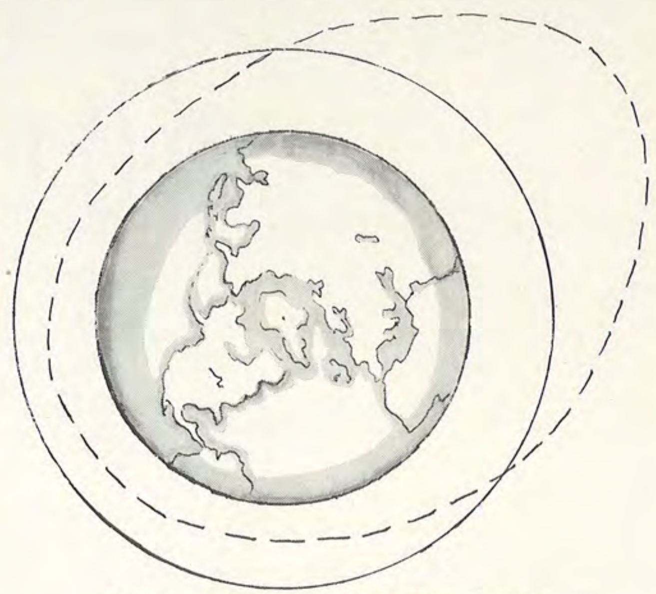

FIG. 3—CIRCLE AND ELLIPSE ORBITS

We have been talking about circular paths, but these would be very difficult to achieve in practice. The speed has to be exactly correct, and at the time of reaching the correct speed the missile must be traveling tangent to the desired circle, or in other words parallel to the earth's surface. If these two things do not happen, the circle simply flattens out at an ellipse (fig. 3). If the entire ellipse is high enough above the earth to be unappreciably affected by drag, then we have an LPR in an elliptical orbit. Speeds, altitudes (although verying now) and periods can be determined just as for circles. A few complications enter. The speed varies, being greatest near the earth, decreasing as the object swings out, becoming slowest at the farthest point from earth and then increasing again as it moves back in. The ellipses can be long and narrow or short and fat—almost a circle. In general the same sort of rules apply to ellipses as to circles, e.g. the bigger the ellipse, the longer the period. The moon's orbit, although nearly a circle, is really an ellipse.

We can also send the satellite around parts of the earth other than the equator. For example, we might send it over the North and South poles (fig. 4). (I'll use circular orbits for illustration since they emphasize points to be made and are a little easier to work with). The same remarks about speed, altitude and period still apply. Incidentally, we can no longer have an assist from the earth's rotational speed in the launching for this orbit.

Why Not? If you cannot figure this one out send 10 cents in coin and a return addressed envelope to the author and you will receive an explanation sometime.

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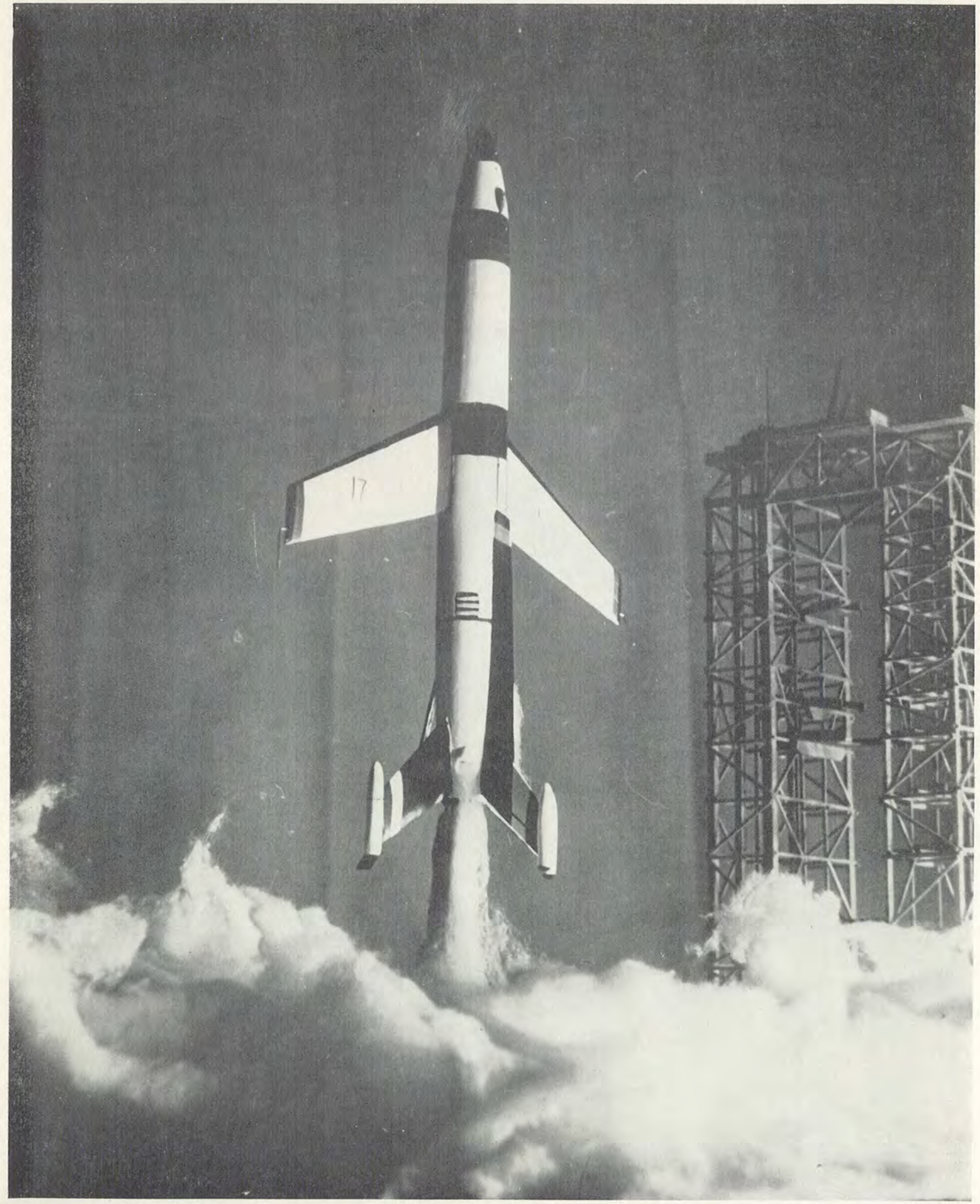
outward bound

Interplanetary Liner Blasts Off—(photo by Lee Correy)



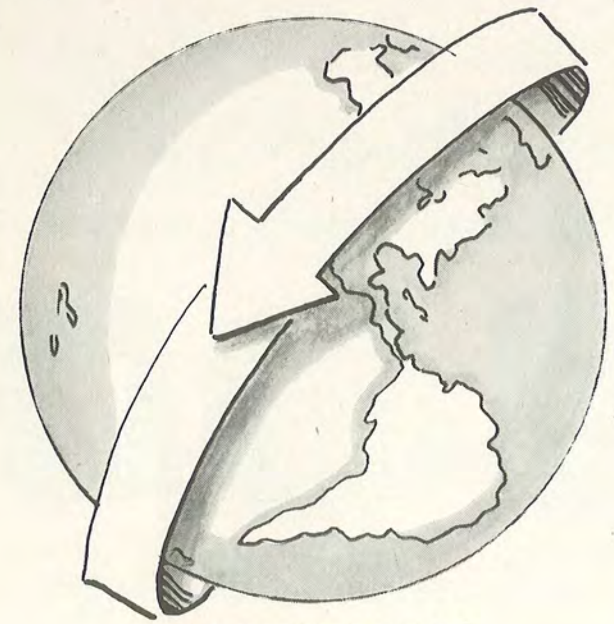


FIG. 4—POLAR ORBIT

Well, back to our polar path. If the above statements are true (and they are) what is unique or advantageous about such a path? Remember the earth's rotation. As the LPR is completing its circuit over the poles, the earth is rotating toward the east. For a 2 hour orbit the earth would have completed 1/12 of its daily rotation or 30 degrees. This does not occur in a jump at the time that the satellite gets around once, but goes on continuously along with the satellite motion. To people watching from the earth, the satellite apears to curve to the right in the northern hemisphere and to the left in the southern hemisphere. If we think of the LPR as drawing a mark on the ground that it passes over, it would trace a curve like the one in figure 5. An interesting and enlightening way to obtain this curve is illustrated in figure 6. Try to draw a circle over the poles of a globe, moving your pencil or crayon at a uniform speed. Try it first with the globe at rest and then with the globe rotating slowly to the east. It's easier if two people cooperate. After a little practice you might try drawing the track of a 24-hour orbit missile. For this move the crayon completely around once while the earth is rotated through 360 degrees.

FIG. 6—CORIOLIS

You have probably already noticed that the LPR in the polar orbit eventually moves over all parts of the earth's surface. This is one of the advantages of this path. From a research point of view it would be very

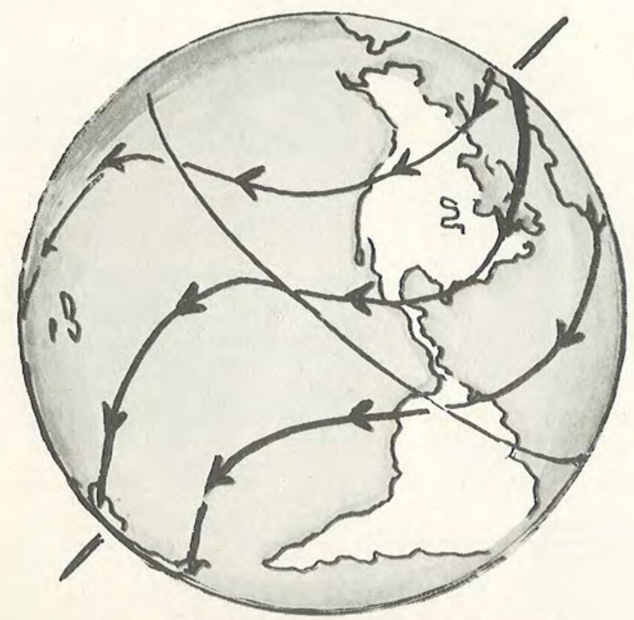


FIG. 5—COURSE OF POLAR SATELLITE

FIG. 7—INBETWEEN ORBIT

(page 21, please)

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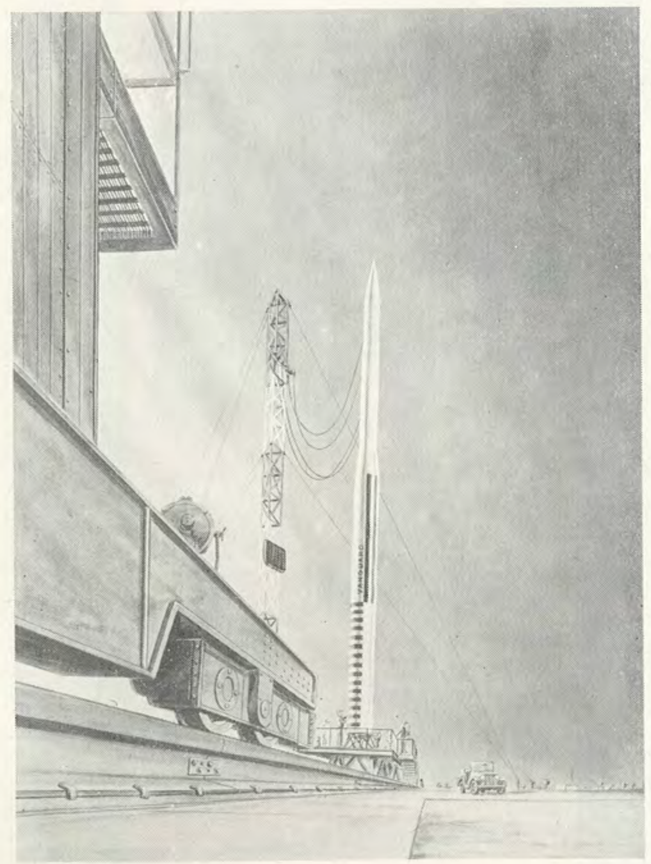
LPR—(Cont'd)

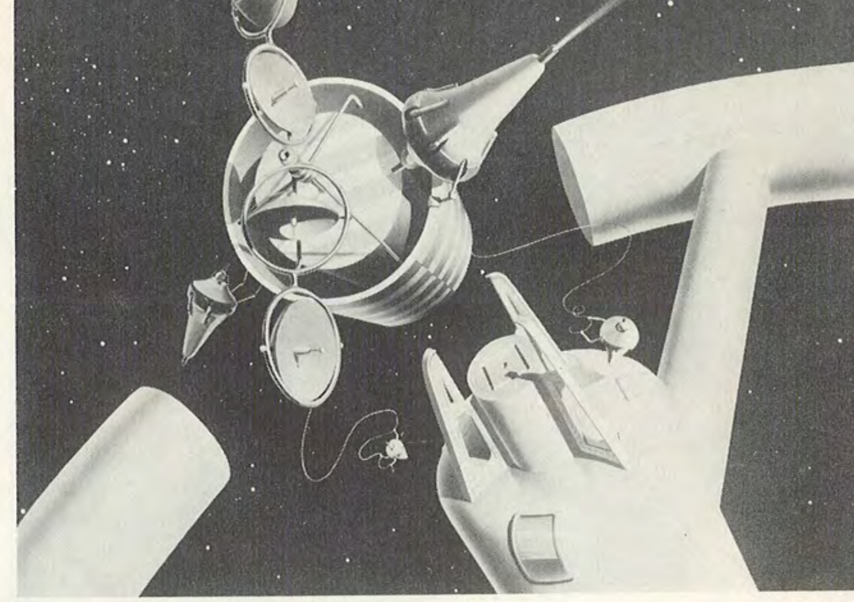
desirable to study the high atmosphere or near-space over all parts of the earth and not just above the equator.

We have considered two quite specialized categories of possible orbits, the equatorial and polar. In between these limiting situations there are paths that combine some of the polar features and some of the equatorial features. The project Vanguard satellites of IGY illustrate these "in between" paths. These missiles will be launched in a southeasterly direction taking some advantage of the earth's rotational speed. They will appear to curve to the right in the northern hemisphere and to the left in the southern hemisphere so that their tracks over the ground will look like the curves in figure 7. They will be quite close to earth with periods between 1½ and 2 hours so that successive circuits will pass over the earth about 25 degrees to the west of the previous path. The maximum northern and southern excursions will fall well below of the poles and will be determined by the angle of launch. Due to the difficulties of achieving the exact values of speed and direction required for circular paths, they will follow ellipses with the perigee (closest approach to earth) far enough out that they will be the first Long Playing Rockets.

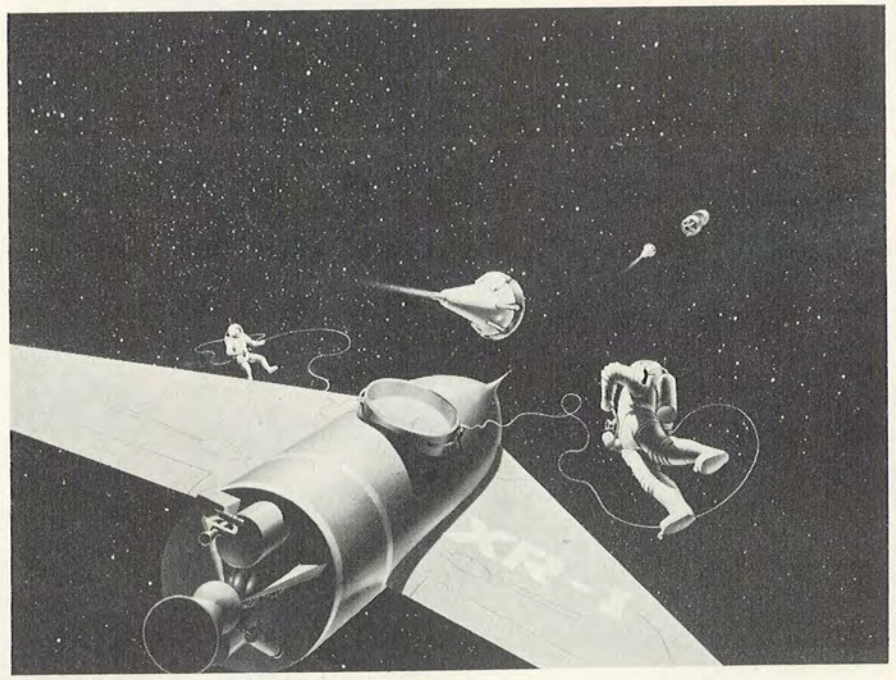


MEN IN SPACE

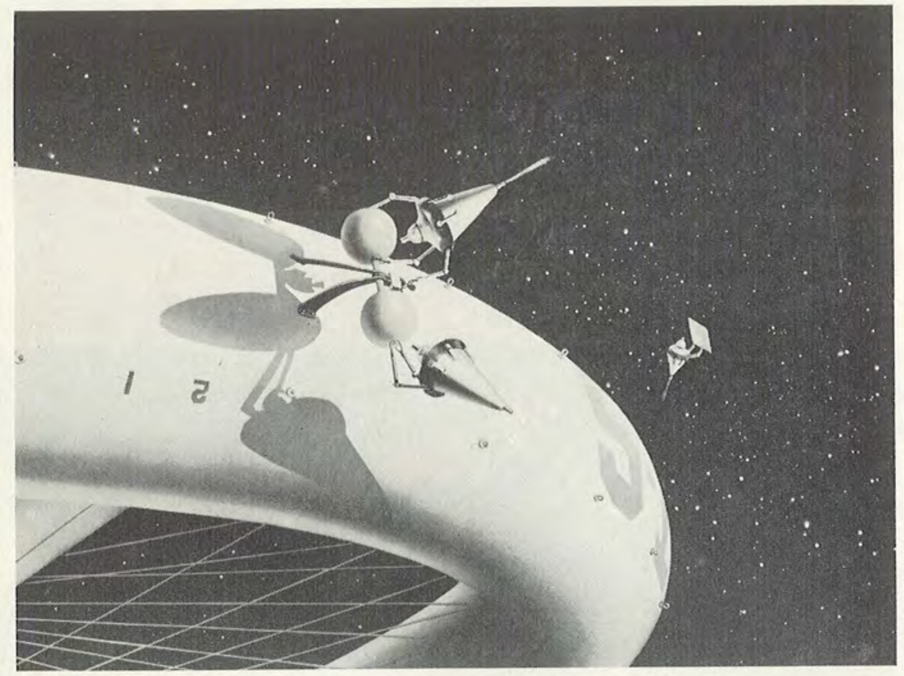
Left: Space ship crew discusses problem.



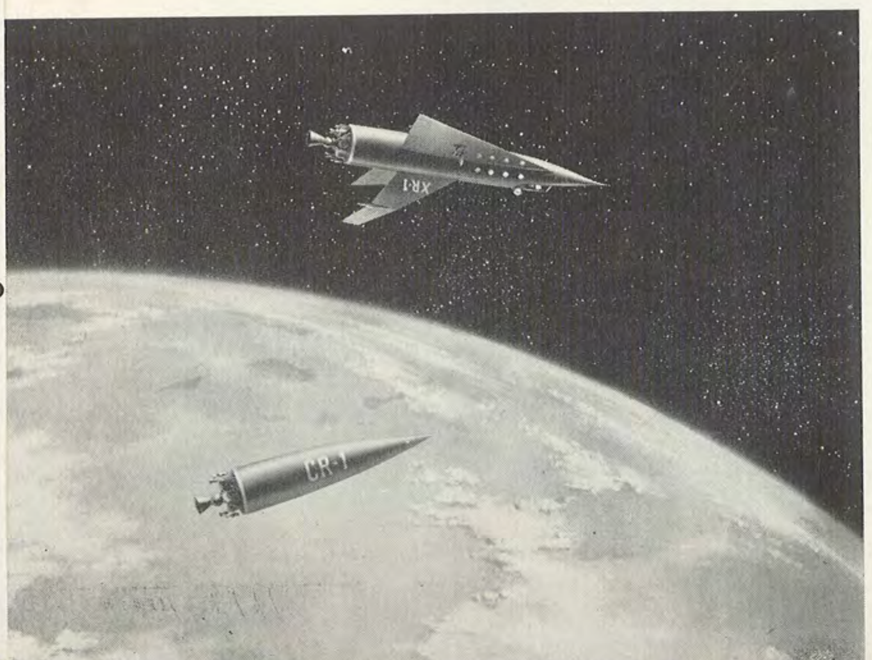
Right: Constructing the space station.



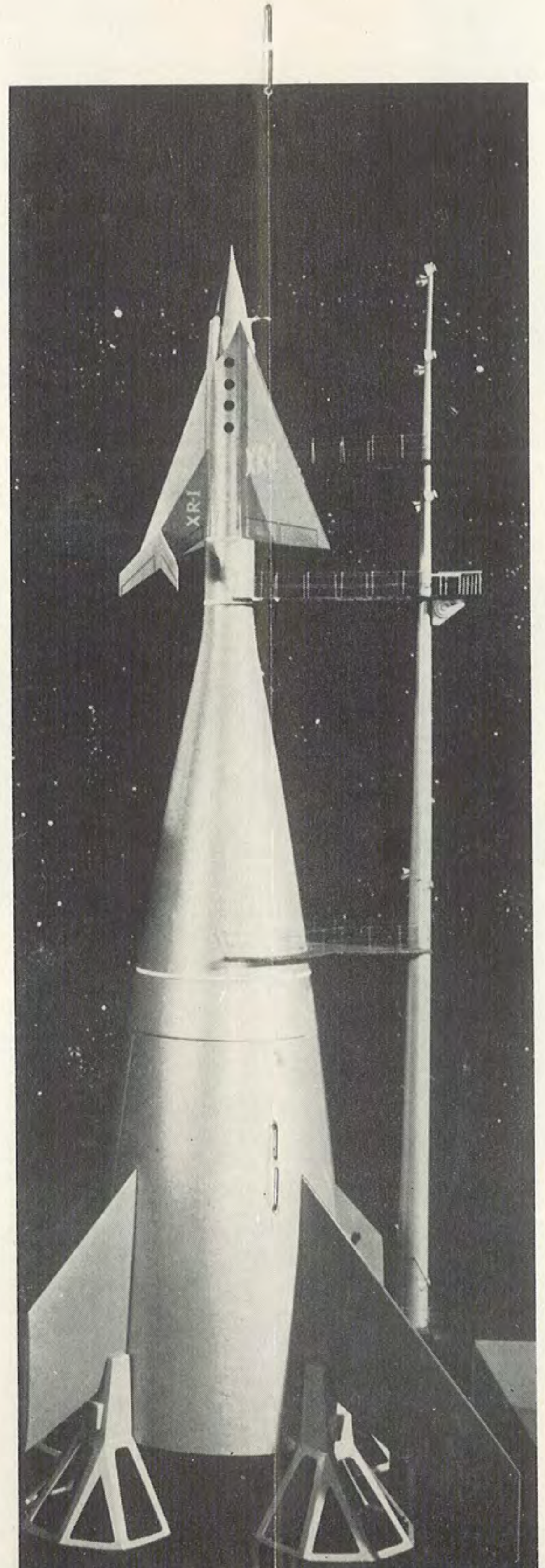
Right: Space-suited men go to retrieve cargo rocket in orbit.



Left: Maintenance crews repair space station.



Left: Guiding the first cargo rocket to orbital rendezvous.



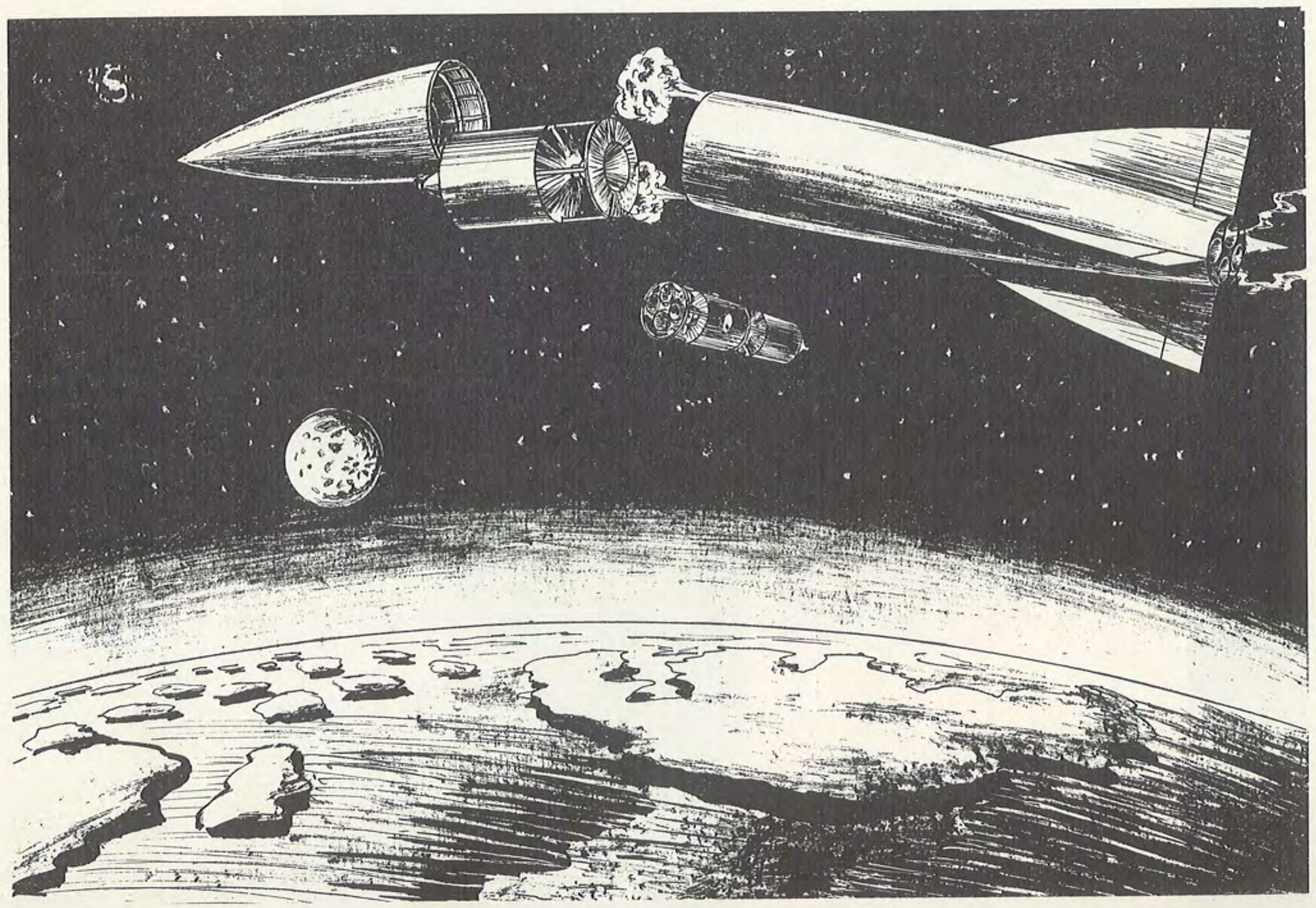
Right: Four-stage satellite shuttle ship.

Right: Astrogation officer feeds trajectory corrections into ship's computer.

SHORTCUT to the MOON?

by
HORACE S. SOLLIDAY

Fig. 1



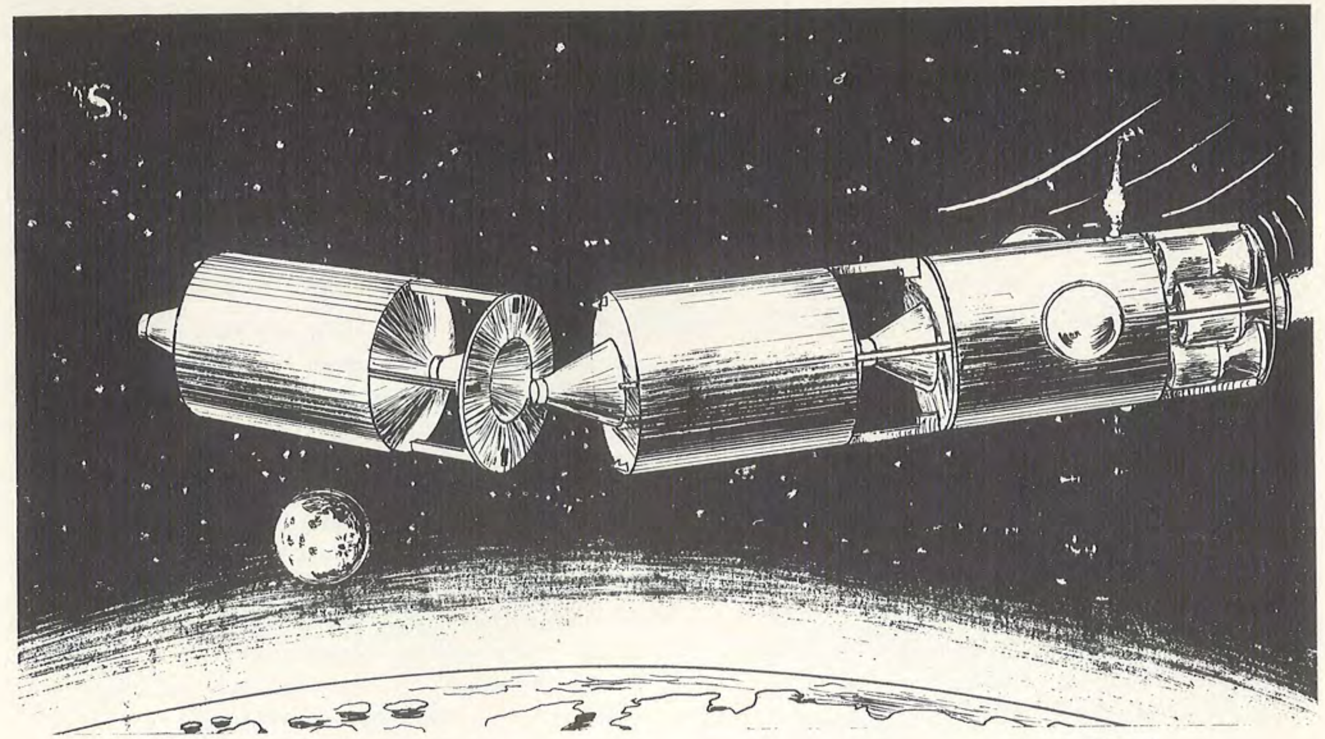


Fig. 2

Space travel presents a continual challenge to an engineer. In essence, it involves all of the cherished principles of the art. One of these involves making use of every pound of material lifted into terrestrial orbit. Therefore, here is an article which proposes a method of building a Moon Messenger rocket using that principle.

It has generally been assumed by most engineers and scientists that the first trip to the moon by man-made craft would have to follow the establishment of an artificial earth satellite. This is to provide a refueling stop-over for such a spaceship. Also it has been suggested that quite a different type of spaceship would travel from the earth satellite to the moon than the rocketship that would ascend from the earth to the satellite. The obvious reason for this is that the large rocket motors and fuel needed to free such a craft from the earth's gravitation and the aerodynamic wings and streamlining would only be a great amount of excess baggage over the thousands of miles of free space between the earth satellite orbit and the moon. Thus the moon craft, all assume, would obviously be built in space beside the satellite.

Another reason that this process has become the almost universally accepted itinerary of the conquest of space is that the present-day development of rocket engineering dictates a rather small payload for any rocket. Thus to send a total payload to the moon capable of producing anything of scientific value, it will have to consist of several payloads brought up separately by separate rocket ascensions, then assembled in space.

Even though these prerequisites are generally unchallenged, I contend that it is not necessary that any earth satellite, manned or unmanned, be established before we see the other side of the moon. Nor do I believe the moon ship has to be built in space. This applies to an unmanned vehicle, of course.

Such an unmanned instrumented spaceship to photograph the moon up close and see the other side for the first time would not need to be a huge machine. This is because no human compartment with the tons of material necessary for living in space is needed, thus reducing the size and weight considerably. Also there would be no need to land and take-off from the moon, reducing the fuel requirements considerably. The size and number of motors would also be less. Later designs, however, may feature an unmanned landing for extremely close photos and perhaps scraping up some mineral samples for return to earth or on the spot analysis to be telemetered.

Now, in the light of the fact that rocket payloads are still so small, you may ask how can we avoid the necessity of building our moon ship in such a satellite orbit.

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SHORTCUT—(Cont'd)

We must agree that it will take several ascensions, but if such an arrangement as I am about to suggest could be made a spaceship could be made and brought up in sections that would merely lock together in space as shown in Figure 2 as each unit is brought up. The first section brought up would be the instrumented power section. All the rest of the sections would be fuel sections and/or instruments not necessary for the operation of the spaceship.

The possible inclusion of other instruments for the physical study of space, such as the 1958 Geophysical satellites will contain besides television and/or cameras and telemetering equipment, will be determined by calculating and weighing the number and payload of the ascending rockets that would be economically and technically practical at this time against the minimum spaceship weight requirements.

External configuration need not be streamlined, but consist only of a simple cylindrical can design. Operational equipment of the power section would consist of gimbal mounted rocket motors or fixed motors plus auxiliary control jets. In either case auxiliary jets will be needed for roll orientation. Also such radio and television control equipment necessary to remotely control the motors for assembly in space and later for flight to the moon; a small amount of fuel (only enough to attach itself to first fuel section); and in-flight-refueling type probe; and an automatic hook type of locking device would be included. The locking mechanism would be located around the perimeter of the probe in four locations as shown plainly in the illustrations. See Fig. 3 and 4.

Figure 1 shows the third ascending rocket bringing the second fuel section up to the orbit with the instrumented power section and one fuel section already attached waiting in the background. Figure 2 shows the power section attaching itself to the second fuel section. Others would follow the same procedure until enough needed for the trip were all assembled. The number and size would depend on the size and payload of the ascending rockets after the total requirements for circumnavigation are known. The fuel sections would be of the same diameter of the power section. The length could vary. Each one would consist only of structure, fuel, in-flight-refueling type drouge on the rear, a probe in front, and locking mechanisms. See Fig. 4. As each section arrives and is

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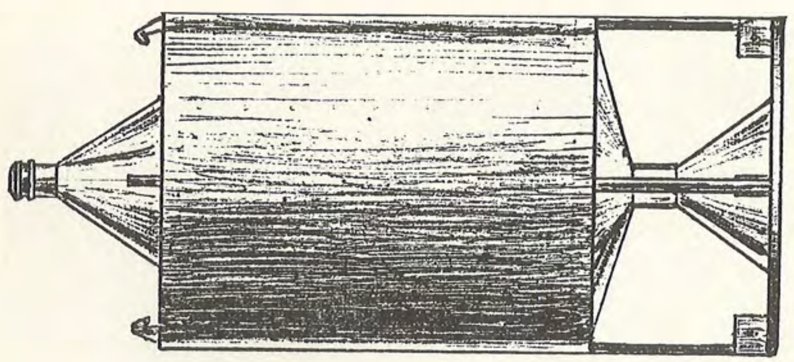
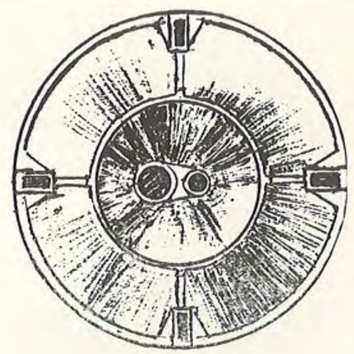




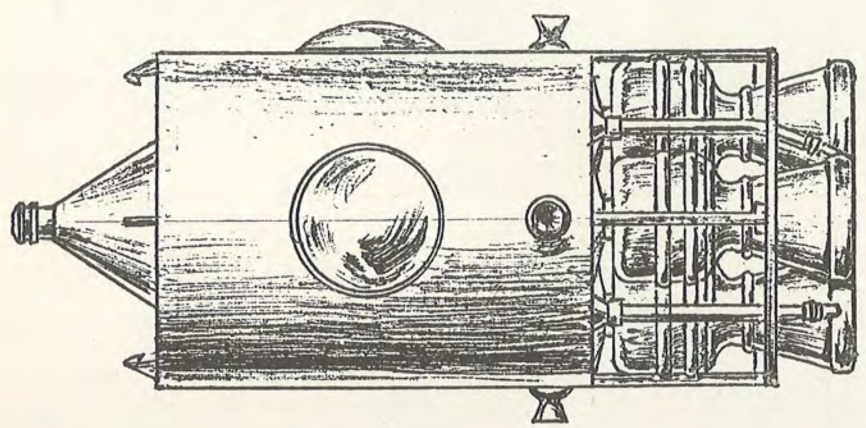


Fig. 3

SHORTCUT—(Cont'd)

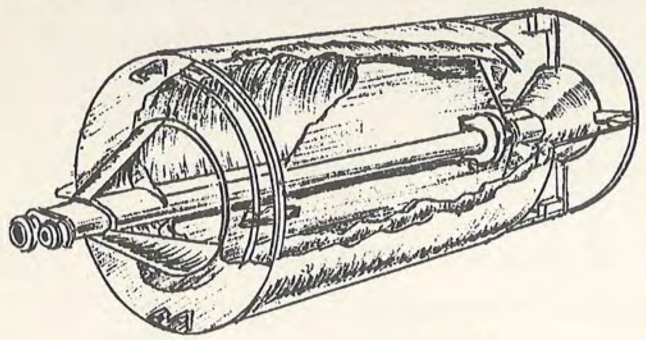


Fig. 4

dumped into space the power section would steer its probe in the drouge of the fuel section. The probe not only serves as a fuel transfer provision but as an indexing stud for easier final approach during remote assembly. This, of course, is the purpose of such flight refueling systems operational today. As each fuel section is added in the same way the final assembly would be ready for operation very quickly—providing the fuel sections could be brought up fast enough.

Before such a project could come to pass many problems would have to be worked out, but I believe we could begin now. I am sure that the close observation of the moon would more than justify the work and money.

I would like to consider just a few of some of these problems. If our little unmanned moon ship is expendable, that is it will not be returned, then obviously only telemetering equipment can be useful. The immediate problem that presents itself is how can ANYTHING be telemetered from the other side of the moon. It would seem that the only value of such an expedition would be a televised close up of this side of the moon. However, I believe that there are solutions. For instance the most forward fuel section could also be an antenna or TV relay transmitter, which would be detached from the rest of the assembly in a separate orbit around the moon. The relay would be following just far enough to be seen from earth and yet be able to relay TV signals from the unit behind the moon.

Another possible solution is the use of a polaroid land camera to photograph the other side of the moon then develop its own picture which would then be projected before the TV lens after the unit emerged from behind the moon or after returning close to earth. Returning close to earth would probably reduce TV transmitter requirements.

This brings up another point. Our present state of TV development may not permit a small enough unit to be practical. In this case it may be possible to develop a small compact version of the newly developed TV tape recorder. The recorded pictures and the complete moon ship would then return close enough to rebroadcast the TV at close range. This would also eliminate having to return camera film thru the atmosphere. Other scientific recordings could be retransmitted in the same way. This is similar to the interval triggered recording considered for the Vanguard Satellite.

Now, let us suppose that we want to bring the whole unit back to earth with camera film, mineral samples and etc. Of course, enough extra fuel sections would have to send and return the entire unit. Also enough should be included to break the ship's velocity before descending into the earth's atmosphere. This, of course, would require reversing the unit to fire the rockets in a forward direction. Perhaps control vanes and fins would also have to be added. If the unit could then be reversed again just before entering the denser layer of the atmosphere this would would permit air friction to heat up the empty fuel sections first. In fact, it would not hurt anything if some of them were completely burnt away. Indeed it would lessen weight for the parachute to drop on the final leg of the earthward trip. Better yet, parachute only the camera film, samples, etc. wrapped in a thick insulated package.

Also enough fuel might have to be included to be used by the controlling auxiliary jets during the critical re-entry phase into the atmosphere. This would prevent objectional tumbling which might break up the unit.

Power for telemetering could be a conventional system for ascent then solar energy during the unpowered portion of the trip. This was suggested for the International Geophysical Year Satellite. Instrumentation could be included to detect even the slightest bit of atmosphere, if any, on the moon. Some astronomers think there may be a very tenuous bit of gas clinging to our satellite.

I am sure other suggestions can be added. In fact, once this is published, it would probably bring quite a few constructive and destructive suggestions, which I would very much appreciate hearing.

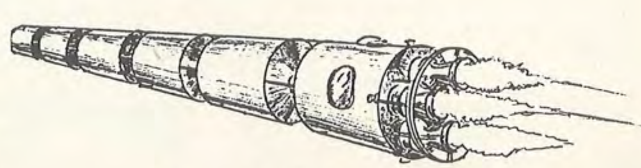
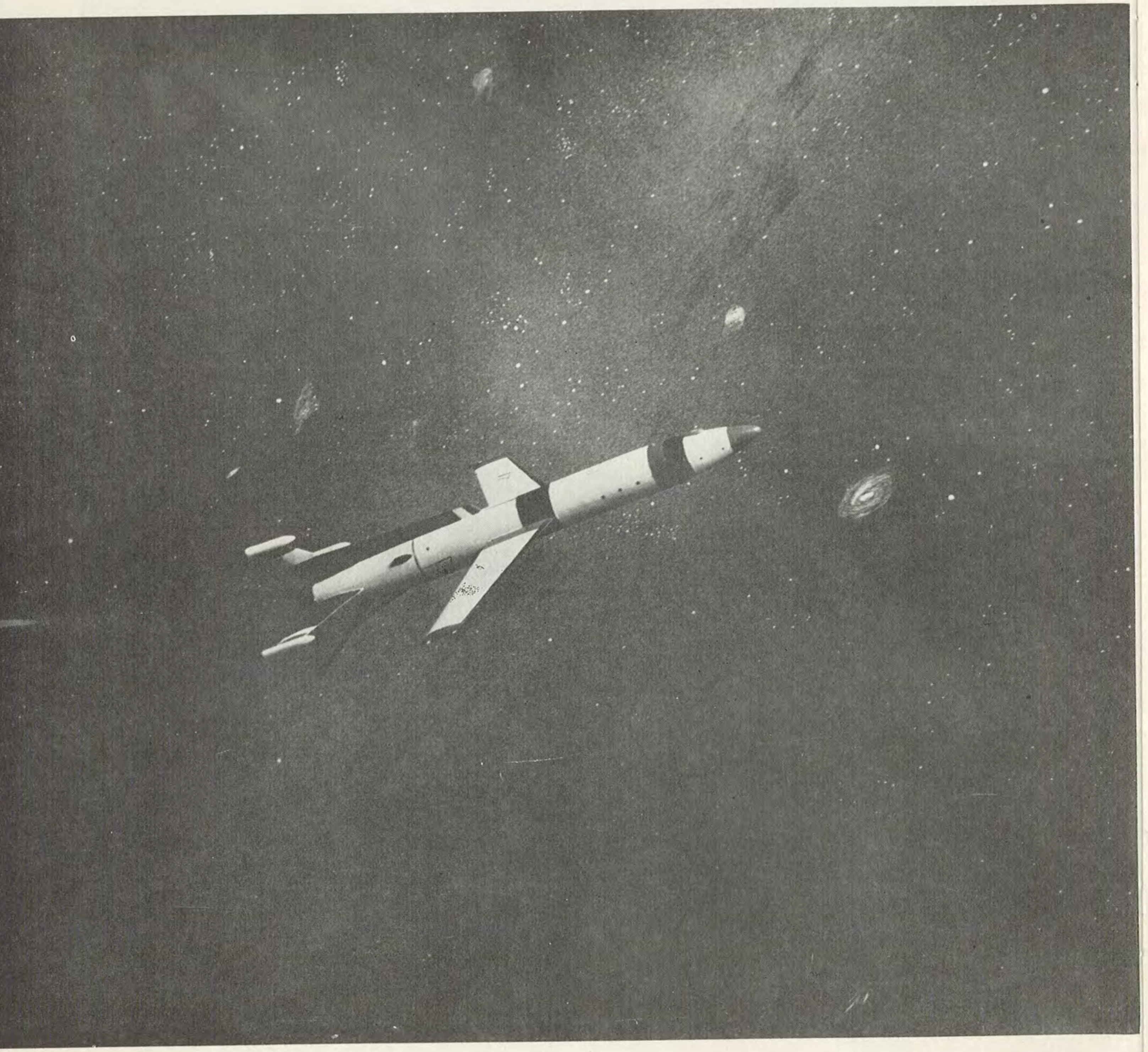


FIG. 5—COMPLETED VEHICLE

"MISSILE AWAY!"

Interplanetary Flight Calculations Simplified



by
DONALD I. THOMPSON

Flights to the planets have always considered the mechanics of "economy orbits" which are grazing ellipses. However, there are an infinite number of trajectories which might be used in interplanetary flight. Other orbits have not been considered in print because of the energy involved to execute them. This lack of energy will not always be the case, and astrogators will have to know the principles of "fast orbits" presented herein.

The objective of this article is twofold. Primarily it is to serve as an introduction to those unfamiliar with the factors involved in calculating an interplanetary space flight. Secondarily it proposes space flights other than the minimum energy ellipse (Case #1). The satellite orbits arbitrarily assigned for Earth and Mars in the following calculations are at distances from their respective centers of gravity of 5,000 and 3,000 miles. For a more detailed analysis of the problems to be encountered in (Case #1), reference is here made to Dr. Wernher Von Braun's excellent book, "The Mars Project", published in 1953 by the University of Illinois Press.

The path of a freely falling body about a center of gravity is a conic section. It can be a circle, ellipse, parabola, or hyperbola. The planets all describe ellipses about the sun, the orbit of Venus being closest to that of a circle. The eccentricity of the orbit of Venus is 0.00680[1] and the ratio of major to minor axis is 1.000023. A flight to Venus would be relatively simple to compute because it may be assumed that its orbit is circular and that it has a constant angular velocity. However, in a realistic sense Venus would not be so favorable a planet to visit as Mars. A landing on Mars would be feasible whereas a landing on Venus would be nearly impossible due to its atmospheric conditions. In the following discussions, Mars will be the objective in ten hypothetical space flight calculations.

Although the orbit of Mars has an eccentricity of 0.09335[1], in order to simplify the calculations it is assumed that the orbit is circular and that its angular velocity is constant. The same assumption is made for the Earth. The mean distances from the sun are assumed to be the lengths of their respective semi-major axes. A short table of the pertinent characteristics of Earth and Mars folows:

Planet	Earth	Mars
Gram mass	(5.976×10^{27})	(0.645×10^{27})
Semi-major axis	1.497×10^{13}cm	2.280×10^{13}cm
Equatorial radium (3)	6.378×10^{8}cm	3.396×10^{8}cm
Mean orbital velocity	2.980×10^{6}cm/sec	2.425×10^{6}cm/sec
Period of revolution (1)	365.256 days	687.0 days

It will be assumed that the space ship is presently describing a circular orbit about the Earth at a radius of 5,000 miles from the center of gravity and that the plane of this orbit is coincident with the plane of the Earth's orbit about the sun. This plane is known as the plane of the ecliptic. The ship will accelerate to such a velocity that its path will become hyperbolic with respect to the Earth. A few hours later the Earth's gravitational effect on the ship will be negligible. The path of the space ship wil then be practically tangent to the assymptote of the hyperbola, the acharacteristics of which have been determined by the burnout velocity. The course that the ship will then follow is determined by the vector velocity which it then has with respect to the sun. It will be seen that this velocity has two components. Initially the ship had the velocity of the Earth in its orbit. Added to this is the velocity components the ship has when it becomes tangent to the hyperbola. (The angle which the assymptote makes

(page 32, please)

FLIGHT ELLIPSE

CASE	R_P (10^6miles)	a (10^6miles)	b (10^6miles)	e	⊕	δ⊕	s (10^6miles)	t (days)	V⊙ (mi/sec)
1	93.0	117.4	114.8	0.208	0°	90°	364.7	259	20.3
2	83.7	112.7	108.9	0.257	59°15′	78°57′	257.8	194	20.1
3	74.4	108.1	102.7	0.311	80°55′	73°40′	215.4	168	19.8
4	65.1	103.4	96.0	0.370	96°19′	69°0′	185.1	150	19.4
5	55.8	98.8	88.9	0.435	108°39′	64°26′	160.8	136	19.0
6	46.5	94.1	81.2	0.506	119°14′	59°37′	140.0	124	18.6
7	37.2	89.5	72.6	0.584	128°51′	54°20′	121.5	114	18.1
8	27.9	84.8	62.9	0.671	138°1′	48°9′	104.4	106	17.6
9	18.6	80.2	51.3	0.768	147°20′	40°28′	87.7	98	17.0
10	9.3	75.5	36.3	0.877	157°53′	29°37′	70.5	91	16.2

ESCAPE HYPERBOLA

(CASE)	V_A (mi/sec)	∅	V_E (mi/sec)	V_{Bo} (mi/sec)	V_{BO}-V_{SAT} (mi/sec)	e	β	∝	Aphelion Correction $\Delta V = 16.7 - V_A$ (mi/sec)	Total Velocity Correction
1	13.4	44.3°	1.8	6.5	2.1	1.17	31°36′	−90°0′	3.4	5.6
2	12.9	19.0°	4.0	7.4	3.0	1.85	57°13′	−16°57′	3.8	6.8
3	12.5	11.1°	5.6	8.3	3.9	2.63	67°38′	−4°35′	4.3	8.2
4	11.9	5.1°	7.0	9.3	4.9	3.53	73°34′	3°10′	4.8	9.7
5	11.3	0°	8.3	10.4	6.0	4.62	77°29′	9°14′	5.4	11.4
6	10.5	−4.2°	9.7	11.5	7.1	5.94	80°19′	14°35′	6.2	13.3
7	9.7	−8.6°	11.2	12.8	8.4	7.59	82°26′	19°40′	7.1	15.5
8	8.6	−13.5°	12.9	14.3	9.9	9.73	84°6′	24°44′	8.1	18.0
9	7.2	−18.7°	14.9	16.2	11.8	12.65	85°28′	30°12′	9.5	21.3
10	5.3	−25.6°	17.6	18.7	14.3	17.15	86°39′	36°39′	11.5	25.8

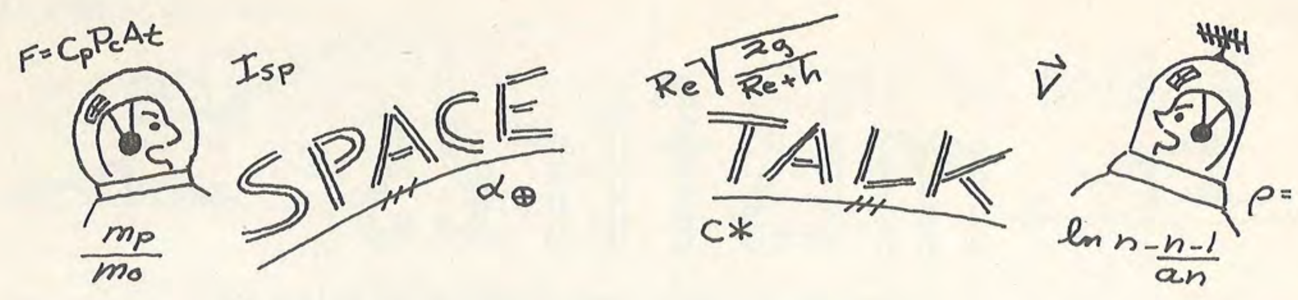
THE PLANETS OF THE SOLAR SYSTEM

Planet	Mean distance from sun (million miles)	Length of year	Mean daily motion (degrees)	Eccentricity	Inclination to ecliptic
Mercury	36.0	88.0 days	4.092	0.2056	7° 0′12″
Venus	67.2	224.7 days	1.602	0.0068	3°23′38″
Earth	93.0	365.25 days	0.086	0.0167	0° 0′00″
Mars	141.5	1.88 years	0.524	0.0933	1°51′00″
Jupiter	483.3	11.86 years	0.083	0.0484	2°29′29″
Saturn	886.1	29.46 years	0.034	0.0558	1°18′26″
Uranus	1,782.8	84.02 years	0.012	0.0471	0°46′22″
Neptune	2,793.5	164.79 years	0.006	0.0085	1°46′37″
Pluto	3,675.0	248.43 years	0.004	0.2486	17° 8′38″

Planet	Orbital velocity (miles per second)	Escape velocity (miles per second)	Gravity at surface (earth=1)	Period of rotation	Inclination of equator to orbit
Mercury	29.7	2.2	0.27	88 days.	near zero
Venus	21.7	6.3	0.85	unknown	unknown
Earth	18.5	7.0	1.00	1 day	23°27′
Mars	15.0	3.1	0.38	24 hr. 37 min.	25°10′
Jupiter	8.1	37.0	2.64	9 hr. 55 min.	3° 7′
Saturn	6.0	22.0	1.17	10 hr. 14 min.	26°47′
Uranus	4.2	13.0	0.92	10 hr. 40 min.	98°
Neptune	3.4	14.0	1.12	15 hr. 40 min.	151°
Pluto	2.7 (?)	6.5 (?)	0.9 (?)	unknown	unknown

Planet	Mass (earth=1)	Volume (earth=1)	Density (water=1)	Diameter (miles)	Albedo (percent)
Mercury	0.04	0.055	2.86	3,100	7
Venus	0.8	0.876	4.86	7,700	59
Earth	1.0	1.000	5.52	7,900	50 (?)
Mars	0.11	0.151	3.96	4,200	15
Jupiter	317.0	1312.0	1.34	86,700	44
Saturn	95.9	763.0	0.71	71,500	42
Uranus	14.7	59.0	1.27	32,000	45
Neptune	17.2	72.0	1.58	31,000	52
Pluto	0.7	0.9 (?)	5.3 (?)	7,700 (?)	15 (?)

(Data from Ley: "Conquest of Space")



The slanguage of astronautics is evolving slowly into a patois comprised of engineering, nautical, and aviation terms. Linguists know that a language develops through use, and, although space flight is not yet a reality, it has been considered in its manifold aspects for twenty years by science-fiction writers who have contributed terms and slang. Much of this is quite good and will probably be both useful and adopted, even as it is becoming today. A file of science fiction magazines produced the following terms which, it is hoped, will evolve into actual use because of the descriptiveness of them.

AIR LOCK—a term already in limited use describing the chamber which is used to enter or leave a space vehicle in the vacuum of space without loss of atmosphere from the ship.

ASTROGATOR—the navigator of a space ship, a term comprised of "astro" (for "star") and navigator. Astrogation will be the art of positioning and charting the course of a space ship by the stars in contrast to the art of piloting by radar.

ASTRO-PILOT—A person qualified to exercise control of the motions of a ship of space. Term already in limited use.

BLAST-OFF—comic book term picked up by the press which has come into limited use professionally. Accurately describes the violence of the takeoff of a rocket or space ship.

CONNING BLISTER—A transparent dome protruding from the outer skin of a space vehicle through which optical astrogation data may be obtained or visual conning accomplished. Also "astrodome", most properly.

CUTOFF—The moment at which a rocket engine stops operating, usually by automatic or manual command. Also used as a verb. Preferable to other terms, particularly for space ships where rocket operation will be stopped by command. Presently in use in rocket engine testing.

HIT DIRT—A verb denoting the landing of a space vehicle on a celestial body or the act of leaving a space ship to go aground while said vessel is berthed or resting on a celestial body.

GO BOARD—The "go-no-go" check-out and indicating panel on a space ship, comparable to the "Christmas tree" on submarines. Term is already in use in the naval service.

JETMAN—The engineering officer or flight engineer who is responsible for the operation, maintenance, and repair of the propulsion system of a space ship.

LANDING JACK—Hydraulic shock absorber positioned such that the craft may land on same following power-on, tail-first landings.

MAKE SMOKE—Phrase comparable to "twist her tail." Variations include "smoke out of here," "smoke this beast," etc.

SHUTTLE—An orbital satellite ferry rocket.

SKYDOCK—Repair or reprovisioning facility of a space station.

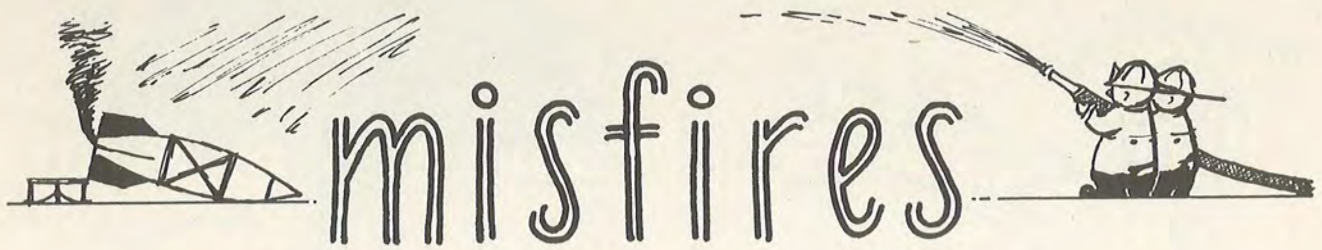
SKY JUNK—Meteors, asteroids, wrecks, garbage, and other assorted, non-charted bodies in space which clutter up the vacuum.

SPACE LAWYER—The astronautical equivalent of a "sea lawyer." A person well acquainted with the aspects of space law pertaining to him.

SPACEPORT—A complex comprising the landing and takeoff areas, shops, hangars, and other facilities for the conduct of space ship operations on a celestial body.

TORCH—A nuclear rocket engine, usually used to denote a system of active mass conversion for propulsive force.

TWIST HER TAIL—Phrase comparable to "floorboard her," "put your foot in the carburetor", "make knots", or "let's get out of here before we have to walk".



Some Considerations on space flight regarding the surface conditions during propulsion and accompanied by acceleration under conditions of (-f).

by

BARON GOTTFRIED VON VOTTSKUCKEN

(author)

According to the work of Chambers and Faires it is apparent that:

$$F_x = (P+dP)\cos\frac{dB}{2} - P\cos\frac{dB}{2} - dF' \quad (1)$$

hence:

$$F_y = dN - (P+dP)\sin\frac{dB}{2} - P\sin\frac{dB}{2} \quad (2)$$

thence:

$$-\;{}^{F_1}_{F_2}\;\frac{dP}{P} = - - f \quad dB \quad (3)$$

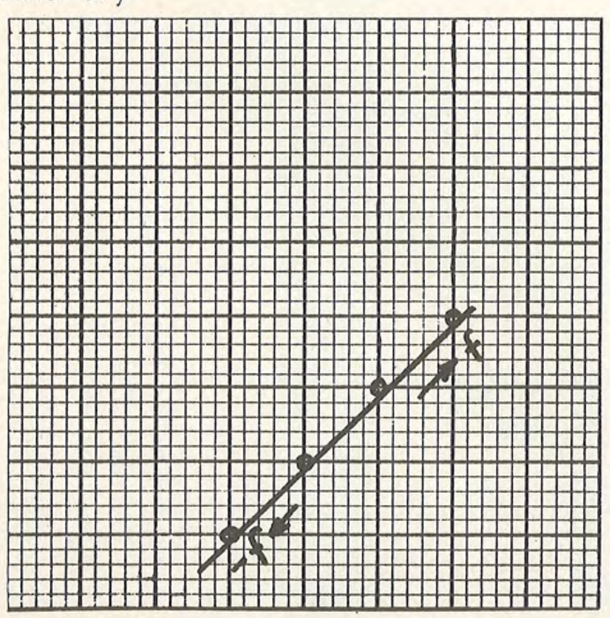
therefore:

$$\log_e \frac{F_1}{F_2} = -fB \text{ or } F_1 = F_2\, e^{-fB} \quad (4)$$

and taking into consideration the conditions at (5)

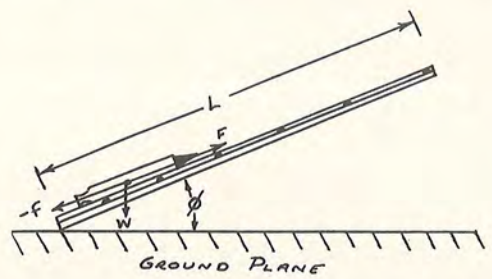
$$-f = \tan n$$

Therefore the following graph was plotted using x as a function of y



as x according to the function $x = f(y^1 + y^2 + \cdots y^n)$:

The experimental set-up was as follows:



It is therefore evident from this that the Varignon's Number for the moments of the forces involved is unbalanced according to the equation:

$$A(OP\cos B) + B(OP\cos n) = R(OP\cos\phi) \quad (6)$$

therefore:

$$\tan\phi = \frac{F}{N} = f \quad (7)$$

thence:

$$R = \sqrt{F^2 + N^2} \quad (8)$$

Otherwise, the unit will be operating on the portion of the curve labeled "reverse english" or (—f).

It is hoped that this investigation will illuminate some of the problems of air drag which have been encountered in the lower levels of the Earth's atmosphere.

The author wishes to thank Robert E. Daly and Lee Correy for their help and criticism.

References:

1. *OPERATION BANANNA-PEEL*: lab rpt., PS-83, Brklyn, NY, RED 1939.

2. *"HOW TO WRITE A TECHNICAL PAPER:—* "Missile Away!", Vol. IV, No. 1, Spring 1956, pg. 32.

(next page, please)

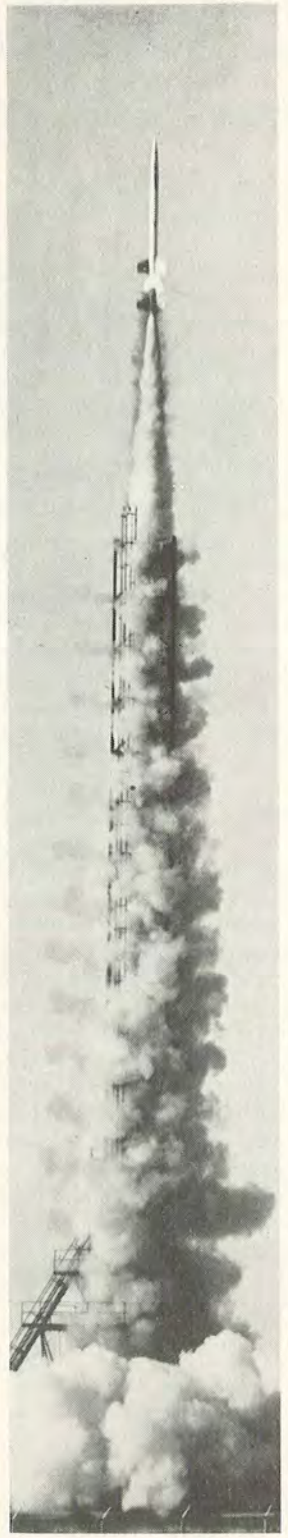
ABOUT THE AUTHOR

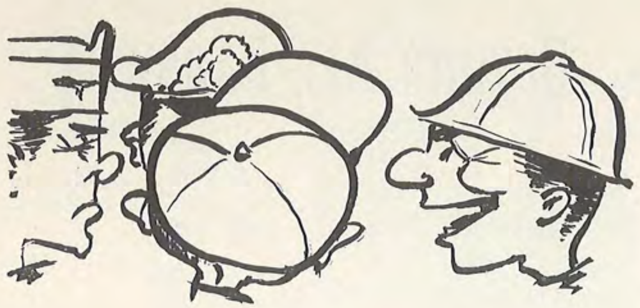
Baron Gottfried von Vottskucken was born in Wilhelmstrasselburg, Bavaria, in 1920, the only child of a well-to-do but decadent family of nobility. He was considered an odd child, one who never played with other children but preferred to sit by himself and either read or think. At an early age, he became familiar with such classics of scientific literature as the works of Euclid, Newton, Gallileo, Kepler, and others. He duplicated the Michelson-Morley experiment at the age of 6 using optical parts filched from the crystal chandelier in the ballroom of the family castle. At the age of 9, he raided the castle wine-cellars and used the vintage wines he found there as fuel for a two-meter liquid propellant rocket which broke the senic barrier, a landscape colored-glass window in the chapel of the castle. He was expelled from Hendelburg for daring to express the opinion that perhaps there were other fields or avenues in mathematics, physics, and the natural sciences yet undreamed of and unexplored. From this point his formal education ceased and, locking himself in the tower room of the family castle, he set about educating himself.

Following this period of self-education, during which he saw and conversed with no one, he formed a local astronautical society. After several years as president and leader of this group, he was forced to resign by virtue of an *anschluss* of the more conventional-minded members of the group, a clique of scientists and engineers, for daring to attempt to lead the experimentation of the society into untroden paths. Shortly after his fall from grace in this group, the society hired itself out to the totalitarian government which had recently come into power and became instrumental in the development of the dreaded RED-S rocket bomb.

The Baron joined the air service of the country, rising to lead a squadron in World War II. By virtue of his ingenuity in developing devices—most of which were rejected even by his squadron mates—he alone was alive three years later when petrol shorages forces the grounding of his fighter airplane, the only one remaining in the squadron. However, the local security police, wary of his radical ideas and outspoken criticisms concerning the conduct of the war, took him into custody and sent him to a concentration camp. This action was discovered by the Allies, and one of the most daring escape plans in all military history was put into action to free him and bring him out. The full details of this brilliant *coup* cannot be told; even the Baron is unable to speak about them since he was stinking drunk at the time on schnapps he had obtained by composing pornographic poetry for the camp guards.

After the war, he remained in this country not so much to retain freedom of intellectual expression as to work out better ways of making a fast buck. He is presently chief of the Metaphysics Department of the Institute for the Investigation of Scientific Principles. His salary and the royalties from his patents provide him with an ample supply of schnapps and support for his three mistresses.





post shoot conference

As a magazine, we have probably tooted our own horn many times, operating under the philosophy that "nobody's going to toot your horn if you don't do it." But we feel that the tooting has always been in good taste; at least, we have tried to keep it that way. A recent newcomer to the field of rocket and missile magazines, however, draws one big, juicy raspberry from us as tooting its horn in several very untasteful manners. For the benefit of the *newcomers* in this field of publishing, we wish to point out a few simple facts: (a) this magazine is the *first* of its kind, (b) this magazine has three solid years of publication behind it . . . and that's twelve full issues, friends, (c) that our material is written not by a paid staff but by the people actually working in the fields they are writing about, and (d) that we have no intention of doing anything other than leading the field and forging frontiers in the general interest rocket publication field as we have done in the past. We welcome each new magazine in this field, and we don't think of them as competition. After all, gentlemen, you may have the big names and the big budgets, but you still can't compete with what we've got!

The outcome of the National Board of Directors' meeting in New York City on November 26, 1956 on the question of advertising in section publications was extremely favorable to us. When Russ Sherburne got through laying the true facts on the line, there was no question as to the outcome. We may continue to solicit all the advertising we wish, along with all the subscriptions we can, as long as we specify that we are *not* a national ARS publication, but strictly the publication of a section of the ARS. We have never done anything but that, so our mode of operation is not changed one iota. On the question of distributing this magazine to all members of the ARS as an interim measure to fill the gap until the national group can get out a general interest magazine of their own, we have presented our offer twice and been turned down twice. Although we feel it would have helped the ARS, we're not sour grapes about it. Our job with this magazine, as we see it, is to accomplish two things: (a) give our members what they want to read, and (b) forge ahead as pioneers. We're far from running out of ideas, and when somebody comes along and uses our ideas, we merely move on to something else.

At the instigation of Frank Koen, Russ Sherburne, Gil Moore, and many others, a "Missile Away Award" was created this year to be presented to a NM-WT member for contributions to the welfare of the Section. It was presented for the first time by Russ Sherburne at the Annual Section Meeting on 22 November 1956. Harry Stine, who was totally unaware that any such award was being created, was the surprised recipient for his work in founding, editing, and advancing this magazine to its present position as a leader in its field.

The 1957 officers and directors of the NM-WT Section met for the first time at La Posta in Old Mesilla on the evening of 13 December 1956, and the aims and programs of the Section for the coming year were outlined by President Meredith and discussed. The Section now has a functioning speaker's bureau to provide speakers, films, displays, and other things before high school groups, college organizations, civic groups, and other organizations. Any interested group is invited to contact this magazine or any of the Section officers. We hope that many of the local groups in this area will take advantage of this service in providing information on rockets, guided missiles, and space travel to anyone who wants to listen.

(page 42, please)

The first Section meeting of 1957 was held in Hadley Hall at New Mexico A & M on January 24th. Captain Jack Siewert, U. S. Army Ordnance Corps and Range Safety Officer for the Fort Churchill IGY high altitude rocket research program, presented a program on the pre-IGY rocket firings at Churchill which were completed in November 1956. Using color slides he took on the spot, Capt. Siewert described the area and drew comparisons between the Ft. Churchill operations and those at WSPG.

The pre-IGY operations at Churchill were highly successful, Siewert pointed out, and accomplished a two-fold purpose: (a) data from the Aerobee and Cajun rocket firings made important contributions to the knowledge of the upper atmosphere in the Arctic region, and (b) a new rocket range was established and proven.

Capt. Siewert, a member of the NM-WT Section, plans to return to Churchill for the remainder of the IGY firings there in 1957 and 1958.

The Holloman-Alamogordo Region is rapidly on its way to becoming a separate section in its own right. The officers of that group have drawn up their by-laws and submitted them to national headquarters. From the looks of things, it won't be long until those by-laws are approved by the National Board of Directors. The proto-section already is holding its own meetings, conducting its own membership drives, and publishing its own four-page monthly newsletter. Boys, we hate to see you go, but wish you all the luck in the world as a new section of the ARS. Hope we can work out a series of combined activities this year.

What makes a rocket or missile engineer? This question popped into a bull session at White Sands the other day. Is it a desire to make money? No, it was decided, because other professions pay better, in spite of the job and salary swapping that is going on today. Security? Nope, because you are liable to be here today and gone tomorrow after the job is finished. Contribution to the general welfare? Perhaps, but certainly it is not the prime motivation. It turned out that it might be any of a number of things, all highly personal and very intangible. Curiosity, desire to create, desire to answer a challenge, or the diversity of it were some of the reasons. What is yours?

Arthur C. Clarke, who addressed this Section about four years ago and who is the author of a great many space flight and science fiction books, was recently in Roswell visiting the Goddard museum there. Other commitments prevented him from dropping over this way, sadly enough. Arthur is now working on a satellite book, something we'll be looking forward to.

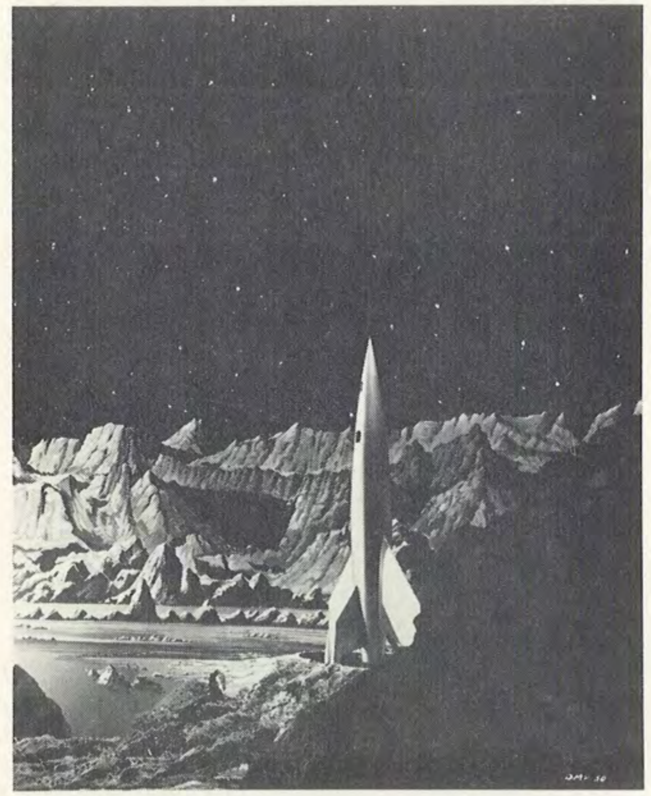
Perhaps some of you noticed the recent addition to the multifarious plastic model kits on the shelves of hobby shops. This kit, a plastic model of the "Atlas ICBM satellite rocket" was as interesting as it was humorous. It is made up of *four* stages, all with fins, and with each stage powered by a staggering battery of rocket engines. To the model manufacturers, we say, "Come now, gentlemen, with all the information and pictures of the Vanguard vehicle which have been released, you certainly could have done a more accurate job than this! The big trouble with you is that you've been reading too many comic books."

Speaking of comics, we still tend to think that the good old Buck Rogers strip is *passe,* having been surpassed by our own mighty technology. Look again, fellows. Old Buck didn't worry his head off about reliability. He batted back and forth between the planets and even out to the stars with rocket power plants which were really sophisticated—nuclear, probably. And have we come closer to developing disintegrator guns, paralysis rays, "impervium", flying belts, and all the rest? You bet your boots we haven't! Sometimes one wonders if the venerable Dr. Huer wouldn't have laughed himself silly at our pretentiousness. If we're so hot, why haven't we licked a few little things like gravity . . . or the common cold? Shucks, boys, even Dick Tracy has us backed into a corner with his wrist-radio and TV system; The best thing we seem to manage is to tear around the sky in air-breathing jets like "Terry and the Pirates" or "Steve Canyon".

"THE TIME IS OVERRIPE . . . !"

"The time is overripe for space travel. This globe grows more crowded every day. In spite of technical advances the daily food intake on this planet is lower than it was thirty years ago—and we get 46 new babies every minute, 65,000 every day, 25,000,000 every year. Our race is about to burst forth to the planets; if we've got the initiative God promised an oyster we will help it along!"

(From "The Man Who Sold The Moon," by Robert A. Heinlein, Shasta Publishers, Chicago, 1950.)



Someday very soon, men will look up in the sky and see Mother Earth hanging there, round and blue and beautiful against the stars. They will be standing on the surface of the Moon, the first celestial body besides the Earth on which mankind will set foot. Behind them will be six thousand years of history filled with stars, strife, and accumulation of knowledge. But before them will stretch an infinite universe full of endless questions, answers, and opportunity.

We still have some work to do before this can come to pass. There is much to be learned. This knowledge must, insofar as it does not endanger our way of life, be passed on to others. Some of it will emerge as tightly reasoned technical material. A great majority of it, however, will be semi-technical, and this semi-technical literature of rocketry must be handed on to the layman and the student in order that they may understand this magnificent achievement.

This magazine is meant, in part, for them. It is available to anyone. A dollar will bring it by mail four times a year.

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