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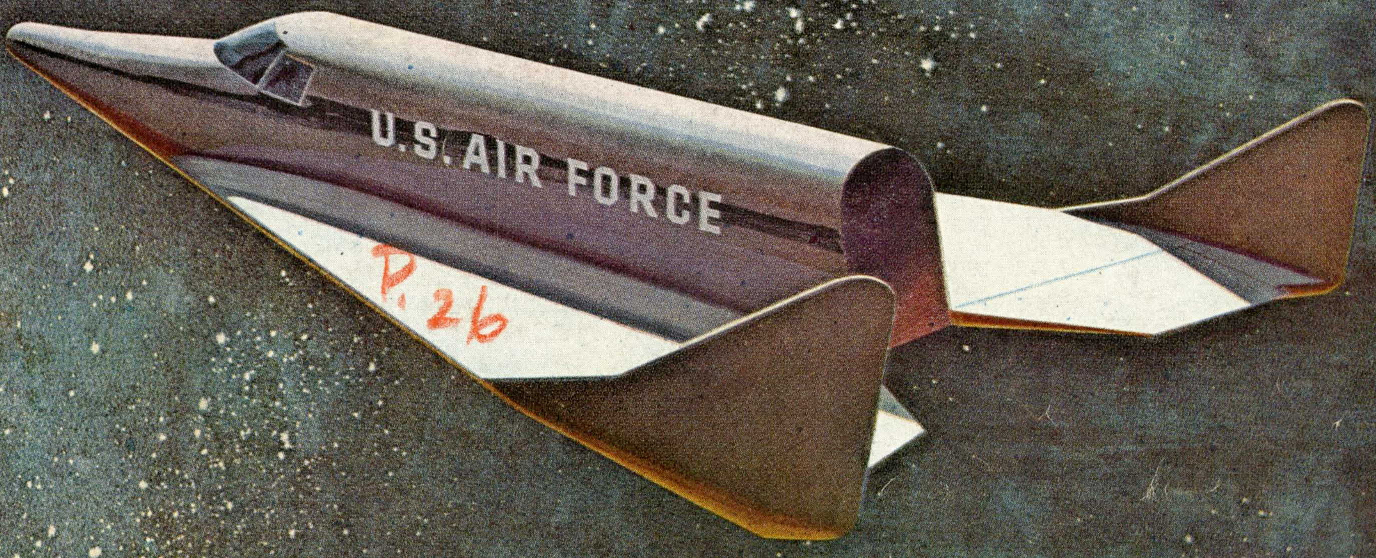
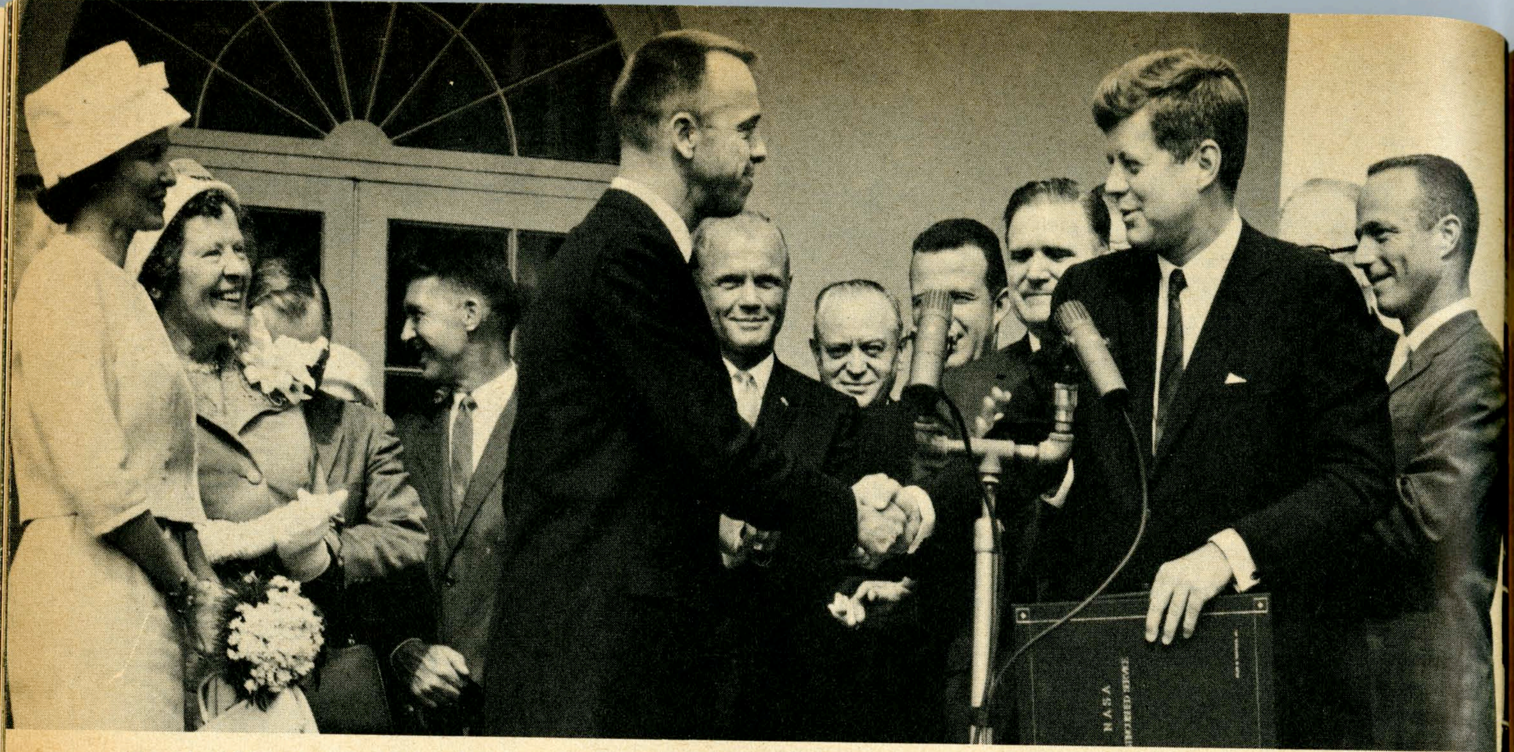


LEARNING TO LIVE ON THE MOON
Oct. 1961
Page 26
by James Gaume

40 BILLION DOLLARS – Is President Kennedy throwing it away trying to put American men into space?

WILLY LEY REVEALS THE FULL STORY–

The Russian 'Murders' In Outer Space



President Kennedy awards medal to Alan Shepard, whose flight marked the first step in our costly man-in-space project.

THE 40 BILLION DOLLAR Q

by OTTO O. BINDER

"What is the advantage in going to the moon?" . . . "All that money could be put to better use right here on this planet." . . . "What can they [the lunarnauts] do when they get there?"

These are typical replies of the man-in-the-street in a recent Gallup Poll which asked if America should use what resources are necessary to put a man on the moon. The poll was taken shortly after President Kennedy exhorted U.S. citizens to support a man-in-space program including a "moon race" with the Russians.

The results, excluding 9 percent with no opinion, came out 58 percent against, 33 percent for the President's proposal.

The Gallup Poll question was put this way: "It has been estimated that it would cost the U.S. 40 billion dollars—or an average of about $225 per person—to send a man to the moon. Would you like to see this amount spent for this purpose, or not?"

Since the President implied we are going to try to beat the Russians to the moon (their lunar target date is 1967), that means almost $6 billion a year will be spent on this project in the next 7 years. A truly staggering sum—if the Gallup Poll stated the figures correctly.

Other answers from typical Americans include comments that those same forty billions spent in other ways would "buy a lot of groceries" . . . "mean better schools for my kids" . . . "easily take care of old-age security and a national medical-care program" . . . "wipe out depressed areas" . . . and so on.

So apparently a majority of Americans are opposed to launching what amounts to a semi-crash program to place a man on the moon before the Russians do.

Scientific Reaction

"For the same money you could support a hundred research projects for 40 years . . . in physics, chemistry and biology . . . we need to finish the job of handling arthritis . . . to know more about the genetics of viruses," says Dr. Vannevar Bush.

All this is better, Dr. Bush insists, than "shooting it into space." The remarkable aspect of this comment from a well-known scientist is that Dr. Bush was one of the directors of World War II's Manhattan Project, a "reaching for the moon" program which produced the atomic bomb. This eventually led, as everyone knows — including Dr. Bush — to peacetime atomic power, radioisotopes in medicine, and many benefits of nuclear science yet to come.

Alvin M. Weinberg, Director of Oak Ridge National Laboratory, agrees with Dr. Bush. Is it wise, Dr. Weinberg wonders, to choose manned flight into space as the primary event in the "Scientific Olympic Games"?

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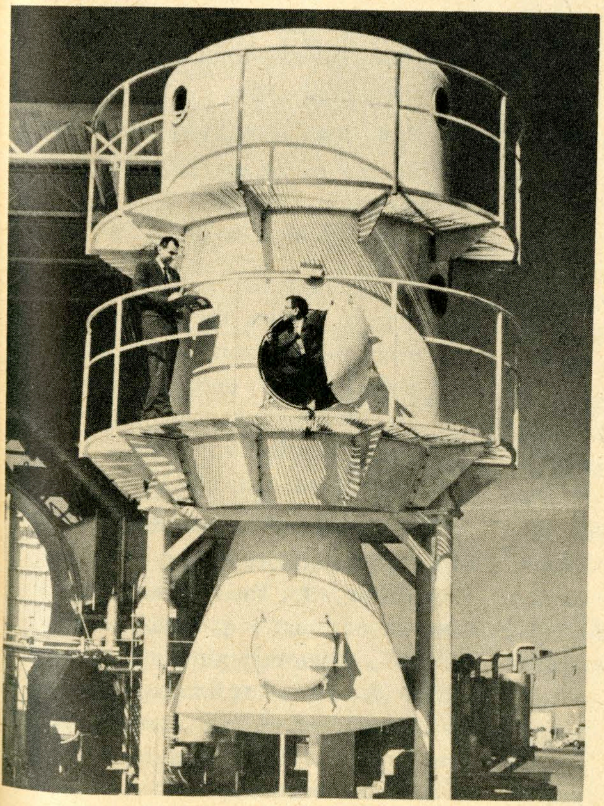
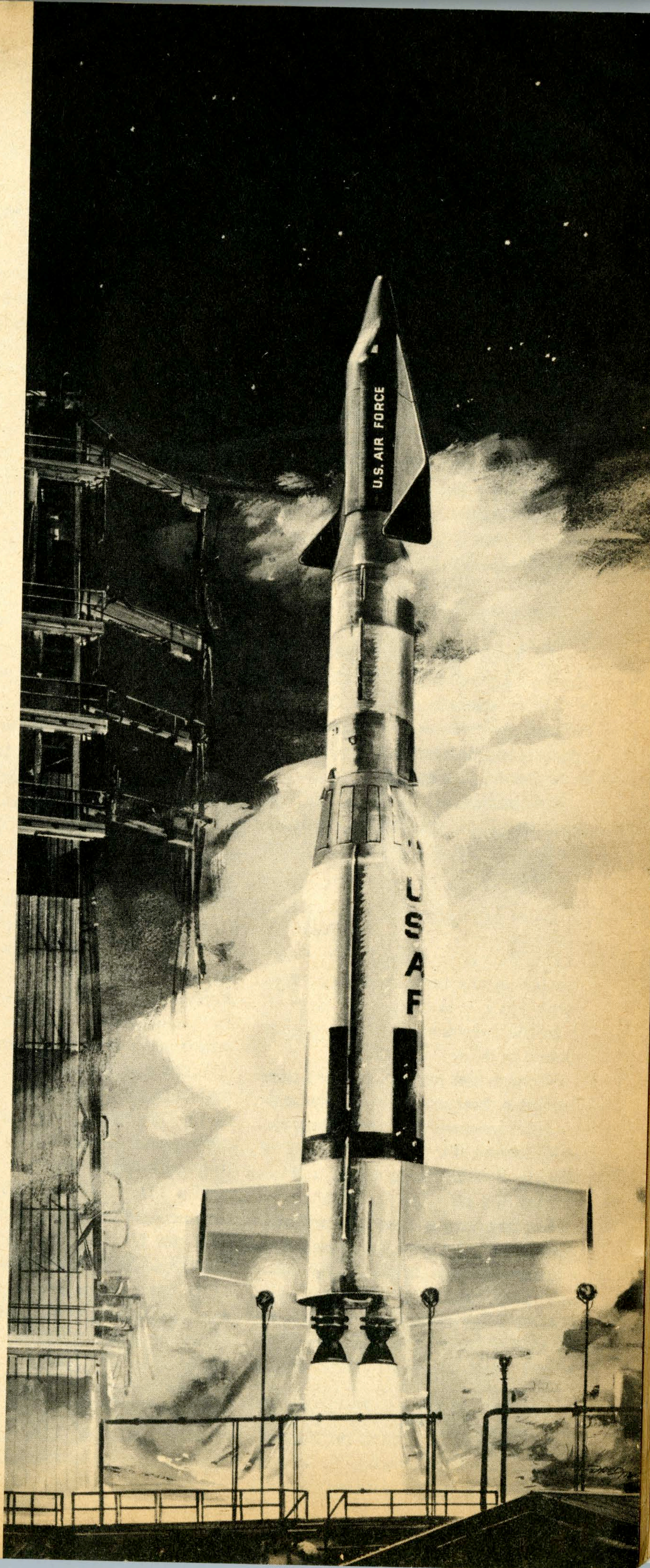
Pres. Kennedy announced a crash effort to reach the moon before the Russians. Will his program be worth the huge sum it will cost?

R QUESTION



Expensive projects. Dyna-Soar, right, and 3-man space station, above, are just two projects that must be completed in order to catch up to Russians.



He concludes that three things make manned space flight projects untenable for many years: radiation hazards, expense and irrelevance. By the latter he means machines can perhaps do the job better than men.

This man-vs-machine controversy is currently raging among astronautics authorities.

Dr. Hugh Dryden, Deputy Administrator of NASA, has repeatedly stated that our unmanned scientific satellites have compensated for Russia's spectacular feats and put us even, or ahead, in the overall space competition. By this, he seems to imply that it is not really necessary to match the flights of their cosmonauts.

The trade magazine *Missiles & Rockets* reports that ". . . the great weight of scientific opinion that has influenced government decisions on space spending has for years favored instruments over man."

The reasons for this opposition, the magazine finds, are that "it is costly, hazardous, and of relatively doubtful scientific value."

The Big Decision

The Kennedy Administration has completely rejected the doctrine that man's place is at home—on earth.

In the President's words, from his speech of May 22, 1961:

"Now is the time to act . . . time for this nation to take a clearly leading role in space . . . achieving the goal, before the decade is out, of landing a man on the moon and returning him safely to earth."

Backing up his resolve, the President asked Congress to appropriate 61 percent more funds to galvanize our space effort. Out of a total addition of $549 millions, the following allocations were earmarked wholly or partially for our manned flight effort:

* $144.5 millions to accelerate the Saturn and Nova booster projects (NASA)
* $62 million to develop alternative giant solid-fuel boosters as backups for the liquid-fueled launchers (DoD)
* $130.5 millions to speed up the Apollo Project, follow-on for the Mercury Program, including 3-man orbiters, circumlunar craft, and the moon-landing ship.

Along with this, the President estimated that it would cost another $7 to $9 billions in the next five years to change our former limited man-in-space objectives to an expanding *men*-in-space program.

This huge sum only covers expenses until 1965. After that, the space budget is expected to be some $5 billions yearly. In total, we will be spending some $20 billions on the space effort between 1961 and 1967.

The Figures

So, we find that the $40-billion figure quoted by the Gallup Poll was misleading. Their question was "loaded" because it accepted the "fact" that it will take "$40 billions to put a man on the moon."

But the facts are far different:

In a paper titled "Costs for a Manned Lunar Landing and Return Mission", presented before the American Astronautical Society by three engineers of Chance Vought's Astronautics Division, every detail of research and development, of building hardware, of using expensive booster giants, and of the elaborate life-support for the crew, was carefully included.

The total: *$3,068,000,000.* Not for one man, but for a crew of three. And not for one short hour on the moon but for a stay of 8 to 10 days!

At least a half dozen other aerospace firms have done similar cost analyses of lunar missions, with variant vehicles and boosters. *In no case has the total come out higher than $5 billions.*

Why then this bloated figure of $40 billlions quoted as being the cost of sending *one* man to the moon briefly?

The answer is simple. The $40 billions refer to our space effort's cost for *10 years* ahead, not just until 1967, when the manned moon landing may be made. It also happens to include *all other* experiments with unmanned satellites,of which NASA has planned some 260 from 1961 to 1970.

Upon close analysis of President Kennedy's appropriations request to Congress,we find the following non-man-in-space items clearly listed:

* $66 millions for exploration, by unmanned vehicles, of the space environment around the earth and in cislunar space. (Though this may be of some aid to lunar flight, the program would be carried out anyway, as scientists simply want to know those things.)
* $50 millions to expedite development of components for ComSats (communications satellites for relaying radio and TV around the world).
* $22 millions to advance the Tiros-Nimbus-Aeros weather satellite program.
* $53 millions for the Weather Bureau to set up data-handling computer systems for those meteorological satellites.
* $58 millions for launch facilities able to service the Saturn and other big boosters of the future (which will be used for launching many unmanned satellites and interplanetary probes as well as manned ships).

Thus, $249 millions or almost half of the $549 millions requested by the President are for the *unmanned* portion of our space program, which NASA is vigorously pursuing.

In testifying before a Congressional committee, NASA cost experts recently gave a round figure of $40 billions for the funds that space research might need in the next ten years. This was mistakenly quoted in the press later as the cost for just one flight to the moon. The figure stuck,

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and was erroneously used by the Gallup Poll.

Certainly all the research costs, launch facilities, tracking networks, office expenses of NASA, paid vacations, labor union overtime and such, which may make a grand total of $40 billions by 1970, can't be charged to the man-in-space program. That would make all the 260 unmanned satellites, and innumerable sounding rockets used for upper-atmosphere research, utterly free of cost.

Nor can all the costs for orbiting manned laboratories around earth, various Apollo missions for pure research, and the construction of manned space stations be slipped onto the tab for the lunarnauts.

Though such expenses do overlap in all unmanned or manned areas, a reasonably realistic figure for just the single program of rocketing an American to the moon by 1967 would be between $7 and $12 billions.

If the Gallup Poll had asked their question quoting *that* figure, the results might well have been a great deal different.

Man-vs-Machines

But even given this reduced figure of $7 to $12 billions, still a huge amount of money, shall we go ahead with the man-on-the-moon program? Are we throwing the money away, as many Americans seem to believe?

Many scientists who believe in the usefullness of the moon program insist that a machine can do better or at least as well on the moon than a man, at far less expense. While conceding that for some moon jobs a machine may perform many tasks without the aid of a human brain on the spot, the evidence for man's ability to significantly improve the performance and efficiency of the moon program, or any space program, seems overwhelming.

Dr. Leo Steg, Director of General Electric's Space Sciences Laboratory, concedes that perhaps unmanned satellites can do a good job in the close orbital vicinity of earth. But, he adds, in all longer range flights "man can outperform probes [because he] has the general attributes of self-programming, flexibility and adaptability . . . difficult to match with a machine."

Dr. Jiri Nehnevajsa of Columbia University: "If for no other reason than that of reliability, man will more than pay his way."

In *Aviation Week,* the trade magazine, General Don Flickinger of the USAF Life Sciences Project, and Scott Crossfield, conclude that "at a price of some 5 to 10 percent in terms of weight, a man can improve systems efficiency and economy by as much as 70 percent."

Scott Crossfield speaks from experience. He has flown the X-15 "manned missile" many times, and more than once has been forced to take over when mechanical devices went out-of-order.

The Basic Question

But even if we can demonstrate the superiority of man *and* machine vs. machine alone, we still face the basic question of whether the program's objectives are worthwhile.

"Why do you want to go to the moon?" people often ask Dr. Wernher von Braun, as though this were solely an ambition of his own. His reply is to quote his friend, Dr. Edward Teller: "Columbus hoped to improve trade relations with China. He didn't succeed, even to this day, but look at the by-product — he stumbled on to America."

James Webb, Chief of NASA, points out that many useful by-products have already come out of space research, in the form of hundreds of miniaturized devices useful in our daily lives. Webb also says that some 3200 space-age products have been developed which "come from the missile and space work. From this 5000 companies . . . now engage in missile and space work. From this new industry emerge new jobs that will help take up the slack of unemployment."

Most scientists—even those who favor robot pilots over human—have no doubt we will be immeasurably enriched by virgin scientific discoveries when space is widely explored.

A second motivation is soberly summed up by R. W. Buchheim of the Rand Corporation: "Who is watching this competition [between the USA and USSR in space]? The whole world, of course . . . If we fail to overcome their space exploration lead . . . we lend credibility to the Soviet claim of a superior economic and political system, and cast doubt on our own vitality."

James Baar, space expert on military affairs for *Missiles & Rockets* magazine, thinks we must make the man-in-space effort as a matter of survival.

He speaks plainly: "In any race for military domination in space, the Russians are clearly well ahead. . . . Some military men [in the U.S.] fear the first consequence of the Soviet military space lead will be the early destruction of U.S. reconnaissance and communications satellites. The next could well be the launching of Soviet orbital bombers."

The same opinions are held by Air Force Secretary Eugene Zuckert, who told the Senate: "The U.S. and the Free World must insure that the means of earth domination inherent in space mastery be not pre-empted by the enemies of freedom . . . The lesson [has come clear] that through and from space, earth can be dominated."

Technological War

Flying Magazine recently announced there was strong evidence that Russia has secretly developed a 2500 mph nuclear jet-bomber that is close to operational status. The information came through the Sino-Korean People's League, which has a pipeline into Red China.

A more recent unofficial intelligence report from this League is that by 1963-64, a Soviet fleet of nuclear-powered space platforms may be circling the earth, with missile launching capabilities.

If these seem like the usual products of a rumor-factory, let's turn to a statement by Lt. Gen. Bernard A. Shriever, the "man who built the

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Atlas", whose words are never spoken without careful deliberation. He cites first the "technological explosion" that has shortened the time between weapon system breakthroughs, then adds:

"Today, we are in a technological war in which the battle lines are in the laboratories and the industrial plants of the U.S. and the Soviet Union. It is a war we must win if we are to survive as a free nation."

Two other quotes are significant.

The first: "Man's first space flight in the world by Major Gagarin marks a new . . . leap in the conquest of cosmic space. No matter how good and how perfect the 'thinking' Sputniks and interplanetary stations may be, man's presence on board . . . opens up grand new vistas."

The second: ". . . the brilliant flight of the first astronaut, Yuri Gagarin. . . will undoubtedly mark the beginning of mankind's triumphant conquest of outer space and the planets of the solar system."

These quotes are from two Soviet academicians, Professor B. Mirtov and Dr. A.I. Oparin, who express Russia's official policy of many-men-in-space with the eventual goal of exploring and conquering the entire solar system.

Shall we just sit back and do nothing while Russia pursues its man-in-space programs? Or shall we, as Dr. Hugh Dryden puts it, send a man to the moon as "insurance against winding up at the end of this decade with a science and technology inferior to that of [Russia]" and risk annihilation in case of war?

Every American can ask himself: Is it worthwhile for President Kennedy, in behalf of us all, to spend billions of dollars to send Americans into space?

No matter what the cost, it's still a cheap price to pay for the security of our nation. ■ ■

Power for Interplanetary Travel *continued from page 33*

problem as otherwise the performance rapidly falls off as charged repulsive forces build up.

Other problems include the requirement that little power be consumed in the generation, extraction, and acceleration of the ions from the alkali metal; that random electrical discharges or electromagnetic field breakdowns within the system be minimized; that accelerator design be such as to wastefully intercept only small portions of the ion beam; that the electrical interactions should not produce sputtering; and that no fast erosion of components' parts occurs.

Nuclear pulse jet. One of the more awesome systems proposed for powering spaceships is best termed "bomb propulsion". This essentially means utilizing the energy transfer from a series of nuclear explosions to provide powerful "kicks".

But serious problems lie in the fact that nuclear bombs, even though small, are used in this application, thus adding appreciable shielding requirements within the vehicle for the crew. Another difficulty is the need for extremely efficient shock absorbers to reduce the impact of peak acceleration loads on the vehicle and the men. Some of the objections would be alleviated if small, all-fusion bombs were available instead of uranium fission types.

Thermonuclear drive. The fusion reactor appears to offer the ultimate in propulsion capability. But this must wait upon development of workable thermonuclear reactors now being researched by the AEC and independent atomic scientists.

Still, it should be noted that it may be easier to apply a fusion reactor to vehicle propulsion than to ground power supply systems due to the unique advantages of the space vacuum surrounding spaceships.

Thermonuclear propulsion concepts can be broadly divided into three general classes. The first permits diffusion of some fusion particles and their radiation to a cooling blanket of propellant which can be exhausted along with fusion products.

A second proposed device magnetically contains or exhausts all energy except radiation losses, which are removed in a closed coolant loop. The third system would utilize the

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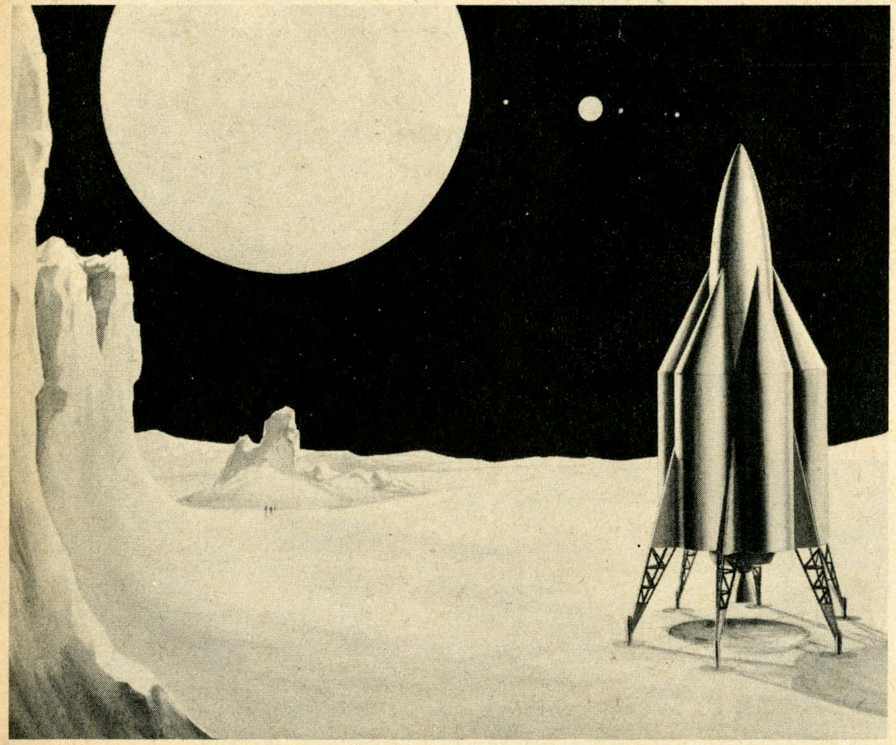

Nuclear Power. Artist's drawing shows nuclear rocket preparing for return to earth after landing on one of Jupiter's moons. Exploring party gathers samples.

thermonuclear exhaust products from the energy release of a fusion chain reaction, such as that which occurs in super novas.

Admittedly, these systems are sheer speculation as of today. The problems to be conquered during their development will be imposing, but research efforts will continue because the potential thermonuclear performance range fulfills the ultimate needs of manned planetary exploration.

Many other advanced propulsion variations have been mentioned from time to time. Some have points of merit; all present serious development difficulties.

For example, the "Fizzler" would be a nuclear rocket engine that resembles an end-burning solid rocket by using a receding core which is controlled critically at the receding end. Then, the hybrid reactor with a solid plus gas core would attempt to increase the power of a solid core system by adding U235 to the propellant gas. Finally, the photon rocket would utilize a highly efficient light source to obtain thrust from the momentum of corpuscular light particles.

In any event, we can expect at least one of the advanced propulsion concepts to someday drive our vehicles out into the interplanetary deeps far beyond the boundaries where chemical rockets falter. ■ ■

Macro-Life *continued from page 17*

If the bottom of the sphere is to be open, then the inside pressure must equal the pressure of the water at the depth of the opening. A reasonable compromise might be about fifty feet from the opening to the water surface. This would mean an internal pressure of twenty-five psi and a differential pressure at the top of about fifteen psi.

The sphere would be divided into compartments according to functions, and would contain living quarters, laboratories, dining and recreation areas, etc. Hydroponic farms might be included if it was decided to operate the base as a closed and balanced ecological system.

Besides the scientific and military reasons for building underwater bases there is also to be considered the value of such a base for civil defense.

It is generally assumed that the population could be adequately protected during all-out war by providing them with temporary blast and fallout shelters. Presumably a family or larger group after spending perhaps a week in such a shelter would emerge and return to their normal pursuits so rudely interrupted by the war. Unfortunately this common picture is far from the truth. If an all out nuclear war should be fought in say 1970, the survivors would emerge from their shelters to find themselves on an alien planet almost as inhospitable as the moon and perhaps even more inimical to life than Mars.

During the short period of nuclear devastation, most of the above ground structures in the country would have been destroyed by blast or fire. Fire storms would have swept the country unchecked and destroyed practically all vegetation. All unprotected animal life would die from acute anoxia brought on by the fire storm, if not killed more quickly by blast, heat, or nuclear radiation.

While the background radiation might fall below the danger point for acute radiation sickness in some areas in a few days or weeks it would represent a danger of chronic sickness for years. The danger of bone cancer, leukemia, etc. would be too great to permit a return to normal earth life for a very long time.

In fact, it would be necessary for the survivors to live and grow their food in sealed shelters just as though they were on the moon.

While it would not be practical to move the entire population of the U.S. underground in, say, the next ten years, it would be feasible to build temporary shelters which could house the population in the critical period during and following an attack. Also, a one year supply of food could be stored in the shelters and the necessary tools and equipment for building permanent shelters. In particular, large quantities of transparent plastic would be required for construction of airtight domes to cover living areas. Also, stores of seeds for all varieties of useful plants and trees would be essential.

Research should be intensified on the problems of storing the fertilized eggs of fish and birds in suspended animation. We should also intensify our efforts toward learning how to raise the mammalian zygote artificially.

An important fraction of an adequate national civil defense program should be devoted to the construction of a number of "Noah's Arks" permanently staffed with volunteer colonies. These "Arks" unlike other civil defense shelters would be completely equipped for an indefinitely long existence in complete isolation from the rest of the world. They would be a close approximation of Macro Life with all the capabilities for independent existence, growth, and reproduction of a true life form.

The Arks could be constructed underground in natural caves or artificial excavations, underwater in fixed bases, or possibly in nuclear submarines. A large nuclear submarine adapted from a military vehicle or constructed specifically for this purpose, could become almost as good an example of Macro Life as the extraterrestrial colony although it would be dependent on a supply of nuclear energy rather than sunlight.

The "Ark" should have a population of several thousand people plus the necessary plants and animals to provide a completely adequate and balanced diet. The underground colony should obtain energy for growing food, powering its tools, etc., from sunlight conducted from the surface through optical systems, nuclear