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(Abstract)

THE EARLY STEPS IN THE REALIZATION OF THE SPACE STATION *

by

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The conquest of space represents the outstanding challenge to science and technology of the age in which we live. Ten to fifteen years from now, depending on how determinedly and efficiently we shall respond to this challenge, the earth will have a second satellite, a man-made moon circling the earth at an altitude of slightly more than 1000 miles in two hours. Assembled from prefabricated parts hauled into the orbit by huge, three-stage rocket ships of the weight of a light cruiser, this station will probably have the shape of a huge wheel of some 250 feet in diameter. It will slowly rotate about its hub and its 80 to 100 inhabitants will live in the wheel's rim. A detailed outline of such a plan was presented in Collier's magazine, dated March 22, 1952.

The station in space described therein will be the most fantastic laboratory ever devised. It will also be the springboard to man's further ventures into outer space, to the moon and the nearer planets. But it will become a reality because of its tremendous potentialities as a deterrent of war. With its powerful telescopic cameras and radarscopes the station's reconnaissance teams could take the most detailed pictures of any suspect area on the face of the globe at least once every twenty-four hours. They can thus pull up any Iron Curtain, no matter where they lower it. But while we may well hope that the station's mere existence would seriously discourage any large-scale military adventures, it has far greater potentialities. When it comes down to cases, the station is also a launching platform for orbital guided missiles against which there cannot well be countermeasures.

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* Lecture to be given at the Second Symposium on Space Travel at the Hayden Planetarium, American Museum of Natural History, October 13, 1952.

What steps should be taken to establish a station in space and to build the rocket ships required for this purpose? Obviously, it would be utterly foolish to tackle the design and construction of a huge manned rocket ship without further ado and try to launch it "destination orbit." The odds would be a hundred to one that any such attempt would result in complete disaster.

A step-by-step development approach is an absolute must for a project of such gigantic proportions. We need a plan, however, geared toward the ultimate goal, as we are taking the first faltering steps. This plan is an important thing. Many a serious rocket engineer, while firmly believing in the ultimate possibility of manned flight into outer space, is confident that space flight will somehow be the automatic result of all the efforts presently concentrated on development of guided missiles and supersonic airplanes. I do not share this optimism. While there is no question that such work will greatly contribute to the development of space flight, the ultimate conquest of space by man himself is a task of too great a magnitude ever to be a mere by-product of some other work. It requires a well-coordinated program. Extending over a number of years, each step in this program must dovetail with the previous and the next one.

The first thing we ought to do is to set up a study schedule which will take under advisement each and every phase of the problem. Such studies should not be limited to comparative preliminary design studies, but should include all aspects of military and scientific utility of a station in space. The verisimilitude of related problems in the fields of chemistry, radio engineering, structural engineering, aerodynamics, and guidance methods must be studied as well as the medical, radiological, biological and similar aspects. This first study phase can hardly be broad enough in scope. It should include investigations on the test facilities required for the development of rocket power plants, the logistic problems involved in manufacture, shipping and storage of the large quantities of propellants involved; training devices and simulators for crews and equipment; even the possibility of standardization of components should not be overlooked! Just think of the time and money for development work and test facilities that can be saved when we do reach the "hardware stage," if the rocket engines in the three stages of a large rocket ship could be standardized.

Prior to designing and building manned orbital rockets, it is surely good sense to develop relatively small, multi-stage rockets and fire them into an orbit, thus overcoming in miniature many of the practical problems which otherwise would beset the full-scale space ship.

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We may take some pretty long steps in our development program without fear of being reckless.

Let's start with what we have today. On the basis of our present know-how and experience with supersonic airplanes we could start with the design of the third stage of our orbital ship and try it out like an airplane. With empty (or almost empty) tanks, it could be towed several thousand feet up and subjected to glide and landing tests by a test pilot. Fully tanked, it could then perform a vertical rocket take-off under its own power; its vertical flight could then be tilted into a horizontal path, out of which the ship could glide down and land. Such vertical take-offs would first perhaps be unmanned, the landing being performed by means of radio remote control; later on there would be a pilot in the cockpit.

Meanwhile, the second stage could be designed and subjected to careful ground testing. After having proven its reliability in extended static test runs, it would be flight-tested with a dummy third stage as payload--no first stage yet! Separation of the dummy and chute recovery of the second stage could thus be tested. Ultimately, the second stage would be used as a booster of an original third stage, thus enabling the latter to be flight-tested at higher speeds.

The large first stage would also be thoroughly developed and ground-tested in static runs. The development procedure is greatly facilitated by the fact that its mighty power plant (like those of the other two stages!) is composed of a great number of relatively small individual rocket motors and other components. The bulk of the ground testing can therefore be performed with individual motors, and only a few functional runs, perhaps with greatly reduced burning time, would be necessary with the complete power plant. (The development of the rocket power plants for the three stages is the most expensive single item in the development budget of a satellite rocket. As stated before, much money can be saved, if rocket motors, propellant pumps, valves and similar elements are reduced to a few standard types that may be used in several of the stages, before the actual design and testing begins.)

Development of its power plant completed, the first stage would then likewise be subjected to flight tests with dummy payloads, to the end of studying problems like the behavior of the swivel motors in flight and to test the parachute recovery.

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Only after all phases of such a development and testing program have been completed could one dare readying the whole three-stage ship for its first manned flight into the orbit.

I have already mentioned that parallel to the program just outlined, it appears expedient to fire much smaller, unmanned rockets into an orbit before we send people up there. Such experiments not only would have a tremendous technical and scientific value, but also would most certainly convince whatever doubting minds may be in control of the budget that a much more expensive manned satellite project is sound, too.

The development of a smaller, unmanned orbital rocket can be incorporated into the over-all project in such a manner that most of the critical parts and sub-assemblies can be used for both the small and the large rocket. A simple scheme to avoid duplication of effort and to save development work and money is this: take a rocket of the dimensions of the V-2 or the "Viking" (perhaps even a presently existing type), and call it the third stage of an "unmanned satellite vehicle." Now develop a second stage for this unmanned vehicle which has the same powerplant as you want to use later in the third stage of the manned satellite ship. Then you select for the first stage of the unmanned rocket the same thrust rating as you would want for the second stage of the manned version. By the time the development of the unmanned satellite rocket is completed, one then possesses already the power plants for the two upper stages of a manned ship, and the only power plant development further required would be the one for the large ship's first stage (which, however, may be composed of individual units already used in the second stage).

The scheme, sketchy as it may be, shows not only how effort and money can be saved in developing a satellite rocket, but it also proves the paramount importance of a well-planned strategy for the conquest of space. There should be a planning board, consisting perhaps of a propellant chemist, a rocket power plant designer, a test pilot with supersonic experience, an airplane designer, a flight surgeon, a radiologist, an astronomer, a navigation expert, a military planner, a federal administrator, a specialist on fuel logistics, and a few others. This board should study the general approach and map the over-all strategy. It would not need a large amount of money to get the wheels rolling--a few million dollars would do. But such a study will easily save billions later on.

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The station in space will be the springboard for further voyages into space, and our obvious next goal would be the moon. The first trip to the moon will not involve a landing thereon. It will rather be a trip around the moon which will enable the ship's crew to take--for the first time--a glimpse at the unknown back side of the moon. But man's exploring urge will not rest before the first explorers have actually set foot upon the moon's surface.

An actual flight to the moon will probably not be carried out by a half-dozen explorers. It will rather be a full-fledged expedition, equipped with camping facilities, ground vehicles and elaborate research gear.

In the Collier's issues of October 18 and 25, 1952, which are just on the stands, you will find the proof that even such an ambitious undertaking will be well in the realm of possibility once we have a station in space.

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Dr. Wernher von Braun - Biography

23 March 1912 -	Born in Wirsitz, Germany. Attended various schools in Germany, -since father (a government official; 1931-32 Secretary of Agriculture under President von Hindenburg) was frequently transferred.
1930 - 1932 -	Institutes of Technology Berlin and Zurich (Switzerland).
1932 -	B.S. Mechanical Engineering.
1932 - 1934 -	University of Berlin.
1934 -	Ph.D. (in physics) University of Berlin.
Spring 1930 -	Joined Professor Hermann Oberth and assisted him (in spare hours) in his early experiments with liquid fuel rocket motors.
September 1930-	(When Oberth returned to his home town in a German-speaking settlement in Romania), instrumental in setting up a small development station for liquid fuel rockets sponsored by the German Society for Space Travel. Worked at this station ("Rocket Field Berlin") during spare time.
November 1932 -	Joined German Ordnance Department (which had shown interest in the work performed at the "Rocket Field") for the purpose of conducting practical liquid fuel rocket development under Ordnance sponsorship. Started out with one mechanic. Built up small development station at Kummersdorf Army Proving Grounds which, by Spring 1937, had grown to about 80 people.
December 1934 -	Test successful launching of 2 rudimentary liquid fuel rockets of the A-2 type which reached altitudes of 1.6 miles.
April 1937 -	Transfer of activities from the small experimental station at Kummersdorf to the newly-built Liquid Fuel Rocket & Guided Missile Center at Peenemuende (which at peak of its activity employed more than 10,000 people). Technical Director of this Center from Spring 1937 to the end of World War II.
1936 - 1938 -	Development of rocket-propelled aircraft, and development of larger, gyroscopically-controlled liquid fuel rockets (A-3 and A-5).

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1939 - 1940 - About 25 successful test launchings of A-5 rockets (10 miles altitude, 12 miles range, parachute recovery).

1940 - 1943 - Development of V-2 rocket. First successful launching of a V-2 on 3 October 1942.

1943 - April 1945 - Development of antiaircraft guided missile "Wasserfall." (44 successful launchings).

June - July 1945 - U.S. Army Interrogation Camp, Garmisch-Partenkirchen (Bavaria).

September 1945 - April 1950 - Project Director, Research & Development Service (Sub-Office Rocket), U.S. Army Ordnance Corps, Fort Bliss, Texas. Simultaneously advisor for V-2 test firings at White Sands Proving Grounds, New Mexico.

April 1950 - present - Technical Director, Guided Missile Development Group, Redstone Arsenal, Huntsville, Alabama.