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Project Star

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project star

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Helmut Hoeppner (left) was born in Ueskueb, Turkey, in 1911 and attended the Technical Academy, Chemnitz, Germany, and the Technical University, Dresden. After graduation, he worked for the Klemm Aircraft Company in Stuttgart, Germany. He served a short tour in the German Luftwaffe and then became an associate of Dr. Wernher von Braun at Peenemunde, where he worked on the development of the V-2 and other rockets. He became an engineer for the Messerschmitt Aircraft Company, Augsburg, and helped to develop the ME-163 and ME-262 jet aircraft. From 1951 to 1954, he was employed by the International Business Machine Corporation in Stuttgart. In 1954, at the suggestion of Dr. Walter Dornberger, he come to America as an aeronautical engineer for the Bell Aircraft Corporation, Buffalo, New York. In 1956, he joined his former co-workers at Peenemunde at Redstone Arsenal in Huntsville, Alabama. He is presently a Senior Scientist for Astronautics with the Chrysler Corporation in Detroit, Michigan. A member of the German Rocket Society, the British Interplanetary Society, and the American Rocket Society, he has published many articles and reports in the field of astronautics. **B. Spencer Isbell** (right) is a native of Birmingham, Alabama, and attended the University of Alabama, where he majored in both mechanical and aeronautical engineering. Since 1951 he has been employed as an Aeronautical Engineer at Redstone Arsenal, Huntsville, Alabama. He presently serves on the technical staff Office of Director, Development Operations Division, Army Ballistic Missile Agency. He is a member of the American Rocket Society, the British Interplanetary Society, the American Association for the Advancement of Science, and the American Astronautical Society. He is on the editorial staff of *Astronautical Sciences Review* and is editor of SPACE Journal.

Editor's Note: This is an introduction to a series of articles on interstellar Space travel which will appear periodically in SPACE Journal. The authors confined this presentation to a discussion of the project's concept, assumptions, and design approach. A more detailed explanation of the system, design, and performance will be given in future installments of the series.

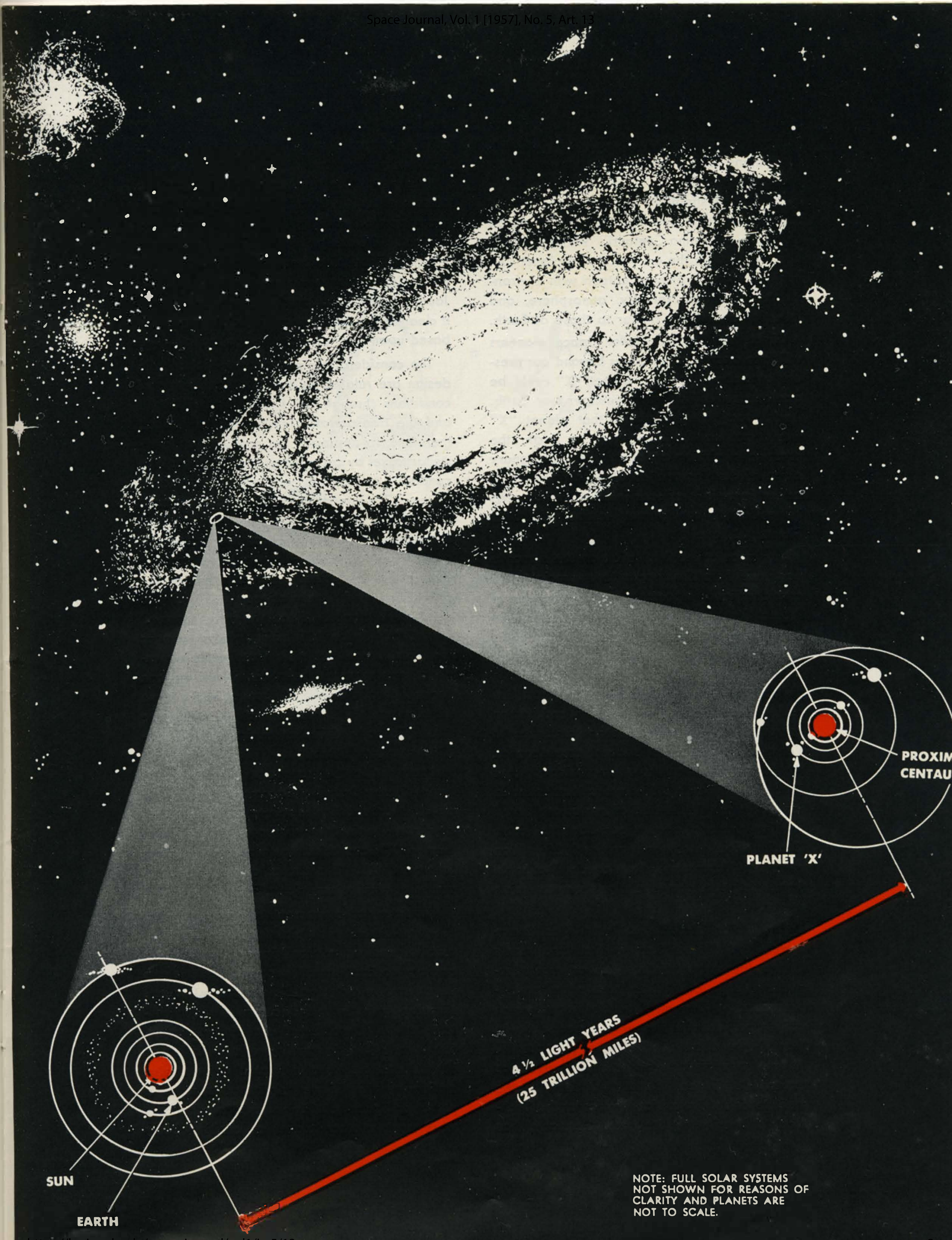
First Interstellar Voyage by Earthmen

Interstellar Space travel will be feasible as soon as man has mastered travel between the planets of our own Solar System. Contrary to the present contention by many astronauts that man's technology will require hundreds, and even thousands, of years to carry him beyond our planets, he can extend his explorations to the stars within a few years after he reaches Mars. If man's past history on Earth is any indication of future events, there is little doubt that he will find the justification and soar past Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto to one of the Sun's nearest neighbors within the family of stars we know as our galaxy.

Today, it is anyone's guess what motivation will provoke Earthmen to venture beyond the vastness of their own Solar System. Perhaps John Hulley[1] has found the key to the answer in his ecological approach to a definition of the role of humanity. Hulley postulates that the primary purpose of the Homosapiens is to carry life from planet to planet. Dr. Philip N. Shockey suggests other possible motives in this issue of SPACE Journal. The reason may evolve as a by-product of interplanetary travel. Exploration of our own Solar System is certain to solve many of today's mysteries. The newfound knowledge could reveal previously unknown dangers to life in this Solar System—triggering one of man's oldest prime movers, self-preservation.

As strange as it may seem, astronomers know more in some respects about distant stars than they do about the planets in our own Solar System. The planets are visible only in the reflected light of the Sun. Stars, on the other hand, shine in their own light, permitting astronomers to learn much about them through spectroscopes and other equipment. An example of this advanced knowledge of the stars is that, by comparison, our Sun is a third magnitude star. There are

[1]The Purpose Of Man In The Universe", SPACE Journal, summer issue, 1958.


PROXIMA CENTAURI
PLANET 'X'
4 ½ LIGHT YEARS
(25 TRILLION MILES)
SUN
EARTH
NOTE: FULL SOLAR SYSTEMS NOT SHOWN FOR REASONS OF CLARITY AND PLANETS ARE NOT TO SCALE.

billions of stars in the Universe radiating more energy than our Sun. And, too, other stars have many more planets orbiting around them than does our Sun.

As the destination solar system for this study, we have selected our Sun's closest neighbor—Proxima Centauri. With this selection, we assume the existence of a planet "X" orbiting about Proxima Centauri with environmental conditions (gravity, atmosphere, and celestial mechanics) similar to those of Earth.

Since the first interstellar Space pioneers will face many circumstances beyond our present capacity to foresee, planet "X" could be one hundred million years younger than Earth. Aside from the probability that planet "X" would not be the same age as Earth, the prospect of visiting a planet in an evolutionary stage of development so different from Earth as we know it is of such interest that it could be added to any primary objective Project Star might have.

A glance at the illustration on the opposite page will help the reader to appreciate two considerations important to the concept of Project Star. It is apparent that the distance covered by our projected journey is small in relation to distances involved in our Solar System and the Universe as a whole. But, the distance of Proxima Centauri from our Sun and planet seems enormous, indeed, when compared to the interplanetary distances to Venus or Mars. This second consideration should bring to mind the often-published times (146 days to Venus, 260 days to Mars) needed for such trips. These time estimates are based on the planet's closest approach to Earth (34.5 million miles for Mars and 25 million miles for Venus) and the speeds attainable from existing or proven designs for propulsion power.

The major obstacle to interstellar Space travel, and Project Star, is *time* and man's limited life span. Before this or any interstellar voyage can be undertaken, a powerplant must be designed and developed which will propel Space ships at a speed close to that of light (about 186,300 miles per second). At least one distinguished missile and Space expert, Dr. Eugen Sanger, director of the Institute of Jet Propulsion Physics at the Technical University of Stuttgart, Germany, has predicted that man may be traveling at 670 million miles an hour (almost the speed of light) within the next 50 years.

It is not within the scope of this article to discuss either the feasibility of photon (light) propulsion or traveling at or near the speed of light. The design feasibility and relativistic effects will be discussed in future articles of this series and by other contributors to SPACE Journal. The important thing here is to make it clear to the reader that Project Star must be based upon such an extreme assumption.

The considerations necessary to Space ship design are relative to both the environmental conditions through which the ship will move and the transportation system. It is logical, therefore, to approach the problems of interstellar travel by considering simultaneously the conditions encountered and the concept of the system. The interstellar Space ship must travel through the Earth's atmosphere and gravitational field, the near vacuum and practically gravity-free conditions beyond the sensible atmosphere, and, finally, descend through the atmosphere and gravitational field of the destination planet. Since we have assumed planet "X" to be 100 million years younger than Earth, and we know that Earth's atmosphere was more dense at that time, we can assume that planet "X" has a very dense atmosphere. This means that we will have three distinctly different environmental conditions to move through. With this in mind, we can divide the transportaton system into three phases: first, the placement of units into an orbit around Earth; second, the long journey from the Earth's orbit to an orbit around planet "X"; and third, the placement of units to planet "X". The phases are of course reversed for the return trip to Earth.

Consider for a moment the complexity of the four-dimensional planning necessary for efficient and economical Space travel by an analogy to Earthbound transportation systems which involve only two-dimensional planning. Airplane arrivals and departures are important to the operation of our airlines today. But whereas the airplane leaves one *stationary* airfield and arrives at a second airfield, also *stationary;* the Space ship departs from a planet or Space satellite which is *moving* and must meet another planet or orbiting body

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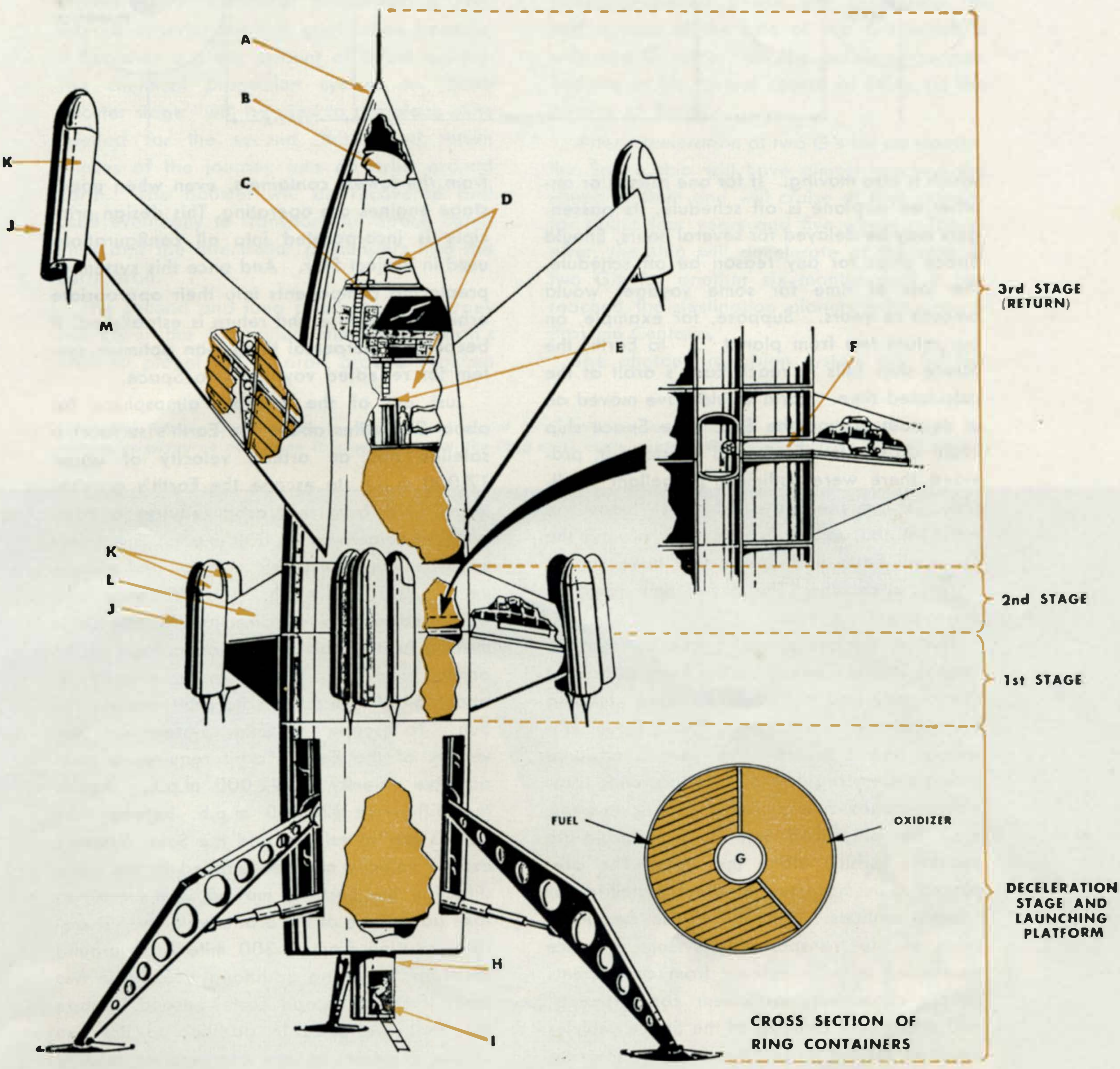
PLANET "X" LANDING AND TAKE-OFF VEHICLE

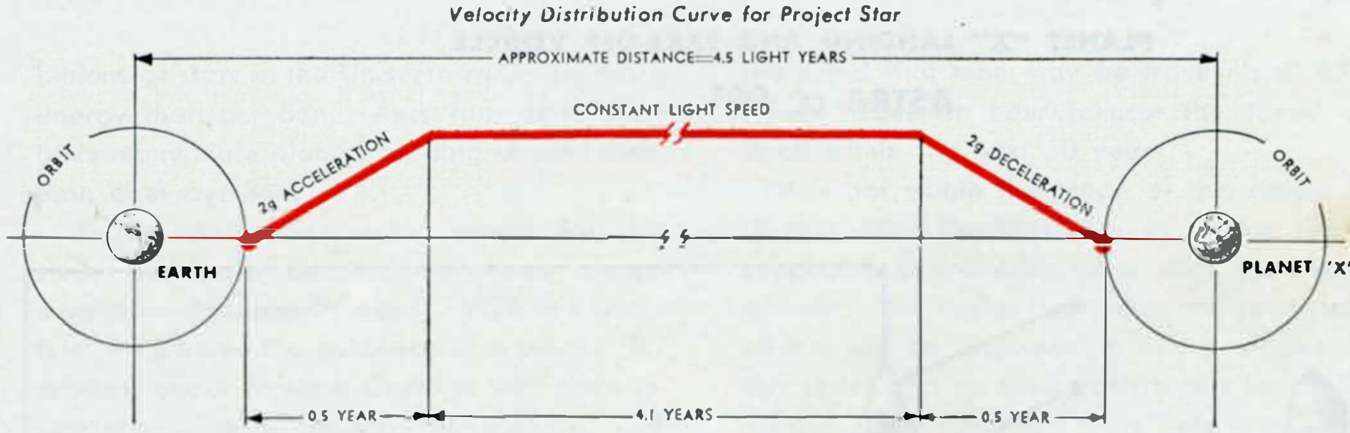
ASTRA-α-001



FUEL AND OXIDIZER TANKS

A—DETACHABLE NOSE CONE
B—RE-ENTRY NOSE CONE
C—CONTROL ROOM
D—CREW QUARTERS
E—ELEVATOR ENTRANCE
F—ENGINE ACCESS TUNNEL
G—ELEVATOR SHAFT
H—TELESCOPING ELEVATOR SECTION
I—ELEVATOR EXIT
J—CONVENTIONAL ROCKET ENGINES
K—COMBINATION TURBO-RAM JET ENGINES
L—FINS/OUTRIGGERS
M—WINGS/OUTRIGGERS

Velocity Distribution Curve for Project Star



which is also *moving*. If for one reason or another an airplane is off schedule, its passengers may be delayed for several hours. Should Space ships for any reason be off schedule, the loss of time for some voyages would amount to years. Suppose, for example, on our return trip from planet "X" to Earth, the Space ship fails to reach Earth's orbit at the calculated time. Earth would have moved on in its path around the Sun. The Space ship could chase after Earth and overtake it, provided there were sufficient propellant available. If not, the Space ship must "coast" in an orbit near to the Earth's orbit around the Sun until Earth and Space ship have caught up with each other. The loss of time could be more than one year.

The vehicle design and system concept for Project Star are based on the three phases of the journey and a four-dimensional planning system already mentioned. For optimum efficiency and economy, the four-dimensional timing system requires that certain units (propulsion stages, fuel containers, servicing units, etc.) be preplaced into their appropriate positions (orbits) along the way. The preplaced units become, in effect, satellites or "Space stations." They are also functional parts of the transportation system and are assembled in orbit entirely from components (empty containers, instrument compartments, and attachment devices) of the Space vehicles required for the three phases of the journey. This means that a compromise in vehicle design is made to permit the dual purpose and economy. But the compromise in vehicle design is held to a minimum by optimizing design features, for example, the outrigged engines and staging principle, where the *engine propellants are always burned first from the lowest containers,* even when upper stage engines are operating. This design principle is incorporated into all configurations used in Project Star. And once this system of preplacing components into their appropriate orbit of departure and return is established, it becomes a perpetual thing—an optimum system for repeated voyages into Space.

Just out of the sensible atmosphere (at about 300 miles above the Earth's surface) a satellite has an orbital velocity of about 17,000 m.p.h. to escape the Earth's gravitational field from that orbit requires a comparative velocity of 24,000 m.p.h. The difference between the obital velocity and escape velocity is 7,000 m.p.h. The difference must be added in the same direction the satellite is moving in it's orbit to take advantage of it's orbital velocity. Earth has a velocity of about 64,000 m.p.h. in its orbit around the Sun. To escape the Solar System from the vicinity of the Earth's orbit requires a comparative velocity of 92,000 m.p.h. Again, the difference (28,000 m.p.h. between the Earth's orbital velocity and the Solar System's escape velocity must be applied in the same direction the Earth is moving in it's orbit to take advantage of the orbital velocity. Therefore, starting from a 300 mile orbit around Earth and applying additional velocity in two steps (first, to escape Earth; second, escape the Sun), we need in addition to the two orbital velocities a total comparative velocity of 35,000 m.p.h. (7,000 + 28,000). When both velocity differences are combined into one step instead of the two separate steps described above, only one energy displacement is involved and the additional comparative velocity necessary is 29,000 m.p.h.

Solar system escape velocity should be

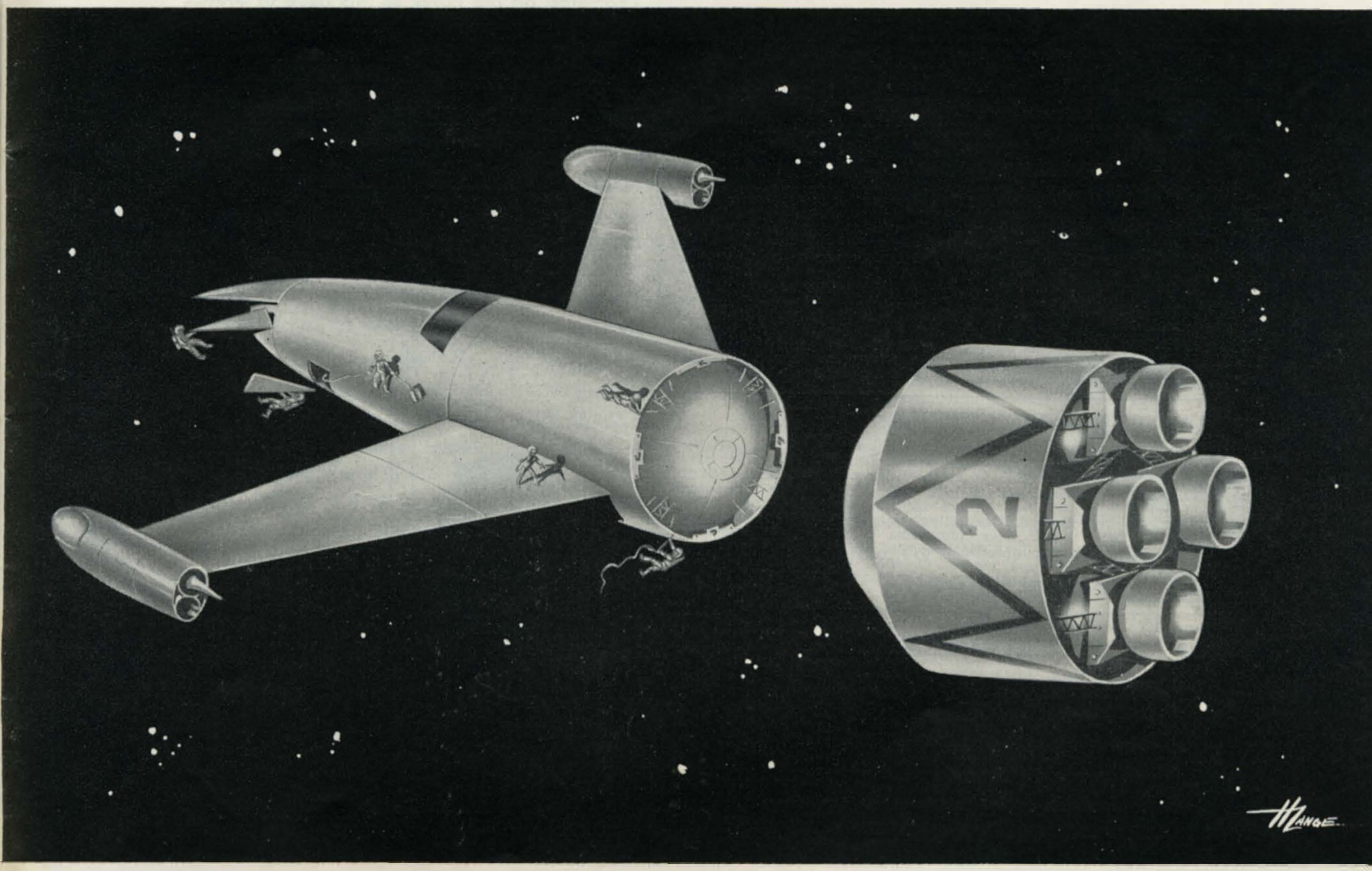
attainable within a decade by conventional chemically propelled powerplants. In fact, we have selected the chemical rocket engine as the power source for the first phase of Project Star. Chemical propulsion is considered superior for this application because it furnishes a great amount of thrust quickly. The chemical propulsion system or "Earth booster stage" will be used to pre-place units needed for the second, third, and return phases of the journey into an orbit around Earth. The booster will be recovered and used eventually to transport the Space cabin units and the interstellar passengers into the Earth orbit.

The second and long phase of the journey will cover the 25 trillion miles from Earth's orbit to planet "X" 's orbit around Proxima Centauri. A photon propulsion system will be assembled in the orbit around Earth and will propel the outer Space ship to and at a velocity approaching the speed of light. The photon-propelled phase will accelerate for half a year at the rate of two G's which is only one G more than the acceleration man endures in his normal course of living on the surface of Earth.

After acceleration at two G's for six months, the Space ship will have almost reached the speed of light and will cruise at that velocity for about four years and five weeks. Thereafter, the ship will decelerate at the rate of two G's for another six months until it has reached the destination planets orbit around Proxima Centauri.

The photon propulsion system will be left

Interstellar Return Configuration in orbit around planet "X". Earthmen are attaching photon thrust unit and removing aerodynamic nose cone in preparation for the long outer Space phase of the journey back to an orbit around Earth.

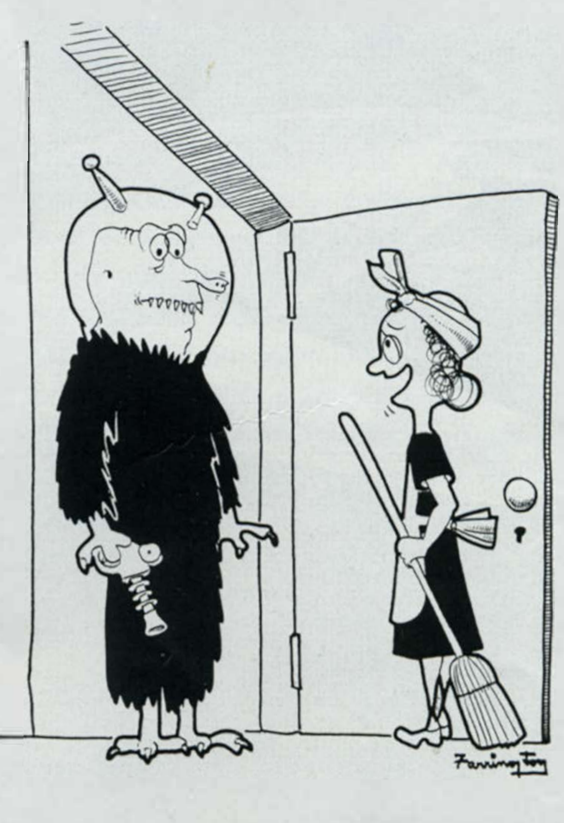


in an orbit around planet "X" to be picked up again on the return trip through the long phase of outer Space. After the disconnection of the photon unit and other preparations for atmospheric re-entry, the third and last phase of the journey to planet "X" is undertaken. Since the atmosphere of planet "X" is denser than that of Earth, the choice of a third and different type of propulsion power is necessary. The dense atmosphere would enhance the operational efficiency of an air-breathing type of propulsion. A turbo-ramjet powerplant in combination with conventional chemical rockets seems to be ideal for this third phase of our journey. The rockets would be used for the initial part of the descent, until the ship reached the sensible atmosphere of the planet. Whereupon the turbo-ramjet engines would take over. Unlike the ballistic-type trajectory or path of ascent that characterized the first phase of our journey from Earth to the orbit around Earth, the approach to a landing on planet "X" must be a path of gentle spirals. The spiral approach is necessary to avoid disaster as a result of aerodynamic heating.

By controlling the thrust of the six outrigged turbo-ramjets and with the aid of retro rockets, a final vertical landing can be made after the long, spiralling descent has sufficiently slowed down the landing craft.

The one-way trip to planet "X" will take a little over five years—barring any unforeseen circumstances and provided the scheduled timing for each phase is successfully accomplished. With certain alterations in the system, the three phases of the journey will be reversed for the return trip to Earth. Therefore, traveling even near the speed of light, the first interstellar Space trip will require at least ten years.

In the event that planet "X" is in a stage of evolution younger than Earth, then the scene illustrated on the cover of this issue of SPACE Journal may well be what the interstellar Space pioneers will first see when they arrive on planet "X". Future installments of this series will further discuss how Project Star may become a reality.



YOU GAVE ME QUITE A START. I THOUGHT FOR A MOMENT IT WAS A BILL COLLECTOR!