From ACROSS THE SPACE FRONTIER, Cornelius Ryan, editor, Viking Press, New York, 1952, chapter on "Prelude to Space Travel", Wernher von Braun, pp. 38-39 (the book is an expansion of papers from the "1ST Annual Symposium on Space Travel" held at the Hayden Planetarium October 1951, subsequently published in a series of articles in *Collier's* magazine under the title "Man Will Conquer Space Soon").

An extremely difficult navigational problem will be posed by the series of rocket ships coming up from earth to meet at the assembly point of the space station. The space station, whether the construction is completed or not, and the original rocket ship are moving steadily in the orbit at the rate of 4.4 miles per second. Thus, if one of the rocket supply ships reaches the predetermined rendezvous point in the orbit as little as 1 second too early or too late, the assembly point will be 4.4 miles behind or 4.4 miles ahead. This timing problem seems formidable, but actually there is a relatively simple solution.

An elliptic path of ascent which at its apogee exactly meets the orbit is not the only possible flight path to the assembly point. Rocket supply ships can also get to the rendezvous point via elliptic routes with apogees, or high points, located beyond the altitude of the 1,075-mile orbit, which they intersect at a shallow angle. Such intersecting elliptic paths require higher cut-off speeds than elliptic routes which merely touch the station's orbit. They are therefore less economical.

Suppose we select a standard elliptic path of ascent which intersects the 1,075-mile orbit at a slight angle—so slight that the additional fuel required will be negligible. The rocket ship carries a very accurate timepiece. As we know, the whole flight of a rocket ship from the ground to the orbit is completely automatic. If the rocket motors are cut off at exactly the predetermined time, the rocket ship will coast out on this standard ellipse and intersect the 1,075-mile orbit at the assembly point. The timepiece of the rocket ship, preset at the launching site, is geared to the accelerometer, which controls the shut-off valves for the rocket motors. If the cut-off point is approached a second or so late, the clock will change the setting of the accelerometer so as to cut off the power at a slightly higher speed. As a result, the ensuing free coasting ascent to the orbit will be shortened by the 1 or 2 seconds lost earlier in the flight.

Should the cut-off point be approached a few seconds too early, the clock will automatically set the accelerometer back to a slightly lower cut-off speed. The rocket ship will then enter a more gradual elliptical path which will cause the flight to take 2 seconds longer.

This split-second timing can be even further refined. The rocket ship can "home in" by using radar. A corrective rocket blast of very short duration could provide any adjustments still found necessary.

Even if a rocket supply ship finds itself settled in the 1,075-mile orbit with the assembly point a few miles away, the error can still be corrected. A well-adjusted power maneuver at a negligible fuel expense will do the trick, although both the assembly point and the rocket supply ship may be coasting halfway around the globe before they are close enough to establish contact.

The cargoes of the supply ships will be carefully organized so that construction can proceed steadily. With the last cargo the station will be finished and the original operation accomplished.