CONSTRUCTION OF THE SPS PRIMARY STRUCTURE BY ANOTHER METHOD

By Thomas C. Taylor - Independent Contractor
136 South Virgil Ave., Suite 310, Los Angeles, CA 90004 (213) 487-5137

N82 22733

The SPS primary structure contains about 10,000 tons of long fragile structural members. This framework can be built using aluminum foam. Not all members are carrying the same loads, so a method which allows the member to be modified to accommodate various loadings would be cost effective.

The aluminum is salvaged from expended external tanks. Each ET contains 63,000 lbs. of aluminum and this material could be the least expensive basic building material we will see in space for many years. The ET reaches 99% of full orbital velocity prior to being jettisoned and forced back into the atmosphere. The ET re-entry location is assured by tumbling the tank to increase its aerodynamic drag on the upper atmosphere. Taking the ET into orbit may increase the performance of the orbiter by eliminating the rollercoaster maneuver performed to force the tank back into the atmosphere.

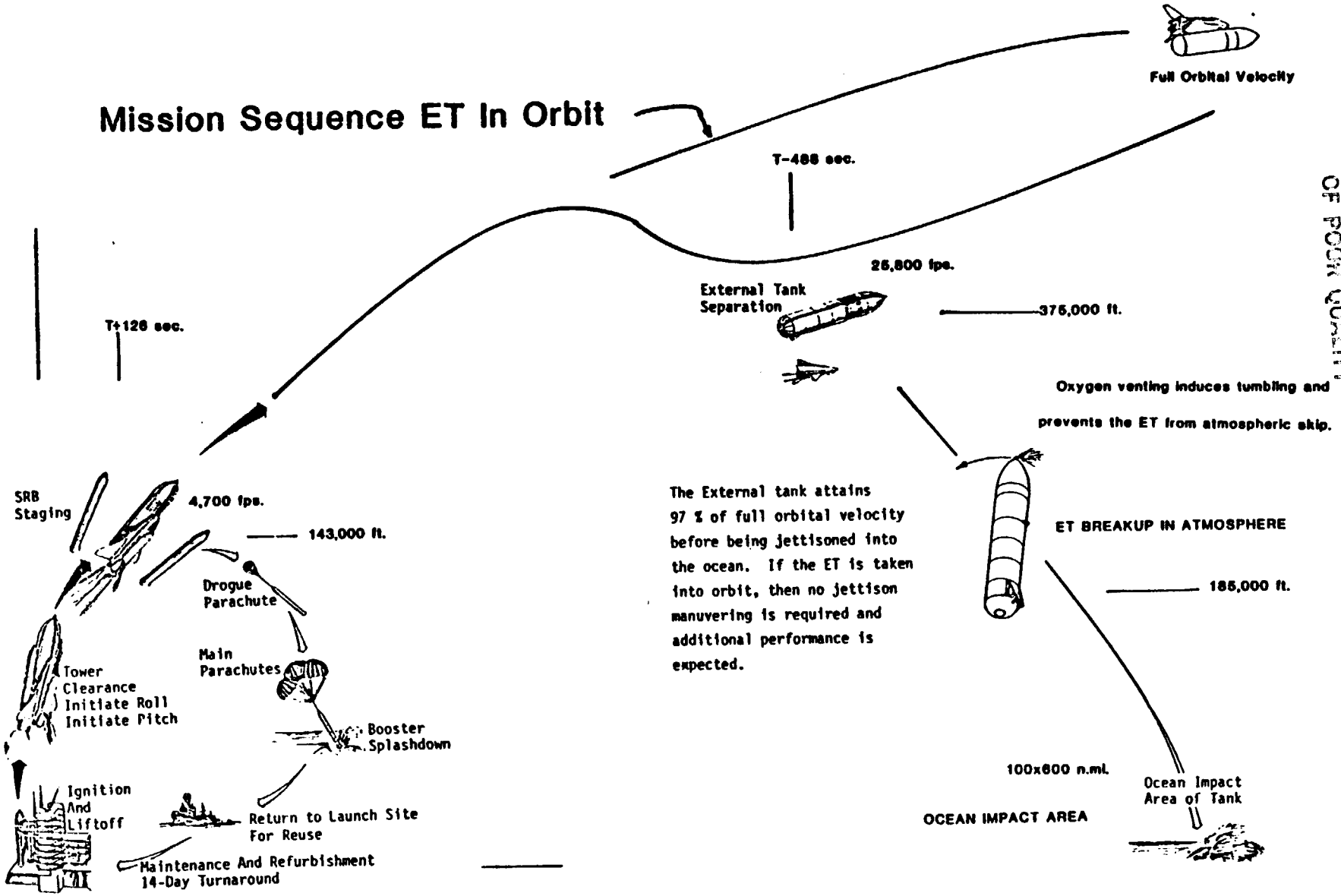
The concept is to melt down the tank using a direct solar smelting device, inject an agent which produces the foamed aluminum and shape it to any section desired. The smelting process can be adapted to other applications and promotes containerless processing in near zero gravity environments. The machines designed to shape the foam can be continuous and do not appear to be far ahead of present surface technology. A solid core cylinder could be produced easily, but a hollow cylinder would be more cost effective. A machine capable of producing a 25 foot diameter hollow foam cylinder can be carried into orbit using the aft cargo compartment (ACC) of the external tank. The machine can vary the thickness of the foamed aluminum to manufacture a section capable of accommodating a variety of member loadings.

The advantages of this construction system include savings in launch costs, faster construction rates, possible lower cost structures, promotes containerless processing in orbit, uses almost any space debris, and it frees the shuttle cargo bay for other uses. This system offers the added feature of being able to withstand the transportation loads from construction at LEO to use at GEO. The cost savings of using foamed aluminum as 80% of the 10,000 tons of SPS primary structure is approximately 7 billion dollars at today's launch costs. Even at $10/lb. transportation costs it saves several hundred million dollars in transportation costs.

The ends of the members include long tapered columns and ball joint connections which allow final alignment prior to foaming the sphere joint assembly. The concept has some technical obstacles which can be overcome with research.

We are about to enter the era of space fabricated structural systems. Foamed aluminum in space could be as basic to our building in this new light weight environment as concrete is on the surface. This concept could provide a less expensive route to an SPS Test Article without the large up-front investment in the next generation of lift vehicles. This concept could change the character and shape of space construction systems in the future by utilizing the expended external tank as a low cost raw material.

Mission Sequence ET In Orbit



SOLAR
SMELTING
56,700 lbs.

ET IN ORBIT
WITH A.C.C.

63,000 lbs.
ALUMINUM/TANK

ALUMINUM
FOAM

A.C.C.
MACHINE
FORMING

TAKE
ET
INTO
ORBIT

SPS FRAME
20,000,000 lbs.