Rockets from the Sea

by William H. Ganoe

Last May a model of the first stage of a rocket was dropped from a helicopter into the waters of Monterey Bay, California. This was the third in a series of drop tests that are part of the design and development work being carried out for the U.S. Navy by Truax Engineering of Saratoga, California.

This drop test is not the type of event that makes headlines. But it does have some impact on the development of low-cost launch vehicles and the private launch industry—even if this particular test was supported solely with government money. The program demonstrates a growing interest in lowering launch costs and it shows that there can be some reward for people who doggedly pursue a dream for many, many years with little encouragement along the way. The background on this project makes for an interesting story.

Retired Navy Captain Bob Truax, president of Truax Engineering, has long been a proponent of simple design, economies of scale and reusability as major goals for low-cost space launches. He was working on these issues in the late 1950s and early 1960s when he was employed by Aerojet General. Truax states that Aerojet conducted significant research into the cost of launch vehicles and concluded that rocket builders should "make them simple, make them reusable, and don't push the state of the art—that is the key to low-cost space transportation."

To underscore this point, Truax noted that the ratio of liftoff weight to payload weight was approximately 25:1 for the Saturn 5, but is a discouraging 68:1 for the Shuttle. The rise in costs occurred "despite the fact that [Shuttle engineers] pushed the state-of-the-art in propulsion and structure as far as it could be pushed," explains Truax.

Aerojet General began looking for a way to apply its new-found philosophy—at about the time that NASA was first exploring the idea of human missions to Mars. NASA would need vehicles that could deliver in the neighborhood of a million pounds to orbit.

Aerojet responded with plans for a colossus 75 feet (23 m) in diameter and more than 500 feet (150 m) high that would have a liftoff weight of 40 million lbs (18.2 million kg). The rocket was too big for overland transportation and would swamp almost any barge. The plan was to build it in a shipyard and transport it simply by towing it through the water. This made the booster an obvious candidate for a water launch and recovery. The design was for a simple, liquid-fueled, pressure-fed system, so the tanks would be fairly rugged and could survive reasonably high-speed splashdowns—permitting simple recovery systems. The rocket was named Sea Dragon.

The requirements for a Mars mission faded in 1970, and the Sea Dragon was too big for any other conceivable mission at that time. Truax down-sized the design and came up with Excalibur, a vehicle about the size of the Space Shuttle that would put 100,000 pounds (45,300 kg) into low Earth orbit. Still no buyers, though.

After being turned down by NASA and the Air Force, Truax wrote to the Secretary of the Navy. About one year later came the response: the Secretary found the Excalibur design "extremely interesting." The Truax designs were forwarded to the Naval Center for Space Technology (NCST), a branch of the Naval Research Laboratory. After a good deal of correspondence, bids and unsolicited proposals, Truax Engineering became the successful bidder on an August 1988 broad-area-announcement from NCST for the SEALAR (Sea Launch and Recovery) concept.

SEALAR specifications called for putting 10,000 pounds (4,500 kg) in low Earth orbit using a two-stage vehicle launched from the ocean. The contract was similar to the Sea Dragon and Excalibur concepts, but the new booster would require another major down-sizing job. Truax was buoyed by the serious interest in his ideas and the development money for Truax Engineering. Last March NCST awarded the company another contract worth $5.2 million to continue SEALAR work.

Truax thinks it will take another two years to gather enough data to support conclusively or refute his design approach. It will be another three years beyond that to have a SEALAR vehicle flying.

Truax is hopeful about the future but he worries that the SEALAR program may become victim to competition from the Advanced Launch System (ALS) pursued by the U.S. Air Force and NASA. Still, and especially with the ALS funding problems, SEALAR looks like a story to keep an eye on. ☆