An upper-stage solid-propellant motor produced by United Technology Center yields increases in performance and payload in delivering

New THRUST For The SCOUT

By Richard W. Larrick

Perched off Virginia’s eastern shore, hard by the hamlets of Greenbackville and Temperanceville, are three unusual islands named Assateague, Chincoteague, and Wallops. What goes on there sets them apart from the scores of other islands dotting the shoreline below them.

Assateague provides a refuge for herds of wild horses whose ancestors came snorting ashore in the 15th century after plunging from the deck of a sinking Spanish ship. Chincoteague harbors a volunteer fire department said to be the richest in the country. These firemen turn cowboys on the last Wednesday of every July and travel to Assateague, where they round up the newest crop of colts, force them to swim the straits to the mainland, and sell them at public auction, the proceeds going into the department’s treasury.

But it is Wallops that has given the area its greatest claim to fame. Almost daily, scientists there launch rockets carrying payloads that range from satellites designed to detect micrometeorites to mice and monkeys acting as advance men for astronauts. Old by space age standards, Wallops Island has served as a launch pad for more than 5,000 rockets since experimental work got under way there in 1945. It was established by the National Advisory Committee for Aeronautics and now functions as a major facility of the National Aeronautics and Space Administration.

Unlike its bigger and younger brother, Cape Kennedy, with its boom-town atmosphere, Wallops does not launch the highly publicized manned shots, nor does it send any satellites to take photos of Mars. While it lacks the glamorous identification with space that the Cape enjoys, its contributions to the nation’s space program are nonetheless important.

Wallops’ basic mission is to prepare, assemble, and launch experimental payloads, position them in space at the right velocity, and track and acquire meaningful data from them. The quiet, day-to-day work done by the competent scientists and technicians at Wallops paves the way for many of the dramatic projects carried out at Cape Kennedy amid world-wide attention.

Last August, a slender Scout rocket sat tail down in its launch tower at Wallops, awaiting final checkout, countdown, and launch. Glistening white in the hot sun, the 75-foot-tall, 20-ton rocket vehicle was about to blast off on an unheralded, but vital, space mission.

Tucked inside a sleek, glass-fiber nose fairing at the top of the vehicle was a sausage-shaped rocket motor with two important jobs to accomplish. One was to prove itself on this, its maiden flight, as part of the NASA Scout booster, which is built by Ling-Temco-Vought. The second was to put a 44-pound payload into orbit around the earth. Produced by United Aircraft’s United Technology Center, the new high-performance upper stage rocket, designated FW-4S, was designed to increase the payload capacity of the Scout by 25 per cent.

During development under the auspices of the Space Systems Division of the Air Force Systems Command, a number of difficult technical

A slender Scout rocket is launched from Wallops Island, Virginia. Aboard is United Technology Center’s upper-stage motor to help hurl the payload into orbit.
problems arose because of the performance demanded in the finished product. One of the most challenging goals lay in the need for the rocket to perform normally while spinning at 200 revolutions a minute. In early test firings, UTC engineers found that as the aluminum particles in the solid propellant were consumed, aluminum oxide, a liquid, was forced through the remaining propellant and onto the rocket's glass-fiber casing. With a temperature of 5,300 degrees, the aluminum oxide overheated the case wall and caused delicate mechanisms associated with the payload either to fail or to work prematurely.

The solution was found in further insulating the case and in reducing the size of the aluminum particles in the propellant. The additional insulation, however, pushed the weight of the motor beyond specifications, posing still another problem. The weight penalty was overcome when scientists at UTC discovered a new material that reduced nozzle weight from 21 to 11 pounds. So important was the discovery of the new material to rocket motor technology that the FW-4S now has the highest mass fraction (proportion of total rocket weight represented by propellant) of any rocket currently in use.

The motor was developed in less than a year, the development program being completed with only one failure during 14 static test firings. Because of its high performance, easy-to-handle propellant characteristics, and reliability, the FW-4S also is scheduled to be used as an upper-stage rocket on the Air Force's Thor and NASA's Thor-Delta vehicles.

When the fire button was pushed last summer, the space launcher, sleek as a greyhound, leaped into the air under 105,000 pounds of first-stage thrust. Spewing fire and smoke, it rose straight and swift until its guidance system sent an electronic message to the steering mechanism to heel it over in a gentle turn and head the vehicle out over the Atlantic Ocean. Sixty-eight seconds later, the first stage burned out and was separated from the rest of the vehicle by explosive bolts. It dropped away to land in the ocean 75 miles down range. The remaining vehicle was now 22 nautical miles high and traveling at a velocity of 3,300 feet a second.

Precisely on schedule, the second stage burned out and the third stage ignited and added its 22,000 pounds of thrust for 36 seconds. At third-stage shutdown, the FW-4S motor and payload were at an altitude of 65 nautical miles, streaking through space at 9,500 feet a second.

Like space vehicles from all United States launch sites, those from