

Large Solid Booster Test A Success

SMOKE SIGNALS — A billowing pillar of smoke climbs high into the air over the Wasatch Division as Thiokol successfully tests the 156-inch segmented solid-fueled space booster on Saturday, December 12, at its test area in Northern Utah.





Test Termed Key Event for Large Solids

Wasatch Division Commended By Dr. H. W. Ritchey

The nation's largest and most powerful solid propellant rocket motor using a gimbaled nozzle was successfully test fired by the Wasatch Division at 11 a.m. on Saturday, Dec. 12.

In the static test, the giant 156-inch diameter (13 feet) motor generated nearly 1.5 million pounds of thrust during the 130-second horizontal firing.

The test was conducted for the Air Force Systems Command, Space Systems Division, as a key event in the National Large Solid Rocket Motor Program, which the Air Force is conducting in conjunction with the National Aeronautic and Space Administration to determine the feasibility of large solid propellant motors for space missions.

During the test, the gimbaled nozzle, largest of its type ever tested, was programmed to move in both the horizontal and vertical planes during the 130-second test firing. In addition, it was also moved in an angle 45 degrees from the horizontal to demonstrate its omniaxial capability.

The nozzle performed as programmed for 100 seconds in tests three times more severe than would be encountered in flight. At that point, part of the ablative exit cone separated, and the final event scheduled for the nozzle duty cycle was not completed.

Scaleability Demonstrated

Commenting on the test, Colonel Harold W. Robbins, Large Solid Rocket Motor Program Director, said, "Basically, we are very pleased with the demonstration. The test has demonstrated solid rocket motors to be scaleable; and, most significant, no combustion instability was present. In terms of any future accelerated development program, there should not be any prolonged development time required."

Colonel Robbins also pointed out that, "The Large Solid Rocket Motor Program is a generalized state-of-the-art advancement program, and is not governed by any vehicle, schedule, or requirements. Our objectives are strictly to determine the feasibility of large solid propellant rocket motors, to demonstrate it, and to learn in doing so as much as we can about related technology."

Speaking before assembled newsmen following the firing, both Dr. H. W. Ritchey, Thiokol President, and E. G. Dorsey, Program Manager for Space Boosters at the Wasatch Division, expressed their complete satisfaction with the test.

"The ignition sequence was perfect, the motor performance (pressure and thrust) was excellent, and action time (duration) was within a couple of tenths of a second of that programmed. All those individuals involved in the program at the Wasatch Division are to be commended," said Dr. Ritchey.

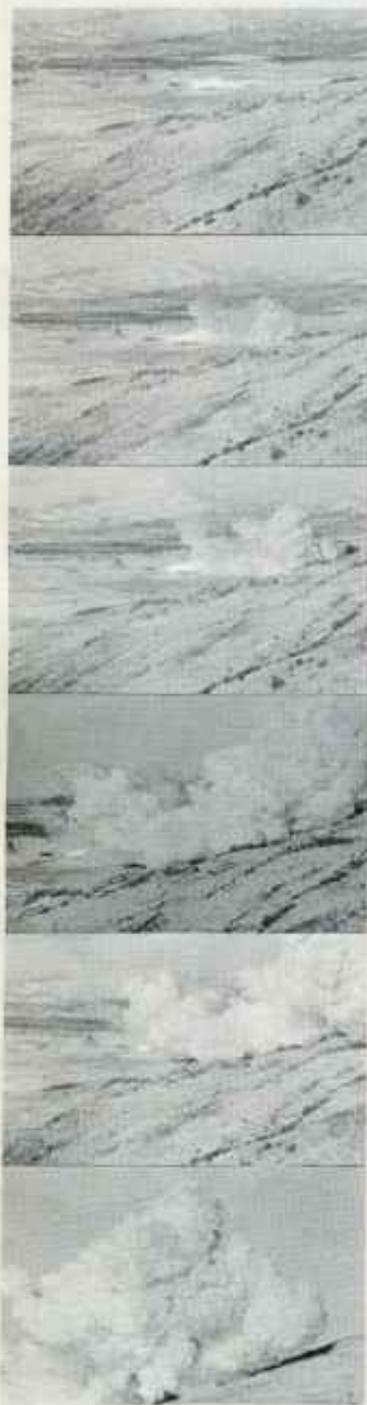
Discussing the separation of the nozzle's exit cone in the final seconds of the test, E. G. Dorsey said that the duty cycle programmed for the nozzle was three times more severe than that to be encountered

during actual flight. "The nozzle throat and actuation system performed as programmed," he said, "and all desired data was obtained during the test."

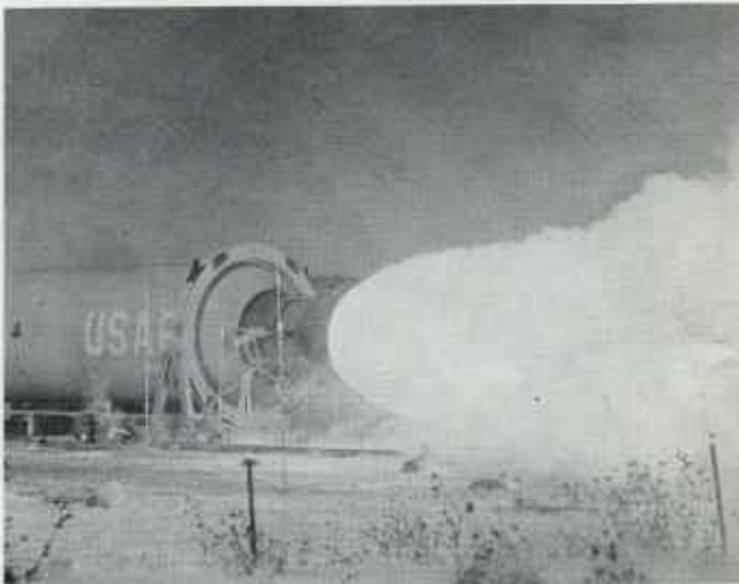
Solution is Simple

"Correction of the nozzle problem is simply a mechanical one of beefing up the exit cone to the point where it will withstand the terrific temperature and pressures it encounters," he added.

Approximately 400 guests, including Air Force and industry officials; press, radio, and TV reporters; and local civic and business leaders witnessed the static firing. In addition, an estimated 1,000 persons watched the test from the nearby highway.



FIRING sequence, taken from more than 6,000 feet away, shows smoke buildup as the giant space booster motor demonstrates the feasibility of large solid propellant motors. The smoke column could easily be seen in Brigham City, 27 miles distant.



World's Most Powerful

GENERATING nearly 1.5 million pounds of thrust, the world's most powerful solid rocket motor tested to date consumes 350 tons of solid propellant in slightly more than two minutes during its successful test.

IMPULSE

Wasatch Division
Thiokol Chemical Corporation
Brigham City, Utah 84302

Editorial offices are in Building A-2,
Publications Production Section, Publications Department, Area Code 801—
863-3511, Extension 3-2136.

Tucker C. Simpson, Editor

Vol. 6 - No. 12

International
Council of
Industrial
Editors



Intermountain
Association of
Industrial
Editors



Personalities In The News



NICK WELCH, a Thiokol Christmas Stocking coordinator, admires the "Money Tree," Marzelle Richey's novel method to boost contributions to the Christmas Stocking program for needy families in Northern Utah. (See page 6.)



BIG BUCK contest winners, Don MacPherson (left) and Dennis Anderson (right) receive their awards from W. W. Dodgson, director of administration. Anderson received the rifle for dropping a buck with a 36-inch rack. The scope went to MacPherson for the highest number of points, 17.



BONUS BONDS — Shirley Olds, A-1 receptionist, presents the winning number to A. L. Franzolino, industrial relations manager, in the recent Wasatch payroll savings plan drawing. Winner of the radio-
stereo combination was George Merrill (right), Plant 78 machine shop.



BRIGADIER GENERAL H. J. Sands, Jr., commander of the Air Force Ballistic Systems Division, and Mr. Cliff Brewer (left), General Dynamics, were recently briefed on Wasatch programs by P. R. Dykstra, director of program management.



156-INCH Source Selection Board members, Maj. R. G. Dingman and Col. R. M. Herrington (2nd & 3rd from left), inspect the 156-inch booster test stand with (l to r) John Higginson, General Manager C. E. Hunter, and Edward G. Dorsey.



HONORARY MEMBERSHIPS in two of the largest, most active groups at the Division were presented to General Manager C. E. Hunter this month. **TOP PHOTO:** Kay Brinkerhoff (center) and Ed Przybys present Mr. Hunter with a Golden Spike Chapter, AFA, desk set and membership. **BOTTOM PHOTO:** Memberships in the Thiokol Ski Club were presented to Mr. Hunter and Lt. Col. F. J. Hart, chief of the Wasatch Contract Management Office, by Al Ramos (center), Ski Club president.



Georgia 156-Inch Test

The successful static test firing of the giant 156-inch solid-fueled space booster at the Wasatch Division earlier this month marked the midway point in Thiokol's program to demonstrate the feasibility of 156-inch solid motors for the Air Force.

Several weeks from now, and 2,000 miles distant, another 156-inch booster firing will take place in Camden County, Georgia, as Thiokol completes the second portion of its Air Force-sponsored program.

Two Studies

Operating under contracts granted by the Air Force Space Systems Division, Thiokol is conducting feasibility studies at the Wasatch and Space Booster Divisions in Utah and Georgia.

Both programs involve 13-foot diameter motors made from high strength, 18 percent nickel maraging steel cases. Produced by Excelco Developments, Inc., at Silver Creek, N. Y., the cases combine a high strength-to-weight ratio with a capability for local rework and aging at any point in manufacture or testing.

Here the similarities end.

Basically, the Wasatch test demonstrated the practicality of an omniaxial gimbaled nozzle thrust vector control (TVC) system in which the huge nozzle was moved, or vectored, in several planes as a test of the booster's in-flight altitude control. A refinement of the movable nozzle concept developed by Thiokol for the first stage Minuteman ICBM, the gimbaled nozzle incorporates the unique O-ring seal and ball-and-socket-joint principle proven successful in more than 1,800 test firings. De-

signed and produced jointly by Thiokol; ARDE-Portland, Inc., Portland, Maine; and the H. I. Thompson Co. (HITCO), Gardena, California, the huge nozzle measures 158 inches in length and has an exit cone diameter of 110 inches.

Plastic components, for the nozzle, made of pre-impregnated U. S. Polymeric fabrics, include a convergent cone, high mach inlet, wiper ring, throat insert, and aft and forward exit cones.

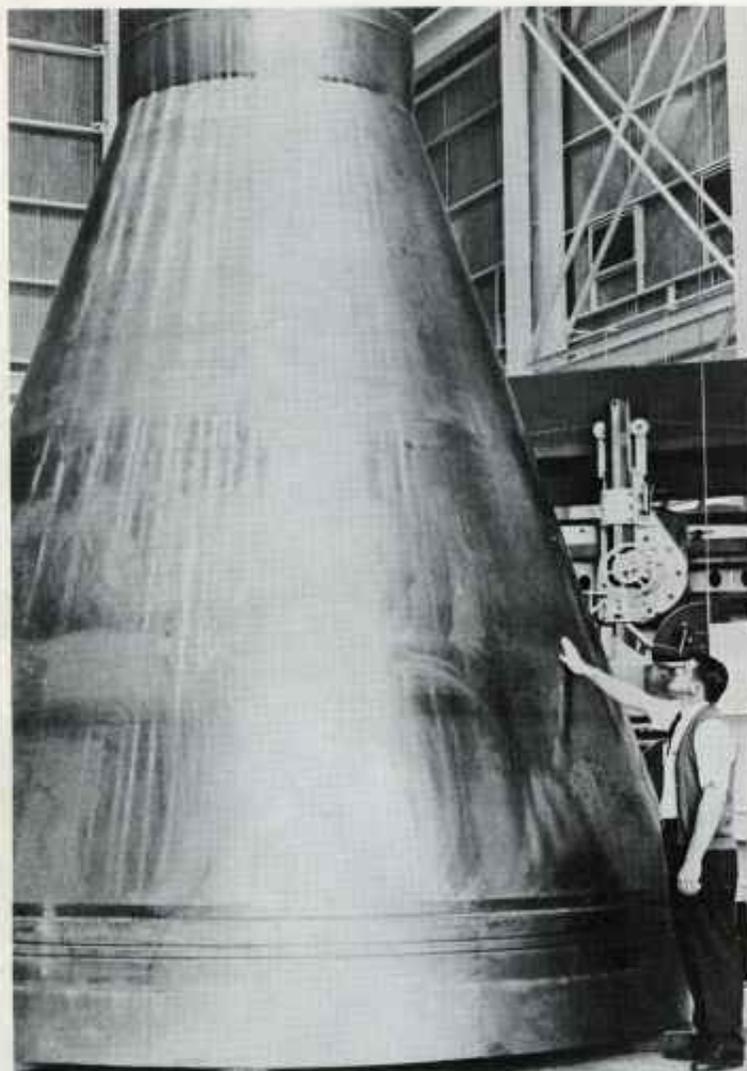
Fabrication was accomplished by a HITCO-developed "rosette" process in which plastic plies are laid up in such a manner that one edge of each ply intersects the component's internal surface, while the other edge intersects the external surface. Advantages of the process include greater strength, lighter weight, increased erosion resistance, manufacturing ease and reliability, and lower costs.

Nozzle Assembly

Fabrication of the nozzle's metal components, machining and finishing of both metal and plastic components, and final assembly and testing were accomplished at ARDE-Portland. All metal assemblies, including an inlet housing, gimbal ring, and inner housing, are made of high strength 4130 alloy steel.

The Wasatch Division's static test also demonstrated the segmented motor concept. Rated at nearly 1.5 million pounds of thrust over a two-minute burn time, the motor consisted of three segments—head, center, and aft—and measured 78 feet in length.

Each segment was cast and cured separately, and then mated at the test site to form the giant, 395-ton space booster.



EIGHT CONE mandrel for the Georgia 156-inch booster dwarfs a Rohr technician. The complete nozzle, identical to the one to be used on the 260-inch booster, measures more than 18 feet in length and has an exit cone diameter of 14 feet.



WASATCH technicians perform final machining operations on a segment case before propellant loading begins in a casting pit.



CYLINDRICAL mandrel, about the size of a Minuteman first stage, is positioned in a case prior to propellant casting.

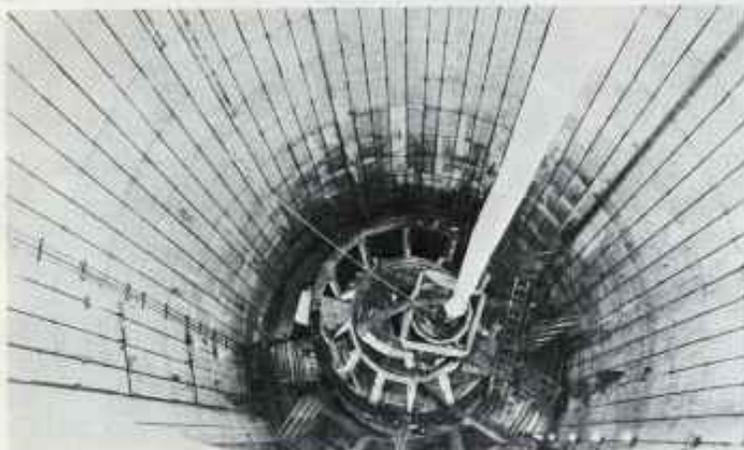


WITH a vacuum bell in place, the prepared 156-inch segment is ready to receive more than 125 tons of solid propellant.



CAST-CURE completed and mandrel removed, the loaded segment is inspected by Wasatch technicians prior to leaving pit.

Slated to Follow Soon



SPACE BOOSTER DIVISION'S gigantic cast-cure-test pit, 120 feet deep and 53 feet across, dwarfs a Minuteman first stage motor case undergoing propellant loading tests in Georgia. The pit has a 26-foot-thick reinforced concrete base.

(Detailed research by the Air Force has revealed the 156-inch diameter segment to be the largest size motor transportable by highway or railroad. Larger boosters must either be constructed entirely at the launch or test site, or shipped there by water transportation.)

Horizontal Test

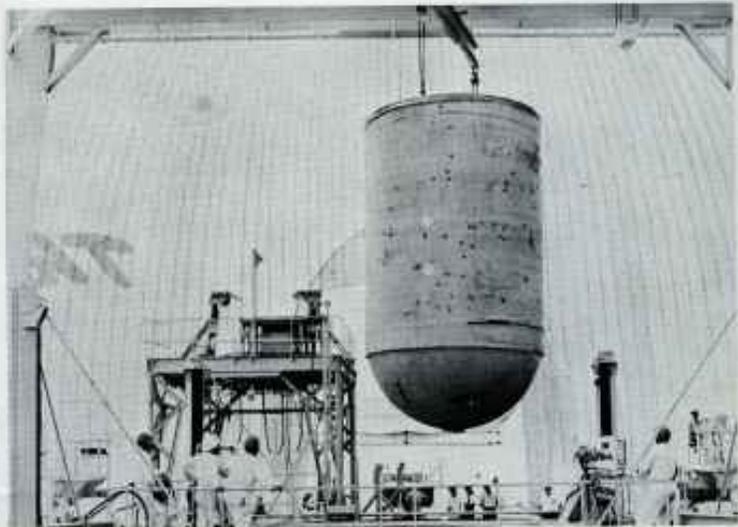
For the static test firing, the motor was mounted in the Division's Test Bay T-24, the only known industrial facility capable of test firing a 156-inch motor horizontally. Originally designed to support up to one million pounds of thrust, T-24 has been modified to accommodate thrusts of 1.5 million pounds.

Ignition was accomplished by directing the exhaust flame from a 43,000-pound-thrust igniter motor

through the gimballed nozzle and down the length of the propellant's cylindrical core. Milliseconds after ignition, explosive bolts released the igniter carriage, which slid away from the test stand on tracks.

During the firing, the nozzle was programmed to move in vertical (pitch) and horizontal (yaw) planes. Also during the test, the nozzle moved in an angle 45 degrees from the horizontal to demonstrate its omniaxial capabilities.

Test data acquired during the firing included: head-end and side thrust measurements, combustion chamber and nozzle pressures, igniter pressure, nozzle actuator pressure (hydraulic supply and return as well as force output), temperature and vibration measurements on both the case and



FORWARD SEGMENT for the Georgia 156-inch booster is lowered into the cast-cure-test pit. All four case segments were mated in the pit prior to casting the entire booster in a single operation, resulting in a monolithic grain structure.

nozzle, and near- and far-field acoustic measurements.

Georgia Program

The Space Booster Division's test firing in early 1965 is designed primarily to check out the nozzle design, materials, facilities, and monolithic grain concept to be demonstrated in a 260-inch diameter space booster test, scheduled later in the year.

The nozzle used in the Georgia 156-inch static test will be a prototype of the one programmed for the 260-inch motor. Both nozzles are being fabricated by the Rohr Corporation at Chula Vista, California. Both measure 219 inches in length, and have exit cone diameters of 168 inches. Both are of a fixed, nonmovable design. Structural components include an entrance cone; forward, center, and aft throat sections; and an exit cone of ablative and heat-resistant plastics. A metal shell of 18 percent nickel maraging steel contains the plastic assemblies.

The 156-inch motor, comprised of four case segments, is about 190 feet long and weighs in excess of 450 tons. It will generate three million pounds of thrust over a two-minute period.

To facilitate production and testing of the motor, all operations will take place in a giant cast-cure-test pit constructed at the Division especially for the space booster programs.

The first of its kind in the rocket industry, the pit is designed to accommodate motors up to 300 inches in diameter. It measures 120 feet deep by 53 feet across, and rests on a 26-foot-thick reinforced con-

crete base. In addition to production equipment, including thermal and air conditioning units for propellant cure and cooldown, the pit houses a giant, three-million-pound thrust test stand. Both the pit and the surrounding work area are protected from the elements by an inflatable rubber building that will be removed at the time of the test firing.

The empty segment cases were mated in the pit. A retractable, six-point star mandrel was positioned, and propellant casting was accomplished in a single operation, much the same as in the 260-inch program, resulting in a monolithic grain structure. Following propellant cure and cooldown, the giant fixed nozzle will be incorporated into the complete booster.

Vertical Test

The motor will be static tested in a vertical position in the test pit, with the nozzle pointing skyward. A 58-foot steel tower positioned next to the pit will support a 145,000-pound-thrust igniter motor directly over the nozzle of the space booster. Exhaust gases from the igniter will be directed into the combustion chamber of the larger motor. One ignition of the space booster, the igniter will release, climb to an altitude of some 200 feet, and make a tethered descent into an impact area approximately 200 yards from the pit.

Test data, in addition to the standard temperature, thrust, and pressure measurements, will include wind velocity (aspiration) readings and atmospheric pressure measurements in the pit — data necessary to accurately determine the booster's generated thrust.



LOADED center segment is positioned on a special pallet by a 200-ton-capacity crane used to handle the giant loads.



RIDING its Thiokol-built transporter, the forward segment moves to the Test Area for installation and assembly.



GOOD SAMARITANS—Wasatch Division employees have been turning out regularly to assist at Christmas Stocking collection centers in Brigham City and

Tremonton. According to Joe Kelly (standing left), program chairman, 25 needy families in Northern Utah will have a happier Christmas.

Payroll Change Reminder

The new payroll system begins January 1965. All employees will be paid biweekly in accordance with the following pay periods and paydays:

	PAY PERIOD	PAYDAY
Nonexempt	For week ending 27 Dec.	31 Dec.
Exempt	16 Dec. through 31 Dec.	31 Dec.
Nonexempt	Two weeks, 28 Dec. - 10 Jan.	15 Jan.
Exempt	1 Jan. through 10 Jan.	15 Jan.
All Employees	Two weeks, 11 Jan. - 24 Jan.	29 Jan.

As noted above, beginning with the January 29 check, paydays thereafter will occur each two weeks with one week's earnings held back.

Questions concerning the payroll system should be directed to your supervisor.



Aw, We Shouldn't Have!

BOWING their heads in all due modesty, Lt. Col. F. J. Hart and Jim Brown (center) receive the 1964 deer hunt team trophy from General Manager C. E. Hunter. Team members not pictured are: Jerry Pohlen, Elmer Masters, and Louis Wampler. In presenting the award, Mr. Hunter noted that it would be a traveling trophy — traveling from one team member to another.

Christmas Stocking Brightens Holidays For Local Families

A fleet of automobiles fanned out from Brigham City on Sunday, 20 December, in the climactic round of the 1964 Thiokol Christmas Stocking. Their cargo — boxes of food toys, and clothing to brighten the Christmas season for 25 needy families in Northern Utah.

Distribution of the packages marked the close of a three-week campaign sponsored by the Thiokol Recreation Council to insure a happy Christmas for the less fortunate. Thiokol employees and their families reacted to the call for contributions by donating a wealth of discarded clothing, usable toys, cash for food, and Gold Strike stamps to purchase equipment for the Utah State Training School for the mentally retarded. Brigham City and Tremonton merchants donated toys, and supplied food at reduced prices.

The hub of the Christmas Stocking activity was the Tremonton and Brigham City collection centers, where the donated items were sorted and packaged, and from which damaged toys and clothing went out to volunteers for cleaning, painting, and repair.

Joe Kelly, Publications, chairman of the drive, summed up the Christmas Stocking by saying, "It was a lot of work, but everyone involved did a wonderful job." He expressed special thanks to Thiokol, to the local chapter of the National Association of Accountants, to the members of the various recreation activities, and to local merchants for their support.



ESKY WINNERS — Finance Director Frank Barry (2nd from left) presents traveling ESKY trophies to (l to r): William D. Ward, Renee P. Allen, and Carl A. Weese. In addition to the trophies, the winners also received portable transistor radios.

Annual Savings of 1.5 Million Forecast for ESKY Program

Based on results of the past eight months, Wasatch Division ESKY officials are forecasting an economy savings total of more than 1.5 million dollars by the end of March 1965.

Since the beginning of the ESKY Program on April 1 of this year, Wasatch employees have submitted 760 Economy, Safety, or Quality (ESQ) ideas. In addition to the tremendous cost savings recorded, ESKY ideas have improved the quality of Wasatch products and made the Division a safer place to work.

This month's competition saw members of the fair sex break into the winners' column for the first time.

Renee P. Allen and Rosa Jordan, preventive maintenance, received the economy award for their idea to consolidate preventive maintenance schedules, repair order cards, and records. The resulting reduction in paper work will save more than \$14,000.

Economy honorable mentions went to Sherman Kitchen, George Tichenor, and Dallas Jones.

Safety Suggestion

The winning safety idea was submitted by William D. Ward, final assembly, who solved a hazardous manual operation by using a jib crane to remove and assemble harness wheels.

A nozzle cone protective device that will substantially reduce costly repairs earned the quality award for Carl A. Weese, final inspection. Weese also received an honorable mention for eliminating an avcoat staining problem, as well as the

sanding operation required to remove the stain.

Thelma Salmas, quality engineering, also received a quality honorable mention for a suggestion that will result in the storage of certain limited-life production materials at their ideal storage temperatures.



Wasatch Division employees who were hired in December 1959 and celebrate their fifth anniversary with the Corporation this month include:

Larry E. Youngberg, Walter A. Johnson, Allen G. Smith, Jones K. Christensen, Vernon D. Williams, Dean F. Redford, Richard N. Brooke, Odell L. Wood, Stanley O. Sjursen, Robert T. Sparrow, Ralph P. Haws, Michael O. Barnett, and William Griggs.

Jimmie M. Jewell, Jerome C. Poland, Donald Cunningham, Conrad T. Nelson, John N. Ream, Nola B. Anderson, Edward J. Heesacker, Challen H. Kelker, Kenneth H. Rock, Ellis D. Bilbao, James C. Miller, Clarence E. Niskanen, Robert F. Brockish, Clifford E. Kristofferson, Joseph P. Buck, and Richard N. Vorwaller.

Kay R. Sutherland, Therald L. Holquist, Jayhugh B. Louthwyler, Owen E. Hess, Anthony H. Baer, and Bill L. Vasilias.

The Lighter Side



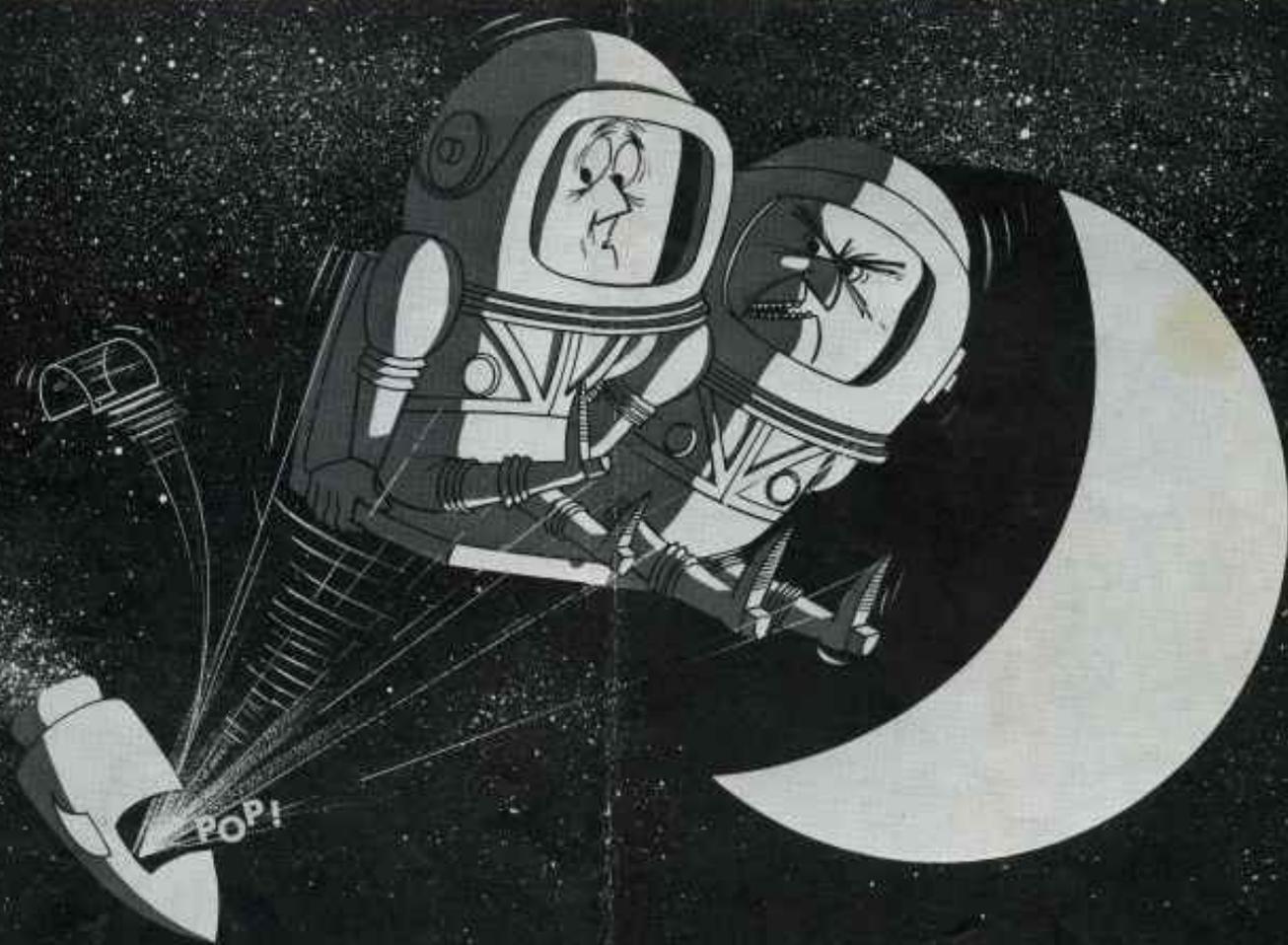
"You thinkin' what I'm thinkin'?"



"Ah, those were the days!"



"Not around his neck, stupid!!"



OOPS, HELL!!!

Space ain't no place for accidents! But then again, neither is good old Mother Earth.

Accidents, whether they occur in the far reaches of the universe or right here at home, are senseless, costly, and often tragic events that need never have happened.

Recognizing this, Thiokol has expended a great deal of time and energy to combat the threat of accidents wherever and whenever it appears. Here at Wasatch, as in other Thiokol Divisions, members of the safety department are on the alert for possible danger areas. Trained to detect and eliminate trouble before it happens, they work to protect us from harm.

However, their most important weapon in the battle for safety is the individual himself.

You, your buddy, and the guy in the next building are the ones who build safety records.

Thiokol can make every effort to ensure the best possible safety conditions; but, unless our attitude is such that we are continually safety conscious and actually WORK at safety, accidents will happen.

Last month we noted a new Wasatch safety record. This is fine. But remember one thing — as each accident-free day passes, the odds against us grow greater.

If we are to increase our safety record, we must increase our effort as well.

IMPULSE
Wasatch Division
Thiokol Chemical Corporation
Brigham City, Utah 84302

UT

Bulk Rate
U. S. POSTAGE
PAID
Permit No. 1528
Salt Lake City, Utah