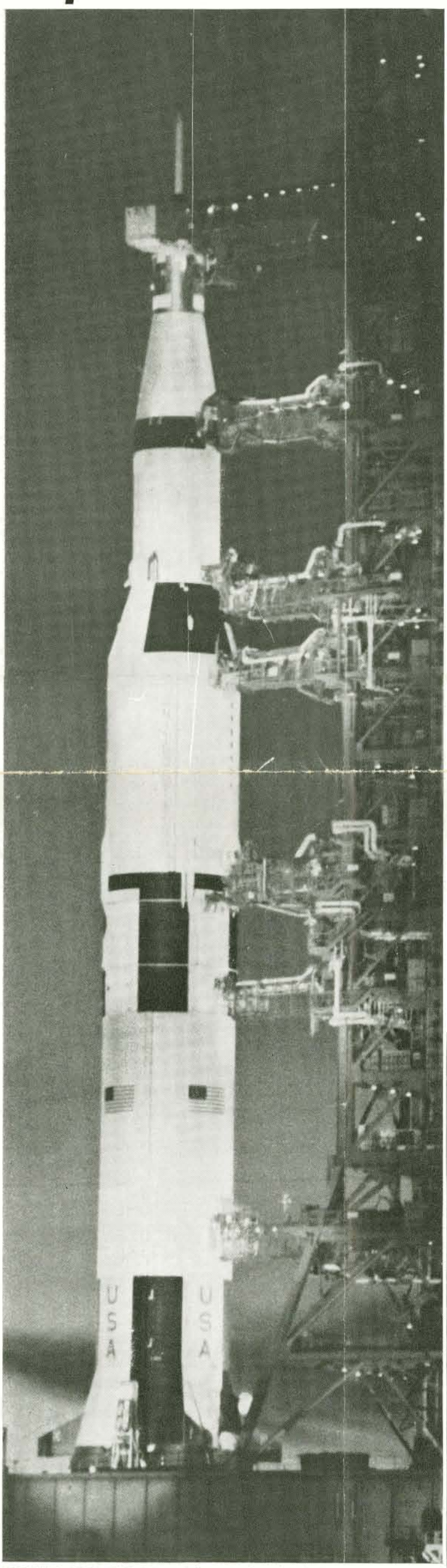
Apollo 8 Ready for Launching



POISED FOR MOON — The 363-foot high Saturn V is poised on Pad A of Launch Complex 39 at NASA's Kennedy Space Center in readiness for tomorrow's historic Apollo 8 mission.

SPACE DIVISION
Skywriter

VOL. XXVIII, No. 49 NORTH AMERICAN ROCKWELL CORPORATION (Aerospace and Systems Group) DECEMBER 20, 1968

Dec. 21 - 4:51 a.m. - One of Great Explorations of All Time Begins

Moon 69 Miles Away to Be Seen by Astronauts

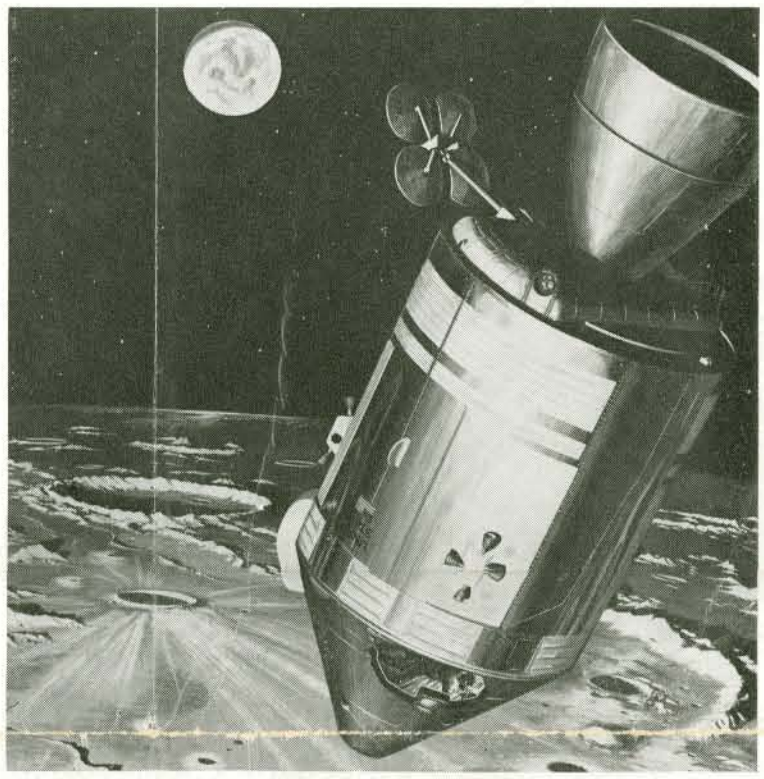
Much of the world's attention is focused on Cape Kennedy where final countdown is under way in preparation for launch tomorrow of the historic Apollo 8 mission.

Astronauts Frank Borman, James Lovell and William Anders, during the pre-dawn hours, will climb into the spacecraft to await liftoff scheduled for 4:51 a.m. PST, from Kennedy Space Center's Launch Complex 39-A.

According to flight plan, the astronauts are to arrive in the vicinity of the moon around 2 a.m. PST, Tuesday, Dec. 24. Following successful lunar orbit insertion, the astronauts are to begin 10 orbits of the moon — each orbit taking about two hours. About 10 p.m. PST Christmas Eve, the astronauts are to head earthward. Splashdown would come about 8 a.m. PST Friday, Dec. 27, in the Pacific Ocean.

This will be the most ambitious mission in the history of the United States' space program. Its successful completion will make safer, and less complicated, the attainment of the nation's goal of landing the first

(Continued on Page 2, Column 4)



DAY BEFORE CHRISTMAS — Apollo 8 astronauts hope to orbit the moon 10 times before heading earthward Christmas Eve. Close examination of possible landing sites will make easier and safer the actual lunar landing mission next year. This, on one of the most ambitious of missions, is a prime goal of Apollo 8 flight.

Saturn S-II Flight-Tested on Two Missions

The second stage of the Saturn V launch vehicle that will be used in tomorrow's Apollo 8 manned lunar orbit mission is the third in a series of S-II stages that will play major roles in the U.S. lunar landing program.

America's most powerful hydrogen-fueled vehicle, the S-II has been flight-tested twice — in November, 1967 when the first Saturn V was launched as part of the Apollo 4 mission, and in April, 1968 when the second Saturn V launch boosted the Apollo 6 spacecraft into earth orbit.

The second stage that will help boost three astronauts into

(Continued on Page 2, Column 1)

NO SKYWRITER NEXT WEEK

No *Skywriter* will be published next week. Regular publication will be resumed on Jan. 3.

What Christmas in Space Means To the Apollo 8 Astronauts

How the Apollo 8 astronauts view the fact that the mission is taking place at Christmas time was expressed during a press conference at NASA's Manned Spacecraft Center, Houston, just prior to the crew's leaving for Cape Kennedy.

Following is a portion of the transcript of the conference between the world's press and primary crewmen, astronauts Frank Borman, William Anders and James Lovell:

Reporter: "How do you feel about making this mission at Christmas time?"

Lovell: *"I'll speak for myself. I feel that the task is so important that we do not have any apprehension or any regrets about going during the Christmas Time. As a matter of fact, it seems that most of the flights that I have been on either back-up or prime have been around this particular time. So, it's not really a change of pace so far as my family goes."*

Reporter: "What about the religious significance? Is there any feeling that this is a Christian Holy Day and —"

(Continued on Page 4, Column 1)

APOLLO 8 FLIGHT SCHEDULED

Following are excerpts from NASA's Apollo 8 flight plan:

Day 1 — Launch. Earth orbit. Translunar injection. Third-stage separation. Translunar coast.

Day 2 — Star/earth horizon sightings. First TV transmission.

Day 3 — Lunar orbit insertion burn. Midcourse corrections. TV transmissions.

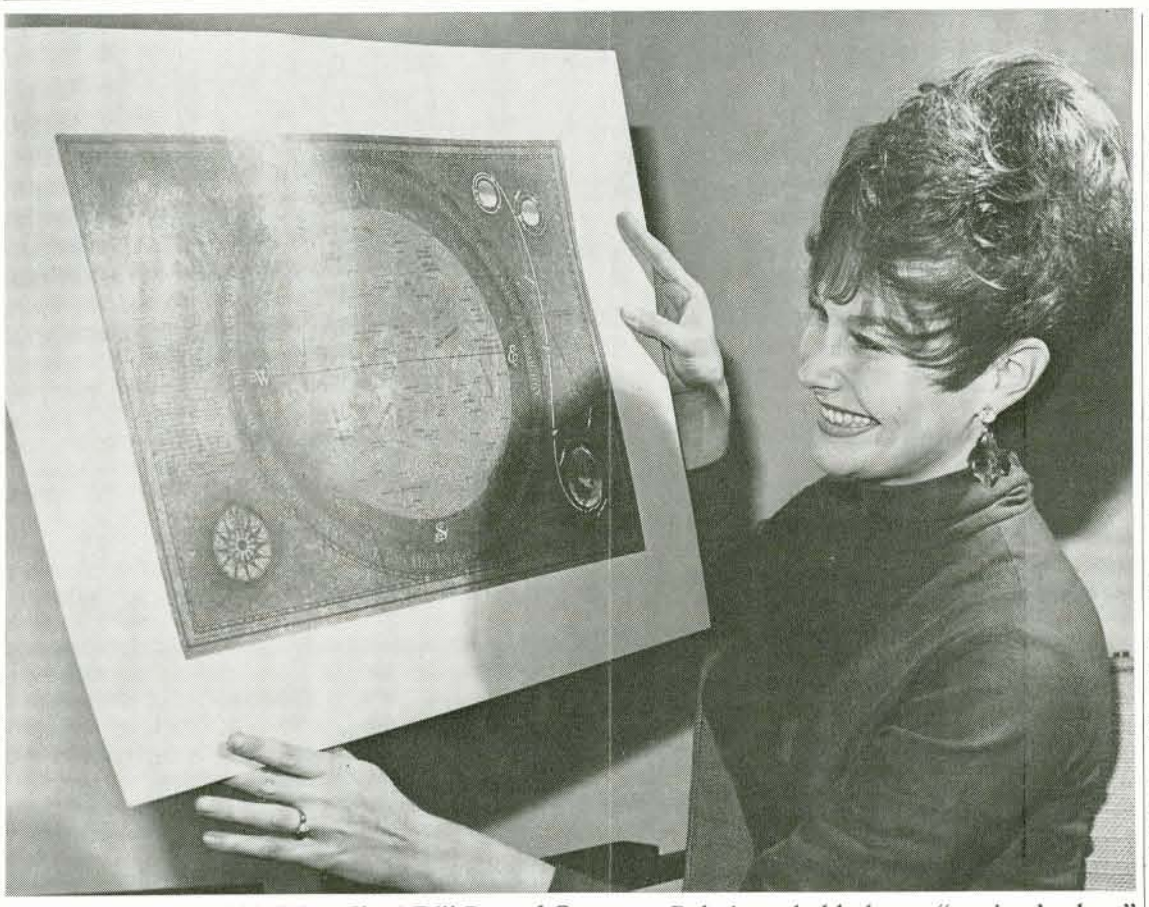
Day 4 — Lunar orbit circularization maneuver. Lunar photography. TV transmission. Star/lunar horizon sightings. Trans-earth injection burn.

Day 5 — Christmas Day. Star/lunar and star/earth horizon sightings. Trans-earth coast. TV transmission.

Day 6 — Star/lunar and star/earth horizon sightings. TV transmission. Midcourse corrections.

Day 7 — Command and service module separation. Earth entry. Splashdown in Pacific Ocean about 8 a.m. PST.

Editor's Note: The Apollo 8 mission will be carried out on a step-by-step basis in which decisions to continue will be made before each major maneuver based on status of the spacecraft and the crew. A full duration mission would include 10 orbits of the moon with earth landing taking place some 147 hours after launch.



CHRISTMAS MESSAGE — Shari Dill-Ree, of Customer Relations, holds lunar "mariner's chart" which is being mailed to division personnel withA story on their selection appeared last week.

Most Powerful Hydrogen-Fueled Engine . . .

(Continued from Page 1, Column 3)
earth orbit December 21 — and on their way to the moon if all goes well — has been designated the S-II-3 (stage two, number three). It is one of 15 S-II's that the Space Division of North American Rockwell Corporation is building for NASA's Marshall Space Flight Center, Huntsville, Alabama.

The S-II-3's mission will be to take up where the first stage (S-IC) leaves off and boost its payload — third stage (S-IVB) and manned Apollo 8 spacecraft — to a near-orbit altitude of about 122 statute miles and a near-orbit speed of almost 14,500 miles per hour.

The S-II-3 differs slightly from its predecessor, the S-II-2. The latter was the second stage of the Saturn V used in April's Apollo 6 mission.

An early shutdown of one of the S-II-2 engines caused some power loss to the stage during launch. Analysis showed that the trouble was caused by a leak in flexible hose sections of the augmented spark igniter (ASI) fuel line. It was determined that vibrations induced by fuel flow in the vacuum of the line's environment caused the leak. The line's flexible hose sections have been replaced with rigid, tubular lines in the S-II-3.

To monitor the performance of the new lines as well as other refinements in the S-II-3, nearly 500 pounds of measurement instruments have been added to those carried in the S-II-2.

Other S-II-3 changes include:

The liquid hydrogen tank ullage pressure will be controlled by use of new gauge-pressure sensing vent valves that will measure low- and high- pressure vent conditions. These valves will improve the venting process which in turn will reduce structural pressure loads during first and second stage boost periods.

Refinement of liquid oxygen and liquid hydrogen mixture during S-II-3 engine ignition and burn has been designed to improve boost performance. This will be accomplished by computerized timing of the mixture ratio shifts.

Motion picture cameras mounted on the S-II-1 and S-II-2 will not be used on S-II-3 and subsequent stages. Separation clearances during the first two S-II flights were determined to be entirely satisfactory.

A vibration isolation system has been added to provide the emergency detection power supply container with a suitable dynamic environment. Accelerometers have been added or relocated to determine worst-case vibration environments during first stage ignition and boost. Engine and prevalve circuits have been improved to ensure proper response to an emergency engine-cutoff command.

Tomorrow — to the Moon . . .

(Continued from Page 1, Column 3)
Americans on the lunar surface and returning them safely to earth by the end of next year. Apollo 8 also will be the most dangerous space mission undertaken by the United States thus far — Spacecraft Commander Borman has compared it to a combat pilot's tour in Vietnam.

Countdown for the launch tomorrow began last Sunday. The entire countdown runs 103 hours and includes a number of planned, built-in "holds" which total nearly 24 hours.

The astronauts, with no formal work schedule planned last Sunday, attended church in the morning and spent most of the afternoon in crew headquarters at KSC. Monday, they underwent their final major physical examinations prior to their flight. The remainder of the week was spent in further flight preparation, including practicing certain aspects of their flight in the command module simulator.

While Apollo 8 will be the second manned Apollo mission, it will be the first manned Apollo mission employing the giant Saturn V launch vehicle. Apollo 7, last October, was the first manned Apollo mission; an uprated Saturn IB was used as the launch vehicle. The Saturn V has been flown on two unmanned missions, Apollo 4 and Apollo 6. Tomorrow's use of the Saturn V will mark the first time that the second-stage (Saturn S-II) will have been used on a manned mission.

Apollo 8 will be an open-ended mission with the objective of proving the capability of the Apollo command and service modules and the crew to operate at lunar distances. A lunar test article will not be carried on Apollo 8, but Lunar Test Article (LTA-B), equivalent in weight to a lunar module, will be carried as ballast.

The mission will be carried out on a step-by-step "commit point" basis. This means that decisions whether to continue the mission or to return to earth or to change to an alternate mission will be made before each major maneuver. These decisions, or "commit points," will be made on the status of the spacecraft systems and the crew.

Several alternate mission plans are available, if for some reason the basic lunar orbit can not be flown. The alternates range from 10 days in low earth orbit, a high ellipse orbit, to a circumlunar flight with direct earth entry.

The crew will wear the inflight coveralls during entry — pressure suits will have been doffed and stowed since one hour after translunar injection. Experience in Apollo 7, when the crew flew the entry phase without pressure suits, helmets or gloves, prompted the decision not to wear suits, once the spacecraft's pressure integrity was determined.

NASA's decision to fly Apollo 8 as a lunar orbit mission was made after thorough evaluation of spacecraft performance in the 10-day earth-orbital Apollo 7 mission in October and an assessment of risk factors involved in a lunar orbit mission.

These risks are the total dependency upon the service propulsion engine for leaving lunar orbit and an earth-return time as long as three days compared to one-half to three-hours in earth orbit.

Evaluated along with the risks of a lunar orbit mission was the value of the flight in furthering the Apollo program toward a manned lunar landing before the end of 1969.

Principal gains from a lunar orbit flight will be experience gained in deep space navigation, communications and tracking, greater knowledge of spacecraft thermal response to deep space, and crew operational experience — all directly applicable to lunar landing missions.

Apollo Lunar Orbit On Christmas Eve

If all goes according to plan, the Apollo 8 astronauts will achieve lunar orbit at 2:15 a.m. PST on the day before Christmas.

They will remain in orbit almost all of Christmas Eve day.

It is hoped the astronauts will be able to send a Christmas Eve message of peace and good will from the United States to the world, broadcast live from the vicinity of the moon.

Christmas Menu to Include Beef, Gravy and Pudding

Christmas menu for the Apollo 8 astronauts will feature beef and gravy for dinner, with chocolate pudding for dessert.

For breakfast for the astronauts' fifth day in space (Dec. 25) the meal plan calls for peaches, bacon squares, cinnamon toast bread cubes and grapefruit drink.

Luncheon includes corn chowder, chicken and gravy, toasted bread cubes, sugar cookie cubes, cocoa and/or orange drink.

The Christmas dinner menu calls for beef and gravy, beef sandwiches, cheese-cracker cubes, chocolate pudding and orange-grapefruit drink.

The Apollo 8 crew had a wide range of food items from which to select their daily mission space menu. More than 60 items comprise the selection list of freeze-dried bite-size dehydratable foods. Average daily value of three meals will be 2,500 calories per man.

Unlike Gemini crewmen, who prepared their meals with cold water, Apollo crewmen will have a choice of either hot or cold water for reconstituting their meals.

TRADE MAGAZINE LAUDS DIVISION ON S-II HANDLING

A recent issue of the trade magazine, *Western Manufacturing,* cited the Space Division for its unique handling of the S-II stage during assembly, checkout, and transportation. The article entitled "How to Handle a 95,000 Pound Egg" depicted in detail many of the critical problems encountered and the solutions that were effected by S-II Material Handling Design.

R. J. Moss, supervisor, and P. A. Kessler, senior project engineer, Material Handling Design, Facilities & Industrial Engineering, accompanied the author on a tour of the Seal Beach Facility to provide weight, ratio and dimensional information.

LAUNCH WATCHERS — Four Space Division personnel are at Cape Kennedy under auspices of the PRIDE Program, to attend the launch tomorrow of Apollo 8. From left are Joseph P. McNamara, executive vice president, and Dale D. Myers, vice president and Apollo program manager, who congratulated the group, and the PRIDE selectees: Dino Cocchi, Steve Avakian, Cornelius Glover, Jr., and Thomas H. Doyle. A story on their selection appeared last week.

ASTRONAUT ANDERS ANXIOUS TO GET AN ASTRONAUT PIN

Veteran spacemen Frank Borman and James Lovell, who flew together during the Gemini series, have directed some good-natured joking toward William Anders, third member of the Apollo 8 primary crew, who will be making his first space flight.

Astronaut Anders will not be entitled to his gold astronaut pin until after he has flown above 50 miles altitude.

In a recent press conference, Borman jokingly mentioned that the crew won't be able to abort below 50 miles because Anders is "very anxious to earn his gold astronaut pin."

It is worth noting for Space Division personnel, particularly those at Seal Beach, that the crew will be "riding" S-II boost power when 50 miles altitude is surpassed.

Nominally, the S-II's five J-2 engines are to ignite shortly after 2½ minutes into the flight, at an altitude of slightly more than 40 miles. The engines will continue burning until the vehicle has reached nearly 122 miles altitude.

Apollo 7 Films To Be Sold Tomorrow

A three-minute color film highlighting the milestone Apollo 7 flight, will be available to division employees in a special sale tomorrow from 8 a.m. to noon at Downey Surplus Sales.

The film is in both regular and super 8 millimeter sizes. It will be available in a limited quantity at $1.55, including tax. Surplus Sales is on Clark Ave., between Lakewood and Imperial in Downey.

Featured in the film are Apollo 7 crew members Wally Schirra, Donn Eisele and Walt Cunningham, animated in-flight sequences, and weightlessness scenes.

APOLLO 8 MISSION COVERAGE PLANNED FOR EMPLOYEES

A closed-circuit telecast highlighting the Apollo 8 mission and its key goals was shown this afternoon for division Southern California employees, previewing the historic lunar orbit flight and mission coverage that will be presented for Southland employees.

The flight will be covered for Downey, Seal Beach, and Compton employees through a series of closed-circuit television and sound system programs presented on all shifts. The launch tomorrow will be telecast "live" and then taped for later showing to employees in the plant.

On Dec. 26, following the Christmas holidays, a telecast will be shown to bring employees up to date on the flight. A "live" telecast is planned covering the recovery operations on splashdown the following day.

Presentations are planned for the first and second halves of each shift, and then periodically as important flight milestones are attained.

APOLLO DESCENDS TO EARTH

Complicated and Lonely Space Maneuver Faces Astronauts

It will be a complicated and lonely space maneuver that the Apollo 8 astronauts perform when its time to leave the moon and start for home this Christmas Eve.

It will be lonely because the three will be in the blackness of space on the far side of the moon, blocked by the lunar planet from communication with Earth. There will be no television, with millions watching; no contact with the control center for last minute advice.

It will be complicated because they will have to start their big rocket engine at the exact moment needed to put the Apollo 8 spacecraft on an accurate trajectory to Earth, taking into account a fast-changing mixture of orbital and rotational movements.

But the astronauts will have the advantage of years of advance work by scientists, engineers and technicians who make such detailed plans for the mission that even the precise point in space-time for starting back toward Earth is calculated in advance.

The main liquid propellant rocket engine, the computer system, all the controls and the spacecraft itself are designed to make possible this accurate maneuver. At this point the three astronauts will be in the spacecraft command module, atop the service module.

Both of these modules are designed and built for the National Aeronautics and Space Administration (NASA) by the Space Division.

When the proper moment draws near, the crew will activate the onboard computer to send signals that start the spacecraft's big rocket engine. With a burst of power, the Apollo will head for home.

This point in space and time when the engine is fired is critical. If started too soon or too late, it would add more distance and time for the trip home. This could eat up more fuel in making midcourse corrections than is available. The trick is to start the engine and get the spacecraft on the right trajectory at the exact moment for the shortest trip between two points, the moon and the Earth landing target.

This trigger point has been decided for the astronauts by mathematicians, physicists, astronomers, experts in orbital mechanics, and computers. The complex calculations must take into account the rotation and orbit of the Earth, moon and spacecraft, the spacecraft speed, the gravity forces, and many other factors.

The return is started from behind the moon because this gives the Apollo the advantage of fuel-saving orbital velocity in the direction of home.

"Any miscalculation might result in more time than the planned approximately 2½ days for the return trip, and the spacecraft might not have the fuel to spare for making midcourse corrections," said the Space Division's Robert Zermuehlen, a guidance and control systems engineer.

Here is an approximation of how the return flight might start: the experts and their computers may have decided, say, that the time for firing the rocket engine will be 89 hours, 4 minutes, and 15.3 seconds elapsed time after launch, while the Apollo is within a certain prescribed segment of its orbit behind the moon.

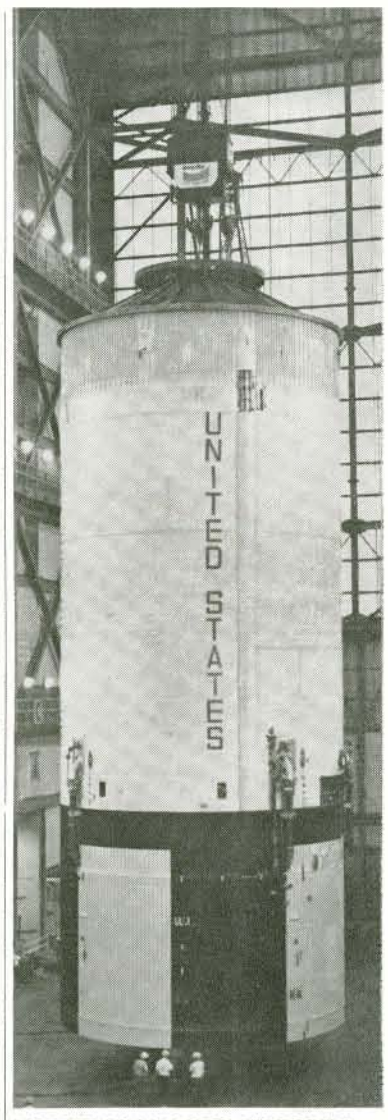
The astronauts will program this information into their spacecraft computer about 30 minutes before time to start the engine. They type out the command signal on a computer keyboard, including the time for firing and the spacecraft speed to be achieved. Any necessary updating of information also can be fed in at this time.

When the programmed moment arrives, the onboard computer will send an impulse to the electronic controls of the service propulsion rocket engine in the service module. The big engine will start thrusting and keep it up for about three minutes. This will get the spacecraft out of its moon orbit and headed for Earth.

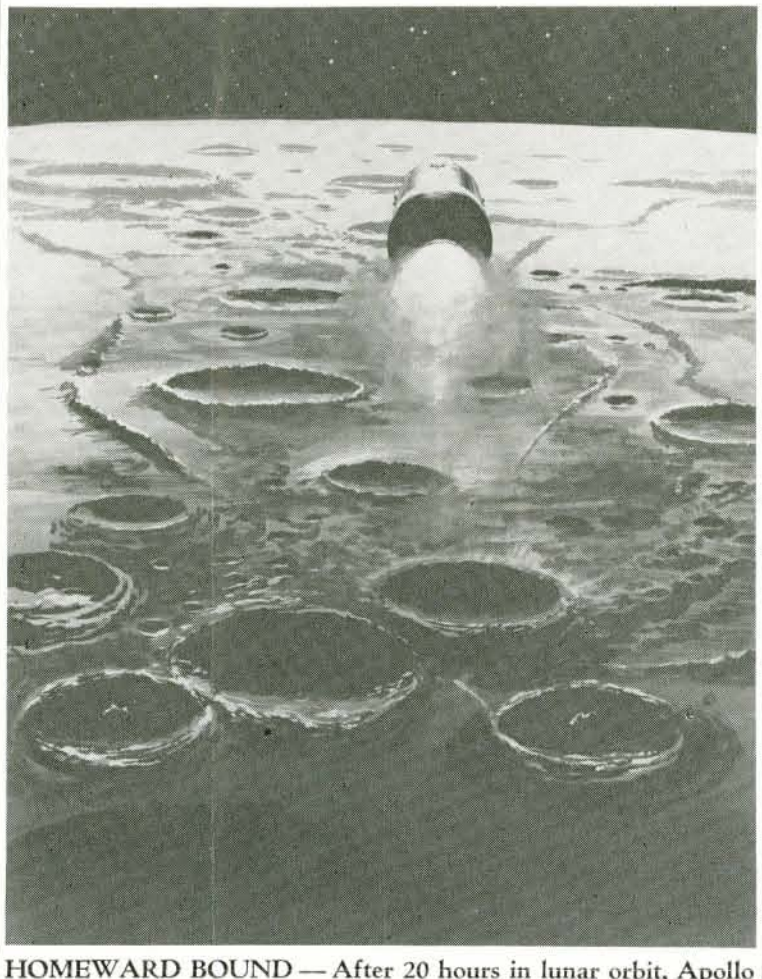
The power that brings the spacecraft home is provided by the 650-pound liquid propellant rocket engine, made by Aerojet-General Corporation.

The fuel is blended hydrazine. The engine is started by mixing the fuel with a nitrogen tetroxide oxidizer. No sparkplug is needed.

On computer command, the fuel flows into the engine through one pipe and the oxidizer through another, simultaneously. This causes ignition in the thrust chamber. The burning fuel creates hot gases which expand through the big nozzle at the bottom of the service module, creating the thrust needed to get the Apollo off and racing for home.



FIRST MANNED FLIGHT — S-II-3, second stage of the Saturn V which will be used in the Apollo 8 mission tomorrow, is shown at the Kennedy Space Center's Vertical Assembly Building just prior to its mating.



HOMEWARD BOUND — After 20 hours in lunar orbit, Apollo 8 astronauts will start the 20,500-pound-thrust Service Propulsion engine and head earthward. The SPS engine will be fired at a precise moment and will burn for about three minutes.

PASSED RIGID TESTING

Rugged Apollo Craft Survived Torture Test

Relentless vibration and pressure tests cleared the way for the Apollo 8 manned lunar orbit flight.

For three weeks a test spacecraft was subjected to the crushing, pulling, shearing and heating that the Apollo must undergo during the rigors of a moon-bound launch. The powerful hydraulic mauling failed to impair the Apollo, according to Dale Myers,, Space Division Apollo Program Manager.

"There were no failures in the test specimen," said Myers. "It exceeded our expectations. Never before have the actual boost conditions been simulated so closely in a ground test."

The testers said pulling, crushing and shearing pressures were applied simultaneously to the stack, but nothing gave. The engineers said the structural loads tested the spacecraft up to 140 percent of the most rigorous flight conditions.

The command and service modules are given many structural tests during construction at the Space Division's Downey facility, but engineers said this was the first time such simultaneous dynamic and static testing was done with the spacecraft components in a stacked position.

The tests were ordered by the National Aeronautics and Space Administration (NASA) to make sure that spacecraft components, when stacked and launched, were as strong on the ground as they have to be in space.

The success of the tests means that Apollo 8 has the structural capability — with room to spare — for astronauts Frank Borman, James A. Lovell and William A. Anders to make the first manned flight with the powerful three-stage Saturn V launch vehicle. This is the giant booster that provides the power needed for a moon trip. The first manned Apollo flight in October used a smaller two-stage Saturn IB launch vehicle.

The structural tests were recently completed at Wyle Laboratories, Huntsville, Alabama, using a 54-foot spacecraft stack. The stack, starting from the bottom, was made up of the top 10 feet (called the skirt) of the Saturn V's S-IVB third stage rocket, three-foot-high instrument unit, the spacecraft lunar module adapter (SLA) section with the lunar module inside, the service module and a structure to simulate the command module.

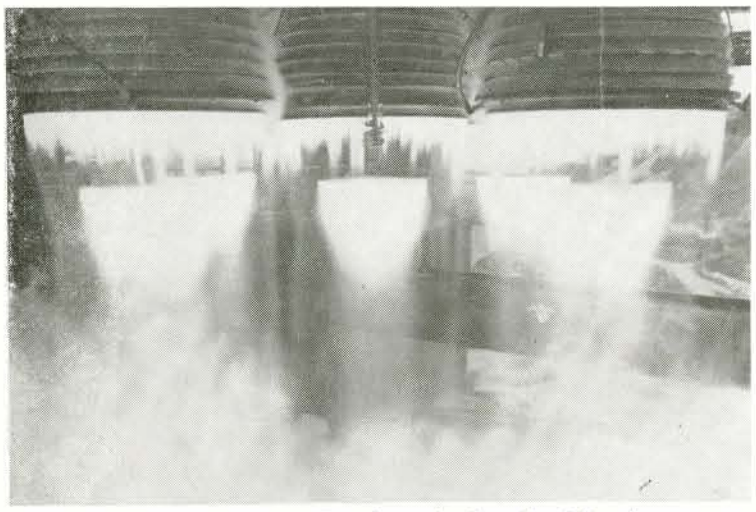
The command module is the vehicle in which the Apollo's three-man crew rides en route to the moon. On lunar landing flights, as the spacecraft approaches the moon, two astronauts transfer into the lunar module for their journey to the lunar surface and back to the orbiting command module.

SPACE DIVISION Skywriter

J. E. Elliott
Editor, *Skywriter*
Judy R. Brown
Assistant Editor

Space Division
Jack Kearney, Ext. 6468

Published weekly by North American Rockwell Corporation, 12214 Lakewood Blvd., Downey, Calif. 90241.



LIQUID HYDROGEN — See-through clear liquid-hydrogen oxygen flame roars from five Rocketdyne-built J-2 engines which will power the second stage (Saturn S-II) of NASA's Saturn V launch vehicle. One J-2 engine will power the third stage.

Liquid Hydrogen Emerges as Most Powerful Propellant

Once shackled by overwhelming scientific problems, liquid hydrogen has emerged as the most powerful propellant in the exotic line of space fuels.

It is the fuel that powers the second stage (S-II) of the National Aeronautics and Space Administration's 36-story tall Saturn V lunar launch vehicle. Called the most powerful hydrogen-fueled rocket built in the free world, the S-II is fabricated for NASA's Marshall Space Flight Center by the Space Division.

Already tested in two previous unmanned flights, the S-II stage will be flown in its first manned mission as part of the Apollo 8 lunar orbit flight scheduled for launch tomorrow.

Liquid hydrogen produces more energy for the least weight of any fuel known to science, and its use increases tremendously the weight of a payload that can be put into space. Hydrogen is the lightest of the known elements — oxygen is 15 times heavier — and its use in liquid form was recognized at the turn of the century as the perfect rocket fuel.

But how could it be liquified and then used?

To liquefy hydrogen, it must be purified and chilled to 423 degrees below zero. Its container cannot leak. Valves and lines must be able to operate in that intense cold.

The engine using it has to withstand -423 degrees — at its inlet as well as the fiery heat of combustion. Handling and tanking are enormously cumbersome, because liquid hydrogen will explode or burn if it comes into contact with the air.

No one knew how to solve these problems until after World War II when the conquest of space became a matter for serious consideration.

The first big hurdles were cleared in the 1950's when researchers for the National Bureau of Standards found a way to manufacture and store liquid hydrogen in large quantities.

With the fuel thus available in sufficient quantities, America's space planners in 1959 recommended development of liquid hydrogen-liquid -oxygen boosters. The idea was to design a family of launch vehicles of increasingly greater ability and complexity.

This family — Saturn — was originally to be composed of five different, but related, launch vehicles. Later it was cut to three, although some of the original designations were retained.

The pioneer was Saturn I, a two-stage vehicle which had an unparalleled record of success from 1961 to 1965. Its descendant, the Saturn IB, was larger and more advanced: the first stage was essentially the same, but the upper stage was the first full-size hydrogen-fueled booster. In flight tests beginning in 1966, the Saturn IB has continued the family's perfect record.

The giant Saturn V — the apex of the family tree — lifted off the pad at Cape Kennedy on its maiden flight in the Apollo 4 mission of November, 1967, and performed perfectly. It is the largest and most powerful launch vehicle ever built. And one of the reasons it is the most powerful is that both its upper stages are propelled by liquid hydrogen and liquid oxygen.

The Saturn V is envisioned as NASA's workhorse booster of the next two decades, the vehicle that will send astronauts to the moon and beyond.

Christmas Meaning . . .

(Continued from Page 1, Column 5)

Lovell: *"I can't think of a better religious aspect to the flight than to further explore the Heavens. . . . I feel also that as a Christmas present, it would be a very good one for the country."*

Borman: *"It doesn't conflict with my personal religion, if that's the question being asked. Jim (Lovell), you spoke for me on that one. . . . We better ask Bill (Anders); he's Catholic. . . ."*

Anders: *"I've got a special dispensation (laughter). But possibly being this time of year, will be a very appropriate time to generate among all the peoples of the world the feeling we have about the exploration of space. It's a good thing. Christmas is a good thing. Maybe this idea will catch on with others."*

Borman: *"I think we are all leaving here with the feeling that was very well expressed at the last press conference by a German correspondent that when you're finally up at the moon looking back at the earth, it's — all these differences and nationalistic traits are pretty well going to blend and you're going to get a concept that maybe this is really one world and why can't we learn to live together like decent people. I think this might be an appropriate season to go along with that. . . ."*

Classified Ads

FOR SALE

AUTOS

'64 Buick Special, 4-dr., $750. 439-4722.
'64 Buick Rivera, Air, $1650, GE 1-7909.
'65 Volvo, Model P1800, 714/637-6209.
'67 International w/camper, $4250, ME 0-5412.
'65 MG Midget, 714/846-9465.
'62 Porsche, "S" Cpe, $2700, 866-5495.
'60 190SL Mercedes-Benz, 714/545-2478.
'60 Imperial, Best Offer, 714/892-2059.
'57 MGA Roadster, 714/892-2650.
'64 GTO, 328-5817.
'67 GTO, $2400, Air/Steko, 547-4965.
'63 Lemans, Cpe/Auto., 862-5043.
'63 Rambler Sta. Wagon, $595, GA 3-6856.
'64 Rambler, OX 3-0235.
'64 Dodge Polara, 4 Dr., $850, OR 1-8573.
'67 Dodge Coronet, $2400, 322-2226.
'59 Renault, $100, 863-0076.
'59 Corvette, $800, 862-6929.
'64 Corvette Fastback, 4/spd., 213/695-6119.
'63 Monza, 213/430-7334.
'65 Kharman Ghia, air, $1350, 434-8239.
'64 V.W., Sun Roof, $800, 348-7257.
'59 V.W., w/rebuilt Engine, $275, 531-4692.
'65 V.W., $1000, TO 9-2154.
'66 V.W. Camper, 714/962-6920.
'57 Ford, PL 4-7030.
'62 Falcon Sta/Wagon, 714/968-2761.
'62 Ford, $225, FR 8-0651.
'67 GTA Mustang Conv. $2095, GE 4-0431.
'66 Mustang, 6 cyl., R/H, NE 9-5432.
'62 Galaxie 500, Air, 927-5744.
'66 Ford Ranchwagon, Auto, w/air, 213/867-1423.

MOTORCYCLES

'67 Honda 90cc Scrambler, $200, FR 1-5892.
'67 Honda 305 Scrambler/or trade f/car, 865-7014.
'65 Honda 50, 714/847-8288.
'66 Triumph TR6 650cc, 213/869-7463.

HOMES

3 br., 2½ bath, WH 1-7469.
3 br., Garden Park, 714-894-1195.
House w/pool, $29,000, Cypress, 527-5015.

FURNITURE

Living Room Furn., 521-8967.
Magnavox TV, 24", $35, 862-4735.
Chairs, quilted, $25 ea. TO 9-5246.
Victorian Antique Furn., 438-6409.

BOATS

23' Cruiser, inboard Spderaft, $2150, 772-3411.
Inboard-Outboard Boat, 375-6676.

PETS

AKC Poodle Pups, 892-9437.
AKC Terrier Pups, 596-3897.
AKC English Bulldog Pups, 282-9276.
Toy Poodle, m/white, 10 wks, 831-3171.
AKC German Shorthair Pups, FR 1-5892.
Golden Retriever Pups, $150, 448-1088.
Samoyed Pups, AKC, $75, 724-4580.
Poodle Pups, AKC, 892-9437.
English Bulldog Pups, AKC, 282-9276.
Cocker Spaniel, free to good home, 927-9955.

APPLIANCES

Philco Refrig., 12½', 714-826-1396.
Westinghouse Refrig., $50, 925-3484.

MISCELLANEOUS

Tricycle, 714/528-0126.
Mini Bike, 923-6869.
Bike, 16", Tr. Wheels, $15. 714/630-1629.
'61, 25' KenCraft Travel Trailer, 714/871-0516.
16' Camping Trailer, 865-7014.
19'8" Lightning Sloop Trailer, $975, 434-8230.
Biltmore Mobile Home, 20x43', 213/923-7026.
Camping Trailer, 1 Wheel Enclosed, $50, 422-3932.
Tape Recorder, portable, 421-2935.
Pentax 35mm, w/3 lenses, 421-2935.
Merc. Outbd. Motor, 30 hp., $175, 864-7212.
'59 Metro Conv., 867-2657.
Auto. Record Player, 4 spd., OX 5-8355.
Girl's Bike, 26" $12.00, Rotor Lawnmower, $10. 925-5159.
Elco FM Stereo Tuner & 50W Amp., 925-4853.
Surf Board, 9', $30, 630-2737.
Bolex H16 w/zoom, $350, 714/KE 5-1877.
Kenmore Washing Machine, 714/826-7464.
Nancy Drew Mystery Books, 645-3614.
Boy's Golf Clubs, 213/430-5040.
Thermofax Copy Machine, $75, 327-5194.
25' Owens, w/slip, 431-0559.
16' Camping Trailer, 865-7014.

WANTED TO BUY

High Quality Wood Lathe, TO 1-2474.
Public Address System, 714/630-1629.
Typewriter Desk, 861-5906.
Encyclopedia, Recent Edition, 871-3469.

RIDE WANTED

Forest Lawn Cypress to B. 302, 7-3:30, 865-0016.

ODDS AND ENDS

Pontiac & Hydro Trans., $100, 596-8356.
Chrys. Marine Eng. $200, 714/772-3411.
Babysitter Wanted, 861-3463.
Carpeting, 40 sq. yds., OX 3-0235.
Chev HD Shocks (2), 927-1093.
14" Chrome Rims, 941-5656.
70' x 300' Lanacster Lots, $2750 ea., ME 3-5021.
San Clemente Lot, $5400, 213/964-5823.
Electric Dryer, 630-6189.
Manifold 283 Lt. Wt., 2-4 Br., $17, 596-8356.

FOR RENT

3 br. House, $275, Downey, TO 2-1218.
3 br. & den, adults only, 429-4596.

Small Business Has Big Stake in Apollo Mission

When the National Aeronautics and Space Administration successfully launches its Saturn V moon rocket during the forthcoming Apollo 8 mission, an electronics technician in Hudson, N. H., will follow the flight with more than a citizen's interest. He helped build fuel temperature transducers for the second stage of the mammoth three-stage launch vehicle.

When NASA successfully brought an Apollo command module and its three man crew back from a record 11-day trip into space during the recent Apollo 7 mission, a machinist in Paramount, Calif., got more than a citizen's satisfaction out of the flight's success. He helped produce aluminum forgings for the command module crew hatch.

The Saturn V second stage (S-II) rocket and the Apollo spacecraft command module are built by the Space Division of North American Rockwell Corporation, one of the nation's largest aerospace contractors.

The New Hampshire electronics technician and the California machinist work for companies termed "small businesses" by the U.S. — independent companies employing fewer than 500 persons. Their companies are two of more than 7,000 small firms in 49 states aiding North American Rockwell in helping to send astronauts to the moon.

There are about 4.7 million small business companies across the nation. Nine out of every 10 firms fall into this classification. These businesses supply one-third of the nation's goods and services.

Space Division commitments to small businesses have totaled more than $335 million since the beginning of the Apollo and Saturn programs in 1962.

About half of the Space Division's Apollo/Saturn program contract dollars have been subcontracted to firms large and small. Major subcontractors have individual commitments of $5 million to well over $100 million.

Space Division subcontracting has sent moon money into 49 of the 50 states (Hawaii is the exception). The alphabetical list of subcontractor states starts with Alabama (over $7.4 million spent with 34 companies) and ends with Wyoming (about $70,744 spent with two firms.)

By area, the western U.S. has obtained $862 million (54 pehcent) of this business, and the east, $735 million (46 percent).

FILE ALL ADDRESS CHANGES

Employees who have moved or had a change in the name or address of the person to be contacted in case of an emergency, and who have not submitted an "Address and Emergency Contact Change Notice," Form 25-B, are asked to do so as soon as possible.

The address an employee has on file with the company as of the end of December is the address to which the employee's W-2 Form and Retirement Notices are sent. It is important that proper addresses be in the file at year end.

Forms are available from department secretaries.

Apollo Plans TV Transmission

What about onboard television during the Apollo 8 mission?

During a recent press conference, Command Pilot Frank Borman commented, "Well, we have plans for two (television transmissions) going, two there (near the moon), and two on the way back.

"I hope that we can get some significant out-the-window views. . . . I hope we can get some good views of the earth from the moon, and of the moon on trans-earth.

"Other than that, I'm not certain — I guess we have to confine it to the indoor activities and we have already been way outdone on anything we could hope to do on that. . . . I think we'll be competing with Lowell Thomas rather than Bob Hope. . . ."

Approximate time for the first TV transmission is noon, Sunday, Dec. 22. All networks are expected to carry the transmission live. Second transmission is planned for Monday, noon.

Mick O'Mach & Buster