FILM SCRIPT

for

SATURN QUARTERLY FILM REPORT NO. 11

(Covering January, February, March, 1962)

UNCLASSIFIED

FILM	NARRATION
Fade in	OPENING MUSIC
UNCLASSIFIED	
Title	
DISSOLVE	
First Title:	
The GEORGE C. MARSHALL SPACE FLIGHT CENTER Presents	
Second title:	
SATURN QUARTERLY FILM REPORT NO. 11	
(Covering Jan., Feb., March, 1962)	

FILM	NARRATION
Checkout of SA-2 booster in new pressure test cell at Quality Assurance Div., including overall view of booster in test cell, various shots of men at work in control room, then back to booster	Final checkout of the second Saturn flight vehicle, SA-2, was completed during this report period at the Marshall Space Flight Center, in preparation for its scheduled flight testing at Cape Canaveral next quarter. The recently completed pressure test cell facility was placed into operation for the first time, as the SA-2 booster underwent an extensive testing program in which high-pressure air, helium, and nitrogen were used to check tanks and mechanical systems for leakage. Pressure levels up to 3,000 pounds per square inch above normal atmospheric pressure were employed in the checkout procedure.

FILM	NARRATION
"Promise" tied up at Wilson Dam	While SA-2 checkout continued, modification work performed at Todd Shipyards, Houston, Texas, on the Saturn-carrying barge "Promise"--formerly named "Compromise"--included addition of an arched cargo cover, a pilot house, ballast system, crew's quarters, fire-fighting equipment, and heating system.

FILM	NARRATION
Overall view of area under construction; MS of cranes operating; MS of old lock; LS of old lock lower gates; PAN shot of coffer dams; close with overall view of construction	At Wheeler Dam on the Tennessee River 48 miles from Marshall, a mammoth repair job neared completion on the lock which had collapsed last June, forcing a temporary change in Saturn transportation plans. The Tennessee Valley Authority announced that it hopes to reopen the lock by April 23rd. Reopening will allow resumption of normal traffic, including barges carrying Saturns beginning with SA-3.
Several scenes of preparation of SA-2 for shipment (let film run a little long)	By mid-February of this report period, the SA-2 flight vehicle had finished its checkout, and was undergoing final preparation for shipment to the Cape. Like its predecessor, SA-1, this vehicle consisted of a live booster or S-I stage, with inert S-IV stage, S-V stage, and payload.

FILM	NARRATION
Loading dummy upper stages and payload onto "Palaemon"	On February 16th, the SA-2 dummy upper stages and payload were loaded onto the Saturn barge "Palaemon". These were carried as far as Wheeler Dam early next morning, and the barge returned for the booster.
Loading booster onto "Palaemon" (let film run long)	Loading time for the giant booster at the Marshall dock was only 10 minutes.
SA-2 booster being rolled on land around Wheeler Dam, and then being loaded onto "Promise"	At Wheeler, the units were transferred by land around the broken lock and put aboard the waiting "Promise", which would take them the rest of the way. Only about an hour was needed to unload the booster, move it the one mile overland, and load it again.

FILM	NARRATION
"Promise" arriving at Cape (let film run long)	On February 27th, the "Promise" reached its destination, ending a 2,200-mile voyage which had taken it through waters of the Tennessee, Ohio, and Mississippi Rivers, the Gulf of Mexico, and the Atlantic Seaboard.
Unloading SA-2 booster from "Promise" (let film run a little long)	At the Cape Canaveral dock, the SA-2 stages were taken off the barge.
Erecting booster at launching pad (let film run a little long)	After being transported overland to the launching pad about two miles away, the booster was erected on the launch pedestal.
Mating S-IV to booster (let film run long)	Shortly afterwards, mating of the inert S-IV stage to the booster began...,
Mating of S-V (let film run long)	...followed by the S-V...,

FILM	NARRATION
Mating of payload (let film run long)	...and finally the payload, a Jupiter nose cone and aft section.
Full SA-2 vehicle in service structure	The fully assembled SA-2 vehicle was ready to begin undergoing the long series of checkouts and preparations which will precede its flight testing next quarter.
Final assembly of SA-3 booster (use stock footage of SA-1 or SA-2, if nothing available on SA-3)	Assembly of the booster for the third Saturn flight vehicle, SA-3, was completed at the Marshall Center on January 8th...,
Overall view of SA-3 booster in checkout area at Quality Division (use stock, if nothing else available)	...and pre-static checkout of the stage was performed.

FILM	NARRATION
Various shots of mass moment of inertia testing of SA-3 booster	Checkout work included testing to determ·ne mass moment of inertia. The test is based upon application of the basic spring pendulum principle. The period of vibration for the booster, suspended on springs of known spring constants, is determined by a photo-electric cell and electrical timer. The mass moment of inertia is calculated from this data, plus weight and center of gravity data obtained by electronic load cells in previous tests.
Static test firing of SA-T-3 booster (can use stock footage of any static firing)	(SOUND EFFECTS: STATIC FIRING; then, LOWER SOUND EFFECTS AND VOICE OVER) A series of three static test firings was conducted during this report period, with the SA-T-3 booster, a test stage modified to specifications of the SA-3. Later, this test booster was removed and the actual SA-3 installed for static firing.

FILM	NARRATION
Beginning assembly of SA-4 booster (use stock, if actual footage not available)	Assembly of the booster for the fourth Saturn flight vehicle, SA-4, began on January 2nd, and is expected to be completed this Summer.
Overall exterior view of Bldg. 4705; overall interior view showing expanded area	Marshall's Saturn assembly area was being expanded this quarter to make it one-third again larger. The expanded area will house a new C-1 assembly station. One of the two present stations will be converted for assembly of C-5 ground test vehicles. The additional area will also provide more office space, a new electrical shop for cable assembly, and a new "clean room" facility for cleaning of tubes and other delicate components.

FILM	NARRATION
LS, overall view of fabrication area (Bldg. 4704); men working at ring fixture; then close with another quick overall look at area	In the Saturn fabrication area, re-tooling is now underway in preparation for structural fabrication of the A-5 configuration--or Block II--tail section, spider beam assembly, instrument compartment, and second stage adapter. Work will be performed on five flight boosters, plus two test boosters to be used in structural and dynamic testing programs at Marshall. Part of the shop is also being converted for research looking toward fabrication methods to be used on the advanced, or C-5, Saturn configuration, including out-of-position horizontal and vertical welding.

FILM	NARRATION
Overall view of SA-5 mockup (aft section)	A full-scale mockup of the forward and aft sections of the Block II, or SA-5 type, Saturn booster is nearing completion, for use by engineers in design verification and also to familiarize assembly personnel with the new configuration. Block II vehicles, which will test live S-IV stages and boilerplate Apollo spacecraft, incorporate design changes necessary to accommodate manned missions.
Large fins	Modifications include attachment of four large fins at the tail, to increase flight stability. The launch pedestal will be modified to accept the fins.

FILM	NARRATION
Stub fins	Four so-called stub fins--actually support structures with aerodynamic fairing--are incorporated to provide additional support points. The leading edges of three of the stubs will carry hydrogen ducts through the inside.
Fuel tanks	Elongated fuel and Lox tanks will hold some 100,000 pounds more propellant for a longer burning time.
Pressurization sphere	Two large spheres filled with gaseous nitrogen will replace the 48 smaller spheres used on Block I to pressurize the booster's fuel tanks.
Retro-rocket	The booster's honey-comb fairing used to far in between the booster and S-IV stage is mounted to the I-beam, as are the four retro-rockets. Attaching the upper stage directly to the spider beam eliminates need for the Block I upper stage adapter.

FILM	NARRATION
One-tenth scale model of Saturn-Apollo vehicle	Another model--this one built to a scale of one to ten-- depicts a Block II booster and a cutaway version of the S-IV stage, carrying an Apollo spacecraft on top.
Ling-Tempco-Vought plant sign, and aerial view of plant	Fabrication of the 70 and 105-inch fuel and Lox tanks for Block II Saturn vehicles is now underway by the contractor, Ling-Tempco-Vought, at its plant near Dallas, Texas.
MS of skin mill shaping flat stock	Manufacturing begins at this skin mill. Flat material is properly dressed prior to rolling it into cylindrical skin configurations.
MS of "hydro-spinning" of dome bulkhead for Lox container	The tank dome bulkheads are shaped by using a technique called "hydro-spinning."

FILM	NARRATION
MS and CU of vidi-gage	Then, the finished units are carefully inspected for uniform thickness by using this semi-automatic vidi-gage.
MS of modified lathe	Prior to in-line assembly, each tank section is trimmed to a specified close tolerance using this modified lathe.
CU of spot welding Z-frames into center section skins	Z-frames are uniformly spaced between the tank segments, then joined...
CU of head of spot welder	...by spot welding the frames to the segments with this precision welder.
MS of portable X-ray unit	To prevent assembly line bottlenecks, a portable X-ray unit is used to check the condition of smaller parts.

FILM	NARRATION
CU of weld specimen being readied for X-ray	Weld specimens and tank segments are inspected at each station point of the tank just before final cleaning and testing.
LS, aerial view of hydrostatic test and cleaning tower	Meticulous care is exercised during the cleaning of these Lox and fuel tanks. Then they are rigorously tested in the hydrostatic test stand as a final proof of overall reliability.

FILM	NARRATION
LS, main building at Michoud; ZOOM IN on sign; LS and CU, man laying floor; LS and CU, man pulling tile from ceiling; MS, men stripping wallpaper; LS, renovated office area, with light fixtures; LS, Chrysler office area, with people at desks; LS and CU, men looking at plant layout board; LS, forklift passing through portion of manufacturing area; MS and CU, men cutting away overhead metal superstructure	Activation of Marshall's Michoud Operations plant near New Orleans was underway this quarter. The huge facility is being made ready for use by Chrysler Corporation, contractor for production of future C-1 boosters, and by Boeing Company, contractor for development and production of the advanced Saturn booster, S-IC. The activation job is being done by the New Orleans firm of Gurtler, Herbert (NOTE TO NARRATOR: PRONOUNCED "A-BEAR"), and Company. The work consists generally of inspecting, repairing, and returning to useable condition the vast manufacturing building, covering nearly two million square feet of floor area, and an adjoining office building, plus certain work on the grounds.

FILM

NARRATION

Choose from scenes 20-32, Douglas input #18

At Douglas Aircraft Company, contractor for the S-IV stage, initial cold flow tests have been successfully accomplished with both liquid oxygen and liquid hydrogen. Designed to check out the fuel and oxidizer systems, these tests consisted of transferring Lox and LH2 from the storage area, through the ducting and valve complexes, into the battleship tank. All aspects of the system performed properly.

Choose from scenes 1-7, Douglas input #18

This full-scale engineering mockup of the S-IV stage will be used to functionally check the vehicle's electrical system and its compatibility with ground support equipment. Many of the mockup's electrical wiring harnesses have been completed, and a large percentage of the wiring has been installed in preparation for the systems integration testing program.

FILM	NARRATION
Choose from scenes 10-19, Douglas input #18	Completed in January, this hydrostatic test vehicle is the first S-IV stage using manufacturing techniques designed for flight vehicles. It is currently being put through a series of hydrostatic filling and pressurization test operations using water for the test liquid. On the final test, it will be pressurized to destruction.
MLS, liquid hydrogen tensile machine setup	At Marshall, a comnrehensive liquid hydrogen test program--indicative of the increasing importance of LH2--was underway this quarter. This metal tensile strength test is conducted by immersing test samples into LH2.

FILM	NARRATION
MCU, man mounting tensile specimen in cryostat	Metals used for S-IV stage fuel tanks, transfer ducts, and fuel pumps are tested and evaluated by mounting them in this cryostat.
CU of clamp hook-up to cryostat	The cover is then securely attached...,
MLS of pre-cooling operation	...and the sample is pre-cooled, by use of liquid nitrogen, to minus 320 degrees Farenheit.
MCU of draining LN2	After desired temperature has been attained, the liquid nitrogen is drained...,
MLS of cooling from -320 to -420 degrees F. using liquid hydrogen	...and the sample is further cooled to minus 420 degrees using liquid hydrogen.
LS of dumping LH2	The liquid hydrogen is drained, and the sample is subjected to a tensile strength test.

FILM	NARRATION
MCU of man removing sample from cryostat	Since the use of liquid hydrogen in rocket propulsion is still relatively new, extensive experimentation is necessary to determine its compatibility with related components.
LS, overall view of liquid hydrogen pressurization test facility	At another facility, liquid hydrogen pressurization tests are run to determine the effect of varying the temperature of the pressurant gas and drain time of the tank on the amount of pressurization gas required.
LS, interior of blockhouse, three men at recorder rack; LS, exterior, transferring LH2	LH2 is transferred from the storage area through vacuum-jacketed lines to the test tank, a double-walled aluminum container with vacuum space between walls for insulation purposes.

FILM	NARRATION
CU, gas cooler	The pressurization gas is cooled by liquid nitrogen when low-temperature gas is required...,
CU, electric heater	...and heated by a D.C. current electric heater when high-temperature gas is needed.
Interior of blockhouse, man operating hydrogen flow, temperature, and pressure measurement console; CU, recorder	Flow rates, temperatures, liquid level, and pressures are recorded to obtain data which indicates the most efficient pressurization method.
LS, overall PAN shot of LH2 "cold flow" test facility, with men working; CU, men working at engine position	Another liquid hydrogen test facility is now being used to familiarize Marshall personnel with handling LH2 in large quantities, and will be used next quarter for static firings of Pratt and Whitney RL-10 liquid oxygen-liquid hydrogen engines.

FILM	NARRATION
LS, "head-on" view of test facility, showing vertical steam ejector; MS and CU, men at consoles in control room	"Cold flow" tests--in which propellants are run through the engine, but not ignited--were carried out this quarter to measure propellant flow rates, pressures, and other vital functions. Flow tests had been conducted previously to transfer the liquid hydrogen from a 7800-gallon trailer tank to the test stand's 2200-gallon run tank.
LS, "head-on" view of test facility, with steam blowing from ejector	(SOUND EFFECTS: STEAM BLOWING OFF) (VOICE OVER:) In conjunction with engine "cold" tests, steam evacuation system tests were also run, in which steam was used to pull a vacuum on the test stand's diffuser system, simulating outer space pressure conditions.

FILM	NARRATION
Artist's conception of new liquid hydrogen test stand	Looking to the future, this artist's conception shows a new test stand scheduled to be built at Marshall for work with liquid oxygen-liquid hydrogen engines.
LS, overall profile view of vacuum chamber	This large low-pressure environmental chamber is being used at Marshall to simulate outer-space conditions for the RL-10 engine in a series of tests studying means of gasifying pre-ignition liquid oxygen childown flow, to reduce explosion hazards. The method being evaluated is the injection of gaseous nitrogen through a manifold into the Lox exhaust stream at the engine's nozzle exit.

FILM	NARRATION
Liquid nitrogen tank to chamber; man (with headphones) working; LS, overall three-quarter view of vacuum chamber; CU, man at gaseous nitrogen trailer tank, attaching hose, and adjusting pressurizer panel; MS and CU, man at controls at aft end of vacuum chamber; MS and CU of two men at console in control room, showing TV monitor	Due to ease of handling, liquid nitrogen is being used in these tests to simulate Lox. During flight, before engine start-up, propellant flows are necessary to pre-cool pumps and feed lines. The liquid hydrogen chilldown flow will be vented overboard, and Lox will be exhausted into the booster-S-IV interstage area. Ambient pressure there may be below the triple point of oxygen, forming solid particles. It is anticipated that the oxygen, whether solid or liquid, can be evaporated, using the sensible heat from gaseous nitrogen injected just below the thrust chamber.
CU, solid particles being exhausted from engine nozzle	This test, photographed at about three times normal speed, shows liquid nitrogen being exhausted in the form of solid particles.

FILM	NARRATION
CU, gas (invisible) being exhausted from engine nozzle	When a specified gaseous nitrogen flow rate is injected into the solid stream, the result is a heat transfer between the gas and solid, causing evaporation. After optimum gaseous nitrogen flow requirements are reached in future tests, the system will be tested on a hot-fire engine at Douglas or Pratt and Whitney.
LS of electric discharge forming system set-up	Typical of continuing varied research projects at Marshall are experiments in magnetic forming and electric discharge forming in a fluid state.
MCU of capacitor bank	Ultra-fast discharge of voltage from this capacitor bank and supporting circuits...

FILM	NARRATION
CU of electro-magnet; men loading cylinder.	...through this large coil provides the shock wave to form metal into pre-determined shapes. In preparation for magnetic forming, a "blank" piece of metal stock is placed over the coil.
LS of forming operation	Then the system is energized. Because of the overload of current, the system discharges rapidly and the resulting shock wave shapes the metal stock. (SOUND EFFECTS: SHOTGUN BLAST, SIMULATING NOISE OF CAPACITORS DISCHARGING)
Men unloading cylinder and examining shaped metal	This method promises to be valuable in forming metals for advanced Saturn vehicles, as well as providing means for making space vacuum seals and facilitating fabrication in space.

FILM	NARRATION
Overall view of fiber-optics instrumentation system	This equipment is part of a new photographic instrumentation system--known as "fiber-optics" being developed for Saturn. It will be flown for the first time aboard SA-5.
MCU of man connecting instrumentation camera to fiber-optics bundle	Filming, during flight, will be accomplished through use of a Millikin instrumentation camera.
MCU of man and optical cable	The optical cable consists of a bundle of extremely fine glass fibers arranged so that when an image is imposed on the face of one end of the cable, the image is conducted to the opposite end and reconstructed on its face.

FILM	NARRATION
CU of man focusing objective lens; CU of near end of optics bundle	The objective lens must be accurately focused to insure a clear image of the subject--in this test, a small propeller.
CU of man using bore-sight fixture in connection with camera	Camera lens adjustments are made by using the bore-sight fixture, allowing for a clear picture between camera and near-end lens.
MCU of fiber-optics bundle showing near end and objective end	The use of optics cables enables camera mounting other than at the point of image. Useful applications in flight are filming the forward sections from the booster, where several fields of view are required to determine rate of separation and to study behavior of the forward section relative to the booster.

FILM	NARRATION
Tight shot through optics bundle showing rotation of propeller (this footage from Millikin camera)	The camera is now filming the motion of the solar-cell-driven propeller. The optics cable has carried the image back to the camera for film recording. Saturn flights will be monitored by eight of these systems.
MS and CU of man picking up static inverter from table, then disassembling unit	A new approach to obtaining three-phase, 400-cycle-per-second power from batteries is being developed and refined at Marshall. This static inverter will supply power for the ST-124 stabilized platform carried aboard the SA-3 vehicle.

FILM	NARRATION
CU of sub-assemblies of flight model static inverter	The circuitry consists of a frequency standard, binary count-down flip-flops, logic elements, power amplifiers, output transformers, and a magnetic amplifier type voltage regulator. The static inverter has no moving parts, consequently no mechanical wear. Cabling requirements are reduced, as well as physical size of the battery. Pound for pound, the static inverter is much more efficient than a rotating inverter.
CU of breadboard model of static inverter	This breadboard circuit is a higher-powered version of the static inverter, and when properly packaged will be used on future Saturn vehicles.

FILM	NARRATION
CU of man making electrical hook-ups from one pin to another on breadboard model	Power transistors are used in their most efficient mode of operation, that is, as switches.
CU of oscilloscope showing build-up to nine-step sine wave; man and breadboard	The output voltage wave is stepped and closely follows a sine wave, having only a 10 percent total harmonic distortion without fluttering.
Fully assembled SA-2 vehicle on pad at Cape (Pick most dramatic scene available--such as, perhaps, at sunset)	As research and development for future Saturn vehicles moved ahead at Marshall and its contractors across the nation, the ultimate test--actual flight--was nearing for SA-2, poised for its attempt to match the spectacular success scored last October 27th by the first Saturn ever launched.

END.