Company	Product	Value
Calmec Los Angeles, Calif.	Helium pressure relief valves	$ 854,000
Collins Radio Co. Cedar Rapids, Iowa	Communications and data subsystems	130,317,000
Control Data Corp. Government Systems Division Minneapolis, Minn.	Digitial test command system spare parts	9,900,000
Cosmodyne Corp. Torrance, Calif.	Liquid hydrogen, liquid oxygen ground support equipment and unique detail spares of liquid hydrogen and liquid oxygen transfer units	4,348,440
Dalmo Victor Co. (Division of Textron) Belmont, Calif.	S-band high-gain (deep space) antenna	13,072,000
McDonnell Douglas Corp. Douglas Aircraft Div. Long Beach, Calif.	Parachute subsystem testing	904,000
Eagle Picher Joplin, Mo.	Post-entry and storage batteries	720,000
Eckel Valve Co. San Fernando, Calif.	Valves	783,958
Electro-Optical Systems, Inc. Micro Systems, Inc. Pasadena, Calif.	Temperature and pressure transducers, signal conditioners, and electronic control units	8,772,000
Garrett Corp. AiResearch Manufacturing Co. Los Angeles, Calif.	Environmental control subsystem	78,308,748
General Motors Corp. Allison Division Indianapolis, Ind.	Service propulsion fuel and oxidizer tanks	13,389,658
General Precision, Inc. White Plains, N.Y.	Mission simulator trainer, control sequence, heat flux sensor	42,083,340
General Time Corp. Aeronetics Division Rolling Meadows, Ill.	Central timing equipment	6,515,023
Giannini Controls Corp. Pasadena, Calif.	Quantity gauging system	11,073,000
B.H. Hadley Co. Pomona, Calif.	Pressure helium regulator unit and liquid hydrogen tank vent disconnects	1,686,085
Hammond Organ Co. Gibbs Manufacturing and Research Corp. Janesville, Wis.	Mechanical timers and clocks	3,065,151

Company	Product	Value
Honeywell, Inc. Minneapolis, Minn.	Stabilization and control subsystem	$134,145,781
ITT Kellogg Chicago, Ill.	In-flight test systems	2,049,872
Kinetics Corp. Solana Beach, Calif.	Power transfer and motor driver switches	1,804,000
Leach Corp. Azusa, Calif.	Flight qualification recorder	1,286,578
Ling Tempco Vought Dallas, Texas	Selective stagnation indicator system	5,398,542
Lockheed Propulsion Co. Redlands, Calif.	Launch escape motor and pitch control motor	10,011,582
Marquardt Corp. Van Nuys, Calif.	SM reaction control engines	37,894,790
McGraw Edison Daven Division Livingston, N.J.	Rotary switches	1,454,263
Metals & Controls, Inc. A Division of Texas Instruments, Inc. Hollywood, Calif.	Toggle switches	931,585
Microdot, Inc. Instrumentation Division South Pasadena, Calif.	Stress measurement system	1,447,098
Motorola, Inc. Military Electronics Division Scottsdale, Ariz.	Link, digital system, spare parts for up-data link equipment, test equipment, pseudo-random noise ranging test set and digital test command system	13,155,449
National Water Lift Co., Div. Pneumo Dynamics Kalamazoo, Mich.	Solenoid latching valves	1,987,153
Northrop Corp. Ventura Division Newberry Park, Calif.	Earth landing subsystem (parachute canopies) and associated GSE, intercommunication system, pressure measurement system, and ordnance assemblies	51,906,846
Opcalite Santa Ana, Calif.	Panels	1,185,377
Parker Aircraft Los Angeles, Calif.	Cryogenic valve modules	1,742,463
Philco Corp. Western Development Lab. Palo Alto, Calif.	Nuclear particle detection system	1,756,522

Company	Product	Value
Radiation, Inc. Melbourne, Fla.	Single-channel decommutator and time accumulator display (CM) and data processing system	$ 3,529,000
Radio Corpporation of America Astro Division Princeton, N.J.	Television equipment	4,216,038
Remanco, Inc. Santa Monica, Calif.	Rocket engine test set	1,000,000
Rosemount Engineering Co. Minneapolis, Minn.	Transducers and mass flowmeter	1,260,000
Sargent Industries (Formerly Electrada Corp.) El Segundo, Calif.	Pressure vessel	1,335,296
Sciaky Brothers, Inc. Chicago, III.	Design, fabrication and installation on weld fixtures for Apollo; heavy duty positioners and carriage fixtures	1,729,000
Scientific Data Systems Santa Monica, Calif.	Real-time simulation system	936,119
Simmonds Precision Products Vergennes, Vt.	Propellant quantity indicating and mixture control system	19,350,154
Stratos Div., Fairchild Stratos Corporation Manhattan Beach, Calif.	Reaction control subsystem helium regulators	1,169,072
Systems Engineering Laboratories, Inc. Ft. Lauderdale, Fla.	Channel data	717,767
Thiokol Chemical Corp. Elkton, Md.	Tower jettison motor	4,550,145
Transco Products, Inc. Venice, Calif.	Telemetry antenna system (R&D)	1,260,000
United Aircraft Pratt & Whitney Aircraft Hartford, Conn.	Fuel cell powerplants	81,123,482
Weber Aircraft Burbank, Calif.	Apollo foldable crew couch system	2,200,000
Westinghouse Electric Corp. Aerospace Electrical Division Lima, Ohio	Static inverters	8,060,695
Weston Instruments, Inc. Newark, N.J.	Electrical indicating meters	2,026,579

CSM CONTRACT

Value of the North American Rockwell Space Division contract with NASA's Manned Spacecraft Center on the Apollo program is approximately $2,996,000,000 ($2 billion, 996 million) as of February 3, 1968. The total is expected to approach $3.3 billion by July 31, 1970.

The Apollo contract is for development and fabrication of 49 manned or test spacecraft command and service modules, 30 boilerplate (engineering test) vehicles, and 23 full-scale mockups, as well as production of accompanying spacecraft-LM adapters, 5 test fixtures, 4 Apollo mission simulators, 3 evaluators, 5 trainers, 2 miscellaneous spacecraft-LM adapters, and tracking and ground support equipment.

The following lists of major end items produced by the Space Division under the Apollo contract is separated into spacecraft, boilerplates, mockups and other items. The numbers (internal designation) are those assigned to each item by North American Rockwell for development and fabrication purpose. The numbers are not consecutive. For example, the list skips from SC 002 to SC 004. In cases such as this, the contract originally called for a SC 003, but the vehicle later was deleted. Any number missing in a sequence was originally in the contract, but later was deleted. A letter designation following a spacecraft number (i.e., SC 002A) indicates a general refurbishment and re-use of that spacecraft).

The use, site, and plan shown for each item is that planned at the time of printing; all of these are subject to change.

SPACECRAFT – BLOCK II

No.	Units	Use	Site	Remarks
2TV-1	CM SM	Thermal-vacuum tests	MSC	Docked mode test; "pogo" test
105AV	CM SM LES SLA #2	Acoustic test	MSC	
101	CM SM LES SLA #5	Manned flight	KSC	First manned flight
102	CM SM LES SLA #6	Pad 34 checkout	Downey	Structure refurbished
103 to 119 (Excluding 105)	CM SM LES SLA	Manned flights		

SPACECRAFT – BLOCK I

001	SM	Propulsion tests	WSTF	Tests completed 9-7-68
002	CM SM	Power-on tumbling abort		Modified to SC 002A. Tested 1-20-66; not recovered

SPACECRAFT – BLOCK I

No.	Units	Use	Site	Remarks
	LES			Tested 1-20-66; not recovered
002A	CM	Land drop		Mission cancelled; modified to SC 002B
002B	CM	Land drop	Downey	Assigned to "pogo" test
004	CM SM	Structural test		Modified to SC 004B
004B	CM	Unified hatch model	Downey	
004A	CM	Static & thermal structural test	Downey	In storage
006	CM SM LES	System compatibility	AiResearch, Los Angeles	Block II ECS tests Reassigned as SM 010 Reassigned to BP-14
007	CM SM	Water tests	MSC	Modified to SC 007A Fitcheck of docked model facility
007A	CM	Post-landing tests	MSC	
008	CM SM	Environmental proof test	Downey	Modified to SC 008A In storage
008A	CM	Land tests	Downey	
009	CM SM LES SLA #3	Unmanned reentry flight		Modified to SC 009A Not recovered Not recovered Not recovered
009A	CM	Land impact	Downey	Modified to support structural test
010	CM SM LES	Pad abort		Mission cancelled; modified to SC 004A Not completed Not completed
011	CM SM LES SLA #4	Unmanned reentry flight		Modified to SC 011A Not recovered Not recovered Not recovered
011A	CM	Land impact test	MSC	

SPACECRAFT – BLOCK I

No.	Units	Use	Site	Remarks
012	CM	Was to be first manned flight	Langley Research Center	Damaged
	SM		Downey	In storage
	LES		KSC	
	SLA #5		KSC	Modified for use with SC 101
014	CM	Was to be manned flight		Modified to SC 014A
	SM			Launched on Apollo 6; not recovered
	LES		MSFC	
	SLA #6		Tulsa	Modified for use with SC 103
014A	CM	Land test	MSC	
017	CM	Unmanned reentry (Apollo 4)	Downey	Launched 11/67; slated for Smithsonian Institution
	SM			Damaged by explosion; replaced by SM 020
	LES			Not recovered
	SLA #8			Not recovered
020	CM	Unmanned reentry (Apollo 6)	Downey	Post-recovery test
	SM			Launched on Apollo 4; not recovered
	LES			Launched, not recovered
	SLA #9			Launched, not recovered
2S-1	CM	Impact test		Modified to 2S-1A
2S-1A	CM	Water & land test		Modified to 2S-1C
2S-1C	CM	Water & land test	MSC	
2S-2	CM	Static structural test	Downey	
	SM		Downey	
SLA #7	SLA	LM-1 flight		Launched; not recovered
SLA #7A	SLA	LM-2 flight	KSC	Assigned to "pogo" test

BOILERPLATES

BP-1	CM	Land & water impact tests	MSC	
BP-2	CM	Land & water impact tests	MSC	
BP-3	CM	Parachute recovery		Tested 9-6-63; not recovered

BOILERPLATES

No.	Units	Use	Site	Remarks
BP-6	CM	Pad abort		Modified to B-6A
	LES	Pad abort		Tested in launch 11-7-63; not recovered
BP-6A	CM	Parachute recovery		Modified to B-6B
BP-6B	CM	Parachute recovery		Modified to B-6C
BP-6C	CM	Parachute recovery	El Centro	
BP-9	CM	Dynamic test		Modified to B-9A
	SM			
	LES			
BP-9A	CM	Micrometeoroid flight		Launched on Pegasus 7-25-65; not recovered
	SM	Micrometeoroid flight		
	LES	Micrometeoroid flight		
BP-12	CM	Transonic abort		Modified to B-12A
	SM	Transonic abort		Tested 5-13-64; not recovered
	LES	Transonic abort		Tested 5-13-64; not recovered
BP-12A	CM	Water impact tests		Planned for display
BP-13	CM	Booster & launch environ-		Launched 5-28-64; not
	SM	ment compatibility		recovered
	LES			
BP-14	CM	House spacecraft-Block I	Downey	
	SM		NR Storage	
	LES			Assigned to BP-23A
BP-15	CM	Booster & launch environ-		Launched 9-18-64; not
	SM	ment compatibility		recovered
	LES			
BP-16	CM	Booster, flight		Launched 2-16-65; not
	SM	compatibility		recovered
	LES			
BP-18	CM	Structural qualification		CM transferred to BP-30
BP-19	CM	Parachute recovery		Modified to BP-19A
BP-19A	CM	Parachute test Vehicle	Northrup-Ventura	Backup for BP-6C
BP-22	CM	High-Altitude abort	MSC	
	SM	High-Altitude abort		Tested 5-19-65; not recovered
	LES	High-Altitude abort		Tested 5-19-65; not recovered
BP-23	CM	High-Q abort		Modified to BP-23A
	SM	High-Q abort		Tested 12-8-64; not recovered
	LES	High-Q abort		Tested 12-8-64; not recovered

BOILERPLATES

No.	Units	Use	Site	Remarks
BP-23A	CM LES	Pad abort Pad abort	MSC	Tested 6-27-65; not recovered
BP-25	CM	Water recovery and handling equipment tests	MSC	
BP-26	CM SM LES	Micrometeoroid flight		Used in Pegasus launch 5-25-65; not recovered
BP-27	CM SM LES SLA #1	Dynamic tests Dynamic tests Dynamic tests Dynamic tests	MSFC MSFC MSFC MSFC	SM 010 (former SM 006)
BP-28	CM	Land impact tests		Modified to BP-28A
BP-28A	CM	Earth landing tests	MSC	
BP-29	CM	Flotation tests		Modified to BP-29A
BP-29A	CM	Flotation tests	MSC	
BP-30	CM SM (015) LES (014) SLA #10	Unmanned LM test Unmanned LM test Unmanned LM test Unmanned LM test	MSC KSC KSC MSC	Backup for SC 020; to return to MSFC Tests with SC 102
BP-1224-1	CM	Flammability tests	MSC	
BP-1250C	CM	Flammability tests	Downey	Cabin pressure vent valve tests

MOCKUPS, TRAINERS, SIMULATORS

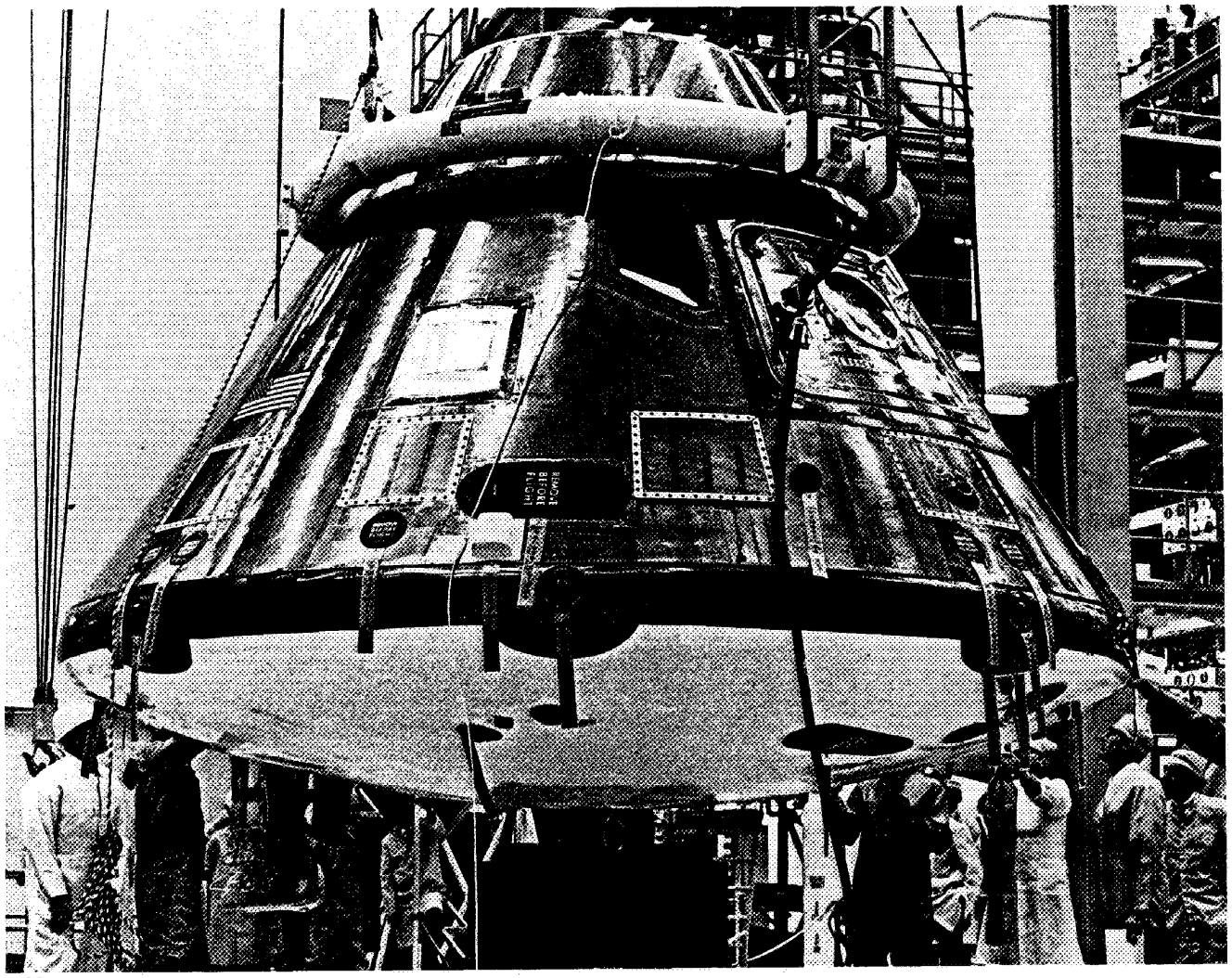
M-2	CM	Interior arrangement	KSC	Modified to KSC-E
M-3	CM	Interior arrangement	KSC	
M-4	SM (Partial)	Interface studies		Excess - disposed 1-67.
M-5	CM	Exterior arrangement	NR Storage	
M-7	SM	Design studies	MSC	
M-8	CM	Airlock & docking	NR Storage	
M-9	CM	Handling & transportation studies	Tulsa	GSE checkout

MOCKUPS, TRAINERS, SIMULATORS

No.	Units	Use	Site	Remarks
	SM		KSC	Part of M-11 as launch verification vehicle
	LES			Used in first Little Joe launch; not recovered
M-11	CM	Handling & transportation studies	KSC	Launch verification article
	SM		Tulsa	GSE checkout
	LES		KSC	Supported SC 009 launch
M-12	CM (Partial)	Crew support studies		Modified to M-12A
M-12A	CM (Partial)	Lighting studies	Downey	
M-18	CM	System interface		Modified to MSC-1
	SM		Downey	Mockup display
	LES		NR Storage	
	SLA		KSC	Grumman use
M-22	CM	Interior & exterior arrangement		Modified to MSC-2; SC 103 configuration
M-23	CM (Partial)	Umbilical tests	MSFC	Updated to latest configuration 7-7-67
	SM (Partial)		MSFC	
	LES (Partial)		MSFC	
M-24	CM	Engineering & Manufacturing studies	Downey	Wiring and tubing mockup
M-25	SM	Engineering & manufacturing studies	Downey	Wiring and tubing mockup
M-26	CM	Lower equipment bay	NR Storage	
M-27	CM	Forward compartment	Downey	
M-27A	Docking system	Studies	Downey	Updated to Block II configuration M-27B)
M-27B	Docking System	Studies	Convair, San Diego	Block II; to be shipped to MSC
M-28	CM	Crew compartment reviews	Downey	Converted from CM-B
MSC-1	CM	Configuration review (SC 101)	Downey	Converted from M-18

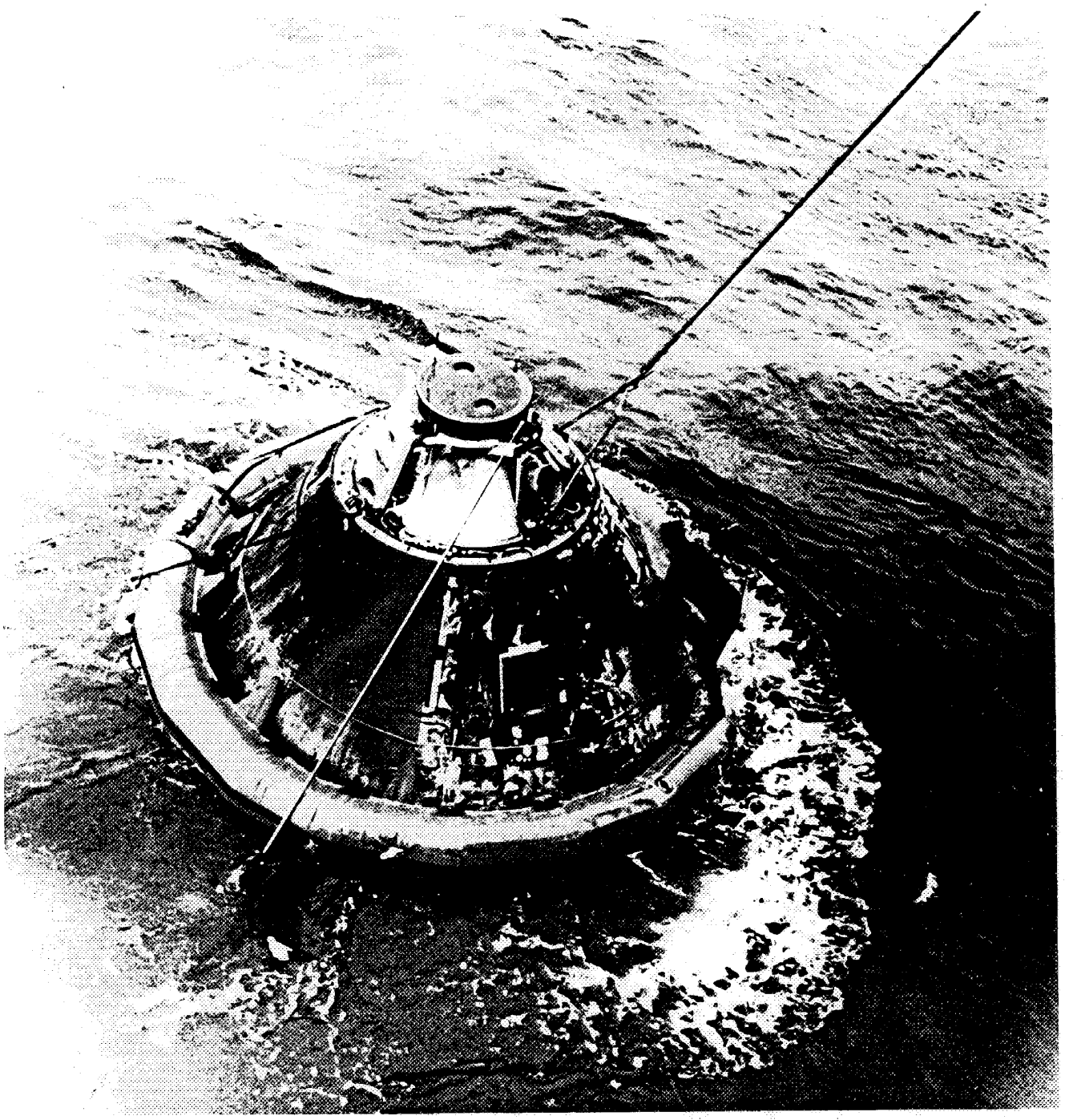
MOCKUPS, TRAINERS, SIMULATORS

No.	Units	Use	Site	Remarks
MSC-2	CM	Configuration review (SC 103)	MSC	Converted from M-22
KSC-E	CM	Ingress-egress trainer	KSC	Modified from M-2
180/CM/MU	CM (Partial)	Sun interference evaluation	MSC	
CM-A	CM	Engineering simulator	MSC	
CM-B	CM	Engineering simulator	Downey	Converted to a mockup
AMS-1		Mission simulator	MSC	Modified to SC 103 configuration
AMS-2		Mission simulator	KSC	Modified to SC 101 configuration



P-299a

Spacecraft command module for first manned flight readied for shipment



P-300

Frogmen secure helicopter lines to command module after successful entry from space flight

BIOGRAPHICAL SUMMARIES

NASA HEADQUARTERS

JAMES E. WEBB – Administrator of National Aeronautics and Space Administration since 1961. Former Director of Bureau of the Budget and former Under Secretary of State. Was Vice President of Sperry Gyroscope Co., Chairman of Board of Republic Supply Co., Director of Kerr-McGee Oil Industries, Inc., and Director of McDonnell Aircraft Co. Born Oct. 7, 1906, in Granville County, N.C. Received education degree from University of North Carolina in 1928 and studied law at George Washington University.

DR. GEORGE E. MUELLER–Associate Administrator in NASA Office of Manned Space Flight. Assumed direction of manned space program in September, 1963. Born July 16, 1918, in St. Louis, Mo. Graduated from Missouri School of Mines in 1939. Holds master's in electrical engineering from Purdue University. Worked at Bell Telephone Laboratories until 1946 when he joined the faculty at Ohio State. Earned Ph.D. in physics in 1951.

SAMUEL C. PHILLIPS–Lt. General on assignment to NASA from the Air Force. Was appointed Director of the Apollo lunar landing program in 1964. Born Feb. 19, 1921, in Springerville, Arizona. Graduated from the University of Wyoming in 1943, holds master's in electrical engineering from University of Michigan. Has an extensive background in ballistic missile systems, including service as Director of Minuteman program.

NASA MANNED SPACECRAFT CENTER

DR. ROBERT R. GILRUTH–Director of the Manned Spacecraft Center since its creation in 1961. Born Oct. 8, 1913, in Nashwauk, Minn. Graduated in 1935 from University of Minnesota. Started at NACA Langley Research Center in 1937 in Flight Research Division. Selected by NACA in 1945 to establish organization and facilities for conducting free-flight experiments with rocket-powered models at supersonic speeds. Named assistant director of Langley Laboratories in 1952. In 1958 was named director of NASA's Space Task Group, which later was reorganized as Manned Spacecraft Center.

GEORGE M. LOW–Manager of Apollo Spacecraft Program since April 1967. Formerly Deputy Director of Manned Spacecraft Center, Deputy Associate Administrator for Manned Space Flight at NASA Headquarters. Chairman of committee which performed original studies leading to manned lunar program. Joined NACA (NASA predecessor) at Lewis Research Center in 1949. Born June 10, 1926, in Vienna, Austria. Graduate of Rensselaer Polytechnic Institute and has master's from RPI. Holds NASA's Outstanding Leadership Medal.

CHRISTOPHER C. KRAFT, JR.–Director of Flight Operations. Formerly Chief of Flight Operations Division. Joined NACA at Langley Research Center in 1945. Born Feb. 28, 1924, in Phoebus, Va. Graduated from Virginia Polytechnic Institute. Holds NASA Distinguished Service Medal, Arthur S. Fleming Award.

KENNETH S. KLEINKNECHT—Manager for Command and Service Modules, Apollo Spacecraft Program. Formerly Deputy Manager of Gemini program and Manager of Mercury Project Office. Joined NACA at Lewis Research Center in 1942, also served at Flight Research Center at Edwards Air Force Base. Born July 24, 1919, in Washington, D.C. Graduated from Purdue University.

NASA MARSHALL SPACE FLIGHT CENTER

DR. WERNHER VON BRAUN—Director of George C. Marshall Space Flight Center, Huntsville, Ala., since its formation in 1960. Director of Army missile development agencies in Redstone Arsenal at Huntsville since 1950. Began his work in rocket field in 1930 (at 18) while at Berlin Institute of Technology. Began full-time research of rocketry in 1934 under sponsorship of German government and from 1937 to 1945 was technical director of Army portion of Peenemuende rocket center where V-2 and antiaircraft guided missiles were developed. Came to United States in 1945 and became U.S. citizen in 1955. Born March 23, 1912, in Wirsitz, Germany. Graduated 1932 from Berlin Institute of Technology and received Ph.D. in 1934.

EDMUND F. O'CONNOR—Director, Industrial Operations, at Marshall Space Flight Center. Brigadier General on special duty to NASA from the Air Force. Technical and administrative manager of Saturn launch vehicle programs and of MSFC's Michoud Assembly Facility at New Orleans and the Mississippi Test Facility. Previously Deputy Director of Air Force's Ballistic Systems Division. Born March 31, 1922, in Fitchburg, Mass. Graduated from the U.S. Military Academy.

NASA KENNEDY SPACE CENTER

DR. KURT H. DEBUS—Director of Kennedy Space Center. Came to United States in 1945 as part of Dr. Von Braun's original group at Fort Bliss, Texas. Supervised development and construction of launch facilities at Cape Kennedy for Redstone, Jupiter, Juno, and Pershing Missiles beginning in 1952. Directed design, development, and construction of NASA's Apollo/Saturn launch facilities. He launched first U.S. ballistic missile (Redstone) and directed launch operations of first U.S. satellite (Explorer I). Born Nov. 29, 1908, in Frankfurt, Germany. Received initial and advanced degrees from Darmstadt University, and honorary Doctor of Laws degree from Rollins College.

MILES ROSS—Deputy Director for Operations at Kennedy Space Center. Responsible for engineering and technical operations at KSC. Joined NASA in September 1967. Previously was project manager for Air Force Thor and Minuteman missile systems for TRW, Inc. Born in New Brunswick, N.J. Holds degrees in mechanical engineering and engineering administration from MIT.

ROCCO A. PETRONE—Director of Launch Operations at Kennedy Space Center. Previously Apollo Program Manager at KSC. Lieutenant Colonel in Army; joined NASA in 1960 from Army General Staff. While with Army participated in development of Redstone missile at Huntsville. Graduated from U.S. Military Academy and has master's degree from MIT. Born March 31, 1926, in Amsterdam, N.Y.

R.Q. MIDDLETON—Apollo Program Manager at Kennedy Space Center. Rear Admiral on assignment to NASA from Navy. Formerly Deputy Director for Mission Operations in Office of Manned Space Flight and a mission director in Apollo/Saturn program. Before joining NASA was commanding officer of USS Little Rock and USS Observation Island, chief of staff of Carrier Division 14, and commander of Destroyer Division 142. Born Jan. 23, 1919, in Pomona, Fla. Graduated from U.S. Naval Academy and has master's degree from Harvard. Promoted to Rear Admiral in July, 1967.

NORTH AMERICAN ROCKWELL

J.L. ATWOOD—President and Chief Executive Officer of North American Rockwell Corp. Was Chairman of Board of North American Aviation from 1962 until its merger with Rockwell-Standard Corp. in 1967 and President of NAA since 1948. Joined NAA in 1934 as Chief Engineer and Vice President, became Assistant General Manager in 1938 and First Vice President in 1941. Born Oct. 26, 1904. Graduated from Hardin-Simmons University in 1926 and the University of Texas in 1928. Holds honorary doctor's degree and is recipient of many industry and government awards.

WILLARD F. ROCKWELL, JR.—Chairman of the board of North American Rockwell Corp. Was president of Rockwell-Standard Corporation before its merger with North American Aviation, Inc. Previously President of Rockwell Manufacturing Company. Was on Rockwell-Standard board since 1940. Born March 3, 1914. Holds engineering degree from Pennsylvania State University.

JOHN R. MOORE—President of Aerospace and Systems Group of North American Rockwell Corp. Also Vice President of corporation and member of board. Was Executive Vice President of North American Aviation and, earlier, President of company's Autonetics Division. Born July 5, 1916, in St. Louis. Received engineering degree from Washington University (St. Louis). Holds many awards, including U.S. Navy's Meritorious Public Service Citation and Thurlow Navigation Award as "navigation's man of the year" in 1961.

WILLIAM B. BERGEN—President of North American Rockwell's Space Division since April 1967 and Vice President of corporation. Formerly Vice President of corporation's Space and Propulsion Group. Formerly President of Martin Co., which he joined in 1937. Born March 29, 1915, in Floral Park, N.Y. Graduated from Massachusetts Institute of Technology in 1937. Holds many awards, including Lawrence Sperry Award of Institute of Aeronautical Sciences for aircraft work during World War II and NASA's Public Service Award for contributions to Gemini program.

DALE D. MYERS—Vice President of Space Division since 1960 and Apollo Program Manager. Formerly Program Manager for Hound Dog missile. Background includes aerodynamic and thermodynamic work with missile studies. Born Jan. 8, 1922. Graduated from the University of Washington in 1943.

ROBERT E. GREER—Vice president of Space Division and Saturn S-II (second stage) Program Manager. Joined Space Division in 1965 as Assistant to President and became S-II Program Manager later that year. Formerly Major General in Air Force; among his posts were Director of Special Projects. Deputy Commander for Satellite Programs, and Chief of Staff for Guided Missiles. Born Aug. 7, 1915, in Orange, Calif. Graduated from U.S. Military Academy and later taught electrical engineering at Academy. Also served on faculty at Air War College.

BASTIAN (BUZ) HELLO—Vice President of Space Division for Launch Operations since May 1967. Formerly Director of Maneuverable Spacecraft Programs for Martin Marietta Corp. and Program Director for Air Force Gemini-Titan II launch vehicle. Born Aug. 29, 1923, in Philadelphia. Graduated from University of Maryland in 1947. Received NASA's Public Service Award in 1966 for contributions to Gemini program.

ASTRONAUTS

APOLLO 7 PRIME CREW

WALTER M. SCHIRRA, JR. (Commander)—One of the original seven astronauts. Flew 6-orbit, 9-hour mission in Sigma 7 Mercury spacecraft and was command pilot of Gemini VI mission, which achieved space "first" in rendezvous with orbiting Gemini VII. In both missions was brought aboard recovery ship with his spacecraft. Graduated from U.S. Naval Academy in 1945. Captain in Navy. Flew 90 combat missions in Korea on exchange status with Air Force. Received 2 Distinguished Flying Crosses and 2 Air Medals for Korean service. Born March 12, 1923, in Hackensack, N.J.

DONN F. EISELE (CM Pilot)—Named in third group of astronauts in October 1963. Major in Air Force. Project engineer and experimental test pilot at Kirtland Air Force Base, N.M., flying jets in support of special weapons development. Born June 23, 1930, in Columbus, Ohio. Graduated from the U.S. Naval Academy in 1952 and has master's from U.S. Air Force Institute of Technology.

WALTER CUNNINGHAM (LM Pilot)—Named in third group of astronauts in October 1963. Was research scientist with Rand Corp. working on classified defense studies and problems of earth's magnetosphere. At UCLA, where he received bachelor's and master's degrees, he developed a magnetometer which was flown aboard NASA's first Orbiting Geophysical Observatory satellite. Flew as Marine pilot and was Marine reservist with rank of Major until 1965. Born March 16, 1932, in Creston, Iowa.

APOLLO 7 BACKUP CREW

THOMAS P. STAFFORD (Commander)—Selected in second group of astronauts in 1962, he flew in Gemini 6 flight and participated in first space rendezvous. Served as command pilot of Gemini 9 three-day flight in which spacecraft performed 3 different types of rendezvous with target vehicle. Has logged nearly 100 hours in space in 2 flights. Born Sept. 17, 1930, in Weatherford, Okla. Graduated from U.S. Naval Academy and entered Air Force; is Lieutenant Colonel. Instructor and chief of Performance Branch of Air Force Aerospace Research Pilot School and author of textbooks on performance flight testing.

JOHN W. YOUNG (CM Pilot)—Selected in second group of astronauts in 1962.

Pilot of first manned Gemini flight and command pilot of Gemini X, in which Gemini rendezvoused and docked with Agena target, changed orbit, and rendezvoused with another Agena. Born Sept. 24, 1930, in San Francisco. Graduated from Georgia Institute of Technology in 1952. Commander in Navy. Formerly test pilot at Naval Air Test Center and set world time-to-climb records.

EUGENE A. CERNAN (LM Pilot)—Selected in third group of astronauts in 1963 and served as pilot in Gemini flight with Stafford. Born March 14, 1934, in Chicago. Graduated from Purdue University and has master's from U.S. Naval Postgraduate School. Commander in Navy. Served in attack squadrons in Navy.

APOLLO 7 SUPPORT CREW

JOHN L. SWIGERT, JR.—Selected as astronaut in 1966, formerly engineering test pilot for North American Aviation and research engineering test pilot for Pratt and Whitney. Received Octave Chanute Award from AIAA for work on space vehicle landing system. Born Aug. 30, 1931, in Denver. Graduated from University of Colorado in 1953 and has masters from Rensselaer Polytechnic Institute and from University of Hartford. Served as fighter pilot in Air Force.

RONALD E. EVANS—Selected as astronaut in 1966. Lieutenant Commander in Navy, served as pilot on aircraft carrier in Vietnam combat operations. Born Nov. 10, 1933, in St. Francis, Kan. Graduated from University of Kansas in 1956 and has master's from U.S. Naval Postgraduate School. Holds 8 Air Medals, Vietnam Service Medal, and Navy Commendation Medal.

WILLIAM R. POGUE—Selected as astronaut in 1966. Air Force Major. Formerly instructor at Air Force Aerospace Research Pilot School at Edwards Air Force Base and math instructor at Air Force Academy. Test pilot for British Ministry of Aviation in exchange program. Flew 43 combat missions in Korean War. Born Jan. 23, 1930, in Okemah, Okla. Graduated from Oklahoma Baptist University and has master's from Oklahoma State University. Holds several Air Force decorations.

2ND APOLLO PRIME CREW

FRANK BORMAN (Commander)—Selected in second group of astronauts, in September 1962, and was command pilot of Gemini VII, the longest manned space flight (330 hours and 35 minutes) and during which the first space rendezvous occurred, between Gemini VII and Gemini VI. Colonel in the Air Force. Was instructor at USAF Aerospace Research Pilots School. Born Gary, Ind., March 14, 1928. Graduate of U.S. Military Academy and has Master of Science degree in aeronautical engineering from Caltech.

JAMES A. LOVELL, JR. (CM Pilot)—Selected in second group of astronauts, in September 1962. Flew Gemini VII mission with Frank Borman, which was longest space mission (330 hours and 35 minutes) and during which there was the first space rendezvous, between Gemini VII and Gemini VI. Was command pilot on Gemini 12 mission. Captain in Navy. Was test pilot at Naval Air Test Center, Patuxent River, Md. Born in Cleveland, Ohio, March 25, 1928. Graduate of United States Naval Academy.

WILLIAM A. ANDERS (LM Pilot)—Chosen in third group of astronauts, in October 1963. Born in Hong Kong, October 17, 1933. Was nuclear engineer and instructor pilot at Air Force Weapons Laboratory at Kirtland Air Force Base, N.M. Graduate of U.S. Naval Academy and has Masters Degree in nuclear engineering from Air Force Institute of Technology. Major in Air Force.

2ND APOLLO BACKUP CREW

NEIL A. ARMSTRONG (Commander)—Named in second group of astronauts, in September, 1962, and was first civilian to fly in space. Was command pilot of Gemini VIII, which saw the first docking of spacecraft. Was naval aviator and flew 78 combat missions in Korea. Was aeronautical research pilot at NASA High Speed Flight Station, Edwards Air Force Base, Calif., and flew the X-15 at altitude greater than 200,000 feet and speed of about 4000 mph. Born Wapakoneta, Ohio, Aug. 5, 1930. Graduate of Purdue University. Received 1962 Institute of Aerospace Sciences Octave Chanute Award.

EDWIN E. ALDRIN, JR. (CM Pilot)—Selected in third group of astronauts, in October, 1963. Has Doctor of Science degree in astronautics from Massachusetts Institute of Technology. Was pilot of Gemini XII mission and conducted EVA. Lieutenant Colonel in Air Force. Worked in Gemini Target Office of the Air Force Space Systems Division, Los Angeles, Calif., and at the USAF Field Office at the Manned Spacecraft Center. Flew 66 combat missions in Korea and received Distinguished Flying Cross. Born in Montclair, N.J., Jan. 20, 1930. Graduate of the U.S. Military Academy (third in his class).

FRED W. HAISE, JR. (LM Pilot)—Selected for astronaut training in April 1966. Research pilot at the NASA Flight Research Center at Edwards, California. Now a civilian, he was military pilot in Marine Corps, Air Force, and Oklahoma Air National Guard. Born in Biloxi, Miss., Nov. 14, 1933. Was graduated from University of Oklahoma.

2ND APOLLO SUPPORT CREW

THOMAS K. MATTINGLY II—Selected for astronaut training in April 1966. Born in Chicago, March 17, 1936. Graduate of Auburn University. Lieutenant Commander in Navy. Is unmarried. Was student at Air Force Aerospace Research Pilots School. Flew carrier aircraft before that.

GERALD P. CARR—Selected for astronaut training in April 1966. Born in Denver, Aug. 22, 1932. Graduate of the University of Southern California, and has Master of Science degree in aeronautical engineering from Princeton University. Major in Marine Corps. Was with Marine air control squadron.

VANCE D. BRAND—Selected for astronaut training in April 1966. Born in Longmont, Colo., May 9, 1931. Holds degrees in business and aeronautical engineering from University of Colorado and a Master of Science degree in business administration from UCLA. Served as a jet pilot in Marine Corps and later as flight test engineer and experimental test pilot for Lockheed Aircraft Corp. Graduated from U.S. Naval Test Pilot School at Patuxent River, Md.

3RD APOLLO PRIME CREW

JAMES A. McDIVITT (Commander)—Named in second group of astronauts in September 1962. Was command pilot for Gemini IV, the 66-orbit, four-day mission from June 3-7, 1965, on which Edward H. White II made first "walk in space." Lieutenant Colonel in Air Force. Flew 145 combat missions during Korean War and received 4 Distinguished Flying Crosses, 5 Air Medals, and a South Korean medal. Later served as experimental test pilot at Edwards Air Force Base in California. Born June 10, 1929, in Chicago. Graduated from University of Michigan.

DAVID R. SCOTT (CM Pilot)—One of third group of astronauts named in October, 1963. Was pilot in Gemini VIII, which achieved first space docking. Lieutenant Colonel in Air Force. Served as research and test pilot in Air Force. Born June 6, 1932, in San Antonio, Texas. Graduated from U.S. Military Academy and has master's and engineering degrees from Massachusetts Institute of Technology.

RUSSELL L. SCHWEICKART (LM Pilot)—One of the third group of astronauts named in October, 1963. Served in Air Force and Air National Guard from 1956 to 1963. Research scientist at Experimental Astronomy Laboratory at MIT, working on upper atmosphere physics, applied astronomy, star tracking, and stabilization of star images. Born Oct. 25, 1935, in Neptune, New Jersey. Holds Bachelor and Master of Science degrees from MIT.

3RD APOLLO BACKUP CREW

CHARLES CONRAD, JR. (Commander)—Selected in second group of astronauts, in September 1962. Flew, with Gordon Cooper, in Gemini V the first extended manned space flight (127 orbits, 190.9 hours, August, 1965). Was command pilot for the 3-day Gemini XI mission and executed rendezvous and docking in less than one orbit. Commander in the Navy. Was project test pilot at Navy Test Pilot School, Patuxent River, Maryland, and also flight instructor and performance engineer at the school. Born in Philadelphia, Pa., June 2, 1930. Was graduated from Princeton University.

RICHARD F. GORDON, JR. (CM Pilot)—Named in third group of astronauts, in October, 1963. Was pilot for Gemini XI mission and conducted extravehicular activity. Commander in Navy. Was project test pilot for F4H Phantom II and test pilot for other naval aircraft. Born in Seattle, Wash., Oct. 5, 1929. Graduate of University of Washington.

ALAN L. BEAN (LM Pilot)—Named in third group of astronauts, October 1963. Lieutenant Commander in Navy. Attended Navy Test Pilot School, Patuxent River, Maryland. Born in Wheeler, Tex., March 15, 1932. Was graduated from University of Texas.

3RD APOLLO SUPPORT CREW

ALFRED M. WORDEN—One of 19 astronauts selected in April 1966. Major in Air Force. Was instructor at Aerospace Research Pilots School, and is a graduate of the Empire Test Pilots School, in Farnborough, England. Born in Jackson, Mich., Feb. 7, 1932. Graduate of U.S. Military Academy and has Master of Science degree in astronautical and aeronautical engineering and instrumentation engineering from the University of Michigan.

EDGAR D. MITCHELL—Selected for astronaut training in April, 1966. Has Doctor of Science degree in aeronautics/astronautics from Massachusetts Institute of Technology. Commander in Navy. Was graduated first in his class from Air Force Aerospace Research Pilot School. Was Chief, Project Management Division, of the Navy Field Office for Manned Orbiting Laboratory. Born in Hereford, Tex., Sept. 17, 1930. Was graduated from Carnegie Institute of Technology and U.S. Naval Postgraduate school.

JACK R. LOUSMA—Selected with 18 others for astronaut training in April 1966. Born in Grand Rapids, Mich., Feb. 29, 1936. Graduate of University of Michigan and of U.S. Naval Postgraduate School, with degrees in aeronautical engineering. Served as Marine Corps pilot from 1959 until his assignment to astronaut program.

APOLLO CHRONOLOGY

1960

July 29 - Project Apollo, an advanced spacecraft program to land men on the moon, was announced by NASA.

Oct. 25 - NASA selected General Dynamics, General Electric, and Martin to conduct individual feasibility studies of an advanced manned spacecraft as part of the Apollo project.

1961

Jan. - NASA studies, by a committee headed by George Low (present Apollo spacecraft program manager), of a manned lunar-landing program were completed. Both a direct-ascent trajectory using large Nova-type launch vehicles and an earth-orbit rendezvous technique using Saturn-type launch vehicles were considered.

May 15 - Final reports on Project Apollo study contracts were submitted by General Dynamics, GE, and Martin.

May 25 - President Kennedy presented a plan to Congress for accelerating the space program based on a national goal of landing a man on the moon before the end of the decade.

July 28 - NASA issued a request for proposal to 12 companies for development of the Apollo spacecraft.

Aug. 9 - NASA selected MIT's Instrumentation Laboratory to develop the guidance and navigation system for the Apollo spacecraft.

Sept. 19 - NASA announced that the recently established Manned Spacecraft Center would be located at Houston, Tex.

Nov. 28 - NASA announced that a contract had been awarded to North American's Space Division for the Apollo spacecraft program.

Dec. 21 - The first four major Apollo subcontractors were announced: Collins Radio, telecommunications systems; Garrett Corporation's AiResearch Division, environmental control equipment; Honeywell Inc., the stabilization and control system; and Northrop Corporation's Ventura Division, parachute earth landing system.

1962

Jan. 22 - The first Apollo engineering order was issued, for fabrication of the first mockups of the Apollo command and service modules.

Feb. 9 - NASA announced that GE had been awarded a contract to provide integration analysis of the total Apollo space vehicle, including launch vehicle and spacecraft, to assure reliability of the entire system. GE was also named to develop and operate equipment to check out the Apollo systems.

Feb. 13 - Lockheed Propulsion Company was selected to design and build the solid-propellant launch-escape motor for Apollo.

Mar. 2 - Marquardt Corp. was selected to design and build the reaction-control rocket engines for the Apollo spacecraft.

Mar. 3 - Aerojet-General Corp. was named as subcontractor for the Apollo service propulsion system.

Mar. 9 - Pratt and Whitney was selected to build the Apollo fuel cell.

Mar. 23 - Avco Corp. was selected to design and install the ablative material on the spacecraft outer surface.

April 6 - Thiokol Chemical Corp. was selected to build the solid-propellant rocket motor to be used to jettison the Apollo launch escape tower.

July 11 - NASA announced that the lunar rendezvous mode would be used for the moon mission. This new plan called for development of a two-man lunar module to be used to reach the surface of the moon and return the astronauts to the lunar-orbiting command module. NASA administrator James Webb said this method was the most desirable from the standpoint of "time, cost, and mission accomplishment."

July 16 - Beech Aircraft Corp., was selected to build the spacecraft storage tanks for supercritical gases.

Aug. 22 - The length of the Apollo service module was increased from 11 feet 8 inches to 12 feet 11 inches to provide space for additional fuel.