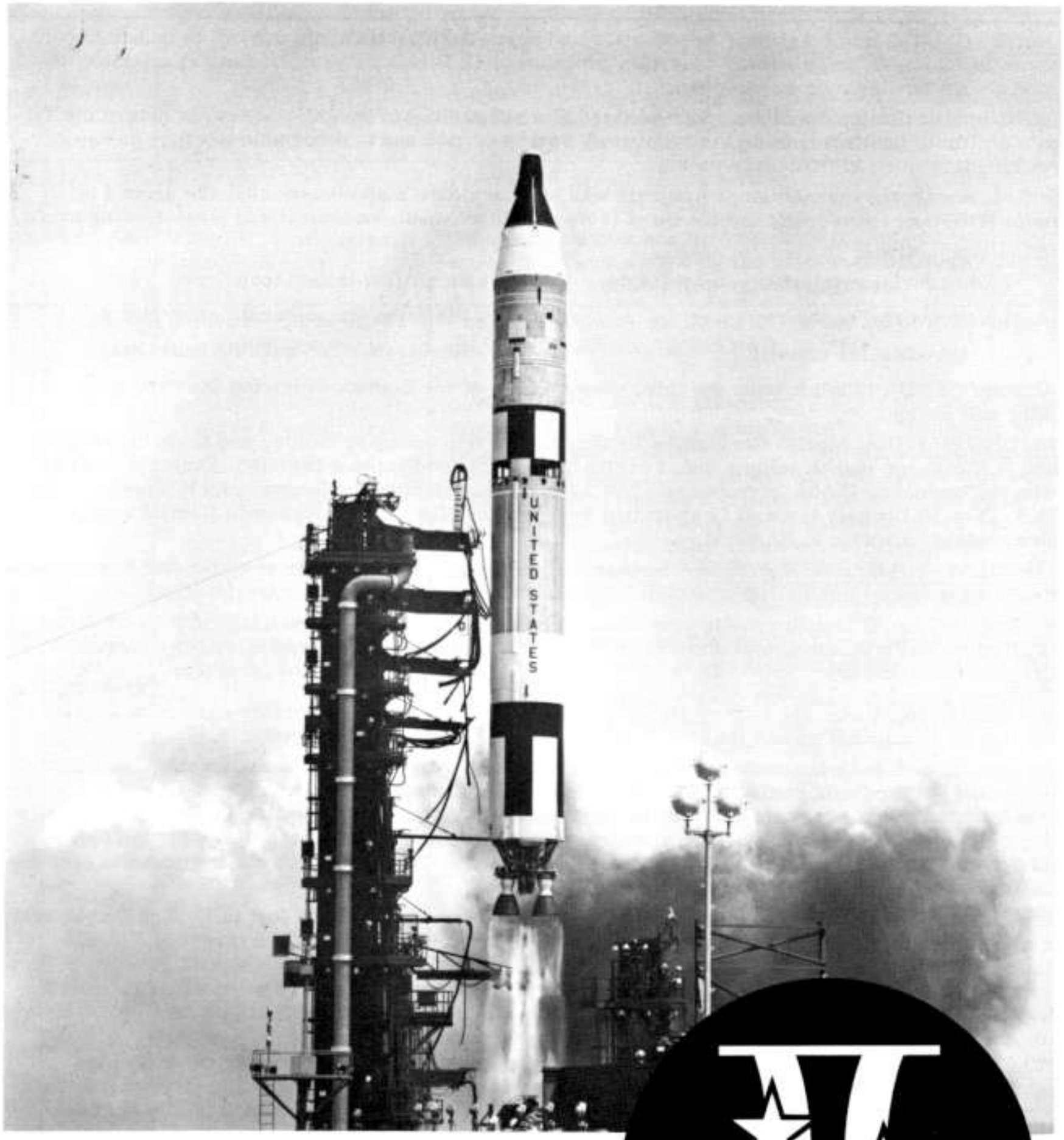


GEMINI-TITAN II

AIR FORCE LAUNCH VEHICLE
for the NASA GEMINI PROGRAM

GEMINI

MISSION: GEMINI is the National Aeronautics and Space Administration's project to launch two astronauts into orbit and perform, during a program of 12 flights, a great variety of missions essential to our landing men on the moon.

GEMINI is also designed to obtain data on the effects of prolonged weightlessness, to determine man's ability to function outside his spacecraft while in space and to determine whether he can perform effective work in that environment.

The first step in the manned lunar program was Mercury (one-man spacecraft), the second is Gemini (two-man spacecraft) and the third is Apollo (three-man spacecraft and lunar landing craft).

GEMINI's objectives:

- Long duration missions--up to 14 days
- Maneuvering in space
- Extravehicular activity
- Simplified launch techniques
- Platform for scientific experiments
- Rendezvous and docking techniques

The name GEMINI is taken from the third constellation of the Zodiac, featuring the twin stars, Castor and Pollux.

RESPONSIBILITIES: Martin Company's Baltimore Division designs, builds, and tests the Gemini-Titan II Air Force launch vehicle under contract to the Space Systems Division of the Air Force Systems Command. NASA gave responsibility for development of the launch vehicle system to the USAF. The McDonnell Aircraft Corporation has responsibility for the two-man Gemini spacecraft under contract directly to NASA.

LAUNCH VEHICLE DESCRIPTION: The launch vehicle is a modified version of the Air Force's Titan II Intercontinental Ballistic Missile, the nation's largest and most powerful ICBM.

The Gemini-Titan II launch vehicle uses storable, liquid propellants, consisting of a 50-50 blend of hydrazine and unsymmetrical dimethyl hydrazine (UDMH) as the fuel and nitrogen tetroxide (N_2O_4) as the oxidizer.

Because the propellants are hypergolic--that is, ignite on contact--no ignition system is required, resulting in simplification and increased reliability of the overall launch vehicle.

The space launch vehicle version of Titan II provides the astronauts with a malfunction detection system and backup flight controls, electrical, and hydraulic systems to improve pilot safety. Among the safety devices is a system to eject the astronauts in their seats if a malfunction emergency develops either on the launching pad or in early moments of flight. This substitutes for the long escape tower used on Mercury flights. In general, the astronauts have much more command over the mission than they had in the Mercury series.

The Gemini-Titan II launch vehicle and its two-man spacecraft stand 109 feet tall. The launch vehicle alone is 90 feet tall, in two stages. The booster engines generate a total thrust of 530,000 pounds: 430,000 pounds in the first stage at liftoff and 100,000 pounds in the second at altitude. For comparison, the Atlas ICBM's used as launch vehicles in Project Mercury were stage and a half rockets with engines yielding 360,000 pounds of thrust. The Redstone rockets which boosted Mercury astronauts on suborbital flights had a thrust of 78,000 pounds.

PROJECT PROFILE: Gemini uses two-man spacecraft, enlarged from those of the Mercury flights, for long duration missions and for rendezvous and docking experiments. Lessons learned from Gemini will help man in space research and lead to Project Apollo, which is aimed at putting a team of men on the moon.

Lengths of manned Gemini flights have varied from the three-orbit flight of Grissom and Young on GT-3 to four-, eight- and fourteen-day missions and the world's first rendezvous of two manned spacecraft--the flights of GT-7 and GT-6 in 1965.

Docking and rendezvous maneuvers will be practiced and perfected on the remaining Gemini flights in 1966. The remaining four flights in 1966 will be three-day missions to practice rendezvous and docking and EVA (walk in space). In these exercises, an Agena "target vehicle" will be launched into orbit by an Atlas. As early as 90 minutes later, as the orbiting Agena passes over Cape Kennedy, the Gemini-Titan II launch vehicle with its two-man spacecraft will be launched with a precision that will place the astronauts near the Agena.

Because of the critical timing involved, the Gemini-Titan II is considered an ideal launch vehicle for the rendezvous missions since its storable, hypergolic fuels permit a shorter countdown period before launching.

SUMMARY OF GEMINI-TITAN FLIGHTS FROM LAUNCH COMPLEX 19, Cape Kennedy, Florida

Flight	Launch Date	Crew	Mission Results
GT-1	4/8/64	Unmanned	Successful launch and flight. Spacecraft and second stage orbited without detaching, as planned, and re-entered and burned up 4 days and 5 hours after launch.
GT-2	1/19/65	Unmanned	Successful launch and suborbital flight testing all spacecraft systems, including re-entry heat shield.
GT-3	3/23/65	Virgil I. (Gus) Grissom John W. Young	Successful launch and three-orbit flight in which a major space first was scored by the astronauts manually changing their spacecraft's orbit plane three times.
GT-4	6/3/65 to 6/7/65	James A. McDivitt Edward H. White	Successful launch and 62-orbit, 4-day flight that included White's 20-minute "space walk."
GT-5	8/21/65 to 8/29/65	L. Gordon Cooper, Jr. Charles Conrad, Jr.	Successful launch and 120-orbit, 8-day flight which set a space duration record and made the U.S. the leader in total astronaut time in space. Problems with spacecraft electrical system forced cancellation of rendezvous attempt with Rendezvous Evaluation Pod and a few other experiments, but primary goal--8 days in space--and most other mission objectives were accomplished.
			THE GT-7/GT-6 SIMULTANEOUS MISSION
GT-7	12/4/65 to 12/18/65	Frank Borman James A. Lovell	Successful launch and 206-orbit, 14-day flight that featured the first rendezvous of two spacecraft (GT-7 and GT-6). Early in the flight of GT-7, Borman and Lovell performed a "station keeping" exercise with the tumbling burned-out second stage of their Gemini-Titan booster.
GT-6	12/15/65 to 12/16/65	Walter M. Schirra, Jr. Thomas P. Stafford	Within 45 minutes of the GT-7 launch, Martin crews at Cape Kennedy were transporting the GT-6 booster to Complex 19 to ready it for the "quick turnaround" launch which took place 11 days later. (Previously, normal time span from one Gemini launch to the next was considered 45 days until Martin engineers came up with the rapid firing idea.) Significant accomplishment of GT-7: The conclusion that man can perform effectively and without damage to himself, the kind of long-duration flights the lunar mission will require. Successful launch and 17-orbit, 2-day flight during which Schirra and Stafford caught up with and maneuvered their GT-6 spacecraft to within one foot of the GT-7 spacecraft. Gemini 7 and 6 flew 20 hours and 22 minutes within 62 miles of each other. With the completion of this flight, most of the major objectives of the Gemini program had been achieved. Remaining to be perfected are the rendezvous and docking procedures essential to the Apollo men-on-the-moon program. At the beginning of 1966, the U.S. had the lead in total man-hours in space for one nation--1352 hours and 42 minutes. (Total man-hours in space for Russia was 507 hours and 16 minutes.)

(over)

Gemini-Titan's 71 foot first stage is loaded aboard the weird Pregnant Guppy aircraft that splits in the middle to receive its cargo. Two trips are necessary to transport the first and second stages of the launch vehicle from Martin Baltimore to Cape Kennedy.

SUMMARY OF GEMINI-TITAN FLIGHTS GT-8 THROUGH GT-12

All flights are scheduled for 1966 and are designed to perfect rendezvous and docking techniques.

Flight	Launch Date	Crew	Mission Results
GT-8	3/16/66	Neil A. Armstrong David R. Scott	On GT-8 two craft were linked in space for the first time. A modified Lockheed Agena target vehicle was boosted into orbit at 10 AM EST. One orbit later a Gemini-Titan launch vehicle with Armstrong and Scott aboard was launched perfectly at 11:41:02 EST, beginning a 6 1/2-hour pursuit of the target vehicle, with link-up occurring at 6:15 PM. After a brief but successful docking with the Agena the mission encountered difficulties, caused by a short circuit in the orbital attitude maneuvering system (OAMS) of the spacecraft. After violent gyrations of the Agena-Gemini; and wild tumbling of the spacecraft after the Agena and Gemini were disengaged, an abrupt termination of the mission was ordered. Armstrong and Scott brought their GT-8 spacecraft to a 10:23 PM EST splashdown at a point in the Pacific as precisely predicted as any previous U. S. spacecraft. Among the GT-8 experiments now scheduled for a later Gemini mission was work in the weightlessness of space using a Gemini minimum reaction space tool developed by Martin Company of Baltimore and Black and Decker Manufacturing Company of Towson, Maryland.

Flight	Duration	Crew	Planned Mission
GT-9	Three Days	Thomas P. Stafford Eugene A. Cernan	Rendezvous and docking flight to develop optical rendevous techniques; after docking, conduct simple maneuvers (using Agena propulsion) with combined Gemini-Agena vehicle. Also scheduled: Man's longest "walk in space"--two hours and twenty five minutes--by Astronaut Cernan. During his extra vehicular activity the astronaut maneuvering unit (AMU) designed by Ling-Temco-Vought will be used for the first time. A NASA-developed chest pack EVA life-support unit will also be tested for a short period.
GT-10	Three days	John W. Young Michael Collins	Rendezvous; develop direct ascent rendezvous techniques ;EVA (walk in space)
GT-11	Three days	Charles Conrad Richard Gordon	Rendezvous; Lunar Excursion Module (LEM) rendezvous simulation ;EVA (walk in space)
GT-12	Three days		Rendezvous; LEM abort simulation ;EVA (walk in space)

GEMINI ASTRONAUTS

GT-3

Virgil I. "Gus" Grissom

John W. Young

James A. McDivitt

Edward H. White II

GT-4

GT-5

Leroy Gordon Cooper

Charles Conrad

Frank Borman

James A. Lovell, Jr.

GT-7

GT-6

Walter M. Schirra

Thomas P. Stafford

Neil A. Armstrong

David R. Scott

GT-8

GT-9

Thomas P. Stafford

Eugene A. Cernan

John W. Young

Michael Collins

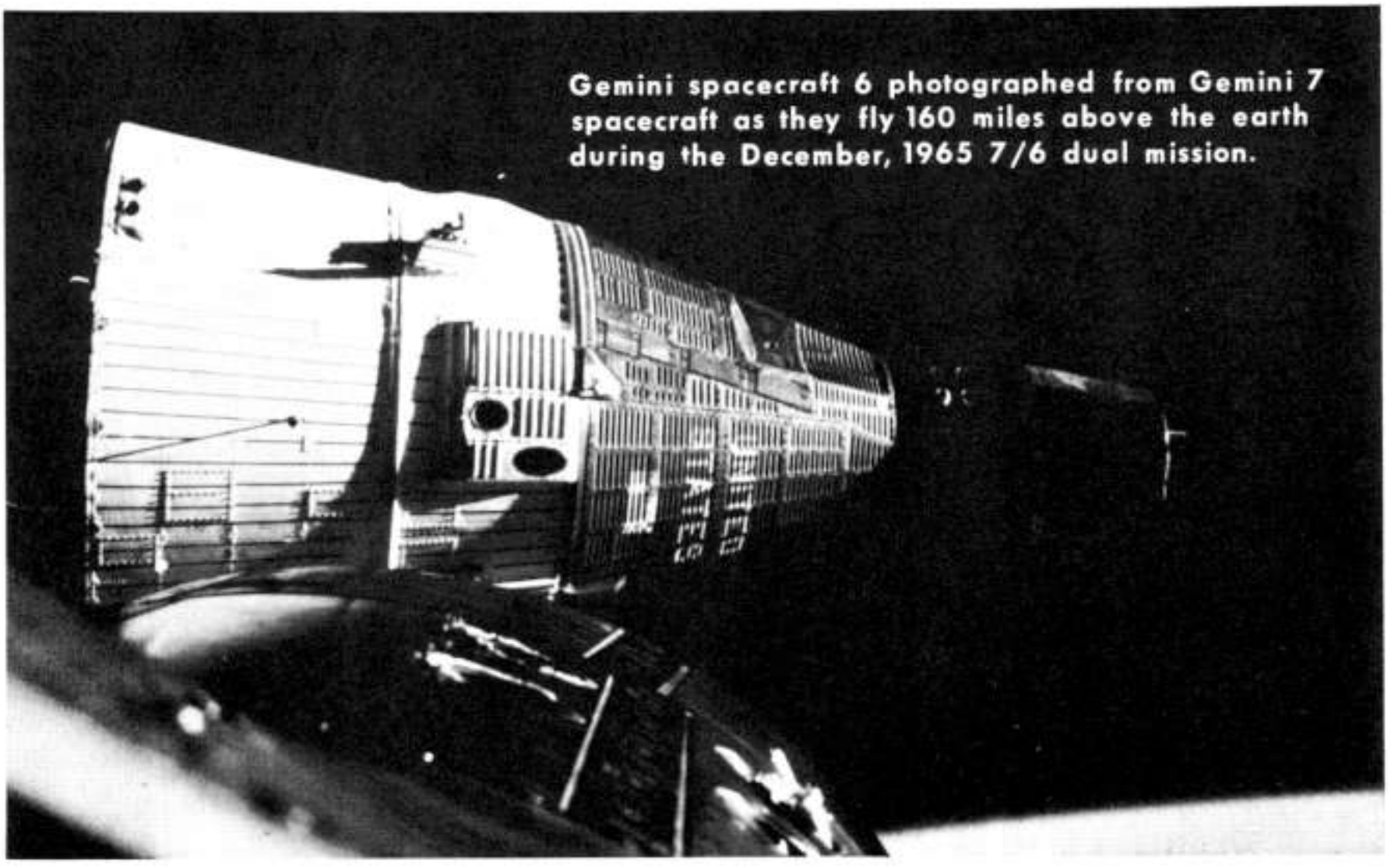
GT-10

GT-11

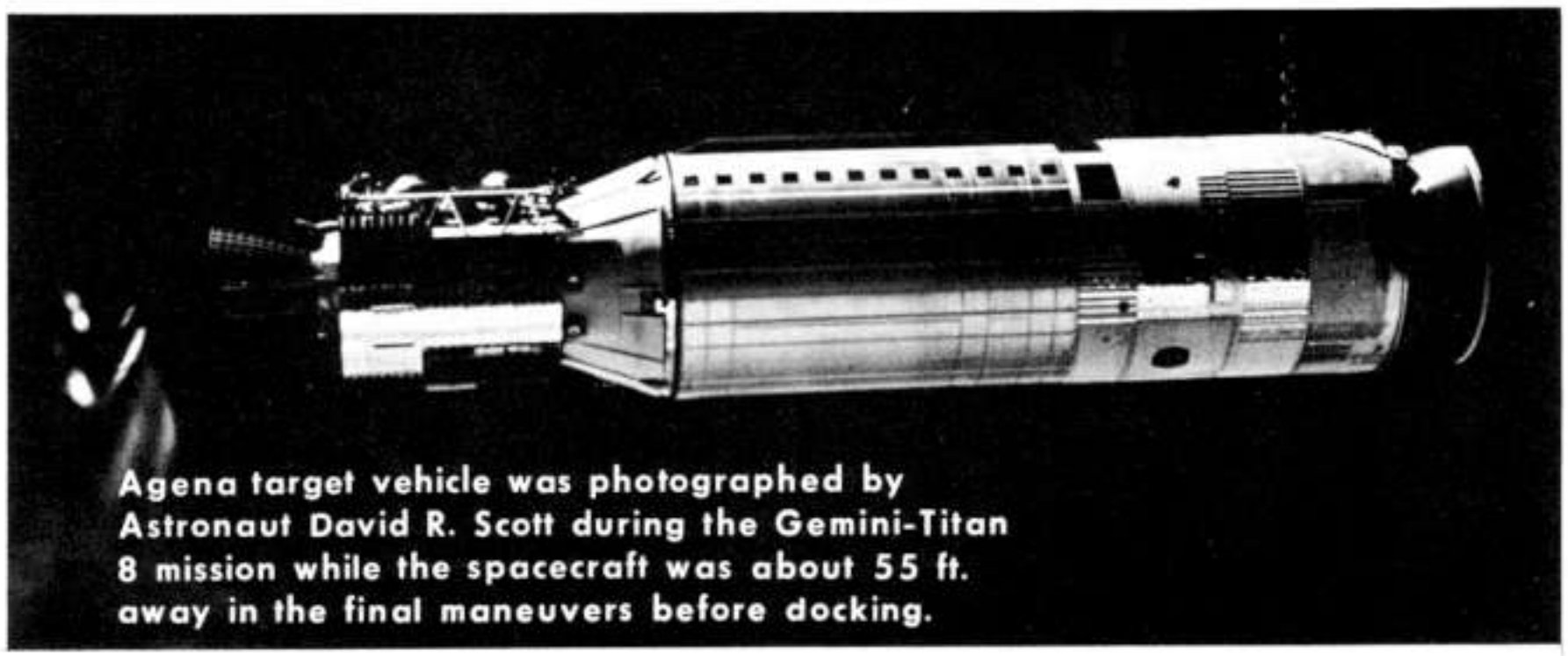
Charles Conrad

Richard Gordon

Nerve center for all Gemini flights is the blockhouse on Cape Kennedy Complex 19



Gemini spacecraft 6 photographed from Gemini 7 spacecraft as they fly 160 miles above the earth during the December, 1965 7/6 dual mission.



Agena target vehicle was photographed by Astronaut David R. Scott during the Gemini-Titan 8 mission while the spacecraft was about 55 ft. away in the final maneuvers before docking.

MARTIN MARIETTA

BALTIMORE DIVISION