NEWS

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Apollo 4 Spacecraft Performance

Evaluation of Apollo 4 mission data at the National Aeronautics and Space Administration's Manned Spacecraft Center, Houston continues to confirm initial reports that Spacecraft 017 met all flight objectives without problems.

Detailed systems analysis are still in process, but evidence to date indicates that spacecraft systems operated properly and met all specifications.

Liftoff was at 7:00:01.4 a.m. EST, Nov. 9. The spacecraft landed in the Pacific Ocean at 3:37:08 p.m., the same day. The landing was approximately six miles from the recovery ship, USS Bennington.

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As planned, the first service propulsion burn was started in a zero-g environment with no reaction control system ullage maneuvers. No adverse affects were noted. The second SPS burn was 13 seconds longer than planned. The longer burn resulted from a switchover to ground control after the burn was started by the onboard guidance and navigation system.

Mission Control Center-Houston took command of SPS on/off after Carnarvon, Australia, tracking site data indicated possible lack of onboard ignition control. The exact history of the burn is still being reviewed. However, it has been determined there was no failure in the onboard systems involved.

Cabin pressure remained between 5.6 and 5.8 psia for the entire mission. This indicates that the cabin leakage rate is negligible and well within specifications. Cabin air temperature appeared to remain stable at 60 degrees F during orbit, increasing to approximately 70 degrees during reentry.

Instrumentation data available at this time indicates satisfactory structural performance of the spacecraft and Lunar Test Article 10R during the launch and boost phase of the mission. LTR-10R simulated a lunar module.

The Earth Landing System functioned as planned. All parachutes inflated properly, and parachute disconnects operated on landing. One of the main parachutes was recovered and inspection shows it was not damaged. Recovery aids deployed and operated normally.

Heat shield performance was good. Maximum char thickness was three-quarters of an inch. The thermal control coating on the hatch and the hatch seal was intact. Maximum indicated seal temperature was less than 200 degrees F. Charring of the crew compartment heat shield was less than expected based on achieved entry conditions.

During the 4.5-hour cold soak to check the spacecraft and its systems at extremes of temperature, the surface of the heat shield away from the Sun reached a temperature of approximately 100 degrees below zero F. Temperature on the Sun side reached approximately 140 degrees above zero.

Entry velocity was .0058 per cent higher than planned because of the larger-than-planned duration of the second SPS burn. Velocity achieved was 36,545 feet per second (24,913 miles per hour). Planned velocity was 36,333 feet per second (24,772 mph). This resulted in higher than planned command module maximum heat rate -- 620 BTU per square foot per second versus 586 planned. Maximum expected on lunar return is 480.

Preflight prediction for the command module trim lift-to-drag (L/D) ratio at 400,000 feet was 0.35, with uncertainty limits of +0.06 and -0.03. Preliminary calculations from the Guidance and Navigation system show an average L/D trim of approximately 0.38 about 40 seconds after the command module passed through 400,000 feet and the dynamic pressure had built up to where the spacecraft could be considered in a steady state trim condition.

The 0.38 level held until about 20 seconds after the first peak G, when the lowest L/D, approximately 0.35, was calculated. Both L/D values are well within expected limits.

Maximum G on entry was 7.3, compared with an expected 8.33 G. Peak G was experienced during the initial entry. On second entry, following "skipout," the spacecraft pulled 4 G, compared to 4.5 G expected. The lower G forces resulted from the shallower than planned flight path angle at entry into the atmosphere.

Fuel cell and cryogenic subsystems functioned normally during the mission, and the capability to purge the fuel cells subsequent to the cold soak was satisfactorily demonstrated. Analysis shows the fuel cells produced potable sterile water. Data evaluated to date shows excellent load sharing and thermal control capability of the fuel cells.

Communications system objectives were accomplished. Each Manned Space Flight Network site, the Apollo tracking ship Vanguard, and at least two of the Apollo/Range Instrumentation Aircraft established two-way communications with the spacecraft as scheduled.

The Guidance and Control system and the Mission Control Programmer performed properly throughout the mission. Entry simulations using tracking data verify the guidance commands issued by the Guidance and Navigation system. Range-to-go at drogue parachute deployment calculated by the Guidance and Navigation system was 2.2 nautical miles. Comparisons with the measured landing point indicate better than predicted performance.

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Operation of the electrical power subsystem was normal throughout the mission. All available information indicates that the spacecraft sequential devices performed normally, with all functions occurring at the proper times.

Both the command module and the service module reaction control systems operated properly.

CHRONOLOGY OF MAJOR SPACECRAFT EVENTS

First SPS Ignition

	Planned	Actual
Time	03:28:20	03:28:07
Geodetic Latitude, Degrees North	13:36	13:46
Longitude, Degrees West	21.33	21.44
Altitude, Nautical Miles	1522	1500
Space-fixed Velocity, ft/sec.	25459	25499
Space-fixed Flight-Path Degrees	27.99	27.81
Space-fixed Heading Angle, Degrees East of North	117.51	117.46

First SPS Cutoff

Time	03:28:35	03:28:22
Duration of Burn, seconds	15	15
Geodetic Latitude, Degrees North	13.06	13.12
Longitude, Degrees West	20.82	20.89
Altitude, Nautical Miles	1552	1532
Space-Fixed Velocity, ft/sec.	25507	25543
Space-Fixed Flight-Path Angle, Degrees	28.44	28.31
Space-Fixed Heading Angle, Degrees East of North	117.64	117.59

Apogee

	Planned	Actual
Time	05:48:43	05:46:50
Geodetic Latitude, Degrees South	28.69	28.68
Longitude, Degrees East	36.39	36.87
Altitude, Nautical Miles	9890	9769
Space-Fixed Velocity, ft/sec.	8405	8469
Space-Fixed Flight-Path Angle, Degrees	0.0	0.0
Space-Fixed Heading Angle, Degrees East of North	100.38	100.38

Second SPS Ignition

Time	08:14:43	08:10:55
Geodetic Latitude, Degrees North	3.67	3.46
Longitude, Degrees East	116.92	117.50
Altitude, Nautical Miles	873	878
Space-Fixed Velocity, ft/sec.	28235	28173
Space-Fixed Flight-Path Angle, Degrees	-23.14	-23.21
Space-Fixed Heading Angle, Degrees East of North	59.87	59.86

Second SPS Cutoff

Time	08:19:11	08:15:36
Duration of Burn, minutes and Seconds	4:29	4:41
Geodetic Latitude, Degrees North	12.64	12.86
Longitude, Degrees East	131.93	133.29
Altitude	375	359
Space-Fixed Velocity, ft/sec.	34816	35120
Space-Fixed Flight-Path Angle, Degrees	-17.98	-17.61
Space-Fixed Heading Angle, Degrees East of North	62.16	62.22

CM/SM Separation

Time	08:21:46	08:18:03
Geodetic Latitude, Degrees North	18.64	18.67

	Planned	Actual
Longitude, Degrees East	143.64	144.86
Altitude, Nautical Miles	148	144
Space-Fixed Velocity, ft/sec.	35912	36146
Space-Fixed Flight-Path Angle, Degrees	-11.25	-11.01
Space-Fixed Heading Angle, Degrees East of North	65.55	65.53
Entry		
Time	08:23:13	08:19:28
Geodetic Latitude, Degrees North	21.90	21.86
Longitude, Degrees East	151.58	152.42
Altitude, feet	400,000	400,000
Space-Fixed Velocity, ft/sec.	36333	36545
Space-Fixed Flight-Path Angle, Degrees	-7.13	-6.93
Space-Fixed Heading Angle, Degrees East of North	68.35	68.26
Landing		
Latitude	30:00N	30:06.4N
Longitude	172:24W	172:32W

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