



Info Sheet

Highlighting Space Systems of the Past, Present, and Future

1960

1970

1980

1990

2000

Apollo 15 The Case of the Missing Control Panels

It rests solemnly under floodlights, the centerpiece of the Space Flight Gallery at the Air Force Museum in Dayton, Ohio. In 1971 it had journeyed to the moon and back on a 12-day flight, carrying its crew of three astronauts on a daring mission of exploration. The astronauts on that voyage, Commander David R. Scott, Command Module Pilot Alfred M. Worden, and Lunar Module Pilot James B. Irwin, were all Air Force officers. And so their Apollo 15 vehicle is honored here together with other historic Air Force craft.

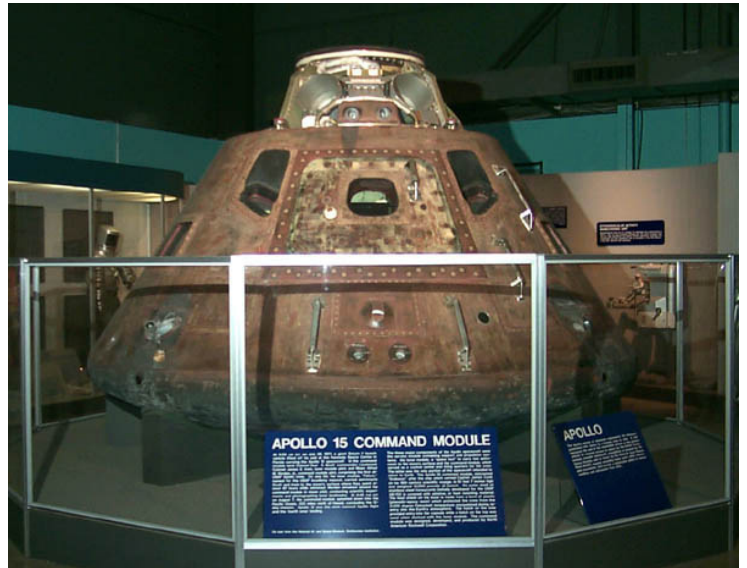
But unlike any other flown Apollo spacecraft on display in museums, Apollo 15's side hatch is closed. Its interior can only be glimpsed through the small portals of the five spacecraft windows, and then only from a distance.

The restricted interior view isn't meant to frustrate curious museum visitors. It's just that there really isn't much to see inside this Command Module. A significant part of the interior, including the main control panels, is missing.

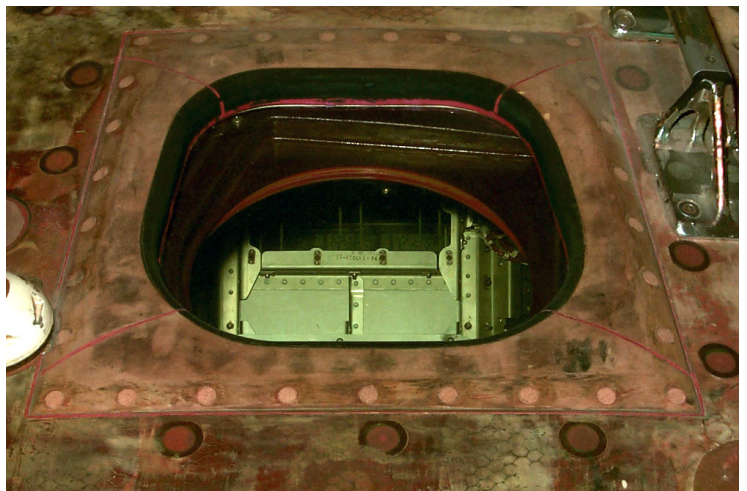
ELUSIVE

One has to wonder, where are the Apollo 15 control panels?

The mystery has eluded even those in the museum community. Max Ary, while director of the Kansas Cosmosphere and Space Center, had sought to recover the panels in hopes of restoring Apollo 15. "We did look in quite a few places," he recalls, "including getting up on a lift and looking into the Command Module on display at the Smithsonian as part of the Apollo-Soyuz Test Project display." But he was never able to locate the panels. "It had become a big mystery for me that I was not able to finalize before I left the Cosmosphere," he says with some frustration.



The Apollo 15 Command Module Endeavor at The Air Force Museum in Dayton, Ohio. A glass and metal barrier protects the display, but the closed hatch limits visibility of the interior. (John Fongheiser photo)



The limited view through the Apollo 15 hatch window reveals the framework for the Main Display Console, but no control panels. The location of the panels has remained a mystery for years. (John Fongheiser photo)

PANEL SHELL GAME

However, NASA documents have now revealed the long forgotten location of the precious panels. The answer to the riddle is at once simple and startling. The Apollo 15 control panels are... well, they're in Apollo 16!

An Apollo Spacecraft Hardware Utilization Request (ASHUR), the NASA permission slip for removing hardware from a flown spacecraft, tells the tale. It is dated December 11, 1973, more than two years after the Apollo 15 mission and about one and one-half years after the Apollo 16 mission. The ASHUR calls for the removal of panels 1, 2, 3 (the main control panels), 7 (a panel to the commander's left), and 277 (a blank panel), as well as the Guidance & Navigation System Navigation Base (sextant), from Apollo 15. [1]

The reason for the removal of the artifacts is almost as startling as the revelation itself. The control panels from Apollo 16 (designated CSM-113) had been removed, and replacements were needed to equip Apollo 16 for display at NASA's Marshall Space Flight Center in Huntsville, Alabama.

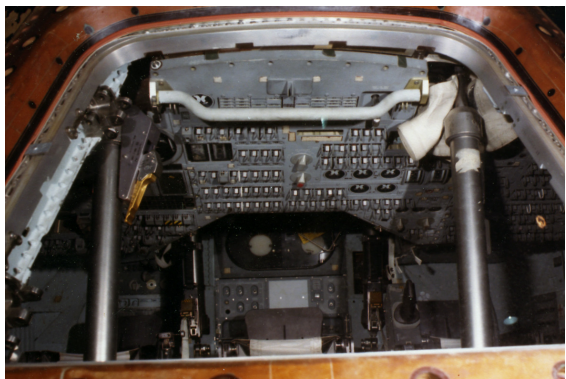
In fact a careful look at NASA post-recovery photographs of Apollo 16, compared with later images of the craft on display, reveals that more than the control panels have been changed. The crew couch has also been changed. Apollo 13 and later missions flew with a newer version of the armrests on their couches. But Apollo 16 is now on display with the earlier version.

APOLLO SPACECRAFT HARDWARE UTILIZATION REQUEST			SDL193
SPACECRAFT NUMBER 112	SYSTEM(S) AFFECTED Electrical	ASUR NUMBER 112 581	
PURPOSE Utilize on CM 113 for display at MSFC			
JUSTIFICATION NASA Request Ref. MCR 39091			
DESCRIPTION Utilize hardware to refurbish CM 113 for display purposes. V36-761111-701 Panel 1 S/N 06362 AAG 9329 V36-761202-601 Panel 2 S/N 06362 AAG 0663 V36-761203-301 Panel 3 S/N 06362 AAG 3271 V36-761117-51 Panel 7 S/N 10174 EO 60399 V36-332120-11 Panel 277 (Blank) 2899982-031 G&N NAV Base S/N AC18			
TO BE ACCOMPLISHED BY: ☒ NR ☐ KSC MAB ☐ VENDOR ☐ GAEC ☐ MSC ☐ OTHER		CONTACT FOR STATUS P. F. Magoski, D/695, Ext. 3724	
LOCATION OF WORK ACTIVITY: SD/Downey		FINAL DISPOSITION OF HARDWARE NASA Disposition	
REQUESTED BY W. J. Lee		TYPE OF ACTION ☐ POSTFLIGHT TEST REQUEST ☐ FLIGHT REUSE REQUEST ☒ DISPOSITION REQUEST	
CHIEF ANALYST [Signature]	DATE 12-11-73	APPROVED [Signature]	DATE 12-11-73
MSC FORM 1148 (REV FEB 68)		(Previous editions are obsolete)	

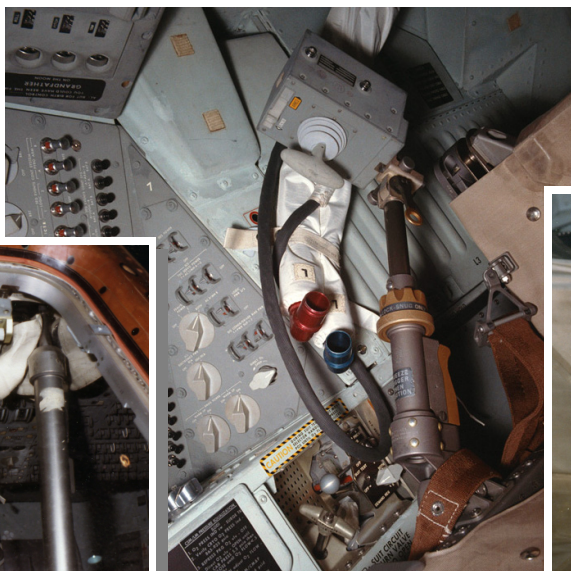
The Apollo Spacecraft Hardware Utilization Request (ASHUR) document authorized the removal of equipment from a flown Apollo spacecraft. This ASHUR, numbered 112581, approved removal of the Apollo 15 control panels. (The official designation for the Apollo 15 Command Service Module was CSM-112, so its ASHUR's begin with "112.") (Scan by John Fongheiser)

Apollo 16 then...

... and now ...



The Apollo 16 spacecraft interior viewed through the open hatchway, as it is now on display at the U.S. Space & Rocket Center in Huntsville, Alabama. Some interior assemblies originated elsewhere. (John Fongheiser photo)



The Apollo 16 Commander's area immediately after the spacecraft's recovery. Note the design of the armrest mounting the T-handled Translation Control at center. A squeeze trigger and knobby gold-colored ring control the armrest's position. (NASA photo)

... and now again.



A couch armrest in the current Apollo 16 display. This armrest design was used on couches before Apollo 13. (John Fongheiser photo)

PINCHING NASA PENNIES

So now we know what happened to the panels flown on Apollo 15. The next question is, what happened to the panels and other items flown on Apollo 16?

Part of the answer lies with a NASA policy of removing equipment from flown spacecraft to use again, saving money on future flights. The parts would be tested to ensure flight worthiness, and then used again or set aside as spares. Although this was practiced throughout the Apollo lunar exploration program, it was especially seen in support of the cash-strapped Skylab and Apollo-Soyuz Programs. Flown parts of every kind were removed to provide spares and flight articles for Apollo missions to the Skylab space station, and for the joint US-Soviet Union mission.

Additional parts were also needed to complete the Docking Module that joined the two craft of Apollo-Soyuz. Flown floodlights, valves, switches, and other parts helped reduce the cost of the unique module. [2] Some time after the mission the Docking Module burned up on re-entry, consuming its small collection of previously flown artifacts.

Flown parts were sometimes even removed for use in training. When simulator parts wore out and no spares were available, flown parts were downgraded to training status and put to work in the simulators. In September, 1972 flown panels and lockers from Apollo 13 were placed in the water egress trainer to ensure the high fidelity of the training. [3] When the trainer's side hatch handle gearbox wouldn't work from wear and corrosion, the flown gearbox from Apollo 15's hatch was removed and installed on the boilerplate. [4] (These parts were later removed from the trainer.)

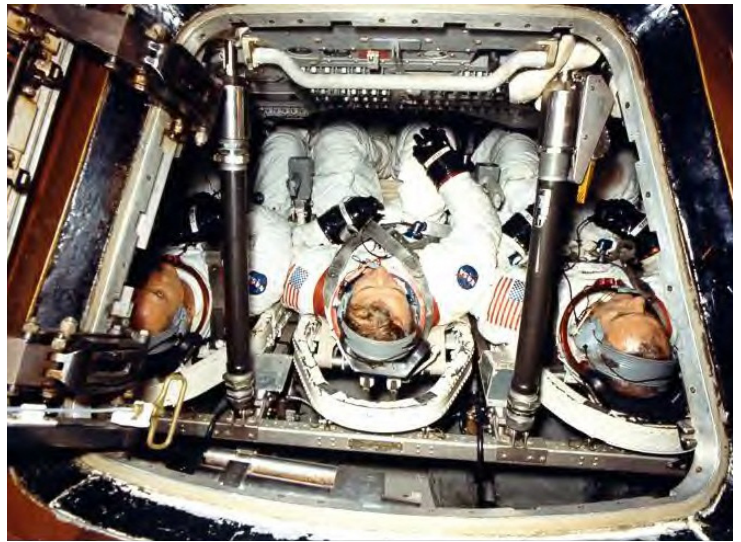
Parts were also shuffled to prepare spacecraft for display, as seen with Apollo 16. Couches, couch struts, individual instruments, and other items were moved to different spacecraft as the need for display arose. The original parts had been removed to support future Apollo missions. Sometimes high fidelity mockup instruments were substituted for the real ones for display. [5]

APOLLO LIVES ON

The flow of parts did not end with the last Apollo flight. At the conclusion of the Apollo Program, many flown Apollo parts streamed into the Space Shuttle Program. Items as diverse as pouches, lighting assemblies and switches were transferred to the Space Shuttle Program to pass



Artist's concept of the Apollo-Soyuz Test Project (ASTP) vehicles in orbit, joined by the Docking Module at center. Many flown Apollo spacecraft parts were needed to support ASTP, and the three flights to Skylab that had preceded it. The Docking Module, including its previously flown components, later burned up on re-entry. (NASA image)



The Apollo-Soyuz astronauts train in the water egress trainer. Do the controls look realistic? They should - the control panels surrounding the Apollo-Soyuz crew were flown on an Apollo moon mission. (NASA photo)

the money savings along, at least in theory. Parts were to be used for simulations, crew compartment configuration tests, training, and, where possible, even for flight. Any accumulated spare parts not needed for Space Shuttle Program support or claimed by the Smithsonian Institution were to be sold as surplus. [6]

Control panel toggle switches were in such short supply that NASA transferred excess panels and switches, whether functional or not, from Apollo trainers and simulators to Rockwell International's Space Division. This included spare flight-qualified switches. They were needed for use in Space Shuttle Orbiter trainers and simulators. Rockwell technicians would strip panels of any useable switches, circuit breakers, and gauges to help equip the trainers, at significant cost savings. [7]

Many were shocked when they heard that in the 1980's NASA technicians had raided the Apollo 17 Command Module on display at Johnson Space Center, for toggle switches. Extra flight-qualified switches were apparently needed to meet the demanding Space Shuttle launch schedule. But for years NASA had been removing parts from flown spacecraft to support active flight operations and test programs. We simply had never witnessed it.

FINAL RESTING PLACE

We know the Apollo 15 panels are now in Apollo 16. But where did the flown Apollo 16 panels finally end up?

We need look no further than Kennedy Space Center, where they are now on display in the Apollo/Saturn V Center. The Apollo 16 panels were installed in CSM-111, the Apollo-Soyuz spacecraft, before its flight. NASA documents reveal that engineers were concerned that the original CSM-111 panel toggle switches had never been X-rayed as part of their quality control process. Decision makers had two choices: disassemble the panels and inspect the switches, or use previously flown panels. To save money they chose to remove the flown Apollo 16 panel assemblies, test them, and install them in CSM-111. [8] So the panels now installed in the Apollo-Soyuz Command Module actually flew twice.

What about the original CSM-111 panels? Most likely they are at a museum in storage or as part of another exhibit. But they were never to have a flight of their own.



Astronaut Vance Brand at the slightly used controls of the Apollo-Soyuz Command Module during the Apollo-Soyuz Test Project flight. (NASA photo)

INNOVATION KEY TO APOLLO'S SUCCESS

The technicians, engineers and managers of Apollo faced myriad challenges, especially technical, financial, and those relating to the schedule. Meeting these challenges required innovation, including re-using equipment which was not originally intended to be used more than once. Their skill and ingenuity enabled the marvelous successes of the Apollo Program.

1. Apollo Spacecraft Hardware Utilization Request (ASHUR) 112581.
2. ASHUR 112144.
3. ASHUR's 109125 and 109126.
4. ASHUR 112578.
5. ASHUR 104124.
6. Christopher Kraft memo, dated October 21, 1975.
7. Aaron Cohen memo, dated September 7, 1976.
8. ASHUR's 113527, 113529, 113538, 113539, and 113543.

This Info Sheet may be found in HTML at collectSpace.com.

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