



# Info Sheet

Highlighting Space Systems of the Past, Present, and Future

1960

1970

1980

1990

2000

## Apollo Hatch Redesign A Matter of Urgency

January 27, 1967 - three weeks before their scheduled launch - astronauts Gus Grissom, Ed White, and Roger Chaffee were participating in a simulated count-down aboard their Apollo 1 spacecraft. Suddenly, fire flashed through the pure oxygen atmosphere of the cabin. Despite their efforts to escape, the crew perished within minutes. The tragedy prompted an urgent redesign of the Apollo Command Module side hatch.

Pacing the redesign effort was the need to complete the modifications, test the hardware, and fly the preliminary missions for a lunar landing before the end of the decade.

### ORIGINAL 3-DOOR DESIGN

The original hatch consisted of three doors: an inner structure (main) hatch; a middle heat shield hatch; and a light-weight outer hatch hinged to the Boost Protective Cover, which was jettisoned with the escape system shortly after launch.

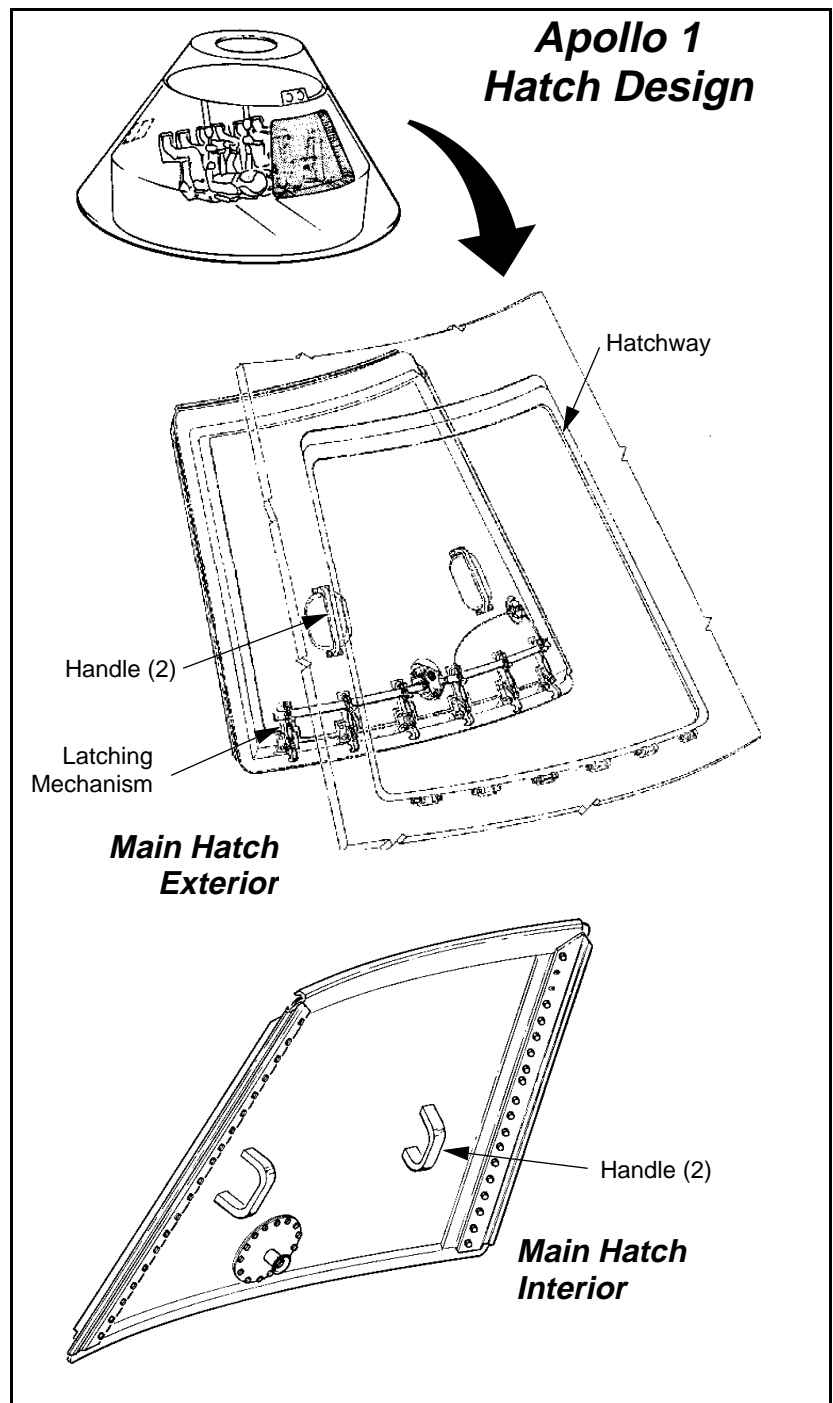
The inner and middle hatches had to be manually unlocked and removed to egress. The hinged outer hatch was unlocked by striking a plunger through the middle hatch that unlocked the outer hatch latches.

Under good conditions the crew could unlock the doors, remove them, and egress in 60 to 90 seconds.

### MODIFICATIONS DRIVEN BY NEW REQUIREMENTS

After the accident the crew egress requirements were drastically changed. The crew had to be able to open the hatch in 3 seconds and egress within 30 seconds.

(Continued)



The Apollo 1 main (inner) hatch used internal air pressure to seal the hatch. A lip along the top and side edges and a series of latches along the bottom edge retained the hatch in the hatchway. To egress, the pressure on the inside and outside of the hatch would have to be equalized, the latches unlocked, and the hatch lifted inside the spacecraft. The middle hatch (not shown) would also have to be unlocked and removed. The outer hatch (not shown) would have to be unlocked and swung open. (North American Aviation engineering drawings modified by John Fongheiser.)

Other requirements were dictated by schedule constraints: modifications to the existing spacecraft structure were to be minimal; no welding to the spacecraft structure would be permitted.

### SOLUTION: UNIFIED HATCH

The selected design combined the inner and middle hatches into a "unified" hatch. The outer hatch, part of the Boost Protective Cover, was only slightly modified.

The unified hatch mounted 15 latches linked together around the hatch perimeter. The latches applied enough force from inside the hatchway to seal the hatch. A ratchet handle allowed the crew to open or close the latches in five strokes of the handle. The handle also triggered a striker plunger to unlock the outer hatch latches (while the Boost Protective Cover was still attached).

A counterbalance improved the opening time in emergency situations. Once the latches were unlocked a cylinder pressurized with gaseous nitrogen would operate a piston to force the combined 350 pound hatch open and lock it in position. (The total weight added by the new design was 253 pounds.)

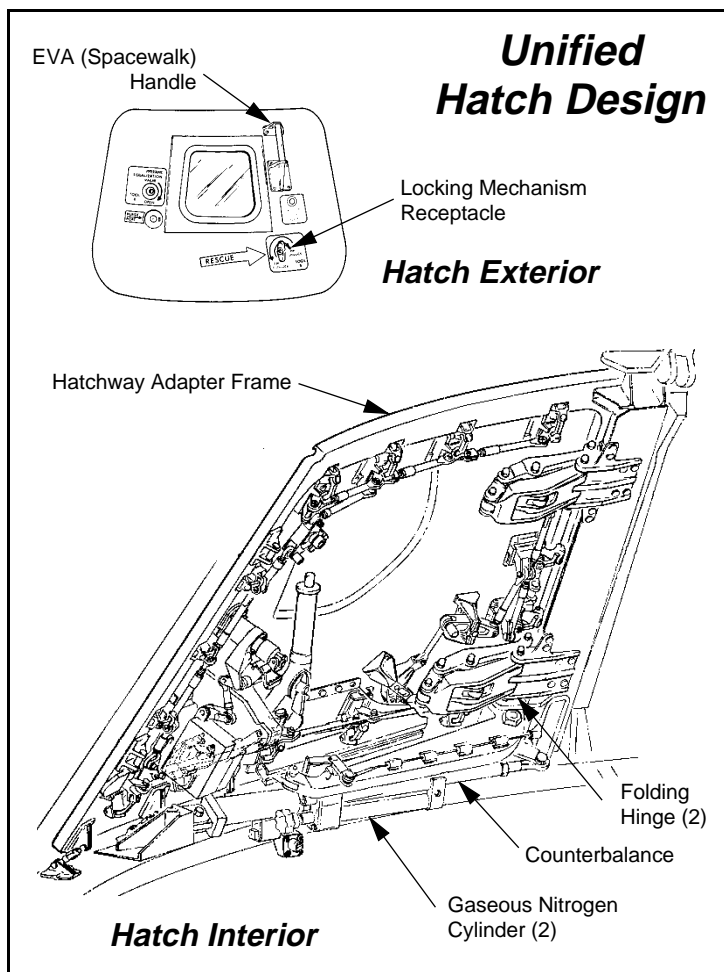
### REFERENCES

L. J. Walkover, R. J. Hart, E. W. Zosky. "The Apollo Command Module Side Hatch System." *Proceedings of the 4th Aerospace Mechanisms Symposium*. Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, January 15, 1970.

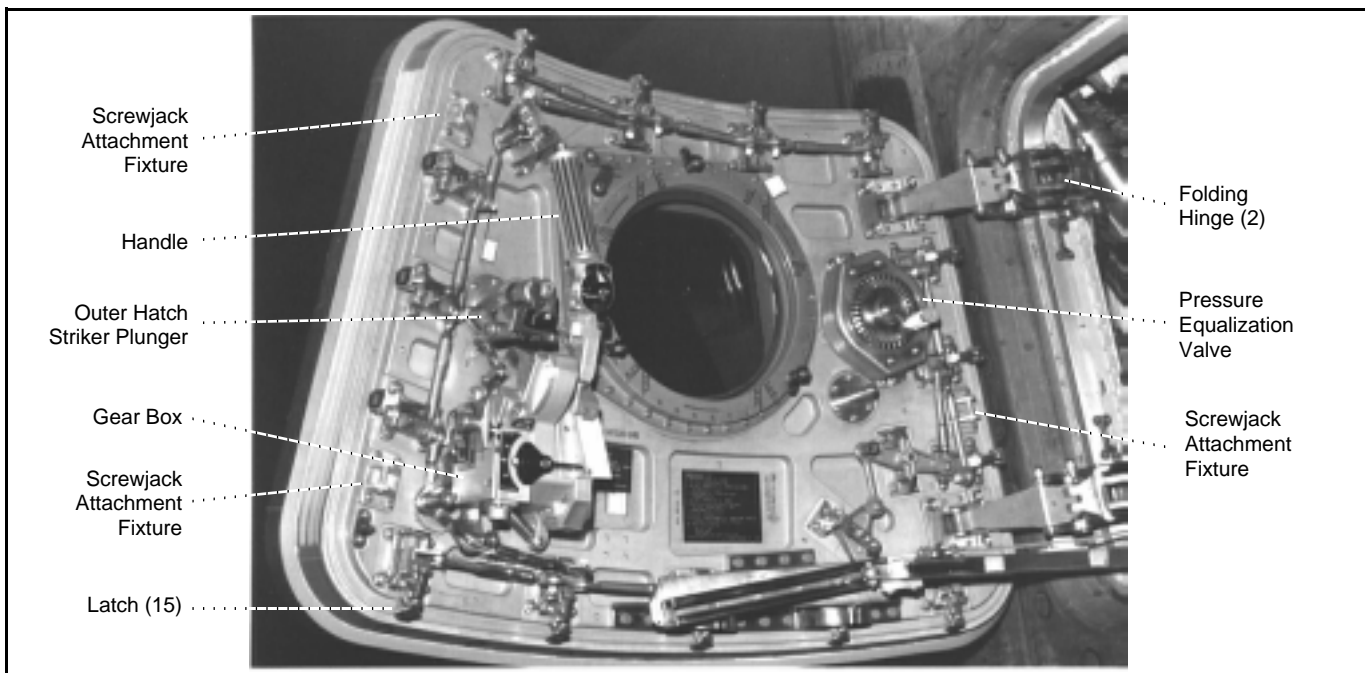
Ivan D. Ertel and Roland W. Newkirk, *The Apollo Spacecraft: A Chronology*, Volume IV, NASA, 1978.

*Mechanical Installation - Main Crew Hatch, (Perspective)* (engineering drawing). North American Aviation, Inc., August 21, 1965.

*Mechanism Installation - Unified Crew Hatch* (engineering drawing). North American Aviation, Inc., January 17, 1968.



The unified hatch design combined the inner and middle hatches. A sturdy latching mechanism sealed the hatch against internal air pressure. A powerful counterbalance would snap the hatch open in an emergency. Mounting the new design to the existing structure required an adapter frame bolted to the hatchway. (North American Aviation engineering drawing modified by John Fongheiser.)



Apollo 17 unified hatch interior shown open with latches in locked position. The 15 latches are linked together in 4 groups which can be disconnected to isolate failures. Three small screwjacks can be added to close the hatch if it has warped from thermal exposure during a spacewalk. (John Fongheiser photo.)

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