January 27, 1967 - three weeks before their scheduled launch - astronauts Gus Grissom, Ed White, and Roger Chaffee were participating in a simulated countdown 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 lightweight 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)
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**


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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.)