

# The Apollo 1 Fire

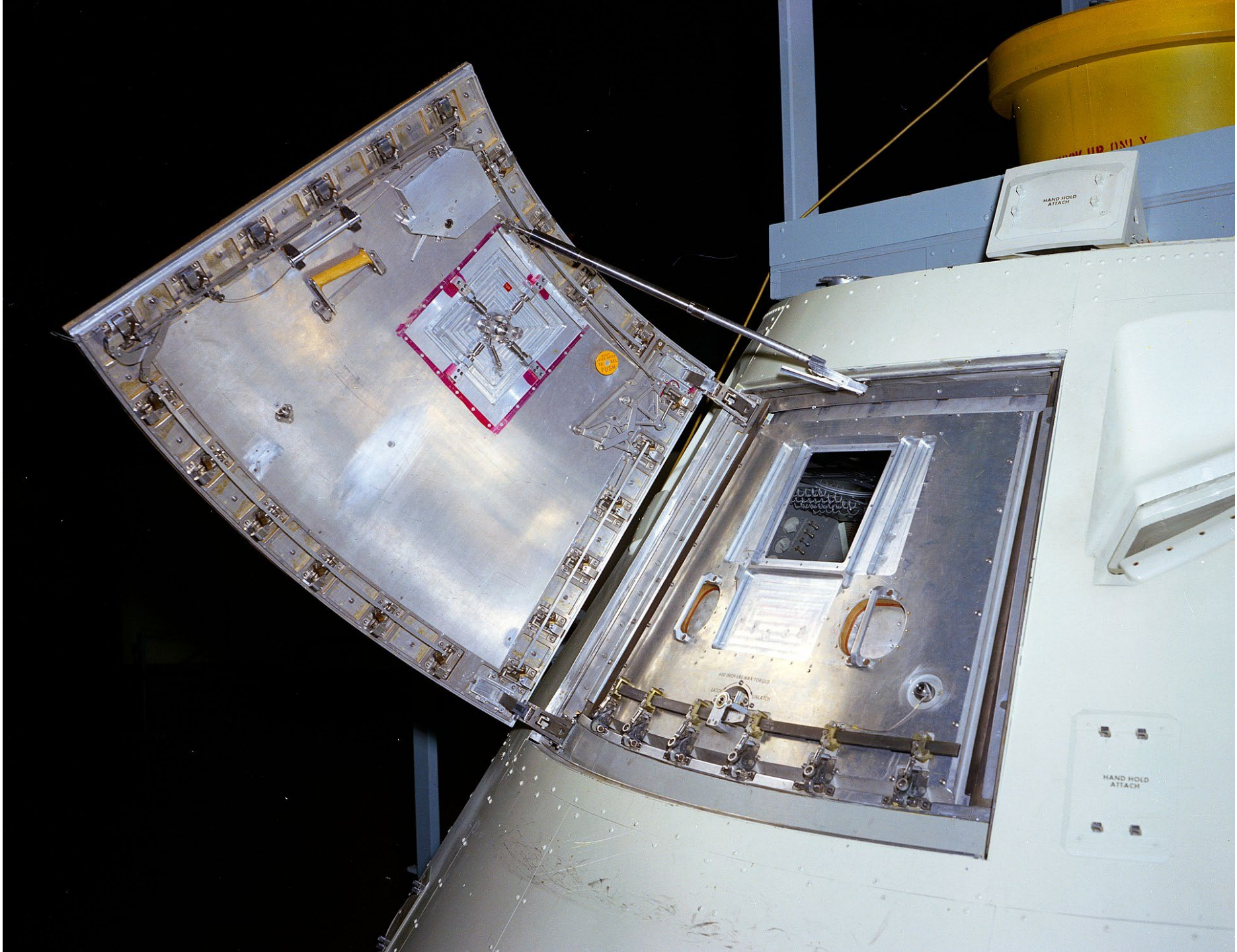
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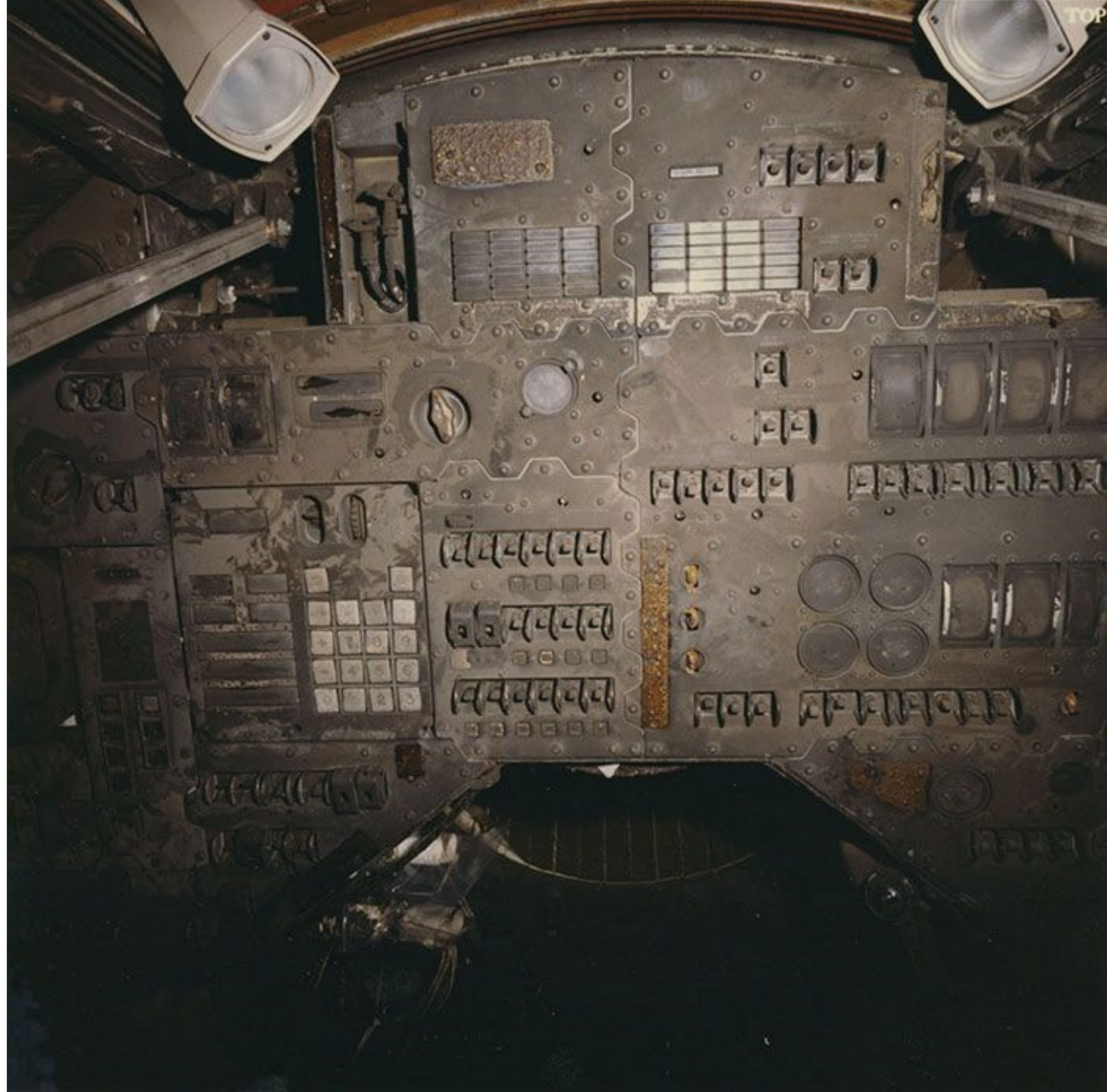
Apollo at 50

[Lee Atwood Interview](#)









Apollo 1 Audio



# Apollo 204 Review Board

- Floyd Thomson, Langley Research Center (Director)
- Max Faget, Manned Spacecraft Center (Apollo designer)
- Frank Borman, Astronaut (Gemini 7, Apollo 8)
- Colonel Charles Strang, US Air Force (Missile and Space Safety Chief)
- Barton Geer, Langley Research Center (Flight Vehicles Division)
- George White, HQ Apollo Program Office (Apollo Reliability Director)
- John Williams, Kennedy Space Center (Spacecraft Operations Director)
- George Malley, Lawyer
- Frank Long, Cornell University (Presidential Science Advisory Committee)
- George Jeffs, North American Aviation (Chief Engineer)
- Robert Van Dolah, Bureau of Mines (fire expert)

# The Path to the Fire

- North American's proposal had a mixed-gas environment
  - NASA directed a change to 5psi oxygen for weight and operational reasons
- Two approaches to minimizing fire risk:
  - Eliminate ignition sources
  - Minimize paths for fire propagation
- Preflight tests involve pressurizing spacecraft to check for leaks
  - In Apollo, a 2 psi overpressure above the normal sea level 14.7 psi was used
- This type of test was not recognized as hazardous

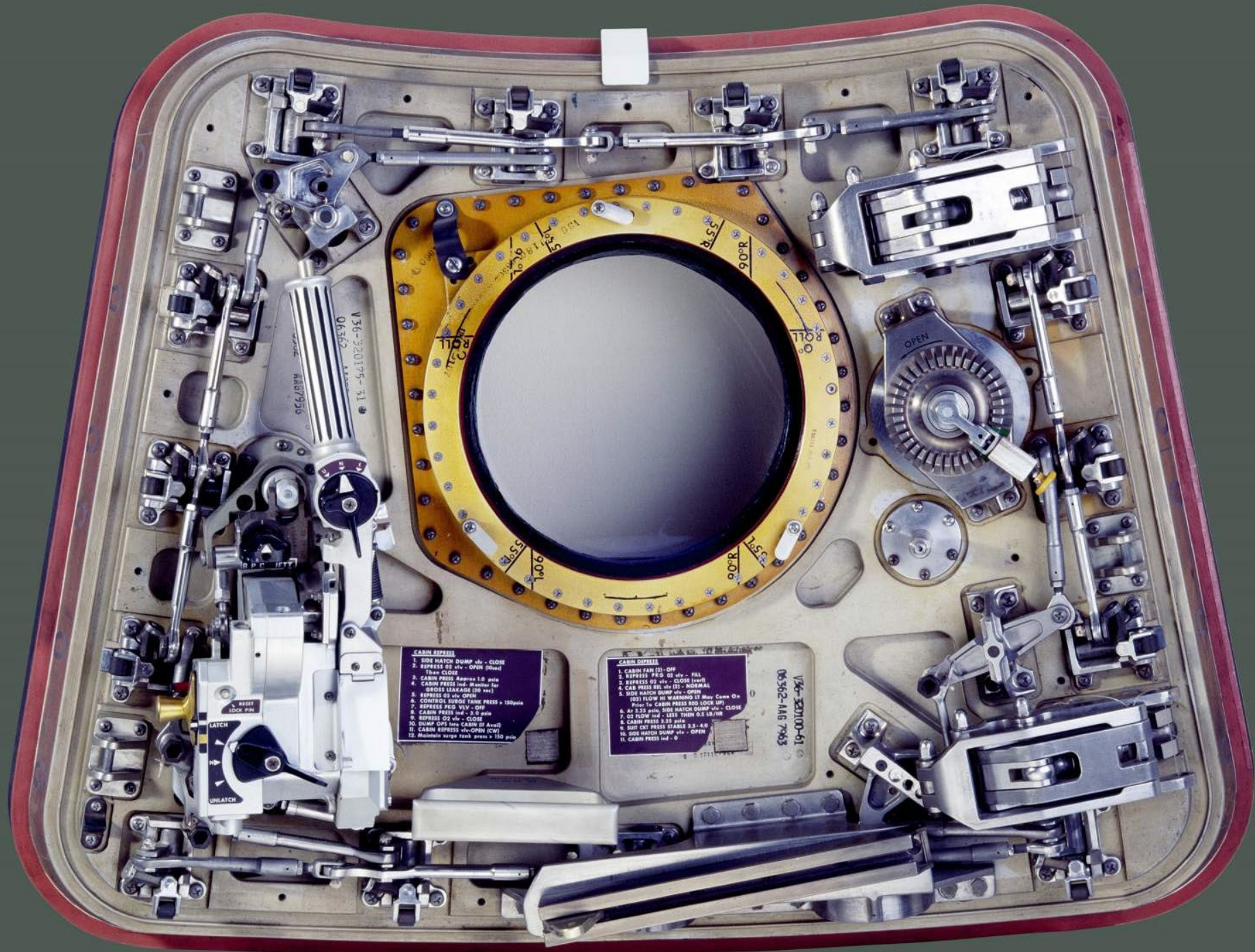


# Spacecraft Design Recommendations

- The amount and location of combustible materials in the Command Module must be severely restricted and controlled.
- Studies of the use of a diluent gas be continued with particular reference to assessing the problems of gas detection and control and the risk of additional operations that would be required in the use of a two-gas atmosphere.
- An in-depth review of all elements, components and assemblies of the Environmental Control System be conducted to assure its functional and structural integrity and to minimize its contribution to fire risk.
- Investigation be made of the most effective means of controlling and extinguishing a spacecraft fire. Auxiliary breathing oxygen and crew protection from smoke and toxic fumes be provided.
- Present design of soldered joints in plumbing be modified to increase integrity or the joints be replaced with a more structurally reliable configuration.
- Deleterious effects of coolant leakage and spillage be eliminated.

# Major Changes

- Decision not to fly Block I command modules
  - To allow focus on correcting deficiencies in the Block II command modules
- Comprehensive flammability review to prevent flame propagation
  - Command module and lunar module
- Mixed gas atmosphere before and during launch
  - 60% oxygen, 40% nitrogen (normal air is 78% nitrogen)
- New outward-opening hatch
  - Reduced time to open from 60 seconds to 3 seconds
- Congress established the Aerospace Safety Advisory Board
  - To advise the NASA Administrator on safety



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**CABIN REPRESS**  
1. SIDE HATCH DUMP vlv - CLOSE  
2. REPRESS O2 vlv - OPEN (50psi)  
Then CLOSE  
3. CABIN PRESS Asseml 1.0 psi  
4. CABIN PRESS Ind - Monitor for  
O2/CS LEAKAGE (20 psi)  
5. REPRESS O2 vlv OPEN  
6. CONTROL SIDE HATCH PRESS > 100psi  
7. REPRESS PREO VLV - OFF  
8. CABIN PRESS Ind - 2.0 psi  
9. REPRESS O2 vlv - CLOSE  
10. DUMP O2 Into GAINI BY ARM II  
11. CABIN REPRESS vlv-OPEN (CW)  
12. Maintain tank press > 120 psi

**CABIN PRESS**  
1. CABIN FAN (2) - OFF  
2. REPRESS PREO O2 vlv - FILL  
3. REPRESS O2 vlv - CLOSE (hand)  
4. CAB PRESS Ind (2) - NORMAL  
5. SIDE HATCH DUMP vlv - OPEN  
(O2 FLOW IN WARNING LT Red Come On  
Pin II. CABIN PRESS IND LOCK OFF)  
6. At 555 psi, SIDE HATCH DUMP vlv - CLOSE  
7. O2 FLOW Ind - LESS THAN 0.5 l/min  
8. CABIN PRESS Ind - 2.0 psi  
9. REPRESS O2 vlv - CLOSE  
10. SUIT O2 PRESS STABLE 20 - 40  
11. SIDE HATCH DUMP vlv - OPEN  
12. CABIN PRESS Ind - 0

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REST  
LOCK PIN

LATCH

UNLATCH

OPEN

ROLL

90°R  
90°L  
90°R  
90°L

# Testing Recommendations

- Full-scale mock-ups in flight configuration be tested to determine the risk of fire.
- The fire safety of the reconfigured Command Module be established by full-scale mock-up test.
- Vibration tests be conducted of a flight-configured spacecraft.
- Management continually monitor the safety of all test operations and assure the adequacy of emergency procedures.
- All emergency equipment (breathing apparatus, protective clothing, deluge systems, access arm, etc.) be reviewed for adequacy.
- Personnel training and practice for emergency procedures be given on a regular basis and reviewed prior to the conduct of a hazardous operation.
- The Ground Communication System be improved to assure reliable communications between all test elements as soon as possible and before the next manned flight.

# Other Recommendations

- That the time required for egress of the crew be reduced and the operations necessary for egress be simplified.
- The necessity for electrical connections or disconnections with power on within the crew compartment be eliminated.
- Review of specifications be conducted, 3-dimensional jigs be used in manufacture of wire bundles and rigid inspection at all stages of wiring design, manufacture and installation be enforced.
- Service structures and umbilical towers be modified to facilitate emergency operations.
- A detailed design review be conducted on the entire spacecraft communication system.
- Every effort must be made to insure the maximum clarification and understanding of the responsibilities of all the organizations involved, the objective being a fully coordinated and efficient program.

# Discussion Groups

- FETM episode 2 (“Apollo One”)
  - A dramatization of the effects of the fire
- Cox Chapter 14 (“Did He Say Fire?”)
  - The engineers’ view of the fire
- Report of the Apollo 204 Review Board
  - Complete history, timeline and analysis of the accident
- **Chaikin Chapter 1 (“Fire in the Cockpit”)**
  - **The astronaut’s view of the fire**

# Voskhod, Soyuz and Zond

- **Scott Chapter 3 (“Red Star, White Star”)**
  - **Astronaut perspectives on the American and Soviet space programs**
- Chertok Volume 3 Chapter 9 (“The Voskhods and the First Spacewalk”)
  - An insider’s story of Voskhod 1 and Voskhod 2
- Spacewalker video
  - A dramatization of the Voskhod 2 mission
- Harvey Chapter 5 (“The First Cosmonauts to the Moon”)
  - The Zond and Soviet lunar landing programs