**Wings Over the Rockies**
**Apollopalooza**
**July 15, 2019**

# APOLLO COMMAND MODULE RECOVERY

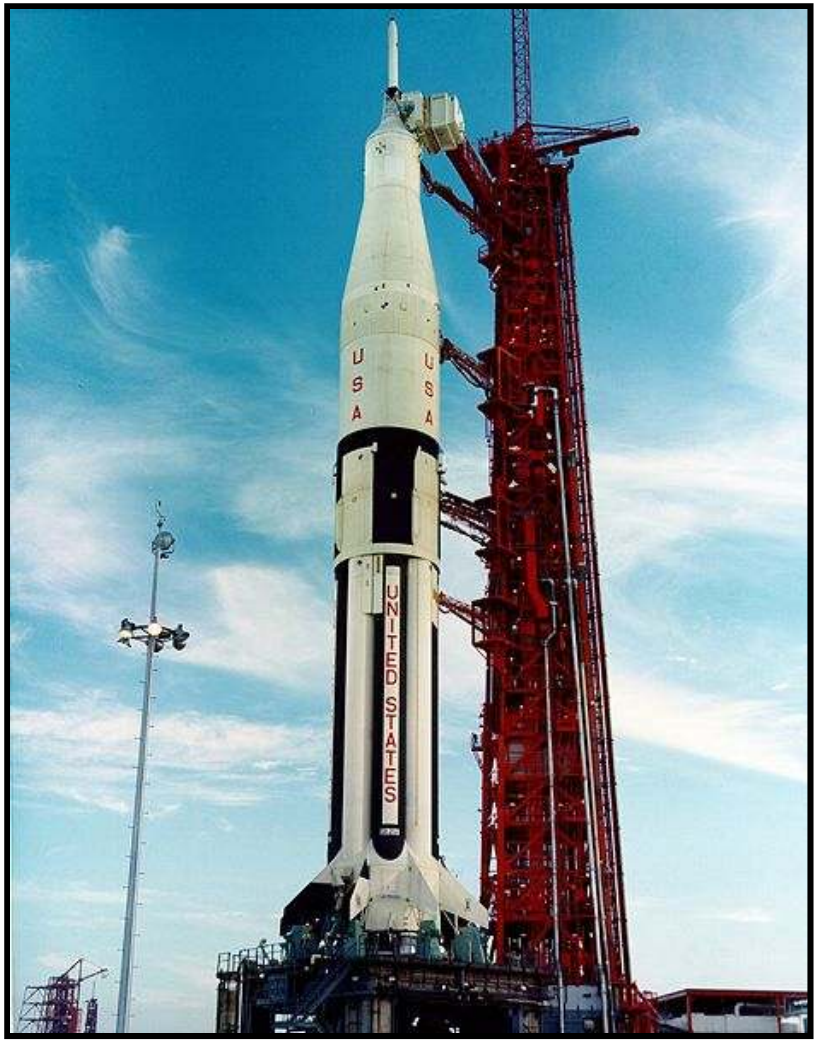
**Presented By**
**Coye Mac Jones**
**Retired NASA-MSC/JSC (1964-2003)**

**Apollo recovery tasks in Landing and Recovery Division 1964-1971:**

- **Project Engineer**
  - **Water test vehicles: BP-25, BP-1101/1101A, CM-007/007A**
  - **Command Module (CM) Emergency Access - Jammed Hatch Kit**

- **Mission Operations Recovery Engineer**
  - **AS-201 NASA rep on Navy destroyer**
  - **Apollos 7-14 CM emergency access engineer for Launch Site Recovery at KSC**
  - **Apollos 7, 8, 9, 12, 15 NASA rep on postflight CM landing safing teams**

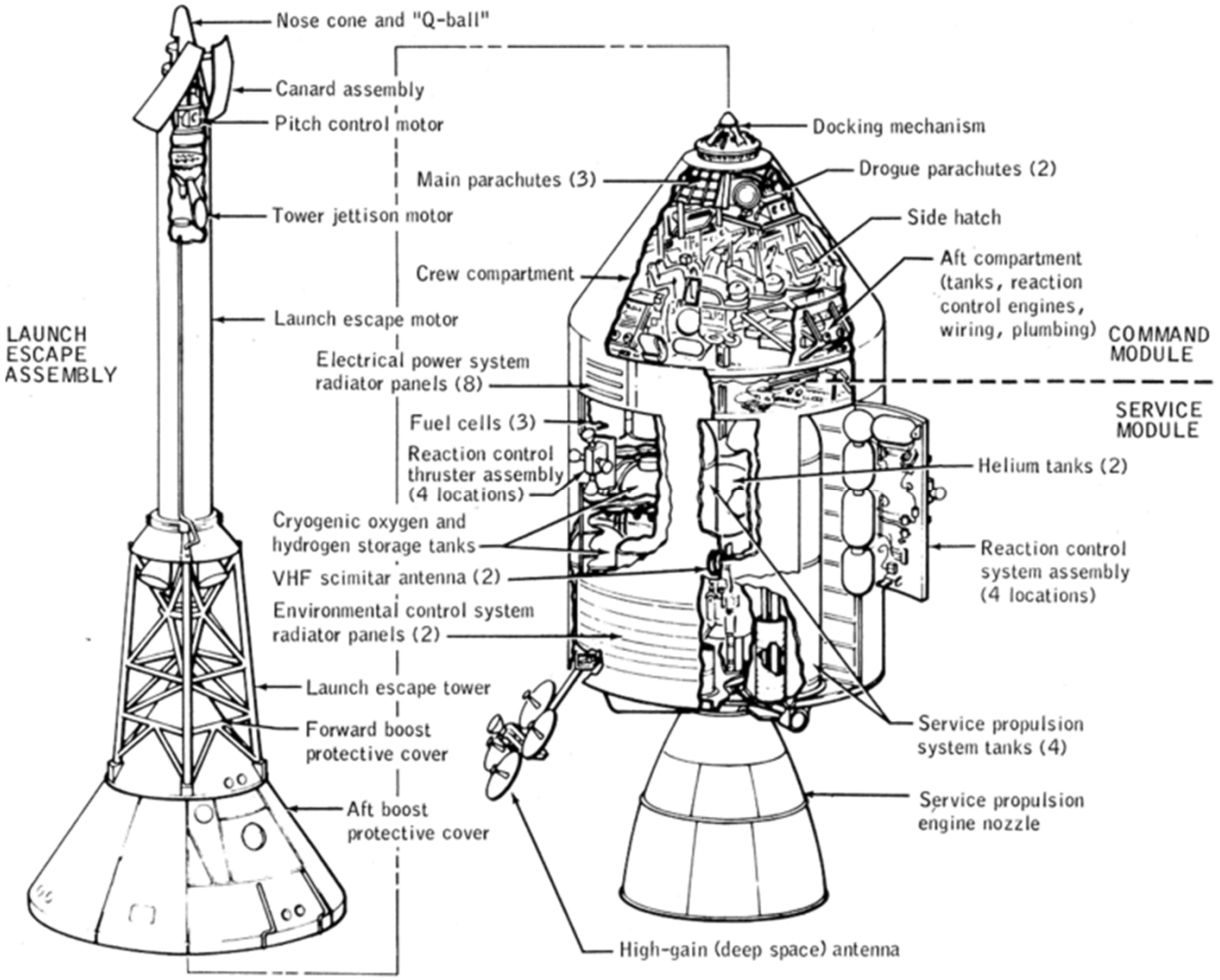
# APOLLO LAUNCH VEHICLES




**Saturn IB**
**Manned Apollo 7**

**Saturn V**
**Manned Apollos 8-17**

# APOLLO LES/CSM*




*Manufacturer of Apollo Command & Service Module was North American Aviation, which became North American Rockwell in 1967, then Rockwell International in 1973

# APOLLO COMMAND MODULE
# BP-1101/1101A

# BP-1101/1101A HISTORY

**April 1965: BP-1101 Initial Weight & CG**

- 1100 Series Boilerplate – Non-flight Apollo Command Module (CM) shell of aluminum alloy 5056 – BP-1101 & BP-1102
- Designed by NASA-MSC Landing & Recovery Division and fabricated by Kelly AFB Air Materiel Command
- BP-1101 delivered to NASA-MSC in Apollo Block I configuration in early 1965
- Water Tank (static) and Gulf of Mexico (dynamic) development tests of flotation collar and Apollo Block I Uprighting System in 1965

# BP-1101/1101A HISTORY (Continued)

**1965: Block I Uprighting Test in Gulf of Mexico**

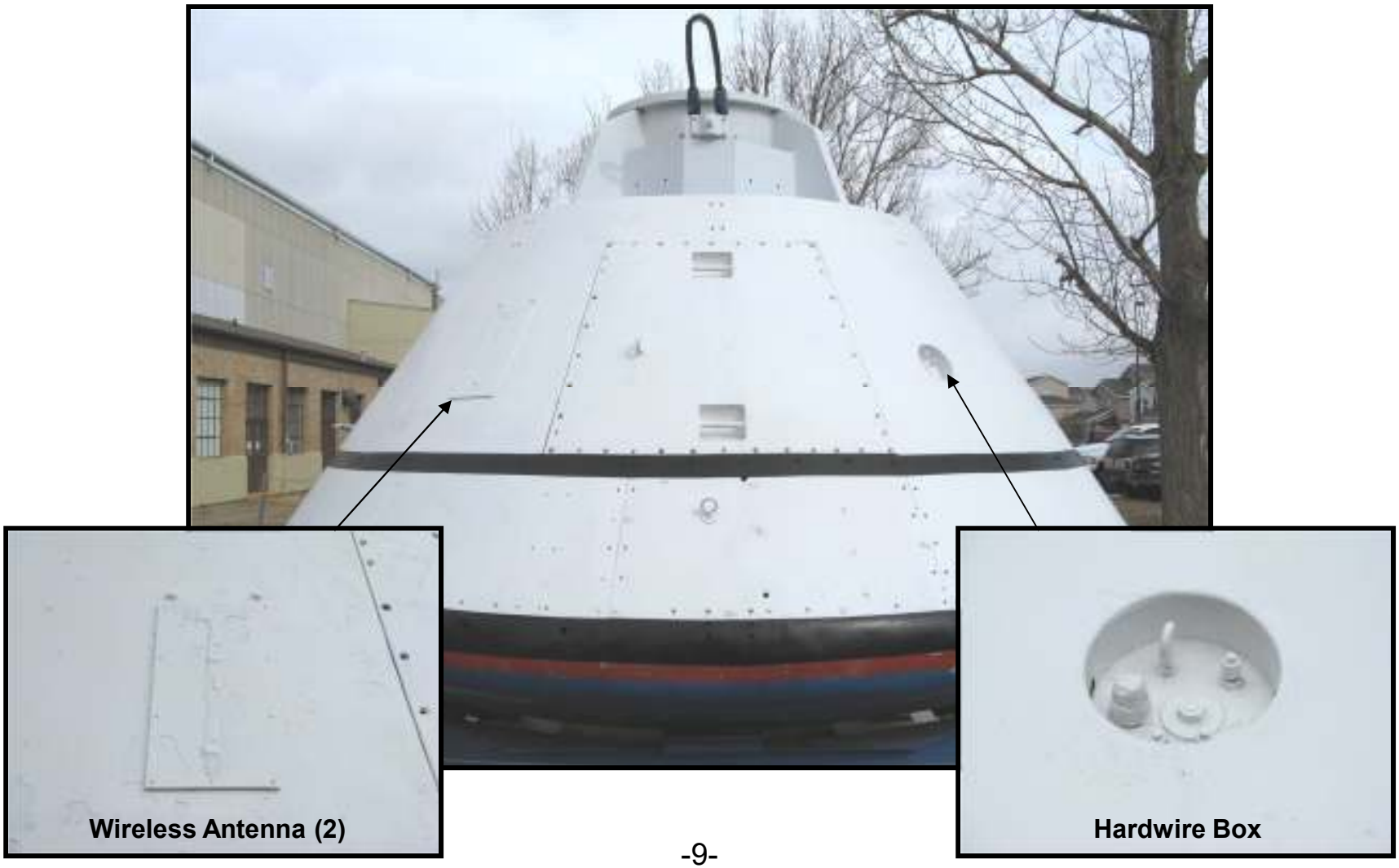
- BP-1101 modified to Apollo Block II configuration BP-1101A in late 1965
- Tank (static) and Gulf of Mexico (dynamic) developmental tests of Block II (1966) Uprighting System
- In storage at NASA-MSC/JSC 1967-1974
- In 1975 transferred to Disabled American Veterans Club, George Klumker Post No. 22 in Wheat Ridge, Colorado for display
- In 2001 transferred to Wings Over The Rockies for permanent display
- BP-1101A is Smithsonian National Air & Space Museum Collection Object No. A19760054000

# BP-1101A CONFIGURATION

• BP-1101 upper deck modified from Apollo Block I (earth orbit mission configuration) to Apollo Block II (lunar mission configuration) for BP-1101A

# BP-1101A CONFIGURATION (Continued)

• BP-1101 Block I hardwire equipment and BP-1101A Block II wireless equipment for uprighting tests



# BP-1101A CONFIGURATION (Continued)

- BP-1101A interior has mounted lead ballast for weight and CG adjustment and old test wiring/plumbing for uprighting tests

# FLOTATION COLLAR TESTS

- Apollo flotation collar evolved from successful Mercury Program and Gemini Program designs and consisted of circular dual inflatable tubes made of rubberized life raft material and installed/inflated with $CO_2$ by Navy UDT swimmers on Prime Recovery Ship
- BP-1101 unmanned static tests in water tank at NASA-MSC and in Gulf of Mexico for unmanned dynamic testing

**BP-1101 on NASA Motor Vessel Retriever**

**BP-1101 Away for 1st Collar Test**

# FLOTATION COLLAR TESTS (Continued)

• Apollo flotation collars were manufactured by Naval Air Rework Facility at Naval Air Station in Pensacola

**NASA Swimmers with Collar Package**

**Flotation Collar on BP-1101**

# UPRIGHTING SYSTEM TESTS

• Uprighting system utilized three Goodyear Aerospace flotation bags, located on upper deck beside main parachutes (Block I) and underneath main parachutes (Block II) in forward compartment, inflated after splashdown to upright CM if inverted (Stable II) and/or to insure Command Module would not invert and stay upright (Stable I) during postlanding recovery operations

• BP-1101/1101A unmanned static tests in water tank at NASA-MSC and unmanned dynamic testing in Gulf of Mexico

**BP-1101 in Stable II (inverted)**

**BP-1101 in Stable I (upright)**

# BP-1101A Block II Uprighting System Tests in Gulf of Mexico in 1966

# APOLLO POSTLANDING SUCCESS

• BP-1101/1101A development tests aided in improving the final systems designs of Apollo uprighting system and flotation collar

  • Five uprightings of inverted Command Modules after splashdown in eleven missions on Apollo's 7, 8, 11, 12, and 16; one uprighting in three missions on Skylab 4; and one uprighting in one mission on ASTP.

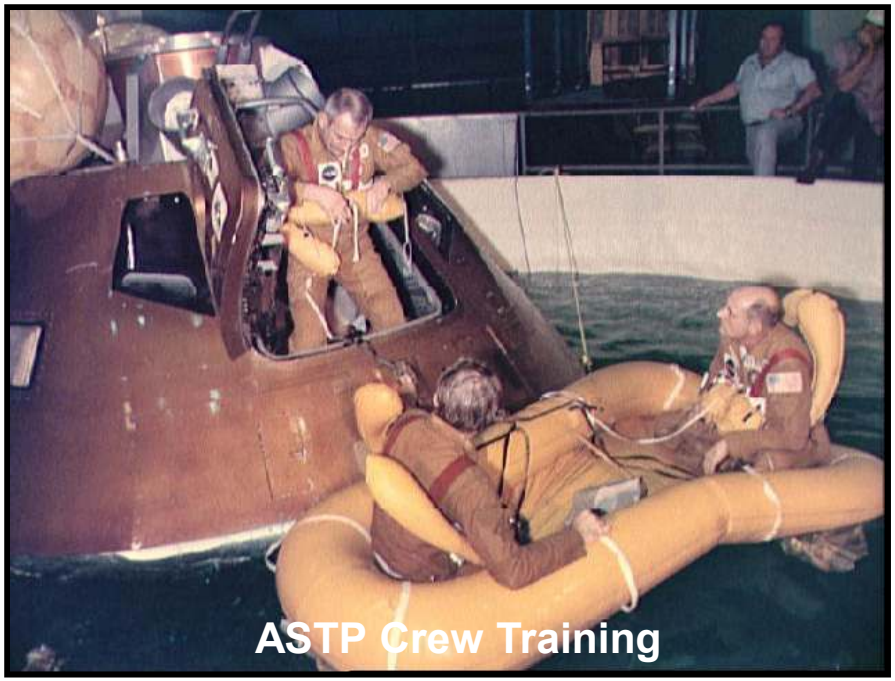
  • Flotation collars successfully installed by Navy UDT swimmers on all Command Modules in postlanding operations during the Apollo, Skylab, and ASTP


Apollo 11


Apollo 17

# APOLLO COMMAND MODULE BP-1102A

- BP-1102A, sister boilerplate of BP-1101A, used for manned postlanding water egress procedures development and crew training of all Apollo CM flight crews
- Interior outfitted with crew couches and simulated hardware to provide realistic training for flight crews
- Currently on display at the Air & Space Steven F. Udvar-Hazy Center with Apollo 11 uprighting bags and flotation collar


ASTP Crew Training


Air & Space Udvar-Hazy

# Launch Site
# Command Module Emergency Access
# Jammed Hatch Kit

# Command Module Launch Site Abort

- Launch Site Recovery Team covers first 90 seconds of powered flight
  - ARRS helicopters (2 HH-53C and 1 HH-3E) and crew (pilots/PJ's)
  - DDMS commander ("Beach Boss") and Patrick AFB firefighters
  - NASA emergency access recovery engineers (prime and backup)
  - Recovery of astronaut crew and CM
  - 1 week team training prior to each launch

- Emergency access may be required in event of CM hard landing (land, beach, swamp) following launch abort
  - Fire suppression by Patrick AFB firefighters
  - Emergency CM access through CM tunnel sidewall in event of jammed CM side hatch
  - Fresh air into CM
  - Assumed incapacitated astronaut crew recovery
  - Jammed Hatch kit stationed on Pad 39B access road for Pad 39A launches

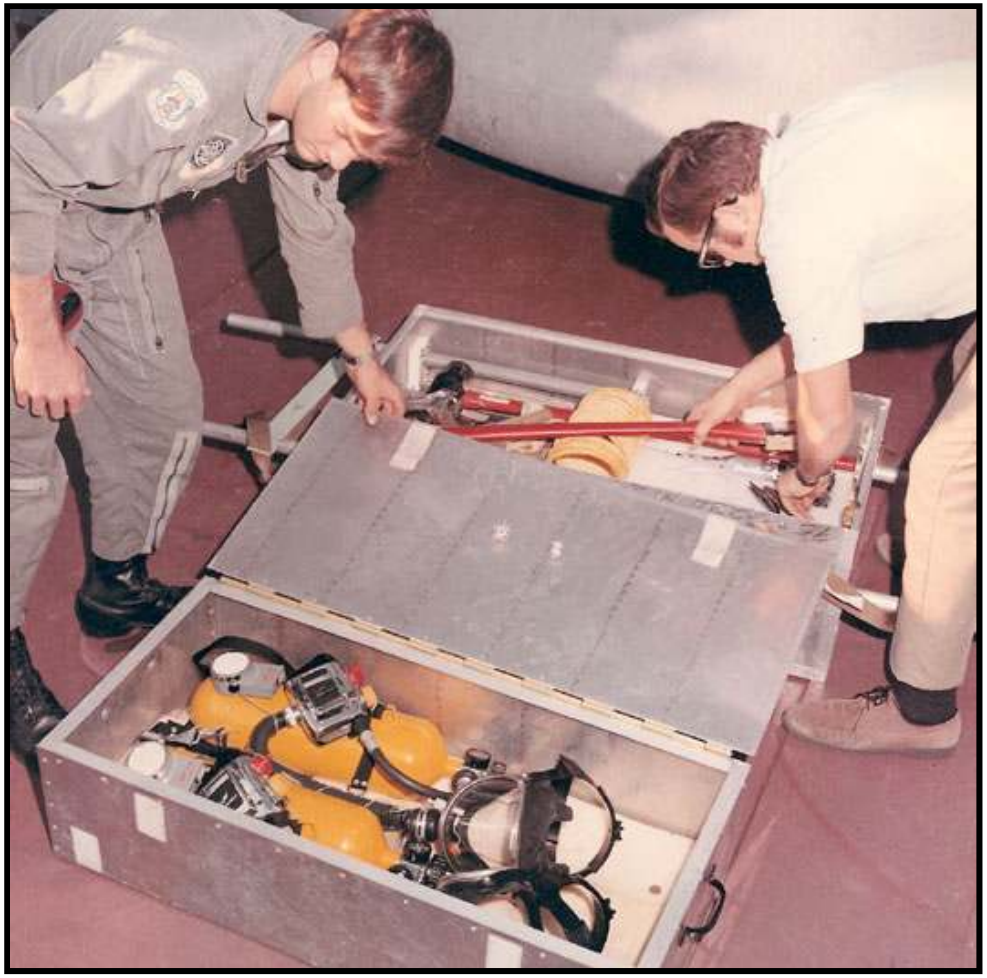
**Launch Site Recovery Team with USAF ARRS, Patrick AFB, and NASA-MSC/KSC personnel in front of ARRS HH-53C for Apollo 9 in March 1969**

**USAF ARRS HH-53C retrieving Apollo boilerplate during Launch Site Recovery training for Apollo 12 at KSC in November 1969**

**USAF ARRS HH-53C retrieving Apollo BP-1207 during Launch Site Recovery training for Apollo 12 at KSC in November 1969**


**USAF ARRS personnel and NASA rep in jammed hatch walk-thru for Launch Site Recovery training using BP-1207 prior to Apollo 12 at KSC in November 1969**

**Emergency access recovery engineer (Nomex suit, Scott airpak, and VHF radio) for Apollo 9 at KSC in March 1969**



**Jammed Hatch Kit (JHK) with emergency access tools and crew breathing equipment in two-part aluminum case with stowable litter handles and lifting sling (not pictured is portable ventilator) for Apollo 13 at KSC in April 1970**

**Prime Jammed Hatch Kit and fire suppression unit on station at KSC for Apollo 13 launch on April 11, 1970**