The BIG Story

**BIG** is the acronym for Biological Isolation Garment, which is the full-body suit the Apollo 11 astronauts wore when exiting their Command Module (CM) after splashdown at the end of their lunar mission. Before the lunar landing missions, scientists were concerned that the earth could be contaminated by lunar material – “Unfortunately, the possibility that living organisms exist on the moon is remote. But if they do exist, and in turn infect the astronauts, the Apollo 11 flight may indeed be a historic event.”

In order not to expose earth, an overall lunar quarantine protocol, including the BIG, was developed in which recovery quarantine was the first step.

Initially, the preferred recovery quarantine method for returning lunar mission astronauts was to bring them aboard the prime recovery ship in the command module (CM) to maintain quarantine. There were concerns with the possibility of dropping the command module back in the ocean while hoisting from failure of the hoisting crane or the CM recovery loop, the spacecraft bumping along the side of the ship as the carrier dead in the water drifted from wind and currents into the spacecraft; and the doctors emphasizing their requirement to have the astronauts available for medical data quickly. An alternate procedure was presented to NASA Manned Spacecraft Center (MSC) management and the Interagency Committee on Back Contamination (ICBC) and accepted to suit each astronaut in the BIG inside the command module after splashdown. (LRD/John Stonesifer presented the recovery quarantine plan.) The three BIG’s were to be delivered by a biological decontamination Underwater Demolition Team (UDT) swimmer, who himself would be dressed in a BIG. Upon exit from the CM into the recovery raft, the three astronauts would be hoisted into the recovery helicopter and flown to the prime recovery ship for entrance into the Mobile Quarantine Facility (MQF). The input from the Navy that their helo crews are professionals in rescuing people from the water, as had been demonstrated by these same squadrons in Vietnam waters, gave NASA confidence that the helicopter recovery of the crew would be safe and preferable.

The BIG was jointly developed in-house by the Crew Systems Division (BIG tech brief and patent) and the Landing and Recovery Division. The design of the BIG featured a full-body suit covering the entire body as a biological barrier and made of a closed-knit lightweight material and a face mask with a plastic visor, air inlet flapper valve, and an air outlet biological filter to preclude contamination of the air (Photo #1). The BIG used by the
recovery swimmer in immediate contact with the lunar astronauts was identical except the inspired air was filtered to prevent contamination of support personnel. While pathogen containment was the driving requirement for the BIG, equally important were the human factor requirements of astronaut comfort, mobility, and safety.

The BIG was tested pre-mission both biomedically and operationally. Biomedical tests included suited subjects in static conditions of high heat/humidity. Frank Janes and Milt Heflin lead the project for LRD, and Fred Spross for Crew Systems Division. BIG fabric material was tested at the Army’s Fort Detrick in Maryland. Test subject LRD/Mike Collins was suited in hot sun conditions outside of MSC-Building 260 to gauge comfort and measure body core temperature increase. Operational tests included static water tests in MSC’s Building 260 water tank and open water tests in the Gulf of Mexico with water egress trainer BP-1102A with LRD test subjects John Hirasaki, Randy Stone, and Ralph Culbertson. The Gulf test in operational conditions resulted in a suit design change which allowed the mask to be removed quickly in an emergency such as heat/motion-induced nausea/vomiting. NASA test subjects Paul Kruppenbacher (LRD), Art Lizza (Tech Services), and Tex Ward (Crew Systems) wore BIG’s (Photo #2) for the recovery quarantine operational dry run in March 1969 aboard the USS Guadalcanal during Apollo 9. Randy Stone wore a BIG to demo the suit for President Nixon onboard the USS Hornet for Apollo 11. The eventual Apollo 11 biological decontamination UDT swimmer, Lt. Clancy Hatleberg, came to Houston to train with the prime astronaut crew and test/confirm operational procedures (Photos #3 & #4).

The Apollo 11 mission ended with an on-target splashdown in the Pacific Ocean. After the CM uprighted from an inverted orientation, Helo Swim 2 deployed UDT swimmers to install the sea anchor, flotation collar and two rafts. Helo Recovery 1 delivered four BIGs and decontamination equipment to the primary raft. The biological decontamination UDT swimmer donned his BIG and passed three BIGs to the astronauts in the CM through a quickly opened and closed main hatch. After donning their BIGs inside the CM, the astronaut crew of Armstrong, Aldrin, and Collins exited the CM into a recovery raft (Photo #5). The biological decontamination UDT swimmer, Lt. Clancy Hatleberg, decontaminated the astronauts in their BIGs with sodium hypochlorite solution before they were subsequently hoisted into the recovery helicopter for the short trip to the carrier and entrance into the MQF (Photo #6).
The BIG performed as designed but in operational conditions and reality, astronaut comfort was compromised\(^8\). The crew reported tolerable conditions through arriving in the helicopter, but then commenced extra body movements\(^9\) (Aldrin and Collins) to re-acclimate themselves to 1-G so that by the time they arrived at the carrier, they were uncomfortably warm in the BIGs with visor fogging. Astronaut Collins wrote, when he exited the helicopter to walk the short distance to the MQF that “Inside the goddamn BIG, I’m not only roasting by now but almost blinded by a fogged visor”\(^{10}\). The other two astronauts reported similar discomfort\(^{11}\). The Apollo 11 Mission Report documented: “Helicopter pickup was performed as planned, but visibility was substantially degraded because of moisture condensation on the biological isolation faceplate. The helicopter transfer to the aircraft carrier was performed as quickly as could be expected, but the temperature inside the suit was uncomfortable.”\(^{12}\)

Subsequent to Apollo 11, it was recommended to replace the BIG with a lightweight coverall and mask respirators\(^{13}\) for Apollo 12 (Photo #7). Crew quarantine was eliminated after Apollo 14 based on non-evidence of lunar back-contamination following Apollos 11, 12, and 14 lunar landings\(^{14}\).

The technology of the BIG was featured in Spinoff 1976 and documented as “A spinoff of the astronaut's biological isolation garment will allow hospital patients who are highly vulnerable to infection to leave their sterile habitats for several hours, carrying their germ-free environment with them”\(^{15}\).

Astronaut Aldrin’s BIG is displayed\(^{16}\) at the Smithsonian Air & Space Museum in Washington D.C.; Manufacturer: B. Welson & Co. (Photo #8)

February 26, 2014
Updated: September 5, 2018

Written By:
Coye Mac Jones
NASA-MSC/LRD Project Engineer 1964-1972
Retired NASA-Johnson Space Center/Houston in January 2003
1. Biological isolation garment (BIG) diagram from NASA Tech Brief #68-10500, dated November 1968. (Credit: NASA Tech Brief 68-10500)
2. NASA test subjects (Paul Kruppenbacher, Art Lizza, Tex Ward) in BIGs walk from recovery helo aboard USS Guadalcanal during recovery quarantine operational dry run in May 1969 during Apollo 9. (Photo Credit: Image capture from 16mm from John Hirasaki)

3. The Apollo 11 prime crew (Armstrong, Aldrin, and Collins) trains in the Gulf of Mexico on May 24, 1969, using Apollo CM Boilerplate1102A. The three crewmen practiced donning and wearing biological isolation garments (BIG) as a part of the exercise. The biological decontamination UDT swimmer, Lt. Clancy Hatleberg, standing up, assisted in the training and is also wearing a BIG. (Photo Credit: NASA S69-34967)
4. Biological decontamination UDT swimmer, Lt. Clancy Hatleberg, is suited in a biological isolation garment (BIG) prior to training with the Apollo 11 prime crew (Armstrong, Aldrin, and Collins on the NASA MV Retriever in the Gulf of Mexico on 24 May 1969. (Photo Credit: NASA S69-34538)
5. The Apollo 11 crew (Armstrong, Aldrin, and Collins), wearing biological isolation garments (BIG), await pickup by Helo Recovery 1 from the USS Hornet on July 24, 1969. The fourth man in the life raft is the biological decontamination UDT swimmer, Lt. Clancy Hatleberg. (Photo Credit: NASA S69-21698)
6. The Apollo 11 crew (Armstrong, Aldrin, and Collins), wearing biological isolation garments (BIG) and followed by NASA flight surgeon Dr. Bill Carpentier, exit the recovery helicopter in the USS Hornet hangar deck and walk toward the Mobile Quarantine Facility (MQF) on July 24, 1969. They were housed in the MQF with LRD’s recovery quarantine engineer, John Hirasaki, and Dr. Carpentier until arriving at the Lunar Receiving Laboratory (LRL) at the Manned Spacecraft Center (MSC) on July 28, 1969. (Photo Credit: NASA S69-40753)
7. The Apollo 12 crew (Conrad, Bean, Gordon), wearing lightweight coverall and mask respirators exit the recovery helicopter in the USS Hornet hangar deck and walk toward the Mobile Quarantine Facility (MQF) on November 24, 1969. They were housed in the MQF with LRD's recovery quarantine engineer, Randy Stone, and NASA flight surgeon Dr. Clarence Jernigan until arriving at the Manned Spacecraft Center's (MSC) Lunar Receiving Laboratory (LRL). (Photo Credit: NASA S69-22849)
8. Apollo 11 biological isolation garment (BIG), worn by Astronaut Aldrin, is displayed in the Air & Space Museum in Washington, DC. (Photo Credit: Smithsonian Air & Space Museum)
References


http://history.nasa.gov/SP-4009/v4p3e.htm.


15. **Spinoff 1976**. NASA SP-5121 (Medical Systems/Biological Isolation Garment), April 1976.  

16. **Biological Isolation Garment, Aldrin, Apollo 11**. Smithsonian Air & Space Museum collection object # A19710809000.  
http://airandspace.si.edu/collections/artifact.cfm?object=nasm_A19710809000