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."[1] 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[2]) management and the Interagency Committee on Back Contamination (ICBC) and accepted to suit each astronaut in the BIG inside the command module after splashdown[3]. (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[4] in-house by the Crew Systems Division (BIG tech brief[5] and patent[6]) 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[7] (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)

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Update November 10, 2023: A search for a spare BIG for a museum display elicited the following BIG memories from LRD veterans:

From Milt Heflin on October 23, 2023:
I was involved A LOT with the BIG. Fred Spross in Engineering oversaw the making of the BIG and I was assigned to overseeing its suitability for real-time us. I'm not a bit proud of its operational outcome - the crew hated it, I hated it - this is not meant to criticize Fred's work. We (collectively) just made a simple garment, without any cooling, for egress during transporting the crew from splashdown to the Mobile Quarantine Facility (MQF) onboard the ship.

On the "lighter side", just for grins, I have three unusual short stories I thought I would share as we developed the operations of the BIG:

Sometime in 1968 I hand carried a sample of the BIG's proposed material to Frederick, Maryland to Fort Detrick, the center of the US biological weapons program, 1943-1969, and during this time it was very common to use a car from a government Motor Pool, "Gray Ghost" it was called, I believe bottom line, it was easily recognized as a government car "For Official Use Only". It was early Fall evening and I was on my way to a hotel that took me right down a major street with several apartment buildings, also a muggy evening with no AC in the car so I had all windows down. There was lots of "humanity" outside on the sidewalks, so I've driving slow through the area and lots of people are pointing and hollering at me, I'm thinking they see me as a Government Official and were sort of "greeting me"??!! This went on for almost a whole block when I discovered that I was going the wrong way on a one-way street. That also explained why I moved by a couple of stop cars honking at me.

Second short story, JSC medical folks wanted to get some idea of just how hot would one would get wearing a BIG in the sunlight so our medical support inserted a rectal temperature probe in our LRD Mike Collins, he donned a BIG, and we set him in a gray government chair in the direct sunlight in front of Bldg. 260 and "confirmed" he really got hot. Now get this, there was NO "pretest" review, and we just did it! YIKES!!!

Last short story is another "BIG" test I dreamed up and just did it without written procedures and no pretest review. YIKES again! For a crewman in the BIG, we needed to provide voice amplification so they could be heard. Engineering came up with a simple, small battered powered mic. Our main

challenge was to make crewman's voice loud enough in the Helicopter prop-wash noise environment. I don't remember if we used our Mike Collins again as our test subject. So here's what we did, again without out a formal test procedure review. our test subject in a BIG, with the voice amplification, and we got in somebody's pickup with an elevated bar just above the cab you could hold on to. We then found a mostly deserted, unfinished strip of under construction Bay Area Blvd. near JSC, and the test subject and I stood up behind the pickup's cab, holding onto the bar, while traveling about 60-miles an hour. We carried on a conversation in the 60 mph wind blasting us in the face. We concluded it would work, and again, we did not provide a test report, nor a formal presentation.

From Mike Collins on October 23, 2023:
I had a BIG at home that I used as a Halloween costume. I vaguely remember the gloves outlasting the rest of the suit. I suppose I just discarded it somewhere along the way.

On the thermal test, we did have a flight Doc (maybe Chuck Lapinta) monitoring the test. I was never in any danger, but I do have a couple of 8x10 photos that show I got really hot. Milt has always taken great delight on telling about my rectal thermometer…

Milt must have used some other sucker for the voice test. That one was not me.

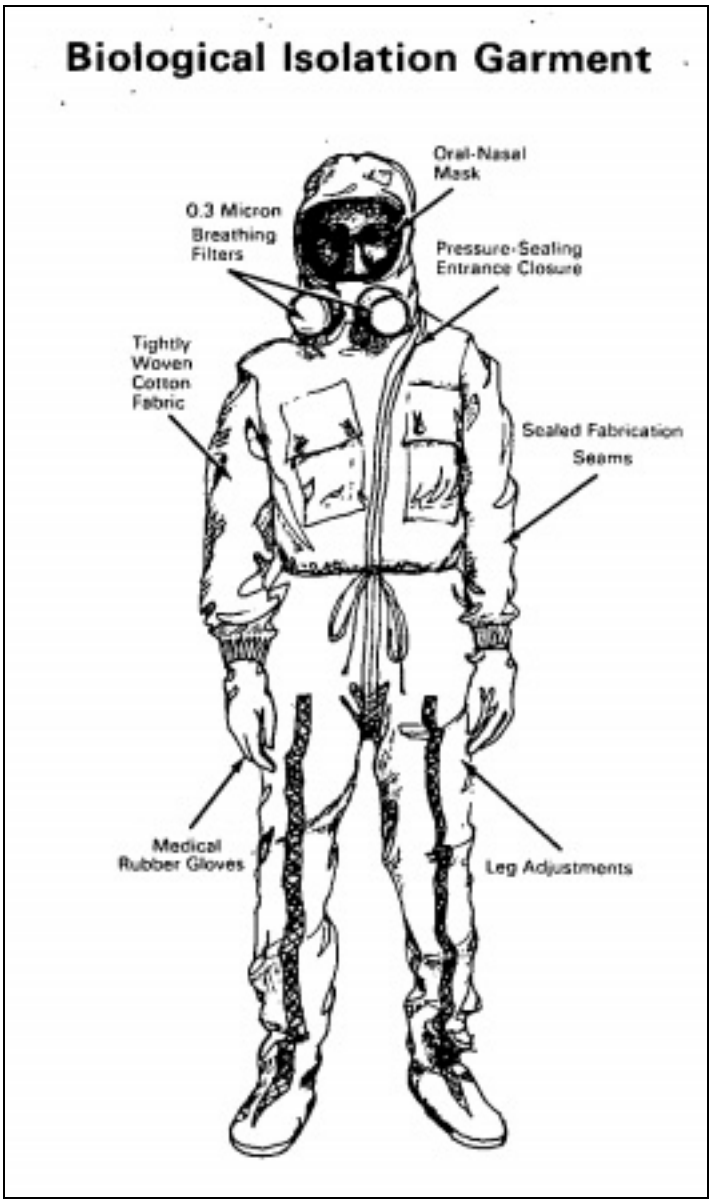
My horror story about the BIG involves an open water egress test in the Gulf of Mexico. On a hot, steamy summer day, I was one of the test subjects for the test. After riding in the hot boilerplate and going through the entire egress procedure, I got seasick and threw up inside the mask. I was unable to extract myself from the mask, and Art Lizza literally saved my life by getting me out. That event caused the redesign of the suit to add the green apple and rip away velcro mask.

I owe Clancy for rescuing me on the open water test we did in the Pacific. One of the swimmers got caught between the raft and the flotation collar. His regulator punctured the raft, and I went ass over teakettle into the ocean. Clancy dragged my ass back up and all was well, but it could have ended badly for me if Clancy had not been Johnny in the spot.
I can't recall all the BIG tests that I was involved in. I can't even remember who the other test subjects were on the dress rehearsal off the Hornet.

Some of the days when I was a test subject, I think the other folks were Tex Ward and Gary Harnish (both from the Crew Systems area). Maybe we had different teams of people on different days.

It doesn't really matter, but I'm pretty sure I was the guy who threw up in the BIG. I always thanked Art Lizza for unzipping the damn thing. There are lots of stories we can all tell, and looking back, we were lucky that nobody was seriously injured along the way.

Photos:



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)

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