The Life of Don Shields: from Atmospheric Nuclear Tests to the Lunar Module

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INTRODUCTION: In this article, we recount some aspects of the tremendous life of Don Shields. As a young Air Force pilot, Don Shields flew the B57 aircraft through the actual nuclear cloud during nuclear weapons blast explosions in Operation Dominic. The data he collected was of vital importance to our country's nuclear weapons program. Don Shields knew of the tremendous risk of radiation but served our country at the call of duty. After his military service, Don Shields served as the subject matter expert for the Apollo lunar module and worked directly with Commander Neil Armstrong and lunar module pilot Buzz Aldrin in training them on the module. During the Apollo 11 mission, Don Shields was being interviewed by Walter Cronkite on the epic Moon landing coverage. Unfortunately, later in life Don Shields suffered from cataracts and leukemia, both of which are known to be related to high radiation exposures. During his old age, Don Shields volunteered at the NASA Ames Museum and inspired generations of young individuals towards the space mission.

KEYWORDS: aerospace history, radiation, leukemia, cataracts.

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In 2019 we celebrated the 50th anniversary of landing on the Moon. We remember many NASA heroes in the spotlight and some who worked tirelessly behind the scenes. In this memorium, we focus on a brilliant man who put his life on the line for his country, Don Shields (call sign "Papa Don").

Don grew up in Kansas and enjoyed learning about the telescope in high school. He went to the University of Wichita, majored in Physics, and joined the Air Force ROTC program. He went through Air Force pilot training and flew the T-28, T-33, B-26, and B-57 aircraft and served in the Korean War early in his career. Shortly thereafter, Papa Don was ordered to undergo an important mission for our country which required that he put his life on the line.

In 1961, during a period of high Cold War tension, the Soviet Union tested the Tsar Bomba, the first of a series of atmospheric nuclear tests.[2] In response, President John F. Kennedy authorized Operation Dominic, which consisted of 36 atmospheric nuclear tests on Christmas Island and Johnston Island in the Central Pacific (**Fig. 1**).[6] Critical radiation data inside of a nuclear mushroom cloud was needed to determine weapon effects; however, the only way to assess this was through sampling within the nuclear cloud. During Operation Dominic, a B-57 was to fly through the mushroom cloud, collect samples, and bring it to the ground for analysis. It was Papa Don and other members of Operation Dominic that would answer the nation's call.

After each atmospheric nuclear test, two aircraft (one observer aircraft and one sampler aircraft) would fly near the explosion. Then the B-57 sampler aircraft would fly into the nuclear cloud to collect samples. In Papa Don's words, the B-57 "doesn't go deep into the cloud, it goes all the way through the cloud." The B-57 was equipped with radiation collection tanks on the wings, specially designed with filters to capture the radiation particulate material. The B-57 pilots wore regular flight suits and regular boots. A significant threat was that some of the radioactive particular material was expected to enter the cockpit through small openings. To mitigate this threat, pilots switched to sealed 100% oxygen

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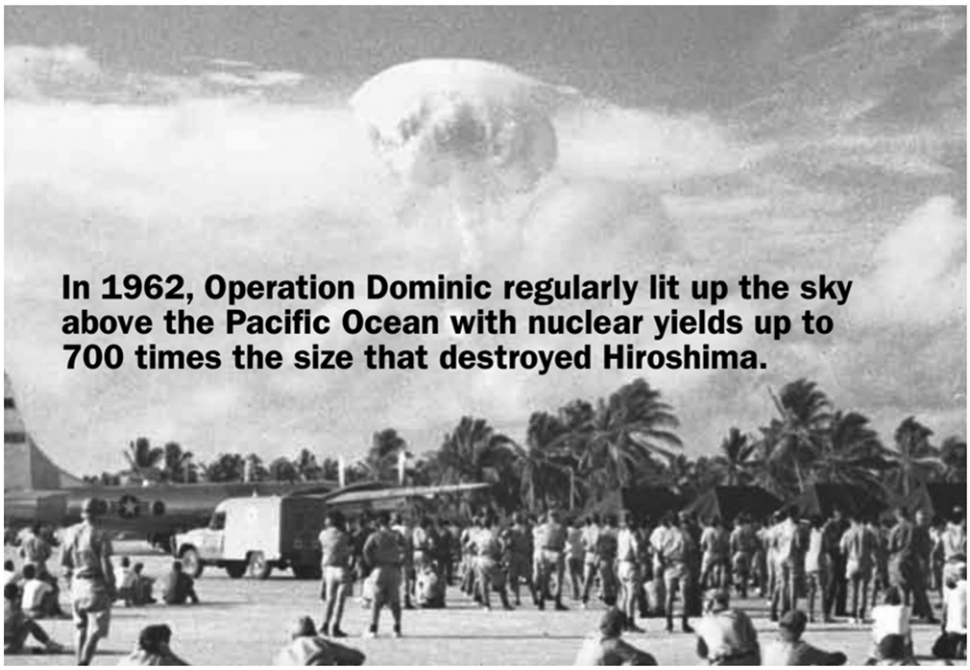

Fig. 1. Image of an Operation Dominic nuclear mushroom cloud, courtesy of the Air Force Magazine.[1]

before entering the nuclear cloud and remained breathing 100% oxygen until after landing the aircraft. This served to minimize any inhaled radiation dose. Upon landing, the ground crew took the collected samples for analysis by retracting the tanks with a long pole. The ground crew also assessed for and commonly found "hot spots" on the surface of the aircraft, inside the aircraft, and even on the pilots' flight suits, posing additional risks. Pilots performed routine postflight checklists, waited for the "all clear", showered, and resumed normal life. After Operation Dominic was concluded, the U.S. Air Force sent Papa Don a card stating that he received 17 REM. This was an extremely high radiation dose, which is equivalent to 340% of the annual maximum dose for a radiation worker.[7] Papa Don knew there were significant risks to his health, but he completed all of his assigned missions in service to our nation. And then our nation recruited Papa Don for a "higher" calling.

Papa Don was one of many individuals critical to the success of the Apollo missions as he served this "higher calling" as the subject matter expert on the Apollo lunar module (**Fig. 2**). Specifically, Papa Don was involved with cockpit design, pilot-machine interface, and contributed in the development work of the lunar module (LM). Papa Don worked with LM-2, which was used as the main design and development test aircraft and now resides at the National Air and Space Museum. He served as the human factors test engineer focusing on LM cockpit layout and design. Papa Don also worked directly with Neil Armstrong and Buzz Aldrin, training them on how to fly and operate the LM-5, which made it all the way to the Moon on the Apollo 11 mission.[5] Papa Don performed the final inspection on the LM-5 on the Saturn V just prior to its launch. And, on 20 July 1969, Papa Don had a brief moment of national fame when he was interviewed by Walter Cronkite on television on the famous day when Neil Armstrong and Buzz Aldrin walked on the Moon.

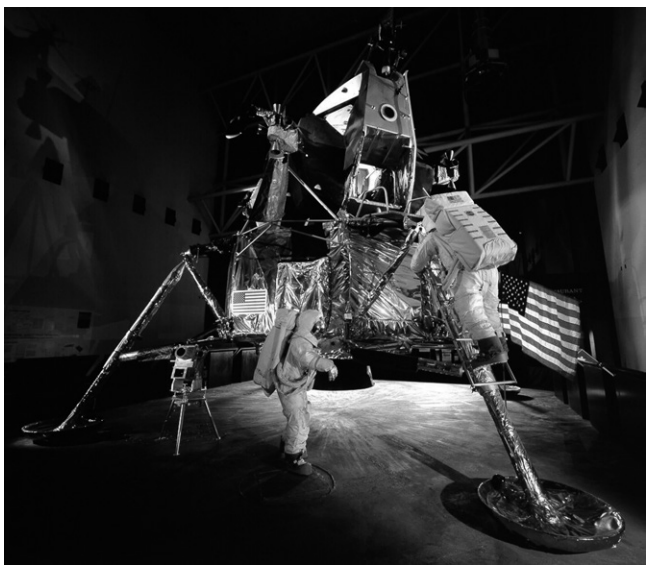

Fig. 2. Photograph of the Apollo Lunar Module-2 (LM-2), courtesy of the Smithsonian National Air and Space Museum.[4] This is the lunar module where Don Shields served as the subject matter expert and trained astronauts Neil Armstrong and Buzz Aldrin.

In Papa Don's elderly years, he continued his passion for physics, science, and service through years spent at the NASA Ames Museum. Unfortunately, the radiation he endured in Operation Dominic took its toll on Papa Don's health as he was diagnosed with both cataracts and acute myeloid leukemia. Both conditions are known to be caused by high radiation exposures.[3] Papa Don kept high spirits even to the very end. We are deeply saddened by the loss of Papa Don, but we will always remember his optimism, his amazing contribution to science, and his extraordinary selfless service to our nation.

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REFERENCES

1. Air Force Magazine. Big Bang. [Accessed 2019 March 4]. Available from: https://www.airforcemag.com/article/1212bang/.
2. Atomic Heritage Foundation. Tsar Bomba [Accessed 2019 March 4]. Available from: https://www.atomicheritage.org/history/tsar-bomba.
3. Kuznetsova IS, Labutina EV, Hunter N. Radiation risks of leukemia, lymphoma and multiple myeloma incidence in the Mayak cohort: 1948–2004. PLoS One. 2016; 11(9):e0162710.
4. National Air and Space Museum. LM-2 [Accessed 2019 March 4]. Available from: https://airandspace.si.edu/collection-objects/lunar-module-2-apollo.
5. Nelson L. NASA'S Apollo 11 Mission. 2013 [[Accessed 2019 March 4]. Available from: http://www.knowjournal.org/when/2013/07/01/lunar-exploration-memory.
6. Nuclear Weapon Archive. Operation Dominic - 1962 - Christmas Island, Johnston Island, Central Pacific. [Accessed 2019 March 4]. Available from: https://nuclearweaponarchive.org/Usa/Tests/Dominic.html.
7. U.S. Nuclear Regulatory Commission. Occupational Dose Limits. [Accessed 2019 March 4]. Available from: https://www.nrc.gov/reading-rm/doc-collections/cfr/part020/part020-1201.html.