4-22-2015

Gardner-Webb Professor Involved in Apollo 13 Rescue Mission 45 Years Ago Shares Inside Story

Office of University Communications

Gardner-Webb Professor Involved in Apollo 13 Rescue Mission 45 Years Ago Shares Inside Story

webpublish.gardner-webb.edu/newscenter/gardner-webb-professor-involved-in-apollo-13-rescue-mission-45-years-ago-shares-inside-story/

Office of University Communications

April 22, 2015

Dr. Thomas Meaders Served on Software Programming Team that Helped Bring Astronauts Home

(Boiling Springs, N.C.) – He remembers the fateful day as if it were yesterday. It was April 1970, and he had arrived at work in Huntsville, Ala., as usual. Then, he heard the words that sent chills up his spine as someone ran into the room and exclaimed, “Hey! They’re in trouble!”

Dr. Tom Meaders is now a professor in the Gardner-Webb University Godbold School of Business. Prior to his career in higher education, he worked for more than 33 years as an industrial engineer for IBM. For 22 of those years, he served in IBM’s space program. He and his team programmed the software for the Saturn V rocket’s navigation system. The rocket served as the vehicle of choice for nearly all of NASA’s Apollo moon missions, including the nearly-disastrous Apollo 13 lunar landing mission that launched on April 11, 1970, and involved three crew members: astronauts Jim Lovell, Jack Swigert, and Fred Haise.

“NASA was running the [space] program, but they contracted everyone else—including IBM—to do the work,” Meaders explained. “When Apollo 13 happened, Apollo 11 had landed, Apollo 12 had done wonderfully. Everybody expected Apollo 13 to be wonderful. Nobody ever thought anything could go wrong because we just had string after string of flawless flights. It had become routine.”

View of the severely damaged Service Module after separation. Photo Credit: NASA

The mission became everything but routine two days after its April 11 launch. Set to land on the moon to explore the Fra Mauro highlands, the lunar landing was aborted after an oxygen tank exploded on April 13. The explosion crippled the Service Module, upon which the Command Module—and the mission’s three astronauts—depended. Several unique and life-threatening events ensued.

“Space is very unforgiving. If anything the least bit wrong happens you could have a catastrophe,” Meaders shared. “And that’s what happened on Apollo 13.”

He recalled his work environment on the morning on April 13, 1970. “I remember I was just going in and somebody came and hollered, ‘Hey! They’re in trouble!’” he offered. “We immediately gathered together and were wondering what the heck was going to happen when they [NASA teams in Houston] sort it out and realize that these guys are coasting to the moon and they have no more rocket engine that works for them on that service module. That’s all gone. All the fuel has leaked out and it’s gone. They can’t do anything.”

Not long after those conversations of concern, Meaders said IBM received a call from Houston. “They said, ‘We’re dividing up the problems and we’re putting together a team of you software people who wrote the programs for all of these pieces of equipment and ultimately we need to figure out how to use the lunar module’s rocket engines to bring them home,’” he recollected. “Nobody had ever thought about doing that. And oh, by the way, ‘you have to fire when you’re behind the moon,’ which was two and a half days away.”

For the team, the task seemed nearly insurmountable. Normally the software programs took a minimum of six months to test for accuracy. This time, the team had nowhere close to that timeframe. Because the lunar module and the service module would need to stay together instead of separate as initially planned, the combined weight of the vehicles would throw their initial navigation system trajectory program off track, resulting in the need for a new trajectory program so that the craft could successfully re-enter the earth’s atmosphere. Any mistakes in the new program code could cost the astronauts their lives. The software teams would need to work quickly, testing trajectories and trying to find the code that placed the craft in the right place for re-entry.

View of the Moon from a Lunar Module window. Photo Credit: NASA

“There was no forgiving. If you miss that deadline, you’ve got to negotiate with God,” Meaders shared. “They would have to send up any software changes to the lunar module computer before it went behind the moon. At that time, computers were primitive and massive. They had a memory of only about 150 kilobytes. It took 20 minutes to run one trajectory program. You don’t just run it and get an answer. You run it and if it doesn’t meet the objectives, you look at how can we tweak and change things.”

Meaders said the process of coding was different in the late 1960s. “There was no computer science at the time,” he reported. “You were a mathematician who did numerical methods and you took assembly language and numerical analysis and then you became a person who wrote scientific software, which is what we were doing.”

Incredibly, within about a day and a half, the teams tested a trajectory program that worked. Next, four different teams in various locations tested the program, and they all got the same answer. “We knew this was the best we could do,” he said, “and we had to go with

it." He attributes the fortune of a quick and correct programming answer to the constant prayers that were being offered for the safe return of the mission.

"Most of the people on the rescue teams were devout Christians," he reflected. "There were lots of prayer groups going on and we prayed whenever we got a break. I actually think God was part of the team. When I think about how many changes were made to get Apollo 13 back, especially in the software area, there is no doubt in my mind."

Mission Control during final 24 hours of Apollo 13 mission. April 16, 1970. Photo Credit: NASA

Meaders continued, "Nobody found any errors in the changes that were made in the reprogramming of the lunar module, and that is unheard of in software programming. All of the coding went in clean the first time, meaning it did not have to be retransmitted to the craft's computer several times. People often do not appreciate—or are quick to forget—how important it is having God on your side in any sort of critical situation."

Once the code was successfully transmitted, the teams were free to leave. But Meaders said they were fully invested in seeing whether their efforts would pay off. He and others went home to shower and change clothes, but quickly returned to IBM where they could watch the mission's live video feed from NASA. "When I came home, I'd been up over 100 hours straight," he reflected. "It took a while to unwind."

On April 17, 1970, after six days in space, the crew of the Apollo 13 returned safely to earth. The 1995 film *Apollo 13*, directed by Ron Howard and starring Tom Hanks, Kevin Bacon, Bill Paxton, Gary Senise, and Ed Harris, chronicled several of the dangers that had to be navigated in order to save the crew and bring them home. Ironically, the efforts of Meaders and the rest of the software programmers were not depicted in the film. "They never showed our part in the movie," Meaders reported. "It's interesting that Hollywood doesn't think that's visually exciting.

Apollo 13 crew arrive on the prime recovery ship U.S.S. Iwo Jima following the ocean landing and rescue in the South Pacific. Photo credit: NASA

These days, Meaders reviews his experiences as an industrial engineer with Gardner-Webb University business students. He teaches information systems courses and shares his knowledge about the space program in the classroom environment. He believes students benefit richly from instructors who can connect business principles with real-world experiences. "I think it's a wonderful thing for people who have been successful in business to transition to higher education and teach what they know," he offered. "And the Godbold School of Business is full of people like that. It's the best second career a person could have."

Located in Boiling Springs, N.C., Gardner-Webb University's purpose is to advance the Kingdom of God through Christian higher education by preparing graduates for professional and personal success, instilling in them a deep commitment to service and leadership, and equipping them for well-rounded lives of lasting impact, Pro Deo et Humanitate *(For God and Humanity).*