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*Going Commercial—Charles Walker*



*Charles D. Walker, STS-41D payload specialist, closes a stowage area for biological samples supporting the Continuous Flow Electrophoresis Systems (CFES) experiment in the Shuttle's middeck on 6 September 1984. NASA Image 84-HC-413.*

Robert Crippen's comments take me back to my college days, when we were first introduced to spaceflight with the MOL opportunity. At that time, I was just beginning to think about what space might mean in my career, although I'd been interested in space for many years. I had read a lot of science fiction and closely watched Al Shepard's first short jaunt into space followed by Gus Grissom's.

Gus Grissom's flight actually brought it home pretty personally because Gus grew up 12 miles from my hometown. Twelve miles in Indiana is a long way, but still everybody is family within the state. So we thought of Gus as a hometown hero, and that impressed upon me that, gosh, real people can go into space. You have to be very well qualified and physically fit to withstand the rigors of spaceflight. But I figured that a small-town boy from Indiana could go into space if he gets a good education. So I went to Purdue University, the same school that Gus went to, and graduated in engineering.

Even then, I believed that I was going to design and build spaceflight equipment. It was only in the 1970s, as NASA began to build the first reusable space ship, that I came to the slow realization that, "It's not just the test pilots, not just the Bob Crippens of the world, that are going to get go into space, but scientists and engineers too. Gosh, I am an engineer. Maybe I can do this."

Lo and behold, I had the opportunity to go to work for one of the largest aerospace companies in this country, McDonnell Douglas. I specifically asked for the opportunity to work on a program that was going to fly equipment in space. The company at that time was subcontracting to Rockwell, which was the

prime contractor to NASA for producing the Space Shuttle orbiter. The subcontract that McDonnell Douglas had was to build some of the propulsion equipment. So they said, “Okay. You want to build equipment that goes into space? Work on these tanks.” That thrilled me for a little while, but then I said, “That’s not really what I wanted.”

I was looking for an opportunity to do engineering and scientific research with processes that could be commercialized. That’s the point at which I wanted to jump into the perspective of the nonprofessional astronaut’s opportunity to fly in space. Spaceflight is certainly a personal experience, and I’ll touch on that.

But I also want to reflect first on the professional experience. My opportunity to fly came through my employer at the time. McDonnell Douglas was looking for an opportunity to exploit the unique microgravity environment of space. In the late 1970s, the company selected a process called electrophoresis, which demonstrated the capability to purify biological materials. Electrophoresis was first very briefly demonstrated on the Apollo 14 mission. In fluid form, virtually every biological substance is part of a very complex mixture of proteins and cellular materials. Electrophoresis is useful to purify pharmaceutical and other chemical products. Purification processes here on Earth have to operate within gravity. But for separation processes in biotechnology, we see impurities created because of the churning in an imperfect purification process. Going into a low-gravity environment should prevent that from happening, and that was the theoretical basis for the electrophoresis technology.

The early experiments didn’t seem to validate that, but we wanted to carry it forward on a scale that had not been seen

before. The Space Shuttle was the obvious way to do that. It was the space truck. It was going to be going into space with plenty of cargo capability, with crew attendants to monitor and modify the early experiments or, later on, the production processes. So McDonnell Douglas applied to NASA for the opportunity to fly the experiment. The first opportunity was on the Spacelab module. Unfortunately, it looked like NASA's process of reviewing our equipment and our processes for safety and function was going to take up to three years.

In the business world, that's called a showstopper. When you've got one-year research budgets, you have reviews even more frequently, and your budgets are scrubbed one year at a time. You have to show results. We needed to have some real significant progress and creative thinking in a lot less than three years' time. This was before John Young and Bob Crippen's first mission, the first flight of STS.

The decision was made to try to fit the experiment package into the crew compartment. Later I found out that this caused some friction because our package was going to infringe upon the food preparation facility space. We accepted that opportunity, and we engineered the experiment to fly in that pressurized crew compartment volume, rather than in the research module, and to be tended by the crew.

The first time it happened was on STS-4, in June 1982, and this flight was very successful. But I want to point out that it took a big investment on the corporation's part, since this was the first such NASA-industry joint endeavor agreement in which there was no exchange of funds. NASA got from the arrange-

ment the opportunity to do research with our equipment. A third of the time on orbit was for NASA-sponsored research, and the remaining two-thirds was our time. For that opportunity and for the integration of our equipment into the Space Shuttle and for crew training, McDonnell Douglas invested millions of dollars.

The safety and fit checks took up to a year-and-a-half to go through. Now this was the first time this had been done aboard the Space Shuttle inside the crew compartment. There had been outfitting for experiments in the Spacelab module, but this was different. The process was grueling at times. A lot of engineering and technical effort was put into meeting the safety and fit requirements.

Function was different. It didn't necessarily have to function. We didn't have to be successful, except for our own objectives. NASA simply wanted to make sure that it was safe for the Shuttle vehicle, safe for the crew, and that it fit in place properly.

We did fly that first time in June 1982. What was unique about that, from a historical standpoint, is that not only were we the first industrial payload to fly aboard the Space Shuttle, but we also did it in an extraordinarily rapid period of time. That year or so to prepare for that first flight was then followed by six more flights within forty-one months. There is perhaps only one other industry-sponsored or industry-participating space payload that has had such a rapid turnaround time. That's flying once every seven months with a different research objective. Most of the equipment was the same, which is what allowed us to fly so rapidly. Industry remained interested because of the very rapid turnaround time and frequent access that allowed an evolution toward a research and a commercial objective. You've got

to have that research environment where you can test. You'll scratch your head over the results, get to that "ah-ha" moment, and then go back and try it again as quickly as possible.

Reflecting back to that flight in June 1982, the experiment operator was one of the two crewmembers onboard on that mission. The first four missions only had two crewmembers onboard. Hank Hartsfield, in the right seat on that mission, was the principal operator of the equipment. He turned it on and off, and took some very good photographs that helped us evaluate the experimental work.

It went very well, so much so that then my company asked NASA the big question. "Say, training mission specialists and pilots to conduct our research is good and important, but the best way for us to obtain the maximum result is to send a research engineer along." NASA's response was, "Well, we've kind of been looking forward to an opportunity like that. We don't know that now is the time, but now that you've asked the question, let's see if we can find an answer. Maybe yes, but they've got to meet all the qualifications that our career astronauts do." NASA then asked my company, "Have you got anybody in mind?" Well, lo and behold, I'd had my hand up for two or three years already. It was getting tired by that point in time, so I was glad that NASA said maybe yes.

It took a while to go through the checkout and qualification process, and, quite frankly, I didn't go through the routine selection process at the same time that the astronaut candidates were going through selection; although the process was the same. So it was a bit of a challenge to synch up with the Astronaut Office since

I wasn't even a resident there. I was still a resident in St. Louis at the time. NASA worked with me and the company on schedules and travel to and from Houston, and it worked out very well.

The opportunity was absolutely marvelous. It was a personal and a professional challenge absolutely. But the opportunity to fly with not only these tremendous career NASA astronauts, but to go into the environment that few other human beings have had a chance to do was a thrill beyond belief. To accomplish some career objectives in that regard made it even more exciting.

Since then, times certainly have changed. When talking about research in space, and in particular the industrial perspective, we've got to come forward from that time in the early 1980s to today. Today we think about the Space Shuttle in the form in which I daresay it was originally intended, as a space truck, not as a laboratory going into space and coming back, but as a truly versatile space transportation system.

We're building an International Space Station in orbit. Sixteen international partners are putting together a research laboratory that is unsurpassed in that environment. Just getting it there is the largest technical peacetime program ever undertaken. The challenges are immense, but the opportunities are tremendous too. Science is being done there now and will continue to be done. Industrial research will be done there as well, both in basic scientific and technological applications.

There have been some recent studies such as the KPMG marketing study for commercial opportunity and commercial applications on the ISS, a study which was done for NASA in 1999. Their finding was that the commercial opportunities were



still very limited as seen by commercial industry. Industry still sees two high hurdles: cost and frequent access. Again, industry needs to respond to boards of directors and to stockholders, who need to see results. You need to have action. You need to respond to research and objectives, and to test these objectives in a potentially commercial program and know where you're going. You need to be able to change course quickly if necessary and cut losses when necessary.

Right now to get on the ISS, it's about an eighteen-month cycle for review of safety, fit, and functionality. That's just for the first flight aboard a research rack. That's a little daunting in itself.

But unfortunately we are still largely at the point where you say, "Well, when I can redo my experiments, how quickly can I readdress them?" And the response is, "Well, you've got to be able to either have telepresence installed such that you can manipulate conditions, temperature, pressure or depending on what your experimental objectives are and your equipment's capability, or maybe we can find some crew time, and we'll be able to arrange that, but probably not on the schedule that you would like instantaneously, or you'll have to wait until the equipment or some part of it can be brought back home or replaced in some many months, or maybe even a little more than a year's time." It is very difficult for industry to accept limitations of those kinds.

Another issue is that there are no payload specialists coming up through the ranks anymore. That was my category of noncareer astronaut, a payload specialist, one who specifically focused on a research mission. There aren't any in the program today, and I think that's a problem for industry and for science and research.

In closing, while the conditions are more rigorous today for the ISS than they were in the very early days of space travel, opportunities still abound, and we just need to overcome the hurdles. As Pogo put it, “By gosh, we seem to be surrounded by an insurmountable opportunity here.” This really is a great time in human spaceflight. We’re doing marvelous things up there from an engineering standpoint. We now have to put them to good use. We need to optimize the 30 percent of the ISS that our federal government and the international partners have available in terms of the Station’s power, volume, and crew time. Despite the recent issues with cost and schedule, as Mr. Goldin has said, this Agency will find a way.

This country and the partners will find a way to restore the ISS’s capability. We need help from this government, from our Congress, from our partners to do that, but it will be done, and then this facility is going to be world class—nah, it will out-of-this-world class.

I’m pleased to be a part of not only the history of spaceflight and the history of industry’s participation in spaceflight, but I’m also pleased to be a part of the future, the future applications, the future benefits that our spaceflight program is going to bring to our economy, to our careers, and to those of us that are both taxpayers and participants as well, to the great joy of seeing success as part of this country, as a part of our intellect, applied to the great beyond.

It’s a wonderful tomorrow. I’m glad to be part of it.