

NASA JOHNSON SPACE CENTER ORION ORAL HISTORY PROJECT

EDITED ORAL HISTORY TRANSCRIPT

PAUL F. MARSHALL
INTERVIEWED BY JENNIFER ROSS-NAZZAL
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ROSS-NAZZAL: Today is August 8th, 2016. This interview with Paul Marshall is being conducted for the Orion Oral History Project in Houston, Texas. The interviewer is Jennifer Ross-Nazzal, assisted by Sandra Johnson. Thanks again for taking some time out of your very busy day.

MARSHALL: Yes, my pleasure.

ROSS-NAZZAL: We appreciate it. I wanted to start by asking you about Orion and this multi-Center approach. NASA's got all these different Field Centers. They're spread across the country. There's different cultural attitudes, and regional differences between all these Centers. What impact did that have on Orion's hardware, processes, or development? If you could share those details with us.

MARSHALL: First of all, all of our programs have always been multi-Center: human spaceflight, spacecraft development, Space Station, whatever. They've always been that way. We've always been used to working with colleagues at other Centers. What we did try to do this time was engage the Centers in a slightly different way. Traditional approach was setting up individual project offices in other Centers, which was sort of a level of separation, if you will, between that entity and the Program. I know when we started in the '06 timeframe, I guess, [we

were] working on defining the relationships with the Centers. One of the things we wanted to do was flatten that out and engage the Centers, I suppose, in a more collaborative way by making them, essentially, part of the Program Office, direct report offices, just like offices that may be physically located here, at JSC. We started that with written agreements with the Center Directors at the time. We spent a number of weeks, or months, working with the Center Directors' offices kind of working through how to articulate the agreement.

Some of the things we felt [were] really important not having to set up another set of contracts, for example. We wanted one contract, and what we needed was workforce to help manage aspects of the contract so at Langley [Research Center, Hampton, Virginia]—it was LAS [Launch Abort System] at the time. At Glenn [Research Center, Cleveland, Ohio], we were engaging them to manage the service module.

And, of course, at any of the Centers, we created the expectation for, and certainly the ability to do, any of the offices could engage specific skills or workforce at other Centers in a matrix however it was necessary. Just like we matrix support from engineering here at JSC, we could ask a Center like Langley or Glenn, “Hey, look. We need a particular skill that we think you have in this guy, or this office is the right thing. Can we set up a point-to-point agreement where they would work for, let’s say, our Vehicle Integration Office that happens to be based here, but drawing in some resources there?”

We have a lot of examples of doing that. For example, one big part of system engineering, obviously, is requirements control. So our System Engineering, or Vehicle Integration Office, is headed up here at JSC, but early on, we worked with some really, really talented people up at Glenn. We matrixed, essentially, all of that requirements management process up there, which felt funny at the time, but it’s worked out really well, because there are

great folks up there and good processes. Any more, with all the gadgets we have for transferring data and that sort of thing, it's worked out perfectly. It's two different kinds of relationships with other offices. They're just somewhat different especially on the office manager roles. The Langley LAS role and the Glenn service module roles [are] somewhat different than we've done in the past. Does that get to the question?

ROSS-NAZZAL: Absolutely, yes. I also wanted to ask you about working with international partners. ESA [European Space Agency] is building the ESM [European Service Module]. Can you talk about that relationship and the impact that that's had on Orion?

MARSHALL: Yes. Of course, it's no surprise—it's not going to be a shock to anybody, we don't do that to make it easy. There's some very clear political benefits for having an international partnership. It goes back to the language of the authorization, the NASA Authorization of 2010, coming out of the proposed cancellation of Constellation. That formal legislative language was very clear in drawing in the international partners for doing exploration. Going back to the Augustine Commission, prior to that, the Augustine Commission, and all aspects of the policy that was articulated at that time, and really since, it's quite clear that for us to be successful in really doing these ambitious solar system exploration missions, the expectation is we will do it as an international partnership of spacefaring nations. We saw an opportunity to step out and take that first step for essentially expanding the partnership that we've established since Space Station forward into these exploration missions.

This initial agreement was enabled by Space Station with some allocation of the operations' cost-sharing agreements that we have. They were able to allocate some of that and

essentially direct it. There was an agreement, but we agreed to allow Europe to spend some of their obligation that they had to the United States for Space Station on this part of it, so that was the foundation of the relationship. It's a direct lineage for the Space Station playing forward into exploration.

Most of us have experience working in the Space Station partnership, so we're familiar with the people. We're familiar with the challenges. Sure enough, we found out that it's still challenging and hard to do some of that spacecraft development activity in that international partnership domain, but we're working every day with the Europeans, and we're finding ways to move it forward. They're responding. They're very, very capable and know that we'll move that into a real service module for EM [Exploration Mission]-1 and on.

ROSS-NAZZAL: You did mention that it's challenging to do spacecraft development. Can you give some examples or elaborate further on that?

MARSHALL: I guess one of the things I'd say is we are highly tuned and highly sensitive to meeting our schedule commitments. Those are U.S. commitments with [NASA] Headquarters [Washington, DC]. We're also working our own political sensitivities to doing things like meeting schedule and all. Some of that is difficult to translate. We know the Europeans have their own set of challenges in how they contract and how they work. When you work with the Europeans, you're working with another 11 countries or more. It's very complicated, and things move slowly.

Ever since 2010, especially since 2010, we've been very much working hard to be aggressive, and move fast, and do things as innovatively as we can to move things forward

quickly. Again, those are just hard things to translate, not translate language-wise, but hard to share motivation sometimes, if you will. Again, they're working through some very hard challenges themselves. They're responding, and I anticipate we'll have a good partnership. That's an example.

Another example is the Europeans started with some assumptions that they're going to do an extension of their ATV [Automated Transfer Vehicle] that they built for Space Station. So a lot of their programmatic assumptions were based on that. It turns out building a service module for deep space exploration is somewhat different than that, from an architecture and system design perspective. There were some things that were found out later that makes it hard for them to meet cost commitments and things like that on their side. We've been working very hard with them to find solutions for those things, too.

ROSS-NAZZAL: Could you talk about how the ESD [Exploration Systems Development Division] CSI [Cross-Program Systems Integration] Initiative impacted Orion?

MARSHALL: How it impacted Orion? The nugget of the idea of having a simplified program-to-program integration process was something that was hatched by system leaders within the programs, even as ESD was forming. ESMD [Exploration Systems Mission Directorate], before them, separate from HEO [Human Exploration and Operations], was brought in to HEO, ESD was formed. As those things were forming, those were the days when it was very clear that one of the major points of the proposed cancellation and anything we're going to do moving forward is based on our ability to drive costs down. Do things more efficiently.

We were very interested in pulling on that string to start characterizing how we can do that, to keep the program-to-program integration infrastructure as small as possible. The dedicated independent integration infrastructure, to keep that as small as possible, relying on the integration infrastructure that each program has starting with the ability for the, if you will, organic integration functions within the three program entities to do integration to get across the programs was the first step. That's what we tried to advocate very much. To understand what capacity was there, and what we could do.

And, of course, as ESD formed, they were formed with this assumption, too. This was something that I think were all shared motivations. It became evident to us that there is a construct that we could [adopt]. Now, there was a lot of concern, especially from the outside, whether it's some of the leadership inside NASA, or some over the external oversight folks that we have, to assure that we don't lose some of the benefits of having independent integration, making sure that no one part of the architecture gets optimized over the other.

To maintain that enterprise, we started calling it enterprise-wide architecture, making sure that was optimized for what the enterprise needs. We were held accountable to find ways to structure our program-to-program interactions with some of the ESD resources that were drawn in, so that we could show that that integration process had authority and accountability, visibility, at the ESD level. We were showing that while we're doing this integration program-to-program initially, and [in many ways] still [today], that we did it in a way that had a governance feature that tied to ESD. [We] have found it to work very well.

For one thing, it allows us to work integration problems that are highest priority right now, so we're able to better set the phasing of when we work things a little bit better, in some respects. We have found that it costs a lot less and is very effective in knocking out issues.

When you ask, “What are the impacts of the program?”, I think we have found that it engages our integration workforce more effectively in that program-to-program domain. There’s fewer—you get in trouble with this sometimes—fewer artificial integration communication paths by having a large infrastructure of both the programs. Since we have fewer of those things, our integration resources inside the program are, on balance, smaller than we had before.

Now, it’s a lot of work. It’s a lot of program-to-program, Center-to-Center interaction, but I think all of those things are really good, really good byproducts of making this structure for integration work, actually. I’ve been very pleased with it. I think that the agency leadership is appreciating more and more how well we’ve been able to make it work. That the issues are being solved. That it’s not driving costs artificially. Yes, there are some costs, obviously, when you solve some of these problems, and we work together to solve them. That hasn’t always happened that way.

In the past, some of the cost-bearing changes—they’re inevitable in program-to-program integration. Anything that’s cost-bearing has always in the past been a battle. I think we have found we are not always able to resolve them, but most of the time we’re able to: one, drive the cost as small as possible and as soon as possible within those discussions, and two, more times than not, the programs that are involved are able to come up with agreements. “You take this part, I’ll take that part,” and show how we can resolve some of these integration problems within the resources that we have, largely. I think it’s worked really well.

ROSS-NAZZAL: I wanted to talk about EFT [Exploration Flight Test]-1. Were you there for the launch, landing, and recovery?

MARSHALL: Oh yes.

ROSS-NAZZAL: What are your recollections of that day?

MARSHALL: It was an interesting day. I was charged with a different kind of job. Administrator [Charles F.] Bolden had a large set of VIPs [Very Important Persons] that they gathered in the OSB [Operations Support Building]-II office building down at KSC [Kennedy Space Center, Florida]. I was a briefer that day. There's a number of us briefing about the mission, ESD, and everything. This is a group of cabinet secretaries, and generals, and admirals, and the VIPs of the Agency, CEOs [Chief Executive Officers], and others. It was a very exciting day. Very exciting time to do that, and it was a lot of fun to provide a descriptive briefing on something as fun as this was. Helping folks understand what we were doing, and what we were accomplishing, and how far we had come, and what this means for exploration going forward.

The planned first day, we did that. We got up at three in the morning and got together early to do that. The planned launch time was like seven a.m. or something, so we did all this in the wee hours. Of course, the first day it was scrubbed. We had a couple of issues, a ship was in the way and other things. It just delayed things, so we came back the next day. We didn't do the briefings again, but I went over there again and was available to answer questions and answered a lot of questions. Folks just came up, and talked, and that was a lot of fun, to be [with] the Hill staffers, and the cabinet secretaries, and undersecretaries, and staffers for them, and others. Folks that we don't normally interact with directly just share the excitement of it on a personal basis.

The other thing I remember about that day was OSB-II has this big patio on the fifth floor or something that overlooks the launch range and the launch pad for the Delta IV Heavy was on the horizon, at a safe distance away, obviously. We're further away than a lot of folks, but I was standing on this patio. I'm tall so I'm hanging back and watching it. We have liftoff. It goes through the clouds. We see it poking between the clouds.

The next thing I know, I am being bear-hugged by this big guy. I turn around, and—our [former] boss, Dan [Daniel] Dumbacher, who ran ESD for a number of years [by that time he had left NASA], and we [all] worked for him, was very much a prime driver for EFT-1. [He] was just so happy. He's a big man. He's picking me up. Was just almost in tears, "We did this. We did this." That really sticks with me, and always will, because we all had a hand in doing something that was hard to do.

It was hard to convince the Agency to do [EFT-1] for a lot of reasons. A lot of folks staked a lot of personal capital on seeing that we could create a rationale that was able to be owned by everybody in the discussion at the time. It was just a very, very unsettled time in the Agency with lots of different perspectives, lots of conflicting points. It took a long time for us to draw the Agency together. I think we largely are now. At the time that we got EFT approved in the '11 timeframe, things were very hard. Folks like Dan put a lot of himself, along with Mark [S.] Geyer, and a lot of the other leaders that we had and have. That moment of launch just meant so much to us. That was [just] one of the ways that it was expressed: One big guy picking up another big guy with this giant bear hug. I didn't see it coming, but I sure knew it was there when it got there.

ROSS-NAZZAL: That paints a nice visual. Tell us about the rest of the mission, and landing, and recovery. What are some memories of that day for you?

MARSHALL: So of course, from this, I didn't have any operational duties, but I did wind my way back to the operations room that we had set up at Kennedy on the Air Force side. I sat in the back of the room and just monitored the flight and marveled like everyone else how well it was going, and how little we needed to correct in-flight. We got some good videos, and we saw some amazing videos when we were at the apogee. The excitement of initiating the entry process and going through it, losing contact, coming through.

One of the more amazing things we ended up seeing during that entry process was—the folks at Armstrong [Flight Research Center, Edwards, California] were flying a UAV [Unmanned Aerial Vehicle], unpiloted aircraft, with some great cameras. We actually didn't know if they were going to be able to find this thing, but they did. Oh my gosh, they got such a wonderful image of this capsule firing through the atmosphere. By that time, we were looking sideways against the clouds, so we had a contrast, and just got a sense of how fast the thing was moving before the parachute started deploying. It was a spectacular and surprising image that those guys were able to get in the entry process.

Of course, it all led to a successful splash-down. Just because I was interested, I lingered a while in the control room as the GSDO [Ground Systems Development and Operations] folks took over the recovery process. Saw how well the U.S. Navy responded to what we found, and in some cases didn't find when the parachutes sank. Just how well that process worked for us, and saw the excitement of the GSDO folks working through the recovery process, pulling it in, berthing it in the well deck ship, and how well that worked, especially compared to some of the

early tests that we had with the well deck ships, and found out that what we were doing was so unique the Navy guys didn't really know how the dynamics were going to work. Over the course of many months and tests, they really worked out a great way to recover the spacecraft, so it was great.

ROSS-NAZZAL: You mentioned that you all had a hand in seeing the success of the mission. Would you talk about what you think is your most important contribution to seeing that come to fruition?

MARSHALL: I don't know. That's a good question. My job is one of those that's described as doing a little of everything and a master of none of them, very broad and with a lot of varying responsibilities. I suppose what I most directly contributed to was helping to craft how we were articulating the rationale and objectives for the tests. How we could show that we were connecting this flight to objectives that drew in the other programs: SLS [Space Launch System] and the GSDO folks. Showing that while most of the flight test was focused on Orion spacecraft objectives, that to do it, to make it successful, we were really exercising important roles from all the programs: hardware that was built by SLS; some of the procedures at GSDO for loading consumables like propellant, and ammonia, and other things; and then, of course, the recovery process the GSDO led for us all. I helped communicate that, and then along the way as we were executing EFT, we were also bringing the program, essentially, back to life.

As we do that, we got attention again from all of the external auditors: the GAO [Government Accountability Office], and the IG [Inspector General], and the ASAP [Aerospace Safety Advisory Panel]. The large tapestry of xyz organizations that evaluate us along the way.

Every one of those created a new opportunity to explain what we were doing, and why. I think all of that contributed to the advocacy process in its own way. I'd say that's my main contribution.

ROSS-NAZZAL: Well, I think we have touched on all the questions that I was thinking of, unless there was something else that you wanted to address today.

MARSHALL: Nothing that I can think of. I appreciate you doing this work, capturing what we can from folks.

ROSS-NAZZAL: Yes. It's been really interesting, so thank you for giving us that opportunity.

MARSHALL: Yes, our pleasure. That's good.

ROSS-NAZZAL: Yes.

[End of interview]