EVALUATION OF THE TRAJECTORY OPERATIONS APPLICATIONS SOFTWARE TASK (TOAST)

Interview Transcripts

Volume II

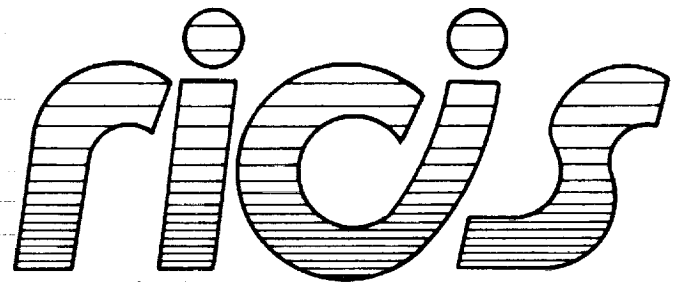
Sharon Perkins
University of Houston-Clear Lake

Andrea Martin
Bill Bavinger
Rice University

August 27, 1990

Cooperative Agreement NCC 9-16
Research Activity SE.36

NASA Johnson Space Center
Mission Operations Directorate



Research Institute for Computing and Information Systems
University of Houston - Clear Lake

T·E·C·H·N·I·C·A·L R·E·P·O·R·T

The RICIS Concept

The University of Houston-Clear Lake established the Research Institute for Computing and Information systems in 1986 to encourage NASA Johnson Space Center and local industry to actively support research in the computing and information sciences. As part of this endeavor, UH-Clear Lake proposed a partnership with JSC to jointly define and manage an integrated program of research in advanced data processing technology needed for JSC's main missions, including administrative, engineering and science responsibilities. JSC agreed and entered into a three-year cooperative agreement with UH-Clear Lake beginning in May, 1986, to jointly plan and execute such research through RICIS. Additionally, under Cooperative Agreement NCC 9-16, computing and educational facilities are shared by the two institutions to conduct the research.

The mission of RICIS is to conduct, coordinate and disseminate research on computing and information systems among researchers, sponsors and users from UH-Clear Lake, NASA/JSC, and other research organizations. Within UH-Clear Lake, the mission is being implemented through interdisciplinary involvement of faculty and students from each of the four schools: Business, Education, Human Sciences and Humanities, and Natural and Applied Sciences.

Other research organizations are involved via the "gateway" concept. UH-Clear Lake establishes relationships with other universities and research organizations, having common research interests, to provide additional sources of expertise to conduct needed research.

A major role of RICIS is to find the best match of sponsors, researchers and research objectives to advance knowledge in the computing and information sciences. Working jointly with NASA/JSC, RICIS advises on research needs, recommends principals for conducting the research, provides technical and administrative support to coordinate the research, and integrates technical results into the cooperative goals of UH-Clear Lake and NASA/JSC.

EVALUATION OF THE TRAJECTORY OPERATIONS APPLICATIONS SOFTWARE TASK (TOAST)

Interview Transcripts

Volume II

Preface

This research was conducted under the auspices of the Research Institute for Computing and Information Systems by: Dr. Sharon Perkins, and Dr. Alfredo Perez-Davila, both Assistant Professors of Computer Science, University of Houston-Clear Lake; Ms. Andrea Martin, Manager, Computing Resource Center, Rice University; Bill Bavinger, Assistant Professor of Architecture, Rice University; David Boyes, consultant; and Dr. Livia Polanyi, consultant. Dr. Sharon Perkins served as RICIS research representative.

Funding has been provided by Flight Design and Dynamics, within Mission Operations Directorate, NASA/JSC through Cooperative Agreement NCC 9-16 between NASA Johnson Space Center and the University of Houston-Clear Lake. The NASA technical monitor for this activity was Mike Evans.

Perspective

The Trajectory Operations Applications Software Task (TOAST) is a software development project under the auspices of the Mission Operations Directorate. Its purpose is to provide trajectory operation pre-mission and real-time support for the Space Shuttle program.

The purpose of the evaluation was to evaluate TOAST as an Application Manager - to assess current and planned capabilities, compare capabilities to functions available in COTS software, and analyze requirements of MCC and FADS for TOAST implementation. The project was implemented through RICIS using a team of faculty, staff, and students from University of Houston-Clear Lake and Rice University. Principal investigators were Sharon Perkins, Andrea Martin, and Bill Bavinger.

As a major part of the data gathering for the evaluation, the team conducted interviews with NASA and contractor personnel. We interviewed real-time and flight design users, orbit navigation users, the TOAST developers, and management. We also participated in code reviews and demonstrations. Each of these interviews was videotaped and transcribed as appropriate. Transcripts were edited and are presented chronologically. Specific transcripts are provided for the following interviews:

Date/Transcript Number	Topics	Tape
April 3		
1. Chirold Epp	History of TOAST	2
April 4		
2. Keith Fletcher	FDO	3
3. Mark Haynes	FDO	3
4. Bill Tracy	FDO	3
5. Bruce Williamson	TOAST Perspective	4
April 5		
6. Diane Campbell, Ken Wallis	Code Review of TOAST Executive	5
April 6		
7. Diane Campbell, Ken Wallis	Code review of Menu Handler	6
8. Ken Wallis	TOAST Demonstration	7
April 18		
9. Wayne Black, Phillip Gentry	Flight Design	8
10. Diane Campbell, Randy Moon, Ken Wallis	Software Management, Revision Practices	8
11. Greg Oliver, Mark Riggio	Configuration Management	9
April 19		
12. Mike Evans	FADS, TOAST	10
13. Malise Haynes, Tony Pocklington	Orbit Navigation	10
14. Bruce Williamson	Orbit Design Panel	11
15. Kevin Williams	Flight Design	11
April 26		
16. Scott Anderson	Flight Design	12
17. Phillip Gentry	FDS Demonstration	13

The preliminary test interviews with Mike Evans, Tim Brown, Matt Abbott, and Roger Baletti were not transcribed due to poor audio quality. Three interviews involving TAE were not transcribed as the subject was deemed outside the scope of the evaluation by the NASA sponsors.

Date/Interview Subject	Topics	Tape
April 3		
Mike Evans	TOAST	2
Tim Brown, Matt Abbott	FDO	2
Roger Baletti	TOAST	2
April 26		
Bill Hollister	TAE overview	12
Ken Wallis	TOAST under TAE	14
April 27		
Bill Hollister	TAE demo	15

Transcription Conventions

In the transcripts, we used (pause) to indicate a noticable silence in the conversation. Where speech in unintelligible, we noted the difficulty using an ellipsis (...).

Transcript 9	Flight Design
Interviewers	Andrea Martin (AM) , Livia Polanyi (LP)
Subjects	Wayne Black (WB), Phillip Gentry (PG)
Date	April 18, 1990

AM I'm Andrea Martin from Rice University, and this is Sharon Perkins. I'd like you to introduce yourselves.

PG My name's Phillip Gentry. I'm one of the users for the orbit design section, its pre-flight work. My main responsibility is the requirements for runstream. Or sequences table or command files.

WB My name's Wayne Black, and I work for Unisys Corporation. That's a subcontractor for Rockwell. I guess basically the last three and a half years, I've been working on the FDS maintenance modification system. The last 6 months or so, we've been trying to move some of that code over to the TOAST environment. Additionally, I've been on requirements in the FADS system in general. I don't know what my responsibilities are because they go in every possible direction. Any time there's a problem, I go off and fix it, so I cover a whole lot of areas.

AM Why don't you tell us some more about what FDS is for the benefit of some of the other team members?

WB Phillip really has more long-term experience on FDS. I guess, in my viewpoint, FDS is flight design system. It is both an executive and a group of applications which exist currently running on the Perkin Elmer. On, well, what was Perkin Elmer, they're now called Concurrent. They merged with the same organization as Masscomp. The original FDS was written sort of half assembly language and half FORTRAN for the executive portion. The applications are all in FORTRAN. It was approximately 150 applications, and they're all tied together and very tightly controlled through the executive, which provides the sequence table controls and all the editing capabilities for the interface tables. The interface tables are the input/output facilities through which the computations get their data as well as send data back out to the user. I consider it a very powerful system as far as analysis goes, that is, it's an analysis tool used by the orbit design personnel. It's also used as a pre-production tool, but on the analysis side, it is a very powerful tool because with the sequence table capability and the way that the system has been designed, it is incredibly flexible. Even if something doesn't work, there's almost always a workaround. For just about anything that you want to try to accomplish, you could usually think of a way to do it at a high level without having to go and actually make code modifications. There is certainly maintenance that goes on. For adding new capabilities and that type of thing.

FADS is intended to be a system that will bring together all of the different groups, that is, flight design groups - ascent, descent, orbit design, orbit analysis, RMS, consumables... It must be 14 different groups. Most of them are all in the Univac or Univac-based, but there are some on the HP9000s and on other computers. And they intend for FADS to somehow incorporate all these groups into one type of computer system to allow several things. They're claiming that it will save the system, they want to try to cut down on redundancy, and they want to try to be able to have higher production with the same number of

people - the intent being they want to go to 14 flights a year. So they're thinking double the people to double the number of flights. And so they said if we built this super computer system, then can we can keep the same number of people, but still double the flight rate. And so that is the intent of FADS. At this point, I think FADS is becoming the front end for the Univac. But that's something that we're trying to work our requirements into this FADS system. And somehow, by miracle, TOAST is going to have to work into FADS as well. You have any comments on that?

PG I think that the major point they are stressing is if you get all the different groups onto one computer system with a common file format, you have electronic transfer of data and reduce the amount of manual input, so that you can reduce the chance for human error on key inputs. So that in essence will also save time and product validation.

AM What about the real-time capabilities? Is FADS supporting the planning stages, and are they also going to support during missions? Or how is that going to work?

PG I'm not real clear on that. I know that in our area, we're moving with TOAST because, of course, in the design world, we have different requirements than in the real-time world, but we also generate similar products, and you want to have a commonality of software. If I'm on the pre-flight assessment and I generate landing opportunities, well, I would want those numbers to be the same as if I was in the real-time environment on their software, so we're making the push to move in with TOAST so that we have that commonality of software with the real-time people. TOAST will be available in FADS, but I'm unclear whether it's just going to be that commonality of software. I don't think the real-time people are going to log into the FADS environment. At that point, I'm not sure.

WB There was no original intent for FADS to support real-time. FADS was strictly the flight analysis design system.

PG That's right.

WB And it was intended for preflight flight design. The only link right now between the real-time is because we've been linked in with this TOAST. The thing that's interesting about that, even though Phillip is pointing out that there are similarities, that's part of the reason they've been trying to overlap it, but I don't know. In my opinion, the real reason that we ever got involved there was because at one time, I don't know if you've met Chirold Epp...

WB He was the orbit design CCB chairman.

AM Come in. This is Livia.

LP Hello, sorry, I'm late here.

WB So he was the orbit design CCB chairman. He was in charge of FDS software. He is also in charge of the real-time FDOs on orbit design. One individual who was in charge of these two different groups, working on different systems - he was the main pivot point that brought these two groups together. I'm not real

certain if both of these groups had been controlled by two different people that they would have ever gotten together.

AM In terms of the way FADS was put together, serving the needs of so many different groups - ascent, descent, orbit - that has a similar thread to TOAST. With TOAST as a program, you have a glue where you can throw all these other applications under it. Is it an intention of having TOAST provide that same kind of glue in the FADS environment, or are you looking for your own system in which you would tuck TOAST in as one application program to run there?

WB TOAST has certainly been proposed as being the manager for the FADS environment. Unfortunately, the only group that has wanted to support that has been the orbit design group. That's where we've been doing some of our work. And of course like I said, not all this is real certain that would be able to handle it. At this point, there really is no real system yet. The system designers for it are currently writing system specifications to put out specifications saying we're going to build some kind of system here, and it's going to have these certain capabilities. It looks like that overall the platform is going to be delivered by an outside contractor.

AM Right.

WB It's going to go through procurement processing, basically. The only good thing so far that we've really heard is, at one point, they were thinking that they were just going to put out a whole bunch of requests for proposals for all these different tasks (laughs). This guy does the graphics, this guy does the application manager. These people deliver the hardware. They were going to put out 14 or 15 different requests for proposals, and we would have gotten stuff from all these different companies. And they may not work together. And I think they've now at least gotten to the point where they've decided that they are going to put out one request for proposal saying we want a system that will provide all of these capabilities such that one organization could get it. And hopefully they can put together integrated systems and pass it back to us, in which case that system will come with an applications manager, menu type system. And TOAST will not be the FADS menu system

AM The solution to that.

PG Right. TOAST will be the orbit design application modules for FADS.

WB And if we can keep it in TOAST altogether then - that has been a conflict up until now. There have been a number of individuals that are pushing so that we can build our application into TOAST, and when FADS comes online, we can just go and pull our applications back under FADS and strip off everything that TOAST provides. The executive and the menu handlers and all that stuff. Strip it all out and put our stuff in there. I'm not real certain that has been clarified yet - that we're going to be able to just take TOAST as one unit and put it under FADS. So you'll be working in FADS menu systems and then you'll drop down into TOAST. And now you'll be working next to TOAST and its organization. I do not feel comfortable yet that that has been approved and blessed. At least that particular portion. And of course it has to do with the constant we've been promised at least in the past, that the same capabilities you currently have on

FDS, you'll have when this whole things finishes, but it's amazing how much we seem to have to fight for every little thing. To get even a portion of the current capabilities on FDS.

AM You mentioned earlier that you viewed it as sort of a front end to the big Univac machine?

WB Yeah.

AM What sort of a front end do you have in mind for this? Are you looking at an X window environment, where you could have popup windows for your various applications? Has that been discussed?

PG X windows and pop up menus are not current capabilities on the FDS.

PG And we're not viewing that. I think what he means is that, of course this is my opinion, but it seems that FADs has come online, the Univacs are overworked. And at the rate we are going, the Univac cannot support the growing flight rate. So there is a problem. The solution is FADS. So they're bringing FADS online to alleviate the problems on the Univac. While they're doing that, they are going to merge all the areas in with a common file like we want runstreams. Well, the Univac had runstreams, but Univac runstreams and flight design system runstreams are on opposite ends of the totem pole.

AM Right.

PG So when you write your requirements, we need runstreams, they say you have runstreams. Then when you go to the next level of requirements and you start putting what all your runstreams need to do, they're boggled. They had no idea you had these kind of capabilities. Well, these are our current capabilities. We need these current capabilities on the system. And they're the way the system is designed. You run into problems on how they're going to implement that. It's like it came up from nowhere. So I think that's what he means and that it was a front end of the Univac.

WB I'm not implying that that's what I want. I'm saying that the majority of the current users work on the Univac. And that to me after attending an ungodly number of FADS, that the real impression I've come off with is that they really see FADS as a front end for the Univac. You know there is a small rumbling of people now starting to say hey, maybe we ought to dump the Univac. (laugh) Because there are so many difficulties that they are encountering between the communication, just the communication across this system, between this FADS they want to design and the Univac system. Right away the first one being in fact the Univac is a 36 bit machine and FADs environment won't allow for 32 bit machine. And so when you want to pass data back and forth across here, you've got a problem. Additionally, the way these people see to using this FADS environment is like using it like a dumb terminal in one sense. They see using it in FADS as a big editor to edit their runstreams so they can feed them across the Univac, and the Univac can still keep doing the same job as it's doing now. So I kind of wonder if they're going to alleviate much off the Univac if they all plan on passing all their stuff back to the Univac to keep it humming away. So that's where I said there are things, of course this is coming from another area, the

rumbles, maybe we really ought to get off the Univac. But that's a small group compared to the people who are currently on the Univac. Both ascent and descent have at this point no plans of getting off the Univac. Being a very large group of people gives them kind of a lot of voice and allows them to direct the requirements of FADS much easier than our group, which is rather much smaller. So we're out here, every time we raise our hands, you know it's like pow. Your requirements are quite as important as ours and of course they outweigh us by about 70 percent and so the vote seems to tilt to their side all the time. Makes it rather difficult.

AM The FADS environment, is that a Unix environment? Is that the work they're looking for.

WB You can't use that word. Posix

AM Posix

PG It's a Unix Posix.

WB Well, they don't write the word Unix in the requirements.

AM The government uses Posix.

WB Posix.

AM But to everybody else that means it's a Unix. And the Unix standard, so okay.

WB Well, everybody kind of assumes that, but on the procurement it can only say Posix. Not even specify Unix.

AM Okay.

AM Livia, you want to get into this.

LP All right. I did gather that the FADS people who are currently working in the FADs environment are less than entranced with the idea of moving towards TOAST or otherwise. Is this true?

(pause)

WB You want to take a stab at that?

PG Well, if you're talking about TOAST as 100% as it as a unit - yes. The way the FADS personnel perceive TOAST is that it's going to be orbit application software and nothing more. All the management functions will be provided by the FADS platform. And

WB And that's where part of the problem comes in. TOAST has some of its own management functions handling files and doing different things. And of course FADS platforms are saying we're supposed to do that. So that it's almost like we're going to in the end have to have an exception to have TOAST. If TOAST comes in underneath FADS, it's going to be an exception, but it's going to be

able to handle its own maintenance type support and management support, and not use the FADS environment. Otherwise we have to use the FADS management system, which may be very good, but we don't know. Because we don't know what it will be. I'm a little concerned that we're not going to get it until three months, until the whole FADS project is due. (laugh) And I'm not the only person that feels that way. Because that's the way it comes out on the schedules.

(laughter)

WB You look at the file schedules, you know they're going to deliver this menu manager system a few months before the whole thing is supposed to be done. It's like how are people supposed to get their work accomplished. But if the requirement is levied upon us to make that happen, then somehow TOAST is going to end up very different from the real-time TOAST, which was not Chirold Epp's original intent. He wanted the

LP Right.

WB them to be very much the same.

LP Do you see that the two systems are going to branch off, and you're going to have one system that serves the needs of the real-time folks and another one that handles the orbit considerations for flight designers?

WB That really depends on the way FADS used TOAST in the end. If FADS, if they really levy on us the requirement to use, let's say, the FADS application menu system and the FADS graphics and some of the other FADS. The FADS database has been levied upon us. We will use the FADS database. Well, if the real-time people don't have the same database right here, there's going to be a branch and that's going to drive possibly our software, assuming it will affect the executive and the way it manages files. It manages software, where software is stored, where executables are stored.

We have another problem - let's say we want, and right now in the TOAST world Phillip's working with, the runstream environment. We want to build what we call runstreams, sequence tables, command files, and there's about six other names out there for these things. But we want to build something which meets our requirements into TOAST. Well, TOAST runs only on the workstations. FADS has currently in its design what they call a compute node. That is, you've got this workstation environment, and if you want to do any really intense computing in your processing, you're going to have some compute node where you pass these things across the network, instructions or whatever across the network and execute or run over there. And of course, that's where the Univac comes in, and Univac becomes one of the compute nodes where you can pass things off to the Univac. Additionally, you have a data node, which is where the database resides, which is located off on another machine.

So I've got three separate groups of machines all networked together. Now these machines may not necessarily be the same brand. Okay, so if over here in my workstation I have program A, and it's been linked and compiled to run on this workstation. Well that same executable's not going to function on the compute

node because it's a different machine. So it's got to be relinked, recompiled over here, where right away FADS is saying, "sorry, can't have program A be in both places, it can only be in one place." It can only be over here in the compute node. Now TOAST doesn't manage the compute node, TOAST only manages it over here in the workstation. My runstream only functions over here in the workstation, but my software is all on the compute node. I've got a problem.

WB And we haven't resolved (laughs) that problem, but that's the way FADS sees me working. FADS sees my workstation being basically an editor and the compute node doing all the actual computation. Whereas the TOAST environment workstations

AM Does all.

WB Is both. It does everything.

AM It does everything. Menu, application, display, and all

WB The data.

AM Right.

WB Is all in the workstation. So there's a distinction right there, which could create a problem for us.

AM Do you think there are enough people resources now within the TOAST team to be able to deal with and support both kinds of environments? Say there was a split and half the TOAST team had to support TOAST under FADS and then you have TOAST for the FDOs. Is that something that could actually be done, or do they have to have a massive influx of people to be able to do that sort of thing?

WB Not a massive influx, but with the current staffing level now, I would not expect them to be able to support the FADS requirements. They're having a hard time supporting the current requirements. You know with the MCCU and the real-time people and we're trying to get our requirements in the back door whenever we can - the executive's been handled by two individuals. I think they've upped it to three now. They're overworked, and I think they would tell you that. (laughs) You know for all the different things that they have to try to get accomplished so as far as the applications go, it's certainly different, so it's very different from FDS. I've been amazed - unfortunately our different sizing you know was from experience. It's off of FDS, and I've been amazed at how much more work is required to get the same kind of program running on TOAST than was required to get it running on FDS, both on the initial building of the piece of software and I suspect the maintenance is going to be far more expensive than it was on FDS.

LP So what kind of capabilities did you have on FDS which are lacking under TOAST?

PG Well, I think that we have runstreams requirements. And

LP And what are they particularly? Ah, perhaps we've gone over that already, what they all were.

PG No, basically, in our area we deal with unique payload requirements. And I can't speak for the other areas. I don't work in those other areas, but it appears that on the Univac-based systems, what they term as a runstream is a sequence path of inputs that you need for processor, and it takes the inputs and then runs the processor. And that's their runstream. But in our environment, we have application software modules that we link the modules together - the output of one module will be the input of another module. And we have limited programming capabilities. We have arithmetic operations, trig, logic statements, loops, ah,

WB It's not that limited, it's pretty powerful.

PG Well

WB You know probably equivalent to basic Easy, except it's designed to work in your environment.

PG and the real-time, they really don't have the type of requirements that we have. But so that when TOAST was fully real-time, they didn't have this runstream requirement either. But since we're coming in with them, we're letting our requirements in. We have personnel brought on to to write the code or to work these requirements, but at this point, you know, we're not at very early stages of that even in TOAST. But it's, in my opinion, it's more receptive in TOAST than in FADS.

And it's not clear that if we get it done in TOAST, we will have it in FADS, that they will use that in FADs. Even if we do get it in TOAST. So our requirements may be met in TOAST and then only the real-timers can use it because we'll be forced to use the FADS platform. Which could be anything.

LP But I guess what I was specifically asking at the moment was that if there are some modifications made in TOAST, will you then have the capabilities you need. Is that it or are there

WB We're not talking some modifications.

LP That's what I'm trying to get at.

WB We're talking some velocity changes for one. Which we've been able to at least verbally get those across to people. They are beginning to nod their heads and say yes, we see we've got a little problem.

LP So what is their philosophy and what is your philosophy?

PG Well, basically in the real-time, they need a product and they need it fast. So they have input menus. They type minimal inputs and they get their output product. And if in real-time, if they're doing landing opportunities, they have one landing opportunity case. So they have an input menu that generates their landing opportunities. But in my area, I may have four landing opportunities scenarios so I have to have four menus that have different names. Well, they don't have that

capability right now in TOAST because they're dealing with one case at time. So that was major difference of philosophy there. But you know we've discussed that and the requirement to have pre-saved menus of unique names. Was a requirement that's come out, and it was brought up on the floor, and it was agreed upon, and I don't know where it stands on implementation, but they do realize that it is a requirement. So it's just philosophy changes like that. Differences.

WB I don't know if you're familiar with Wordstar, a word processor. And if you're familiar with EZ, which is another thing put out by Wordstar, the same people. The difference between those two programs - they're were written by the same people, but EZ is as it's name implies. You know it's got a few little menus, it does a lot of things for you, you don't have to know that much, whereas with Wordstar, to get full use out of Wordstar, you've got control characters, you've got all kinds of keys. And so Wordstar is very very powerful for someone that knows what they are doing. (laugh) And EZ is much much easier to use for somebody who doesn't, but it only allows you to do things one way. And if you want to do something different or unique or special, you can't do it with EZ. You have to use Wordstar, which has all the capabilities.

That's very very similar to what they have built on TOAST, and the way FDS analysis works. In TOAST, they design their system to work one way. To solve a particular type of problem. To get a particular solution one way. And if, all of a sudden, that user decides I want to be able to change some sort of variable or maybe a constant, well I can't do it. Why? Because most of the constants are hardcoded inside of the code. Whereas with FDS, there are no constants hardcoded inside the code. They all come through data files that all the users can access at any time. All the output goes into a data file that is easily accessible to the user at any time. Because the the runstreams have complete control over driving how the processes are done, have complete control over changing data, not only moving files around, we're talking about an operating system where I can delete files.

From my command line I can actually modify individual elements inside of a file, whatever data type they are whether they're real, double precision, time, whatever. I can spool particular elements, I can extract from a huge data file, I can go through and I can extract the sixth element all the way down this data file, take off one element by itself. Then I can take that array, and I can shove it into a graphics processor, and I can plot the thing. It's very much designed for analysis, what if type things. You know, what if I do this, what if I change that, what if something changes. It is very powerful as is, which makes it difficult to use possibly for somebody who just comes in the first time, except, of course, it has the ability to put a question mark in anything that you give a textual description. TOAST doesn't even have that. At this standpoint.

And that's something that we're saying we want to be able to do. But the FDOs said no, if the user doesn't know how to use that tool, he shouldn't be doing the work. Well, that may be true in the FDO's world, because any given FDO, he's in charge of two or three tools and boy he'd better know those tools inside and out. In the analysis side, these guys may have hundreds of tools available to them and they may only use one of these tools, you know, they may use a couple, a set of them fairly frequently, but they'll use one or two of these tools

just maybe once every three or four weeks or longer. And they're not going to know every entry on everything. So they go in there and they get little problems and say what is that, they can put a question mark to it and give a textual description of what's there.

WB Yeah, and of course this is designed ten years ago and you're a new guy and say wow they thought of this stuff you know, long time before Macintosh and all these other things, with these ideas of popup menus and all this stuff. This thing's a line editor, but it's a very powerful system. And so to get all these capabilities, these what if type capabilities, these analysis type capabilities, into TOAST is a hundred and eighty degree change in the philosophy of the way TOAST was designed now because the requirements are very different.

Then, of course, it's because the difference between flight design and the real-time world. The real-time world, you want an answer right now for a particular type problem. I know exactly where I am at a current point, I want to see events that are going to happen in the future. These guys are doing something backwards — they're saying, I've got all these events I want to meet, where do I need to be? And so they have to backtrack and try to figure out like when should I launch such that I can satisfy all these constraints? In the real-time world, I launched, I know what time I launched, I know where I am, what do I have available? So it's a very different approach, and the philosophies are quite different, and trying to merge them together is creating lots of conflicts. Like I say, we've been discussing these things, people are nodding their heads and saying yeah we see we've got a problem - on the TOAST side right now, every menu has one file behind it, and you can only run thing.

LP Uh huh.

WB On this side, these guys have a tendency to run 12 or 14 of the same program one right after another, meaning they have to have different names on each one so that you can't hardcode the name of the menu in there, into the code itself. You have to have the ability to submit program A using data input one, then submit program A again using data input two, then submit program A again with data input three, and then I have to be able to have, and in our scenarios we have to be able to get to the bottom and check some data, test something from our runstream language. And if we didn't meet the constraints that we want, loop to the top and I want to start this thing over - make some changes in the inputs and start the whole thing over again. You know so that's

AM So you think that

WB some of the things we need to do.

AM with such a major difference in the current design, that they ought to start with something else, instead of trying to make TOAST fit that mold?

WB I don't know. If it had been in how TOAST would look now, if we had those requirements, or if they have been levied up front, I don't know how different it would have been. That's of course a difference in FDS. FDS was planned system. That is, somebody actually sat down and really laid out the requirements for the majority of the system before any of the code was ever built. Okay, so

when they built it, they had foreseen everything they wanted to do at that time, and they built the system that way. It appears to me that TOAST has been built by piecemeal requirements. That is, they set a set of requirements and built something, and said let's put these more requirements, so they added some more. And because of that, they're constantly having to back track to fit back in all the changes that are occurring. And we're even seeing that now when we're trying to build some applications to run under their executive. Well, every time they make a change, it ripples all the way through. They make a change in the menu handler, well we got to go back and redo all of our code. They make another change, and we got to go back and redo all the code. And to handle these changes, it's pretty much in a state of flux now. I don't know if it really should be another design, but I do know we need to get our stuff in there as quickly as possible. Because as we continue to grow and continue to produce more applications, we continue to make the system bigger. These ripples are going to be more and more costly every time somebody has to go back and redo all of these applications.

LP So what are some of the specific capabilities that you are missing when you go to write an application under TOAST? What's missing for you?

WB What's missing to write the application? If I want to write it using the current TOAST philosophy, nothing. I mean that's the philosophy that's there. If I want to write it using an FDS type philosophy, there's a number of items missing. One - how do I get my data to come in. Where do I get menu file from. There's nothing to tell me that. Currently they hardcode those names right into the code. So if I could leave that hardcoded name out, it doesn't know where to go. There's no way to connect program A and its menu file. It's just actually written right in the code. This is the name I'm looking for to go out to get the data and bring it back in. The data files themselves, some of them are fixtures of GFF format, some of them are ASCII text format. Standards needs to be levied if we use the GFF, which is fine. Then we need to start levying standards on what's in the dictionaries and the way dictionaries are structured such that once we actually write a script or a runstream capability, that my runstream will actually be capable of going out if I tell it that I want to pull the Cartesian state out of file A or something, that it can actually go, and it can find that darn Cartesian in file A, and it can extract it out. And stuff it in some place else.

And if I don't have standard format, then this runstream has to be capable of recognizing all of these mixtures of formats, and figure out where all these things are. But of course that runstream is missing right now. If currently our software on FDS is written in a way that the items themselves try to be standalone tools. Some of them do have iterations inside for solving certain kinds of problems. But, for example, ACOST, which basically does one thing - it takes you from point A to point B with a number of stop options, but it's not necessarily real fancy and really has to be because you can go one level higher, which is the the sequence table. And if I wanted to do multiple iterations to stuff, I could do that from the sequence table. I don't have to do it inside of the FORTRAN source. But I don't have that flexibility in TOAST, so if I want to do any kind of iterations, I have to build it into my program because I don't have a higher level that can do the iterations for me. That can run this thing multiple times over and over again making small changes and stuff to accomplish something. So any of those functional capabilities I have to build right into the code, and I can't leave it

to this higher level language, which could drive this thing and make loops and make logical decisions based on tolerances that are set by the user. Last of all, the the user capability on FDS is like I said - all the data comes to them through from outside data sources. There are no hardcoded constants, not even things like pi that's not going to change. But that's not hard coded in our code. That's outside. So if old Phillip here, he's smarter than everybody else, he has his own pi number,

(laughter)

he can put it in there. He can change it, and it will use that value for all of its calculations. But he can change most anything. I 'm not saying it's perfect; it's not. There are some places where people didn't always follow the standard, there are some hardcoded things. But the majority of them, those are the standards, and that was what was followed most of the time. And that doesn't exist right now. So everything is hardcoded. Of course they ran into problems almost immediately with their solar flux, so then they go out and build a special solar flux program just to allow the users to change the solar flux table, so they can feed that into an application. But we're not saying we want to build special program every time we want to change a data file - we want it to be a generic thing that uses a data file and the users can change them.

WB And of course those are future enhancements that we've discussed now, whether these guys might say those are requirements everybody knows, but they're not written yet. They're just across the table discussions. You know we're working on some of that right now. It's off in committees trying to put those requirements on paper. But I don't know, they realize that it's going to have an impact on the way the current philosophy works, especially the runstreams stuff. It's going to impact all of the applications that all work right now exclusively with the user on the thing. We want to build a runstream to the point where that runstream should be able to do anything that the user could do at the terminal, and through a menu he should be able to put those commands into a runstream and submit it off of batch and go home. And it will do anything that he could have done at the terminal. It can do in batch, and when it finishes and he comes back in the morning, there's his file product. That's our intent of what we call runstreams. And that includes logical divisions. If I know that I have to meet certain values, have to be within certain tolerances, I should be able to put those tolerances in those runstreams and when it checks those things if they didn't do it , it'll go back to the top and make changes and do the thing again. You know because otherwise as it stands now, if these guys want to run anything they have to physically sit at that terminal and they have to make the decision every time the output comes out and even then they can't. Sometimes they can't even see their output.

WB I don't know. It goes back to the difference in philosophy. They're different, they have goals, they have different requirements. In real-time they know when they launched, they know what they're trying to achieve. On the other side, these guys know what they want to try to achieve, and from that they figure out when all these things should take place. It's a very different direction.

PG Most of the work that we do, I would say 90% of the time I am executing on the system, I am executing within a sequence table. I rarely ever run anything

standalone. Because I have a problem that I have to recreate my data. We start two years before a flight works. I may have a sequence stored, and in three weeks I may get new requirements. My data may have changed slightly. But I have to do the same processes; it's just that it's different data. So anything I do on the system, I have stored in a runstream or a script. So that I can reproduce my data in the same techniques. And I don't think they really have that requirement in real-time.

WB I mean, you don't have any need to do something twice.

PG Yeah, in real-time.

WB If you didn't do it the first time, you missed it.

(laughter)

WB Everything is gone.

LP One of the things that we are really trying to to get at is we're trying to get an understanding of what the requirements are and then what the capabilities are that TOAST has and what kinds of extensions might be needed in order to meet those capabilities. So that's in fact why we're sort of pushing about it a little bit. Okay, well there are environments ... and what seems to be needed by TOAST in order to be able to meet those things that aren't there. And I think you begin to answer some of those things. And another one of those things that I think you pointed out was that is it the case that for the users, they're going to need online help and different tools and so on available to them?

PG I think so

WB In our area we will

LP For your users.

PG I mean currently we have 150 applications, software, and I can't even imagine that maybe I've probably used thirty to forty of them. So the majority of the software that's out there, I haven't even touched yet. And so I know ten or fifteen like the back of my hand; I don't need online help for those. But there are others that I've used and I've used frequently, but I may not have used them now for three months, and it comes down I still need online help. I'm real familiar with the software, but I still need some online help.

WB The element set type and the other one - I always get those two confused. Just knowing a weird name or something, you don't necessarily know what it is. You don't want to run and look it up in the book someplace although FDS does have good documents, but you'd like to get an answer right there and not run off and find a book somewhere.

LP I guess one question perhaps suggested by the X windows question was that if you were running, if you were saying that essentially you might have several different runstreams at once, is that something that a window application might be helpful for you?

PG I've never worked on a window, in a window environment, so I have no knowledge to base a decision on.

AM I think from the needs that they described, he's not really interested in sitting at a terminal and typing something except maybe one to say this is the name, run with this one or to set up a series.

PG Well, I may have a sequence table that when I run it, it asks me for values. That I can input values in, run the same sequence table without ever going in and editing it and changing it and running it and coming up with different answers because it asked me for different input. I could see see using a window environment to create a runstream where if I go down and say I want to run this application software and I get a menu that gives me the names of the input menus and I can click on that, and so now I'm going to run this application with this input menu - I can see using that and that could be real handy. Right now if I see I want to run and I give it a name for input menu, I could've made a mistake and gave it an input menu for a different processor, and you know if you have a window that that tells me the name of all the ones for that specific... Sure, but like I say, I'm not that familiar with the window environment. So,

LP So, it's hard to know what it will buy you

PG Right. But I'm always looking for new and better capabilities.

AM I think we need to start the next set before we get too far behind schedule. Do you have any summation type things that we

LP No...

AM need to ask? I think they gave us a very good perspective on how TOAST and FADS will cooperate in the future.

PG I know they're not cooperating now.

All (Laughs)

LP If we have any more questions,

PG We'll see if they're cooperating in the future.

LP maybe we can talk with you at some other time.

PG OK.

AM Thank you very much.

LP Thank you very much, yes.

Transcript 10 — Software Management, Revision Practices
Interviewers — Andrea Martin (AM) , Livia Polanyi (LP), Sharon Perkins (SP)
Subjects — Diane Campbell (DC), Randy Moon (RM), Ken Wallis (KW)
Date — April 18, 1990

LP This is configuration management. I guess the question that comes up perhaps as a first question is how is this board functioning?

DC What board?

SP Orbit design panel.

LP The orbit design panel.

DC That has nothing to do with configuration management.

LP First off

AM There are several things that we're interested in. One is how you make changes in code and what is the process if somebody finds a bug - how do they go about reporting it, getting fixed, how is it tested, that sort of thing.

LP We understood there was some relationship with that.

DC We don't consider that configuration management.

SP Exactly right.

KW To find a bug we have a form for either change request or for discrepancy reports. That you either fill out or call one of us and we'll fill out that; you're basically saying that there is a problem with this program.

SP I want to make this

KW I want this to change for some reason or another. And you basically say what the problem is. That goes to the orbit design panel where they approve or disapprove the request. And then from there, it gets assigned to a programmer to implement, which for most applications there's one person that's developing the application, so it's automatically going to be him. If it's an Executive type feature, then it will come to one of us. And the users may or may not know which one of us it's going to be. And then it's pretty much free form - the developer has to figure out how to make that change. Changes aren't defined in code to this.

AM Right

KW I want this to do this instead of that. And it's fairly free form in order to meet the requirement, and we have to do our own testing. Then it goes into a prereleased version of TOAST. Then the users come in and do verification testing on it. And they have to come in and verify and build a test plan that says I want to test this and I'm looking for these problems in the old version, these solutions in the new ones. And test it and make sure it meets what they said. Then they take their results to the software control board. The software change control board.

SCCB. There they certify it. For support. And then from that point, it's moved into the actual certified version of TOAST.

AM So you maintain a pre-release version and a released developers version that you're working on and then you have this one, that frozen code that they use for running flight.

DC Yes.

AM Okay, how long does it take to go through this kind of process?

DC It depends on how may changes there are or how big they are. When they say rewrite

KW What kind of priority they place on them. Things have come out of the wood work, we've got to have this by the end of the month.

DC And you get it by the end of the month.

KW The end of the month. In other cases, they say well we want this database

DC It's got an 88 on there.

KW You know it's pushing a year now and it hasn't come out of the shelf yet.

DC Two years.

KW A lot of it depends on the priority of the task, how much is affected by it. For example, locks or something there have been expired for ages. But the impact of implementing the new one would hit everybody in the entire system, and they didn't want to hit that big of an impact this early.

LP Who sets the priorities?

DC It varies. Generally, up until now, the application priorities have been set by the ODP. And most of the DRs we get are little ones and we just get them and say they'll be on the next release and they don't have a priority. So that really hasn't been an issue. The Executive, Ken and I set the priorities because most people don't know what the Executive is. Most of the DRs aren't on the Executive because we find them ourselves, and tell them this really is a problem. And you need to let us fix it.

KW But a lot of whether or not the Executive changes get in is determined by how many applications will be affected by it. Because if it's a little bitty change, that is going to put a colon in the argument on there, we have to redeliver all of the programs.

DC All 55 of them.

KW Then you're talking about pulling in verification test for 55 programs, 8 or 10 users, a lot more time to get it done and all.

DC We

KW Plus now instead of one developer being touched by it, you're talking about the entire development team being hit by it. That just gets pushed out and we'll wait till all the programs can be updated anyway.

DC Lets us collect all these major hits into one delivery and then shotgun them at the other developers. That's what this next release is, a whole boat load of changes that impact the applications.

KW Yeah

DC And they make them all at once.

AM How do you get those changes out to people so that they can start working on making the changes that they need to make?

DC Right now all of our users are in their own office. So it's fairly easy - we just give them a copy of the library and put them on their machines, give a nice CD interface control lock and say "knock yourself out and if have any problems let me know."

KW But basically with the services and all, the service routines have to be available before the application programmers even start the development. And then they can make their changes, which then have to be ready before you can do the verification. So where it takes you, we try to back up from flight. If you're going to support a flight, it has to be certified and blessed 30 days before flight. Well, that means it has to be through the control board then, which means it's got to be to the users at least a week to two weeks before that. Which means its got to be through inhouse testing a week before that and then it takes three months to develop it to get it back there. And then if it requires new services, so we have got to start a year ahead of time. And you just finally say okay. If they say "I need this changed, it's going to affect everybody," you say, "well I don't have a year until that flight." You know it's going to take a year to develop that, we just don't have that time. But if it's something you can isolate. For example, one thing we did, one of the first releases of TOAST, is we had two versions of Menu Handler, quote unquote, on the system. What we did was we had one Menu Handler out there. That was user doc. Well we had a lot of programs that we developed previously under a different version of Menu Handler that we did not have time to upgrade to the new one. So we wrote cross interfaces on FORTRAN to C interfaces. We crisscrossed them to where the old calling arguments came in on the new routine and we dummied out all the ones that didn't exist. To a reasonable default. But we did that with the last Executive where essentially all the services were there in the last release. But none of the FORTRAN programs knew about them. Because we dummied the FORTRAN interface. But that gives the services added development time and testing time before they have to be implemented into FORTRAN code.

AM And how long might that be? Until you come out with the version that has the dummy calling argument that hides it and changes and does it behind the scenes for them. And then you give them a year between releases?

DC It depends, for 5.2 came out

KW The last flight.

DC The last flight?

KW February 6.

DC 36.

KW Yeah,

DC And the next release where they're actually upgrading to the new interfaces is 40, which is in August.

KW but the services are already in place. That way, you can develop the services all the way down almost to the certification date. The FORTRAN interfaces don't take hardly any time to build. Once you've got a couple of them around, they're really easy to build. So in a couple of days you can have all the interfaces built. And you can go straight into the testing. And then the next time the application programmers come back, all they have to do is upgrade, but then you don't need that lag time to build the service. So they can start right at "okay, I've got to do these upgrades." And the services are already there and again the FORTRAN interfaces take a day or two to build so they're easy to get the real ones in and in place. And then they can gradually change over as they get the chance. And if you keep both interfaces around and you only get part of them upgraded, you can continue to press forward.

DC There are situations where there is an incompatibility. This release, for example, the structure of the databases changed a little bit. So you cannot use the old routine. It just won't work.

KW So there were again some changes inside the services this time.

AM How soon do users find out about that

DC They don't know about services anyway. These are not user changes,

AM Ah, right, programmer

DC these are programmer changes.

KW Programmer

DC They are the ones that generally dictate the changes.

AM So they're expecting this to come down, and they know they're going to have some work to do to

DC Yeah

AM redo all of the

DC Yeah, we don't change the services just for something to do. It's the requirement mostly from the programmers. This release in particular, most of the changes were generated from the fact that when more than one position wants to use the same application they had to have their own copy of it, and we saw that as a big problem, a configuration manager's nightmare.

AM Right.

DC And we finally came up with a way and we all, Ken and I and the programmers, the applications programmers, talked about it, said here is how, what interfaces are going to change and this is what you are going to have to do and this means this and this means that, and worked it all out. So they are well aware of what's going on.

LP But the training is mostly through conversation and talking it out and working back and forth and so on.

KW Yeah.

DC They

KW Of course, it's all geared to the fact that up until real recently, we've all been in one office area. Randy had a change to the Menu Handler, and you were four desks away, you just holler and say hey, I got a problem, you investigate it, and you talk out a solution. Now that we've got some other users that aren't

LP Um hm,

DC We don't know what we're going to do about

KW quite so closely located

LP Right

KW it's going to be a little more difficult to

DC Nobody has set up procedures yet for coordinating with all the other programmers. And I'm not clear how it's going to work. I have mentioned it to several people, we have these other people out there, somebody tell me how to tell them here's a new Executive, and you HAVE to upgrade to it. I don't have that authority. Somebody with that authority has to make that move.

KW There is also the problem that, where we were all in one office, when somebody said, gee I wish I had a

LP Um hm

KW you could say, "oh that would make a great service." That's when Diane and I would take over and we'd do it and then just give it to 'em in the end

LP Um hm

KW cause we could say, well that's something that more than one person would probably want. Now that you've got people in several different locations,

LP Right

KW that's going to be a lot more difficult for someone, gee I wish I had,

LP Uh hm

KW and it has to be propagated to everybody.

AM Well, is there a way that you could build that in as another TOAST menu or something, or where you had like you and I were talking about it in the the demonstration, where they could suggest something into the log and you might have a menu that would come up say here are the latest changes that are coming down. Just this little news thing

DC But

AM that you could build in.

DC but these

KW Most of that we were thinking about for the users, where when they saw a discrepancy immediately record it

LP Right.

DC But

KW and then we'd be able to look

DC But they're not programmers.

KW at it. Most of the other... Yeah, it's the programmers that come up with it. Like when John was developing QUAC. He was looking and says gosh I wish I had a wind data format. Okay, fine, it sounds like a good Menu Handler requirement since we have programs now with wind data, so we incorporated wind data as a new feature. But when someone over in the Rockwell building says, "gee I wish I had," I'm not going to hear them, and I'm not going to pull it in.

AM Right

KW So they have to think and say well I wonder if this would be a common service, and they're going to have to call us and ask us for something. And those kinds of

AM There's no kind of electronic communications or anything between where you all are and Rockwell.

LP Link

DC They don't like certain machines being connected. Especially flight support machines - those cannot be connected to any machine outside the building.

AM Is there another one that might be? I'm just trying to look at different ways of communication because when I talked to

KW Theoretically the office machine could probably be connected, by modem, or something like, you wouldn't want to run a LAN cable

AM No, not a LAN, but some way that you could call

KW but you could probably run a modem over there.

AM them and get some data to them .

DC Except nobody will buy us one.

KW Even then there might be a problem. Because they're kind a picky about what modems are on machines.

DC Our machines are used to develop what will be used. Software that we use for classified flights. Therefore the machine, the environment with which this software is developed, has to be protected. And the modem is not in the realm of protected, necessarily.

AM What about even a PC? I mean in terms of being able to get information from other sources, because as TOAST extends

KW Yeah

AM You're going to have less different kinds of

KW We do have a PC. She now has PROFS IBM system that you can send mail on and all that. For the most part that kind of thing is used for flight training.

DC We are also not

KW On everybody's part to do.

DC in the position to make those decisions. We can suggest them all we want, but until somebody higher up decides that's a good idea, that there is an efficiency in our development cycle, it doesn't matter what we say.

KW You know theoretically, the ODP is the the point of control for this.

AM Right

KW I mean in theory when John said I wish I had a wind data format, if he hadn't been located right there in my office, he should have gone to the ODP and said can we do this? And then had us say yeah. And pull it into the services. And if everyone does that, then there won't be problems. Provided that everyone is there. Diane and I don't support a lot of the ODPs because they're

DC I hear a little more ground up conversation.

KW They're mostly geared for the applications.

DC People don't want to listen to the Executive, they're really not that interested in it. So

KW Now they lose as soon as they go into orbital mechanics. I mean once you start

DC Ken's going over there.

(laughter)

KW No, I could go to sleep or leave. But so we're not there a lot. So there would still need to be some

RM I don't even know if they knew that the Executive changed.

DC Well, I have had this conversation with people several times and since the ODP is being restructured, I've drug it up again and thumped on it awhile. And that is, somebody needs to have a form or the programmers can get together. Us and the other programmers, and there needs to be a form for talking about Executive requirements. I just completely reworked the Executive and we're doing it again with this release. And nobody else had any inputs. They need to have their inputs put in. And there's no mechanism for that really.

KW A lot of it, for the other users it's a COTS package. It's commercial delivery, and you can't change it.

RM Change it.

KW For the application programmers to sit there in the office with it, they change it all the time. And thought this doesn't work right. And go in and we'll

DC Tweak tweak

KW make changes.

AM Right, how many of those changes are informal kinds where they yell over the cubical versus the things that come down the pipe in the design world.

DC Most of them do actually go through the ODP. Most of the changes that are made that don't go through the ODP are so trivial. This is advertised to work this way, it doesn't, I tried to use it, or I as a programmer need this transparent to the user capability and a lot of those. Some of those, we just go ahead and as long as we're in that routine making changes, has to be routine changes anyway, go ahead and put it in.

KW Yeah.

SP Who checks that, to make sure that those changes are made, and is anybody responsible for following up?

DC What changes, the ones that go through the ODP?

SP Yeah. Anything that goes through the ODP, any changes that are made as a result of them okaying

DC They're ...

KW Approving a CR or a DR?

SP Right.

KW When you get it certified, you're supposed to state which CR and DR is closed so that would say that I closed this one, closed this one, closed this one. And by that point, hopefully the user that originated this CR was tasked as the user to test

SP Okay

KW the program on that release, and therefore he has concurrence to his CR or DR

SP Okay.

KW closed.

DC That sounds a lot more concise and predictable than it really is.

SP than it really is. Okay that's what I was

KW Yeah, a lot of our users, by the time they write it, then they change functions or for various reasons they're not available to be the tester the next time around, and therefore there's not a real positive feedback.

DC And when you're talking about the Executive, the testing, the original assumption on the Executive was if I cannot see it from within TOAST, then I do not have to test it. And I argued that there's a lot going on in the Executive that you can't see. You cannot see from running TOAST, and it could be working terribly wrong and look right, and if you don't get into Unix, develop some tools, go digging through the directories, dig in through the system and making sure it's doing the right thing, you could get caught short. And the only way I managed to resolve was to say, okay fine, if you won't do it, will you allow me to do that testing and give it to the CCB? And they said fine, why don't you go ahead.

KW Or at least do the testing and keep it documented in some fashion.

SP And who keeps all those documents?

DC Mark Riggio

KW Yeah, Mark Riggio. Of course, now he's another person that's changing jobs.

DC He's leave, he's not changing that one.

KW He's not changing that one? Okay. But he's always kept the the CM for all of the DM and workstation based executables. Basic machines and the Lotus spreadsheets and then TOAST and everything. But

LP That sort of sounds like it would be possible for someone to put in a bug report of one sort or another and for that to fall through the cracks and not get followed up on. Is that possible or is that

DC It's possible, my opinion is that most of the smoothness from the system comes from within the development community, not from without in the organization itself.

LP And so it's just a question that you were raising as well as the question of what happens when your community expands. Do you feel that there are in place at the moment ways to really cope with these kinds

DC In addition to the software configuration, we also have system configuration and data configuration. TOAST is very, very data driven. And reconfigurable and once, let's assume we've delivered the very last delivery of TOAST. We'll never make another change to it, it's there for now until never. There are still changes that you can make for the data. Who does that, who has the authority to do that? Who has the, when can you do it, how do you know that you've done it? And a lot of those questions that really haven't been answered. With application sharing, will this position be able to use this position's applications? Who says you can do that? I mean, flight control positions are very well defined. They're in charge of particular pieces of data, and if you want a piece of data, you go to the person who's in charge of it. You don't generate it yourself. Now that we can share applications who's to say that I can use your application. I'm not real clear who can say that. Who says who has access to what flights or what positions? I'm not sure. Who says who can change data? Well, I'm not real sure.

AM Is that something that

KW and TOAST can be finalized, and you can continue to deliver after the applications in TOAST forever. Just by changing data files and putting the executables in the directory. They're online. I mean, you don't have to sign off TOAST. User just has to install it, call up that choice menu, and it's there.

DC You know

KW So who does that.

DC These are the kind of questions that we're hoping to get answered right now. For example in this new release, applications now belong to a position. And that is hardcoded. So

KW In the exec, in the program,

DC In the yeah,

KW when he develops an application that the FDOs told him to develop, he puts in there "this is a FDO application." So that it will know that it's based on FDO, and it will work that way.

DC But recently everybody has been logging in as FDO. And what's the point of having a multi-position limited processor access assuming everybody logs in as the same guy. Loses its effectiveness. And we raised that concern too. You got people here that are supposed to run one Executive, one program, and you're telling them, they can run everything that FDOs can run. Don't you consider that trouble?

SP And who do you say this too?

DC Well, we're unsure. (laughter)

SP Oh no, you said it to somebody

KW for the most part, for the most part, we

SP right

KW say it seven or eight times to the ODP.

SP Okay

KW For example, the database that we showed you. You have TOAST, and you have this SDA, which was your flight cycle session. Three years ago, they were called different. But you have effectively what was called, FCPS

DC PFCS

KW PFCS, no, that was more recently. You had function

DC Position was at the very bottom of all those.

KW Yeah, it was function,

DC Flight cycle,

KW No, flight cycle, function, position.

DC Yeah

KW FCFP. So you had flight, as a directory. And it had to be installed. And cycles, as a directory, it had to be installed. AM function which would be whatever your session is today. And then it also had to be installed, and then position. And we kept telling them, well that says that if I sign on as FDO, and someone else signs on as hard, you're in two different directory trees, how do you share data? And we said, don't you really want that to go away? No, they sign on the same position. And that's where she's saying, where is the multi-position if the world

signs on the same position? So eventually we got the tree turned upside down. To where, and then now we even dropped the position off the flight cycle session. But a lot of the requirements, we're saying, look users, this is what you're telling us, but this is what you're really wanting. You're not saying you want it, but if you'll let us show you why you want it, it's what you want. The first couple releases of TOAST, services were not certified. Menu handler was blessed by the fact

DC People used it.

KW 55 programs used it without problems. Okay, that means it's good for those 55 conditions, but it doesn't mean it's good.

SP What happens if you change Menu Handler, then who recertifies?

KW Yeah? Yeah, I mean if it's data driven, we're

DC Who can change that data?

KW Yeah, there's a new program, comes online and what is it, how do you know that you're using good pieces of software? So we begged and pleaded to be allowed to certify libraries and services. And they don't have users to certify those, so I write that I'm the developer and the tester of Menu Handler. Diane did that with all of her certifications. But how do you bring those things forward, those things we basically do.

DC You know, the last two flights were the first time we've had multi-positions. And the rendezvous guys said, gee I like that program over there of yours, can I use it? And I said, no problem here. I don't have that authority. But who does and

KW Right now we also decide what users have access to what positions, to what flights.

DC But there's not

KW Or access to TOAST.

DC No, there's no formal mechanism that says, yeah, verily the trajectory operations manager who I think should be in charge, is in charge of everything over there. If you want a TOAST account, if you want to add applications, if you want to share applications, you've all got to go through him. Because some position could grab an application and say gee I'd like to use that, I guess he knows what he's talking about, he's uses it, makes flight calls off it, he has no right to be using that program. And all hell breaks loose.

KW For the most part right now, that's not a real problem. Because they haven't been in multi-position sessions. But if you go to a multi-position session and now our ... generates the prime ephemeris that the FDO's making calls from, you may have a problem. Once we get functions in line that allow you to send data outside of TOAST, like you want to update the MOC. You send a maneuver to the MOC, you know that those aren't authorized applications for anyone but designated

positions. But who has the authority to say, okay, we're going to give this really neat function over to someone else and allow them to go blasting data from the MOC.

LP Another question which has come up has to do with what happens when there's a problem. So

DC Define problem.

LP Yes,

DC You mean real-time problem? During a flight or during development? Randy turns around and yells at me, submit doesn't work any more. Ah, what kind of problem?

LP Yes

KW Diane and I have two users, that is one thing, we're con, you know. I have program users for Menu Handler, and I have interactive users for Menu Handler. So I can have problems from two avenues. When Randy has a problem, like she says, he hollers at me, come look at this, it doesn't work you know. You go over there and say, yeah, you're right, it doesn't work. You know - tough luck. (laughs) Poor Joe, there's no way to fix it. If another user has a problem generally, they call us during the day. If it's something they don't want to bother us about, they wait until the next day and call us. During flights, we're on beeper

So we walk around with a little beeper all day. Or we have a pass around beeper actually. And they can call the beeper, get somebody, and we're on 30 minute turnaround to come in and find out what's going on. Of course, you can't make any software changes in that kind of real-time, so if there is a problem, the best we can do is come in try to identify what the problem is, and try to identify a workaround. For example, a couple of flights ago. The orbit opportunities stops. One of the functions key is a print. It wouldn't print. Nothing comes out on the printer.

LP Oh, thank you.

KW (laughs) and finally they called, and said, hey, we need some hardcopy out of the printer and so we went in and tried to figure out why it wouldn't run, and come to find out that in the Menu Handler, one of the calls that's illegal under WEX in operation mode is to submit a shell. Menu handler was submitting a shell with the command line argument of the printer. So it wasn't submitting a shell, it was submitting the the printer. But WEX has no use for submitting a shell and flushed the job. (pause) So we couldn't do it that way. Well, it turned out that DOPS also has another function that's a hardcopy function that says submit these programs to do prints. And it also calls up the display program, but with a different command line argument, to tell it to print instead of display. And you could go through that avenue to get your printouts. So in real-time we said, well, yeah, you're right. You can't use the printer that way, but here's a workaround for this flight, we'll fix it in the next release. But we got a flight call on it. Ah, this last flight got a call on DOPS and QUAC, they come up every flight. (laugh) They're the two that came out in the "I need this by the end of the month" type

thing, and so they sometimes have some problems. But if you called up the menu program to generate the DOPS and you ask for more than I think

RM 10

KW 10? 10 or more vectors, there was one field on the menu that would be corrupted because the orbit counter. And if you tried to change the orbit counter, it would trash the program. And so they got a panicked call and in the middle of the night

DC Sunday morning.

KW come fix DOPS.

DC Or Saturday morning.

KW And they had to come scurrying in and figure out what the problem was. You know it turned out that flight developer for DOPS was not one of the people on the beeper route so Randy's up here on the phone talking to Roger at home. Saying why won't this work. So just because you're not on the beeper doesn't mean you're not going to get called. (laughs)

DC But the workaround was still upset.

KW Yeah, the board at that time was yeah, you can use my vectors, that's it.

DC I have got to go.

LP Thank you, Diane.

KW But we get calls in the middle of a flight. Drag that out.

AM Let's talk about

KW It kind of depends, but like I say, the developers, most of their problems come in either. Right now they have problems with the forty release, which is going to be coming out in a couple months. And at that point in time, you know it's pretty free form, working out your problems. Hopefully by the time you get to certification phase, all those have been caught. And a lot of them turn out to be data release problems. We got a couple flight calls, first sim calls, such and such a program won't run. And when we got over there, we found out that a new program had been delivered for that release, and it a had slight modification in one of the data files that we were not aware of when we installed the new applications. So now you've got an old data file and a new program that don't mesh. You go over there and you find out, and then bring in a new data file, and it works.

AM We talked a little bit about transitioning pieces of software. And I presume you keep old versions around. I know when David was here ... which one is the real version. You have a certified version and presumably you've got backup of these someplace. Is that

KW We have the source to regenerate any version. What we've been doing, we've played a couple of games to try to get it set up where we really like it. We have a TOAST configuration management account and a TOAST operational account. Under the TOAST operational account, generally we'll only have two, maybe three versions of TOAST in executable form that are there. There'll be the currently certified, there may be a developmental or pre-certification release, and there may be the one that just got bumped out after certification. In other words, the most recent old version. But that's about the most executable that you'll have laying around. Then in the configuration management account, we have essentially all the source that has been delivered for TOAST. It's basically broken down - you have a version of TOAST overall. Right now it's version 5.2. You have a source directory here, and under it you have the Executive, the FDO applications, the Menu Handler. And then under each of those, it will break down into any other modules you've got. So under the Executive, you'll have each of the libraries, each of the main modules. At some point you'll get down to where you have a module. Under it will be all of the versions of that module that have been delivered. So Menu Handler has versions, it's up to version 6.5 right now on the next release. So currently in TOAST CM, you should see the first certified release of Menu Handler up to 6.4. And then under that would be all of the source to create that version of Menu Handler. And any discrete data that it required. So you got a FDO application, DOPS. It will have menu appl this, and under Menu Handler, under the menu program would be all its versions with all the source to create those versions.

AM So you're maintaining multiple copies of source rather than having some control program that can read

KW Right

AM things at the end and say this belongs with this version.

KW Yeah, we haven't gone with the

AM Using the Unix package.

KW Unix packages for doing that. We had some inhouse developed programs, but that's the source tree. Then over here, you'll have each of the versions. Like right now we have version 5.2. And under it, it will also have a source directory. With Executive, FDO applications, and Menu Handler. But under that it will then have only the copy of Menu Handler that was in that version of TOAST. So it would only have one copy there.

AM Right.

KW And they're together, so that they're essentially the same, so you've got two paths to get to the same point. When you deliver a new program. Or when you make a delivery, there is a piece of paper for you to fill out. It says what you're delivering at the module level. The version that it is, any data files or menu definition files that go with it. Where to pull them from so you can get them out of your development catalog, put it in cm, say where they are in your development account. What they are. And then you tell it about any source files from previous releases you put that are not being used or being deleted or

replaced essentially. And then you tell it any new files that are being added. Diane developed a program that runs

AM Will go on the back of those files,

KW take a piece of paper and type it in to a little file that she's got. And it shows it off program on the data file, and it will generate the new. So when I go through Menu Handler 6.5, I'll put on there Menu Handler version 6.5, whatever exec, whatever data files to change, which I don't have any. None, come forward. You need modules that are being deleted. You include that kind of thing. And she'll type it in, and when she runs the off program, it will generate in 6.5, copy forward all of the source from the previous one, delete any that are supposed to be deleted. And then overlay all of my deliverable modules on top of that. And then generate a makefile for it. And then we also have in the cm, under the version directory that I was talking about, we have source. We also have a cm directory. It has off programs in it that you can use to make Menu Handler. And it will then determine what the version is for this release of TOAST. And make that. I mean you can make the Executive, and it will go in and find out each of the libraries, run the makes for all of those, and you can grad, and it takes three makes just to make TOAST run out. You make Menu Handler, you make the Executive, and then make the applications.

AM And Diane's program will go in and stash all the stuff automatically from your development directory. Or do you have

KW Well

AM to basically copy it over?

KW The first one I did, that I created, handed her a piece of paper. It will copy the the files from wherever they are into the cm account. Then you make a new version of TOAST. After she got all those copied into cm, she does a make of a new version. So she'll create 5.3 out of all the things under it. Then you go through data file there, and make sure that you've got all the versions tagged right, so that you can pick up Menu Handler 6.5, walks 5.2, whatever they are. And when you run that shell script, it will generate the three off programs for making Menu Handler, making the Executive, and making the applications. Generate each, run each of those in serial. And it will generate all of the Executive, all the applications, and all the libraries, the executables basically. And they will come out into the version directory. And then the TOAST administrator has to run a load TOAST script to copy those over into the ops account.

AM Okay.

SP Excuse me, I have to go.

AM Well, we have just a few minutes before our next people come in.

(pause)

AM In terms of maintaining compatibility, we talked a little bit about that. And putting in dummy function calls. Do you do any other kinds of things?

KW For the most part, we have pretty much refused document compatibility. For one release or two, we might. For the most part, the services have changed significantly enough that applications need to be upgraded. And it's just been understood that TOAST is still a new enough product that you have got to expect those changes. We tried to emphasize the need to get the services up to speed before we start really putting a lot of emphasis on bringing a lot of applications online. Because the more applications you bring online, now when we upgrade, it locks. You're affecting that many more applications. So we've tried to really emphasize that we have to get all the services up to snuff. Before they do a lot of deliveries. That is one of the reasons though that we try to wait with the new services until everybody is going to get hit. Or until we've got enough together that we can justify "okay, this is a major release that is not compatible with any other, if you want to come in under it you've got to do the full upgrade." But we really haven't tried to maintain any multi version really.

AM You have any more questions?

LP Well I guess my only question is something which we touched on before, which was we kept getting reports from users and from applications developers that when anything goes wrong, there so many levels of things that can go wrong and so many types of people and types of organizations and machines, that eventually what happens is that they yell and either you or or Diane comes and fixes it. Even though there are lots of different types of problems that would involve lots of different types of organizations. Comment on that or

KW Well, one of the things that we have problems with was, for the most part, it's in the operations modes of running the MCC where the standard reporting mechanism, when you have a problem on a workstation. Is to report it to the WLC or the workstation controller, which is another flight controller position. And that's his job to deal with workstation problems. If you had any problem regardless of what it is, you're supposed to call him. And that's what's in the flight rules. If you have a problem, call WLC and deal with it. But what ends up happening is a lot of problems when you do that, they say, well we need to reboot the workstation. So they reboot the workstation. They don't necessarily check to see if there were front and back room users on the machines or that there really wasn't a problem. All you had to do was run this and

RM they don't look

KW If they know a program crashed. And your cursor is now on blinking red on the screen or something. Well, Menu Handler didn't close it out right because the program crashed. If you just run the program again or run from a new window, everything will be fine. Don't worry about it. So we get a lot of calls of that kind. Basically we try to circumvent it and say if you have a problem, give us a heads up to let us think about it and see whether or not it's a problem that we should deal with. Because, for most flight controllers, they're running one program, and they can either obviously tell if this one program's at fault or if it's a generic workstation problem. So calling the WLC is the right way to go. For a lot of our stuff they ran one program, TOAST. From there, they don't know

when they're starting a new programs. So what we're trying to tell them is if you have a problem inside TOAST, let us look at it first to see if it's a problem in TOAST or if it's a problem overall. Most of our problems right now come in the configuration management because WEX, when you sign on operationally, dynamically loads the software on the machine that you're supposed to support. Or supposed to use in support. It also downloads what's called PPLs, process parameter list, which is a data request that you send to the MOC to get data, basically. The PPLs are only downloaded for the specific flights that they are uploaded for. Well, they're really only uploaded now for one flight at a time. So right now they're uploaded for 31, because that's our next flight. Well, they're running 31, 35, 40, 44 sims. So if you go over and support a sim, you try to get MOC data, and you get this message back you could not retrieve MOC data. And normally that would be a LAN controller problem, and they'd call the WLC and find out what's wrong. Well, we tell them, no, call us, we'll come over and look, and we say you've got several problems. You need to call WLC and get them to turn GDR on so that it's enabled. Secondly, we've got to download your PPLs for you. So then we manually download the PPLs from the right place. Maybe some other problems that they've got. But we have to basically check out the system and see what they've got before we bring someone else in. Diane and I get a lot of calls. But, we've trained most of the application guys to where they can track most of those now. After two or three problems, times that you hit it, you find out what's going on. Another thing that happens, the PPLs are downloaded, GDR is enabled, the programs are all there...

KW ..door. Which means they moved the box from this machine to that machine. When they do that, all of the workstations lose their host connection. And if you look at the top of the bar, it says, the flight you're on and the host you're supporting. And it'll send you a little red message at the top. Such and such. But you're working in the center menu and you look down there, well it doesn't look like so you go back to work. Next time you do GDR, you can't get any data. What happens - it dropped you off the host. So all you have to do is go up there and click on the window, pull up a host, pull up flight, and you've got GDR back. But the first few times you do that, GDR's enabled, PPLs are here, program's not submitting them. (laughs) You know, in fact you got cycled. You've got to go back up and reset.

LP And there's nowhere to go besides calling you or talking to the guy next to you who might know or else, just happening to know yourself. There aren't essentially

KW Right.

LP any set of documents or any kind of thing to help you out.

KW Well, for the most part the things we're learning in real-time like that one we found out in real-time, and well I know we signed on with the MOC because the signon menu requires a flight ID. So why don't I have a flight ID on this menu. Well, you don't put a flight ID and a host, even though the host is optional in the signon menu. You don't have them on the support menu, or it doesn't cycle over. You lose them off of the other menu. So we've gradually learned that you have to have those there. And the users have learned that and they say, GDR

doesn't work and you say, yes, I checked. (laugh) I have a MOC, and I have a flight. That's not the problem. Well, okay. And we'll go over and we'll find out what's going on.

RM But we're the only ones that know where to look. And if this is going wrong, like the WLC's not going to go over there and check that the PPLs are downloaded

KW Right. See he doesn't know anything about the data configuration or the executable configuration. Our stuff. So he can't test any of that. We've had some other problems that were OS related. We have a program that runs, as we said TOAST runs as TOAST. When it gets downloaded, it gets downloaded by root. Therefore it's owned by root. But the effective userid's messed up. Well, if you run it, you're going to run it as whoever you are. Which in operational mode is your position. Which won't work.

LP Right.

KW So we had to task a special routine be written for us, that changes the owner and sets the effective userid to make it TOAST. Every once in a while that program doesn't get run. For one reason or another. So it gets downloaded and is owned by the wrong person, and you can't proceed. Or there are several conditions under WEX, can corrupt the download. And what you end up with is all of the files are there, but none of them have execute permission.

AM And so this is something that people see from time to time as they get a feel for that kind of problem

KW No, for the most part there, we get this call that TOAST won't come up.

AM Right, Okay.

KW And you can't get TOAST, that sounds like a problem, and we'll go scurrying over there at full speed and find out what the problem is. If they're in, they are saying, well, I can't get GDR data. You say, well okay, make sure you've got the MOC selected, make sure you've got a flight selected. Make sure that GDR is enabled. Try it again, and if it isn't there, then call us back. And then they will call us back, and say okay, and then we'll come over and look.

LP I understand that sometimes it actually got to be the hardware, or turned out to be the operating system.

KW We've had a couple of problems that were with the operating system on a couple of occasions when they had to do some sort of OS upgrade or change or something. The node name in the machine had been changed. No one knows who or how or when. But you went in one day and the machine worked, you went in the next day and you can't sign on. You know because the LAN doesn't recognize the machine. And so those have not been seen recently. Those were in the very first releases under WEX, where something was wrong and nobody can tell what. So you sign on development mode and you run in development mode. But you don't have any GDR capability.

LP Somehow those kinds of things usually land with you two or

KW They do, yeah. They just say, hey, we can't sign on. And so see what most of the other ones do. Flight controllers actually do the programming. So they know the software well enough to where they can look at the software and figure out what's wrong with the software. In our case, most of our users don't know the software. And the users that do know the software, most of them only know a few pieces of it. We have some of them that know the Executive real well, but then they're not any of the applications software. Others that are the application sponsors that don't know the Executive very well. So there's really nobody other than us that knows, where is the clash. Where is the problem here that we need to investigate. So since we just told them if it's a problem and it appears to be in TOAST, call us, let us come over and look at it and if we can track it down, and then if we can't track it down, then either we'll call the WLC or come down here and take a look at it or any number of other things. Most of the OS and all that is worked out over the last couple of flights. But we were having a lot of trouble with it.

LP You sort of get actually put in

KW Sort of ironed out

LP to the loop very early on, awful lot of different types of problems and an awful lot of

KW Yeah but, that's by request.

RM Right

KW Because we have the familiarity with the programs to go in there and really look at them and say, this is our problem, let us fix it. Or this is not ours, let some one else handle it. Of course, we tried because up until 32, we were also the OS support for the machines. So anything you had was going to come to us anyway.

AM Thank you, helped answer and clarify a lot of questions for us. We'll probably have more.

KW Okay.

LP (laughs)

AM Thank you.

Transcript 11	Configuration Management
Interviewers	Livia Polanyi (LP) , Andrea Martin (AM)
Subjects	Greg Oliver (GO), Mark Riggio (MR)
Date	April 18, 1990

AM What we wanted to talk about this afternoon is to have you describe who you are, what you do, how you're related to TOAST, and then talk about some of the software control boards and that sort of thing. So would you like to start, Greg?

GO Okay, Greg Oliver. For the last two and a half or so years, I have been the trajectory operations manager, and also in the past I've flown for many years as a flight dynamics officer, so I have console experience. In the trajectory operations manager job, it entailed primarily, well, a lot of different things, but one of the parts was to run the control board for the real-time offline software. Of which TOAST is a subset. Mark originally and I started from scratch as far as creating a control document for what standards need to be met and all this kind of thing for software. And by middle of 88, we had a document on the street that outlined all that. And we've been working in that ever since. This last month, in March, we had a reorganization and since reassigned to the section head for the ascent entry, for the flight dynamics FDOs. And so when they go ahead and select a new trajectory operations manager, I can transition that role over. But I have an inherent interest both in the control of it, but also the end product as far as the flight dynamics officers. Your turn.

MR My name is Mark Riggio and I've been working with Greg. As the administrator for the ops board. Before that, I also was a flight controller. I was an attitude and point officer for about seven years. And now I've been serving in this role, currently preparing the document, basically setting up meetings, taking minutes for those meetings, consulting for what kind of policies we want to establish. As we see things coming up that we need to discuss, things that hit us that we've not seen before that we know we need to address. That sort of thing.

LP What kinds of specific work have you been doing that involves TOAST?

MR Well for myself, the meetings that we have. The TOAST software, we will be presenting it at the meetings where we would discuss what documentation elements they had in place. What testing they had gone through. See if anybody had any questions. That sort of thing. I mean see that everything was as it should be.

GO Let me expand a little further. We're the certification body for all the TOAST applications. So they bring to our board all of their documentation results, and we have to view it to make sure it meets the standards as well as look at the results and see if it is acceptable. And then we're the sign off that it is certified or send it back to rework it. Prior to it getting, in this case, uploaded to the CM host for use in the MCC.

LP Do you actually set up the test procedure and who is in fact testing which piece of software?

MR That's done supposedly through the engineer. The test engineer. I say that because it could be done in conjunction with the programmer. Where he tested

the plan developed by those individuals and carried out by the independent testing engineer. And he tests it; his findings are put down in a report, which is one of the items that is reviewed at the meetings.

AM Would the work that Bruce Williamson's committee does with the orbit design panel, would the results from their committee go then to your group?

MR Right

AM Is that how that would work?

GO Yes.

MR Right.

AM And they would go through the procedures and get the testing and cycle it back through until it met their criteria and then they would submit it to you and then it would

GO Ideally that's how it should work. But

AM How does it work in actuality?

GO In history, I think we found some cases where the ODP or Bruce Williamson board, like who's doing the testing or who's writing the test planner - that kind of thing has been disjointed at times. And we both thought the other was taking care of it. And so, we tried to be a little more conscious of who's actually tagged to do testing or get the documentation together, but conceptually by the time it comes to our board, all that stuff should be done and ready for certification. So I think we've gotten involved to help move it along, and make sure we are getting everything so that it will come to the board in a complete set. And we do have the right testing completed.

AM There was a question raised in some of the previous interviews about the fact that certification extends to the programs, and then they run the test program, but it doesn't necessarily apply to the data files that are coming in. And there was some question as to who should be responsible for saying the FDO position can share these programs with rendezvous or vice versa. Who would address that kind of question?

GO Well, we've talked it at our boards in the last couple months actually in our board. And we have basically come to a plan of the databases themselves. The databases, we are not planning to certify like we do the application. However, a lot of that is due to the user has the ability in many cases to change the database in real-time and the inputs to a given processor. So prior to a given flight, we now have a sign off sheet that either in this case the lead FDO or some application sponsor for a given application, does his QA on the full database and says yes, I've looked at it prior to the mission, and the mission database that we are gonna fly with, it's all what I expect it to be and I've done my QA, and he signs off. And we collect those pre-mission. It's not a certification; it's just a low level QA to say, we're going into the mission with what we believe is a good sound database.

(pause)

AM Another question that came up, that we've been talking to various people about - what is tracking changes and how to keep them from getting lost in the cracks. People don't bring them directly to you. I presume they would go supposedly through the ODP or the other

GO Right

AM planning force. Is that sort of issue something that would concern the board that you're on?

GO Well, it concerns us in the extent that we don't want to deliver for a given flight a set of software that is missing a piece or two because of some technicality. I really believe it's on the onus of the ODP or the other group to bring us the full set of whatever changes they think are necessary for a given flight. And I think there have been many instances when we've tried to get in the middle and make sure all that was happening. But in the end, I don't believe that's our responsibility. To make sure they've got everything headed our way that they want to use.

LP What is your feeling about overall function of the ODP? Is it giving you the kinds of things that you need, when you need them, in the way that you need them most of the time? Or are there any kind of organizational changes or procedures that would, in your opinion, improve the functioning in one way or another?

GO You want to answer that?

MR I think for the most part... I'm not sure about any improvements in the regards to ODP. Or what it does. I'm not real sure of

GO We're going, you probably already know that, we are going through the organizational changes right now. And it's gonna change the direction of the ODP quite a bit from what it was before. However, the overall concept of ODP as managing the development process and doing the work plans and trying to control what's gonna be delivered for a given flight. I don't think that changes in any way.

LP What do you see the major changes being, between the

GO It's just gonna be more of a visible challenge to balance the orbit design element with the real-time element and make sure that that's all done in a timely way so that you not only incorporate the design requirements, it meets the requirement timing schedule-wise for the real-time guys.

AM Have there been problems with that in the past?

GO Not too much. Although I believe that if you design TOAST to have the interface that the real-time guys need, but incorporate all the application requirements that the design guys need - ideally that's how we'd end up with the best product for our use as well as that by the designers. In the new organization we're going

through, it looks as though perhaps there will be a stronger focus to make sure that we are satisfying all of the designers' constraints, and I may have a misconception that it may be somewhat at the cost of the real-time requirements being made. But we're still in the infancy stages of that. We don't really know how that will develop.

AM Do you see that they really need to be the same system? Maybe the requirements are so diverse between the two sets of needs of the real-time people versus the people that are doing the flight planning. That maybe you really do need two different pieces of software?

GO Well that's where we were. And up until three years ago or so, we did have totally independent systems. And I'm sure you've talked to Chirold Epp. As we got into it, I agreed with Chirold that there's enough overlap that common tools ought to be a goal within our division. For both sides of the house. I think there is enough overlap that we can, with a few exceptions, have a common tool base. (pause) And actually to go further, I also believe that all the real-time software within our division should be incorporated in under the TOAST umbrella, so that we all have a common interface to WEX. So it seems to me, there's a lot of advantages to having one common interface for all of our real-time support under WEX. Which is what I've been pushing.

(pause)

LP What do you feel is going to be the effect of FADS changes that will come about in relation to the FADS environment being the important part of the whole configuration?

GO I don't think I have enough data to know the impact yet. Because I don't know that they've baselined enough in TOAST for us to know a certainty or they haven't baselined enough in FADS for us to know whether TOAST is compatible or not. So I don't know. I mean, I think a lot of people are concerned about it. TOAST has one direction. It could be very serious to our TOAST development in what we've done to date. But I don't know that we have any sure answers yet.

MR I do think that the ODP, they're trying to stir up the pot for the FADS folks to prompt them into letting the ODP know what their requirements are. Because the ODP I think is making a conscious effort to not just go romping along in one direction. Without any regard for what FADS needs are. So I see them kind of like prodding the FADS folks trying to find out what direction they really want. And I think that's a good thing. They're trying to be accommodating. You know, the best that they can. And they're making the effort to make sure the software is going right. Work both ways.

(pause)

AM Is the configuration management board here, how long does it take to certify something?

GO How long does it take to certify something?

AM Yeah, if I dump a a stack of printout on somebody's desk and say here are the test results, here is the software, what do you do with it at that point?

MR Well basically what happens - copies are made and sent to board members so that they can review them. And we review them as well. As part of the board obviously.

AM Who makes up this board?

MR Well, Greg and I and flight con, various flight controllers and programmers who are involved in there and are competent we feel to review these things intelligently.

LP And who appoints the board?

GO Well, let's not deceive you. We had a board assigned in our old organization before we just org'ed. And the intent was to have key people or a representative from each of the sections on the board. So whenever reality struck, it appeared as though board members showed up when their particular applications needed to be certified and the rest of the time not.

And so today if we get the applications ahead of time, Mark is able to send them out, and all the board members have them in hand and have the opportunity to review and comment and bring them to us. Well, I would say at least half the time the people that are doing the verification work show up at the board meeting with a pile in hand and maybe or maybe not some copies, and

MR Yeah

GO and say here we are. To get certified. So I guess first thing is the board membership is not firm. I mean if the later happens

LP Right

GO whoever is at the meeting has to vote on certification. And usually in the case of a pile of things that has to be looked at, I need to go through it to make sure I understand the accuracies and that the results are summarized and all the standards are met. And if they bring something like that in that hasn't been before the meeting, then most every time I have to take it and go back and look at it. Certify it at a board later.

MR Ultimately he will always review it. If nobody else gets a chance to, he will always review it.

GO But then on our sign off, the applications sponsor signs that it met all the requirements, and verification's good, and he's ready to certify it, and his section head has to do the same.

MR That's correct.

GO Before I see it and sign it.

MR That's correct.

GO So almost independent of the board from the process at least, you've got three levels that have looked at it and seen that's it's ready.

(pause)

GO That's what you were looking for?

AM Yeah, because we were interested in a process that if somebody makes a change to TOAST, what is it they have to go through, how many people have to look at it and how long does this kind of process take. If I want to, make a one line change to an application, is that going to tie up man months to have to get that certified as configured software.

GO Okay.

AM You know that's the the kind of question that

MR On small changes, it's generally not gonna cause a lot of grief. A small change is evaluated, just what testing is needed. Because of what that small change would affect. Sometimes even a small change may mandate a complete retest, depending on what it is you're doing. Most of the time, however, not.

GO Our configuration handbook talks to different levels of changes, and for very small barely insignificant change, there is a subset of the documentation standards and testing. Testing that has to be met is a very minimum. And for a major change, it's bigger than that. You may have gotten inputs from some of the controllers perhaps that say well, shoot, it was a two line change, we shouldn't have had to do much of anything to get it on the system. And we've had a fairly good battle to enforce the standards and to show that there is some regression testing and we have confidence in what's out there.

(pause)

AM Now that was one of the questions that we've been asking people all afternoon - how much of this goes on informally versus having to go through the formal procedures. And what is your feeling about how much happens despite talking to the person in the next cubicle saying, "oh let's just fiddle" versus "well we have to do all this testing and get everything together to get it blessed"?

GO On the requirements side, I don't think I can really comment, because the requirements are baselined at the ODP level.

AM Okay

GO And, with development, well from the requirements, I'm sure there may be a fair amount of that going on. My view at this point is you've got an end product, and it's supposed to generate this quality of data to this accuracy compared to this external source. And that's what I look at - does it do what it says it's gonna do and to what accuracy. And are all the documentation standards met as best I can tell. So that's what I'm looking at

AM So by the time it gets to you, it's very much a formal process, and you don't really know where it came from other than

GO Right

AM you assume the ODP has blessed that and

GO right.

LP And what are the kinds of documentation that you're looking at to insure that in fact it's gone through these various levels of review, or is there some technical documentation as well?

GO Go ahead.

MR Yeah, well, we do want to make sure that the technical document, number one, technical documentation is in place. Number two, that it is consistent and correct.

GO That you can expand technical documentation and were talking like programmer's guide, or user's guide

MR Guide

GO and so on. And some kind of

MR AM requirements document.

GO results

MR testing

GO results, testing, and test cases.

MR Yeah, the test plan will be there, some evidence of what testing was done, the final report on what the finds were. Discussed at length, at the meetings.

LP How often do you get a report saying this should be certified?

GO Well it doesn't get to our board if we've sent stuff back

MR We've stopped it, sure. We've stopped it

LP What kind of grounds have you stopped it on?

MR Insufficient evidence of the program doing what it's supposed to do. You know, they might have done the testing, but hard copies might not be evident that show that, and us coming in looking at it, how are we to know?

LP And for the TOAST effort, how often has been that it turned out to be more than a purely formal procedural kind of matter in terms of this particular piece of

software or this particular document wasn't quite in place. Have there been other problems? That have reached your attention?

(pause)

MR There have been occasionally. I think where there were problematic problems. Like logic problems that had not been completely solved. I think that might have happened once or twice where there's some programmatic problem. But is

GO But you see out of the numeric results,

MR Yeah

GO at the very end that we questioned. But as far as the requirements, most of the documentation on the TOAST software we've had to this point has generally been in good shape. Of all the different software we certify, that's probably the easiest to go through,

MR Yeah, it is.

GO and make sure it's all accounted for documentation-wise.

AM And that the applications that are not the menu handler or

MR Even that is not too bad to go through either. I mean they kind of set it up the same way.

GO I can't site you any specific cases where they're deficient in the documentation or something that we had to go back and recycle again. Usually the biggest drawback is technically - it doesn't meet with good enough accuracy, and we have to go investigate it further. Or we haven't had the adequate testing time, or something like that to certify it. And so it just gets posted on to a later meeting.

LP When and if the TOAST effort expands and there are lots more users and lots more developers and so on, do you think you see the procedures that are currently in place as being a good set of procedures, a reasonable one for a sort of scale up effort? You see it as being sufficiently wieldy, that's the opposite of unwieldy. Or do you foresee that there could be problems when things get somewhat larger? And more diffused?

GO I believe that the certification process that we have today should be able to work with the higher volume that we'll have in the future. You know, probably the only area that we need more focus on is the role and procedures of the system administrator because I have suspicion that task will grow into more and more of a full time task in order to maintain the system. The actual review and certification of the documentation and verification data shouldn't change, I don't think, from where we are today.

MR I don't see that.

LP And you actually also certify documents such as user guides and things of that sort?

MR Right

GO Yeah.

LP And so would you then be the people who would then certify online help?

(pause)

GO Unique to TOAST you mean?

LP I mean, let's say that was one kind of path that people took developing further and expanding.

MR If that was considered like a user guide or part of a users guide or a software form of a users guide, let's say. Most certainly you'd have to check that to make sure this

GO And probably, you know that's a good point. Probably would need to handle the certification of that through uniquely as opposed to the way we do applications. Our certification of the generalized data retrieval, PPL. I don't know if you've discussed that? We basically had to create what certification requirements were necessary for those. In this kind of case, I suspect we'd end up doing the same thing.

MR We're flexible enough. Whenever something new comes up we do address it and are able to resolve it. Like the PPLs.

LP One thing which often arises I guess is the whole idea of a users community and the users community somehow acting as a resource for itself and other people - is that something which you see happening here? As far as TOAST goes, because it seems at the moment that this is a rather close knit group of people with the developers and the application programmers and the flight dynamics officers. But it also seems that there's going to be rather a change in the ecology of the situation. Often new users and new types of environments. And so I've been wondering about that kind of informal users group and informal set of ideas about how things work and things don't work and so on. If that's going to be a problem or if you feel like that's something that needs to be formally overseen? Or is it just something that hasn't come about to deal with.

GO I'll let you answer that one. (laughs)

MR Well let's start off

LP I was sort of thinking that

MR That's a tough one to answer. From what I see at least in the the flight dynamics officer area, the users are pretty much defining what they want. And they talk about it offline, and ultimately it'll go before the ODP. Where they make the request formal, so that I think that kind of serves that. I think the ODP is trying to broaden that, their formal process of that. To extend to the FADS community. And they can talk about what they want and decide, have a consensus amongst

themselves, what they want. And say, let's go to the ODP and tell them what we want. And everybody can debate how it will be implemented.

LP I guess the question that I was really getting at is the question of what kinds of help are available in the whole situation, and they obviously are very official. Could be official guides and those seem to be ones that you actually find involved

MR Oh,

LP with the certification. That it should be online.

MR There's people that are available to talk to, if it's one thing to write things down, and have them read through it. But probably nothing's gonna be as good as just going to somebody and saying hey, you know, what's, and there's people available. They can talk to me or Greg if they have a logistics question. Let's say, is it feasible to program something this way. They can talk to like Ken or Diane Campbell.

LP I guess you

GO Well, let me try. I think you were sort of alluding to as the system grows larger, larger and larger. You know, our ability from the flight control or the operator viewpoint is to say, well I'll call Ken and Diane and get them over here, and they will fix it automatically. It's gonna be harder to guarantee because there is such a diversity out there and magnitude-wise. Ah,

LP And also the education process is going to shift. Okay at the moment, there's a lot

MR Yeah, kernel

LP and then there looks to be this formal thing that finally gets addressed. But as the whole situation expands, I'm sort of interested in what kinds of ideas for overseeing, perhaps what kinds of training and what kinds of information you're gonna get to someone with the system as well. I'm wondering if that's been one of the sort of concerns that you've been having.

MR It probably should be.

GO Yeah.

MR I'm not sure that we have got a scheme or way to manage that. I do believe though that the end product, this sort of simplistic way is to do development. One is to write requirements and ship them off to some developers. And they create something, and then you get it back and test it, and you see whether it did it or not. And a lot of the traditional mass of kind of things.

Greg To an end product that we are all happy with

Livia Right

GO And, independent of the scale, I hope that we will be able to retain that relationship, that the users and the developers can continue to converse and converge on an answer that is acceptable. That's probably very very, I don't want to underplay it, it's very critical to... the overall success of the end product is linked to that, I believe.

LP Yeah, and I guess that since that's been very much the spirit of the whole enterprise, then the question is, when there's a scale up, have there been any real thoughts of how to perhaps institutionalize that spirit. Or how to make sure that kind of spirit continues, or whether it's just a thought that "well that's the way it's been, so I guess things will work themselves out."

GO Depends on how it manifests itself really. And it's hard to predict how it will do that. So I guess that's probably why thought hadn't gone into it. Who knows, it might be yes. We really need to... if it has started happening, and you can recognize that's it's happening, you can say let us institutionalize, or you can see that yes, it is scaling up, but things are either working well then, maybe you don't need to do anything.

LP Right.

MR One simplistic way to help assure that though is to guarantee that the developers are fairly close located with the users. And that is, it seems like, such a simple step, but it seems like it's half the battle. It is, I guess.

GO I guess it is.

MR On the same proximity so they can keep talking and this developer can get a question answered instantly and keep going back and forth. Ah,

AM And as that base grows, it's gonna be harder and harder to do that, and you've got people in buildings scattered all around the center on different floors, and it becomes very difficult. People don't feel nearly as comfortable about having to go to the next building to ask somebody about something versus just hollering over the top of the cubicle. And I think that's what Livia is trying to get at. That as you grow and things do expand and certainly incorporating the FADS environment, you're gonna have a lot of the users, and how do you think about gearing up to that and trying to maintain this closeness that you've achieved today? I think that's what she is trying to say.

LP Because another question which I think relates very much, that the documentation is the nature of training materials. Are they also certified? Or are they also looked at, for example when there is the developers course or things of that sort. Does that kind of material also get looked at by somebody?

GO Like developers training class materials? They have not in past. I mean we haven't considered that in the past at all.

LP (laughter) Coming out on the side of more and more and more bureaucracy, I don't mean to really think that way. I'm just sort of asking about what the ah, cause I think that's also gonna shift, which may be a bit in the wind, the question

of whether users are necessarily absolutely expert users of TOAST, or whether you might have users of TOAST, who are at some different levels of expertise, so I'm sort of wondering whether there's been a question about control or help or really addressing the problem of training and communication. For users who are not necessarily as expert as the FDOs, end users that you've had. And the developers who seem to have been also working very very closely with the systems people.

GO There I will say that up at least up until now, the TOAST individuals involved in their applications have set up a training class, let's say, for the flight controllers.

LP Right.

GO So there is that, in place currently. As far as anything in the future, I don't know. I really guess that I haven't thought about it much other than there probably would be something similar, where you would have some sort of training like that. Where it might get to be a problem would be having a multitude of individuals, and now you're having a time shortage problem or something like that. To be able to do all that. That might be the kind of problem you are looking at, but the feedback I've understood is that these training exercises have been very successful.

LP Are there plans to expand the training effort do you know? Or is it

GO I'm not aware of any, but that's just me.

MR You know, I hope you all come out with some suggestions in that respect. Because I think right now we are probably in the mode of trying to move into X windows and getting new applications online and flight to flight production, and I'm not sure that we spend enough time looking at the options for interactive user help and training of operators and developers and that kind of stuff. That probably could use some more attention. I don't think that we have a strategy yet.

LP Not that we've really had much chance to explore that with people. I think that's why you maybe are getting pushed

AM That's right.

LP about it.

AM One question I'd like to put to you, Greg, before we run out of time since you're now moving back into a more operations mode, the FDOs - the ascent, the descent is that it? In terms of what you've seen today, where do you think TOAST ought to go? People are mentioning X windows, and other schemes that I've heard. Where do you feel that for the users that you have today, what do they need out of TOAST?

(pause)

GO Well we need an offline tool. Well, from my viewpoint you need a real-time offline tool that's compatible with the MCC upgrade. Contrary of things that

include WEX and the X windows and everything else. To make it compatible in the control center. I believe that if the managers of the ODP, or whatever the name they've got today, are able to juggle all the requirements that they are getting, which is MPCC and Orbit design and the real-time guys and there's a few other external impacts. If they can keep a fairly good balance and keep a focus. I can't come back to focus on the IO needs to be real-time compatible, but the applications should be universal enough to meet everybody's requirements. Then that's what we need. A list of applications that goes under TOAST is long, and I don't think you want that. But IO needs to be responsive, and we need to be able to keep it under, I believe, a common interface that WEX ... configuration management that's easier to manage than having each person doing their own separate interface to WEX, which is what in my mind would be a harder system to manage. (pause) Do you have any more to that answer which you're looking for?

AM That answered most of what I was looking for. We had a discussion with the FADS people this afternoon, and they were discussing the compute nodes and how from their viewpoint, you're gonna have somebody that's just doing data entry on a terminal, and it's shipped off to any number of machines to be run. It seems like there is such a contrast in being able to have direct control of programs in the TOAST environment, like you have now, versus that kind of environment. I was wondering how you foresee the two coming together?

Greg Granted there are gonna be some differences to run it in batch mode and design where as in real-time, we very seldom would have a need to do that. I think all along that the TOAST developers or the ODP managers have said we recognize that as something we need to provide and we're gonna do that, but the user interface should be more suited to a menu and real-time environment rather than just manually typing out things similar to the flight design system of today, which is what the orbit designers are being weaned off perhaps in the future.

AM Okay. Have anything else?

LP No I think ah,

AM We get you on all possible topics

LP Right

AM You came in with a different position today. So

GO Okay

(laughing)

AM Signed on, logged on in a different position, it happens

LP That's right.

AM Thank you very much.

PEOPLE MOVING, GETTING OUT OF CHAIRS

GO When're your results of all this supposed to be due?

AM 31 of August.

LP 31 of August.

AM But we'll be getting a formal presentation to the TOAST people probably about the first of June and then a larger presentation in the middle of June.

GO Hmm, okay.

AM Almost tomorrow.

(laughter)

GO Good, more time.

AM That's right. You may find yourself quoted.

GO Ahhoo. Thank you.

LP As a certain person that we once talked to said. (laughter)

MR Wishes to remain anonymous.

AM Right, bye bye.

DOOR CLOSES

LP But I thought of this great thing and I can't remember what it is.

Transcript 12	FADS, TOAST
Interviewers	Livia Polanyi (LP)
Subjects	Mike Evans (ME)
Date	April 19, 1990

LP Good morning.

ME How are you?

LP Okay how are you?

ME Ah, how is everything going?

LP I think it's going alright. I think one that I would really like to catch up with you on FADS, and the relationship between or proposed or possible between TOAST and FADS, what's the environment for? And

ME Sort of one big question.

LP (laughs)

ME There's a couple of different interpretations on this. I wear two hats in this manner. I'm serving as the TOAST, I don't know what I am on TOAST. I'm kind of a TOAST coordinator. And that's where I wear my TOAST hat. I am serving also as the FADS project engineer. Under the FADS project manager who is a division level person in our division. So I have to look at the problem on two ways. From a FADS perspective,

LP Could we sketch it?

ME Well, sure, from the FADS perspective, it's desirable to the division to have one set of tools whenever possible because software maintenance is reduced by doing that.

LP Right.

ME It's just, they would like to make everything as common as they can within reason. However, to go to that commonality forces a rewrite of software, which is also expensive.

LP Right.

ME So you have to balance the expense of rewriting software on the front end to get to the commonality goal. Against long term maintenance, which is an expense downstream. So they're kind of trying to strike a balance here. Across multiple disciplines. Orbit design is just one discipline. We have

LP Right.

ME ascent design, and entry design, RMS and Props ops and some other area. Orbit design is unique in that we've already got so much history behind us. In the

TOAST development project. So some decisions that were made for FADS were based on this status of the software in other disciplines.

ME Orbit design just kind of has to learn to live with the decisions. So they're driving some things from a FADS perspective. What they would like to have is your operating system. And underneath your operating system, you would have your user interface. And then within each one between the user layer, then you have each one of your specific disciplines. You know this might be orbit, this might be ascent, this might be entry. This might be RMS. RMS is the arm. On the orbiter, Remote Manipulator system. And so what they are trying to do is really... There's a couple of other pieces here that I didn't adequately draw. There's a piece in, extend my box.

ME One of the big pieces is the operating system running up here. Something called the DMS. The data management system. By design, the operating system is gonna be a Posix or Posix-compatible

LP Right.

ME Operating system. The DMS is a NASA coded set of software, which stands for Data Management System.. What they're trying to do is, provide for a depository for all of this code. Not code - from a user perspective, we generate things called products.

ME Products are what we do flight design with. It's like following the steps in a cookbook. At the end of every step, there's a piece of paper generated called a product. So before you go from step one to step two, you generate a product. And then you turn it over to the next guy, who does step two. And then he generates a product, and then you go to step three.

LP So a product is your end statement, and it constitutes a paper trail of

ME Yes

LP of this process.

ME Yes. Of the process.

LP And that's whatever process that it

ME Right, or orbit, ascent, entry, whatever. And when you get into hand off problems, like I in orbit may have to do step two, and you in entry have to do step three. So we document the process by generating a product. And the product has data in it, and the data is transferred from me to you via the product.

ME This has always in the past been a very manual process. Very paper intensive, very manual. FADS wants to automate the process. Do it electronically. The way that we're going to accomplish that goal is by designing the thing called the data management system. In FADs, it will provide for electronic data transfer of products.

LP But those products are going to now be similar to what they are now, which is

ME Yes

LP essentially forms, or it's going to be actually a file with this state of the system, that says this is where I am?

ME Um, ah,

LP And is it going to be

ME It will probably

LP sort of a document or a metadocument.

ME It will probably not be a quote form. You know

LP Right.

ME With the lines and characters like that. But it will certainly contain all of the data that's currently on a piece of paper. In a file.

LP Is that kind of paper, is like who did it and

ME It's the data, it's the actual data.

LP It's things like this is the trajectory or this is the

ME Yes.

LP vector.

ME Yes, exactly.

LP Uh huh.

ME State vectors, it is what is the state at this point in time. It is the attitude of the vehicle at some point in time. It is the the shape of the trajectory on an ascent. It is the proper deorbit burn.

LP So that

ME So it

LP Oh, so it's the end of this process. You end up with a trail which basically gives you the history of something.

ME Yes, of the flight design. We do flight design. Well let me continue the electronic data transfer for products. It is also a way for us to provide configuration management on FADS. Because we use baseline data, a set of data that we all start from. So that we all start in the same place. We start, everybody knows the radius of the earth. There's one radius of the earth. I don't use one and you don't use one that's a couple meters different or something. There's one radius of the earth.

LP Right.

ME There's one set of atmospheric data that we use when we're modeling a trajectory through the atmosphere. These numbers will also be included here so that they can be managed and everybody gets the same copy of them. That's another component of the DMS. So this provides for, this is really data management. This is how we move

LP For flight design.

ME For flight design. This is how we move from a paper based system to an electronic system.

LP Okay.

ME And what this will probably be is a set of 4GL, data based management type services. Including the ability to search and sort. To extract, to provide for data manipulation. On a file basis.

LP And that's something that the user will be doing? Will be

ME Yes.

LP The user will be using these databases. Manipulating the data in them, in order to construct this

ME The data he needs to generate the next product.

LP Product.

ME That's exactly right. I always know that when I begin my part of a product

LP Right.

ME When I begin my part of the process, I'm doing step three, but you did step two.

LP Right.

ME I know to go look for the data that you generated in step two someplace. And that's what the DMS will provide for me.

LP Okay.

ME That's where the data lives. I know to get the data. And then I go on and get the pieces I need. I generate my product

LP Right.

ME It goes back into the DMS. And the next guy in the line can get the data and start on his thing.

LP Okay.

ME And most of the time, a lot of what we do in flight design is sequential.

LP Right.

ME Like I just said, you do what you do, then I do what I do, then he does what he does.

LP Right.

ME There is some parallelism. So I'm not always sequential.

LP Right.

ME But, for the flight design we've built things from what's called a flight design template. It's the cookbook. You always follow step one and then you do step two.

LP Right.

ME You always generate this before I generate that

LP Right.

ME And that's how we drive the process.

LP Right.

ME One of the things that FADS started out was that we would not change the way we did flight design. We would just move it from a piece of paper to an electronic

LP Okay.

ME form. In fact, FADS is going to change the way flight design does business. But that was a byproduct of the process. That wasn't the original intention. The next layer here in FADs. This is all FADS. Is what I'm calling the user interface. The user interface is the set of software that actually talks to the terminal. It describes the way things look and feel to the user. This is look and feel.

LP It's how things look and feel to the user about the situation that he's designing?

ME It's how data is presented to the user on a terminal.

LP Okay.

ME It's the colors, it's the fonts

LP Okay, all right, it's look and feel, the method.

ME It's the buttons that the user clicks on,

LP Yeah, right.

ME It's the way a mouse operates on the screen.

LP Yeah. Just your normal user interface.

ME It's the windows. It is just standard user interface stuff.

LP Okay.

ME And the FADs perspective is that they would like this to be COTS. And there is a feeling in FADS, that this should be a single product for all disciplines.

LP All disciplines

ME Here again.

LP involved in flight design.

ME Yes.

LP Okay.

ME Yes, yes, yes. That this should be so to reduce that long term maintenance cost. So that we don't have to train a bunch of people to do software maintenance in a bunch of different tools. The feeling in FADS was there should be one user interface product that provides this set of capabilities to all users.

LP Okay.

ME And then this is where you can get into your discipline specific stuff. This is where you are. This is where descent coders write descent programs. And entry coders, you know all that.

LP Right.

ME TOAST is this piece from a FADS mindset. TOAST is this piece right there. TOAST is a set of discipline specific applications only. FADS would provide the user interface. The data management. And the operating system of course to go with. This is how FADS views TOAST. TOAST is only from a FADS perspective, TOAST is only set of orbit design applications.

(pause)

LP Okay.

ME Now that puts Ken and Diane out of business.

LP Yes, with the

ME All you're doing is picking up the FORTRAN code that's generated. That TOAST does and dropping it into a new environment. We do not... Okay, now I'm going to change hats.

LP Okay.

ME Now I'm going to put on my hat as a TOAST coordinator,

LP Right.

ME Or whatever my title is. And, we in orbit design, we in orbit have multiple jobs to do. We do orbit design. We also do orbit dynamics. Which is the front room position. We're also supporting another project. Called MPCC, which is kind of a hybrid front room position.

LP Okay, so orbit basically involves both orbit design and real-time orbit.

ME Yes, yes exactly. This component is only handling the design.

LP This ah, yes.

ME design. Only design, FADS is only concerned with the design. Now we in the discipline though we're saying wait, it doesn't make sense for us to have two tools. Why should we have a set of tools to do design, and different set of tools to do real-time.

LP Right

ME It increases training costs. It confuses the user when he has to run back and forth between systems. It can lead to errors. Because on one system I may be used to doing this, and on another system I could try to do that and generate an error. So we believe that there should be one set of tools, that are the same. In both environments. And we believe that should be TOAST for our discipline. Our discipline is orbit. Orbit design, not rendezvous. There's another orbit aspect called rendezvous. Which we're not handling yet.

LP But I see whether I've got somehow a possible picture here.

ME Sure.

LP I probably don't. But it suggests to me something what you've said so far, suggests something like this. Okay, this is FADS. And it has a a bunch of different

ME Disciplines.

LP different disciplines associated. This is TOAST, this is orbit, let's make it bigger. Okay,

ME Okay,

LP for the moment. This is orbit. And orbit not only is involved here as a discipline in the design phase, which is something that FADS would be involved with. But orbit is also involved

ME Right.

LP It's also involved with MOC type things, it's involved in the real-time.

ME Call this project.

LP Yeah.

ME Do it by project.

LP Good.

ME You're getting the right idea. This is called FADS, this

LP Right.

ME from the design, side. This project is called MCCU.

LP Okay.

ME Mission control center upgrade.

LP Okay.

ME All of the disciplines have components in the design side

LP Right.

ME and in the real-time side. Some more than others.

LP All these disciplines, like for example ascent and entry also. There's a design sort of

ME There's a design component and a real-time component.

LP Right.

ME Everybody has to do both jobs.

LP So we get something like this - we have design, we have discipline, and then we have to move the design, and actually do something in the real-time.

ME You bet. And in the past this has been a wall. Designers, do design. Real-time

LP Okay.

ME do real-time. The only way you get stuff between the two is you throw it over the wall.

LP And that's what's throwing over the wall means. We've heard about this throwing over the wall.

ME Yes.

LP It's not been exactly clear who was throwing

ME You just, there's a wall here. I have no idea what you do, I've never seen you. I

LP Right.

ME don't know what you are. Hey, it's not my job. I just generate data and throw it over the wall.

LP Right, okay.

ME And I don't know what you do with it

LP Right.

ME I don't care really what you do with it. That's not my job. It's a very parochial view of life.

LP So,

ME That you only concentrate on this one little piece, and I say, Hey man I can this, I know how to do that.

LP Okay.

ME I don't know what you do, I don't care what you do, I'll just throw it over to you.

LP Right.

ME And you just do whatever you want to do

LP So here we have TOAST here, as far as the orbit discipline is concerned

ME Right.

LP Something like that.

ME Right.

LP And the idea is that what this is supposed to do is handle

ME Make this the same.

LP It's to handle the throw over the wall.

ME Right. Get rid of the wall.

LP Okay, and this is basically trying to automate the product expedition process. Is it something like that?

ME That's what FADS does.

LP Yes.

ME FADS is

LP Product expedition for flight design.

ME Yes, increasing the productivity. Making it the, you know why FADS came to be. Is because they did a study, and they said that NASA is gonna be flying more and more space shuttles. They're saying that our flight rate, which is what we all talk about, up until now has been six to eight flights a year. Okay, in a couple years we're gonna be flying twelve to fourteen flights a year. Twice as many flights, that means, we're gonna be doing one shuttle mission a month. We're not going to be increasing our manpower. NASA has a manpower that's fixed by Congress. And we don't see doubling our manpower in the next two years.

LP Right.

ME So our management said, we can't do the job. We cannot support that flight rate.

LP Right

ME What do we need to do to make it so that with the same number of people we can support twice as many flights. And we said we'll simplify the flight design process. The flight design process is a very, very labor intensive

ME Mystical.

ME Magical almost, it's not even a science, it's an art.

ME And so they said, well let's do something to clear up (pound pound) this mess. And so they dreamed up FADS. And FADS is the way to do exactly what you said. Expedite the product generation, and make it so that people can do more work in a faster time.

LP Right. Now

ME That's why they did FADS.

LP Now TOAST. I mean orbit has TOAST,

ME Yes.

LP Okay, it's essentially a discipline specific set of tools

ME tools right.

LP Does ascent have a set?

ME No, not for this, not for this.

LP Yes, okay, does anybody else besides orbit, or is orbit the only person

ME Rendezvous has a set of tools that pro

LP Make

ME It's ODDS,

LP Okay, just so that

ME Rendezvous has something called ODDS, orbit design something something. Anyway, this is a set of rendezvous tools, but it's heavily weighted in the design side.

LP Okay.

ME ODDS is not, whereas if I

LP Rendezvous

ME had to draw

LP heavily designed in the real-time side.

ME Real-time side. Right, if I had to say, where does this line fall in TOAST. I mean it would be out over here. Most of TOAST is real-time weighted. We're trying to push that line this way, to get more

LP Right.

ME You know it'd be in the middle ideally, but

LP And somebody

ME on the ODDS discipline, it's heavily designed oriented.

LP Okay, all right, all right.

ME And there's one more project here to complete your diagram. There's another project which is kind of out here in the middle. Called MPCC. MPCC is the multiple program control center. Multi program (pause) control center.

ME In the mission control center we support shuttle. In multi program we're going to support other than shuttle. This includes other vehicles. Things that you may or may not have heard us talking about called the OMV. The orbital maneuvering vehicle. It's a free flyer. That will be putzing around up there dishing out satellites and bringing 'em back to the shuttle. There's another vehicle called AFE, the aerial assist flight experiment. This is a vehicle that the shuttle is gonna drop off and it's

gonna come down and cut through the atmosphere, to test atmospheric breaking. And then be recovered on the shuttle again. It's a free flyer. These vehicles are not dumb payloads.

LP Right.

ME What they are is very very sophisticated vehicles in their own right. That require a separate control team.

LP Right.

ME And they can't do it here. Because this is all shuttle.

LP Right

ME So they build another control center called the Multi Program Control Center. The MPCC where the control for these vehicles will happen. And these vehicles will fly in 91, 92.

LP Is that here?

ME Ummhuh. Here at NASA Johnson Space, it's right in building 30. Right next to mission control center.

LP Okay.

ME This'll fly in 90. I don't what the schedule. All

LP Right.

ME I know is it's been slipped because of the budget cuts. 92 maybe, an aero flight is 94. Something like that.

LP Okay.

ME So there's another control center. And then eventually there's gonna be yet another control center, the SSCC. Space Station Control Center. Which comes on stream in the '90s. And this will be for station. It's another real-time.

ME It's exactly like the mission control center, but it's for station. And it will come on steam down the road a way yet. Now there's discussion. See all of these projects are kind of mixed and merged, and there's a lot of interaction going on between them. Especially in the world of software because NASA would like to not to have to reinvent the wheel every

LP Every time

ME they start a new project.

LP Sure.

ME So they are saying how much software can we move from here to here.

LP And every time they start a new interface, but the thing is that what we're seeing and the reason it's been so difficult to get straight for us is that these are interfaces at different levels. Some of these things are

ME You bet.

LP interfaces for a process, for example, let's do flight design. And then let's run the flight? That's one kind of thing that sets up this kind of a problem.. Then we have here, which is a sort of thing, we say, okay, if we're going to do flight design, then we want to basically be able to have one set of tools across flight design. Then we can also say we'd like to have one set of of tools not only across flight design but for example in a particular

ME Discipline.

LP particular discipline we'd like to have one set. Now that set of tools.

ME But you see this is entirely different way of structuring the problem.

LP It's orthogonal.

ME Right, right

LP Okay? And then we can say okay, but not only do we want to do that, not only do we have essentially something like a plane, we also have planes intersection. We have something like

ME That's what these other projects are.

LP What these other projects are.

ME And, you've nailed it. That's exactly right. The FADS perspective is they want to do the grouping this way.

LP Right.

ME The TOAST perspective is we want to group this way.

LP This way. Right and then

ME And so we're fighting. Because FADS wants to tell the orbit designers that they're gonna have a new user interface

LP Yes

ME that would take these FORTRAN applications that TOAST has developed and put them under that so that there's a common look and feel to all of FADS. But they're saying wait, hold it, TOAST wants a common look and feel across real-time and flight design.

LP Yes.

ME And so that's why there is much discussion going on right now as to what is the role of Menu Handler in FADS. Menu Handler is Ken's product

LP Right.

ME that is the user interface for TOAST.

LP Right.

ME That is built to support mostly real-time requirements. So that the discussion is well, what role does that have in FADS.

LP Yes.

ME From a FADS person, none at all.

LP Yes, because they have their own look and feel, which is COTS basically.

ME There they're gonna try and find something. The big contender, this product hasn't been picked yet. And in fact my recommendation on this is that they not pick a single product.

ME I believe that they can accomplish what they want to accomplish in FADS by choosing a set of standards. And allowing the disciplines to implement those standards and whatever package they think best suits their needs. In our case we could meet the FADS requirement for this common look and feel by customizing Menu Handler in the FADS environment

LP Right

ME and still allowing us to use Menu Handler in the real-time environment as it was designed. If we could do that, we could fix the problem. We could say we'll use Menu Handler in FADS and MCCU, but in the FADS world if we need to do something to give it a FADS look and feel we can customize it.

LP Okay, now

ME Now that's my opinion only

LP Okay,

ME That is not a blessed opinion.

LP Right. But now I need to ask you to put on your third hat.

ME Okay.

LP Which is your role vis a vis us, in the TOAST

ME In the evaluation.

LP In the evaluation.

ME Right. Okay.

LP Okay, which is what seems to be one of the kinds of things that needs to be evaluated from I think our perspective here. Is first of all, there's the question of the TOAST software itself, what's going on there. And that's certainly happening, that's going along fine. But then there's another question, and it really is a question it seems to me which has to do with whether TOAST is an appropriate object to actually be able to fulfill this kind of role in the FADS environment.

ME That's exactly what we're asking you to tell us.

LP Okay.

ME But that's a portion of what we're asking you

LP Yes, of course.

ME Because that's not, like Ken and Diane have told me, this isn't done

LP Yes.

ME That's why we did, you know, that presentation

LP Right.

ME we did for you, TOAST under X.

LP Right.

ME That what you're evaluating there is not actual

LP No.

ME You're evaluating plans.

LP Now that's fine.

ME And because we are in fact gonna try do this and it is fair, what I want you to do in the evaluation is to tell us, can TOAST handle. I mean since we're obviously proposing something that's

LP Yes.

ME opposite the way the project wants to do it

LP Yes.

ME we have to make sure first that we can do it.

LP Okay, and then I think that one of the things that we're gonna need to know more about, is we're gonna need to know more about flight design, and we're gonna need to know a little bit more about what are the constraints that this whole process essentially is putting on what has to come out of here.

ME Okay.

LP Okay because, at the moment I mean, and this has been a very interesting part of this project for me and I think for others. And I think also it's sort of in a sense part of the history. It's also symptomatic and whatever, which is that the whole relationship between TOAST and the FDOs as the user community has been essentially all that gets seen from the TOAST perspective.

ME Yes.

LP Okay, so this is

ME By its very nature.

LP By its nature, and we end up replicating that. And then there's been this very clear kind of thing which is all this other stuff around the edges

ME That's yeah

LP and now I think we really need to make that

ME That's why I

LP make that transition.

ME I so strongly wanted you to talk to the FADS community

LP Yes.

ME Yesterday.

LP Right.

ME I felt it was very important because they do kind of in the TOAST world. I try very hard to assuage their fears, but they fear that they are gonna be steamrolled.

LP Right

ME That their requirements are gonna be ignored. And that's not the case.

LP Right.

ME But you still have to remember that we are supporting missions with TOAST and so therefore it must retain responsiveness to the real-time environment. So

LP Yeah, what about this situation here. Now what kind of machines does this talk to? This is FADs.

ME This is POPR. Okay this is all because we're in the process on the FADS cycle right now where this stuff hasn't been picked. But I can give you a feel for the direction we're going. The workstations for FADS will probably be Sun Sparc type workstations.

LP Right.

ME Sun 3, Sun 4, Sun Sparc

LP Yes.

ME Sun something. Um, the operating system is Posix. By directive all NASA projects developed after some date have been told by

LP Right.

ME on high that they shall be Posix compatible.

LP Right.

ME Which is kind of a joke in itself. Because Posix doesn't even exist yet.

LP Right and everything's in FORTRAN anyhow. (laugh) As far as I can see.

ME The DMS will probably end up being like I said, it's a set of custom coded, NASA coded products tools, essentially, that will look a lot like a DBMS. It may in fact have a DBMS in it. But that's not decided yet. The user interface, there's kind of a feel in the FADS community towards something called TAE, Transportable Application Environment. I saw, I think it's a set tools that have been developed by Goddard Space Flight Center. Because it was developed by another NASA center, it's free to us.

LP Right, Transportable Applications

ME Environment. I think something like that.

LP Do we know anything about that much?

ME We can certainly find some information for you on it.

LP Okay, cause I think that

ME Sure we can.

LP Yeah

ME Ken knows a lot about TAE.

LP Okay, so we should talk to Ken

ME You can talk to Ken about TAE, certainly.

LP Okay.

ME You'll get his flavor on TAE. I can give you a FADS person to talk to you about TAE also.

LP And they're gonna have another

ME They're gonna have... Ken's gonna come out kind of anti-TAE

LP Right.

ME I can give you a FADS person, who will come out "TAE is the greatest thing since sliced bread".

LP Yes, Okay, right

ME I can give you that perspective too.

LP Yes, okay that's good too. Now is there one set of mainframes or

ME The way FADS is current, okay here again

LP Right.

ME there's an architecture debate going in the FADS

LP Yes.

ME world right now. The way FADS is currently discussed being implemented is you have a LAN, with your workstations on it. This is a FADS architecture. (pause) workstations, note the workstations are all diskless. NASA did not want to get into the problem on FADS of having to maintain two hundred. There's going to be about 250 workstations.

LP Right

ME 250

LP Copies of anything

ME disks. Yes.

LP Yes.

ME So, all the workstations then on a LAN are attached to a file server. (pause) The file servers are in turn linked on a backbone. We're gonna have multiple copies of this. LAN on a file server connected to a backbone.

LP Okay.

ME On the backbone then is something called a data node. And the Univac is up here. We have a Univac

LP I was wondering when the Univac was gonna

ME Univac is up there. And then we're also gonna have 4

LP Well this is the compute node?

ME Four things called compute nodes.

LP Oh, okay

ME down here. These are the compute nodes.

LP And what kind of machines are they?

ME Well, they are probably going to be okay. The Univac is not really considered a compute node - he's a special beast. Because he's his own operating system, he is his own set of tools.

LP Right that's what I've been trying to figure out

ME he's just

LP the relationship

ME he's just

LP of this

ME He's just here for connectivity purposes because there's some stuff here on FADS on the Univac that they can't afford to rewrite to this environment.

LP Yes. So yesterday in the discussion with the FADS people, what they're seeing as their machine environment really apparently is the Univac.

ME Well

LP Maybe

ME That's interesting because they're not Univac people. Orbit design right now lives on a different system entirely called Perkin Elmers.

LP Right and

ME Which is an entirely disconnected system right now. It's a dedicated system. You have a dedicated

LP Right.

ME mainframe on a dedicated terminal and

LP Right.

ME that's the Perkin Elmers. This is going away. That is being moved out

LP is that what these people

ME into the FADS environment.

LP Okay, these people

ME Wayne and Phil are both very strong background in the Perkin Elmers.

LP They're Perkin Elmer types.

ME That's were they're coming from.

LP Right.

ME The Perkin Elmer software is what orbit design uses now. Right now today. We use the Perkin Elmers to generate our products. That software will come here, not to the Univac.

LP Okay.

ME Their concerns probably are as I was saying earlier because orbit design is just one discipline in this whole FADS project.

LP Right

ME These guys live on the Univac.

ME These guys live on the Univac.

LP Okay.

ME These guys live on the Univac.

ME And this poor little discipline over here lives on the Perkin Elmer

LP Perkin Elmer, okay.

ME They're kind of the step children.

ME The entire flavor of the project is towards where the center of gravity of the user community

LP Right.

ME well, lives, which is strongly Univac

LP Univac.

ME That's, this is old.

LP Right.

ME So the Perkin Elmer requirements, the people who are supporting the Perkin Elmer requirements in FADs are feeling kind of stomped upon. Because so much of the FADS requirements reflect this Univac

LP Univac environment

ME mind set.

LP Okay.

ME In my opinion, I don't know which hat I'm wearing, I guess I'll put on my project engineer hat for FADS. I believe they ought to get rid of the Univac. I think they ought to rehost everything off of the Univac onto the FADS environment and get rid of that machine completely. They may in fact do that. There's a cost issue with recoding some of that software. Which is why they said keep it in the first place.

LP Okay, so Univac is the data node.

ME A data node which is

LP Could be

ME I don't really understand why FADS is doing this. I don't really understand what they're doing here. There's discussion of having something like a back-end processor. DBMS engine. I don't know, are you familiar with any of that?

LP No.

ME They're special machines out there that do nothing, but they're called back-end processors. And it's a DBMS machine. It's a big

LP Right a big number ...

ME It's a big file server. No, it's not a number cruncher.

LP Oh, it's a file server.

ME It's a super file server. Sort of. It's like a DBMS engine, and what they do is a lot of data manipulation with this guy. It 's a silly machine.

LP Right.

ME I don't understand why they're talking about using it. But when FADS was developed. They talked about the triad. The triad in FADS has always been considered compute node, data node, workstation.

LP Right

ME And that triad is what formed the core of the FADS architecture. Currently I don't believe in the compute node or the data node. I think you can do everything on workstations, but we're fighting that battle in the FADS project. The compute node

LP Because FADS being a design environment, you don't have the kind of problem of control over the data that you do in the

ME No, it's not near

LP the real-time environment

ME nearly as as strongly configure managed. There's not as much configuration management on the data.

LP Right.

ME In FADS as there is in the real-time

LP Real-time environment

ME Because this could be catastrophic if you make a boo-boo

LP Right.

ME if you make a boo-boo in design, well, okay,

LP The system goes down and you

ME and you redo it. But if you do it over here, you could crash a shuttle

LP Right.

ME Then FADS also has these things over here called compute nodes, which are like an Alliant or Pyramid. Um, number crunchers. These are number crunchers.

LP These are the number crunchers.

ME Yes.

LP Okay, fine.

ME If you don't believe that the workstations can handle number crunching, you put your applications over here and you do pre and post processing on the workstation. I don't believe that. I believe the workstations are in fact capable of handling the number crunching. I think this is a wasted

LP Right

ME I think this is a wasted expense. I think we could do all of FADS on workstations connected to file servers.

LP Right.

ME We may in fact move in that direction. That's not currently the plans in FADS. This is the current FADS plan.

LP Okay. So that when people are actually thinking about FADS, and they're really thinking about what kinds of design decisions they're making and what kinds of capabilities they want, they basically are gonna want to be able to support this kind of thing.

ME Yes.

LP They're gonna be thinking in terms of continuing to be able to talk to these Univacs.

ME If they need to,

LP For this

ME For these disciplines. The orbit design community doesn't need to talk to Univac.

LP Right. And they're going to be thinking about needing to talk to the Alliant, the Pyramid, and they're going to be thinking about what kinds of ways the software ought to be in order to be able to make those kinds of

ME There's a network management problem here

LP Right.

ME because the the issue of your number crunchers may be running some applications and your workstations may be doing manipulation and so you've got this flow, here across this network,

LP And this is FADS

ME This is FADS.

LP Now if we sort of put this guy over here and make it a discipline of orbit

ME Okay,

LP Okay, and then his is going to be the design side of orbit. This is going to have to be interfacing with this whole environment.

ME Right.

LP Now over here, okay, we would have the whole real-time, MMCU

ME MPCC. MCCU/MPCC.

LP Okay.

ME They're both considered real-time

LP Okay, kind of environment and whatever all their kinds of things.

ME You want me to draw that?

LP And that seems to be the thing with the large IBM. Right.

ME Well, okay, here's sort of how, and this one is easy by comparison. The MCCU environment is much worse. The MCCU environment you've got something up here called the MOC.

LP Right.

ME Mission Operations Computer. Which is a big IBM mainframe

LP Right.

ME And I'm gonna draw it the way it will be not necessarily

LP Okay.

ME the way it is today.

LP Cause I think that's what we need to

ME You've got

LP thinking and sort of seeing whether FADS is, whether TOAST is going to be able to be

ME You've got another thing called the flight support host. Which is another IBM mainframe.

LP Okay. So this is IBM environment.

ME Yes. Very strong. In the old days the MOC, the way it is now you just literally have banks of consoles

LP Right.

ME in the mission control center.

LP These are the little green guys.

ME Yeah, these are the green consoles.

LP Right. And this is

ME And the MOC drives the green consoles. It's that simple

LP Right.

ME These are stupid. That's where all the intelligence lies.

LP So this is now.

ME Now, that's now.

LP Okay.

ME In the new environment. Under WEX 2.5. WEX

LP Right.

ME WEX, we'll talk about (pause) when we talk about MCC, Mission control center. This is MCCU, mission control center upgrade. This is when WEX shows up.

LP Okay.

ME WEX shows up here. What you have is you have WEX, running on the flight support host, and he has all of the data. This is were all of the data lives and you have to do a data download.

LP Right.

ME The way you do a data download is there's this LAN out there called the real-time LAN. LP

ME Okay, and on the real-time LAN, there's two LANs really. There's something called a general purpose LAN, GP LAN. And there's something called the real-time LAN. In between all of this, you've got Masscomp 6600. These are the workstations. In the mission control center upgrade project. We have three Masscomps 6600. This is orbit only, okay.

LP Right, let's say

ME I mean, this is TOAST. This is TOAST, this is for the FDO's world.

LP This is the FDO, this is right FDO

ME FDO.

LP This is the FDO world, and it doesn't include any of the other real-time people. Doesn't include

ME PROP,

LP Yes.

ME Or INCO or all those guys. All those guys have this same architecture, but I'm only gonna talk to you right now about the

LP Okay.

ME FDO world.

LP Okay.

ME We are connected, our Masscomps are connected on something called a back-end LAN. It's just a piece of wire that connects our three workstations as completely independent from everything else.

LP Right.

ME This is how we do multi-session multi-tasking

LP Right.

ME the multi stuff within TOAST.

LP Right.

ME Back-end LAN provides us with the capabilities to do all the multi stuff. That's what Diane built it to do.

LP Right.

ME Across the real-time LAN here's the MOC. Then on these Masscomps are workstations. Typically four workstations per Masscomp. Okay. Two of these workstations live in the mission control center. The rest of them live in the back rooms.

LP Right.

ME Okay. And the reason we went to this is because the Masscomps will only support 4 workstations each.

LP Right.

ME It's a design problem with the Masscomps. And we said we need 12 workstations. And they said, okay therefore you get three Masscomps.

LP Three, right.

ME We would probably would rather had one Masscomp

LP Right.

ME because of this multi problem. Now we get into multitasking problem. Because we have to now have three machines that have to coordinate.

LP Right.

ME It would have been easier to have one

LP One

ME Sun 4 talking to a whole

LP Right

ME bunch of Sun 3s.

LP Right, yes.

ME It would have been easier to do that.

LP Right.

ME But that's not the way

LP Okay.

ME they came up with

LP Now what else is on the GP LAN.

ME GP LAN. Okay, the real-time LAN is really... There's 2 types of data that flow back and forth here across the two LANs. And the man who really needs to talk to you about this is Bruce Williamson. Bruce is very

LP Oh, Bruce.

ME very good at this stuff.

LP Okay.

ME When do you talk to Bruce.

LP I think we already have.

ME No; you're talking to Bruce this afternoon.

LP Okay.

ME So let me defer that discussion to when you talk to Bruce. There are very specific types of data that flow across the real-time LAN. And across the general purpose LAN.

LP We talked to him about the real-time LAN

ME And GP LAN.

LP Okay, okay.

ME And he can talk specifically about that. Essentially this is stuff now. I'm not even going to get into it.

LP Okay, fine.

ME That's a whole discussion.

LP Fine, okay.

ME in itself.

LP I'm gonna show him this picture, and say help me with

ME What happens on this LAN and what happens on that LAN.

LP Right.

ME So this is the real-time environment. You can see that these environments are completely different.

LP Yes.

ME Completely different,

LP Yes, right.

ME The only similarity that you can draw between the environment is that these guys are migrating from the Masscomps. 6600 is not a good machine. They will probably migrate these machines to Suns. So you're gonna have Suns here, and someday you'll have Suns here. The software, runs on these workstations, it will run on these workstations. That's your similarity. This the flight support hosts and the MOC is nowhere in FADS. There's nothing called

LP Right.

ME compute nodes in the MCCU

LP Right.

ME it's different. But the similarity is at the workstation level.

LP Right.

ME Which is why I strongly believe TOAST running at the workstation level can live in both environments.

LP Okay, so what our one of our ideas here that we need to be involved in is that we need to be involved first of all in really thinking does the TOAST architecture, the TOAST implementation, the whole TOAST system as it as it's been designed now and as it's been implemented, which is basically really been involved with all the real-time constraints. The real-time world, the whole FDO world, is that in fact an appropriate tool for the

ME For this environment.

LP for the design people who in fact have to live in this environment.

ME Right. That's it.

LP Okay.

ME And that's the question.

LP Okay, we're going to be needing to do talking a little bit more with some of them.

Transcript 13 Orbit Navigation
Interviewers Livia Polanyi (LP)
Subjects Malise Haynes (MH),Tony Pocklington (TP), Mike Evans (ME)
Date April 19, 1990

ME Okay, Malise can talk to you a little bit about the RTGP because her project is going to be hopefully getting data off of this GP LAN. Okay.

LP Okay.

ME I drew some pictures for her to explain a little bit about the MCCU environment and a little bit about the FADS environment. She's really interested in what it is, what ONAV is, and how it's going to work with TOAST or talk to TOAST, or you can talk to her specifically about some of the problems you've had with getting GP data.

MH Okay.

LP Okay, good.

ME Why don't you guys sit down, and we'll make sure you're positioned, and then I'll leave.

LP All right.

ME Okay. Thank you, bye.

LP Okay, good. First of all, I'm Livia Polanyi.

MH Malise Haynes.

LP Nice to meet you. You've probably heard a little bit about what we're doing here. We're basically trying to evaluate some of the suitability of TOAST for doing whatever it is that it really needs to be doing here. So one of the purposes, as I understand it, is that ONAV may be making use of TOAST.

MH We eventually want to go into that.

LP What does ONAV do?

MH Okay, ONAV is an onboard navigator. Our responsibility is that we monitor to help the onboard state vector. We also monitor the navigation sensors that feed into the state vector to update it. We then advise the guidance and procedures officer who is in the front room; ONAV is a back room position. We advise him as to the status of those, and we make certain calls like if a censor is good we tell them to allow the state vector to be updated using TACAN. So that is our function. We work in three phases.... ascent, entry and rendezvous.

LP Okay, and you're all real-time.

MH We're all real-time, yes. We are interested in going under TOAST for several reasons. In the MCCU environment, you have to work under WEX. We foresee,

hopefully in a couple years, when ONAV is mature enough, when the expert system is mature enough and we're using it.

LP ONAV is an expert system?

MH ONAV is in a flight control position right now. We have two people working it. We're developing an ONAV expert system to hopefully one day become console assistant and then eventually we'll replace the old NAV2 position. We want to go under TOAST. It's just that they really have a lot of expertise in WEX. And they will always be a group that's out there.

MH If there are any new developments or new applications in WEX, we wouldn't have to worry about understanding WEX because we'd be under TOAST and then TOAST would be responsible for fitting under WEX. So eventually we do want to go onto TOAST. About twelve months ago, we had some discussions with TOAST about going underneath them, and they just said that they were not ready yet to provide a real-time cyclic data acquisition for us. So, we said fine. We'll go off and do that, and when you're ready, come back and talk.

LP So, what data handling needs do you have? What computational needs to do you have? Are they similar to one which we've found Orbit has or are they very different? In your view?

TP The computations we do are a whole lot of computations. The harder the system, the expert system with its rule base, and that's where most of the processing that goes on is done.

LP Okay, and what's the expert system?

TP CLIPS.

MH CLIPS.

LP What's CLIPS say?

MH It's a NASA developed AI language...C language integrated.

LP Is it basically a C type language?

MH Yes.

LP Okay. What is the expert system run on?

MH Masscomp.

LP So, it runs on a Masscomp.

MH Yes.

LP Okay.

MH It barely runs on a Masscomp. (laugh)

LP It runs under Masscomp in the present kind of environment?

MH Right.

LP What kinds of tools do you use, or do you need to have available to you, that are on the Masscomp now and that are in your development effort or in user effort? What I'm really asking is are you on the Masscomp

MH Right.

LP and that you have an expert system on the Masscomp? That seems to be a rather different kind of object than the ...

MH Right.

LP other objects that are on

MH Right.

LP the Masscomp. (laugh) Okay, and so I'm just trying to figure out what your environment is on the Masscomp with this expert system. What kinds of things, to what kinds of computational tools or applications or whatever, do you need?

MH Well probably the biggest thing we need is what's called GDR, which is generalized data retrieval. That's how we get our telemetry and trajectory data across to our system. That had been a big stumbling block until WEX 2.3 came out. GDR was not available until WEX 2.3. Until that time, we could not run the system real-time. We could not use it on console. So the biggest stumbling block for us was to get that. Even now, we have used the expert and run the expert and pre-flight not using GDR. Two or three flights are now using GDR. There is still some hesitation over it at STSOC, where the GDR is safe, as to whether it is an application that can be used or not. Our problem is that if they turn it off, we will not be able to run. There's just no other way for us to get data.

LP Yes, and how useful do you think TOAST will be in your expert system development, or are you thinking about it just merely in terms of what happens when the user actually needs to be involved with it or whether the user is going to? I'm asking whether TOAST is going to be in any way involved for you as a development environment for

MH No. TOAST will not. We don't ... at all. In fact we're a little bit farther ahead in our data acquisition than they were. This was our stumbling block as to why we haven't gone under them yet. The only reason we really foresee for going under TOAST is that we foresee them as being a group with three sources and being out there many years down the road with an understanding of WEX. Plus, we feel that the rest of the division is heading under TOAST. So, to stay in common with the rest of the division, the expert system probably

LP Right

MH should slide up under there. We foresee that we login under TOAST, click over to the expert system, and that would be our only real interface with TOAST. But no, they are not helping us with the development or anything.

LP Right. Would you then be writing any particular TOAST applications? I mean your whole expert system would be in some sense a TOAST application. Right?

MH Right.

LP But you wouldn't be writing that application using any kind of TOAST environment. Your whole development effort

MH Right

LP is not going to be involved with

MH Right

LP TOAST as a development environment or in any sense. So you would then write a TOAST frontend to your expert system. Have you looked into that or whether there are things that you ...

MH No, we haven't because they just told us that they weren't ready for us to come on yet.

LP Have you been thinking about what would be involved in doing that?

MH No, nothing except on a high level.

LP Okay, could you sketch out perhaps on a high level how you see that working. What are you going to use there? Or is it merely that you act and it's the important thing. So the fact that I'm using merely isn't the point. Is it really the case that you're seeing not so much the TOAST environment, but almost the TOAST support system, as being something that is going to be important for you. So, basically you don't necessarily have to go and do all the WEX interface

MH Right.

LP yourself.

MH Right. We just feel it would be much easier to interface with TOAST down the road than it will be having to worry about the changes in WEX. So, that's really what we're looking forward to.

LP So, have you had any experience yourself with TOAST?

MH I haven't, at all.

LP Okay. I'd like to see if we can do a little thinking here because we're trying to evaluate the suitability of TOAST for your needs as well as anyone else's.

MH Right.

LP Okay, perhaps you should see whether it's the best decision for you to slip under there. Okay. It would help me if we could brainstorm a little bit to figure out what you think you'd need from it. I mean, have you actually seen TOAST?

MH Yes, I've seen it.

LP Right. Have you seen how the applications work?

MH Right

LP That doesn't feel like an expert system application to me.

MH No.

LP Okay, (laughs) and so I'm wondering what you know. Do you see the whole menu system as being something that you're going to be working with? Is that the way that your interface is going to be working? Or is it more a case of what you'd really like to do is to pull down a menu, click on that menu, and then be in some other world all together.

MH Right.

LP Okay, and then you'd like to know what kinds of capabilities and constraints TOAST is going to place on you, if any.

MH Right.

LP You really have gotten much feeling whether there are those things.

MH When I originally first talked to Diane and Ken, they hinted to me that there would not be any constraints when we were set and when TOAST was ready to obtain real-time cyclic data. They said there wouldn't be any problem. They foresee it just like you did. You just pull down a window and we'd be off in our own little world.

LP

MH Essentially so. They hinted to me that they didn't think it would be a problem. We've dealt with WEX, and Tony is basically our real-time programmer on the system. He's really dealt with WEX and with the problems that we've seen in WEX. I can't imagine that TOAST would be anymore difficult to deal with than WEX. (laugh)

LP Okay, so what you have is that you're under WEX now directly?

MH Right.

LP Okay, so now you logon to WEX.

MH Yes.

LP You essentially obtain your expert system and you go from there?

MH Yes.

LP And you're having a lot of problems. There have been a number of problems making that interface? You want to sketch some of those problems? Maybe that would be helpful to us.

TP The problems were initially just learning WEX. He runs fairly smoothly now. We're still not finished with the interface, the data portion. There are several programs that we run in the end that will run feeding the cyclic data to the expert system. I assume that's the part that would be merged in with TOAST.

MH Right.

TP They currently don't have a need for cyclic data. They are mostly

MH one shot.

TP Yeah, they'll pull a vector out of the MOC and use that for whatever they do with vectors. Where we are in more of a monitoring mode getting this cyclic data, (pause) so most of the problems we've had have been just getting that data in a reliable fashion.

LP Has that been helped by the GDR?

TP GDR is part of WEX.

LP Right.

TP GDR was easier to deal with than WEX was. There's a lot to learn. There were a few things that the WEX documentation wasn't as clear as I would have liked, or maybe I just didn't read enough of it. Once we started getting data back, it was fairly easy to tie it into the expert system.

LP What is it that you've found WEX cumbersome in having to deal with, but once you could overcome the problems in it, you were able to do what you needed to do? What you feel now perhaps is that under TOAST, you'll have some people to run a bit of interference for you.

MH Right.

LP But since you actually can run under WEX, and do everything that you need, you feel that if TOAST can manage with WEX, then you can manage with TOAST because you're already getting the information you need out of WEX. Is that more or less the the case?

MH Yes, we're just looking 4 or 5 years down the road,

LP Right.

MH when Tony's gone and we won't have the people, but TOAST will probably always have a group out there, that

LP Right.

MH knows WEX. If we're under TOAST, we don't have to deal with WEX. TOAST is there to handle that for us.

LP I think the key point is if you can in fact manage under WEX as far as getting your data. There's no particular reason to assume that you're not going to be able to get your data under TOAST

MH Right.

LP since TOAST is under WEX. Okay, good. Thank you. I think that's probably

MH Okay.

LP what we need to hear. It sounds as if there shouldn't be any particular problem for this kind of extension. But, I just wanted to start talking to the people who are involved with projects where TOAST might be part of their environment. To see whether in fact that's the case or whether there are other kinds of problems or other kinds of things that we should be thinking about as far as suitability. But this doesn't seem to present us with a lot of problems, as you know of course.

MH Yes.

LP That's what we needed to know from you. Okay, thanks a lot.

MH Okay, thank you.

Transcript 14 Orbit Design Panel
Interviewers Livia Polanyi (LP)
Subjects Bruce Williamson (BW), Kevin Williams (KW)
Date April 19, 1990

LP I think one of the things that we're going to talk a little bit more about is the ODP.

BW Okay.

LP The other thing, which I was hoping you might be able to help me with, was that I always seem to put you in the middle of other people's pictures. This a picture that Mike Evans was drawing for me. I was trying to get some idea of what was going on with FADS and what was going on here. So he basically said that the MOC and the FSH

BW Flight support host. This is called the real-time host. The MOC is called the real-time host or RTH. The other machine is called the flight support host.

LP Okay, and they both are on the RT.

BW No.

LP On the RT LAN? They are not? Okay, Okay.

BW The flight support host does not connect to the RT LAN.

LP Okay.

BW The MOC does, and they both connect to the GP LAN.

LP So this talks to the GP LAN too. This one doesn't talk to the RT LAN? The RT LAN basically gets us into our little Masscomp environment here.

BW The RT LAN only had a couple of places that data can get on it. Everybody else just listens. Right now, both of those places are in the MOC. The two things that get on to this LAN, telemetry and MOC events, are both broadcast. Right now, they come out of the MOC. Eventually, the telemetry will come out of a separate box called a data network data driver.

LP Okay.

BW That's a future

LP Okay. Everybody listens which means that

BW And that will

LP all these Masscomps here are listening and

BW Right.

LP whoever else is on

BW Right.

LP Yes, okay.

BW Now this GP LAN is a two-way communications street. Any node on that LAN can talk or listen on that LAN. The workstations can send commands to the MOC and receive responses from the MOC. They can send data requests to the MOC and receive data responses from the MOC. The ordinary sequence of events, when they first sign onto their workstation, is that the sign on request is verified in the flight support host, which has an IBM data base manager product (the data base) by passing the Unix login structure. So I don't have to have an account on this Masscomp to log onto it. I don't have to be a Unix user, identified in the password, as long as I'm in this IBM database. WEX will

LP Let you on.

BW update the Unix password file and let me on.

LP Okay.

BW Then once I have done that, WEX talks to this same configuration management application here and asks what software is he supposed to have when he runs. If it's resident here, the version for the flight I've signed on for, and current, then that's fine. If not, it downloads the files I need from here, so it will have a complete, current, certified software load in my workstation

LP So all of this

BW based on what I've am supposed to have.

LP So all of my initial work so far has been on the FSH. All my login and the ... and getting my files on the right machine.

BW That application is not the only application running in the flight support host. But that application is referred to as ... There are other things that run in that machine.

LP Oh, and that is referred to as configuration management.

BW That's right.

LP Okay.

BW My concept of what true configuration management is a small piece of what a configuration management system is. But that is what everybody refers to as configuration management.

LP Yes, that part which essentially

BW dictates what certified software can run during the work...

LP Right.

BW Now, there are nonoperational modes, when the GP LAN has some controls on it, that say it is either in the operational or in the test mode. If it's in the operational mode, the scenario I just described applies. If it's in the test mode, that means that the people on the workstations are allowed to run noncertified software in order to test it, and they would do that, and the workstations itself can be in an operational or development mode.

We have been assuming that the workstation was in the operational mode, and that the LAN was in the operational mode. Together, they come up with the operational mode.

If the LAN is in the test mode, and the workstation selects the operational mode, we get what is called a certification mode, which is a combination of those. I can still get at the CM and download things from it, but I can also override any of those files with the development file resident in my workstation. So I can test that piece of software, and it will, other than it's operating in the same environment that I would if I were doing operational.

All the checks for WEX, in order to do LAN communications service, work the same way as in the operational mode. That's how I test my software in its final operational environment without having it certified.

LP Good.

BW The final opportunity is if the workstations could choose not to be on the LAN at all and go into the development mode. When the workstation chooses the development mode, it is prevented from access in the GP LAN.

LP What else is on the GP LAN?

BW Except for one exception,

LP Oh, yes.

BW and that is that I can still talk to the flight support host and download files from there. Other times, when you have permission to talk in the GP LAN, either in certification mode or operational mode, you can talk to the MOC, which is the main control computer for the flights. You can talk across this GP LAN to other workstations.

LP But you can't.

BW There is a way by the use of a second lock, which is called a dynamic standby computer. Dynamic standby computer runs the same applications and ordinarily receives all the same inputs as the MOC, so that's kept at a synchronization with the MOC.

BW If this machine ever has any kind of a failure, they can immediately switch over and make that the active MOC... It's available. They do that during critical flight periods, such as a launch, so they can continue flying without any interruption if they have a problem with the mainframe or its applications. If it's a generic application fault, the fault will exist in both machines. Generally speaking if you

have power problems, hardware problems, or the MOC computer, then the dynamic standby computer is there and available.

LP What else is on the GP LAN?

BW The MOC and the workstations.

LP Between the MOC and certain...

BW All the workstations.

LP But this is just...

BW Well?

LP This is the back-end LAN right? Over here.

BW The one in the middle there.

LP Back-end LAN.

BW The trajectory back-end LAN.

LP Right. What else is it besides the back-end LAN?

BW On the workstations?

LP No, on the...

BW On the GP LAN?

LP On the GP LAN.

BW These network data drivers will eventually be on it. There is a another facility which is called the multipurpose multiprogram control center. It has workstations that look just like these, and they're connected to both of these LANS. They have the same RT LAN, and they have the same GP LAN. But they also have their own unique MPCC version of the RT LAN. The workstations that are hooked up in that configuration can also access payload telemetry (pause) through that MPCC RT LAN. That facility is in a different room with the different workstations dedicated to servicing the needs of a particular payload.

LP This is a payload?

BW Multiprogram refers to other payload programs.

LP Other payload programs?

BW Right now, the payload program that we are supporting from there is the tethored satellite system which is the orbital maneuvering vehicle, the aero assisted flight experiment. TSS, the tethored satellite system, flies next year, and the other two are downstream 1993 or there about.

LP I think, yes, maybe I ...

BW Our trajectory workstations, we're highly involved.

LP This one is the multi-program center?

BW Right.

LP Okay, and these are all real-time people.

BW They have both real-time and design going capabilities in the MPCC. Baseline is that you can do some design activities as well as real-time. We're an integral player in that and for TSS, in particular, we will not use that facility. But we will be hooked up as though we were in that facility with our regular workstations and our trajectory ... We'll be playing that game out of our workstations in the trajectory .... which brings up interesting little side lights. The power supplies in these Masscomps will not support the number of terminals and LAN cards that we have baselined to put in there, starting the first of May.

LP Right. (laughter) Just to take a small...

BW That's just the normal problems of life that have to be solved in order to get from here to there.

LP But what you're going to actually end up doing, as far as I can see from the little conversations that we've had, is that while having the Masscomps, you're going to strip off all the terminals. Then, once you're done, you're actually going to be able to do the kinds of things that you need to connect up with the various lans.

BW Don't leave a keyboard or CRT.

LP That's right. (laughing) As long as nobody needs...

BW As long as we can talk to the machine, clairvoyance or something...

LP Yes, or not talk to the machine, just have it talk to other machines, as it will. Yes, because this seems to be a real problem. This is another version, right, that you can only have four terminals, and then you can't have...

BW Right.

LP the you know.

BW With anything more than two, you can't have the LAN cards, and we're not the only one with more than two terminals. We are probably the only ones with 4 terminals right now, but we have three machines in each of our two ... Two of those machines have 3 terminals, the fourth one has 4 terminals, and we're probably going to be adding to that complement. It's going to be a lot easier to buy a $10,000 or $15,000 terminal than a $300,000 Masscomp.

BW It is not clear to me why we're putting ourselves in that kind of architecture. I personally believe that an architecture where every new terminal is its own CRT, own keyboard, and its own CPU is a better expansion architecture. One of the

reasons that they went to this kind of an architecture originally was baselined with two terminals. They might have two things that one guy needed, so they put in one of the workstations. But I think that they need to step up to solving the workstation and the workstation communication problem completely. Then every CRT can talk to every other CRT, but each one has its own dedicated CPU at least.

LP That seems to be almost a philosophical move coming out of the MOC with the individual green screens. This kind of idea will need two screens. (laughs)

BW It could be more than two workstations with two each.

LP Right.

BW But that makes the screens very expensive. That makes them cost $150,000 a piece.

LP Suggests you want windows.

BW Well that is not necessarily a good solution. It may have some virtue. But a lot of times, for flight control purposes, you need to have the two displays up side-by-side and comparing some information from here and some information there, or combining information in your head from here and there. You know this tells me I can do this, and that tells me I cannot do what I wanted to do. So I have to make another decision.

LP So why couldn't you do that if you had two windows on the same display.

BW The windows are going to be occluding some part of each other because the display is too big. I can't squeeze them down to where they each take up one-sixth of the screen.

LP What happens, in the...

BW You must have a full display, which may require two-thirds of the screen, to put it up there. Now, if I have two displays that I need to see all of both of them at the same time, and they each require two-thirds of the screen real-estate, how do I see them both in 100% if you have windows?

(pause)

BW One of them has got to be overlaid by part of the other one.

LP So that's the question, and how they...

BW Windows. If I'm going to have windows, so that I can see the data, I've got one on top of the other or occluding part of it. Why did I bother? Why not say look at this one, then drop it, and call up the other one. Look at that one for a while. What's the advantage of windows?

LP I don't think that you... Well I'm not the person even to... I'm not even going start having any conversation on this. But I don't believe that they have to occlude each other.

BW They do under the constraint where I know the size of the information I need.

LP Is that large?

BW It's bigger than half the screen. And, if you get them down to half the screen now, what if I need 4 displays to see the data? I can't get 4 windows, each equal to 50% of my screen space, on one CRT. I could on two. But then that's the best I can do.

LP Sound's like you need larger screens.

(pause)

BW I need more screen real-estate, now that's the solution to that problem.

LP Okay that...

BW Our solution was to get more CRTs. And we'll make them all have equal access to the data. So that...

LP The screen real-estate problem... Okay. Could we change hats for the...

BW Sure.

LP I guess we've got a few minutes. Talk a little bit more about the ODP. One of the questions, which I have about it, has to do with ... Well there were couple of questions that I was wondering about. One of them was whether the ODP is involved in evaluating, certifying, or passing in any way on training material, and whether that's anything that any organization is going to be thinking about.

BW The ODP is reasonable for the user's guide for the software.

LP Right.

BW The developers produce it, but the ODP is the body that accepts that document, that says now it's available. So that has something to do with training.

LP Right.

BW The ODP has historically been the forum in which training, for other software developers, has been arranged.

BW So that other people who want to build TOAST applications

LP Right.

BW would identify their need for training to the ODP, and the ODP would schedule that into the work plan of the developers, so the developers, who know how to, can then train other developers in how to develop TOAST applications, TOAST utilities, and things like that.

LP But that sounds like that...

BW That's not end-user training.

LP No, actually I was interested in developer training.

BW Okay. If you're interested in developer training, yes, the ODP has that responsibility.

LP But it seems to be taking it as a scheduling responsibility. I'm wondering, do they also? Is there anyone who is overseeing and saying "Okay, we're going to need training in this area." I'm looking towards the situation when there is going to be a large expansion of the development programmers. And if some...

BW Right now, basically what we're doing, in terms of defining what training is needed, is saying that we have people who are developers. We ask them to define for us what you need to know to do this, and what would you have needed to know to be trained in it, to start it. And you write that training up and deliver it to other people. So we're using the learning process that has existed to give other people that same training.

LP But the ODP bit...

BW As the chairman of the ODP, I don't feel technically qualified to say that you do or don't have the right stuff in that training class.

LP Yes, it's more...

BW I say to these people, "We've got a whole bunch of people coming into this system, and they're going to need training. Let's schedule a class." Let's talk about what that does to our development schedules, and what products have to slip in order to give this class. And things like that.

LP Because one of the things, which came up with some FADS people, was a real desire for something like online help. And online help is a very similar kind of problem to the documentation problem. And it's almost very close to a training problem, and yet that would be something that if you had online help, it would learn on the machine. So...

BW The developers online help?

LP Yes, the developers online help. Yes.

BW I would have to go back and check with current developers, but when I was team lead of TOAST development team, the developer had come up with a method of incorporating source comment cards into their programs that mimicked the Unix manual pages for their library routines. They actually built a utility to extract those comments and a Unix manual page, so they could have online help, in the standard Unix developer form, for the library routines that they were building. There are other concepts that I would recognize a developer needing some of the documentation for, other than just the library routines themselves, and we had no mechanism for putting those online.

BW But at least at the library routine level, we did.

LP And what about for the end users?

BW The end users. The only online help that they have is what they have identified, in their requirements, should be there. That comes through things like I want from meaningful error messages to with the... But meaningful messages do occur when certain situations happen. But if I asked the program to do something, and the data file needs to do something that's not there, or what, or those kinds of situations.

LP That's ODP...certify error messages.

BW The ODP accepts the requirements, which define the messages that users say are the messages I need to see. Then the designer will come back with the design, and he says, "Here's a complete set of everything that we put in, and it should contain that as a subset."

LP Right.

BW But he will have found other things in his design that he will have added to it.

LP Does anybody test that, or look and see whether those, in fact, are useful?

BW Yes.

LP And that gets reported back to your department?

BW That is part of the the testing. We have a separate certification process for real-time use. The certifying authority is not the ODP. It's the trajectory operations software configuration board.

LP Right.

BW And they're

LP We talk to them.

BW the ones that actually do the final certification, but any problems that are found would come back to the ODP to get fixed.

LP Right so what...

BW DRs are just preference again. They could write what we call a CR, a change request.

LP We talked with some of those people yesterday, I think. Is that Greg Oliver?

BW Yes he's on the

LP Yes.

BW He's the current chairman of that board.

LP Right, yes, so that's why I'm asking you because I know that at some level, they're even less connected with the technical in some sense.

BW That is correct. And I think there was a deliberate choice to do that, because the position which creates him as chairman of that board is called trajectory operations manager. Well the trajectory operations manager is fundamentally oriented towards coordinating all the real-time activities of the flight controllers and trajectory. And as such, he is as close as you can get to the manager of all the real-time users.

LP Right.

BW And we said that we want that certification to not be in the hands of the software developers, we want it to be in the hands of the users. They're the people that should say, "Yes we believe it's ready to meet our needs."

LP Okay, and what's going to happen then when, for example, flight design people are brought on board, then when they're not real-time users and...

BW There will be

LP Whose going to certify for them?

BW a separate certification method for flight system, the flight design analysis system FADS.

BW It is governed by a whole different hierarchy. Its users are a community.

LP Right.

BW And although there might be some occasions when a real-time user would want to do some analysis and use the FADS system for it and so forth, and actually there are some occasions when our flight designer will come into the MIPS and do some real-time support with the real-time system, the two facilities are really different

BW FADS doesn't use the same hardware, and it does not use color. Its baseline to be a monochrome system. There's a lot of things...

LP Right.

BW that are different about it, so we go to the flight design user community, and we ask them to set up their own certification process for the FADS applications as...

LP So that the...

BW much as possible.

LP But the ODP then is going to be only real-time?

BW No, no. The FADS OPS SCCB is only real-time.

LP That's right. I was sort of seeing that the ODP was going to be in the middle on the one hand, but they report up to the Greg Oliver group, and on the other hand would be reporting to let's say the flight design group.

BW The flight design group.

LP Right.

BW And this is a subset of all the flight designers. It's not all the flight designers?

LP Right. Is he the...

BW This is the orbit flight design.

LP This is the orbit and possibly the ODDS.

BW Well they're ODDS is the rendezvous people, who are onorbit people, and also answer to the same group level manager as the other orbit...

LP Right.

BW people.

LP So these people...

BW Yes,

LP So does this group exist?

BW Yes.

LP And what's that called?

BW Well right now, with the way we have structured that is, I don't know if it's got a name. But we know who is in charge of it. It's a fellow named Kevin Williams, who is a a unit supervisor over in the flight design world.

LP Okay, I'm going to be talking with them next.

BW Right. His manager over there has a mother board that is at the same level as the ODP or panel that's the orbit. These boards are called software screening panels. I don't know why, but he has the orbit software screening panel.

BW Now he has delegated to Kevin the responsibility for this software development effort for orbit flight design. He has other unit supervisors. A unit in Rockwell is like a section at NASA. It's the lowest managerial unit. And Kevin and another unit share the users of this system, but Kevin is going to be our point of contact for requirements and so forth. And Kevin will be responsible for saying to his boss if I certify this software, "We have tested it, and we believe it's right."

LP Okay. So he will be at the same level as far as you're concerned

BW That's right.

LP as Greg Oliver

BW That's right.

LP even though Greg Oliver's group seems to be functioning in a bureaucratic administrative kind of structure to some extent. This seems to be at the moment still more informal.

BW Well, why don't we just say less mature.

LP Yes.

BW Greg's board has actively been certifying software and participating in the process of interfacing with other organizations that actually take the software and upload into the CM system. That exists, and all of that has been happening. This flight design, the FADS system, will not be operational for another three years.

LP Right.

BW Then we are just a part of all that.

LP Right.

BW So we have not been delivering operational software into an environment where people are actively using it for flight support

LP Right.

BW on this side.

LP So has Kevin Williams been involved in evaluating the software or thinking about it, maybe not the new software, but existing software or something which...

BW Right now, his primary concern is to review the software in terms of what it does, and what his requirements are to make new requirements on too.

LP Right.

BW And that's not through this board, that's through the ODP. He participates here.

LP That's different. That's his different hat.

BW Yes, he wears a least three hats. Okay? One is this certification authority hat. The ODP. I have just met with my executive committee, and we have made a structural change to have some subpanels, of the ODP, meet on a regular basis. We've always had subcommittees. The subcommittees were based on topics of this particular requirement. You guys go off and work it.

LP Right.

BW These are going to be discipline subcommittees. One will be the real-time people, and one will be the flight design people. And Kevin will also chair that subcommittee. So it's an interesting dichotomy. Kevin is a subcommittee chairman under my ODP, and then he is a higher level authority than me in terms

LP Right.

BW of certification at this level. Brian Huysman, who you will not enjoy meeting today,

LP Right.

BW will be the chairman of the other group, which is also a little bit strange, because Brian is a supervisor of developers, and he's going to try to coordinate requirements from users. But...

LP Yes, but so that

BW But that was my choice.

LP Okay, the ODP is basically involved in dealing with things in this environment?

BW Well

LP In this environment, this is the

BW that is one of our two major environments.

LP Right, and what is your other?

BW That's the real-time one. The other one is FADS.

LP And ODP is basically involved in all the software that has to do with the real-time and all the software which has to do with FADS?

BW Not all of the software for FADS, and not all of the software for real-time, but the orbit trajectory software for both of those systems.

LP The orbit trajectory software for both...

BW FADS and real-time.

LP Oh, I know.

BW There is also...

LP Oh, you're here. You're one of the disciplines.

BW Right.

LP Okay, we actually are beginning to get this.

BW Now in the real-time system, theirs sometimes overlaps some of those other groups.

LP This is like orbit.

BW Right.

LP Basically it has both the design part and the real-time part.

BW Right.

LP Okay, and you are the board which is going this way, and then there's also some FADS which

BW And there's some other boards supporting FADS.

LP All right, all right.

BW As far as I know, we are the only board that is trying to simultaneously support both places.

LP Yes.

BW The other boards

LP Simultaneously trying?

BW are primarily devoted to one regime or the other.

LP You are the only. So you're a Janus kind of object, just like TOAST could be a Janus object in the sense of, on one hand, having real-time and, on the other hand, having design. And...

BW I don't know the term Janus, but

LP Oh, Janus is the the god with two faces.

BW Oh, okay.

LP So you sort of look both ways.

BW That's right, that's right.

LP So you're that kind, and then one of the things that we're trying to get straight

BW This was a deliberate choice that was made about two years ago, that there was a sufficient requirements commonality between the two worlds that we should strive to

LP Right.

BW not build two totally different systems, and then find out that this has the capability that that one lacks, and vice versa, and

LP Yes.

BW have to maintain two sets of software and all that.

LP So one of the things...

BW The environments are sufficiently different that we're going to still have differences forced on us, especially in the user interface. And

LP This is one

BW one of the things that some of the new users, I mean new developers that are coming into our system, are experiencing is that the user interface, a lot of the times, is 50% of the work.

LP Right.

BW And they're not used to building systems that are user oriented, and they're complaining about this and saying, "We want to be building applications, not user interfaces."

LP Right

BW And I said, "Well that's too bad." You know?

LP Yes.

BW This is what the users have said that they want, and this is what we're going to build for them.

LP And there's the question of whether this is a very iterative process. These talking to people, and there's you in a sense. You know people eventually say, "But that's what I told you the first time, and you said okay." But now

BW But now I understand...

LP I understand a little bit about it. Okay, now I understand a little bit about what these different pools are. And so this is our view at the moment which is like orbit. You can say that we want to basically share software between design and real-time. Okay, then one can take the other view which is let's take the whole design world. It has some idea. It has needs in common too, and we also don't want to duplicate software.

BW Right.

LP And so this is one kind of take on the problem, and then there's this other kind of take

BW That's right.

LP on the problem.

BW That's exactly right.

LP And...

BW And all of those activities are going on, and they're not exactly intersecting. (laugh)

LP And one can see why.

BW But we do know who is handling each one of those things. The FADS world has its own hierarchical structure of things happening. The real-time world has a different structure of things happening. One of the things that we had hoped for in the former NASA structure, which was reorganized the first of this month, it doesn't exist anymore. There was a division that built software systems for the

LP Right.

BW flight controllers and flight designers.

LP Right.

BW And that same division was going to build the system part of FADS and the system part of the MCCU, the real-time system. We were relying on them to coordinate with them themselves, so we would get consistent things, and they've never coordinated amongst themselves except in some very specific, small discipline areas like LAN technology, but not system-wide over all architecture systems.

LP I must admit that I'm not surprised, from our conversation last time.

BW Assuming that it was going to happen, without saying it was probably a big mistake.

LP I think now in a way, we are beginning to see...

BW We had built our own user interface software packages in the real-time system. I believe the FADS hierarchy is going to make a decision that says that you may not use that software in FADS. You will have to do or don't do a COTS product or semi-COTS product. There's

LP Right.

BW a thing called application executive, TAE, which was built by Goddard Space Flight Center. It's apparently a leading candidate among other FADS disciplines for their user interface. So our best evaluation of it was that it doesn't do all the things that our real-time users said they wanted in a real-time system.

BW In fact, the last experience we had with it was kind of depressing because we thought the way it worked was that every time you went from one input field to the next, you had to take your hand off the keyboard, take the mouse, move the mouse cursor, and click on that new field before you could actually type in that field. And that was a real distraction, we couldn't just in this field, tab, go to the next field, tab, go to the next field, and tab.

LP Right. So they had to basically...

BW Really interrupt their movements and the process.

LP Right.

BW And there are so many fields on the user input menus, that gets to be a lot of activity. So we thought that it was not a most appropriate user interface. Some people have said that is not necessarily the...

LP Hi. Are you Kevin?

KW Yes, is the...

LP Hi. Come on in. Yes.

BW I've been explaining to her how you are my employee and my boss.

KW No, I'm not a boss yet.

BW Well, not yet, but you will be when you start certifying the software.

KW Well...

BW The certification board is a higher level than me, and...

KW That's true although Scott will be doing that. I will be certifying somewhere, but then Scott will be responsible for that also.

BW He has the final signature.

KW He'll probably just delegate it.

BW That's what I figured is going to happen. You're going to get the monkey on your back.

KW Yes, I always do.

LP Okay, so I guess...

BW Are you happy with me?

LP I'm happy with you. Very happy.

BW Kevin's a good man. You ask him anything you want to. (laughs)

LP Can you come sit over here?

BW Sure.

LP Okay Bruce, it was good seeing you again. We may see you again before this project is over. Probably will. (laugh)

Transcript 15 Flight Design
Interviewers Livia Polanyi (LP)
Subjects Kevin Williams (KW), Bruce Williamson (BW)
Date April 19, 1990

KW Maybe you can give me some background as to Mike Evan's intent with all of this.

BW I don't really know if I can put you at rest.

KW Okay.

BW I think the best I can tell you is their intent is to try to do an evaluation of TOAST being developed appropriately for the environments in which it's targeted.

KW Okay.

BW I thought that a lot of the effort was going to go into evaluating software standards and development techniques and coding techniques and things like that. They are doing some things also to look at what are the environments, how it is being managed, and what are the problems that are likely to come out of that environment. I think that's why they are talking to people like us.

KW Okay, well I know Phil and Wayne talked to them yesterday, and they were caught off guard a little bit by the atmosphere of the questions.

LP Okay.

KW Okay.

BW I would really find it very interesting once they've collected all of this data to see how they are able to put it together and say you haven't been talking to each other. I think it would be really interesting.

KW Yes, good job for the Mike.

LP Yes, I think that is exactly the way. Oh, I'm Livia Polanyi.

KW I'm Kevin.

LP This is exactly the way that TOAST is being developed. The way that TOAST is being implemented is the way that TOAST is being thought about and is that really going to be able to be the tool of choice? Let's put it that way and in the range of environments which it seems as if my need functions in.

KW Right.

LP And so one of the FADS ...

KW Let me give you a little background on my area. I come from orbit design which you talked to Phil about yesterday.

LP Right.

KW So he's from the same area I am.

KW We're looking at using TOAST in the FADS area. Matter of fact, we started prior to FADS coming about. We started looking at combining real-time, design software tools, and the orbit arena.

LP Right.

KW Just because we saw a lot of commonality between the number crunching that was going, the subroutines, the utilities, and some of the processes.

LP Right.

KW So we started along that path with Chirold Epp as our section head about a year before the FADS effort really got moving.

LP Right.

KW So that's where we're at now. We've gone in that TOAST direction. We've got developers working in that direction.

KW FADS is just now to the point where they're deciding what they're going to incorporate into the FADS ball park, and TOAST is a potential that I don't know whether it will be brought in as an application, or whether it would actually be an application manager within the FADS environment. So

LP As far as I've been able to tell after talking with Wayne and Phil yesterday, it seems as if the orbit people on the design end are the ones who are really caught in the big crunch between everything.

KW Exactly, (laugh) exactly. It has been decreed that we will, as a discipline, be part of FADS and that our applications and capabilities have to be present in FADS. Yet, we've been previously designing in the direction towards combining capabilities with real-time.

LP So I saw you in this kind of situation. I don't know whether that's right. You have the real-time world here, and here you have the design world. ... They basically seem to be saying that you've got to share software, be compatible, and help the product expediting situation over on the design end. Then, they're also saying that you're an orbit discipline. Therefore, you should be sharing software with the people in the real-time environment.

KW Right.

LP And see, you're right there.

KW Right. So far, our direction is to continue our efforts with the real-time side, merge our software, and develop common tools.

LP Right.

KW We know that we will have to identify some output menus, displays, and input menus that are design unique and some that are real-time unique. We can merge the lot of them together and develop some common tools. Certainly, we can use common subroutines and utilities across the the board in a lot of areas. We have been given direction to continue that progress. In the meantime, FADS is still up to the point of making its decisions as to what it's going to incorporate.

LP Yes.

KW Should they decide not to incorporate TOAST, we are still going to have to make sure those processors and those capabilities are present in FADS, but now they must interface with maybe a new menu builder and maybe a different applications manager.

LP Right. That is one of the questions which we were trying to get at with Wayne and Phil, and maybe those were some of the questions that they were having problems with. But I'm understanding what we were trying to get at and had to do with. We've been talking to the FDOs, and we've basically been getting a lot of feeling about what are the needs and what are the constraints on the real-time environment. We haven't been talking very much to the design people. I think we're really beginning to think we better know quite a lot more about that than we do, particularly what kinds of capabilities that you all feel that you need. Then I think the real question is whether the things which you want and need are going to require such a radical restructuring of TOAST that perhaps it isn't the right way to go. So that's the question that we'd like to explore a little bit with you, and I think it is probably a key question for you.

KW I know, without getting into some of the nitty-gritty details, that there are some differences, and I know the primary difference is our runstream capability.

LP Right.

KW We have the capability of taking our applications, which we call prompt call processors, and stringing them together in a ordered sequence. I'm going to run A before B, then I'm going to run C, and maybe go back to B before running D.

KW We also have the capability of manipulating information that's produced by some of those tools, prior to going to the next step. We can construct and run this stream in a demand mode either step-by-step in quite a few fashions, or we can run this stream in a "go do it and come back to me when you're through."

LP Right.

KW In what we call an automatic mode, we also can take these streams and set up a batch job such that it runs in the background. I can sign off, come back tomorrow, and my job's completed. It's either given me the appropriate paper output, or it's stored information into my personal database.

LP Okay.

KW My personal save area. Runstream capability does need to be developed onto TOAST, and I feel that the project is really not properly identified at this point as to how we're going to handle those runstreams.

KW I think the project, Bruce, myself and Chirold, realize that it needs to be done, and because of other outside conflicts that have moved people around for periods of time, we haven't done that yet. That needs to be done very soon.

LP Right.

KW We need to know exactly how we're going to bring runstreams into it and how we're going to integrate into that. Then, we can identify people and other problems with the FADS environment that are going to impact us. Until we know how we're going to do it over here, we can't compare deltas to how they want do it over in the FADS arena.

LP Right.

KW The other thing is the runstream capability that orbit design has is reasonability specific to the orbit design set discipline.

KW The reason the real-time area arenas do not have that is because they have processes that they use to support flights, and they go through those same processes time and time again. They don't deviate from those to a large extent. When they do come onto a new requirement, they'll build a software tool to handle that.

LP Right.

KW In the design side, we have so many unique payload requirements that come in for each flight especially with the manifests. The way it is with the the manifests of deployable space labs, ... rendezvous, etc.

KW We have the capability in our area to be very flexible to these requirements and to be able to assess those rapidly. This runstream capability along with the processors and the many tools that we have, all allow us to do that, and to manipulate data, to store the sequence that we've used, to run a considerable amount of data to launch window data, etc. Manipulate it accordingly if necessary, but save that stream, use and edit quickly from a user standpoint, generate information, and present that for the the rest of the flight team to to do their work on. We must have that flexibility in our area to adapt quickly with today's schedules on the flights, etc.

LP How do you do this now?

KW Well,

LP Obviously you don't do it with TOAST, cause TOAST can't do it.

KW No, no, currently we are on Perkin Elmer on the flight design system.

LP You're on the Perkin Elmer.

KW Perkin Elmer is the computer, Concurrent. I believe that is the name now.

LP Right.

KW We do all of our work on that system. We do have what we call a flight production system. We do have some software on Univac that we generate some standard punch the

LP Right.

KW button, punch some number type products, super tape, etc. Those are generated on the Univac. But most of our flexibility in determining the trajectory and the launch window, all of those tools are over on the flight design system

LP Right.

KW which has the runstream capability currently or command file. I've heard it called by different names, but basically that job streaming capability.

LP Do you feel that the Perkin Elmer, as it's set up now, does what you want it to do and has the...

KW Well, yes, it certainly does do what we want it to do. There certainly are changes to certain tools that we would recommend. As a matter of fact, on most of those cases, we've got CRs, SRs and of the system, to correct or to make those changes. But we've got them on hold because we're working on the TOAST activity, and we'd rather, if we're going to do this TOAST activity, make those changes as we're bringing the new tool into the TOAST environment.

LP Are there documents which describe what you have on the Perkin Elmer?

KW As

LP concerning requirements.

KW As far as the runstream capability itself, there are some users guide documents, and that's probably one of the biggest differences between the TOAST development
KW over the period of years and the FDS development. The FDS development basically sat individuals together in behind quote closed doors, developed the concepts, developed users guide documentation, developed all of the requirements documents, their standards documents, more or less before they went off and generated the system itself. I feel that the TOAST system has probably not done it quite that way. They have allotted their standards documents and users guides, etc. are being developed as the process evolves and as the development evolves. Some of that is good in certain areas such as standards and other things. It probably would have worked more effectively if they'd sat down and developed some more consistent standards early.

KW I know there's also some other characteristics of the flight design system that are currently being thought of to put into TOAST. As

LP Good.

KW a matter of fact, we're working along some of the lines, some of the constants that are in each of the tools, or the processors and taking some of those constants that are used commonly between processors, and separating those out into what we call quote master databases, such that an individual can change those in those common areas, and he doesn't actually have to go into each tool and change a particular value; for example, an atmosphere model

LP Right.

KW or CD area, those type of things. User can control that outside of these individual tools. Now, he can always go in a particular tool, specify a change

KW But the default would be to use some common master data area

LP so that basically he can set up a universe, that

KW Yeah.

LP kind of thing. He can set up a universe, and then when he goes to use a particular tool, that particular tool is going to have that universe.

KW Right and that quote master database structure is not as prevalent in TOAST, and we've discussed it over the last few months in the orbit design panel. As a matter of fact, previous discussions have occurred also. I think we're to the point now that we realize that we're going to need to incorporate some of those items. We're stepping in that direction, but at the same time it probably would have been easier for the overall TOAST program had that been done earlier. We're not there, and we're acting accordingly to correct that situation.

KW I think a lot of the FDS capabilities as far as the tools themselves are really either there on the real-time side or the design side. One of the things that pretty much goes hand in hand with the runstream capability on the flight design system is that each tool produces information, and it produces a file from that application. It'll provide you displays, but it's also depositing information over here in a file for the user to use.

KW The user can access that file, take values out of that, do some algebraic, trigonometric calculations, etc., and use that as either information to go into the next tool, or as information to make a decision upon as to which direction I'm going to go with the process. That is really not at this stage of the game developed in TOAST, or we're just now currently trying to identify how we're going to handle that, and how we're going to allow the tools not only to create these files. Creation of those files is done internally in TOAST, but how do we make those files identifiable and available to the user, and does the user have capabilities such as taking those files and renaming them, such that I might be able to take the same tool and create several files which I may gather data from.

KW Those capabilities are just now being identified as requirements for TOAST, and working those capabilities in is in progress. So a lot of that is not in infant stages of development, but in pretty early stages in the development of the major tool. So there are large burps to the process

LP Right.

KW that the developers are going through. It's just the fact that those type of activities are going on at the same time, and that FADS is trying to identify how they're going to handle certain things. This provides for a large integration nightmare

LP Yes, yes.

KW for our particular discipline.

LP Yes, I can. Your particular orbit flight design just seems to be

KW Right.

LP really scared.

KW In the FADS arena, the other disciplines in the design side do not necessarily have the same streaming requirement. They, in some of their tools, have designed it such that when they go through to deliver a particular product or perform a particular analysis, they go through this process pretty uniformly in almost every case.

KW The other disciplines, for example ascent and descent, are probably the easiest examples. They tend to have a process, and from flight to flight that process doesn't change a lot. They don't, as often or as rapidly, have unique requirements come into that. I may have an ascent that designs to different altitudes, and I may design different abort locations, etc., but in our area we may have a completely new requirement that we

LP Why is that?

KW Well, because we're more payload oriented versus a lot of the other disciplines being generally flight trajectory oriented. Take, for example, descent. They've designed their processes to handle being able to determine opportunities in deorbit from opportunities independent of exactly where I am relative to that site. So their tools do that process, but there's not a lot change to that process other than I'm different sites and my trajectories are at different angles, etc.,

KW and I might have orbiter performance characteristics that come in and change that process and have impacts on my tools etc., but that is not a rapid change process. Whereas we have quite a few flight payloads that come into the manifest each year and that we fly each year. Each of those have their own requirements. Different types of payloads have quite different requirements.

LP What kind of different requirements? Just so we could get the...

KW Well, for example, a standard geosynchronistic foible, a communications satellite. They'll generally come in with right ascension and ... inertial node requirements. They may come in with longitude band requirements, saying I need my node to be within a certain ... longitude region. Whether you are tracking or targeting, they often come in with some beta angle requirements, orbital orientation with respect to the sun. But those are their general types of requirements. I may have a planetary

payload such as Galileo and Ulysses, etc. It comes in with right ascension of ascending node requirements, but they're not in a format that our tools are set up to handle. We've had that happen on a couple of flights where they've given us right ascensions, but they're not defined at midnight, which is our current standard for our tools. They've defined the right ascensions at a particular GMT, etc. So we have to learn to adapt to using those, transforming their information into a format that we can use on our common tools,

LP Right.

KW such that we can develop common charts, etc. It's much easier to take that information, manipulate it, put it into a standard format, and draw that chart out than it is for me to take that information and somehow write down to my software developers downstairs. Give me either. Give me my personal database,

LP Okay.

KW my personal save area, a tool to handle this, or I'll do it by hand, and construct this chart. Both of those cases take much longer periods of time. We have other payloads that have different requirements. Our space lab type flights have a unique requirement. A lot of times, they have earth targeting that they want hit specific nodes with specific lighting requirements, maybe we have some flights that they're wanting to look at or ... under certain lighting conditions.

KW We also have flights, such as the ground up rendezvous flight 32, where it has unique requirements and in its case, it had a deployable on board. So not only do you have the ground up rendezvous requirements of hitting a vehicle's plane that has already been up there in space with an acceptable distance between you and the target,

LP Right.

KW but you also have to meet a deployable requirements. They got some RAM requirements, and so you got periods that you can launch and satisfy their requirements, and periods that you can launch that you can't.

LP Right.

KW 32 may not be the best example of that, because on 32 the simcom payload relaxed a lot of their requirements, so they would be compatible with that flight. They were very forgiving. They actually came in and worked with us real well, such that they could make it onto that flight. So simcom is maybe not the best example, but other flights you do have some other requirements.

LP Right.

KW As far as other types of flights on the manifest, of course, DOD always has its requirements also. Those we can't talk about.

LP No, no, of course not.

KW But each of those types of flights come in often where we're already into the flight design process and identify their requirements. You would like for them to identify the requirements before you begin that process. You'd like for them to identify those requirements in a standard mode such that our tools are set up to handle. Unfortunately, that's not always the case. Often, we'll be in the middle out of four cycles. We may be in the middle of the third cycle, and the payload comes in with a unique requirement that you've got to meet, or they feel that they must meet whether it's to prove they're targeting, their science, or whichever the case.

LP So they'll decide they want it to do backflips on the second day, or something, and that has just hit you as the requirement.

KW Certainly, or things can happen, and correctivities may change the plan for ... objectives. So we've got a new requirement. Our requirements cannot only come in from payloads, they can come in from the STS area. But we have to be able to adapt to those quickly, such that we can, whether it be during that particular design cycle, or be ready for the next cycle, know how to handle that requirement, so that we do not disturb the flow of reconfiguration and training for STS. As a result, the tool that we have now, flight design system, with the capabilities that it has, allows us to do that reasonably rapidly.

KW We can do all that with what I feel is a minimal amount of personnel supporting that, plus the other activities that we're working. If you take that away from us, you're going to have a lot of impacts. In fact, if those capabilities are not provided, you're going to require more people, and you may have impacts on software personnel downstairs to support you. You may have impacts to actually schedules. You may say that certain requirements, I can only handle in certain times. If they come in beyond that, I'm out of the water.

LP Right. Okay, it seems to me that it would make a lot of sense for us to look at the users guides, the requirements documents, the machines, and the systems that you are actually working with and

KW Yeah.

LP see what I think will help a great deal to give us a feeling whether the way that TOAST is being designed, implemented, and whatever is a reasonable kind of system for you all to be involved with.

KW I can say that in the process of trying to integrate our requirements in FADS , it's been a battle. I think one of the reasons for that is that you've got the disciplines out here such as ascent and descent, and others that are reasonably large groups because of the activities that they do, that all tend to use some common tools. Not all of them are common, but some of their tools are common such as the Univac.

LP Univac, yes.

KW Because of that, I think the FADS arena, a lot of the individuals in that group are very familiar with what they do, and the tools they use, and because we're a smaller group, my people are familiar with what we do and how our tools do that and why. So we've had to go through some education processes as to identifying exactly what our capabilities are, why do we need those, and how do they help us.

LP Have you done that in,

KW We've been going through part of that process, matter of fact, over the last few months. With the FADS, CCD, and other arenas. One of the things that we're putting together now is a demo actually on the flight design system, such that we can get these individuals over here and and show them exactly the capabilities of the machine, how we use them.

LP Okay, I think that's exactly what we would like to do. If the demo isn't finished, it doesn't matter. You can just tell us if we look at a demo.

KW As a matter of fact, Phil Gentry, the gentleman that you talked to yesterday,

LP Right.

KW is doing part of that activity, so that is in progress right now. As far as the exact time frame, I'll have to talk to Phil. But within a week, that should be available.

LP Well, even if it's not, even if all that happens is that we get a real briefing from you all about what you're doing, and the chance to actually look at the system that you have, that's going to give us a great deal of

KW Yes, I think that will help.

LP I think, that part of what was going on yesterday was that at a certain moment, it became certainly very clear that we really needed to know a great deal more about about what you did and how you did in order to do things. I think that probably with a certain amount of questions coming, sort of randomly, as we were sort of trying, well, wait a second, okay, this is something that we really have to start looking at. So part, it sounds like as a matter of fact. You've been trying to educate people. You've probably even got some kind of presentation or something.

KW Yes. We, as a matter of fact, put together some oral presentations, but this is, I think, the first real demo

LP Really.

KW we've intended for the FADS group. We've put demos together for open houses, etc. But this is really intended for the education of the group that is going to make the decisions based upon.

LP Right.

KW That's something that we had tried to stress earlier, and we just didn't get the people willing to come, sit down, and look at it. I think after the last few months, the education that we've gone through, we're seeing more interest. So we're going to continue along those roads. I think we need to do that. Certainly one of the questions in the development of TOAST and FADS together, is how exactly FADS, now realizes that these are indeed hard requirements that we have

LP Right.

KW for the flexibility that we need. Some of the questions that are coming up to be answered over the next few months are how are we going to provide that within FADS, and who is going develop that?

LP Right.

KW Certainly in TOAST, we're at a point where we feel that we need to be developing those now. We're somewhat going along those lines. As matter of fact, we've got a person identified that's working with the TOAST executive individuals and talking to the users of the flight design system.

LP Who's that?

KW That is Tamara Kramer.

LP Oh.

KW I don't know if you ever scheduled...

LP No, we haven't. But I think that she might be a good...

KW Yes, you certainly want to a talk to Tamara. She's also interfacing with the developers, Wayne Black, and some of the other Unisys developers over at Rockwell. She's trying to become educated on the current flight design system capabilities. Her background is such that she doesn't have a lot of previous experience with the flight design system.

LP She's basically working both with the TOAST people and with the Unisys people.

KW Right.

LP Okay. Yes, I think that she's probably undergoing exactly, at the technical level, some of the things that we would need to know in order to be able to say that this really is the right kind of object. The people that will, you would have such a conversation.

KW I think she'll be able to help you a lot. She has only been involved in the process over probably a period of months. So she's reasonably new to that and still in an education mode.

LP That's not unhelpful because sometimes a person can just say that I've been trying to figure that out, and then it will go a little further. But I think that this certainly has been very helpful. The other question which came up, if we could take one or two minutes about that, has to do with the certification of the configuration management issues. I'm collecting pictures which are then annotated by other people here. So this is what we were sort of coming to. There was the ODP, and the ODP was talking to .. basically, I always forget these acronyms, so of people that Greg Oliver and the group

KW The FDOs group right?

LP and that there was a .. on the flight design side there was another kind of

KW Yeah we had a well,

LP that you seem to be. Yes, you were in this group here, and then I think you were also named, I think, over here.

KW Yes, we've actually had a flight design working group associated with the TOAST activity, primarily Cathy Osgood and myself. Phil Gentry has come into that over quite a period of time. They're some others also. But we have been the primary individuals working this from the orbit design side along with Scott Anderson, who came into the process initially. We also have an orbit design CCB out that currently just takes care of our FDS maintenance and modification type activities. That CCB has not directly been tied to any of the TOAST activity although the chairman of the CCB for quite a long time has been Chirold Epp. It's just recently transferred to Scott Anderson. But Chirold Epp was also our section head and also chairman of the orbit design panel.

LP Right.

KW So there has been a tie whether we say it or not.

LP Whether it's just been one person, even if it's not in their hats.

KW Right. So as a result of the new organization, we're going flight design and dynamics. Chirold Epp will be going to a different section, it looks like. As a matter of fact, I believe it's official at this point. Bruce is not the Orbit Design Panel Chairman.

LP Yes, I believe that is official.

KW Brian Huysman will be heading up the RSOC TOAST developers over here that have been working on TOAST for quite a while on the executive and menu builder, menu handler, those type of applications, and also some of the applications on the the real-time side, both applications that are solely used by real-time and those applications that are used both by design and real-time. They do also develop some of those applications. Brian is leading that group, along with picking up some responsibility to organize inputs from the real-time side of the house.

KW I will be doing a parallel function over on the design side, although I do have a supervisor that actually takes care of the supervisory tasks for the Unisys developers over at Rockwell. Rama Chivalee. So I will be working with Ram. I will be working to manage the inputs and requirements from the design side of the house, and at the same time working with Ram to make sure that the work plans and schedules that we establish meet the the goals of the overall group.

LP Who are the people who actually have been developing flight planning activities under TOAST?

KW Well, on the real-time?

LP On the design end,

KW I'm sorry, on the design side. Wayne Black has probably been the primary developer

LP Developer?

KW along with Paul Bicquart. He's actually going to kill me if I forget names here.

LP Okay, well, we're going to erase this part of the tape.

KW But there is probably almost or just below 9 people and that is their eventual goal. Initially, it was 3 or 4 people. So it has grown over the last six months. So (pause) their primary responsibility on the Unisys side of Rockwell is just the development of applications.

LP Right.

KW Primarily, we have these individuals working on applications that are used by the design side of the house. Now that's not comp. That doesn't completely hold true because we do have some. For example, we divide our processors into categories. I may have several tools in ground acquisition, and I may have orbit acquisition processors. I may have quite a few under there. I may have launch window, etc., in the ground acquisition, for example. Well that includes several tools that the real-time groups use, several tools that both groups use, and some tools that the design side just uses. So there are tools that are in there real-time used only.

LP Right.

KW Not that we won't find uses for them in some way on the design side, but developers on the Unisys side at Rockwell do have some tools that they are developing to be used for the real-time users

LP For the real-time users?

KW and the same is true of the real-time developers that are doing application developing on their side. Over here at building 30, they're also developing some tools that not only will be used solely by real-time, but some that'll be use commonly.

LP Well I think we've come to ... Thank you very much this was very

KW Okay, I don't know if there are any other areas that you wanted to

LP These were the areas that I wanted to cover at the ...

KW Okay

LP and I think that we are finally coming a little bit up to speed perhaps with a least where we need to be looking on the flight planning side in order to be able to be of some help here.

KW It'll be interesting. I think with this new reorganization we're headed in some of the right directions where we're going to start holding regular management meetings with Bruce, Brian, myself, and others

LP Right.

KW actually sit down, and every other week talk about the structure teams that are working together. Do we have any problems? What are the things that we need to be thinking of and getting people working in that direction. For example, right at the Orbit Design Panel just work and look at the actual approval and requirements input to the actual tools themselves. I think this is going to help a lot. As far as our interfacing with the FADS organization, I feel like we're still in an educational mode, and we're going to be in that mode for another month or two.

LP Right.

KW It'll be interesting. I think with this new reorganization we're headed in some of the right decisions being made down the road here. Whether they help us or hurt us, they'll be made such that we know the directions that we have to take. But right now, we're just not there. We're trying to educate them so they can make the right decisions.

LP Yes, I think that actually this TOAST evaluation is in some sense part of that process as well, I think.

KW Yes, this is one of the reasons I asked how this is going to be used. I know there's been some presentations made for how they are going to sell TOAST using FADS, etc., and TOAST versus TAE. They've talked about different menu builders, etc.

LP Right, yes.

KW As far as the menu builders go, I think, a few of the presentations that I've seen were a little one-sided, and they need to be corrected before they are actually presented to make decisions upon. As far as I'm concerned, you can probably use both and it wouldn't be an issue.

LP Right.

KW I hear all this fighting about TOAST or TAE . We're just going to have one and everything. I haven't heard firm justification of why we couldn't have both.

LP Both? (laughter)

KW So?

LP I think what we're going to be looking at, because we're on the TOAST end here, is what people are saying they want and need in order to do their jobs, and what does TOAST have to offer to do that.

KW Yes.

LP Period. Whatever anybody does with that, whatever happens with that is another issue, but

KW Okay.

LP I can't imagine that this isn't going to be helpful input somewhere. (laugh)

KW I hope so.

LP I hope so. Thanks so much.

KW I'll be curious to see what happens with this. I assume Mike will get back with us, and at some point after you guys have put all this together, he'll ...

LP I assume so. I won't speak for him, but I assume so. Okay, thanks so much.

KW Thank you.

Transcript 16	Flight Design
Interviewers	Livia Polanyi (LP)
Subjects	Scott Anderson (SA)
Date	April 26, 1990

[We had difficulty transcribing this tape due to noise in the room. Problem areas are noted with ...]

LP Okay, we're being brought in to do an evaluation of the TOAST system. And one of the things that we need to be aware of is the relationships of TOAST and flight design. So I was hoping that we'd have a chance to get some sort of feeling about those sort of activities. So I guess the first thing to ask you is what are you doing right here.

SA I am the current manager of the flight design. TOAST is our next generation orbit flight design system. Basically what we use that for is to provide the analysis portion of trajectory, the determination of launch window, and ground support. Basically ... do the job for us in the future.

LP And what are you using now?

SA I'm using the flight design system right now.

LP And how's that going?

SA It does all the functions that we need. It is cumbersome and is not user friendly. There are areas within the design activity that we can't alter very well, to upgrade to ...

LP My understanding is that the idea for ...

SA The primary activity for our current development is our orbit design. There is an effort to have a common interface for all the orbit dynamics activities on the real-time side. TOAST is that system.

LP Would you give me a sketch where you are in the world, and how the world looks to you. That really seems to help us a lot.

SA Okay, (pause) (drawing) We divide the world into two areas. The real-time support activities and the design ... Primarily ... this ... design, design analysis, ... Each of these functions are under ...

SA There is a similar activity on the other side. There are right now basically two functions. One is the FDOs ... (door opens) those are in general terms, ... Orbit keep ... really only interested in ...

LP It sounds sort of like the other one on the other side.

SA Right, and there is ... So this is basically where I am, this is my ... There is a lot of commonality between what we do, between operations and design. Both organizations worry about propagating expense. They're worried about

communications ... So that's ... They're worried about the modeling maneuvers. The change ... and designing them. ... And then the computer tools to support them. The basic concept to have, since you're doing a lot of the same functions, that renewal base, is do those first things. Basic algorithm should be the same. For the most part that is true.

SA There are some nuances that affect this, particularly the real-time operations. You're usually worried about short term. Some people ... Where design is worried about the ... So there's again subtleties on exactly what ... (pause) There are still unique things that are known to each other, and the best example is the design side. There's one Orbit Dynamics operations side. We could still put that under TOAST environment. Operations has similar unique activities. Are you familiar with ... that particular data says ...

LP ...

SA Yes, ... they were going to develop that ... TOAST would develop ...

LP Now as I understand it on the design side, you also have a whole complexity that involves orbit design and also part of the ... design.

SA That's right.

LP ...

SA Right, just larger organization is letting us do ascent, descent, systems ... and top level integration. This total organization ... computer network allows the mutation data in house do be done more efficiently like ... and to provide a configuration control on it for the data ... in each area ... That activity which is a task right now is ... system. It has in a large scale ... involved both software and hardware ... changing velocity, potentially in areas like building a centralized computing system. ... What we are doing in TOAST, is trying to solve both requirements, to have a common tool set that is consistent in real-time and design, and fit into a communication structure or system that allows us to ...

LP One of the things, as I begin to understand, about TOAST is that it's been developed in the real-time environment, and now they're having to see how it will fit in the design environment ... certain kinds of ... difficult to see how it's going to work. ...

SA That's right, runstream.

LP Runstream ... What's your ...

SA That's again whenever we're talking about some of the nuances between operations and design.

LP Nuances ... So I'm just trying...

SA It's a lot.

LP How big that is?

SA Nuances is probably the wrong word. It is an executive environment, and how we do our job, design of operations is a limited option in nature. You have the orbiter in a different place. You only have certain amount of gas ... Design, on the other hand is very ... You have launch ... (thump)

So that environment infers a larger amount of iteration. For expanded analysis, you have to get a large field as opposed to over at the ... We do that also, start with a large ... and go down to small ... So there the executive ... is particularly .... and it's where it manifests itself. I think the easiest way to see--we have a requirement to be able to run a lot of the script in that ... with the ability to carry parameters to the individual company using the analysis. Our current flight design system ...

LP ...

SA We do that ... I know basically ... We also have the capabilities there to change the output look, basically the... So you can take data ... and then format it for a certain kind of ... Given that we are mainly requirements driven type of analysis, we do ... There are times when there are no tools to do a specific thing that we have to do. So we have to take our tool set and manipulate it to make it do we want to do for some ... From that, there's a determination that's ongoing ..., the transition backbone, in terms of a runstream environment using or misusing the processors ... software development to create a configuration that all the software is associated with that particular ...

LP So what you're saying actually is that you're ending. You as end users in fact are getting a lot of on the spot applications development by taking the tools that are available and figuring out how you can make those tools get you the kind of requirement that you need to ...

SA Basically.

LP If it turns out that there's a lot of people that are needing to jury rig the same kind of configuration, then the idea maybe should go to software development and have them build an application for that in general use.

SA Right, there's another step there for why we can't do it. We can't manipulate what we have. It will be done in that format, and we turn ...

LP So how is the Perkin Elmer environment ...

SA It does, but it's a very difficult approach. You have the range of data manipulation, but you don't ...

LP What kinds of things would you like to be able ...?

SA Things we can do are simple algebraic functions. ... Things we can't do are ease of data comparison in a large set of data, and I think a database function will allow you to sort it, to plot it, to enter it ...

LP ...

SA The whole environment that I'm doing for the database management can script ... requirements to lace into do ... Like we mentioned before, this is a user interface

... in operations. It has inherent limitations that we just talked about, no real database functions. ... the development to make it something that we can use on both as far as the changed ... will it get there, I think so.

The jury is still out. There's a definite understanding on the management ... that those requirements exist. Whether it will be a continuation of our current capability or an improvement on our capability, I don't know. There are possibilities that both could occur

LP ...

SA in such a way, whether I think it will make it or not, will be an improved environment.

LP Yes.

SA I don't know.

LP How difficult do you think it might be?

SA It is very difficult in the sense of that you are developing in FDS. We've created a system that is very machine dependant. The applications are very ..., and FDS executive does a lot of of work for the application. We built it to do basically a runstream or ... that allows a basic function to occur ... being that it is ... very much a part of the everyday operations of ... In TOAST, you're going to be using this ..., but you want to create the capability to have machine, or you're ... you don't get locked into Perkin Elmer that is now 11+ years old.

SA You find an operating system that is less ... None of the capabilities that you have ... are not there. So those two activities, the ability to continue to expand where we can use them everyday, ... and the desire to ... are not totally compatible. They are ... There are things that need to go that it can do.

LP Well one of the things is that it's ... and under TOAST there are some similar...

SA That's right.

LP Obviously there are going to have to be changes made ... whichever one of those ...

SA Well for us hopefully they are both the same. Hopefully our contribution to advance will be TOAST. There are different levels. I'm not exactly sure what you're talking about, things like ... We have an internal, and there's an external.

LP Okay, so you're actually talking from the perspective where TOAST is ...

SA That's right.

LP What's your view about interface on whether ... What kind of interface ...

SA Right, it's a burst out of the office environment. You interface these very much driven by similarly look and feel to the ... You people have been here long enough ... that's correct.

LP ...

SA That's right, and either way we go, we're gonna have to ... unless they accept the original impact ... and ease of use. I think there's a lot of ... TOAST whether it's used as its interface ... is an improvement over what we have. Whether it is the best thing for us to be using under the FADS environment, I think the answer is probably no. It is not the best we could use. I think some of the other newer more common companies industry-wide type interfaces like TAE, for instance, may be a better choice. ...

LP You want to give me little more detail perhaps about why you prefer some of the other interfaces.

SA Well the other interfaces

LP ... that kind of input in here.

SA Yes, the other interfaces when you start a new environment that has certain limitations, and you develop your look and feel contact, you're basically corrupting that to meet other requirements. You still have to ... squeezing in or changing it a little bit to figure out how to have this basic formula that you want to do this. I'll put this extra box right here, or I'll do this other little thing here, but you still have a basic environment, ...

LP Right.

SA When you start from an open system, that you do not have, the system's basically developed ..., and then you take that and build what you need for you to be able to do a total job. You have more of a design ... opposed to a changed environment. Therefore, inherently you have a capability that's more suited for what you want to do.

LP Okay.

SA So that's a basic reason. But two since I've not worked on TAE and I've not really worked on TOAST, it is more of a philosophical approach as ... doing this particular thing, or do we like this particular thing, or you know, it is not that at all. It is just more than, as I say, that sort of philosophical approach. (bump) The other areas, not necessarily design, ... run on ... Again we say real-time operations is a subset of TOAST, as they use TOAST. They have already developed sort of a TAE of their own type because it's been like that, and they are already ... A modern system on an interface system that is as good or better than TOAST is ... You're getting stereotyping, or ... has to be just as good as that.

LP And what is the ...?

SA I'm really not qualified to answer. ... is really more of a philosophical ... approach than I want ... I'm not really qualified.

LP What is your ... two-headed kind of situation that that orbit design ... has a common ...

SA There is inherently a division between those two because there are differences only ... big picture. ... the operations environment limited data ... The differences are always ... When you go to your tools, you want the best of both worlds. That's why we are at where we are now. We want to create on the materials, the smallest number of tools required to do the job. ... that you create an environment that allows transition of personnel from one area to the other with more ease. Because there are at least two, to some extent, we are using similar tools. I understand the limitations and capabilities ... the requirement for the communication of your data with the rest of the design world.

SA All these activities are required, and the marriage of these two activities is the best of those two worlds. It is a compromise to make that happen. The process of compromising inherently means you're giving something up to make ..., and that part is still going on. Where we end up through all the compromises and all the ... management changes control especially the FADS activity ... We'll see in time if it works. ...

LP What do you see as the really most problematic ... unconfident.

SA (pause) Probably the biggest problem in my mind is ... and ... (pause) is the bigger fear. There's two fears that I have. I'll start with my fears about TOAST. My fear there is that I will not have ... the job I can do now, or I'm not even sure I can ... I think we should be able to do ... on that side of the concern. On the FADS side, I am afraid that one of two things will happen. If I stay too close in to the TOAST environment, I will become a conceptuality. I will have a system similar to what I am now, and that FDS in 1978 was what FADS is today. The desire to get ascent, orbit, descent on systems (door opens) and I (slam shut) and it failed basically.

LP What happened?

SA Its overall functions get all the pieces together. It achieved in orbit to develop a tool base that we can use. But its desire to be totally encompassing failed. So we were isolated on this one machine where all the majority of the other disciplines were over on a Univac, and at least two other complexes. ... I'm afraid that if I stay to strongly with the TOAST department ..., and I'll be stepping out on some bridge.

LP Right.

SA But I won't be in the same ...

LP And you need to be in the same country ...

SA That's correct. I think we can do the job a lot more efficiently. I can create a database of whatever I'm doing, ... that I can see that those results ... the data, and getting back to me and saying wait a second ... a lot more efficiently and a lot more quicker ... The other potential deal is I could go to much the other way. That I am in an environment that destroys all ..., and I still have the same algorithms on different machines... That in time the two systems converged ..., so I have two areas that I can go, and the marriage of those is different. ...

LP Are there a set of documents that you could talk about?

SA Yes.

LP You mentioned something about a year and a half ago?

LP We've developed many documents ... We developed the ... what is called basically a ... This is how I except 1990 and ... I've written up requirements for the last six months for runstreams scripting ... So there is a series of documents ... The last ... is the development process,

LP Yes.

SA management side of it actually. The way TOAST designed the ... basically divides up the work that has to be done. Take that piece and assign two people to it. One person is the developer, and the other person is the user. ... and they go off and develop the requirements together ... the end user side, and you start developing codes with the emphasis on the developer ... during testing ... FADS is not that way. FADS is in its nature more of the old fashioned way of doing software development where you go off and have the users develop a set of requirements, take that set of requirements, throw it over the fence, and then go off and develop what you need whether you like it or not. Then they give it back to you. That's overstating it. They are trying to improve that kind. That's the other fear, that they can't improve that. That's not an efficient way to develop. That is not efficient to get the users what they want, and ...

LP I think that this is the way that things have been done on the real-time side, and ... developers. You actually think that this is ... for your people ...

SA The more you can put, one of the words that that defines is a new environment of software development, you no longer have really users and developers. You have users to some scale or another like ..., and you have developers to some scale or not that do the handling that do the ..., and when you marry these two groups, each of the team players ... parts of the spectrum. (phone rings)

LP It seems like a little bit of that has been the way that you have developed it. ... put together applications for ...

SA I think that would be overstating it. What we can do in the FDS executive environment can do a lot ..., can create these scripts that can do what we want. That may be the basis for a ... software, ... That type of development is very very limited in scope. We really can't go in, and in this process, do new algorithms for new propagation, or do new algorithms for acquisition, or what ever. That is beyond the scope of what we are doing and that's the real software development.

LP Right, right.

SA When you're doing, you took something that was a runstream and created a processor. For the most part, it is a minor activity. It's just adding lines or adding ... to each other, as opposed to running one and going through a manipulator. So yes, it is there. We could do it to some extent. But the way we do it ..., we won't do it ourselves ...

LP That's sounds like what you wanted ... that are actually going on here together with what you've actually been using ...

SA Yes.

LP Well, all right, thanks very much.

Transcript 17	FDS Demonstration
Interviewers	Andrea Martin (AM), Livia Polanyi (LP)
Subjects	Phillip Gentry (PG), Pamela Fisher (PF), Bruce Williamson (BW)
Date	April 26, 1990

[We had difficulty transcribing this tape due to noise in the room.
Problem areas are noted with ...]

PG Okay, so here's the basic time element

LP Right.

PG And we have two systems. The A system and the B system. Which is for production. And we have secure systems and the system that they do the development on. Now basically for the black flights, we have the A and the B system. And I can just toggle and there's a M request, and I can request either the A or the B system. (beep) At this point my work's on the B, so I choose the B system. BBB stands for Perkin Elmer. And there is the prompt.

MUCH BACKGROUND NOISE

PG Okay, one of the capabilities that we have is sending messages, so I had another account and I sent a message to this account to demonstrate that if you are not on the system, the message will be stored until the next time you sign on. Then the message will appear.

Next we have the private id, which they use for accounting. They want to keep track of how many people sign on and work on what flight, if they're doing generic work, things like that. So they've installed the ... code, and it doesn't say whether they got computer resource or accounting code. So for this one, I am charging this to FADS. FADS is sort of the accounting tool being used. Each month I get accounting reports from both of the systems that include sorting by flight, by department, by user accounts, and I sort those in like the flight page ups management, and I keep track of all the rest.

Okay, at this point we're at the executive prompt. Any time you see a percent, we're at the executive prompt. I can talk to my personal database. And you can get an idea of the number of databases that I maintain. I have 50 allowed currently on the 40A, and I'm allowed 30,000 sectors currently on the 21,000 sectors. Basically it means I should go in there and clean it up

PG For this account, I've set this account up as a storage for the entire group. I'm in control of it, but if someone creates sequence tables that are generic for general purpose of the whole group, I allow them to store them into this account. And a lot of preliminary work I store in here. But basically I'm going to get demos and ...

LP ...

PG You want the screen

LP I can imagine that maybe along the way that we might like you to give us screen dumps.

PG Okay, I've got it set for automatic. If I come to the end of the page I'll get a screen dump. I do have the capability that I can, instead of looking at all of the [screen], what I'm interested is just a portion. Of BD, I can specify a range across it. I want to look at all the databases just from D to E. And I'm interested in demo. So I can clear. Now I can talk to my active area and I have nothing in my area.

AM [How long does it take to get up to speed on FDS?]

PG You want to answer that Pam?

PG What's the question.

PG How long do you think it takes to get up to speed on FDS? They have a class, and it's been so long since I've taken it, but I think the class we did takes a couple of hours a day or something like that. But

AM ...

PG Right. We're definitely looking for an easier system to learn on.

AM Okay, I just made the comment, they're not going to ...

PG Basically the the purpose I created this demo was not for just me. I want to show the executive people for FADS all the requirements that we need for these runstreams.

LP That's exactly what we wanted to see it too.

PG Basically I have an actual flight problem that I solved using my runstreams, and I put a bunch of pieces together in a master sequence table that [we] will go through.. So basically, the point I want to bring out is these are sequence tables or runstreams, whatever you want to call them, for one PF. And it's not three or five, there's twenty, thirty, we use this a lot. You want screen dumps?

LP Yes.

PG I'll just go ahead. Your printer better be working. Okay, using a formatted write statement, I've set this up that when I come into a page and when I want to go the next section, I'll clear the screen so I don't have to worry about clearing the screen myself. And when I'm ready to hit return, I hit return. What I'm doing now is initializing master data. I have another sequence table that says go to this master database for orbiter parameters, or geomagnetic parameters, or earth constants and things like that, the radius of the earth, so I need those for my processors. So basically, every one that gets on has a master sequence table that gets all the generic ones that they need everyday. And you may want a specialty processor that is not in there, and you have to think, "Oh, where is it?" And you have to go find it.

Okay, basically what I'm starting now is on STS 41. We're attempting to deploy Ulysses. And the customer gave us RAM data. Right Ascension Mode. And

from this RAM data, we have to pick out a launch time such that we can afford them, inertial frame so that they can get on to were they're going. The problem was that they did not give us the RAM in the right format that we could use for our processors. So the first thing that I did was I input the RAM into a data development, and here you can see that that's just a listing of the data dump. And if I input anything into the computer I have to cue 80. And I don't like looking ... plus one, so I use a FORTRAN write statement, and I print them out with the dates and the open LAN and the close LAN and ... in the same format that they gave me. So I have almost two identical papers and I can go through and make sure I didn't type anything wrong...

And now I'm showing you a listing of sequence tables I used to calculate the launch time. And for the purposes of the demo, I chose to highlight this section and I have launch ... arithmetic operations. So I kind of enlarged that. And on here, it's going to clear the screen now. And here you can see a formatted write space that looks pretty close to a write space. Now I'm going to go through this automatically, going to auto turn off so I won't stop it. So I'm automatically executing this sequence table, but I choose list the line numbers while I'm executing. It's one of the options that we have. Originally I did this for 19 days, but I only want to go [for one day] so it's from i to one to one. I give the day I'm interested in, and I set my liftoff time for zero. And I turn the display off because this is just a preliminary guess right now. And I set a time span to take a particular sending I go through and a base time is going to initialize the launch state and the launch time, the transform state vector, the ohms to cut off vector, and orients it for that day. Then I have to create a varied element set. And run this processor which is called LATX, and it's going to give me a latitude cross. On anything. In with the latitude processing, it's going to give me the right ascension of this sending node at the node. That's the format it gave us, the equation of their numbers. So I calculate, I pull it out, and I compare it. I change it into degrees because that's what I have it in. All variables are internal units, radiants beam. So I've got my constant that's going to convert from rads to degrees so I convert to degrees. And I'm going to check it against the given RAM that they gave me. So once I get the RAM delta, I divide the delta by the rotation of the earth, and I have a launch time. And I store it as a launch time, but that's not good enough. I have to verify that it does give me the right numbers, so I go though the sequence with a new launch time. I take a vector, and I'm going to eventually come down to running that LATX again. This time I will get a display of it.

LP All of these things have you typed in at some point?

PG Yes, I can show you that later. I started with nothing and edited an interface table, I gave it a name, it gave me a line number, and I just started putting these lines in on what I wanted to do. This time, I turned the display on, so that I can see the latitude crossing display. So here's what the display looks like. You can see here that this is the RAM from the display, and then using this write statement I put the date, the exact launch time to open. And this is the RAM that I input from the customer so that I can look at this and say okay, that's my launch time. So basically it's going through it again for the closing node. And I had to do this 19 times for display, for Galileo, which I also worked on. I used the same basic sequence table, and I had to do it for 34 days, so it wasn't a one shot application, but it's not the norm.

AM What are you typing in?

PG No, it's just a comma.

AM ...

PG It can type the form. And if I want to automatically execute the sequence table, you can type auto, but it only accepts the first two characters. So if I'm doing a lot of typing, and I don't want to type bogus numbers, bd does the job so I type bd, hold on. (pause) And these two lines are launch window analysis. We don't launch on the exact seconds, but we round. And if it's opening time, you raise it up to the nearest, and if it's a closing time, you just truncate so that you are conservative. And that's what these two lines did. So what I'll show you next I believe is going to be the digital that I calculated. This is semi-automatic mode now; I choose to concur at each execution of a line. So at each line, I requested, and basically, what I want to show you here is that if I have a write statement, but I'm also doing the clinet loop, so instead of setting up a loop and going from one to 19, I've got one line that says, just print them all out one to nineteen. And there they are.

But to show what the final output display looks like, that would be the final display. I have my launch times now, but I need a graphable plot. So that posed another problem. The RAMs they gave me weren't at midnight. Midnight is the time I need for automatic clocks. But they gave me, that was about thirteen hours, so I choose to interpolate. This is interpolation sequence table which I would have done, and now I probably would write a more generic and just assign the parameters in there. But that time I just wrote it. And this is just for my personal use so I didn't do anything fancy, but I just listed the midnight and the day and the year. And an open and close RAM. I put these RAM into my application software to get a plot. And basically that's what the plot looks like. Now with my plot, I can get digital data also. So this is what the digital data would look like from the application software. There's a glitch in it. We didn't use this data, we used the exact data we calculated. A lot of them are really close, and some of them three to five minutes off. Three to five minutes on your launch time is really not acceptable so we use the graph, and we use the digital display that I generated.

At this point I have no idea what I'm doing next. Okay, this is to demonstrate name substitution. Okay, I have a parameter I'm going to call ... And inside it I set 10 one comma b, and 2 one comma b. So using name substitution, I'm going to pull out and get displays of the two vectors with the same piece of software. I don't have to make any code changes to the software. So this one is a-1, and I'm just going to do A1 and 2. I'll have two null ones. B from one to three. Okay, here's the SSVD demo. And at this point since I'm in semi-automatic mode, I can say list. (pause)(typing) So now I can show you that I have $vec a. And the dollar sign signifies that I'm using name substitution. A's in the loop so from one to two.

And the message capability that I talked about earlier. I sent a message to a guy earlier to say, "Hey I'm doing a demo, send me a message." So ...

LP (laughs)

PG while I'm executing a process, a message will come out and as soon as I get an executive prompt or in this case, just semi-automatic execution, the message will pop up. So I get the message.

LP (Laughs)

AM What kind of message ...

PG So I can come back in semi-automatic mode and I can send a message to access PRODB, and I send him a message back. So now I'm back to the SSVD demo. And I hit return. (pause)(printing) I think there are a lot of people on the system; that's why it's so slow. But you can see here that I'm doing the ephemeris called TET, one comma one. So that's the first application on TET. Now at this point I can list the VF one, so now I can list the VS two. So I can go through the loop and I printed one comma two. Well I don't want to, so let's assign B equal to three. So I've just changed the flow of my program.

PF Not only can you change the flow, you can change the data that's being cast

PG Right.

PF Everything is like a little file that you're working. It's like you have global variables. You can access those off of those as you need to.

PG But you can see I skipped two and I went to one, and then changed A to two. I'll just go ... on this one, because I don't want to go through the whole thing. I hit demo, and you can see that I'm now using TET two. So it comes in handy for a lot of our products. They want listings of all the elements in the trajectory. You get a timeline to TET. So you set up a sequence table that says from one to 17. You can counter, you input the name of it. So now you have a generic sequence table, so someone doesn't have to go through and do it by hand the whole time.

LP Just another question, your products are all fixed products?

PG At this point most of the products that I generate are paper products. Now we do have electronic transfer. Vsend, they take some numbers, vectors from us, so I set it up in a BD, and I give them the name of the BP, and they pull it over. But I also get good paper products for QA. The big product is called supertape. And it is a tape. But we also get a 1500 page printout, 1000 - 1500 pages, and we perform spot checks and QA to be sure that that it's been executed correctly. But the actual tape is delivered ... Do you know who all it goes to?

AM No

PG It goes to bunches of people. But FADS is trying to get to total electronic transfer of data, but ascent is not all on the Perkin Elmers, it's Univac, so we have to tape the products.

I think what I'm showing now is a trajectory that I'm using log name substitution and so here I assign K equal to 17. Now I'm assigning Z equal to 42. Those are magic numbers; that's the maximum length of the ephemeris that I can create. So I'm allocating this name to be TT, Z comma K, but I'm going to use name substitution. So in semi-automatic mode, it substitutes line 220, allocated Z comma K, to this mixed format. So I'm going to create this TET, it's slash D.

So now I'm initializing. So I change Z to one and K to one. And I'm taking an Ohms two cut off vector that came from a paper product from Ascent. I loaded it into this interface table for this processor.

LP That means you typed it in.

PG I typed it in. And what I typed in, I typed in these elements that say radius left, launch two ... And we work with TG Cartesian oscillating elements. I get my Cartesian elements time to cut off. I'm getting my ohms two cut off time. All our times are in internal units so I have to take the liftoff time and subtract it to get the MET time. Coefficient of drag and area, and I'm referring this to a varied element. We have certain processors that create a trajectory timeline. And once it's created, then we run this INVAR, invaried element processor, and then most of your other processors run off of that. And latitude processing sunrise, sunset, landing opportunities and all these run off this varied element. Now node is 6, I'm doing 6A. This is a little of the same thing. It's with the same Ulysses trajectory. So I take my latitude crossing, I'm looking for node 6A. What I'm interested in is this MET time.

PG So we have data elements, now I can do anything to a data element. I can create one, add numbers to it, subtract number, multiply, divide. And then we have what they call disk resident elements. Or data files. ... I just have some word numbers on a record. And it's hard to manipulate data so we have the application software, that at this point I'll list. (typing) ... So this is what I'm terming a flat file. It has a header record, and it has record number four, which could have 500 records in it. And they'd all be the same, and record one, two, three, four, five. So what I'm doing with this I'm saying I want to start at record four, go to word two, and pull out the two word. I'll like the two. So I'm pulling this time out right here, which this time looks nothing like that time. Looks a lot like this time. GT 9.

PF DRDD's are the ... and it lets the data files ... They use those to store the really long files, the files that are particularly fairly long. Because the data elements are limited to a maximum size, so that's what why we have the dispersal.

PG So at this point, I have pulled out so I can list dumb 6A. And it's just a free format. It says, well I don't know, tell me what you want it to look like, so I want it to look like a time format. So you can see that it's been twenty one nineteen four. Which is there. And I'm going to assign it to TH time. (typing) So I can list TH time now. And it's the 713, so that's the MET time. Now I set my RU to the latitude and I set it. I'm going to propagate now to this time. What I'm doing is saying I want to use this as my reference time. And I want to coast to an angle that's so many degrees before that time. So essentially the requirement was that they wanted to eject at a point so many degrees before the MET. So I'm calculating what that time is that they're going to eject. This is the time. Remember the node time was 7 hours and 13 minutes. I'm a little before node and this is my ejection time, and for the the separation sequence prior to the ploy I have to back up an hour and five minutes. I make that ejection time, which is also going to be digital use, so I have to subtract the liftoff time to get that. Subtract the hour and five minutes. And I run the process. I store this in a temporary place because I don't need that location in my ephemeris. So I set it aside into a temporary.

PG So now this is an original ... cut off vector that I had. And I'm propagating to a time at 6129. Okay, it says it's still one one, but it doesn't reach the first one, and it'll store back into the first one the original data it had, and then it'll store in some density models, solar flux used, the propagation constant that it needs... It'll store in there, and then the next record stores the location of the new position. At this point again, on back to the substitution I had to make K and Z equal. What I want to do is subtract the weight. I know that 8,2 which is the eighth element of the vector record is where the weight is stored, and I want to subtract the weight, and I'm going to simulate deploying the payload. So I subtract the weight. And I go back to one and start the position of the station. And now I'm going to coast it to do a burn. (pause) So I coast it for about a minute. And I'm going to do a burn. And this is the general purpose maneuver processor which shows me the new ... four bit orbit I incurred. Build the ... to give me a magnitude of the ... And some other information that generally, I'm not too interested. When I'm building my trajectory... burn time.

PG I generally rarely get on the machine and type anything unless I'm in a ... Very few times, especially if I'm doing flight work. Now I may set up a signal staple that says assign this value equal to this number. I'll go through semi-automatic mode. And so I'll step through and step through, and when it says find that number, then I'll try this and try that. And when I get it to where I want it, I can exit it out, I can edit my sequence table. I put the number I want in. And the number's in there and it's saved, so I don't have to go through that again in case I forget something. So on TOAST you can do the second burn. Yes ...

It's just the bottom line. I mean, if I have something wrong and they say, well, what happened. Well, if I was just hunting and pecking and typing, you're not going to be able to reproduce it. Of course there have been occasions with sequence tables that we've had problems. And you can't reproduce them. So, I mean, you can't get everything.

AM ...

PG Right. But I'm doing basically the same thing now that the node's 16, I'm using the same Univac(?) table. I'm just changing a parameter, and it's giving me a different location. So now instead of pulling out this node 6, I'm pulling out node 16, and notice I didn't even rename it. It's just going to pull a number out of a file, so it's called T68, but I'm using for 16 now. The file's named the same.

AM ...

PG Right. That brings up a good point. What I'm doing now, I'm going to list my main driver sequence tables and see more on that. I've done interpolate. I'm at the very last example so I'm just going to bomb out of here. Now you're talking about the name. (typing) You can see here that these are all interface tables. And with the interface tables, it's going to tell you what application software goes with it. And you can see here that I have one, two, three, four, five. I have five different interface tables and one application. Now currently in TOAST, they don't have that, they have one menu. You change it to get your numbers. But I've got several ... They do different things. In one case on this inbar, we've got one process that will only accept less than 50 records. So we have one little interface table that does the directories. But when you're doing your inbar, for your supertape input, you want 30 minute steps on there, and you get seven

hundred records. So that's a common where you're going to have two different interface tables. Of course you could have it set up to where you input the delta time, but sometimes it pays to have separate ones, so that you don't use the ... to get the change parameter and you run it again.

AM ...

PG Those are the number of interface tables I have, for this flight. This was taken from one flight, yeah. I did add a few things into it.

AM ...

PG It's probably person dependent. With a lot of the capabilities we had coming up with FDS recently, I would say that you could probably reduce a lot of the number of interface tables you have. You can use name substitution, you could set up generic interfaces tables, though you have to go through and assign everything. And to me that could get real confusing. I like to have generic sequence tables, don't get me wrong. But if I'm going to do TOAST burn, TOAST burn. I don't want to use the same burn for two of them, the same TOAST for all of those. But I want to have the whole thing set up where I can input any name I want. You could probably get by with one of each. But you have to be real creative, and it could get real hard real fast. So to me, you're buying back less interface tables but you're adding a glitch that may be hard to assure that you have the correct product. You may be assigned on so many different things that when it boiled down, you don't know what you've done. Well there's a happy mix in between there where you can set up generic sequence tables and you know that you can run a lot of things, minimal changing, but you can still have product assurance. Basically I have a generic thing that we were going to do that we have... I'm at an executive prompt. I can type question mark, those are all the commands that I have at this level. And say I want do a ... and I can with my online help.

PG Okay now, I've already shown you this.

LP And how often do you ... obviously get it ...

PG We have extensive online help for interface tables.

LP Help is sometimes helpful, sometimes not though.

PG I picked one that I'm not that familiar with, but basically I edited a default table. So what it's going to do, it's going to prompt me for all the parameters I need that aren't stored, it's going to ask me for. And all I have to do is type a question mark, name of the changes and the time line. So it's telling me by invoice something that DRDE does the large file. I could hit return, start, stop. So basically an area that

AM So you have the parameters for every line?

PG For every line, right. Now what I can do here, I can back slash, and I can list. So you can see what the interface table looks like basically. Also you can find out if you're still not sure from here, what data element or what variables it's prompting you for, you can look at attributes. And it will tell you the format of the variable ...

PG You see one through 679 here, okay, 17. 19. Well there's a parameter 18, but it's not required. It's what they call a missing parameter; it's an option. So I can do MO comma M, which is optional, and it will show me that I need 18. For this particular one that's the only one. Now I can do what she was talking about. Get a hard copy at this point. And prompt is ... And what this does for all the parameters in the interface tables - it tells me the size, rows, and columns, the class, if I need to know what type, time or character or a mixed format, I'll just explain mixed formats later. And here it's telling me is it an input or an output parameter, is it required or optional. And you can see that that one little 18 is the only option. It's an output, and it's an optional output. So that helps out a lot when you type something that says mismatch. Not right format ...

Okay, I've been talking mixed formats, well. We have a space, fixed number, fixed format that we can use. So I'm doing something, and I want to store certain numbers together, I have look through here, and say do I have an integer with two times the field of a real field. I'm looking at a real number with an open and close and an orbit number or something. So I have to look through here. And that's something I don't really like ... I could assign this three comma four with a real time, and that's a problem I don't format in. But these are inside to have a place for software, so they standardize. I'm not against standards, but I like a place to create my own if I have to. And the MO73, this right here times 7 repeating double precision, and you've got two integers and characters size 16, and double precision, and this is the basic trajectory. Trajectory and timeline format.

The format is three pages, and we only got one and a little bit. (typing) Okay, here's the MO73 TET that we've been talking about, where this would be the ohms two cutoff time. And I could look here, these are the solar flux, area CD. So basically if you know what you're looking for in this vast amount of numbers, you can tell what a person has done when they built their trajectory. And I capitalize on that later, on another sequence table I'll show you, but it lists your maneuvers, title, so you can step through, and there's a processor code, 502-10. That's a general purpose maneuver processor, so I can tell what software they used to go through this state to the next state. So that's also helpful when you're cuing to make sure the thing filters trajectory properly.

PF Now this is a standardized format that certain processors output from inputs that we give it, and then it's handed to other processors to manipulate it. And we can also manipulate this particular one directly because it's a data element. So when a model deploys, we go in and address the weight element directly and delta that weight, now that it's deployed. So we can manipulate this directly. Before it goes between processes.

PG I'm thinking sporadically here. I'm jumping back and forth. I'm hoping that you all will be able to piece this together. I think at this point I want to show you another sequence table that I've generated that really saves us a lot of time. Before I do that, I want to show you that we have the capability to look at who's on the system right now. I'm on the system. Pam right next door is on the system. GV is a guy in the Rockwell building. He's on the system. And HK, I don't know who HK is, but they're two batch numbers available. So I can look and see who's on the system at this time. I can't tell who's on the A system, so I can't really say that TOAST is going to have that capability because they're on workstations. And they're just going to read FADS. I mean to a certain extent,

we're distributed. There's people working on the A system, and I don't know how the workstation environment's going to be until we use all the system, how you can send messages back and forth.

PG We've been talking, saying I want to look at all the PF names that she has that have a three in it. So I've got a three here and a three here. So what I'm looking for, this'll work...

PG The fault we had here was we have a product that was called Sequence of Events. And the way we used to do business was we wrote out the sequence of events on a piece of paper. Turned it in to the secretary, and she typed it up. And she handed it back to us. Now when we wrote on the piece of paper, we collated, when she typed it and got it back we collated it. Now all the numbers are stored in the machine. But there was not readily a way to get those numbers and put them together in the format that we wanted. (typing) And basically that's the format. So what I did was

AM ...

PG Basically did all these sequence ... were just to do this one task. This is a generic sequence table and bring in your specific sequence information into this PG and run.

AM ...

PG So I've got what I called a driver sequence table, but basically that's two of them that are so long. I'm only allowed so much space in a sequence table. And I exceeded that, so I just went about half way down to chop it off, and I put this bottom half in a new name, and the very next person says do the second one. So that's kind of one way around it. Now this part is inputs. So this first part is tell me flight number, give me the delta v off that ascent piece of paper they had to deliver to us. Give me a landing time. And tell me if it's daylight savings time or not. So that was just the first part. (typing)

LP How do the sequence tables get ...?

PG I'll show you that in a second. Now remember I was telling you that inside that trajectory is that timeline. And that there were a lot numbers in there. Well I'm using that a lot in this logic here. I can tell myself well if there's a change in mass, I may want to pull that out. If I see that 5 O 22, which is the general purpose maneuver processor code. Well the maneuver has been done so I need delta d's, and I need orbit changes. So I can say check for that, and let's go off and do this. And the great number, I don't know what it stands for, but that means that you're done. That's the end of test. So after every processor runs, it puts this down. When you run another processor, right after it, it writes over that and puts what processor it is in that same location.

PG Okay, so I'm going to skip the inputs. And basically I made only a little menu. So it's going to take a minute to trace. (typing)

AM And you made your own little menus ...

PG Well here's my first code of my sequence of events. Basically these numbers are fine. But you know these aren't the right labels that I want to have in there. So it says well are there any changes that I need, so I type yes. (type) And I send out a response. (pause) Okay, now it tells me to input the event. So I know that I'm supposed to have a boy in here, so I'm going to say one, two, three, four, five, six of those. (type) What it does is see here's my little menu, what do I want to change, and then I messed up. Because I think it should have been insert an event after the one you choose. So I picked the wrong one. So what I'm going to do is take that out and I'm going to list ... I'm going to see where I can get back into this thing. How about 669. (pause, typing)

TALKING IN THE BACKGROUND.

PG Well, there aren't any changes needed. And I hit the wrong key. But I sure didn't want to add something because I didn't have the brains to think it had a delete function in there. So if I added something, it really goofs me up. I just found out and since I wrote this I knew where to go find out. Right now we're undergoing having all these flowed out. Flow charts, documented so that they're more user friendly. Since I've written them, I can use them fine. But other people, if things don't go just perfectly right, they have problems.

AM ...

PG When I run a sequence table, I'm not specifically doing a save. I have a work area, and while I'm working everything is in my work area. Now when I get ready to get off the system, I better save, because when I sign off that's when I lose things.

LP This, does this kind of ... that a user might want to do in order to be able to have ...

PG Right, I mean I could.

LP Kind of like an existing kind of of user special detail

PG Right.

LP of capability ...

PG Right, because the thing is that I could have written in a request to have some software person downstairs create a black box that would do this for me. When would I get it? '92, '93. I loaded and had it working probably in less that 3 days. I'm not saying that somebody that's been here for 2 months could do that but it's working now, granted someone might pull up their flight and it may not work. I can't plan for everything. NO one can. The black boxes can't prepare for everything. So you use these under stipulations that they work for the majority of the flights, but that they will not encompass everything. And running in three days, now they say okay, we liked it. If they want to put it under configuration control and go have the black box written, that's fine. But I didn't have to wait three years to see the end result. I had the flexibility to come on and get my product. And that's the same with that Ulysses launch window we showed. We didn't have time to wait for a software modification for our black box. So now I can come through and say ... And I didn't look at this. And notice at this point I have to type EX. We have a new capability that you have a

sign prompt; just type it in, hit return, and it will progress. So now it's asking for which I want to do. And I want to insert an event after this. ...

PG It'll prompt me for it. For everything. Basically I forgot to pull time so I'm just going to do it for three hours. It's going to ask me for a Delta V, there's no delta V involved, in the deploy at the deploy vector. I had my maneuvers later on. So I needed a way that I could lock out. So I decided that I allocated this delta V to a certain field length. So all I do is I just put a number outside this field length and it's going to give me a ... so that's my way around. Arithmetic. (pause) Oh, see that was cute. So somehow I typed the wrong number, so I lost everything. That's one of the points, that it's not that user friendly or if something goes wrong in the typing the EX and the things, that adds room for error. And that's why we're going through this at this point. And I don't have the time to do it myself. And some of the new people that don't understand the system as well, they learn the system, they learn to do capabilities we have. They're learning how to use sequence tables, and they're updating. And blowing these out. So it serves several purposes, and I don't have to worry about it cause it makes me happy. But what else you want to show them, Pam?

PG What else do you have questions about?

AM Capabilities, so we see ...

PG Right, I'll tell you this right now. This is clumsy, okay. The way I had to do this is real clumsy. Now supposedly I don't know if TOAST or FADS, we will have a document generator type. From what I understand in TOAST is that any number that shows on the screen is stored in the file. And I don't know the gist of how they're going to pick it out, but I foresee in TOAST or in FADS saying I need these numbers, these numbers, these numbers, and these numbers. And I will call up my document generator, and I'll say I want to put these in this position, and these in this position and these in this position. When I type run, it prints this out. And that's quick and easy. That's not going in and looking at this processor code, and this goes to this, and this goes to this file. It took a lot of thought and effort to make this thing work. And I still feel that it's real clumsy. You just saw, I typed in one 9 too many, and I got an arithmetic fault. But if it bore the whole thing and I lost half my display. I don't want them to tell me though that you have your document generator so you lost this capability. Because in that document generator plan for everything that happens. I don't think so. I still like having my write command that I can put in a sequence table as a backup. Because you know, I'm used to the flexibility, and I don't want you to say we'll give you this black box, and you don't get that requirement. It's like give my requirement and give me the black box, and I'll decide if you can take it away from me later. I don't want to be caught short.

PF [It's a difference between the] real-time folks and the design folks. And the design folks need more extensive capabilities. The real-time folks may not need this. They may just need the black box and product

BW You've got your senior people who are very knowledgeable in the system, and when somebody comes in with a what if analysis type problem, those are the people who give them this, and they'll whip out something if it's not already there. And then you've got your standard production type things. You're going to give those to the less experienced people who will run the recipe type things

more. And they'll be learning how to do some of this more extensive analysis. But until that time, they're not going to be doing these kind of things.

PG I can't speak for everyone in our area. But you've got some people that have a very limited computer background. And all they want to do is tell me, let me use this black box and this black box. They do very basic things, they don't like computers. They do just what they need to do to get the job done. And then you've got people that want to use this system to the limit. What can this thing do? Can I improve the associate? And that's in one community. You're talking basic design and real-time, different ways of doing business, that are trying to mutually grow with some of each other's requirements. I mean, they use menus, I love menus, give me menus. Give me a full screen editor. So I think that merging is fine; it's just levying the requirements to suit all. And I said how I have a problem with that. And I think it will work out.

PG Editing wherever you get sequence table, that would be pushed. Okay, I'm going to edit. Since I don't have an old, I'll leave these old things blank, hopefully I don't have one made. Oops. So I'm just saying edit no old names. So give me a sequence table called time. (pause) I have a line number, there I am. Now, what I could do, I could say node, I did it wrong. I just hit return. I can stop, I can loop. Now I have a little subroutine somewhere in another sequence table that might work out real well here. So from sequence table called SEQ, I'm going to insert lines 20-100. Now I can put a comma here, and I can insert in between 10 and 20, or I just leave them blank. Now you do realize that it's going to be barbed cause I don't know what 20 - 100 was, but it's not going to look like. But let's see if it's going to work.

LP Do you have this idea in your head somewhere ...?

PG Okay, ah, well,

LP ...

PG You could do that. What I would do is I've taught sequence tables and I'd say it might be in a local one so I can list from sequence tables, and there are some routines in there. I just want the whole thing. I can type insert with the name, and it types the whole thing. Or I can just take a few line numbers out of it. There is a capability called cross references. But it is a node cross reference sequence table for a particular data element. Especially if you don't know the name of the sequence table. Because what it does, it goes through all the sequence tables looking for that data element line by line, and while it does this, for some reason it locks up everyone else on the system.. It's taking all the CPU.

LP (laughs)

PG It is one of the things you don't want to do because when people find out, they get real mad at you. It works real well if I have a lot of interface papers. So I want to cross reference the interface tables. I don't want to look at all of them. I had two pages of interface tables. I messed up. Cross reference. (typing) And of course this is one of those deals. It's telling me I don't have any interface tables in here; this is just a production piece. So if any comes in handy, I have forty interface tables. I only want to look at the ones ... what did I name it? I could cross reference IP, and now we have a new command that I can talk for new elements. So I can say, talk all the interface tables for new...

MANY PEOPLE TALKING AND LAUGHING IN BACKGROUND

PG If I show you, this is a good computer. Back to the old sequence table, so I can do this now, and of course I input a bunch of garbage. Okay, now if I exit this, now I'm going to do a table of contents. You notice that I have one that doesn't have the date at the top. Because that's a new one, when I substitute, or store without it, the system called it back up without the date and time on. But now I want to look at the new one. It doesn't give me all the old ... I'm going to look at all the data elements that are here.

AM Would you lose the sequence if you lost power?

PG Yes, if I got off right now, if we had a power surge, that sequence that I generated, it's not around. Okay, I have to do a save, or what's called a store or substitute. If it's something I brought up and I want to give it a new name, I use store. If I already have something there, I can use substitute. And I can do things like append, if I just bring over a little one, then I don't have all of my PG, and I change something I can append it back into. So there's several.

AM As long as there's something not already named

PG Yeah, if you append, it can exist in there already. That's something new.

AM ...

PG ... Commands that are available to you will change...

PG Do you remember that little message that I had them put on? Where's bang bang. I got it. I want to list the schedule and I already cleared it. What's it called? (pause) Yeah, but you've got to have the master data. Right here. Well, get a hardcopy. We had them put a schedule on the system. And I seemed to have gotten rid of it. There's a little message when you first sign on, says, if you've cleared, you can type this and get the schedule back.. But I don't remember it. (pause)

PG Anyway that's a copy of our schedule. It lists the A, the B, and the X. In all the schedules of all three machines. Because if the B's down, you can't get to the B system. So you can go to the A system to find out if the B is scheduled to be down, and if it's not, you can tell them the B's down. So they schedule block time and things like that. So we have an idea of when we can work and when we can't.

(pause)

PG We've had our share of difficulties. All in all it's been a long time, and it wasn't so much the Perkin Elmer as it was the lines from the Perkin Elmer to the Rockwell building. You've got lines and black boxes that join this and that. Ten black boxes, and each company owns a different one, and you got a problem, it's not my problem, it's that box. You just went down the line. Finally we got some coordination together. It took about two months, but we went down to zero one day, with no computers and when that happened we got some demands for ... and I can't remember the last time I wrote a DR on that. We had some disks last

week that a disk pack or something, they had a failure on. They took the system down, and they had a spare. They brought it back up and maybe an hour down time one machine that, we had some critical work, transfer it. So they give you enough time to get your stuff from one machine to another for emergencies. So it helps. I don't know what they're going to do about FADS when they have a disk that has bad node. Are they going to have backup nodes? See

PF I think the backup from what they were telling us archive ... You can have a set up you know, ...

PG Yeah, if I'm sitting here working, and I delete my PG and I say, oops. They have backups. I can call up and say, I need the last backup you did. Of course, it won't have all my information there, but I'm not starting over from scratch. I may have lost a week's worth of work, but you've got to pay some price. They can't do instantaneous backups. So

AM I was just curious. I really [...question about reliability]

PG We have our share of that from time to time. But another good one is three day weekends. It's always a good point to take vacation after a three day weekend. For some reason, I don't know if they always turn the electricity off in the building on three day weekends.

BW Not always, there's two a year. So that some of these people over here at JSC, Perkin Elmers are over here.

PG Right

BW Use the three day weekends and one of them ... Maintenance on the electrical system. Half the building on site will be without power and all the computers in those building, you better shut down gracefully, before the weekend times goes.

PG Well usually it's like Perkin Elmer has a 48 hour battery. But it's always that 3 day weekend. And so we always generally have problems like that after they bring the power down. Now I'm not sure the power surge will do that. We had a move one time. They moved some computers and they put a plastic bag around something and moisture filled in or something blew up. We're not without our share of problems.

AM ...

PG Yeah, we had a hurricane--it's like protect everything. They bagged it up. It got moisture in there, they turned the switch back on

PF Did they lose power or just shut everything down?

PG I'm not sure, but I don't think any system is without its problems. But I don't know.

AM Do you have any more questions?

PG I think it's a flexible system. We can get the job done. ... I'm up for more requirements. Give me what I got plus menus, full screen editors. Hey, I love it.

LP What else, what else, keep those requirements coming. What else.

PG What I have... I'm not the kind of person that thinks of new things. I know what I have now. And there's some things that I would like to see.

LP Okay.

PG I don't think that is god. This is what we have, we don't need anything else. This will do everything for us. I don't believe that. I've been here four years, and I've seen this company of scrawny little system I thought wasn't working much. I like it now. You know the many new capabilities that we've gotten. It's been phenomenal.

MANY PEOPLE TALKING AT ONCE

PG We're waiting for 28.0. And about five or six executive releases.

BW My point is the Perkin Elmer design system is 12 years old. We started working here.

PG Right. But you talked to some of the, I'm not going to call them dinosaurs, but some of the very experienced people that used to work at NASA that now work at Rockwell. That designed the FDS back then. And they didn't want you all to have that back then. They didn't want the users to be able to do that. And then one of the things that they purposely didn't design in the system that now they're saying, yeah, let the users have that. And it's turned into a great system.

LP (laughs)

PF One thing about the interface system. You know a lot of the stuff when you get like these faulty LAN ... But they're just data only and you can manipulate that. It tells them a default. But if you need to change that you can. The ability is out there to do that. Where you keeping saying it directly affects those models and things. Tracing ... so it comes up as default, and you know that's fine and dandy, but if you want to get on there and do something quick. The ability is out there to do a lot more if you need to.

(pause)

LP Okay

AM Anything else. Well, thank you very much.

PG I kind of feel like I got scattered. I started jumping around. I had this piece of paper here that I was to be so logical about.

AM I think you gave us what we needed.

QUESTION IN THE BACK

PG Yeah, cause I actually showed you how I screwed up and lost something. (laughs)

PF That's right. Day to day activity.

BW Did you reload the disk when you started over?

PG Okay, if you want to bring that up, I can do this. BES, BE. I'm going to delete all the the data elements. As long as you get it. What was your BD called, Pam? ULY O3C1. (pause) So I'm getting all my.

PF ... names. slashes dots and dashes.

(pause)

PG Just get all the data elements.

PF Is that all.

PG So that works. We go from one cycle to the next, and it's basically the same. These times may change a little bit. So you bring up an old one, and you might just edit or run the whole thing over, or you just needed options there. So usually I have the generic sequence tables so that anybody can use this, but I'll bring the generic over, throw my data in, and rename it for that flight and cycle. And then later I'll purge it. So

AM Do you have to allocate it first?

PG Well

AM and then you have to assign a value to it, and you have to ... But if you have used that counter it's a global variable. ... so you use it ...

PG Here I have I and J. And that's something else,. This sequence table is almost at maximum length. Okay when it gets to about one and half pages, you're looking for trouble. But if I can edit, then I'm going to say, let me change, the PG, so everywhere there was a J in my sequence table it's going to change to PG. So with the exception of our monitor, I think that's the only ... It will do anything for you. Then if I decide that I didn't even want to do that, all you've got to do is flush that out. It didn't change anything. Exit it. It would have saved it in the A. What's that called?

BW In TOAST, it's called section data.

PG Well, it's not permanently saved. If I called that sequence table up and it had those numbers in it, but ...

AM It's a work area, so it's not save.

PG Right, it's a work area.

AM You could actually leave out of the work area and go back out and

MANY PEOPLE TALKING AT ONCE.

PG That's about all I can think of.

LP Okay, thank you

AM Thank you. And you also had off camera Bruce Williamson and Pam Fisher. Even though we didn't get them on camera. Thank you very much.

PG Here's a bunch of papers.

AM I appreciate it.

BACKGROUND TALKING

PG I tried to ... topics of what? I have two of these, Dave Shipley quit and left me his brief book, so I have.

PF So do you want to give her this and then you can just bring the other one back up here?

PG Well, see I have this. I don't know if you've seen a blue document about this thick. And I think it's to like learn FDS document. I think it's what they give the training people.

AM No, I haven't seen that one.

PG I've got those two documents, and I was going to bring those over here, and Kevin said wait and get all, and I don't know if someone's supposed to talk to them, if I am or Cathy or someone is supposed to talk to them to see what kind of documentation

AM We're still recording.

PF Oh, okay.

PG But Kevin was just saying wait and give it all to them at once.

AM Oh, alright, well, this was written in 80. So there are new ones? Is that right?

PG No, that was updated in 80.

AM Updated in 80, I'm sorry.

PG This document was written before one line of code was written. Okay, this is what I'm told. I wasn't here. Well from what I'm told, they sat down and wrote it all out and then this document was written before one line of code was written.

AM Do you have dates for that?

(pause)

PG Cause it's not recent. It's like ...

PG It kind of describes the structure ... Are the some things that have been updated and ...

B ...

PG Well, they're not looking for a copy of the processor documents or anything like that?

LP No no no.

PG I think that this book, and I used the documents. Somehow it landed on my desk, but I think it's not very big. It explains it and I think

PF It probably runs through a lot of the processors too

PG I think it's our trajectory design class.

PEOPLE TALKING AT ONCE.

AM We're looking for the functional environment. ... The kinds of things that you do and what you need. Some of those ...

PG I just went back over 5 volume set. I think that is was the original FDS user requirements. And I got them and delivered them to a user person downstairs. Because that was all I wanted to look at. So they have things like that obviously, they have an old archive around here somewhere. It took me about a week to get it.

LP Huh?

PG And I don't know if that's what you're looking for or not.

AM Right.

PG So you're looking for system requirements. I'm sure we could find that.

AM Are the user guides, this is the

PG This is the user guide

AM I mean this is probably for you guys?

PF It would give you a real feel for what's going on

AM Right

PG Are they still publishing that book?

PF I don't know. I thought so. Yeah, I guess they are. But are you all going over to RSOC later I guess?

AM We may go over there tomorrow.

PG Yeah, I can talk to Bruce about that.