

**Appendix C: Operations (People, Process, Technical) - consolidated 31, 32, 33**

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<b>Tagline</b>	<b>Theme &amp; Tags</b>	<b>Presenter</b>	<b>Abstract</b>	<b>Find It Here</b>	<b>Index</b>
Develop an inclusive decision making culture	MMT Process Improvement - Decision Making	Wayne Hale	Clearly, The Mission Management Team (MMT) was a place where senior managers and NASA could come together and review the progress of the mission, but the decisions were all made by the chair.	11937 - Mission Management Team Changes Post Columbia Clip: Context; Time marker: 00:45	31
Recognize and critically assess the dynamics in mission critical decision forums - Little Give and Take	MMT Process Improvement - Decision Making	Wayne Hale	In fact, the Mission Management Team is almost exactly the same team that participates in the flight readiness reviews and the other pre-launch reviews the ET, SRB made and the orbiter made reviews that lead up to the flight readiness review. Effectively the same people doing effectively the same things, and those processes I had known for some time, and anybody who participated, knew for some time that they were troublesome. There was a lack of "give and take" in those meetings.	KBR 11937 Clip: Context; Time marker: 02:00	31

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Recognize and critically assess the dynamics in mission critical decion forums - Intimidating Forum?	MMT Process Improvement - Decision forum dynamics	Wayne Hale	They were typically large meetings held in a big room and the culture was if you are not an expert in the particular topic that was being discussed, you didn't participate; you didn't speak up, you didn't ask questions.	KBR 11937 Clip: Context; Time marker: 02:20	31
Recognize and critically assess the dynamics in mission critical decion forums - Stilted? / Heirarchal?	MMT Process Improvement - Decision forum dynamics	Wayne Hale	It was a very strange and stilted culture that was going on, very hierarchical; not much discussion. It clearly did not allow for input of many, what we would call dissenting points of view. There were other avenues and certainly people use the social network and those sorts of things to talk about these issues outside the meeting, but the meetings were stilted and formal and hierarchical.	KBR 11937 Clip: Context; Time marker: 03:15	31
"We knew we had to change the culture"	MMT Process Improvement - Decision forum culture	Wayne Hale	We had a number of senior managers that had been brought up through the NASA human space flight system that had very hierarchical points of view and we knew that we needed to change that culture.	KBR 11937 Clip: Mitigation; Time marker: 00:40	31

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Implement training in interpersonal interaction - II	MMT Process Improvement - Decision forum participant training	Wayne Hale	We had a Behavioral Sciences organization come in and sit in our meetings and watch our behaviors and then give us feedback. You had to say "please and thank you" and be polite. Some of the old-line managers had a real problem with that attitude change because coming from an almost military, hierarchical, we're "all about the facts" and "we don't suffer fools gladly" type of organization, it was difficult to sit and listen.	KBR 11937 Clip: Mitigation; Time marker: 04:10	31
Implement training in interpersonal interaction - III	MMT Process Improvement - Decision forum participant training	Wayne Hale	We developed a plan to train people [to be on the MMT] where they had to actually read some material, they had to observe some MMT's doing what we call "on-the-job training", they had to take some class work to be prepared and then they had to be formally certified.	KBR 11937 Clip: Mitigation; Time marker: 05:30	31
Implement training in interpersonal interaction - IV	MMT Process Improvement - Decision forum participant training	Wayne Hale	Part of the training was this culture change and that we're going to speak up; we're going to poll everybody. We're not going to throw people out of the room.	KBR 11937 Clip: Mitigation; Time marker: 06:00	31

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Recognize social dynamics within the decision forum	MMT Process Improvement - Social Dynamics	Wayne Hale	As a manager, a leader or whatever in an organization you need to understand social skills and you need to be proficient in them because they are equally important with the technical skills. You will not make good technical decisions if you are a poor people manager and you don't understand how to communicate and engage and motivate and really relate to people and hear what they're having to say.	KBR 11937 Clip: Lessons Learned - Culture Change; Time marker: 03:50	31
Take the time to communicate effectively.	MMT Process Improvement	Wayne Hale	Communication is the key element in that and it is a human, not a technical, it is a human interaction thing and you have to take the time to develop the networks and have the rapport and listen more than you talk to have good communication	KBR 11937 7th Clip: Communication	31
Recognize the developmental training embedded in flight test experience you test the hardware	Ares 1-X Training the team	Steve Davis	The flight test itself, beyond the fact that you learn so much about the vehicle, which is the reason why we really did it, just training the team and training the personnel was incredibly beneficial. That was as beneficial, in my mind, as actually learning about the systems.	Ares 1-X: Clip: The Importance of Flight Testing	31

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<p>Select and train crews to have broad basic skill-sets then provide just-in-time training for specific tasks</p>	<p>Training / People / Skill-set</p>	<p>Don Pettit</p>	<p>First of all you have to have a good skill set. Maybe you don't know how to use a special microscope but you know how to use a standard microscope, you can take your knowledge and skills and apply it to the new event. You don't need to have a class on how to use the special microscope in order to figure out how to use it, but you do need just in time training – watch a video or read a background paper after that you can jump right in and use it. With good background skills and just in time training you can get it done expertly.</p>	<p>ISS Video Dashboard Don Petit Clip 3</p>	<p>31</p>
<p>Provide crew with hands-on electrical and mechanical skill development training</p>	<p>Training / People / Skill-set</p>	<p>Don Pettit</p>	<p>Something that occurred to me after my last mission is probably 80% of what we do on orbit could fall under the realm of mechanical or electrical skills for repair and maintenance .... so I would say that say that sending astronauts to emersion training on the T38 aircraft with a certified mechanic and spend a week in the avionics shop a week in the hydraulics and engine shops and then we will spend time on the hanger floor doing maintenance on the airplanes and then the three weeks of training you get more mechanical training than you would get for years of training for a ISS mission ...</p>	<p>ISS Video Dashboard Don Petit Clip 4</p>	<p>31</p>

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Provide high fidelity training and simulation mockups	Training / People / Skill-set	Don Pettit	For the space shuttle,.... we had outstanding simulators and that was a well-oiled mechanism, but if you look at ISS in a six month period the configuration of ISS can change because rack and pipes and plumbing can be changed – its ever changing which is good but it makes it hard for the simulators on the ground.	ISS Video Dashboard Don Petit Clip 5	31
Minimize crew training template. Cover the critical systems, then supplement with JIT	People / Just-in-time training / operations	Ginger Kerrick	We create dedicated packets of review information that we would send up to the crew prior to executing a specialist-type task. This would include PowerPoint presentations and videos and things of that nature as if you were sitting in a classroom environment down on the ground except they'd be performing that training on-orbit. So we call this "just in time" training and that is a concept that we are now looking at implementing and expanding the use of onboard ISS and we think it would be a very good starting base for training for exploration as well.	ISS Video Dashboard Ginger Kerrick Clip 4, 4:00	31
Form a strong bond between team members	Dedicated workers Teamwork	Ben Greene	By forming a cohesive team for the RCC repair task, even after some members left the team or moved on to other tasks, as repairs were required we always had members come back to help out with the repair when needed. This was a team across multiple disciplines in the community that worked well together and it showed in the high quality of the work.	11934 – on orbit RCC repair – Organization and teamwork	31

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Opinion overload may create impasse	Minority opinion, risk	Lora Bailey	I would say that our sensitivity to risk had in some ways actually hamstrung us from being able to proceed in a more aggressive approach or at a more aggressive rate schedule wise than we might otherwise have been able to do. Because we were operating in this environment where we wanted to make sure that everyone who had an input got to have their input and that we addressed every input. And so it was a little bit where the pendulum swung to one side and it was so far over that you nearly at an impasse to some degree.	KBR 11938 Clip: Context; Minority Opinion-Time marker: 1:41	31
Leverage external experts	People Success	Karen Lucht	The second really important piece is realizing that you don't have to do it all yourself. So about 6 months into it we started to realize hey there are experts out and I think it's a NASA Shuttle culture that we manage the program so we want to do it ourselves, but realizing there were many experts out there that we were able to leverage their knowledge that they already had there.	Space Shuttle Transition and Retirement Lessons CLIP 2 Roles and Responsibilities: Time Marker 3:31	31
Engage your people		John Olson	You've got to have the best people you can, engaged through that communication and through that plan. But you've got to put trust and responsibility and hold your people accountable, and then they will just amaze you.	Space Shuttle Transition and Retirement Lessons CLIP 9 Top Three Lessons Learned : Time Marker 1:21	31

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Brainstorm everything in assessing critical decision forum effectiveness	MMT Process Improvement - Decision forum evaluation	Wayne Hale	We literally brainstormed everything that we could think of that would improve the decision making, retrain the managers, and address the perception problem.	KBR 11937 Clip: Mitigation; Time marker: 01:50	32
Bring in outside opinions and consultants	MMT Process Improvement - Decision forum evaluation	Wayne Hale	We hired various consultants.	KBR 11937 Clip: Mitigation; Time marker: 02:00	32
Implement training in interpersonal interaction - i	MMT Process Improvement - Decision forum participant training	Wayne Hale	We put all of our senior managers through what used to be called a "Cockpit resource management" which is a training that NASA developed with the FAA for airline pilots and air crews.	KBR 11937 Clip: Mitigation; Time marker: 02:10	32

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Rethink communication modalities and effectiveness	MMT Process Improvement - Risk communication	Wayne Hale	We had Dr. Tuffte come and do his course on presentation materials. It did point out that some of the things we were doing were pretty horrific in the way that presentations were put together. It encouraged people to do more "white-papers" than PowerPoint presentations.	KBR 11937 Clip: Mitigation; Time marker: 03:30	32
Listen for weak but important signals	MMT Process Improvement - Leadership	Wayne Hale	We specifically trained our leadership to try to listen for weak signals and to understand that just because someone is not presenting very coherently or articulately doesn't mean that there isn't a concern there that we need to address.	KBR 11937 Clip: Mitigation; Time marker: 06:45	32
Provide critical decision team participants with contingency response exercises	MMT Process Improvement - Decision forum participant training	Wayne Hale	We subjected the Mission Management Team to a number of integrated simulations, stressing problems that were related to TPS damage and those sorts of things but also including other unrelated problems. They were very effective; they made us think as a group, they educated the team on the entire operation, and folks that were not typically involved in the mission execution phase of the flight became very involved and actually, by virtue of being trained, smart, observant managers, provided really some key insights to the operations team from time-to-time on how to solve problems.	KBR 11937 Clip: Mission Simulations; Time marker: 02:00	32

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Ensure the critical decision forum is an inclusive, positive physical environment	MMT Process Improvement - Decision forum environment	Wayne Hale	We rebuilt the Mission Management Team room. We decided we needed a bigger room. We needed a video conference. I was particularly adamant that we needed a round table; I didn't want to have a head of the table.	KBR 11937 Clip: Mission Simulations; Time marker: 03:00	32
Be wary of embedded assumptions in a critical decision environment - such as "there is nothing we can do"	MMT Process Improvement - Embedded assumptions within the decision forum	Wayne Hale	At all levels, management shut down these kinds of "let's try something" discussions with this "Well, there's nothing we can do" phrase. After 107, we took that out of our vocabulary. We are going to try to do something. It empowered people that had ideas and had concerns to come forward and express them. So that little culture switch that got flipped right there was really very critical. There is always something we can do.	KBR 11937 Clip: Lessons Learned - Culture Change; Time marker: 03:00	32
Recognize the reality that an operational decision must be made - the least imperfect decision being the goal	MMT Process Improvement - Decision Making	Wayne Hale	We tried very hard to make people learn how to play nice together and in that way I think we over did it. There are some people that are never going to be satisfied. At some point you have to decide "Have we done good enough?" It is never going to be perfect. And that is the real heart of the whole thing.	KBR 11937 Clip: Lessons Learned - Culture Change; Time marker: 06:00	32

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Actively seek participant input in critical decision forums	MMT Process Improvement - Decision Making	Wayne Hale	The communications emphasis that we had on the MMT was that we called on everybody. So everyone was told that they were expected to participate in all discussions, every member of the MMT.	KBR 11937 Clip: Lessons Learned - Communications; Time marker: 01:10	32
Build in a break to enable informal reflection and discussion prior to a decision	MMT Process Improvement - Decision Making	Wayne Hale	If we're discussing a difficult situation that's going to have complex ramifications, after looking at all the details, we're going to take a break. After that we would have the chair propose a course of action and then say "Now let's take a break and everybody go think about that." Go poll your delegations, go out in the hall and see if you have any more questions. Let's walk around and talk about it. So you get out of this formal, stilted hierarchy where we're all sitting around the table looking very solemn.	KBR 11937 Clip: Lessons Learned - Communications; Time marker: 03:30	32
Demand cogent, clear, thorough presentation of safety critical information	MMT Process Improvement - Mission critical communication	Wayne Hale	It's not just PowerPoint or bullet charts but it's the mentality behind we have to cram very complex subjects into the fewest number of English words humanly possible. That's poor communication technique.	KBR 11937 Clip: Lessons Learned - Communications; Time marker: 08:20	32

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Engage independent engineering and SMA organizations in identifying and assessing risk	MMT Process Improvement - Risk Management	Wayne Hale	We used these independent technical authorities, like Safety and Mission Assurance organization, like engineering organization, to help us categorize the risk, not just in this technical sense, but in this likelihood versus consequence base, and try to deal with them in an appropriate manner.	KBR 11937 Clip: Lessons Learned - Assessing Risk; Time marker: 03:00	32
Remain vigilant - stay worried about what could go wrong.	MMT Process Improvement	Wayne Hale	It takes vigilance, and that's what I would like to pass along, probably as a parting word, is you have to be vigilant. You have to always suspect that you're not as smart as you think you are, that things aren't going as well as you think they're going. You have to be hungry and worried about what could be going wrong. Those are the real keys in a high risk, high reliability organization, is you have to always be worried about making a mistake, about having an accident. That leads you to stay on your toes, being hungry, being vigilant, and if anything, that will prevent the accident that you're worried about.	KBR 11937 Last Clip: Key Remarks for the Future 1:20	32
We can do it - but we should minimize on-orbit assembly	On-orbit assembly	Mark Geyer	So I think we learned a couple things, we learned we can do, we absolutely can do complex assembly. I think in my mind, we also learned that we should avoid it when we can. So I'm a big fan of the big rocket because we should minimize this assembly because it adds risk every time you do it. But even with the big rocket we're going to have some. And so when you do that you need to lay out your plans, you need to figure out	ISS Video Dashboard Mark Geyer Clip 8	32

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			whose the responsibilities are, then you got to figure out a reasonable test program on the ground to flush it out.		
Prepare for and remain flexible enough to reformulate research questions	Crew / people / training / skill-set / Frontiers	Don Pettit	for me a frontier is a place where your normal intuition no longer applies and the answers are no longer in the back of the book.... Here is the irony – you go into a frontier with a set of questions, you figure the answers out and after you look at the answers you say “we asked the wrong questions” and so now you formulate a whole new series of questions	ISS Video Dashboard Don Petit Clip 7	32
Change your plan	Planning Processes	Jonathan Krezel	Unanticipated consequences, your refinements and estimates are going to change. What are the processes you’re going to leverage to make continual adjustments to your plan? Do you have to have rigorous documentation of those processes? Can they be handled more informally? That’s going to change depending on the circumstance. Who do you have to interact with? Whose approval or consensus do you have to gather to make changes to that plan? How are you going to gather that consensus? So you have to think through your processes.	Space Shuttle Transition and Retirement Lessons CLIP 8 Top Three Takeaways: Time Marker 1:28	32

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Practice, Practice, Practice	Critical Lifting Operations (Orbiters)	Stephanie Stilson	So the key lessons that we gained from this task was how valuable and important it is to do a dry run to begin with and while you're doing that go back and look at those procedures to see if you need to make changes that make it more understandable for the current culture that's working on that... we had public affairs film our dry runs....	Space Shuttle T&R Practice, Practice, Practice (Stilson Clip 4)	32
Always have a Plan B and periodically reevaluate your Plan B	Operational contingency planning, risk management, ISS	Kirk Shireman	...the message here I think, or the thing to think about, is focus on the contingencies depending upon the phase of your program and know that they're going to evolve over time. So, when your program reaches another phase or about to enter another phase need to go back and reevaluate what are the contingencies	Space Shuttle T&R Shireman Clip 7	32
Challenge the requirements	Verification	David McCann	You got to challenge the requirements as you develop hardware. One early requirement that was levied on the SARJ was that we shouldn't have any liquid grease in the system. Many times in the development of the program there were suggestions that they move to a grease and that was always discounted because of this requirement they had to not use liquid greases. What it turned out to be was there was no hard written down requirement like that, it was just always believed that you shouldn't be using liquid lubricants.	KBR- 11825 SARJ Vibrations Pose Risk to ISS Power and Operations	33