

INTERVIEW WITH

# Michael Coats

BY DON COHEN

Former astronaut Michael Coats joined NASA in 1984 and flew three shuttle missions before leaving the Agency for Lockheed Martin in 1991. He was appointed Center Director of Johnson Space Center in November 2005. He talked with Don Cohen in February 2006.

**COHEN:** Johnson has major responsibility for the Crew Exploration Vehicle [CEV] and related work. What is your role in making these things happen?

**COATS:** Our first priority is to fly out the shuttle safely. When that last one rolls to a stop, I'll feel good if I can look back and say I had something to do with that. Operating the space station is important to us. We'd like to finish building it and start the real science with a much larger crew up there. Now we're starting the Constellation program, which is the future of NASA. The exploration program is exciting for us because for the first time in maybe forty-five years we've got clear direction from the president

and administration and Congress about where we're trying to go. Just to know that we need to go back to the Moon and learn to use it as a test bed to get ready to go to Mars is exciting. My job at the Johnson Space Center is to make sure that we—3,000-plus civil servants and 10,000 contractors—can support the programs here and learn from each other. I hate the word “synergy,” but that's what we're looking for. How do we take lessons learned from the shuttle and station and forty-five years of experience and apply it to Constellation?

**COHEN:** How do you make sure people learn what they need to know from the people who have important knowledge?





WHEN YOU'VE BEEN **up there**, YOU START **thinking** MORE LIKE A **member of the human race** THAN AN AMERICAN...



**COATS:** One big challenge is making sure that the experience that we have accumulated doesn't walk out the door as people retire. Fortunately, the people who have worked in this business for decades love it. I've had most of the former center directors in here so I can pick their brains. Every one of them is dedicated to the space program and proud of what's been accomplished. They've had very productive and satisfying careers. Starting from scratch and landing people on the Moon in eight years—the blink of an eye—was amazing. And they had no infrastructure. They had an open checkbook, but they had to invent everything as they went along.

**COHEN:** Their Apollo experience is going to be useful for the CEV.

**COATS:** Mike Griffin calls the CEV "Apollo on steroids." We're taking the lessons learned from Apollo as well as the Soyuz program and applying them along with our operational experience on the shuttle and the station. I need the shuttle folks to work on the shuttle right up to the last flight, but I also need to draw on their experience as we design and

build the CEV. So I'm going to co-locate those folks. My support organizations, like finance and procurement, are going to support both programs so that they're married as much as possible. We've also got a fantastic mentoring program here with over 400 mentors and 600 protégés signed up over the last couple of years. It's working very well.

**COHEN:** The mentors are actively engaged in program work as well as mentoring?

**COATS:** Yes, they've got their regular jobs. We send them through some training so they know what to expect. I've got people who are both mentors and protégés. Contractors are doing the same thing. The whole aerospace industry is getting pretty senior, so we're worried about the knowledge walking out the door.

**COHEN:** My sense is that mentoring usually works better than documents at passing on that knowledge.

**COATS:** One frustration is that we do a good job of documenting lessons learned—we've developed fantastic

books of lessons learned that we put on a shelf, and no one uses.

**COHEN:** That's an almost universal story in organizations; it's easier to collect information than have people use those documents.

**COATS:** And they tend to disappear over time. I lived through the Challenger tragedy. We learned a lot then and tried to document it, but after Columbia folks had a hard time finding that information. We're trying to figure out a way to make sure that the final reports on the Columbia accident will be readily accessible to somebody down the line—hopefully a lot of years down the line. With the Internet, all you need to do is Google a few words and print out all the information you want. We ought to have a similar database available for the space program, but how you go back and capture what was done for the last forty-five years is a challenge. If you're an engineer designing a reaction control system for the CEV or the lunar lander, wouldn't it be nice to type in "reaction control systems" and call up the history of all the space programs, including Russian vehicles, so you don't have to reinvent the wheel? It breaks my heart that something like the Apollo fire happened to the Russians several years before it happened to us. It would have been good to learn those lessons before we paid such a steep price.

**COHEN:** You can capture important data in a system, but what about the subtler stuff that maybe mentoring and experience teach more effectively?

**COATS:** I think both government and industry do a good job of training and educating people through formal programs. The government has excellent program management classes, but we don't do as good a job making sure they have the breadth of experience they need to step into a program-managing job. If a person is in engineering or operations or safety or finances, they tend to spend their career there. There's nothing wrong with an engineer who just wants to be an engineer, but he shouldn't be a program manager. But if they're successful and talented, we say, "This guy is a shooting star!" and make him a program manager. Program managers need to understand all the disciplines and challenges they are going to face. We want to identify people who have the inclination and desire to move back and forth between programs, and we need to do a better job of rotating people around to get the breadth of experience they need to speak the language of each of the disciplines. Ninety percent of any job is knowing the right questions to ask at the right time and how to ask them. You need to read between the lines of what people tell you. You need to know about the potholes in the road. That comes from experience.

**COHEN:** How has your astronaut experience affected the way you see the challenges ahead?

**COATS:** Everybody that's flown in space looks back at the Earth and realizes what a tiny little spaceship Earth we have. One of my strongest impressions when I got up there on my first shuttle mission was, "Holy cow, it's a little bitty Earth; it's

beautiful, and it's going through a great big black void of nothing." We'll explore, but billions of people will never leave the Earth, so we've got to learn to take care of it. When you've been up there, you start thinking more like a member of the human race than an American or Texan, which means you've got a lot in common with other people who have worked in this business. I believe any big venture in the future will be international. The space station is setting the precedent. Space is expensive; it's better to share that cost. It's also a tremendous way to open up communications between countries. Communication between scientists, engineers, astronauts, and cosmonauts can be a foundation for countries working together. Even during the cold war we shared information with the Russians and their program—a lot of medical information, for instance. Right now, India and China are producing many times the scientists and engineers than we are, but the space program is one area that attracts young people into thinking about math and science. The kids in the national technical honor society group I talked to last night are excited about the exploration program. I also talked about nanotechnology that will have a tremendous impact on our lives. If I have a frustration in life, it's that I can only expect to live another twenty to twenty-five years, and I want to live longer so I can see this stuff we'll discover. I told the kids last night that I envy every one of them. I said, "You were born at a great time. You're going to see things that we can't even imagine."

**COHEN:** Is the Constellation work going to involve all the NASA centers?

**COATS:** We have to use all the strengths of the NASA team wherever they are. I would like Johnson Space Center to lead the team as much as possible. I want the first word to be spoken from the surface of Mars to be “Houston” just like it was from the surface of the Moon. To make that happen, we’ve got a lot of work to do. We’ve got to get expertise and team up with the expertise we don’t have, because missions to Mars are going to be deep-space operations involving robotics as well as humans. We don’t have that deep-space and robotics expertise, JPL [Jet Propulsion Laboratory] does. I’ve been working with Charles Elachi out there. We obviously work very closely with Marshall and Kennedy. We need to continue to build on that, but we also need to take advantage of the strengths of Ames and Langley and Glenn. I agree with Mike Griffin: to be a strong Agency, we need ten healthy centers. Four centers have focused primarily on aeronautics work, but the budget is not there for aeronautics. We need to help those centers keep the aeronautics work alive but also need to keep them strong helping us with space flight. We have to find the work packages that can move to the centers that are hurting right now to make them healthy. We are challenged to do long-term, self-sustaining human space flight, which we’ve never done before. The furthest we’ve ever been from mother Earth is two and a half days. Now we’re talking about two and a half years. When you fire those engines to head off to Mars, you’re on your own and you’re not turning around. How can you be truly self-sustaining? How do you recycle everything that can be recycled? How do

you take along the pharmacology you might need? How do you protect from radiation? There are a lot of medical questions that need to be answered, and we’ve got a lot of work to do before we’re ready to be truly self-sustaining.

**COHEN:** So there’s a lot of need for communication and coordination among centers.

**COATS:** Mike has a monthly senior management council where all the center directors and associate administrators get together. We move it around to different centers, so we see each other face to face at least once a month. I’m still a believer in meeting face to face on a regular basis. Communication is about ten percent verbal and the rest is body language. I knew most of the center directors already.

**COHEN:** Are there other aspects of your astronaut experience that are especially useful now?

**COATS:** I’ve seen the science side of NASA as well as the operation space flight side, so I hope I’ve got a balance, but I look at things from an operator’s point of view. How can we design our vehicles, robotic or human, to be operator friendly? I think that’s especially important when we’re talking about longer and longer flights. Mass is always going to be a challenge; having to lift everything out of Earth’s gravity well is expensive. How can we design a vehicle that’s as efficient, lightweight, safe, and operator-friendly as we need? I’m interested in how to design a spacecraft that is both functional

and comfortable for the crews that are going to spend a long time on them. I have an appreciation from my shuttle flights, which were only seven or eight days long, of what’s important when you’re trying to live and work in that environment. And part of the operator’s mentality is always thinking, what’s my backup, what’s my out? It’s a way of thinking you develop as a military pilot, a test pilot, and an astronaut. As you’re flying airplanes, you’re always thinking, if the engine quits, where am I landing? You do it automatically. We’ve got to keep that in mind as we’re designing the series of vehicles we’re going to need for Constellation. How can we make them as safe as we can afford to make them? That’s the operational mentality at work. Different perspectives are important. I learned to respect scientists, engineers, and medical doctors who have a different way of thinking, but we astronauts had to teach them to think operationally. You’d ask a scientist, “How long is it going to take you to perform this procedure with the mechanical arm?” “Oh, twenty minutes,” they would say. Then we would say, “How about two hours?” We knew it takes a while to do things.

**COHEN:** I think in the Mercury and Apollo days there was a good bit of friction between pilots, engineers, and scientists.

**COATS:** Healthy tension is good. You need debate. Somebody may say, “That’s stupid, you ought to do it this way.” Then you think, we can do it even better this other way. I’ve seen it happen many times. It’s beautiful to watch; you come

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up with some elegant solutions when you have the openness and freedom to say, “That’s really stupid.”

**COHEN:** Have you had any surprises in the months you’ve been center director?

**COATS:** Surprise may not be the right word, but I’ve been impressed by how much talent and dedication there is.

**COHEN:** I’m struck by how positive people are about working for NASA.

**COATS:** In the space business, you have tremendous highs and tremendous lows. When a mission succeeds, whether it’s the shuttle or a crew coming back from the station, or Stardust, everyone is on cloud nine. You work for years to pull off something challenging and you do. It makes you feel you’ve done something special in this world. On the other hand, when we have a Columbia, it doesn’t get any worse than that. It’s never, never boring. People love working here. When I ask a question or say I’d like to research a certain area, people make things happen, to the point where I’ve got to be careful about thinking out loud.

**COHEN:** What kinds of things are they researching?

**COATS:** I’ve asked them to do some long-term planning. In the government, we have a five-year plan and nobody looks past that. Now that we’ve got direction about where we’re going to be going for the next twenty-five, thirty, or fifty years, we need to do long-term planning to understand what facilities, core competencies, and skills we’ll need.

**COHEN:** There’s a real contrast between the excitement within NASA about Constellation and some of the public who are complaining that the Agency is doing the same old thing over again.

**COATS:** I think the public is so unaware of what we’re doing, they don’t even know what questions to ask. The results of focus groups we’ve conducted were depressing. We asked people what they think of the space program; the answer is, they don’t. Not one person had heard about exploration. After we told them about it, they thought it was great. At NASA, we live in our own little world. Occasionally we make headlines, but the general public doesn’t know what we do. The Space

Act of 1958 requires us to disseminate information on our activities to the general public, but we don’t do it well.

**COHEN:** Do you see a lack of public understanding of the grand plans and the achievements that benefit people directly?

**COATS:** We’ve got partnerships with medical institutions for medical research we need for long-term space flights—research on bone loss, radiation, early diagnostics. I try to use medical examples when I’m talking to the public because everybody has got someone in the family who has osteoporosis or cancer. I’ll say, how many of you have had Lasik eye surgery? Maybe half raise their hands. I say, “You’re welcome. We use NASA’s tracking to develop that technology.” We’re doing a lot of things for bone loss that applies to the general public. The list of direct applications is huge. We’ve got to make the public aware that they’re getting something for their space dollar. You can argue all day long about whether we should be going to the Moon and Mars. All I want is a chance to discuss it, because John Q. Public doesn’t know what we do. ●