

OSIRIS-REx chief opens book on NASA's asteroid mission

HENRY BREAN

Arizona Daily Star

When OSIRIS-REx swings past Earth next week to drop off its priceless samples from asteroid Bennu, no one will be more relieved than Dante Lauretta.

The University of Arizona professor has been working on the NASA mission since 2004 and leading it as principal investigator since the death of his mentor and former boss, Michael Drake, in 2011.

Lauretta will be at the Department of Defense's Utah Test and Training Range, west of Salt Lake City, on Sept. 24 to help secure the newly arrived space capsule containing rocks and dust snatched from the surface of Bennu on Oct. 20, 2020.

The pristine asteroid samples are thought to contain clues about the origins of the solar system and maybe life on Earth. Their successful recovery will mark the end of a \$1 billion, multi-billion-mile space voyage for which Lauretta has played a central role for almost 20 years.

Not bad for a kid who grew up without a television — or indoor plumbing, really — on a patch of desert north of Phoenix.

Lauretta was born on Oct. 19, 1970, in Montreal, with the dual citizenship to prove it, but he spent his formative years in a single-wide trailer at the end of a dirt road in New River, Arizona.

He went on to study math, physics and Japanese at the UA, where he now serves as a Regents' Professor at the prestigious Lunar and Planetary Laboratory.

The 52-year-old scientist is also a married father of two,

who likes to unwind by playing guitar, doing yoga, designing award-winning board games and writing books. In July, he published a 3D atlas of Bennu with Brian May, a Ph.D. astrophysicist who also happens to be the lead guitarist for the rock band Queen.

Lauretta's next side project is a memoir of sorts, though he insists the coming book also serves as a biography for Drake, the spacecraft and its mission. 'The Asteroid Hunter' is set for release on March 19, 2024, but it's still missing one crucial chapter.

Lauretta plans to write the epilogue, titled 'Homecoming,' in October, after OSIRIS-REx delivers its precious cargo.

He recently sat down with the Arizona Daily Star at his office at the UA for a wide-ranging chat about the long journey to Bennu and back, his background and how he's feeling as the mission's last big test approaches.

(This conversation has been edited for length and clarity. The full version of the interview is available online at tucson.com.)

Star: Describe what you and your team will be doing on Sept. 24.

Lauretta: I'm on the field recovery team, by choice. I really wanted to be out there. I've got to welcome this sample to Earth, right? I'm on the welcoming committee.

Star: So you'll be standing by as the sample-return capsule comes down, and then you'll fly out to the landing site in a helicopter. How close will you land to the thing?

Lauretta: 250 feet. You don't want to have the helicopter blowing dust onto the capsule and all that stuff. Then it's (attached to) a 100-foot-long line in a harness when we remove it from the field, so the helicopter will never be within 100 feet of the capsule. It will fly the capsule in that harness back to the receiving area (where) other members of the team will physically pick it up and carry it inside of a portable cleanroom. Then we're going to start to disassemble it. The treasure box is what's called the science canister. It's like this aluminum housing that's got the sample head and the sample inside of it. All we care about is that canister that will get sealed up and flown to Houston the very next morning.

Star: Are you getting on the airplane with it?

Lauretta: Yeah, Monday morning (Sept. 25). That's the green-light schedule, everything going according to plan.

Arrival anxiety

Star: Is there a part of this last stage of the mission that worries you the most?

Lauretta: Yes, the final performance of the sample-return capsule. Because it's been quiet, and the batteries have been off since we launched (in 2016), so we haven't talked to any of that. And I know it's all been tested, and it's all going to work. But there are batteries that we're not going to hear from until a couple hours before we hit the top of the atmosphere, and those release the parachute.

I just want our sample safe on the ground on Earth, right? That moment, I'm carrying so much anxiety about it. It just feels like that's going to be a watershed moment in my life.

Star: And all that starts with the parachute?

Lauretta: Yes, I think if I see the chute open, we're good. We're good.

Star: It's going to land somewhere.

Lauretta: It's going to land somewhere, that's right. And we've got the Air Force watching it. They're gonna know exactly where it is.

Star: You probably get asked to explain this mission all the time. What's your response when someone says, tell me about OSIRISREx?

Lauretta: Well, we built a robot to go to an asteroid to get dirt and rocks and bring it back to Earth. And the question is, why would you go do something like that? The reason we're interested in our specific asteroid named Bennu is really two-fold. The first is what I'm really interested in: the origins investigation. I'm interested in the origin of life, the origin of the solar system and the origin of Earth, specifically as a habitable planet. Bennu is an ancient remnant from the beginning of the solar system. It's four and a half billion years old. It formed before the Earth did, and it records the earliest chemistry of carbon and water and the kinds of things that were delivered to the Earth by objects like Bennu in our ancient past. So it gets to that question we all ask ourselves: Where did we come from?

The second reason is Bennu is a near-Earth asteroid that's considered potentially hazardous. It might impact the Earth about 160 years from now in the year 2182. So the OSIRIS-REx mission gives humanity the information it needs in the event that this asteroid, or really any asteroid in the future, is going to come and impact the Earth. All of the technology, going out to the asteroid and characterizing its orbit, its chemistry, its geology, its rotation — that will help you with a future mission where you might need to prevent the asteroid from hitting the Earth.

Star: So you're learning what you need to know to launch a planetary defense mission one day?

Lauretta: Exactly. And you're also really refining the odds of whether this particular asteroid is going to hit the Earth or not.

Star: You've got a pretty solid sense of that at this point, right?

Lauretta: It's a .05% chance in the next 200 years, which is low. I like to say you'd cross the street with those odds.

Star: Help us visualize the amount of asteroid material you think the spacecraft is bringing back.

Lauretta, grabbing a plastic foam coffee cup from his desk: Like eight ounces, right? So it should be like a coffee cup full. This is probably an eight-ounce cup. And it depends on the density. If it's really low density, it'll be over-filling the cup. If it's high density, it will pack down in there.

Star: And that doesn't count any bits that might be clinging to the container inside the return-capsule.

Lauretta: That's right. I think there'll be dust covering everything inside the canister.

Star: That's one of the few problems you've run into with the mission so far, right? You ended up stirring up so much asteroid debris that it was leaking from your sampling device.

Lauretta: That's right, and we lost (some) sample (material) because of that.

Star: And that happened because Bennu didn't behave the way you expected it to?

Lauretta: Yeah. Every time we've tried to interact with a planetary surface for the first time, we've been surprised. We knew something would happen. We were ready to be surprised, which is kind of the best you can hope for in those situations.

Formative years

Star: Tell us about your childhood.

Lauretta: I moved to the States pretty quickly after being born in Canada, then moved around quite a bit and landed in Arizona in 1975. New River was like fourth grade through freshman year of high school, so kind of the formative years.

Star: That's when you were living in the mobile home?

Lauretta: In the middle of nowhere. I went to Deer Valley Middle School and Deer Valley High School. It was like an hour each way. We were out at Carefree Highway and 16th Street, and there was nothing out there. We didn't have plumbing. We had to go haul our water. We had this

big 500-gallon tank that we had to drive to a filling station whenever it ran out, get 500 more gallons and bring it back.

Star: Wow. **Lauretta:** It's crazy to think about. We didn't have a TV. Books and school was kind of it for outside information. I had a job starting at 11 years old. I was a stable boy basically, cleaning out horse stables at a local Arabian show-horse ranch. I got a job there, and I saved \$60, and I bought a 13-inch black-and-white cathode-ray-tube TV so I could see what was going on in the world.

Star: So how do you go from stable boy to astrophysicist?

Lauretta: Well, I did well in school, and I got a scholarship to go to the University of Arizona. I came here as a math major, theoretical math, partly because I had no clue what it meant to pick a major. I was the first person to go to college in my family, and I was like, 'Well, I'm pretty good at math. Let's do that.' And I also figured that if you learn your math, you can do a lot of different things with it, so I expanded into physics. Then in my last year in college, I got a Space Grant from NASA to work as an undergraduate researcher, and that really opened my eyes to this whole field of planetary science. That is kind of where I got the spark and decided, all right, I want to get in on this.

And it was an interesting time. It was the early 1990s, and NASA's planetary science program had kind of been in the toilet for most of the '80s. It was all (space) shuttle, and there were no new missions being funded. But in the early '90s, the Mars exploration started to come back online, and I thought I was gonna get involved in that.

Star: It didn't quite work out that way, though.

Lauretta: Yeah. I started on the Mars Observer spacecraft. That's what I went to graduate school to work on. And that spacecraft was lost within months of my arrival (in 1993). The spacecraft disappeared, the mission was over, no data was returned. I'd been working a full two months on the program, so I was like, 'Well, now I gotta go figure out something else.' But my professors and mentors had been working (on it) for decades.

Star: So I guess that's another thing that you carry with you, right? You've seen what happens ... **Lauretta:** when these missions fail. That's right. Careers can be over.

Star: And right at the goal line. **Lauretta:** Just like we're facing (now).

Star: What has been the most stressful part of all this for you?

Lauretta: Honestly, the most nerve-wracking time period was very early in the mission, when we were still in the proposal phase. Mike Drake, who was my mentor and the P.I. (principal investigator),

was really sick, and I had to step up and lead. Then Mike would come back and be healthy for a while, and I would step aside. So I was really worried about him, and everything was on the line. Like if you don't win that phase, you're done. You don't fly.

So it was really those early days. First of all, just being there with Mike, somebody I cared about who was dying, was very stressful. And also because without Mike, I was the one that had to do it, right? I was pretty young; I was in my 30s. I was like, 'I don't know if I'm ready for this job.'

Star: There must have been some people, maybe even involved with the mission, who were thinking the same thing.

Lauretta: Exactly. There was a lot of doubt about my ability to come in and lead the charge. And there was part of me that was like, 'Well, maybe I should listen to them.' But the other part of me was like, 'You can do it.' And Mike, you know, we had this moment at the end, where he really passed the torch. He was in the hospital, right before his last procedure, and he said, 'You've got to take it. You've got to go. You're the guy.'

Staying busy

Star: So how do you decompress from a high-stakes job like yours? What do you do to relax — or at least look relaxed?

Lauretta: I think side projects. You know, we've got the Bennu book (with Brian May), and I have another book that's coming out. I try to be creative. I'm a board game designer, so I've designed games. And I love playing board games, especially with my kids and other family members.

In the mornings, the first thing I do when I wake up is usually a workout — yoga or strength training or maybe a hike. And I play my guitar. Not well, but, you know, that's not what it's there for. It's there for stress and to go on my back patio and howl with the coyotes or whatever.

Star: And now you've written a memoir. Except the final chapter of OSIRIS-REx is not in the book.

Lauretta: It's to come. The epilogue is not written. Right now it ends in May of 2021, when we depart Bennu. That's the last paragraph. So the agreement was we would get this into production and get everything copy-edited and typeset, and then I would deliver the final chapter a month after the capsule is on the ground.

Star: You've certainly got a good story to tell.

Lauretta: It's not just about me. That's the fun part. 'The Asteroid Hunter' is actually OSIRIS-REx. I didn't know that when I started writing it, but as the book unfolded, it's OSIRIS-REx that turns out to be the hunter.

Star: So it's OSIRIS-REx's memoir.

Lauretta: Basically, yeah, and I'm involved. But OSIRIS-REx, obviously, is a big part of my life.

Star: Nearly 20 years. That's almost a career. It's close to a generation.

Lauretta: Exactly. And I'm in my early 50s, so I still have some runway ahead of me, hopefully.

Star: Now the real work begins.

Lauretta: That's right. The whole mission was about the laboratory science, which is why I signed up for it in the first place. That was the deal.

Star: How many people are on the OSIRIS-REx team these days?

Lauretta: So direct employees here at the University of Arizona, we're at about 35. Then we have our partners at NASA, and we have our partners at Lockheed Martin. There's about 250 people full time on the mission right now. And when I look at my extended sample analysis team, there's another couple hundred (at) laboratories around the world that are getting ready to receive samples.

Star: Is anybody else going to have a lab as nice as the one you've built here?

Lauretta: (Laughs) No, we're going to have the best. There's lots of really great laboratories on the team. I don't want to sell my collaborators short. But we have an amazing facility here. We're going to do cutting edge research.

Star: And for a long time to come, right?

Lauretta: The rest of our lives and our students' lives. The great thing about sample return is that it just keeps on giving. We're reasonably smart, we've got these great new instruments, we're going to tackle all these big questions. But the people in the future, they're going to be even smarter, they're going to have even better instruments, they're going to know everything we know, and they can design whole new experiments.

I think I'll be involved in Bennu sample science for the rest of my life. And I'm training a bunch of students, and they'll continue to study this.

Star: That coffee cup full of material is going to go a long way.

Lauretta: It's an infinite supply for us. We work at the atomic scale. So when you start counting atoms, there are a lot of atoms in this material.

Contact reporter Henry Brean at hbrean@tucson.com or 573-4283. On Twitter: @ RefriedBrean
QA
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Dante Lauretta, OSIRIS-REx principal investigator. **M A M TA POPAT, ARIZONA DAILY STAR**



Dante Lauretta, left, poses with his mentor and OSIRIS-REx predecessor, University of Arizona professor Michael Drake, in 2007. Drake died in 2011, six months after NASA awarded the asteroid sampling mission to his UA team. **M AMTA POPAT, ARIZONA DAILY STAR**



Dante Lauretta, left, a UA professor and leader of NASA's OSIRIS-REx asteroid sample return mission, reacts after the spacecraft touched down on Bennu on Oct. 20, 2020. **NASA GODDARD YOUTUBE CHANNEL**

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