

Breakthrough: Snapshots From Afar

SPEAKER 1: Five.

MINAL ROHIT: The risks were high.

SPEAKER 1: Four.

NANDINI HARINATH: It was a race against time.

SPEAKER 1: Three.

SEETHA SOMASUNDARAM: There were nail-biting moments.

SPEAKER 1: Two.

MINAL ROHIT: We are going in a marathon race.

SPEAKER 1: One.

NANDINI HARINATH: No country's reached Mars in the very first attempt.

SPEAKER 1: Zero.

[MUSIC PLAYING]

[CAR BEEPING]

SEETHA SOMASUNDARAM: ISRO, that is the Indian Space Research Organization, was formed in the 1960s. Based on the experience we gained in growing the space science community within the country, ISRO decided that we could go farther out and go into interplanetary space and go to Mars.

I'm Seetha. I work as the Program Director here. I coordinate all the space science activities of ISRO. MOM, or the Mars Orbiter Mission, was a mission to prove that we had the capability to actually reach a planet and orbit around it. That itself was a big challenge. MOM had to be built within 18 months.

NANDINI HARINATH: It was a race against time because we were all first-timers working for an interplanetary mission. I don't think I ever thought I would be working in ISRO Satellite Center. If you are doing mission operations, you really don't need to watch a science fiction movie. We see that excitement in our day-to-day lives.

I'm Nandini Harinath. I was designated as a Project Manager, Mission Design and a Deputy Operations Director for the Mars Orbiter Mission.

SEETHA SOMASUNDARAM: The placement of Earth and Mars such that you traverse with minimum energy, that comes once in two years.

NANDINI HARINATH: We wanted to get into a capture orbit, capture orbit in the sense this Orbiter remains around Mars. We went for an elliptical orbit because a more circular orbit would have required more fuel.

MINAL ROHIT: The main purpose of Mars Orbiter Mission was to derive many other technologies-- launching, insertion in the orbit, autonomy, but also, we should have payloads so that our scientists also start working on the Mars atmosphere, Mars science, which will be helpful for the future missions. And I was deployed on this project.

I'm Minal Rohit, and I'm a scientist engineer. And I was the Project Manager for Methane Sensors for Mars. That's one of the payloads which was flown in the Mars Orbiter Mission. When I was small, I saw many scientists wearing white garments, and it was so fascinating. And at that moment, I got like, oh, wow. How good to be there.

SEETHA SOMASUNDARAM: One challenge was all the payloads were made small and compact.

MINAL ROHIT: 15 kilograms for all the payloads. And these payloads had to be built for the rugged space environment, so that was a challenge. Methane Sensor for Mars, I consider it a first baby.

NANDINI HARINATH: The presence of methane indirectly hints at the possibility of the presence of life. That was one of the reasons why that payload was extremely important.

MINAL ROHIT: So for that itself, in very less time, it was hardly, I think, six months. And we were to come up with all designs, all concept model, everything. Dr. Seetha, she's a very strict lady, OK? She was very particular, like what is the primary objective? Are your cameras going to meet that? How are you going to meet that? How are you going to demonstrate it? It was very stressful.

We have a Mars Colour Camera, MCC. It was for outreach to the country, motivation, and enthusiasm into the public they wanted to bring in.

NANDINI HARINATH: Every launch gives me butterflies in the stomach.

MINAL ROHIT: The weather was not favorable. Five or six days it was delayed. Already the margins were getting eaten up.

SPEAKER 1: Standby by time mark. Mark minus one minute and counting.

MINAL ROHIT: Please lift off. Please lift off.

SPEAKER 1: 3, 2, 1, 0, plus 1, plus 2, plus 3--

[INTERPOSING VOICES]

SPEAKER 1: --plus 4, plus 5.

NANDINI HARINATH: We were relieved and happy that the launch vehicle had put us in the right orbit.

MINAL ROHIT: After some few hours, Mars Colour Camera is going to be on. India came up there. And that was a moment.

NANDINI HARINATH: We needed a certain velocity to get out of the Earth's sphere of influence. And we couldn't do it in one shot because our engine wasn't that powerful. So we had to gain that energy slowly. So every time we went around the Earth, we would fire the engine to get that extra energy.

So after six such burns, the Orbiter had enough velocity to exit from the Earth's sphere of influence, and it went into the cruise.

The cruise to Mars, that was about nine months.

MINAL ROHIT: It's like a baby is delivered, but nine months in the womb it has to be taken care.

SEETHA SOMASUNDARAM: The Mars orbit insertion was the grand day. That was 24 of September, 2014. We'll never forget it in all our lives.

NANDINI HARINATH: Of course, the Mars orbit insertion, that was the most critical maneuver.

SEETHA SOMASUNDARAM: If we had had slightly less velocity, we would have crashed onto Mars. If we had had more velocity, we would have just gone off as a fly by.

NANDINI HARINATH: It's like hitting a bullseye on a dart board standing some few 10,000 kilometers away.

SEETHA SOMASUNDARAM: We monitored it. It went behind Mars. And then, for two to three minutes, we just were holding our breath. Communication was established, and

we saw the telemetry and that it was in orbit. That was probably the sweetest words we heard on that day.

NANDINI HARINATH: All protocol was broken. Everybody got up from their consoles.

[CHATTER ON RADIO]

SEETHA SOMASUNDARAM: It was excellent moment. People will never will forget that moment.

MINAL ROHIT: Then Madam Seetha asked, what is it? Where is the data? Now the focus turned on the camera.

SEETHA SOMASUNDARAM: Disk images from various Mars missions were actually using mosaic images using several hundred images.

NANDINI HARINATH: And because the orbit, the farthest point was 80,000 kilometers away, we could get the entire Mars disc in one single frame.

SEETHA SOMASUNDARAM: And so that was what caught the public eye.

MINAL ROHIT: That's the reward. We are there. We are there looking with our own eyes.

SEETHA SOMASUNDARAM: We had designed it for a six-month lifetime. And since our instruments are working well, we continue to operate the mission and take as much data as we can.

NANDINI HARINATH: I think to date, only 40% of the missions to Mars were successful. And we've done that in the first attempt. And it was done on a shoestring budget and done in a very short time.

MINAL ROHIT: There are hundreds of engineers who have worked day and night to push this on time.

SEETHA SOMASUNDARAM: When I started my career, there were a few ladies working along with me. And now, there are quite a lot of women in both science and engineering working in ISRO.

This has been a great stepping stone for ISRO to get the confidence for going farther out into space.

NANDINI HARINATH: It was one event in which the whole country participated. So there were schools watching it live, and there were so many people looking at it at that point of time.

MINAL ROHIT: When I was small, I had a dream to help common man. When they see something like this in newspaper and media, and then they really feel that, yes, why not?

[MUSIC PLAYING]

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