

Burning Questions Podcast

Transcript of Episode One

A conversation about... EIRSAT-I, Ireland's first satellite

Host: [00:00:00] Welcome to Burning Questions, a conversation podcast brought to you by the Royal Irish Academy's Engineering and Computer Science Committee. Through interviews with leaders in the fields of mechanics, engineering and computer science, we aim to shine a spotlight on expertise in the applied technologies across the island of Ireland today.

This month, Vikram Pakrashi met with Lorraine Hanlon and David McKeown from UCD for a fascinating discussion about EIRSAT-I, Ireland's first satellite.

Ambient sound from EIRSAT-I launch: T minus 9, 8... 3, 2, 1. Go SpaceX.

Vikram: Lorraine and David, massive congratulations to the two of you. Could you tell us about EIRSAT-I, the first Irish satellite?

David: So, EIRSAT-I is Ireland's first satellite. It's up there in space. I call it 2U CubeSat, so it would fit in your hands. It was built by UCD, [00:01:00] with the help of ESA, the European Space Agency, and their 'Fly Your Satellite!' program.

So, it's like a fully functional satellite's, it's just smaller in size, but everything kind of miniaturized. And what it does is it carries three payloads. It has a gamma ray burst detector; it has a thermal experiment for thermal materials, and it has a control system for orientate the satellite.

So, we built it to test those technologies, but we also built it for the education of the students in UCD.

Vikram: I mean, this took a very long time and so many people were involved. Could you tell us how long the whole process was? How many were involved? What kind of a team it was?

Lorraine: It started in about February 2017. That was when we submitted a proposal to the European Space Agency to participate in their university student program called 'Fly Your Satellite!'. And we were then selected in May 2017.

So, we launched on the 1st of [00:02:00] December 2023. So it was about six and a half years in development. We had a core team of about 20 graduate students, so PhD and research masters, and then another probably 30 or so undergraduate and taught master's program who participated in smaller chunks along the way.

Vikram: That's a long time and a massive team to be involved with. And I'm guessing that it comes with also a sizable investment that is required to be done. But is space a good investment for a small country like Ireland?

David: I think it's a great investment. I mean, we have a space industry that's just growing massively.

So, we're looking at it being a trillion-euro industry by 2030 and beyond. And it's whether Ireland wants to be a part of that and being part of that is developing our infrastructure and our knowledge and our skills now. That's important in a university like here in UCD that we're producing the research and the graduates that can fuel an Irish space industry to get our piece of the pie.

We [00:03:00] also have companies and industry in Ireland that are building things for space, and they're growing. So, what we find is that for every euro that the Irish taxpayer puts into the space industry, there's a multiplier of three or four. More than that - it depends on which way you look at it - if you add in kind of their suppliers and the supply chain going down. Investment in space industry, whether you like it or not, as a thing is good for the economy for Ireland. So the returns are good and the knowledge returns are also very good. So, I think, yeah, it's a winner at the moment if we want to be involved in industries that are growing.

Vikram: Now that you mention the knowledge and the economy, what kind of national capacity, skills, and scientific excellence will this space industry bring to Ireland, do you think?

David: Yeah well, the excellence, scientific excellence has been here in Ireland, you know, EIRSAT-I was our first satellite, but we've been working in universities on projects with [00:04:00] European Space Agency and NASA and all these groups for many years.

And that's a bit of the background, how, you know, 10 years of my group and more with Lorraine led to us being able to maybe start thinking about building a satellite. So, the excellence in astronomy and excellence in engineering is there. Company wise, it's the same. We don't have a large prime, as we call it, somebody who builds a whole spacecraft here in Ireland, where we have lots of small, small to medium sized companies that are plucky and destructive and, fast growing, who are working in kind of the new areas.

We talk about new space, the idea of kind of moving away from everything being done by a space agency and to kind of a more commercial space where small companies and small countries like Ireland can be there. So, we're growing and there's definitely room for a lot more growth here, but we're building upon, it's not a zero heritage, but we're building upon the foundations that have been kind of built grassroots [00:05:00] up in Ireland.

Vikram: What I'm also hearing is that many different disciplines worked very well together on this. Yeah. Now, we all know like disciplinary boundaries are eroding very fast, but maybe Lorraine, how do you see the interdisciplinarity of this entire project?

Lorraine: There's certainly no way we could have done this project without an interdisciplinary team working on it and bringing the scientific and engineering expertise together and building something much greater than the sum of its parts, I think.

So, there's definitely shared knowledge and learning has come from that. And I think a lot of the future projects we're building, we want to build together because we've seen the important complementarity in the mindset we bring to solving problems and the technical know how we bring.

So, I think that's been really positive from, from the EIRSAT-I mission. And I think more broadly, bringing an awareness of [00:06:00] space to different areas that may not have traditionally felt they had any role to play in space and the space story has been a big part of the mission, bringing humanities researchers and in particular creative writers and creating the poem that's on board has been I think really eye opening for them and for the students involved and for us to see the public response to it has added a very important dimension.

And while it's not interdisciplinary research, it's showing the importance of us having a shared vision of, you know, the planet and our role in the solar system. And that may sound very grandiose, but I think it does inspire a lot of that kind of thinking. So even though it's a small satellite, it had big ambitions.

Vikram: I mean that sounds fascinating, Lorraine, but I'm sure the entire project wasn't without its challenges. What do you think were the biggest challenges in the entire project? [00:07:00]

Lorraine: Well, it might surprise you, but things like insurance proved to be very challenging. Things like the authorization process.

So, I guess the technical problem was a huge one, but for sure, we knew we had the team that could solve the technical problems, but I think it was really an unknown, unknown, the whole authorization. How were we going to actually brand this as an Irish satellite? Who was, who was taking care of that? And how would we - what was the mechanism that we would create to allow that to happen?

So, for sure, for me, in my role as an you know, as the endorsing professor who had to do all the background stuff. That was probably the biggest challenge and I think hats off to the civil servants who supported us on that because they did a wonderful job and we just found out last week that we're now on the UN register of outer space objects.

So, Ireland is on that [00:08:00] list now for the very first time.

Vikram: So, all these things culminated almost on the day, I'd say, emotionally, at least for the two of you. Maybe if I could ask how was the feeling?

David: Well launch day was special, yeah. So, we were out in California. So, it launched from Vandenberg Space Force Base.

Yeah, I mean, seeing six and a half years of work go up in the air, attached to a very powerful rocket was fairly surreal. Yeah, it was quite emotional. You know, there was lots of hugs with the team, out there. I had a sense of relief, I guess, that it actually had happened, it's quite a build up for that.

I think I was strangely confident that it was going to work. So, yeah, really amazing. It's obviously a one-off feeling.

Lorraine: Yeah, I still don't think I've fully processed that it's actually out there. It did, as you said, feel surreal on the day. There was about, I would say maybe two or three hundred people just along the [00:09:00] road.

So, we weren't actually on the launch site. We were a little bit away from it because it's a military site, but it had the feeling of a music festival. People, you know, had their picnics out and their binoculars and there were all kinds of interesting characters in camouflage gear and you know, giving us advice.

So, it was a bit of a slice of American life as well. And yeah, just a wonderful atmosphere. As soon as we saw the booster come back down, there was this sonic boom, this really loud boom, and it

landed back on the pad in Vandenberg. So, that was a big plus because that doesn't often happen there.

But then we had to race back down to this town of Lompoc because we had to talk to the team back in UCD and you know, then the work of actually establishing contact with the spacecraft began. So, there was the euphoria of the launch and then it was almost straight away back to business and you know, making sure we were [00:10:00] ready to hear the first beeps from the beacon.

When we first started getting the reports from the amateur radio enthusiasts from Europe, I think there was from Luxembourg and Czechia, we knew that the spacecraft was in a healthy state and the beacon signal was strong. When I think back to the thousands of hours of work that went into developing that antenna module from scratch by the team, how much rework, how much testing and redesign went into it.

It's just brilliant to hear that the signal is loud and clear.

Vikram: So, irrespective of whether the project, because you didn't know whether it would be eventually successful or not because there are so many unknown unknowns, is it this long engagement, that excitement or anticipation is what keeps you in STEM?

Or what excites you, what encourages you [00:11:00] to continue to work in STEM? Is it this or is it the final success.

David: Well, I mean, I think it's the big challenges and building Ireland's first satellites is a big challenge for me. I think Lorraine hit on it. You're working as part of a team, a big team across the campus here was also great, you know, because you get involved in research and you can be a lone wolf if you want, but I think it's not as good fun as working with others, and I don't think it's as rewarding.

And then trying to do something that's impactful too. You know, EIRSAT-1 to be historic, as being a first, to kind of inspire that way, but the momentum after that, you know we're doing this to build, you know, our space research, our space industry, you know, it felt like we were doing something that was more than, I guess, any other research project, I'd done before. But then there's the public engagement side of things when we start using this to try to get other people [00:12:00] into STEM, into stuff that we love. Lorraine, if you want to talk about the public engagement.

Lorraine: Yeah, just following up on that.

I think. You know for students and graduate students it can often be isolating to work on their own research project and go down for four years in a topic in great detail. And I think one of the things that was great about EIRSAT was that there was that aspect for the PhD students and the research masters, but also a shared challenge that they were working on collectively that they felt really empowered by and connected to each other by.

And I think trying to replicate that in future projects would be great because I think it really supported the students. Remember, we were doing this through COVID as well. So, having something shared and collaborative and people, they could connect with as well as their own individual line of research was important and valuable.

And then, yeah, on this. Public outreach [00:13:00] we've had such an active schools program and done a lot of schools' materials, resources for school kids on our website and we're working with the Department of Education to build out more curriculum resources as well for secondary schools because I think there's nothing as good to motivate your learning as real people doing real science or real space engineering and to say actually my I can see why CAD and technical graphics or why my dynamics in applied maths or why my Kepler's laws and physics matter because I can see this very tangible example from my own country.

So, that's something that's been incredibly important to the team and the project. And I think we're only at the beginning of that story.

Vikram: Now that EIRSAT-I is up in the orbit. What's, next? What's coming up?

David: Lots. I guess [00:14:00] some stuff's been started before EIRSAT launched.

So, Lorraine and myself have been working on a Science Station Ireland-funded project around making satellites faster and making it easier to integrate payloads and build missions. And we're about halfway through that. There's another project with myself and Sheila McBreen looking at a bigger satellite called GIFTS, a 6U satellite, another gamma ray burst detector.

Just at the start of March there it kicked off - the largest investment in Irish space research. So 7.9 million was invested in what's called the Destructive Technology Innovation Fund at DTIF. So UCD is leading that, and again, Lorraine and myself are involved, but also six Irish companies. So it's the link between the research and the industrial research.

These companies are SMEs, and we're looking at things like optical communications, we're looking at AI, onboard AI that's happening on the satellite in space. We're looking again at how we test these, how we do bring the kind of the things that we [00:15:00] have to go outside of Ireland to do for EIRSAT, how to bring those testing facilities here into UCD.

And again, all about speeding up the development of the project. We hit at the start about, it took six and a half years to build EIRSAT. So, how do we build that faster? And how do we, yeah, make this kind of more reliable and robust. I guess the other thing is that what we're doing is operating EIRSAT.

It's not a project, but EIRSAT will stay up there for three years, around that. So it passes Dublin in the morning and the evening. And every time it does we have somebody on our ground station picking up the data and what they do with that data, and kind of exploring the scientific side. We didn't build EIRSAT just to launch it.

There's also payloads with science and engineering tech demos on it. So, we want to get our worth from EIRSAT. So, a massive amount, really, which is, which is great is what we wanted. But yeah, to see that building now is, I guess, really rewarding for the six years of graft that we put in.

Vikram: That sounds really exciting.

I think [00:16:00] we are coming towards the end of this podcast. As you know, this is called burning questions. So, if I might ask the two of you, what are the burning questions around this topic right now in Ireland?

Lorraine: For me, it's ensuring that we have a place where space research has a home because the industry and the sector is really important and is owned by [Department of] Enterprise Trade and Employment, correctly, but the underpinning space research doesn't have, really a home. It may be funded by SFI sometimes, as David mentioned, or individual students, may be funded by the Irish Research Council, but when you think about the bigger missions, and really a lot of EIRSAT is about positioning ourselves to have the space skills to be able to participate in larger European, ESA, [00:17:00] for example, missions. But they take, you know, we talked about six years for EIRSAT, those missions are in development for potentially decades. So, how do you ensure that your team and your skills and your facilities get the support that make you a really a good collaborator and a key team to help these big missions for astrophysics.

That's really where we want to go. We want to lead international payloads for scientific missions. So, I think for me, the critical thing is putting that piece together around understanding those requirements for space, real leadership in space, and building a strategy for the country on space research that will enable the best researchers in these areas to meaningfully participate over the long term.

And I think that's a piece of work that I think is now going to start happening. We're going to start building this [00:18:00] national space research strategy. And I think it's really timely to be looking at that now on the basis of all - what we have learned from EIRSAT-I.

David: Yeah, I mean, I guess, but mainly echoing that, I mean, it's how big is our ambition, how this sector is growing massively and how big part does Ireland want to be of it.

And some of those, yeah, questions have to be answered now and Lorraine hits it with policy. How do we have a structure on this, whether it's a state office or state agency or something that's really leading, having a vision from it, because we have a vision, but what's Ireland's vision for this, because it involves university, it involves research and also involves our industry. It has to include kind of everybody in it.

How do we build on what's been done today to, to make sure that we don't get left behind because if we try to do it in ten, fifteen years, it's going to be much harder than doing it now. So, the time to strike is now. So, yeah, how big do we want to be? [00:19:00]

VIKRAM: Thanks both. That was fascinating and wishing all the best for space research in Ireland.

INTRO: T minus 10, 9, 8, 7, 5, 4, 3, 2, 1. Thanks. Go Korea 425. Go SpaceX.

HOST: Thank you for listening to this episode of Burning Questions. Thank you to our contributors and editors and to our colleagues on the ECS committee who have supported this initiative.

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