Constellations Podcast

Episode 96 – Ground- and Space-based Telescopes, Space Factories, and the New Space Economy

Speaker: Gino Bucciol, Co-Founder & Chief Development Officer, Officina Stellare - 19 minutes

John Gilroy: Welcome to Constellations, the podcast from Kratos. My name is John Gilroy, and I'll be your moderator. Our guest today is Gino Bucciol, co-founder and chief development officer at a company named Officina Stellare, or Officina Stellare as well. Let me give you a few hashtags to describe today's episode, #telescopes, #ruggedizedopticalsystems, and #lasercommunications. Sounds like a great interview. Yeah. Well, we're about to get into the heart of it with our guest, Gino Bucciol, talking with us today from Italy. Gino is the co-founder and chief development officer at Officina Stellare, a company based in Italy and active in the design and production of telescopes, optomechanical, and aerospace instrumentation for ground and space-based applications.

John Gilroy: Gino will discuss the new space economy, which is how Officina Stellare refers to those opportunities that will arise in the future, thanks to a growing accessibility to and democratization of the space industry. Some of the applications that will drive the new space economy are Earth Observation or EO, Space Situational Awareness, SSA, laser communications and ruggedized optical systems. SSA and EO both use ground telescopes and space-based optical payloads to monitor awareness. In today's discussion, we will learn the advantages of each. Finally, Gino will share with us the importance of ruggedized optical systems in a congested and contested space environment. Well, Gino *sei pronto* Are you ready?

Gino Bucciol: *Sono pronto.*

John Gilroy: Oh, good. That's two words I know in Italian. That's not a good way to start the conversation, I guess. Let's start off with what we call on here, it's the elevator pitch. In 30 seconds, can you give us a little nutshell, but tell our listeners what Officina Stellare does?

Gino Bucciol: Thank you, John, for having us. John, I will do my best with them. Please stop me if something is not clear. Officina Stellare is an Italian based company, not far from Venice. It is a vertically integrated design and manufacturing firm focusing on all the processes involved within the development of an optical system. Optical systems that people normally call telescopes for both ground and space-based application. This is our strength. What make us interesting on the international panorama is that the full value chain is kept in-house. It means that we can easily go from the mirror idea to delivery and the commissioning of

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a product, so we can support the customer in a fast, smart and cost-effective way.

John Gilroy: When I think of Venice, I think of Marco Polo and the end of the silk road. And so, 500 years ago, Venice really was the center of the world for communication, wasn't it?

Gino Bucciol: Right.

John Gilroy: Right. And you're doing it again, only you're going up instead of East and West, huh?

Gino Bucciol: Yes.

John Gilroy: Yeah. Marco Polo. Well, we never thought we'd talk about that in one of these podcasts. So, Gino, your telescopes are ground-based, space-based, or both?

Gino Bucciol: Our telescopes are designed for both ground and space applications. When using them on Earth, they typically serve research and astronomy activities or defense applications like weapon tracking. Talking about space, our telescopes are used for the debris tracking, satellite collision avoidance, or laser communication.

John Gilroy: So there's a strength and advantage of each one, when do you use ground-based, when do you space-based?

Gino Bucciol: Oh, on the basis of the customer requests. I mean, some application needs for space-based telescopes, some other application needs for in-orbit application. As example, in-orbit, we perform with our telescopes Earth observation, or again, laser communication from the other side of the comm link.

John Gilroy: When I went to your website and did some research on your company, there's three words you kind of reinforce, and the words are new space economy. So how do you describe that for our audience?

Gino Bucciol: You're right, John. Space is quickly becoming a place where it is possible to develop commercial activities. The easier access to the orbit, thanks to the launch reduction costs and the availability of space compliant technologies has made it possible also for private companies to do business up there. This is the famous space democratization. From here the decision to focus on all the applications that have a telescope in their core. I'm referring to this field of application mainly Earth observation, space situational awareness, and laser communication.

John Gilroy: Good. I'm just going to focus on one aspect of what you folks do. Telescopes, radar, and RF sensors have all been used in space situational awareness. So how do they differ in their approach, each one of those?

Gino Bucciol: Space Situational Awareness need for both kinds of sensors. The information obtained from the different sensors you mentioned must be combined together to get to the result. The result is the full awareness of the real-time position and the trajectory of the tracking objects. Telescopes are perfect to provide information on that angular position, thanks to their extremely high resolution. Radars instead are perfect to obtain a precise measurement of the object's distance. Then the combo of the two sets of information, gives you a complete awareness of where the tracking object is in space. And where it will be.

John Gilroy: Yeah. So one alone may not be enough. However, two or three combined can give you information about where an object will be. Huh?

Gino Bucciol: Right. Correct.

John Gilroy: Good, good, good. I want to focus again on space situational awareness. These telescopes are ground-based aren't they or space-based?

Gino Bucciol: Spaces Situational Awareness, SSA, till now has been performed mainly from the ground with a dedicated tracking telescope. The recent evolution of space situational awareness techniques is now also including space-based assets. It is a really new field of application in which we are starting to be involved. EO telescopes, Earth observation telescopes I mean, are very different from the laser one, for the laser comm ones. The first one, the Earth observational telescope, are designed to produce a higher resolution picture. And these are required for larger diameters and special imaging sensors. The second one, laser comm, are designed to send and receive modulated laser beams with a totally different set of a specification and related hardware.

John Gilroy: Good. You mentioned Earth observation earlier, EO, and I'll tell you what, all kinds of applications are growing. I mean, you read magazines and see what's going on, you're getting bombarded with all kinds of applications. Can you give our listeners, maybe give us a clue on how optical systems are being used for satellite Earth observation?

Gino Bucciol: Sure. Space telescopes are placed in a perfect position for observing the Earth and we can use them to get a precise image of a specific area in order to monitor what is happening in that area. It could be useful for natural disaster prevention, intelligent agriculture, border protection, sea and river monitoring,

et cetera. There are many, many applications that can use the set of information that get obtained from a high-resolution picture of the ground surface.

John Gilroy: Try and expand on a comment you made earlier about laser communications. I think Officina Stellare goes way beyond laser communication, going way beyond telescopes. Is that true?

Gino Bucciol: Yes. An optical ground station, this is the name, the right name for a ground-based telescope, but used the for laser comm application. Optical ground station includes a telescope and extremely precise tracking mount to keep the satellite aligned with the line of sight of the telescope and the set of light modulation devices. All these parts are developed in-house by Officina Stellare. The problem is of the future laser communication infrastructure is its capability to transfer data with a way faster throughput, a worldwide coverage, lower power consumption and talking about quantum comm, a totally secure transmission.

John Gilroy: Gino, thousands of people from all over the world have listened to this podcast, go to Google and type in Constellations podcast to get to our show notes page. Here, you can get transcripts for all 97 interviews. Also, you can sign up for free email notifications for future podcasts.

John Gilroy: When I went to your website and I did some research on your company, it looks like Officina Stellare also produces optical payloads. I mean, are they different from telescopes and how are they used?

Gino Bucciol: You are right, John. Sometimes people are confusing the two items. With payloads, We normally refer to the combo of an optical system and the imaging device, plus all the other electronic and the hardware it is related with, like the focuser, for example.

John Gilroy: Maybe you can define it a little better for me. So, an optical payload is just a system that a satellite would contain? Is that what it is?

Gino Bucciol: Yes. A satellite dedicated to the Earth observation application is a satellite with inside an optical payload. The optical payload is a combination of two main parts, the telescope, then the optical section and the imaging device, the camera.

John Gilroy: Ah, okay. I got it. When we look at the evolution of technology in the last four or five years, nothing really evolves without some serious challenges. So, what challenges do you face in the world of optical technologies?

Gino Bucciol: Many, many, John. The optical world is a challenging one. For example, space applications are asking for a larger telescope diameter, lower weight, and a smaller overall allocated volume for the payloads, because the cost of the launch is directly related with their size and the weight of what you are sending up there. Then the people are looking for a more compact and lighter solution to perform their research. The new designs, new materials, and new technology shall be developed in the near future to cope with these requests. In addition, the continuous improvement of the imaging sensor demands for a better optical performance to increase the resolution and the quality of the pictures taken. It is definitely not an easy job for us.

John Gilroy: In other words, Gino, you want to buy a car that's as fast as a Maserati, but costs what a Volkswagen costs. Not just produce that, right?

Gino Bucciol: That's new space economy.

John Gilroy: And that's a challenge, I'd say.

Gino Bucciol: Right.

John Gilroy: So there's a concept called a space factory. Are you finding folks trying to look to create some kind of a space factory?

Gino Bucciol: A space factory and our one is one of the very first in the world, it's a place where all the design, manufacturing, integration, and the verification phases of a space product, an optical space payload, in our case, can be performed with small needs for external support. As I said in incipit, it is a vertically integrated manufacturing firm with raw materials in input, glass and metals in our case, and finished products, the optical payload at the output. Having in the same building, the engineering team, the optical and mechanical manufacturing, the clear rooms for the integration, and all the really special assets that are required for the test of the space product, like the launch and space simulators is a uniqueness of Officina Stellare. New space economy is asking for smart processes, faster developing time, cost saving and the risk mitigation. We can deliver all of that.

John Gilroy: So I need an Italian lesson. So how do you say the word lawyer in Italian? How do you say that in Italian?

Gino Bucciol: Lawyer is *avvocato*, probably.

John Gilroy: *Avvocato*. Well, one of our recent guests, Randy Segal of Hogan Lovells is an *avvocato*.

Gino Bucciol: Okay.

John Gilroy: And an expert on space law. And she was explaining how merging space law was attempting to address space debris. Now, is this something in your strike zone, is this an application where telescopes can help track debris?

Gino Bucciol: Definitely yes, John. Space debris are an issue that is having a fast-growing attention by multiple players like satellite operators, military people, and for sure also space law experts. The number of satellites, especially in the low orbit is increasing as consequence of the space democratization. In fact, the possibility of a collision is now not remote. Ground and space-based space situational telescopes are extremely important to look to mitigate the risk, thanks to the patrolling activity they can perform.

John Gilroy: Good. Might be a tool that they can use to control space debris. When I read your press releases, I hear about your company, I talk to people about Officina Stellare, it looks like that you design and develop optical systems for the defense industry. So, give me an idea here. What's the typical application the defense sector looks for when they commission optomechanical systems from your company?

Gino Bucciol: For the defense market, we develop an important know how to serve customers dealing with weapon range tracking application. These telescopes face large thermal and mechanical stresses because the harsh environment and the challenging operating condition in which they are normally used, like extreme acceleration, high vibration, wide temperature operative range, and so on. Our heritage is based on the peculiar optical and mechanical solution we implement and our military telescopes are becoming now an interesting option for the customer worldwide.

John Gilroy: You gave me an Italian lesson with the word *avvocato*, so I'm going to give you an English lesson and the word is roundup. It's an old cowboy word. We have put all things together in some kind of a ranch or something like that. So the roundup I'm going to give you is I'm going to name you three topics, and I'm going to give you 30 seconds, and you've got to punch through some creative ideas on what's going on with each one of these areas, because you have a good perspective on them. The first one, give me 30 seconds on Earth observation, and what are the big developments in the next few years in that category?

Gino Bucciol: Less than 30 seconds, John. First, a better value versus performance ratio. They so-call it swap, size, weight, and power optimization. It will be an important design driver for the future. Together with the capability to be operative from

lower than usual orbit, closer to the Earth surface for an improved imaging resolution.

John Gilroy: Okay. Your crystal ball for laser communications. What do you see in the future for that?

Gino Bucciol: In this case, cost reduction and reliability are the main focuses now. Laser comm is working very well in laboratory but is now important to make it market ready through an optimized process of industrialization. An amazing number of optical antennas will be deployed in the future. The hardware shall be inexpensive and above all really reliable and able to work under all weather conditions, both are challenging items for a complex electro-optical device.

John Gilroy: So, Gino, you can tell an American that we were going to put laser communications in work boots. That's the phrase that'll resonate with my audience. I don't know how to say work boots in Italian, but it's what we use here. And finally, number three of the roundup, space situational awareness, what developments is foreseen in the next few years in that area?

Gino Bucciol: Okay, easier here. In this field of application, the request is for a better resolution, basically. The owners of the SSA assets would like to know with a great accuracy what is happening up there. They want to know if an offender is getting close to their satellite in orbit, catching sensible information or hacking its control system, or be able to understand if a collision is on the way with a very small margin of error. To properly answer a different range of optical system with special adaptive optics are required to see more and better.

John Gilroy: Well, we're coming to the end of our interview here, Gino, you have given us a great perspective on innovation. I'd like to thank our guest, Gino Bucciol, co-founder and chief development officer at Officina Stellare. Thanks, Gino.

Gino Bucciol: Thank you, John.