

Interview with Wallis Laughrey, Vice President of Raytheon Space and Airborne Systems

Exploring the Future in Space in Dealing with Changes in the Business Environment

By Japan SPOTLIGHT

The space business is facing unprecedented opportunities and challenges as competition among nations and firms intensifies. How do business people within the industry see the current situation? We interviewed Wallis Laughrey, vice president of Raytheon Space and Airborne Systems, a leading US company and the largest contributor to the global space industry.

(Interviewed on May 23, 2018)

Introduction

JS: Could you give a brief self-introduction, including your professional career in the space business? I have learned that Raytheon was originally founded in 1925 as a military business but recently has moved into the space industry under the name Raytheon Space and Airborne Systems. Could you also give a brief summary of Raytheon's involvement in the space business?

Laughrey: First, about my background. I went to the United States Air Force Academy and served in the Air Force for approximately six years, where I served in the airport space command headquarters and developed software and command and control systems. When I transitioned to industry, I worked in space protection and airborne programs. For the last two years, I have run the space business at Raytheon Space and Airborne Systems.

The history of Raytheon's involvement in space goes back almost 50 years, everything from developing the initial technology that beamed back Neil Armstrong's words from the surface of the moon ("One small step for man, one giant leap for mankind") to building visible and infrared instruments for weather, earth science and remote sensing. That history is quite successful. We have a 100% successful turn-on rate after launch with over 100 sensors delivered on orbit at all orbital regimes, for more than 500 instrument years in space. We continue to lead in this segment of the market in space; examples of this include Raytheon's development of the first weather imager from geosynchronous orbit, the first dedicated land imager, commercial ocean color imager, and a number of other instruments.



Wallis Laughrey

The most recent is the Visible Infrared Imaging Radiometer Suite (VIIRS) sensor, a key program of the Joint Polar Satellite System, and we continue to develop. Space is a technology-differentiated business so we continue to develop new technologies and systems that span the gamut of our customers' missions.

JS: Just a minor point to be clarified, Raytheon's headquarters is in Massachusetts, but Raytheon Space and Airborne Systems seems to have two main offices — one in Texas and the other California, where you are now. Is that correct?

Laughrey: Raytheon Space and Airborne Systems is headquartered in McKinney, Texas, and Raytheon Space Systems is headquartered in El Segundo, California.

A Variety of Space Business Activities

JS: Your company seems to be working on a wide range of space businesses — radars and sensors and communications/warfare solutions, as well as research areas such as linguistics and quantum computing. Which part of the business are you most focused on today? Cyber-threat protection, space launches, or GPS control? I think GPS control is very important as a space business, for air traffic management, Earth monitoring and so on, but which of these do you think is the most important?

Photo: Raytheon Space and Airborne Systems



JPSS-1 Launch — Launched aboard NOAA-20 in November 2017, VIIRS provides an unprecedented level of detail that contributes to more precise weather forecasts.

Laughrey: As you pointed out, Space and Airborne Systems has a broad portfolio of sensors — tactical, surveillance, electronic warfare, and integrated systems for military, civil and international customers around the world.

For me, from the space perspective, my portfolio includes advanced missile warning systems; Earth observation climate monitoring; intelligence, surveillance and reconnaissance (ISR) systems; and a whole range of space protection strategic systems. An example is the VIIRS sensor. We build VIIRS for NASA and the National Oceanic and Atmospheric Administration (NOAA), providing state-of-the-art Earth monitoring for decision-making. It is available and utilized by the international community for weather prediction, and provides very comprehensive coverage, high sensitivity and accuracy for prediction, ocean color, agriculture and forestry data. VIIRS provides a new way to observe Earth from space with low-light imaging that we call the “day-night band”.

We leverage our technology and capabilities across our range of customers. Another good example of this is that we are building the payloads for the WorldView Legion constellation with Maxar’s DigitalGlobe, which will provide the next generation of imagery for the commercial industry. The fundamental basis of these payloads is a portfolio of technology that we have invested in, which allows us to provide these types of capabilities to our customers.

JS: How about big data? Data dissemination seems to be very important for the space business in the future. Do you have some focus on this area?

Laughrey: Absolutely. Another part of Raytheon does ground systems, processing of data and the dissemination of data. We do some processing at Space Systems for instruments that we build.

What I would specifically say is very important relative to the burgeoning market of new systems producing all this data is the quality of the data. As a sensor builder, it is critical that we build sensors that provide the quality of the data, the knowledge and integrity of the data so that our customers can exploit it in many different ways.

Coming back to VIIRS, it is a fantastic example because the data is publicly available, and we are always finding that there are users who are figuring out new ways to use data coming from the sensor that was never previously contemplated. Users are finding new ways to exploit the data, and as a hardware designer, for us, we are really on the cutting edge of the implementation of focal planes, electronics and other areas that allow the downstream user of the data to find new ways to solve their problems, leveraging the systems that we build.

JS: A large part of the space business seems to be related to national security, since 30–70% of each national government’s budget for space development seems to be used for national security. In this regard, do you think the US government’s defense strategy in the future will seriously affect your business?

Laughrey: We are seeing an increase in future investments, but the

company and Space Systems, in particular, could not be better aligned with the US National Defense Strategy. The call for increased and sustained investment to counter Russia and China's activities and sustained efforts against North Korea, Iran, and terrorism — our common threads really necessitate the need for broad global cooperation. We are carefully assessing the gaps that we have in our technologies and partnering with our industry teammates, countries and companies to bring capabilities to bear for our government or international customers. It absolutely has an effect, and we are in a lot of discussions right now across the globe with customers, in particular US government customers, to understand what their needs are and offer solutions.

JS: Are you also working closely with academics?

Laughrey: Yes, we have a very broad portfolio of teammates and partners. Technology is what drives us in many cases, so we work extensively with US Federally Funded Research and Development Centers, universities, other industry teammates and certainly with governments.

JS: In light of strengthening the national defense system today, as you mentioned, delivering intelligence technology would be very important. In particular, I am interested in cyber-threat protection; do you think cyber-security will increase in importance in defense strategy?

Laughrey: The impact of cyber-security reaches beyond just the defense strategy. It impacts all of our lives and is built into everything that we produce. Space is no longer a pure safe harbor so we have to build the same type of protection into all of our systems, regardless of who they are built for — commercial, international — so I absolutely agree with you on the importance of cyber-security.

JS: Besides cyber-security, what do you think will be the next frontier for defense opportunities?

Laughrey: We know there is a mountain of data out there that is continuing to grow; and it's a question of sifting through all of that data and finding ways to use it to solve problems. The information out there needs to be connected end-to-end — from the hardware builder to the use-case or problem that you are trying to solve. From the people who supply the hardware, to the people who are flying it, to the people that are selling the data, and the people using the data — there is a gap in there. The people on the analytics side are still

trying to understand the full capability of the sensors flying so they can leverage the information to support solving their problems. At the end of the day, that is where there is an enormous amount of opportunity — finding ways to leverage data.

JS: Besides technologies related to national security or defense strategy, perhaps weather forecasting or national resources management constitute the other important incentives for improving your technologies. Would you concur?

Laughrey: We build systems and provide the ability to exploit various phenomenology. A downstream user who has a problem where they are trying to look at utilization of natural resources, may turn to, as a good example, VIIRS for tracking or monitoring elements of the ocean. VIIRS is an example where we build systems that are not necessarily intentionally built to achieve only one mission; it has the capability of multiple missions. Going back to data, the sensor has a set of capabilities to exploit a broad portion of the spectrum, which will allow somebody to solve a certain problem. Many of our systems are used for elements of monitoring the environment or looking at changes in the environment that have a downstream effect on natural resource management.

JS: According to news sources, you have expressed interest to have the US Department of Defense (DOD) meet its weather monitoring needs. I think these needs would be emerging as the next frontier of defense opportunities. Why would weather monitoring constitute an important defense opportunity?

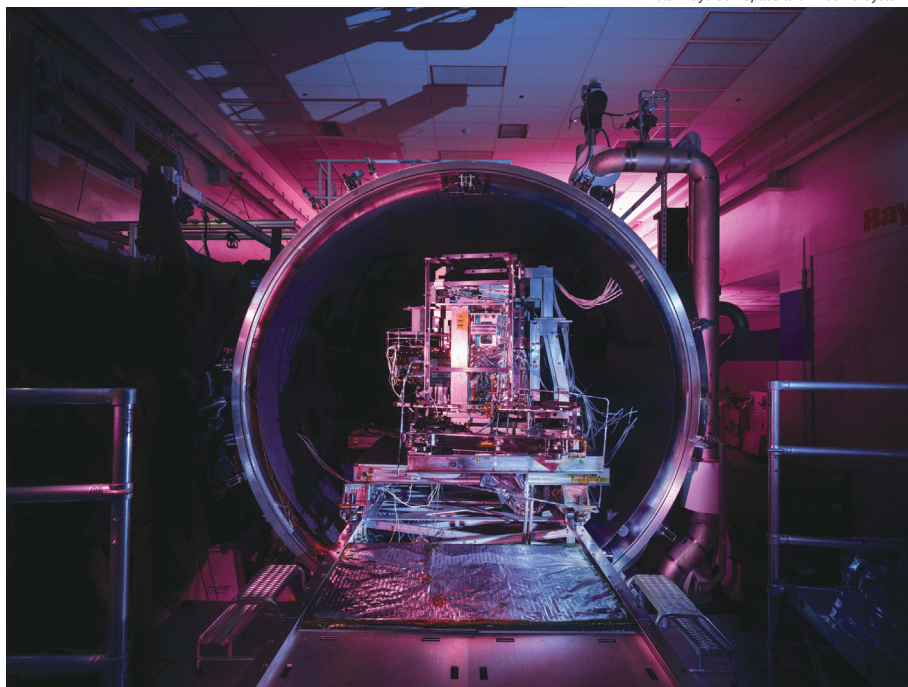
Laughrey: Weather is critical, not just for commercial needs or civil communities for forecasting, it is also absolutely critical for a lot of defense customers. The VIIRS system that we built was, from the outset, also built to meet the DOD's forecasting requirements. The sensor was built to fly in what we call the early morning orbit — and that orbit is specific for military weather monitoring. We often say VIIRS is “mission ready” — it has a hot production line. What we are trying to advocate is that the DOD is already using VIIRS for its mission planning and weather monitoring today, it is just not flying in the exact orbit to meet all of its weather needs. We are already a trusted source for the mission critical weather information and with the hot production line we have, it can ensure the continuous delivery of mission critical data for mission planning.

Photo: Raytheon Space and Airborne Systems



Raytheon Space Systems VIIRS instrument goes through rigorous testing to ensure it is ready for space. Here a Raytheon engineer inspects the JPSS-2 VIIRS instrument following testing in the thermal vacuum chamber.

Photo: Raytheon Space and Airborne Systems



After an incredibly cold workout in the thermal vacuum chamber, Raytheon's third VIIRS instrument is ready for the extreme temperatures and vacuum of space.

JS: Commercial customers are also very important, in addition to government customers. Today, you seem to be keen to attract commercial customers by getting into the commercial imaging market by manufacturing high-resolution imagers. Will this be a new trend for your business?

Laughrey: We always ask, what is our customer's mission requirement? We have a long history of building optical payloads and taking innovative approaches based on a portfolio of technologies that are simple in design but ready to be manufactured and produced at an affordable cost. Rather than deliberately going into the commercial sphere, it is more the case that a customer has a problem that aligns with our technologies and the execution model that we have to build a program.

JS: High-resolution imagers are one example, but do you also produce telescopes, detectors and other commercial products? Do you have any plans to attract commercial customers for such products?

Laughrey: Another part of our business builds detectors and focal planes, some of which have commercial products. We did not necessarily set out to cultivate the commercial market. We are very much about developing technologies that we believe are differentiated and provide our customers with the most capable solutions at an affordable price. Our strategy and approach is technological differentiation that supports our customers' needs.

Space Ventures Today

JS: Are you interested in cooperating with space ventures, in particular working on commercial products such as high-resolution images to take photos of parking lots and providing the business information obtained with those images to some private companies?

Laughrey: We assess each opportunity as it comes. We have had a number of discussions with commercial partners and if our technology offers a solution at an affordable price then we are definitely interested. We don't necessarily actively seek out commercial business, but if it is an imaging product or a new payload with a new telescope and a detector with something that we build, we will absolutely pursue it.

JS: I'd like to ask your personal opinion about space ventures. It seems to attract a lot of attention, in particular in California.

Laughrey: It is good for the industry, no doubt about it. I am optimistic, especially as we see launch costs going down. I think it's good that we are going to see a lot of businesses' systems on orbit whereas in the past they couldn't get to orbit because it was too expensive. I'm definitely excited. It's good for all of us in the industry. It's good for our customers. We also see a new generation of engineers coming into the business, so it's good across the board.

JS: Today, Japanese ventures seem to be working hard also in the areas of space debris removal and other similar business, but the cost does provide a high entry barrier. In the case of the US, there seem to be a lot of billionaires who can start space ventures. Would you agree?

Laughrey: There are a lot of privately funded ventures in the US. It's an exciting time to be in the space business.

International Picture of the Business

JS: In your financial highlights, 68% of total sales are domestic and 32% are international. Do you think this will continue for a while?

Laughrey: The company in 2017 had record international sales and that is continuing to grow. It is core to the global growth strategy and we approach each country as a market with multiple customers. We have a long history of international collaboration and partnerships across the globe, and bringing Raytheon products from around the company to support many of our international partners has been certainly very good for the company, and also very good for international cooperation across the board. I would definitely expect it to continue to grow.

JS: The US market share of the global satellite market is around 60%, much higher than any other country. China seems to be spending so much money on the space business. How do you see global competition in the space business changing in the future?

Laughrey: Across the board there is definitely more competition, more players in the global satellite market. I don't see that changing

anytime soon; you can just look at the number of new satellites that are being launched into lower orbit. The geosynchronous orbit is a lot harder to get to. If you look at the new space ventures that are popping up, we are watching really rapid expansion of these companies. Global competition is a good thing because it drives down cost, and it increases the supplier base for critical subsystems for satellites. One of the challenges in the economics of space beyond the high cost of launch is the fact that traditionally our industrial base has not built a lot of satellites. But now we are watching a larger quantity being built, which will drive down costs across the board. The competition is there and is definitely not something that changes our outlook. We are well positioned to meet many of our customer's needs.

JS: In light of the global market share, the US is first, followed by Europe and then China and Russia, and Japan. Japan's market share is very small. How would you assess the Japanese space business?

Laughrey: We are spending more time to learn about it. Our export regulations for many years have meant that we have not been able to have a lot of dialogue about space, but we are starting to have more discussions. I am certainly excited about the opportunities and being able to engage in the Japanese market in particular. As you think about the challenges in the Pacific region, space brings a lot of capabilities, and we certainly have a lot of matched capabilities that we are interested in assessing. We are also interested in understanding more about the needs and the market place in Japan.

Long-term Perspective on the Space Business

JS: What do you think are the challenges and opportunities for the space business in the long run? For example, costs, additional requirements from government due to possible changes in defense strategy, increased needs to adjust services and product provision to a shorter timeframe for customers, etc.?

Laughrey: I think that one of the biggest opportunities we are going to see is a decrease in launch costs, and the frequency of launches. That will drive us into a situation where space becomes much more accessible and the speed at which we deliver systems will also increase. We are always pushing the edge of technology for space systems, so I struggle with the word "challenge". Even when we are solving some hard problems, it is an opportunity to grow some of

our talent and bring our capabilities to bear for our customers. However, I'm reminded always that we are challenging our engineers and teams to think outside the box and go farther as it is win-win when we solve really hard problems that help make the world a safer place or solve our customers' hardest problems.

As we look forward, there is a whole range of opportunities in human space exploration, earth observation and, as you mentioned, debris mitigation, space traffic management and asteroid mining. There are many exciting opportunities and they are almost limitless. It used to be called the final frontier but I think we are only beginning to see the opportunities in front of us and we will be pushing the limits of technology to get there, which is very exciting.

JS: It appears that there are new moves afoot to start exploration on the Moon and Mars. Would that provide new opportunities and technologies?

Laughrey: As you look at the long-term exploration road map that is being coordinated by NASA, there is a whole set of terrestrial technologies and capabilities that are going to become critical as we look to manned exploration beyond the Moon. Really understanding the technologies that we use today in everyday life and making them capable to be used in space — those are aspects that we are looking at today.

JS: Global climate change is a challenge to humankind. Observation of space would seem to be a very important tool in helping to mitigate climate change. How do you see your business contributing to this?

Laughrey: We provide capabilities that our customers use to solve their problems. We provide a capability with VIIRS that NASA and NOAA use, really state-of-the-art for Earth monitoring and improved decision making. We provide capabilities that our customers use to solve their problems. VIIRS really allows more and more operational weather forecasting, and agriculture and forestry-related products. We provide sensors to our customers for them to assess and tackle the problems that they are working on.

JS

Written with the cooperation of Mayu Fukutani who is a freelance translator.