where or whether we look to launch from Australian soil, I think the pandemic has shown us which way we need to look," Whitington said. "Building the Australian ecosystem and industry to support those endeavours will be paramount."

The second critical area is bringing information back down from space, particularly Earth and deep space observation capabilities.

"This refers to the use of space and near space assets to collect, monitor, analyse and disseminate actions and activities," Whitington said. "This will enable us to understand environments faster and with more precision."

To advance Australia's capabilities in space domain awareness and observation, BAE Systems Australia is a partner in a number of cooperative research centres (CRCs), including the increasingly important SmartSat CRC.

"AN ADDITIONAL CHALLENGE IN THIS AREA IS EARTHBOUND SUPPLY LINES; A GLOBAL VULNERABILITY THAT HAS RECENTLY BEEN EXPOSED BY THE PANDEMIC. IN ADDITION, THE FORMATION OF RED OCHRE LABS BUILDS ON THE COMPANY'S ON-GOING EFFORTS TO GET KIDS EXCITED ABOUT SPACE AND STEM DISCIPLINES."

"The research and development that BAE Systems Australia is undertaking through its involvement with several universities and research bodies looks to the development of both ground based, near space and space based space technologies, with a keen interest in the development of secure and trusted AI frameworks to underpin more diverse aware and autonomous sensors," Whitington said. "So our partnerships and discussions with the growing Australian space industry community have been extensive and we recognise the need to develop current and the next-generation thinking and understanding."

Through the SmartSat CRC, the company is cooperating with Adelaide University, UNSW, Latrobe and Sydney University.

"Those four universities are predominantly engaged with us around AI cyber security and the enhancement of a lower swap, so size, weight and power," Whitington said. "So enhancing the processing ability in satellites as payloads."

The joint effort BAE Systems Australia is undertaking through the CRC is ultimately aimed at developing the next generation of space technologies and bringing them to market. It intends to capitalise on the 'Space 2.0' revolution, in which access to the last frontier moves from government to industry.

"The CRC is predominantly there to engage and attempt to foster an Australian ecosystem, to build an Australian ecosystem, not just for research and development but also for industries to come to commercially viable products," Whitington said. "It is about the application enhancement of current technologies, but it's really attempting to go to that next generation of satellites.

"it really will start to change the feel from space from being exclusively zoned for governments and military usage; we'll see commercial and industry playing a far bigger role in those lower orbits."

So how will the formation of Red Ochre Labs facilitate the company's presence in Australia's nascent space industry?

"Red Ochre Labs looks to enhance or deliver the next generation of technologies," Whitington said. "So it's looking at probably not what is clearly apparent or right in front of people's faces right now as technology to prosecute, but what will it look like for the next generation; the 'what ifs'.

"[For example] constellation and autonomous flights, and the development of AI in a multi-modal sensor capability. So near space and space based assets being able to determine courses of action based on their environment."

In addition, the formation of Red Ochre Labs builds on the company's on-going efforts to get kids excited about space and STEM disciplines.

"Even outside of Red Ochre Labs, I'm involved in a number of discussions with BAE Systems Australia to support a lot of STEM activities through high school developments, undergraduates, even Year 9 and 10 students coming out for vocational work," Whitington said. "They come out and learn, see what we're doing, have a look at some of the development activities.

"If you ever needed a particular domain that's inspiring, space is it."

SIMULATION


DEFENCE

KATHERINE ZIESING | CANBERRA

IN many respects BAE Systems Australia is known for its platform business. But the company also has form when it comes to products. One of the lesser known products that has achieved global export success (in use with 13 navies around the world) is the ship air defence model (SADM).

Beginning life in the early 1990s when simulation tools were still in their relative infancy, SADM was originally designed to showcase how to protect ships from missile attack.

The SADM simulates own-ship and task group protection using guns, missiles, active decoys, chaff and jammers, and includes detailed models of shipboard sensors and their interactions with ship combat systems.

JOURNEY GOES GLOBAL

LEFT: SADM uses feeds from ESSM, Nulka, radars and a number of ship systems to produce a coherent ship defence picture.

It also includes weather effects to model signal propagation and signature attenuation in rain and other conditions.

SADM today is a versatile operational analysis tool that simulates both task group and single ship operations against multiple aircraft and missile threats.

"The concept was so revolutionary when we began that it was hard to explain without some kind of visualisation," BAE Systems Chief Technology Officer Brad Yelland and one of the SADM 'fathers' explained to ADM.

"Using flight simulation information to build a set of 3D CAD drawings that could be combined and rendered to build the animation, the initial product was essentially a marketing tool.

"But we soon realised what it was we had in our hands – we could expand the capability to reflect different payloads, how different missiles would interact with the ships' systems."

"And, not long after we realised that what we were developing was an exemplar simulation of an air defence scenario for maritime.

"Then we started to think about all the different applications and realised that if we could get really good high fidelity models of radar seeker heads, the RF environment, ship motion together with building in the capabilities of other ship sensors and weapons, then what we would have is a pretty sophisticated naval air defence model that could be used for a number of different purposes.

"So we recruited experts to build that capability into SADM, using much more capability computer-based simulation and visualisation applications to produce a tool for three main purposes."

The tool is still used to inform developers as continued development and improvements to the capability are made. Customers use it to develop requirements for air defence systems and combat systems. Finally, SADM is also a training tool.

The company is also working on a development plan that would see a fourth application in real time operational aid where in the ops room the sailors can actually use it, running faster than real time to work out the best approach to any given scenario therein.

A SADM users group consisting of all 13 navies that operate the system was initiated by the Canadian Navy because it wanted a forum that could be used to communicate easily with other users of the model to talk about modifications, upgrades and additional capability they wanted, how to do certain things with the model. This forum still meets on a regular basis and it cost-shares modifications to the model. There are open modifications that are shared among the community.

"One country might pay for it but is happy to share it amongst all the other nations using it," Yelland said. "There are other enhancements that we do that are sensitive to one nation's particular needs that remain exclusive to that country's eyes only. It's used extensively in defence establishments such as the Naval Research Labs in the US, the Maritime Warfare Centre in Canada, DST Group in Australia and UK MoD. Many NATO nations use it too."