AAC CLYDE SPACE

SPAACE TALK

Issue #2

MESSAGE FROM THE CEO

Children born today are likely to face seven times more extreme weather events than their grandparents.

That is the headline of the 'daily chart' in The Economist, which lies open on my screen. From the severe flooding in China earlier this year, which forced more than a million people to relocate, to the deadly ice storm that swept through Texas leaving millions without power, extreme weather events are occurring across the planet with increasing frequency and disruption to lives and livelihoods.

Tackling this global issue requires a combined strategy of prevention and cure, and data from small satellites has a vital role to play in both.

Firstly, by helping us to address the source of the problem: climate change. Small satellites enable us to observe key planetary indicators in real time. This data empowers us to do more than talk about climate change; it empowers us to take action and make better decisions that reduce our impact on the environment.

For example, most traded goods are moved by sea. In fact, the shipping industry is responsible for nearly 3% of global greenhouse gas emissions - more than airplanes[1], and more than Canada, Brazil, Indonesia or the UK[2]. If left unchecked these emissions could increase 250% by 2050[3]. Right now, we're working with Saab and ORBCOMM to deliver a new space-based communications system for the maritime industry. Amongst other things, it can be integrated with e-navigation systems to ensure that ships take the most direct and most efficient route, enabling a reduction in fuel usage and emissions of up to 25%[4].

Secondly, small satellites improve our predictive capabilities, enabling us to better prepare for and react to extreme weather events when they do occur.

Take hurricanes, for example. Three questions people need to know about hurricanes are when, where and how strongly they will hit. The problem is that hurricanes – in fact, all extreme weather phenomena – are by nature more erratic, so to answer these questions accurately we need high-quality, real-time atmospheric data. In other words, we need to see inside hurricanes as they are evolving.

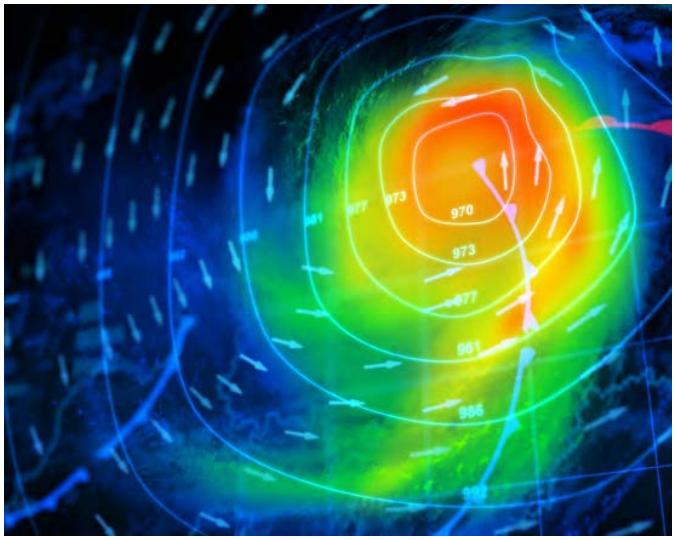
Current methods, such as NASA's CYGNSS[5] constellation, use reflectometry technology to do this. But now, by combining AAC CubeSats with AAC Omnisys microwave sounders, we can get a much clearer view. The CubeSats allow us to keep an eye on the hurricane, while the microwave sounders enable us to see through the clouds to the structure of the atmosphere in much greater detail. And with the much lower cost we can launch large constellations, giving us granular, high-frequency data. This will improve our understanding of a hurricane's core, helping us to make the leap from observation to anticipation – and saving lives and property.

It's a powerful combination that gives us a leading position in space-based weather data more generally, an area I am hugely excited to develop. If you're interested in understanding more, read the interview with Dr. Anders Emrich, co-founder of AAC Omnisys, on page 11.

We also have a roundup of developments from the last quarter, including a special feature on the launch of AAC Space Africa.

Overall, I hope this issue leaves you feeling inspired. What we do here has the power to protect and improve the lives of people across the planet.

Luis



'This data empowers us to do more than talk about climate change; it empowers us to take action'

1. https://yaleclimateconnections.org/2021/08/maritime-shipping-causes-more-greenhouse-gases-than-airlines/
2. https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE
3. https://ec.europa.eu/clima/eu-action/transport-emissions/reducing-emissions-shipping-sector_en
4. https://aos-vdes.com/
5. Cyclone Global Navigation Satellite System

THE BIG IDEA

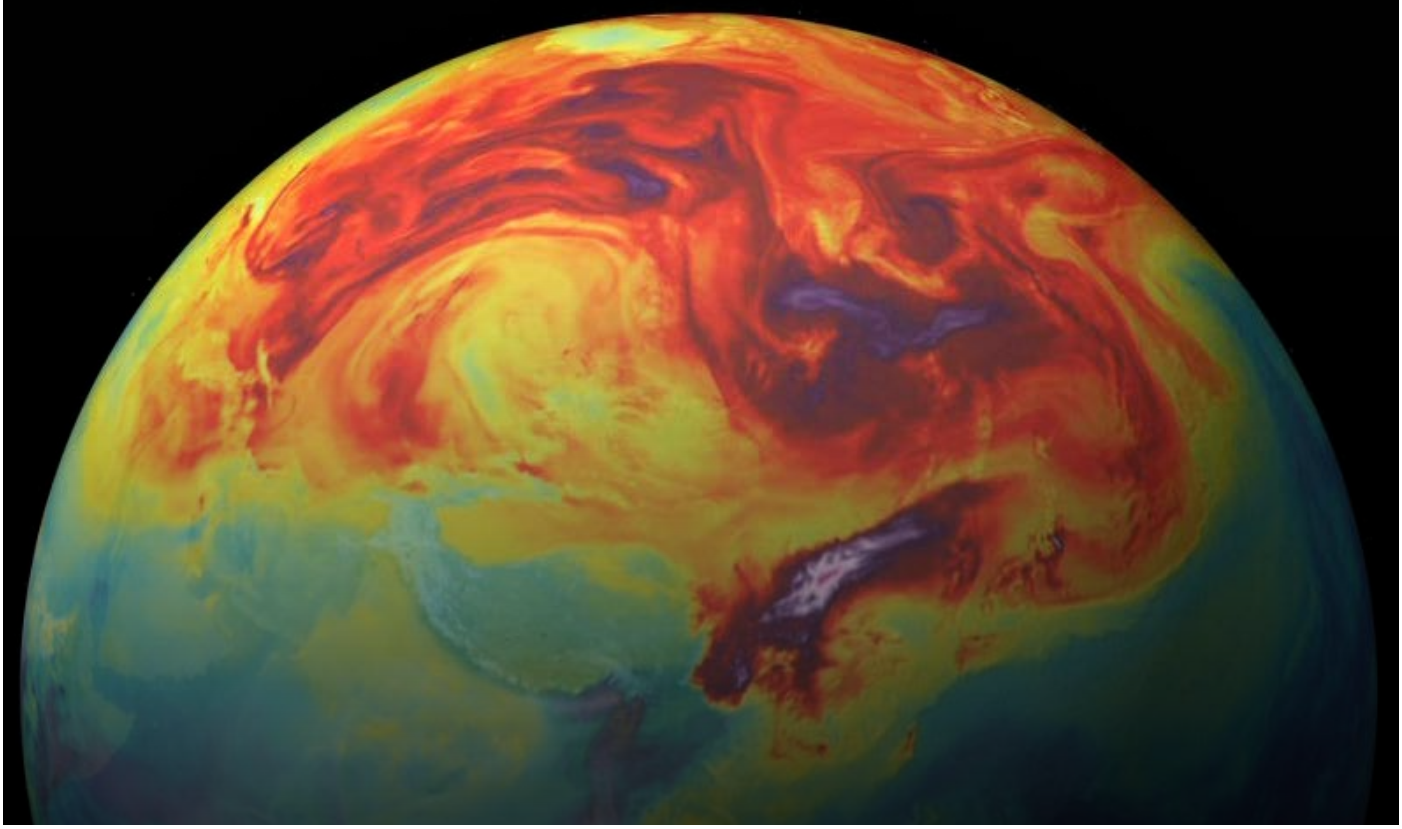
SPACE FOR SUSTAINABILITY

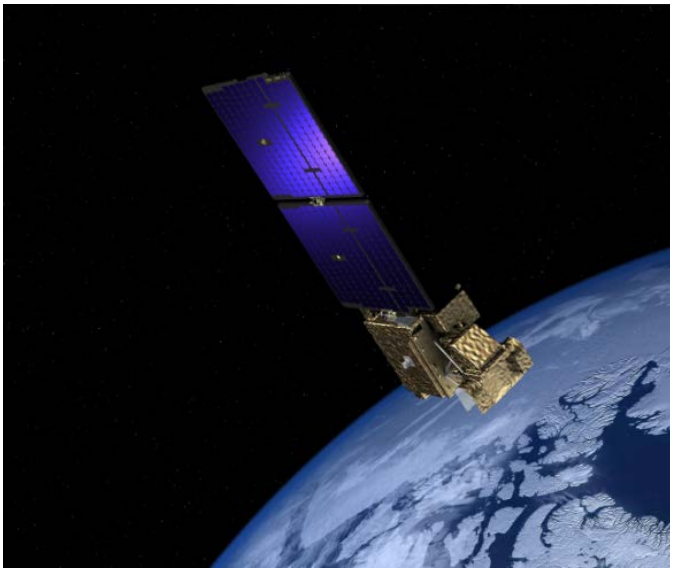
The eyes of the world were fixed on Glasgow in November, as world leaders gathered at COP26 to address one of the most important and urgent issues of our time: climate change.

Less than a mile down the road, we hope the work we're doing at AAC Clyde Space will have a meaningful role to play in this collective effort to create a more sustainable Earth.

Small satellites are an integral part of the climate change mission. As the adage goes, 'what gets measured gets managed'. Now, thanks to innovation – such as advanced sensors, miniaturization of components, high-speed data transfer and better storage capability – we can use small satellites to measure key planetary indicators accurately, on a global scale, in close to real time. Think greenhouse gas emissions, sea levels, the size of the polar ice caps, forest cover, and much more.

Our role at AAC is to help capture and deliver this high-quality, timely data to those who need it. In doing so we can fill the gaps in our understanding of climate change and equip scientists, policymakers and businesses to develop more effective strategies against it.





We are developing a number of initiatives, from spacecraft that pack more capability and processing power into smaller cubes; to applications that monitor Earth and enable better decision-making; to innovations that tackle the growing issue of space debris.

Ultimately, the commercial small satellite industry is uniquely positioned to support our global sustainability and climate change goals by providing access to increasingly sophisticated and timely earth observation data and space-based services. If analysed and acted upon quickly by businesses and governments, this can make a meaningful difference.

Here are just some of the ways in which we are having an impact:

WEATHER FORECASTING

AAC Omnisys' advanced sensors are raising the quality of weather data, enabling significant improvements in weather forecasting and climate research. This has important implications for minimizing the damage and disruption caused by extreme weather, which is occurring with frequency across the planet. All too often, the response to extreme weather is reactionary because businesses and governments lack the information needed to prepare. The result is unnecessary lives lost and economic setbacks. In fact, the United Nations estimates the direct economic losses from weather disasters between 1998 and 2017 at almost USD 3 trillion[7].

AAC Omnisys' latest type of microwave-based sensor could help to lower this figure. It has already been selected by the European Space Agency (ESA) for the Arctic Weather Satellite constellation, designed to improve forecasting not just over the Arctic, but also globally.

GEMS: ENABLING BETTER RESPONSES TO EXTREME WEATHER

We've been working with Orbital Micro Systems to deliver CubeSats for its Global Environmental Monitoring System (GEMS). GEMS uses microwave sounders to record temperature, humidity and precipitation at multiple altitudes, regardless of cloud cover. This information can be used to improve storm forecasts and, in turn, enable faster, informed decision-making by businesses and governments in the face of weather-driven emergencies. At full deployment, GEMS will deliver near real-time data for any point on earth.

'Through GEMS, we further extend our involvement in space missions aimed at enhancing the understanding of our environment. Missions of this kind help us all in the quest for a safer and more sustainable life on Earth'

Luis Gomes, CEO, AAC Clyde Space

MARITIME SURVEILLANCE & COMMUNICATIONS

The oceans cover three quarters of the Earth's surface and represent 99 per cent of the living space on the planet by volume[8]. Their temperature, chemistry, currents and life – drive global systems that make the Earth habitable for humankind.

But they are also subject to neglect and pollution which is disrupting ecosystems and biodiversity. If left unchecked, this could be devastating for the future of the planet. Our technology supports better ocean management, from enabling faster reactions to oil spills to detecting harmful microplastics, tracking illegal fishing and reducing fuel usage and emissions.

SEAHAWK: MONITORING OCEAN HEALTH

A key indicator of ocean health is to observe the changing biology of the ocean surface. This can be done using satellites to perform ocean colour monitoring: changes in ocean colour reflect changes in marine phytoplankton and other types of particulate matter, revealing valuable insights into ecosystem processes and overall health. Ocean colour monitoring is an Essential Climate Variable but also a prohibitively expensive activity. That is, until 2019, when we designed, produced, and launched the SeaHawk platform. Seahawk is a collaboration with the University of North Carolina Wilmington and NASA's Goddard Space Flight Center. It is a follow-on mission from the highly successful SeaWiFS (Sea-Viewing Wide field-of-View Sensor) mission, launched in 1997.

Just over 20 years on, Seahawk can replicate the performance of the SeaWiFS mission, except it is approximately 100 times smaller, lighter and cheaper.

The spacecraft carries a cutting-edge multispectral imager, designed by Cloudland Instruments, called 'HawkEye' to perform ocean colour monitoring.

These images are available free of charge via NASA's Ocean Color website. The data is integrated into NASA's SeaWiFS Data Analysis System and distributed worldwide. It supports greater understanding of the marine food chain, oceanic climate, fisheries and pollution phenomena, which is vital to supporting healthier, more sustainable oceans.

VDES: CREATING SAFER, CLEANER OCEANS

Around 90% of all traded goods are carried by ships[9], with maritime trade volumes set to triple by 2050. This huge increase in ocean traffic is prompting growing concern about the detrimental effects to the health of our oceans, the safety of seafarers, and congestion.

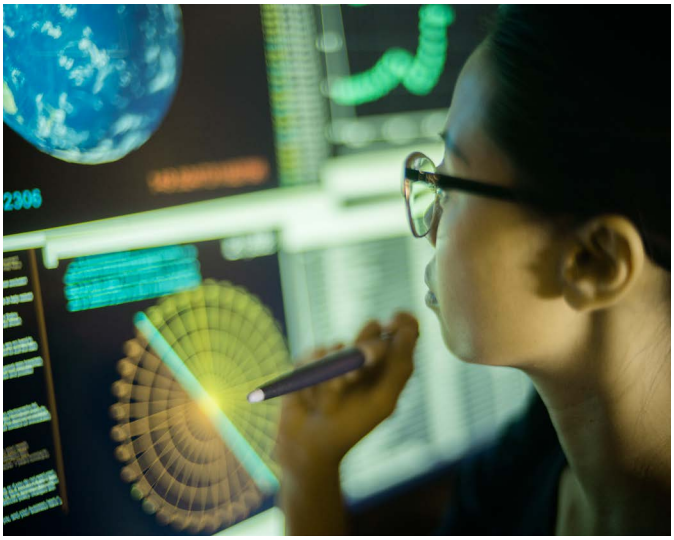
Satellite-based services can support greater safety and efficiency. For example, we have just signed an MoU (Memorandum of Understanding) with Saab and ORBCOMM to create the world's first dedicated, global maritime communication system.

Using VHF Data Exchange System (VDES) with added space-based capability, we will enable, for the first time, ship-to-ship and ship-to-shore communication anywhere in the world - with up to 32 times more bandwidth than the currently widely used Automatic Identification System (AIS) communication.

VDES will contribute to a greener shipping industry. For example, it can be integrated with e-navigation systems to enable savings in fuel and emissions of up to 25 percent.

Furthermore, improved coordiation between ships should result in fewer accidents and safer oceans for seafarers. Where accidents do occur VDES will enable quicker response times.

The system is especially impactful when combined with other technology for the detection of piracy, illegal fishing and smuggling as it can't be turned off manually like an AIS.



AMBER: COMBATING ILLEGAL OCEAN ACTIVITY

Using satellites to create improved detection and reduce illegal activity can not only reduce threats to the maritime industry but ensure seafarers are kept as safe as possible while out at sea. We are manufacturing, delivering to orbit, and operating a fully integrated CubeSat, IOD-3 AMBER, for our partners at Horizon Technologies for use in its AMBER SIGINT (Signals intelligence) programme.

The satellite will be used to provide commercial customers worldwide with end-to-end data services to help track and combat illegal maritime activity.

Two additional AAC Clyde Space satellites will make up part of the Horizon Space Technologies' Amber™ constellation, dedicated to delivering Maritime Domain Awareness (MDA) intelligence data. The constellation will be used to locate and track vessels worldwide by geolocating and demodulating RF signals in a system that can be used for illegal activity such as piracy, illegal trans-shipments and other detective purposes.

SPACE DEBRIS

The global space economy is projected to reach $1trn by 2030 by some estimates. This will be driven by the launches of many new satellites over the next decade. However, this growth is threatened by the increase of human-made space debris, which is approaching a critical level. According to a statement released at this year's World Economic Forum, close to one million objects larger than 1cm travel at 27,000 km per hour in Earth orbit – each one a threat to satellites and other spacecraft performing valuable services to our global economy, from earth observation to navigation, communication and research. We agree that as an industry, we need to do a better job at safeguarding the Earth orbits and ensure we use them in a sustainable and safe manner now and for future generations. Part of this is about developing technology that will make the next generation of satellites more sustainable. We are currently working on propulsion technology to help avoid collisions in space and to accelerate the spacecraft's re-entry, minimising time spent in space after end of life.

In fact, our CubeSat propulsion module, developed with Dawn Aerospace, was the first ECSS[10] compliant, 3D bi-propellant propulsion system permitted for launch into space.

We're also proud to partner with clients like Astroscale, who are working to clean up space by developing technologies for the disposal of spacecraft at end-of-life, and Space Forge, who are exploring the possibilities of reusable spacecraft.

ASTROSCALE: CLEANING UP SPACE

We have been selected by Astroscale to co-engineer its satellite platform for its spacecraft decommissioning service, ELSA (End of Life Services by Astroscale), which is moving into a commercial phase this year.

The servicer itself, ELSA-M, is designed for constellation satellites and will remove multiple retired satellites from Lower Earth Orbit in a single mission.

'Traffic in Low Earth Orbit is expected to increase exponentially over the coming decade. For the space economy to progress effectively, and safely, the industry needs to adopt new practices to minimise space debris. We are happy to help to create pioneering solutions that support Astroscale's efforts to actively remove debris from the small satellite space highways.'

Luis Gomes, CEO, AAC Clyde Space

7. https://www.undrr.org/news/un-20-year-review-earthquakes-and-tsunamis-kill-more-people-while-climate-change-driving
8. https://www.un.org/en/observances/oceans-day/background
9. https://www.oecd.org/ocean/topics/ocean-shipping/
10. ECSS: European Cooperation for Space Standardization

COMPANY HIGHLIGHTS

THERE'S A NEW KID IN (CAPE) TOWN: AAC LAUNCHES SOUTH AFRICA SUBSIDIARY

Founded in August, AAC Space Africa gives us a strategic foothold in Africa's rapidly growing market for satellites and space services. From here we will design, build, and deliver space missions and data to the continent – and develop advanced radio communications for the entire Group.

Africa's space economy is ramping up. More space companies were founded in Africa in the last decade than in the previous five. The industry is expected to generate over USD10 billion in revenue by 2024, with national space budgets on the rise. Across the continent, governments have earmarked USD550 million for national space programs in 2021 – that's a 94% in three years[10].

We are working with two pioneers of the African CubeSat industry, Dr. Robert Van Zyl and Francois Visser, to capitalise on this rapid growth through the launch of AAC Space Africa. Robert and Francois take up the roles of Managing Director and Technical Director of the new subsidiary, respectively. Both have been long term partners of ours at the Cape Peninsula University of Technology (CPUT) and together, they bring over 40 years of small satellite experience to the Group across various missions – including the first ever CubeSat launched by an African country.

AAC Space Africa will also be the centre of excellence for advanced radio communications across the AAC Group, supplying advanced radio systems for space missions worldwide. Radio communications are essential for operating satellites and, crucially, bringing the data they collect down to Earth.

'The need for space services in Africa is growing rapidly as the government, companies and communities seek efficient ways to support development and build out crucial infrastructure. Adding local presence and expert knowledge to our existing commercial offering will put AAC in an excellent position to address these needs. We look forward to taking an active role in the South African space community and the wider market', says AAC Clyde Space CEO Luis Gomes.

The move to launch AAC Space Africa follows several initiatives in the African market. Most recently, we supported Mauritius in its efforts to become a space nation by delivering the country's first satellite, a 1U CubeSat (MRIC Sat-1). MRIC Sat-1 employs earth observation technologies to track ocean currents. Mauritius will use the mission to build its expertise in space data and technology. Ultimately, it hopes to use space infrastructure to tackle issues of national priority, including fish depletion and natural disaster mitigation.
Mauritius is not alone in focusing on the space sector and the benefits it can bring to a country's development. African governments are increasingly aware of the opportunities created by the space sector and the industries that support it. Botswana, Rwanda and Namibia have all launched their own space programs, agencies or policies in the last 12 months, while Burkina Faso, Djibouti, and Zambia are developing new satellites that will launch their national space programs. At a supranational level, Agenda 2063 – Africa's master plan for socio-economic transformation over 50 years – recognizes opportunities within the space sector as key to boosting rapid development of the continent.

'The fact is that every country in Africa is large enough to benefit from a space programme', says Robert. He points to a map of Africa with other countries of the world superimposed. 'What people forget is that within Africa you can fit most of Europe, the US, China, India, Japan, the UK... this puts into perspective the scale of Africa's socio-economic needs. Without generalising too much, Africa has now decided to start looking collectively at ways of solving these macro problems – and space is a key avenue.'

The team at AAC Space Africa is expected to grow quickly to meet this growing demand. We sat down with Robert on his first day in the job to find out more...

You're an educator by background. Why did you decide to join AAC?
I was an educator, but I've always been entrepreneurial, even within a university environment. Over the past 10 years I've achieved what I set out to do at CPUT – we've got a STEM programme, academic and post-

grad research programmes, we've launched satellites! We've established the Africa Space Innovation Centre. That's where we developed the radios which we commercialised in 2012 with the help of AAC Clyde Space in Glasgow. Now, I want to challenge myself in new ways. What I like about AAC Space Africa is that with all the support from the Group to us and us to the Group we can make an impact here in Africa and benefit our shareholders at the same time. I see it as a win-win. That's why I'm here.

Why is it an exciting time for the African space industry?
Africa is good at exploiting disruptive technologies. For example, we don't have a lot of wired telephones in Africa, but almost everybody has a cell phone. So, we almost skipped a step. In a similar sense, I think we are skipping Old Space and now the New Space era is here for Africa to capitalise on.

Right now, everything is still on a small scale, but we are at an inflection point where things are going to take off. You can see that in the numbers from the African Space Industry annual report. It's exactly the right time for all parties, with outside investment from the likes of AAC Clyde Space and all the investment Africa is making into national space programmes. If we can get the planets to align, all of a sudden, the whole African continent is going to jump up as a group, resulting in new scalability in the business that you can do here. It's a huge opportunity for us to get involved.

What are the major risks to Africa delivering on its space ambitions?
A key risk is Africa's ability to grow the engineers and the scientists to develop what is termed sovereign indigenous space capability. Over the past 20 years I've been working hard to do just that. My government made a huge investment and now, CPUT has about 80 to 100 Master's students to show for it – but it's still a drop in the ocean compared to what is required.

Skills retention is also important. Africa needs to synchronise this growth in engineers and scientists with an ecosystem for them to work within. Otherwise, they will go elsewhere to practise their skills. That for me is the big challenge – to grow the infrastructure within Africa to retain and develop those skills – and to show more people the value of space. It seems expensive, especially when there are pressing issues for tomorrow, but the long-term value created through that investment is so much higher. Governments are now realising that, which is very encouraging.

Why South Africa?
South Africa's space industry is relatively advanced – we don't have that many companies, but we have core upstream space capabilities, advanced technologies, and highly skilled engineers and data scientists. For example, we have a strong position in communication systems. We want to build on that experience.

Also don't forget that here, AAC Clyde Space is a household name with stakeholders who appreciate the role it has played in the space industry you now see in South Africa. AAC Clyde Space was much more than a distributor for CPUT; it was a strategic partner, instrumental to our success. AAC Clyde Space would tell us what the market required and we would implement it. It was synergetic – a true partnership.

What are your goals as Managing Director?
We are at the point where Africa's New Space industry is exploding – in a good way. We want to position ourselves to benefit from that – and contribute to it.

For example, I've developed a vast network across Africa which I want to leverage to develop business for the company. But I am also very passionate about the continent. I'm from Africa. I live here and I want to make a difference by leveraging international partnerships and providing value to the Group at the same time.

I see opportunities to help grow an industry that we can do business with. But before people will buy data from us, there must be an appreciation at large of what space can do. This is why I was very involved in STEM and going to communities in Africa and showing them how these little satellites can be of practical value.

Why do you love working with satellites?
I believe that satellites can help to provide global solutions to global problems. They are also multidisciplinary. Working on a mission brings people from so many different fields together: engineers, technologists, scientists, business, law... I saw that with Africa's first CubeSat launch, how lots of people were focusing on different aspects of this small 1kg satellite – and then you've got this one magic moment where everything comes together.

You pioneered Africa's first CubeSat launch. What did that moment mean to you?
That first satellite was a pathfinder. Sometimes journeys stop there, but fortunately my government had the vision to sustain ours. Now in 2021, less than 10 years later, three satellites are being launched that will provide maritime communications – a direct benefit to the country. That's what makes me tick. Putting people and resources together and moving from technology demonstration to something useful within 10 years.

What's more, 80 engineers from across Africa have since graduated from the CPUT satellite programme. The challenge now is to create employment opportunities for them by growing the African space programme.

10. Data taken from the African Space Industry Annual Report 2021

XSPANCION MOVES INTO PHASE 2

In November, we kicked off phase two of the xSPANCION project: a transformational three-year project to design and develop an innovative satellite constellation service.

xSPANCION is co-funded by public and private partners, including the UK Space Agency via the European Space Agency, and will revolutionise our Space Data as a Service (SDaaS) offering. The technology and processes we are developing will reduce the cost of every message collected, every image captured. This in turn will allow us to share space data and services with customers quickly and at significantly lower cost, supporting those business cases that to date have not been economically viable. It will also catalyse a new generation of applications not previously possible.

The launch of Phase 2 follows the successful completion of the preliminary design review and means we can continue the project at full speed. This phase includes detailed design of constellation-ready spacecraft, development of digital production processes, constellation operations capability as well as licensing, regulation, and more efficient launch coordination to deliver a step-change in our capability to deliver constellations. We also continue discussions with selected customers to enter agreements for data delivery from the constellation, which is expected to be operational by 2024.

AAC ENTERS INTO MOU WITH SAAB AND ORBCOMM TO REVOLUTIONISE MARITIME COMMUNICATIONS

In another key milestone this quarter, we entered into a Memorandum of Understanding (MOU) with Saab and ORBCOMM to create the first dedicated, global maritime communication system. Based on a VHF Data Exchange System (VDES), it will enable, for the first time, ship-to-ship and ship-to-shore communication anywhere in the world.

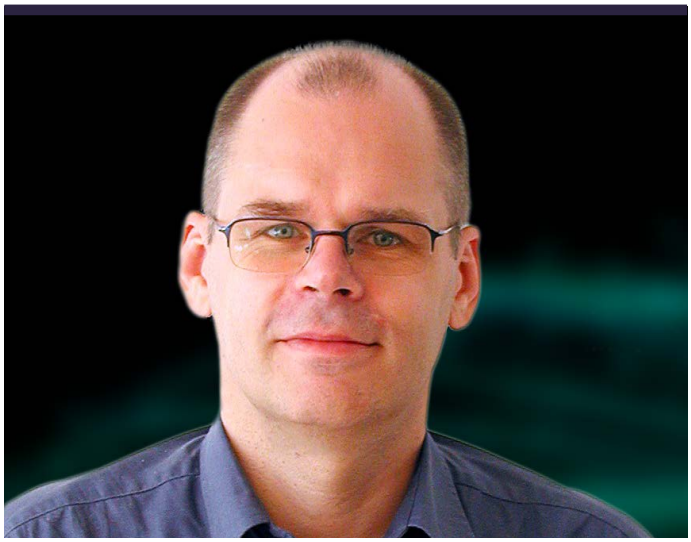
This will not only improve the safety of seafarers but will also contribute to a greener shipping industry – a critical part of the climate change mission. For example, with up to 32 times more bandwidth than the current, widely used Automatic Identification System (AIS), VDES can be integrated with e-navigation systems to enable savings in fuel and emissions of up to 25 percent.

Our work with Saab and ORBCOMM to establish the next generation of maritime communications has been underway since August 2020, but the formalisation of this cooperation, now branded 'AOS', creates an important platform on which to fine-tune our efforts and develop value-driven commercial and government applications for VDES. We plan to have our first VDES satellite up in space next year.

5 MINUTES WITH...

DR. ANDERS EMRICH

The co-founder of AAC Omnisys explains why combining microwave sounders with small satellites is a game changer for weather prediction – and why the end user is king.



How is weather forecasted today?
Most weather forecasting is done by computers. The models they run require a lot of source data, which is captured by a variety of sensors located on the ground, on aeroplanes...but most importantly, satellites.

We've heard that AAC Omnisys microwave sounders will give us a leading position in space-based weather data. But what are microwave sounders and what do they do?
Of all the different types of sensors on satellites, from infrared to microwave, the most valuable for weather prediction are microwave sounders. They measure on different frequencies to gauge key components of weather, like temperature and pressure of the atmosphere. In fact, they are the baseline for weather prediction today.

What are the most important factors for weather prediction that microwave sounders measure?
For a long time, oxygen emission was considered the most important factor - it's actually from this that we derive temperature and pressure of the atmosphere. But over the last decade it has become clear that water emission data is at least if not more valuable. This is where combining AAC's small satellite technology with AAC Omnisys microwave sounders is a game changer.

What is game changing about this combination?
When measuring oxygen emission, the models can cope with a two- to four-hour time gap between measurements – and up to 50km resolution over Earth. So, you just need a few satellites to get enough data points for the models to work.

But water emission is different because changes in water and humidity in the atmosphere occur on a much smaller scale and faster timeframe. We're talking five to 10km, not 50km – and every 10 to 30 minutes. If you measure water emission with two- to four-hour time gaps, you're blind to much of what's happening. This is what's known as 'under sampling' and it is a big problem for accurate weather prediction.

'Our vision is to provide the world with better weather forecasts, and as part of the AAC Group, we can see a clear path to realizing this.'

So, our plan is to build and launch our own constellation of smaller, lower-cost satellites to significantly reduce the time gap between each water emission measurement. We have also improved the spatial resolution to less than 10km (current microwave sounders have 25 to 15km resolution at best).

Together, these changes will enable meteorologists to measure this important water emission parameter correctly and provide much better forecasts.

It sounds good...but aren't microwave sounders very expensive?
Traditionally, microwave sounders are extremely expensive, developed by large companies for millions of Euros each.

Where we are different is that we have asked the end users – what do you need? What are the most important parameters that we must meet? By understanding their requirements, we can ensure the right assumptions are made – and optimise the instrument to reduce costs while providing high-quality, pertinent data.

It's a really important point because to optimise, you need to make trade-offs. For example, the end user may think they need 12 receivers on an instrument but to build a small one we cannot have more than four. By understanding their requirements properly, we can quickly remove the eight of least value. This ability to prioritise means we can deliver much more cost-effective solutions to clients that still meet their needs.

Does this mean we will be able to predict the weather exactly?
Weather prediction is extremely tricky – it's Chaos theory. So, it's not that we'll suddenly know exactly what the weather will be next Saturday.

But we are addressing the most important instrument there is for weather prediction and improving the measurements it takes considerably. I'm confident we will see a big improvement in near-term and short-term forecasting using our data. That means little to no surprises in the weather on the same day, and recognizable improvements in forecasting up to 72 hours.

Will we be able to forecast climate change?
One of the most important parameters for climate is the water balance of Earth – that means how much water is in the atmosphere versus how much is stored in the planet, mainly in the seas and lakes.

Water in the atmosphere acts like a mirror on radiation, so any systematic change in the water balance will in turn impact energy flows to and from Earth, a key factor in global warming and climate change.

We do not yet know the exact water balance of the Earth – right now we are guessing – but a constellation would be a very good way of measuring it.

What are the implications for forecasting extreme weather?
Our combined technology should enable significant advances in severe weather forecasting.

Severe weather is not only the worst kind of weather; it's also the most unpredictable. For example, a slow increase in heat can be modelled easily, but with severe weather things change very rapidly. That's a big problem when the most important measurement , water emission, is only done once every four hours. You don't know what's happening because it's completely under sampled. For severe weather there should be a much shorter time gap between measurements. Small satellite constellations make this possible.

'I'm confident we will see a big improvement in near-term and short-term forecasting using our data.'

The other issue is that when you observe severe weather phenomena using optical satellite imagery, you can't see what happens inside the clouds, you just see the outer layer. For example, if there's a hurricane you just see a big blob. By using microwave sounders you can actually see the internal dynamics of the storm.

So, water is a key variable in weather prediction – especially extreme weather. Are there others that we don't yet measure?
At much higher frequencies, for example the Arctic Weather Satellite measures at 325Ghz, it's possible to derive some information about ice particles high up in the atmosphere which can help on long-range forecasting (five to 10 days). But this is relatively unexplored territory and a bit more unproven.

It's not the highest priority right now but it could become of much greater interest in the next five to 10 years.

Why did you decide to join the AAC Group?
Our vision is to provide the world with better weather forecasts, and as part of the AAC Group, we can see a clear path to realizing this. AAC has the knowhow to build constellations and we have the expertise and the end-user knowledge to build a new generation of weather sensors – it's a perfect match.