Grant Sanderson, CEO, EOS Defence (EOS photo)

CHIEF EXECUTIVE OFFICER, EOS DEFENCE, **GRANT SANDERSON** SPEAKS WITH APDR EDITOR **KYM BERGMANN**

Kym: Let's start with a quick overview of your career.

Grant: I joined the Army in 1983 transferred to the Reserves in 2007. After four years at Duntroon, my career was primarily spent in infantry battalions, mainly the 3rd Battalion, in the days when it was an airborne battalion, and in Special Forces. But after Staff College, I spent most of my last years in the Army in either Army Headquarters or the Force Development Group doing experimentation, analysis and concepts work.

After that, it was Thales for four and a half years, and then Elbit for four years – followed by consulting for a couple of years. And then to EOS now for just over 12 months.

Kym: What was the attraction of EOS?

Grant: EOS was one of my clients when I was a consultant. I had been exceptionally interested in EOS for a long period of time, since my days in uniform. Watching what they were doing in America - and then looking at the EOS technology position with remote weapon stations on ADF vehicles. The same focus applied at Elbit with the C4I. The whole discussion for 20 years has been about how to link the sensor-shooter architectures together and improve the speed of engagement. To take observed events, information, and turn them into knowledge and then action to affect the battle space.

It seemed to me, from an Australian industry perspective, that bringing the platform OEMs, the C4I OEMs together with the digital weapon solution was always a desirable integration objective. EOS is an Australian company with Australian IP and Australian software. It struck me as a logical partner. There was even an exploration when I was at Elbit of trying to buy EOS.

EOS is predominantly an export entity. The technology's Australian, comes from Australian minds and is built around our core capabilities in stabilisation and cutting edge understanding of optics and lasers - primarily drawn from the science side of the business. The ability to turn that science into physical form - whether it be for the space business or whether it be for the defence business in remote weapons stations - is the key to EOS's success. Because what we do here is so advanced and world-class we have tended to find that overseas entities have always been our lead customers because they are prepared to take higher levels of technical risk and in pushing the boundaries of what is possible.

Kym: So, what's the magic ingredient behind this success?

Grant: EOS was founded in 1983 predominantly as an offshoot from Commonwealth work, predominantly in the space business, and predominantly supporting the US in space. What got us into the defence market was our ability to build ruggedised optical payloads for space launch - including the ability to control those payloads under challenging conditions to achieve very precise tracking and engagement capabilities. That's what got us into remote weapon stations. That's what put us into the box of being the primary remote weapon station designer for the US Army for 14 years.

From 1993 to 2007, we developed under contract the first remote weapon stations in the world. And delivered the first billion dollars' worth of product into the U.S. CROWS programme.

Kym: That's quite an achievement.

Grant: What can I say - Dr. Ben Greene, the founder of this company, is a very smart man. The U.S. focus is one of the reasons why our history in this country is not well-known. We had a very significant position primarily with the United States Army until we lost the CROWS 2 competition in 2007.

That loss shook the company, and we've had to go back and rebuild the defence side of the business. We've done that. We now have significant growth and significant production including a backlog that runs through to 2023 on existing contracts. We're in full rate production of our systems and in the last 12 months we brought another 3 products to market.

Kym: What are the main orders?

Grant: Our primary orders are for the R400 System, which is the product that we first developed under CROWS but have now taken to a new level of capability. The key differentiator in the market is that we're the only company in the world that has received contracts for delivering light-weight systems with light-weight 30 mm cannons. This weight of firepower was previously unable to be delivered in this size and weight package. We are now delivering systems under multiple contracts and with different weapon payloads to seven countries. We have now contracts for delivering Dual R400s with missiles and rockets on them for both land and naval applications.

In the past we've delivered systems for naval and land platforms and also air platforms. We've had over 1,000 systems in service for quite some time around the world, and we're contracted to deliver over a 1,000 more in the next few years including with the long term training and logistic support.

Kym: And in Australia?

Grant: We have delivered over 200 systems to the ADF over time for Bushmaster. And we have now commenced some upgrades to those systems including some rebuild activities from systems that have been in operations over the last decade.

Kym: Turning to Land 400 Phase 3, what are you doing there:

Grant: We are part of the Hanwha team. Under Land 400 Phase 2, and Phase 3, we've been designated as a preferred provider of remote weapon stations. They are not large numbers. The Phase 2 volume is for the un-turreted CRVs, which is about 80 systems - which at the moment, represents about two months production for us and they're not due to be delivered for quite a number of years. Under Land 400 Phase 3, we are working with all the tenderers to provide quotes for remote weapons stations.

Kym: Do you have an exclusive arrangement with Hanwha?

Grant: No, for remote weapon stations it's not exclusive but for the turret it is. We have jointly worked with Elbit to deliver a joint product for the Hanwha team. The T2000 is essentially an Elbit turret shell with EOS fire control software, turret drive control, HMI and electro optics. And we are the prime for that turret. The turret also brings together the Elbit Active Protection System, the Elbit IronVision See-Thru Armour System and embedded simulation. The EOS remote weapon station integrated to the turret is in a configuration able to provide counter UAS defence and also operate as part of the integrated Active Protection System.

Kym: So the remote weapon station is additional to the turret and is armed with what?

Grant: It can be anything from 5.56mm through to a lightweight 30 mm cannon - including multiple weapon configurations.

Kym: Okay. And can they operate separately?

Grant: Yes. Separately - so, in a Killer-Killer configuration. The weapon station acts independently but has the same sensor capability and control HMI as the turret. The Commander's weapon station, operated by the Commander or the Gunner has exactly the same optical capability as the Gunner sight. The two can operate collaboratively or independently. And they can provide different functional roles depending on the situation. They're also integrated and can be slaved to the heads-up displays for the crews through the IronVision system.

Kym: But doesn't that crowd the turret?

Grant: No, actually it rationalises it. Normally, to put a weapon station on a vehicle that has an independent Commander sight, Gunner sight, active protection, smoke launchers, it is true that you get clutter. So upgrading a legacy turret with all these systems it does end up with a Christmas tree effect. Where the T2000s and the integration with the R400 differs is that we are synthesising all those capabilities into a much tighter package.

The weapon station performs a three-tier role. It provides the independent Commander Sight function. It provides a role of secondary engagement system, which would normally be brought by either an RWS or pintal-mounted gun and it also provides a third role as part of the vehicles protection suite as it's fully integrated with the existing APS effectors and the detection systems, the radars and the optical detectors.

Not only when the active protection system is activated do you get automatic engagement through the APS, you will get engagement options with the weapon station and the turret as well. Two very different type of engagement options. What we've done in is produce a very clean turret – which is much cleaner than any legacy turret where these things are being integrated as secondary considerations.

Kym: So this is a manned turret?

Grant: Yes, for Land 400. However, we've already offered the turret to another customer in another competition in an unmanned configuration. I expect that the first T2000s that we deliver for evaluation will not be in Australia.

Turrets these days, new turrets, that are entering the market tend to be designed to be optionally manned or unmanned. From a professional perspective, there is still a debate going on globally about the merits of manned versus unmanned. Primarily in the global marketplace there's a significant shift to unmanned. We only do 5% of our business in Australia, so we have a very much overseas market perspective because that's where our customers are driving us.

And the predominant push overseas is to unmanned configurations. Which is good for EOS because ultimately we're a remote weapon station entity but there's a grey area and overlap between the two. The T2000, yes, has the ability to be either.

Kym: Unmanned seems the way of the future.

Grant: Look, there are also very good operator considerations around manned turrets – such as the ability to be oriented separately from the direction of the turret to the direction of the vehicle. If you're sitting in the vehicle and the turret's pointing one way and you're not in the turret, there are challenges to orienting yourself. So, there are very much different perspectives from different user experiences. But certainly, it's easier to build protective capsules for people in the hull than it is to build for people in the turret.

Unmanned turrets also have a growing market due to the proliferation of active protection systems - especially in countries that have fielded them such as Israel and Russia. Active protection systems are simply controlled explosions. They are offensive weapon systems that are fully automated in order to be fast enough to be effective. Once they're turned on you don't have your head stuck outside the turret, the concussive effect is not OH&S compliant and we're now strapping radar emitters to the outside of turrets as well - not including the missiles embedded in the turrets.

Just because something's unmanned doesn't mean you still can't stick your head out of the vehicle and once you take the crew out of the turret there are other ways in which you can better manage the balance of protection. So unmanned is where many countries have decided to go. The other issue of course is weight. An unmanned turret that doesn't have people in it does not need to be protected nearly as heavily as the vehicle so can be lighter and on some legacy vehicles turret weight is a significant consideration. Certainly, the country

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T2000 turret (EOS cgi)

the T2000 was originally developed for is moving down an unmanned path.

Kym: What are your thoughts about the Hanwha vehicle?

Grant: I've been around a lot of vehicles since I've left the military from an industry perspective of design and production. The AS-21 is an exceptionally good vehicle. It's actually, very low-risk. All the core components are already fielded. The shell, the hull, is essentially the new component, but the drive line, the running gear, and the electronic fit-out are essentially operationally brilliant systems.

Kym: Sure – and they use MTU diesels and an Allison transmission.

Grant: Same transmission as the M1A1 tank. The running gear and the drive line has been deployed on existing armoured vehicles that Hanwha has sold in Korea and globally and their engineering capacity, their ability to manufacture those things, it's absolutely world-class. And the T2000 turret, while it's the most modern turret on the market today, has a core DNA that is in current production. So, the active protection system's have been manufactured, the turret shell, the drive, the software, the fire control, the sensors - they're all off the shelf products.

Kym: You also have Elbit as part of the mix.

Grant: Elbit Land, Elbit C4I and EOS have been working together for a long time. When I was at Elbit, we received the EOS weapons system and integrated it with the WIN BMS Suite in the Elbit Systems Integration Lab in Canberra - which was done seven years ago. They are now integrated together through the ASGVA and Land Data Model at the Land Network Integration Centre.

Kym: I have no idea what that is.

Grant: So, Army has a Land Network Integration Centre in Fyshwick where Army does its integration. The Australian generic vehicle architecture which is the Army GVA is built on an application layer called the Land Data Model that is run out of Fyshwick and is used as the Army's C4I test bed. The Elbit Combat Management System and the EOS Weapon System have been integrated in that facility for over a year now. So, technically, the the cornerstones of the integration have been around for a long time and EOS and Elbit have been looking for things to do.

Kym: Does this mean that in the future cross-cueing between weapons and platforms will be possible?

Grant: The T2000 and the R400 integration can deliver that now.

The R400 weapon stations on Bushmaster with the Elbit BMS, LAND 75 BMS, could deliver that now if it was in the scope of work of any of the Army programmes. For other customers with other BMSs' we have delivered that in other countries already.

Kym: Could you give a real-life example of how that might work in practise?

Grant: Well, it's the ability for any entity in the network, not necessarily vehicles but also dismounts, helicopters or UAVs to sense a target and then be able to hand information to the network so all effectors on the battle space can be informed. Then for a commander to allocate the appropriate weapon, or the best positioned system to achieve the effect that they're after. It doesn't necessarily have to be a hard-kill system. It doesn't have to be direct fire. It could a long-range missile, long-range fires. It could be a non-lethal effector and then allocate that within the network of assets that is at the commanders disposal in whatever way that they deem appropriate.

Also, it could as simple as just handing it off to something that's in a better position. The technology to do that is fielded in the world, and is in operation right now. Our systems have the ability to be networked in that way to support that activity and our fire control software integrates with that. There's no question that this is becoming a much more common requirement for customers all over the world.

Kym: And I'm told by the experts that automatic engagements are possible

Grant: You can almost, if it's fast enough and precise enough, automate that process. The growth of autonomous, semi-autonomous, and robotic systems into networks, including with the

application of artificial intelligence, creates a range of opportunities to deliver ever decreasing reaction times for the sensor shooter loop.

The efficient and effective networking of the systems and integrating of the sensors together brings lots of advantages. Our philosophy at EOS is that our systems are primarily sensor systems. They will spend, our weapons stations, our turrets will spend 99% of their life looking at things. So, we put a lot of effort into the precision of our sensors and the ability to move that sensor data effectively around networks that may be challenged for bandwidth.

We also make sure that any sensor that we deploy significantly over-matches the weapon system which it's supporting so that you can clearly identify, see and identify whatever you're looking at before you engage it. The ability to move that imagery around is key. The objectives is to give the Commander exactly the same vision that the user is seeing. So, the user can say, "This is what I'm looking at, this is what I'm going to shoot." And he can say, "Yes." There is no need to verbally describe, to paint a mental picture of what is happening.

Even some of the world's most effective systems, networking systems allow people to 3D-orient themselves on the imagery that they're seeing as well. So, you can take a 360 degree battlefield view or the imagery of that battlefield can be turned into a three-dimensional image and people can reorient that image to make sure that they're looking at the target from the shooters perspective. That technology is here now. The core issue for EOS is our ability to provide high-level second and third generation imagery in formats that are easily transportable through networks.

One of the core components of that software is how we move our imagery around, how we record it for posterity and how we ensure that what people are seeing is an accurate portrayal of what's going on.

Kym: What sensors are we talking about?

Grant: We make our own thermal imagers, we make our own day cameras, we make our own laser range finders here in Australia. They are packaged into very stable high quality sensor packs that don't drop their bore-sight. So, you only have to bore-sight the sensors once.

Kym: How do you achieve that?

Grant: Well, if we can put a sensor pack through 50g shock for a space launch - it's all in the design and the production of how we do that.

Additionally, being able to integrate with other sensors such as radars, such as other optical detectors, passive detection systems, whether they be EW or IR-based, or quantum-based - that stuff we've already delivered.

Kym: The sheer numbers of vehicle involved in Land 400 Phase 3 must make it an attractive prospect.

Grant: Oh, well, the final numbers will be determined by the Commonwealth, the final configurations of how many remote weapon stations and turrets they require. Clearly, there are a number of non-turreted platforms where you would expect there would be weapon stations as in Phase 2. Some of the offers will have weapon stations on the turreted platforms, so the numbers may vary. Again, they're not in huge numbers and they're fairly well down the track as well. The Australian customer is very important to us, it's our home customer. Land 400 is a globally recognised programme, so that's important.

One of the core components of that software is how we move our imagery around, how we record it for posterity and how we ensure that what people are seeing is an accurate portrayal of what's going on.

But, the schedule's still some time in the future. We're pursuing many billions of dollars of opportunities around the world at the moment. Land 400 represents, maybe, 15% of realistic opportunities for EOS products. So while Land 400 is got a huge focus here and we are putting a lot of effort into it and we have full-time people working on the programme, it's at least two to five years away from major production work. There are significantly larger opportunities for us in the world right now.

Kym: I know that some export orders are sensitive or classified, but are there significant ones that you can identify now?

Grant: Well, the critical ones - there are a number of large opportunities in Asia, Europe, and the Middle East. But the key opportunities for us are in North America, primarily back in the United States. The United States military is moving forward very fast with a range of next generation combat vehicles for all three tiers of its manoeuvre capabilities. So, there's significant priority being put on replacing Bradley for the Armoured Brigade Combat Teams, there is a significant programme of record for the lethality upgrade to the Stryker vehicles. Plus there is a significant operational need for the Infantry Brigade Combat Teams for the light reconnaissance capability. Not including opportunities in the US Marine Corps, US Special Forces and the multitude of robotic programmes that are running.

Our systems the R150, R400, and the R800 offer advantages to those programmes that other products can't necessarily deliver. So, we have a very strong focus on that. We have a major business established now in Huntsville, Alabama. That is to support our production capabilities for the global market but it's also clearly, about positioning ourselves for the opportunities that are unfolding very rapidly in the United States.

Kym: In separate conversations with Hanwha, they've indicated an interest in the US vehicle line

Grant: Yes. Well, that's really up to Hanwha on the turret development with Elbit. North America is an Elbit-led market for the turret. So the Optionally Manned Fighting Vehicle component of NGCV for which the RFP is imminent is going to be a hugely important programme in the United States.

The US Army is moving enormous amounts of money around to facilitate that. The Bradley replacement is not the highest priority for EOS, however, we are in discussions about supporting a number of companies who are looking at the robotic component of the NGCV programme. Our primary focus is on supporting the Stryker Brigade Combat Teams and the Infantry Brigade Combat Teams lethality programs.

Kym: What does your order book look like?

Grant: Well, we have three large programmes that we're under contract for. One will be predominantly completed by the end of this year. Another one is starting very soon this year with deliveries commencing mid-year and a third programme is being delivered as tranches over multiple years.

However, while it's all well and good to be focused on big programmes we have a lot of important smaller customers where we are delivering significant and on-going annual packages of products and services. These regular and ongoing partnerships are the life blood of any sound business so are extremely important to EOS Defence.