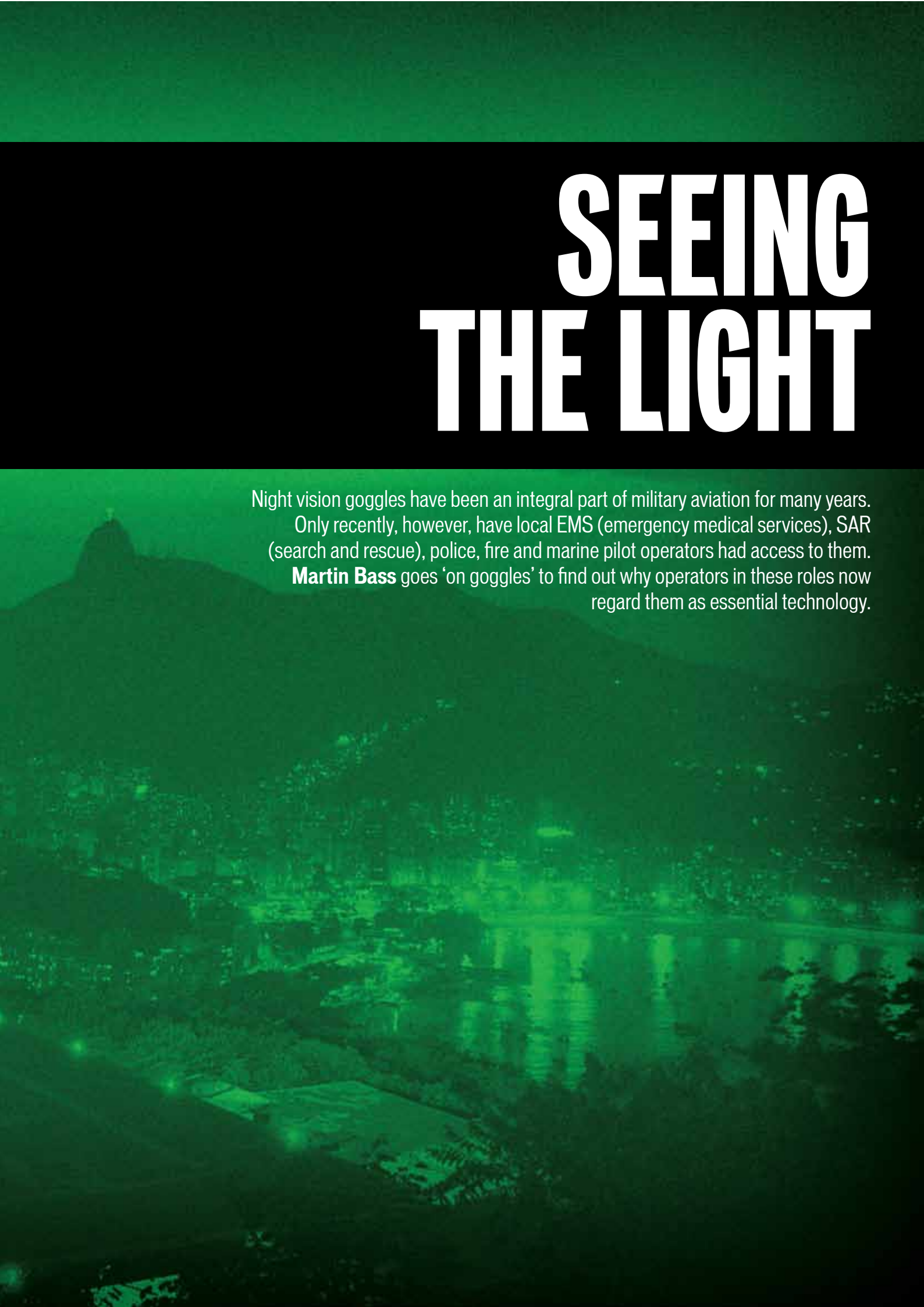
SEEING THE LIGHT

Night vision goggles have been an integral part of military aviation for many years. Only recently, however, have local EMS (emergency medical services), SAR (search and rescue), police, fire and marine pilot operators had access to them. **Martin Bass** goes 'on goggles' to find out why operators in these roles now regard them as essential technology.



If you ask any EMS, law enforcement or military helicopter pilot their thoughts on the most significant advancements in aviation technology since the development of rotary-wing flight, they'll probably give you the same 'big three'. The first will likely be the turbine engine; the second will be GPS (global positioning systems) and the third? Without doubt, most will sing the praises of night vision goggles.

While night vision goggles (NVG) technology has been utilised for decades by military pilots, and for many years by civil operators in EMS and policing roles in countries such as the US, its application in the civil aviation sector in Australia is relatively recent, having received CASA (Civil Aviation Safety Authority) approval for use in limited roles in 2007.

CHAMPIONING THE CAUSE

Hobart-based Rotor-Lift has been a pioneer in the use of NVG and in training pilots and aircrew in how to use them, largely due to the foresight of managing director and long-time EMS pilot Roger Corbin. His introduction to NVG happened in 2006 when US company ASU went to New Zealand to present its FAA-approved (Federal Aviation Administration) NVG training course to pilots at Helicopters Otago. As an ex-pat New Zealander, he was following NVG developments 'over the ditch' and participated in the training.

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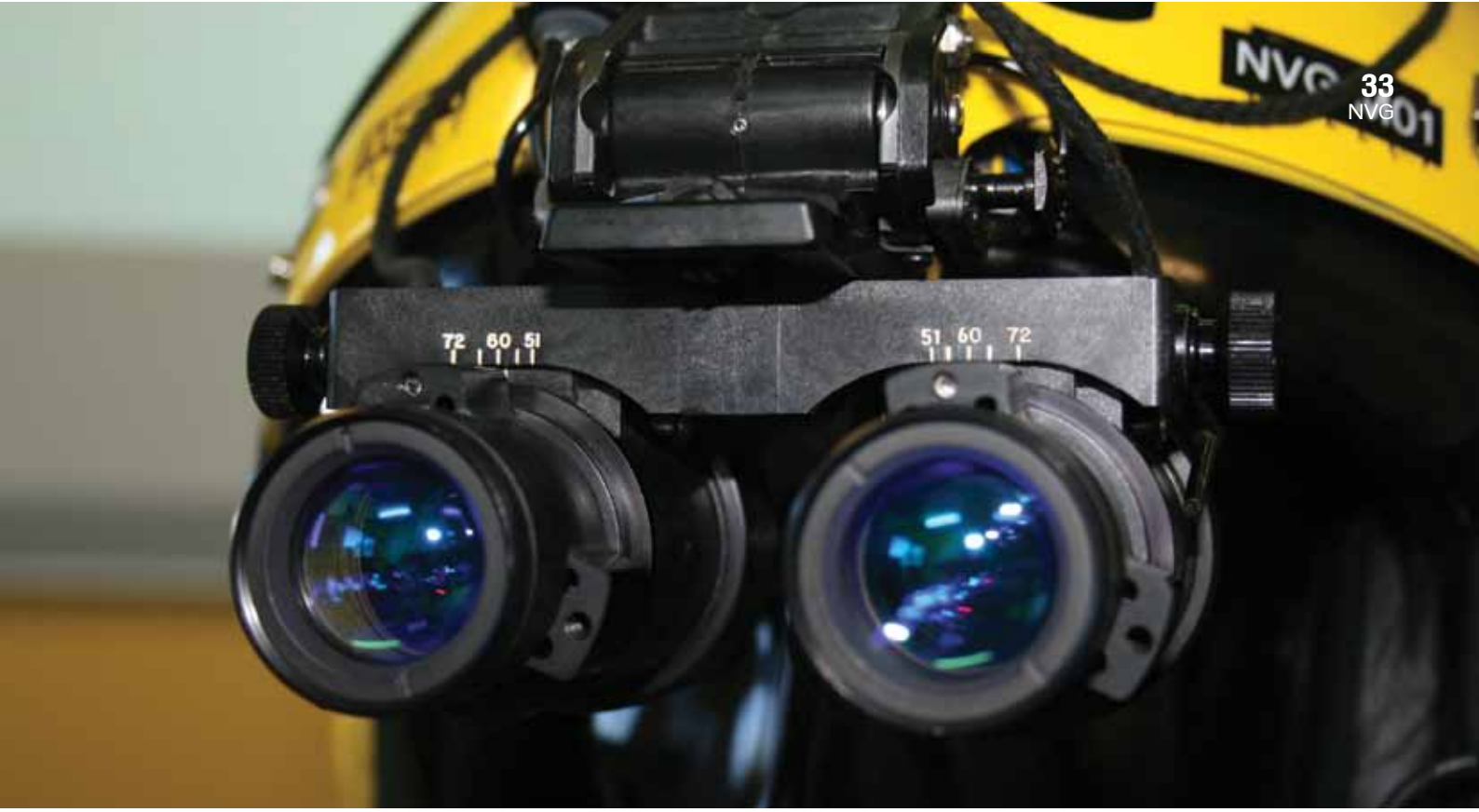
Recognising the enormous safety benefits of the goggles, and their capacity to broaden the capabilities of many helicopter operations, Corbin organised the first FAA-approved NVG training course in Australia in December 2006. With no rules or regulations governing how or by whom NVG may be used in civil operations, however, CASA stepped in and banned the use of the equipment in all civil operations, pending the passage of appropriate legislation, and the training was put on hold.



Then followed months of consultation, evaluation trials, liaison and deliberation between industry representatives and the regulator to develop CAO 82.6, which defines and regulates the use of NVG in civil aviation operations in Australia. This legislation became effective in mid-2007 and several months later Rotor-Lift received the necessary approvals to conduct NVG operations and training. In the early years, Rotor-Lift benefitted considerably from the assistance of ASU in how to operate on goggles safely and efficiently. Since this time, Rotor-Lift's Advanced Training School has run regular NVG training courses for pilots and crew working in EMS, SAR, law enforcement, aerial fire-fighting, aerial fire-fighting support and marine pilot transfer roles.

Keen to experience the 'magic' of the goggles for myself, I join Rotor-Lift for several days to participate in a training course that comprises both theory and flight time. There are a host of prerequisites to be able to undertake the pilot training for NVG and, as I don't have all the experience required, I am limited to the observer's course. Nevertheless, this will give me all the experience and insight I need to understand the benefits that the goggles bring to night flying.

A THOROUGH GROUNDING

Before getting airborne, I need to spend a day in the classroom as instructor Jamie Humphreys gives me a thorough introduction to the goggles, how they work, how to handle them and what to expect in the air. As a recent arrival at Rotor-Lift, Humphreys has spent many years in the RAN (Royal Australian Navy) and then the Army Aviation Corps, flying Seahawks, Squirrels and Kiowas, both as a pilot and a flying instructor.

He brings a wealth of knowledge and experience to the classroom, having recently gained flying time on goggles at Oakey and Nowra. Humphreys also brings considerable operational experience from deployments to the Middle East where he flew Seahawks by day and night in Iraq, the Arabian Gulf, the Gulf of Aden, the Arabian Sea and the Red Sea.

Over a coffee, he runs through the day's learning, which will address a range of interesting and relevant material. "We'll look at aeromedical factors and NVG components and systems, and we'll also take a look at the legislation covering the use of NVG in civil aviation roles," he explains. From a flight perspective, we'll cover areas including night-time illumination sources and effects, terrain interpretation and flight planning."

He also reassures me that there'll be plenty of hands-on training during the day with practical demonstrations and trials in the myriad adjustments that can be made to suit the user, mounting goggles onto the helmet and general care, handling and cleaning. With each set of goggles costing in the order of $13,000, the small details in handling and set-up become paramount and I take several opportunities to pull them out of their case and mount them onto my helmet until I feel comfortable.

A MARVEL OF SCIENCE

The most amazing thing about night vision goggles is how they work. The underlying science is genius and my mind boggles at how some inventor, many years ago, could have turned principle into practice so successfully and in such a compact package.

"In very simple terms, light particles enter the 'objective lenses' at the front of the goggles and are focused on a photocathode lens and transformed into electrons," explains Humphreys. "These electrons then pass through a micro-channel plate with the diameter of a 10 cent piece containing millions of microscopic glass tubes where they are amplified. The electrons are accelerated

and multiplied as they move through the tube. They then pass through a phosphor screen and are transformed back into light energy with each light particle having been amplified by around 6000 times."

This description is the tip of the iceberg, with Humphreys' presentation peppered with fascinating facts and figures, and vital information and perspectives about what to expect in the air. At day's end, with the winter bringing an early sundown, the last part of the learning is devoted to a full goggles set-up, giving me my first chance to experience the goggles first-hand.

Standing at the edge of Rotor-Lift's car park and staring into the darkness, I switch on the power pack and enter the greeny-grey world of NVG. What was a pitch black hillside somewhere in the middle distance becomes a clear vista of subtle undulations and freshly mown grass. These wonders of science have literally turned night into day and I am starting to understand the high esteem in which this technology is held by those who use it. Further away, street lights around Hobart Airport are adorned with halos, an effect created when looking through the goggles at incandescent lights.

After some careful tweaking of the fore and aft, lateral, vertical and focus adjustments, I have a crystal clear image through each eyepiece with enough separation between my eyes and the goggles to enable me to view maps, charts and whatever else I need to see in the cockpit. I am ready to experience the goggles in the cockpit environment.

AS CLEAR AS DAY

For my airborne training, I am handed over to Rotor-Lift's chief flying instructor (CFI) Terry Summers. As the advanced school's foundation CFI, Summers worked closely with Corbin to establish the NVG training program and has since amassed many hundreds of hours of instructing on goggles.

Our aircraft is a Bell JetRanger with all the necessary modifications and additions to equip it for NVG training. My training sorties are programmed over two nights. The first session involves some circuits for general familiarisation before we head into the hills north of Hobart for some procedural training, confined area approaches, pinnacle landings and goggle failure scenarios. Following this, we return to Hobart Airport, where Summers demonstrates several autorotations on goggles.

> If the pilot experiences a full goggles failure, the crew must provide the eyes, talking the pilot through to a position of safety, away from terrain and other obstructions.

While I am observing rather than flying the aircraft, the sortie gives me very good insights into flying on goggles. As we fly several circuits, Summers talks me through the various considerations that have to stay in the forefront of the pilot's mind. "The main thing to remember is that the goggles only give you a 40-degree field of vision, so you have to keep turning your head to maintain your orientation," he emphasises. Following his advice, I move my head constantly, getting into a good habit of maintaining awareness of our height, surroundings and specific landmarks.

Away from the airport environment, there is minimal 'cultural lighting' and we are reliant on any moonlight or reflected light that the goggles can pick up to give us some vision. In the distance, Summers points out a small clearing surrounded by trees that will be our approach point. As observer, my task is to look out for wires and any other obstructions in the vicinity of our landing area. There is enough light to give us good vision and, aside from the predominant green and grey colour scheme, the whole exercise is just like flying under daylight. "As you can see, the added safety provided by the goggles is huge, particularly in this kind of flying environment," says Summers, as he hovers around the grassed area and demonstrates some slope landings.

Back at the airport, he demonstrates several autorotations from 1000 feet and then from a five-foot hover. In each case, the goggles enable the exercise to be performed with the same precision as could be achieved in daylight conditions.

During the various flying scenarios that Summers takes me through, several characteristics of NVG become apparent. As he directs the searchlight upward into our field of view, my vision through the goggles becomes cloudy and blurred. When he lowers it again, however, there is a point at which the light beam actually enhances the capacity of the goggles, particularly near to or on the ground. So I discover that it is essential to move the light around to find the 'sweet spot' where the goggles are working at their peak.

During one exercise, we descend into a pine forest, terminating at a hover at the intersection of two service roads. Summers manoeuvres gently around the area, enabling me to pick up visual cues and orient myself within the environment outside. Despite Summers reassuring me several times that there is abundant clearance between our main rotor and the surrounding trees, the tall pines around us look alarmingly close, a trick of the goggles that requires some getting used to.

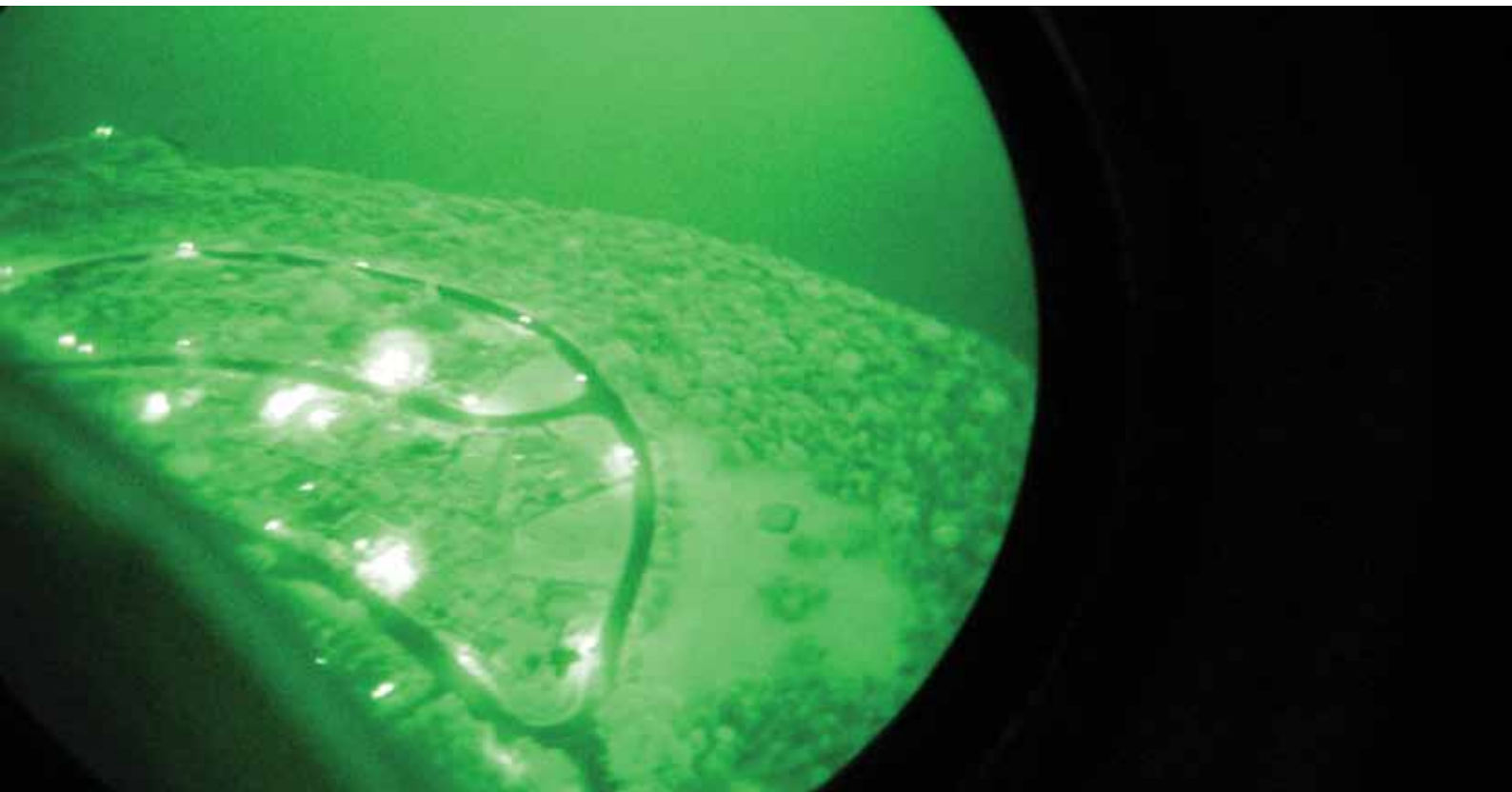
He settles the JetRanger onto the ground and says, "Flip your goggles up for a moment and tell me what you see." I follow his instructions, raising the goggles and staring into the darkness ahead. With all lighting switched off, I stare into the darkness ahead, unable to detect any features or landforms outside. "Nothing," I respond. "I see nothing." The trees outside could be a foot away or a mile – without the goggles or a light source, it is impossible to tell and the feeling is slightly unnerving. Flipping the goggles back down, the world outside is visible once again and I am instantly back in my comfort zone.

After two hours in the air, I am starting to feel the extra one and a half kilograms on my head and we return to Rotor-Lift for a post-flight briefing and some preparation for the next sortie, a couple of navigation exercises interspersed with a practice low-level missing person search.

FINDING MY WAY

After a good sleep and a rest day we reconvene in Rotor-Lift's main classroom in the late afternoon to do the preparatory goggle set-up and study the map for the evening's sortie. Our destination is open country about 30 minutes' flying time north of Hobart and our target is a farm with a hangar and helipad. After a landing, we will depart and fly a practice search scenario in a nearby gorge.

With the sun well down, we depart and track north along our planned route. My role is to use the map and ground features to navigate and confirm our position. Crossing a ridgeline north of the city, another characteristic of NVG flying becomes apparent. While we are holding 2000 feet AGL (above ground level) with more than 1000 feet of clearance over the ridge, we can see with reasonable clarity the surrounding features, but with the advantage of height to make visual navigation easier. When we go lower down to 500 feet above ground level, however, our clarity of vision improves markedly, even though navigation is more difficult by being so low, as well as the limitation of the 40-degree field of view. "There aren't so many molecules of moisture that we are trying to see through down at this level," says Summers. "So the sharpness of the landscape features improves."



He explains that the civil NVG pilots with a night VFR (visual flight rules) background continually tend to default back to Lowest Safe Altitude, as if they were flying night VFR rules without goggles. Whereas, the ex-military pilots tend to default to a tactical level well below 500 feet AGL. "It's all about visibility," he adds. "Not cloud ceiling, but how quickly the visibility can change from the minimum legal requirement of five kilometres, down to well below that in the blink of an eye. Then finding yourself inadvertent IMC (instrument meteorological conditions) in fog/low cloud a few hundred feet above the ground in a canyon in the middle of the night!" Hence the need to treat goggle flying with the greatest of respect," he concludes.

From a navigation perspective, NVG flying enables me to draw from many of the techniques that I typically use in day VFR flying. I am able to confirm our position en route through the identification of landmarks such as roads, rivers, bridges and other features of the landscape. Cross-referencing urban lighting shapes and sizes with the map even enables me to confirm our location with reference to towns and villages along the way.

After landing at the farm, we depart for the nearby gorge and Summers talks me through the search exercise. "We're searching for a lost child and following a power line recon at 500 feet; we'll be flying down the gorge at 200 feet AGL at 40 knots," he explains. "I'll be scanning constantly with the searchlight. You follow the path of the light and conduct the search and I'll maintain our clearance from surrounding terrain."

As we fly down the gorge at a slow pace, I follow the light, looking intently for our mythical lost soul, spotting scores of kangaroos, bats, rabbits and an array of other creatures of the night. After several flights up and down the gorge, we call it a night and, as we climb to cruise height for the flight home, I have a strong sense of how much NVG has transformed night operations in EMS, SAR, policing and other roles, from high risk to something akin to day VFR flight. "The goggles certainly don't negate the risk, but they reduce it immeasurably," says Summers.

As we fly back to Hobart Airport, he demonstrates the kinds of problems that can arise with NVG and how to manage each eventuality. "Single lens and full goggles failure are always possibilities in flight and managing this requires good crew coordination," he says. "If the pilot experiences a full goggles failure, the crew must provide the eyes, talking the pilot through to a position of safety,

away from terrain and other obstructions. In this situation, the pilot must revert to instruments to keep the aircraft in stable flight and this is one of the main reasons why I feel that the instrument flying skills from a Command Instrument Rating should be made a necessary prerequisite for NVG training," says Summers.

For pilots and crew, there's no question that NVG represents a milestone in the technological advancement for aviation. While military operations have had access to NVG for many years, the technology is still in its fledgling stages in civil aviation application in Australia. From the outset, its application has been an unqualified success with every pilot in EMS, SAR, policing and offshore roles depending on it for safety and efficiency in their operations.

With this introductory phase complete and NVG in use widely within the civil rotary-wing sector, Rotor-Lift is now focused on expansion in its application, with trials being conducted in a wider range of fixed- and rotary-wing operations such as air ambulance and fire suppression – so far with great success. With the regulator now satisfied with the aviation industry's capacity to conduct NVG operations safely, this technology may enter service in these new roles in the very near future. **HN**