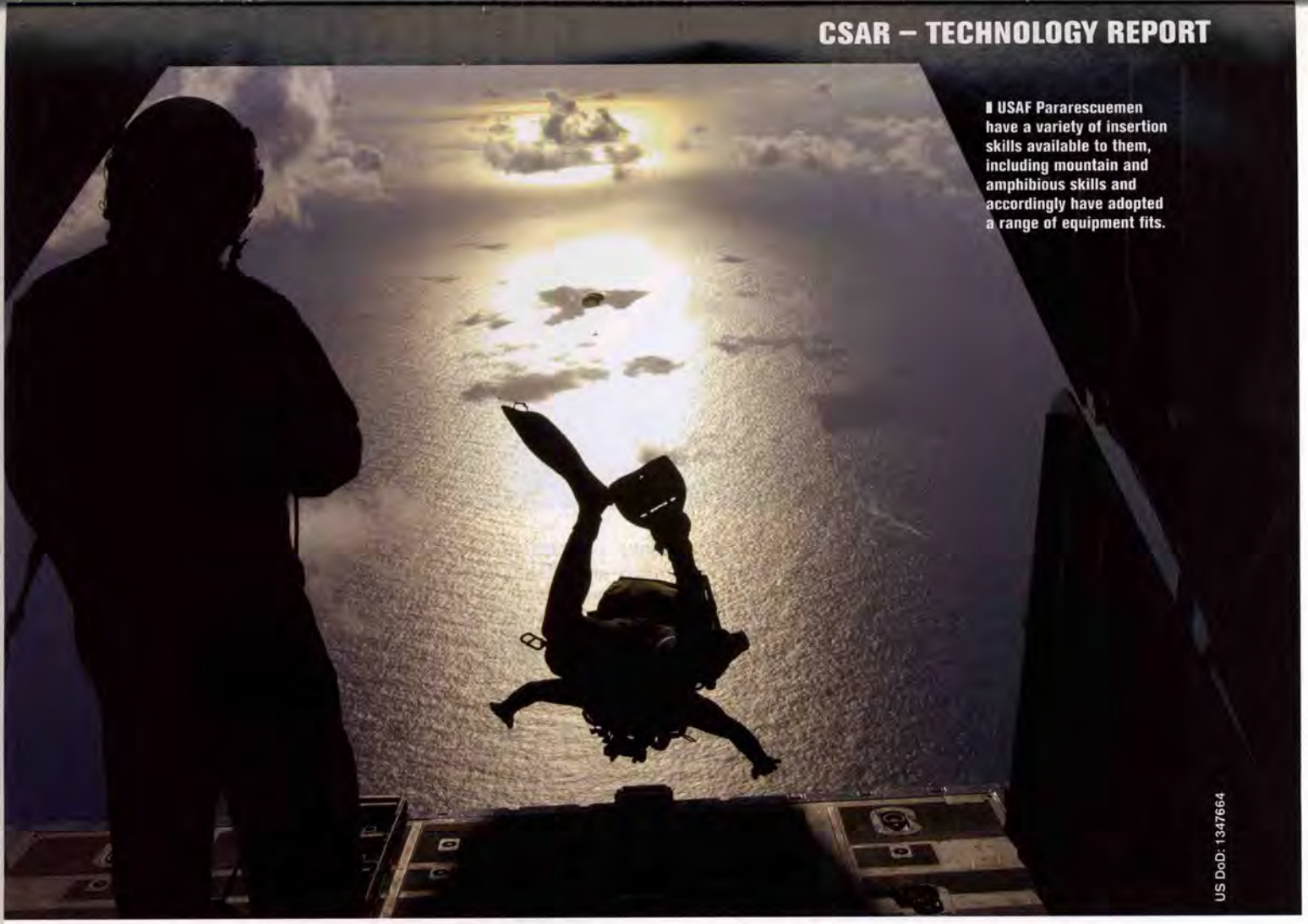


■ USAF Pararescuemen have a variety of insertion skills available to them, including mountain and amphibious skills and accordingly have adopted a range of equipment fits.

US DoD: 1347664

Super CSAR: technological advances open up new frontiers for rescue forces

The changing nature of combat search and rescue operations has led to the evolution of specialist equipment, enabling dedicated forces to undertake evermore difficult and complex exercises, reports **Andrew White**

In June 1995, a US Air Force (USAF) F-16 was shot down while patrolling the no-fly zone over Bosnia. After evading Serbian patrols for six days and struggling to communicate with the NATO airborne command centre, Captain Scott O'Grady was eventually picked up by US Marines and returned to the USS *Kearsarge*.

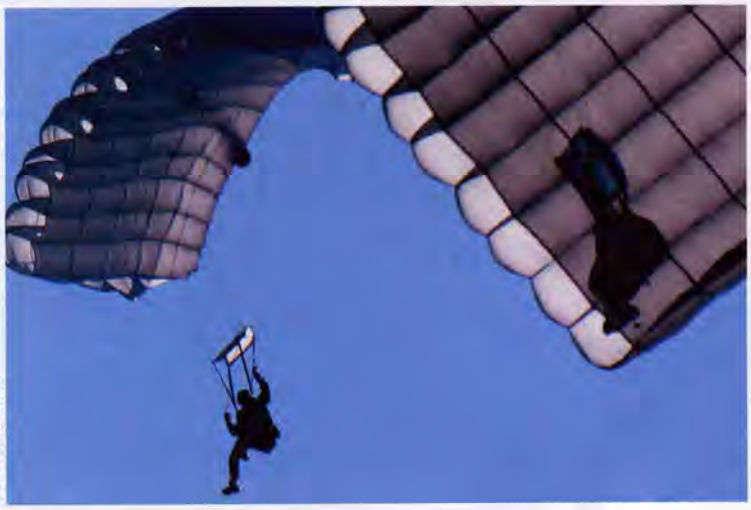
Highlighted by the world's media, his story turned a public spotlight on combat search and rescue (CSAR) operations. Nearly 15 years on, the field has developed, with new specialist equipment for high-risk personnel and evolving operational concepts.

In western parlance, Joint Personnel Recovery (JPR) refers not only to CSAR but also combat recovery (CR), deployed search and rescue (DSAR) and search and rescue (SAR), in descending order of perceived threat levels. JPR also incorporates associated survival, evasion, resistance and extraction/escape (SERE) procedures, as well as unconventional assisted recovery of isolated personnel (IP) in the form of special forces hostage rescue operations.

For the USAF, the major practitioner in the field, CSAR operations have changed significantly over the past eight years according to its dedicated CSAR force, USAF Rescue. Captain Jose Cabrera of the 58th Rescue Squadron, based at Nellis Air Force Base (AFB), tells *Jane's*: "The overseas contingency operations that we have been involved in since 9/11 [11 September 2001] really mark an evolution. Pre-9/11, Rescue's primary focus was on a traditional, linear battlespace where we conducted CSAR missions behind enemy lines to recover high-risk personnel, including aircrew or special operations personnel in combat situations.

"Post-9/11, especially in ongoing operations in Iraq and Afghanistan, the vast majority of the recoveries, or 'saves', have been associated with casualty evacuation or medical evacuation taskings in support of our joint, coalition, or host nation forces, and in some cases host nation civilians or even anti-coalition forces," he adds.

Since first deploying to US Central Command (USCENTCOM) eight years before 9/11, USAF Rescue has recovered or treated more than 3,500 personnel, with approximately 50 of those being USAF aircrew. However, from February 2009 onwards, the tempo of military operations in



US DoD: 1347665

High altitude jumps with 'square' and 'round' parachutes have proven useful for operations in areas inaccessible to helicopters for pick-ups.

Afghanistan has started to increase with USAF Rescue forces recovering or treating more than 1,400 personnel.

Personnel recovery was upgraded to one of the USAF's 12 'service core functions' in September 2008 and emphasis on CSAR operations has never been greater. However, US Pararescuemen (originally called Pararescue Jumpers and still known as PJs, despite having formally dropped the 'jumper') warn that joint force commanders need a greater understanding of the operational capabilities available to them across a full range of military operations.

Equipment is pivotal to a CSAR team's role at both personal and team levels. Without suitable equipment for specific scenarios – be it specialist climbing, diving or freefall equipment – certain rescues could not be achieved.

This is especially true for air assets, particularly in the 'hot and high' conditions of Afghanistan. Peaks in the Hindu Kush mountain range can top 17,000 ft, making them inaccessible for even the stripped out, lighter CSAR-specialist airframes, necessitating USAF Rescue to conduct high-altitude jumps from HC-130 Hercules aircraft.

Global recovery capacity

Outside the US, the German Air Force is in the process of developing its assets for operations within NATO but a spokesman told *Jane's* that it was too early to provide any specific information on equipment. A future CSAR roadmap for the German forces was in the process of being drafted as *IDR* went to press.

In June the German Army revealed plans to upgrade its fleet of CH-53GS Stallion transport helicopters with CSAR capabilities in a EUR25 million (USD38 million) deal with Eurocopter Deutschland. Upgrades include a mission-tactical workstation and additional sensors, and the first helicopter is due to be delivered in early 2010. It is not yet known if the German Federal Ministry of Defence (MoD) will deploy a number of these airframes to ongoing operations in northern Afghanistan.

The USAF currently operates HH-60G Pave Hawk helicopters and HC-130 Combat King fixed-wing rescue aircraft and is the only service within the Department of Defense (DoD) that has systems and equipment – not to mention manpower – solely dedicated to recovering IPs.

"Those elements of the USAF Rescue force are part of a global personnel recovery capacity that can support US national security objectives where and when tasked," Colonel Darryle J Grimes, commander of the 347th Rescue Group based at Moody AFB, Georgia, tells *Jane's*.

"When the Secretary of Defense made the decision to cancel the CSAR-X programme [a DoD requirement designed to procure 141 search and rescue helicopters, with an in-service date of 2018] in April 2006, he also directed his staff to assess current DoD policy on service personnel recovery requirements in order to inform the department's decision on a follow-on programme for air force HH-60G aircraft and provide a basis to ensure that a national CSAR capability provides for recovery of any downed, injured or isolated service member, including combat environments," he adds.

In the past six months, the USAF says utilisation rates of Rescue force HH-60Gs have averaged more than twice the normal domestic station average, with the past 60 days seeing nearly four times the regular activity. This is because USAF Rescue force HH-60G and HC-130 aircraft are in high demand supporting casualty and medical evacuation operations, special forces recovery and traditional CSAR for a variety of customers on ongoing operations within Operation 'Iraqi Freedom' (OIF) and Operation 'Enduring Freedom' (OEF).

Unlike many other aircraft in international rescue service, the US aircraft are usually heavily upgraded specifically for the role, with high standard fit specifications to better suit them for their natural operating environment. "Advanced systems like FLIR [forward-looking infrared] allow us to provide coverage during low illumination night operations, when some other service's aircraft are restricted from flying," says Col Grimes. That said, the number of western aircraft outfitted for night-vision flying is growing rapidly and the number of operationally capable crews is proliferating in line with experience in Afghanistan and Iraq.

While these overseas contingency operations continue to highlight the demand for the capabilities of USAF Rescue, the air force is working with the Office of the Secretary of Defense and Joint Staff to determine appropriate acquisition strategies to sustain this joint force rescue capability for the long term.

According to the USAF, while a long-term decision for a follow-on Personnel Recovery Vehicle is being made in the wake of the

US DoD: 1347666

The HH-60G Pave Hawk is the primary insertion method for USAF PJs.

cancelled CSAR-X, the service has identified an immediate need for Operational Loss Replacement HH-60G aircraft.

"Current USAF plans to modernise our Rescue force also include an ongoing programme to acquire new, more capable HC-130Js to replace our 45-year-old HC-130 fleet," explains Col Grimes.

Once air assets have dropped off a rescue team, or 'Guardian Angel' callsigns as the USAF have dubbed the PJs, personal equipment then takes over as top priority for the successful extraction of IPs.

A rescue team normally comprises Combat Rescue Officers (CROs), PJs and SERE specialists, not to mention the pilots and crews of the air assets.

US CROs and PJs currently employ the Guardian Angel Operations kit family of systems to "prosecute" ongoing rescue operations in OIF and OEF. The family includes small arms, ground rescue vehicles including quad bikes and HMMWVs, night vision devices, aerial insertion systems, medical kits (with a requirement to provide care for at least two casualties for 72 hours), command-and-control systems, technical rescue, maritime rescue and mission planning equipment.

Individual loads

Typical individual equipment loads carried by rescue operators bear a basic resemblance to equipment carried by infantry conducting ground operations. This includes Colt Defense's 5.56 mm M4 carbine, the Beretta 9 mm M9 pistol, night vision goggles (NVGs), load-bearing equipment, radios, fragmentation and smoke grenades, harness, helmet and body armour. Systems such as Gerber's strap slashers are also useful for cutting through harnesses to escape from downed aircraft or caught parachutes.

Team leaders are required to carry Harris AN/PRC-117G radios with satellite communication capability as well as satellite phones, blue-force trackers, encryption fill devices and thermal imaging equipment, which can detect human-size targets at ranges more than 5 km away.

"Our mission-critical equipment has made possible freefall jump missions into the Hindu Kush in areas above the altitude range of helicopter operations, extrication of coalition forces trapped in armoured vehicles victim to roadside IEDs [improvised explosive devices] and dive missions in OIF to locate and recover KIA [killed-in-action] personnel," Capt Cabrera adds.

Mandatory equipment for an IP includes a radio beacon communication system, which when turned on automatically sends a GPS position to a Joint Personnel Rescue Centre via a satellite network in minutes.

UK, US and other NATO nations currently operate Boeing's AN/PRQ-7 CSEL (Combat Survivor Evader Locator) handheld radio system, General Dynamics' AN/PRC-112G and AN/PRC-112B1 transceivers or one of SARBE's Advanced Aircrew Personal Locator Beacons. However, if an IP is captured by enemy forces, his beacon radio is easily detectable by body search and can be easily disposed of, thereby severely reducing the chances of any rescue attempt, especially if he is moved to a different location.

A popular solution to this scenario, already preferred by special forces and intelligence operatives around the world, is the Personal or Personnel Locating Device (PLD). Easily concealed within clothing, the PLD can also be covertly initiated. Hidden Technology Systems International's (HTSI's) PLD is capable of providing live tracking, data logging, GSM audio monitoring, RF tag location technology and an in-built inaudible alarm. Incorporated into body armour or carried in a pocket, the system can be initiated by either a pull-out pin or panic button, which provides automatic and immediate notification to the monitoring base of a life-threatening situation.

US DoD: 1347687

A PJ administers a casualty aboard a HH-60G. His stand-up kit resembles that of a standard infantryman fighting on the ground.

Tracked by HTSI's CP2 platform, an individual can be located to within an accuracy of 8-10 m, a company spokesman tells *Jane's*. A 16 GB flashcard stores GPS grid references, date, time, speed and bearings data (if on the move) and the device can be configured to log such data up to every 20 seconds if required. The log file can then be uploaded via a secure GSM to the CP2 tracking software.

The size of a packet of cigarettes, the unit can be used for up to 57 hours continuously and runs on a lithium polymer rechargeable battery and provides the relevant grid positions for an IP over that period of time. Such a capability is considered important when a PLD signal dies, because it then allows special operations units to conduct hard arrest operations and interrogate people associated with that last known position location for follow-up operations.

One rescue mission of two NATO special forces operators in Iraq saw ISTAR (intelligence, surveillance, target acquisition and reconnaissance) assets successfully detect an ongoing kidnap situation. An unmanned aerial vehicle (UAV) then tracked their position from one compound to another, eventually leading to a HR operation, allowing special forces to rescue the operators at the first opportunity.

As the UK Royal Air Force explains in its JPR doctrine: "If an initial electronic search fails [by beacon radio or PLD] to determine the position of the IPs, a more extensive search may be required with the tasking of ISTAR assets. In a hostile area, stand-off search techniques may have to be employed."

Once an IP's position has been confirmed, he has a number of tools at his disposal to help the rescuing team pinpoint his exact location as they approach. He may need to do this due to a number of factors, such as the need for IPs to relocate in order to avoid enemy patrols or follow a designated escape route (Designated Area of Recovery), as briefed in the Escape Plan of Action part of orders. Once text or voice communications have been established with a CSAR aircraft by way of beacon radios, an IP can be told what bearing it is flying in on and at what altitude. These can also be predesignated in the orders process to assist an IP in identifying a friendly callsign – as opposed to enemy search aircraft – at the earliest opportunity.

One such example is the use of lights and lasers to signal incoming CSAR aircraft. Cejay Engineering currently provides US forces with around 500,000 Phoenix Junior IR lighting systems each year and also supplies UK forces.

Designed for combat identification to prevent blue-on-blues, the lights have been designed to be easily recognisable when compared with the muzzle flash of semi-automatic and automatic small arms. "This was first used in Operation 'Desert Storm' and since then has become a regular requirement for US forces," business development manager at Cejay, Steven Bronson, states.

Guiding light

The company's Pegasus 7 and 8 lights can be programmed to flash in a progressive and linear manner to mark out temporary landing zones and helicopter landing sites, which again provide important aids for pick-ups during CSAR missions, especially for fixed-wing aircraft. They also include an irregular flash rate that can be preprogrammed before a mission.

Elsewhere, Cejay has developed its Paris 3 laser system as a potentially more covert alternative to a traditional flare. It has two modes – laser and infrared (IR) light – which serve the same purpose of attracting the attention of an aircrew while denying enemy forces a chance to track the beam back to an IP (in IR mode).

The laser can be pointed in the vicinity of an incoming CSAR aircraft on a backbearing of its designated flight path. With a range of 20 miles for a coloured laser or 15 miles for the IR variant (which a pilot can

easily view with a pair of NVGs), the Paris 3 laser begins as a minimal beam and widens out to a 1,000 m wide beam at its maximum range, allowing an operator to 'paint' the windshield of an incoming CSAR aircraft. This is achieved by 'roping' a target or simulating a figure-of-eight in the sky.

Bronson acknowledges to *Jane's* that clouds and other obstructions can dissipate the laser but stresses that Paris 3 would nevertheless increase the "opportunity for quick pick-ups".

Following a successful 'roping' of the air asset, once the CSAR airframe is within a 3-5 mile range of the IP, Bronson says an operator can turn off the Paris 3 and switch to the Paris 2.

A flashing combat identification beacon which replaced ACR Electronics' MS-2000 Distress Marker Light, Paris 2 is also available in IR or coloured versions. Similarly, predesignated colours, passwords and/or isolated personnel reports (ISOPREPs) can be briefed in the orders process, including specific colours to show an IP is under duress.

"CSAR pilots will get in visual range of an IP and look for the flashing beacon which is easily identifiable at ranges up to 5 km," Bronson states.

Another alternative is Cejay's SERE stick, a version of a blue, red or IR chemical light stick, which, when one or two are attached to a piece of cord, can be swung above the head in a circular motion rather like a lasso, in order to indicate an IPs position. This is known in the CSAR community as the 'Buzzsaw'.

The Paris 2 and 3 solution has recently been selected by UK Typhoon crews and Bronson tells *Jane's* that the USAF PJs are also evaluating it. Paris 3, which weighs 147 g, has a 12-hour battery life and costs USD230 while the Paris 2 weighs 116 g, runs for 400 hours constantly and costs USD120. Both systems run on CR-123A batteries.

Bronson says the Paris 3 system is being evaluated by the US Army Sensors and Lasers team and says Cejay is currently negotiating to conduct a similar evaluation programme with the US Navy.

"The capability of CSAR signalling [lights and lasers] systems has to advance in what it delivers to the end user. The distance at which they are visible for both IR and colour lights will increase in years to come," he says.

Looking to the future, Bronson foresees the CSAR lights and lasers market shifting over from 9V batteries to AA, seeing as they are the most common batteries to be found in Afghanistan and Iraq markets where IPs might find themselves on the run.

However, even modern technology is never soldier-proof and much emphasis has been placed on technical equipment carried by IPs. But when communications systems go down, which they inevitably do on operations due to weather conditions or enemy jamming procedures, a survival kit for an IP is crucial.

Certain NATO special forces operators now rarely pack such equipment due to the rapid response times of current CSAR operations and a preference to carry as little weight as possible. Faster reaction times signalled a reduced requirement for being able to survive in the field for a protracted period of time.

Hidden Technologies: 1347669

Personal locating devices, such as the Hidden Technologies PLD.

Survival kit

BCB International continues to offer the Survival Kit Individual Mk4, which includes a sleeping bag and foil blanket, nylon cord, compass, fishing kit, snare wire, wiresaw and razorblade. It also includes a survival tin with reflective mirror lid, which carries two needles, tampons (for water retention and tinder), water purification tablets, cotton wool, flint and steel, fire making blocks and condoms (for water carriage).

Add to this two first field dressings, knife, matches and combat application tourniquets (CAT); standard equipment carried by troops in Iraq and Afghanistan. The CAT system allows an operator to fit and tighten a tourniquet to himself or herself with one hand if necessary and it has been credited with saving numerous lives on operations.

Currently being trialled by the UK MoD is Lifesaver Systems' filtration water bottle, which can be useful if stranded for extended periods. Weighing a total of 600 g and costing just under GBP99 (USD161) each. Designed to remove bacteria and viruses from a contaminated water source, unlike purification tablets and other products, which purge parasites with chemical additives including iodine.

Capable of purifying up to 25,000 litres of water before the filter wears out and the system automatically becomes inoperable, the Lifesaver bottle could prove useful in areas such as Helmand's Green Zone where the majority of fighting is taking place and which has an abundant supply of dirty water.

Despite the many technological improvements over the past few years, rescue teams continue to seek improvements in the CSAR field. One such designated area in which the USAF admits to suffering from "capability shortfalls" is in communications and rescue vehicles.

"Despite great advances in the realm of tactical data links, our operators continue to lack a capability to transmit and receive data in the battlefield. With more platforms acquiring datalink capability, this is creating an information bubble around us, which will affect our ability to conduct operations as part of a CSAR Task Force.

"Additionally, our radios are ill-suited for the range of environments that we operate in and often fail to work in maritime environments," Col Grimes concedes.

An additional capability shortfall is in the integration of ground vehicles into the air force rescue action plan.

"While our primary methods of insertion [HH-60/HC-130] provide great flexibility, the battlefield has changed drastically and there are times when the right answer can be to embed mounted rescue teams with other air force ground forces such as Joint Terminal Attack Controllers, EOD [explosive ordnance disposal] operators, Office of Special Investigations and security forces conducting operations.

"Last but not least, there are changes in the battlefield making evident the need for more advanced tactical and technical skills for our operators. Similar to other USAF weapons systems, there's a need for our operators to constantly adapt and improve," he concludes. ■

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Paris 2 and 3 lights and lasers, as used by UK Typhoon crews, offer final guidance to complete a CSAR operation.