Photo: mmagallan/www.sxc.hu

In an attempt to boost levels of wildlife protection and combat the devastating effects of poaching, conservationists are calling for new methods. **Nir Tenenbaum** outlines how UAVs can play a vital role in future efforts.

Into the wild

Despite commitments by governments, funding agencies and conservationists to protect endangered species and their habitats, wildlife is in a constant battle for survival, as demonstrated by the rise in elephant and rhino poaching in recent years.

The wildlife conservation field consists of many players, from local to global scales, working to save the diminishing animal populations that once surrounded us.

Yet, the methods and systems used to monitor and protect wildlife have evolved little in the past 20 years, despite exponential technological advancements in civil and military systems. Conservationists are using obsolete methods, with a lack of information and technology to succeed in their missions – wildlife management (monitoring and migration, inter-wildlife conflicts and human-wildlife conflicts), law-enforcement and habitat control, which may be ameliorated with the application of innovative technologies and methods.

MODERNISING MONITORING

The fact that many wildlife habitats are geographically dispersed and encompass rugged terrain makes monitoring using on-the-ground rangers very difficult. In addition, given the objective of monitoring numerous animals, to date no one system has been able to aid in controlling and monitoring multiple species. Another aspect of the monitoring challenge arises from the fact that wildlife are mobile, sometimes migrating to neighbouring countries and areas where they have no protection and face many threats.

When viewing conservation security operations, it is clear that current protection and surveillance strategies are obsolete, non-technological solutions.

In order to develop sound wildlife protection strategies, both strategic and realistic tactical analyses must be implemented in conservation, together with advanced technologies that can be easily deployed and implemented in the field.

The model outlined in this article was initially designed for a national park in Africa. This specific region serves as a preliminary example for the possibilities of the technologies chosen for the mission.

In the designated area, standard security measures included mainly ranger patrols by vehicles (routine and spontaneous), together with routine air surveillance by fixed-wing aircraft with rangers observing via binoculars or the naked eye. This model combined three major components – aerial surveillance, ground surveillance plus an overarching command/networking system.

Advances in the global defence arena over the past decade have contributed to rapid technological developments, creating alternatives to the more traditional methods of placing a 'human eye in the sky'.

Increasing financial investments by police forces, civil aid organisations and militaries have facilitated technological advances, ranging from police helicopters and small aircraft to mini-UAVs (MUAVs).

Aerial surveillance systems are characterised by their ability to provide a view of designated terrain from long distances, observe objects discretely during day or night and enable transmission and recording of images.

These capabilities have been assessed for wildlife conservation purposes as early as 2003, but rarely have advanced defence systems with efficiency, endurance and durability been utilised. Since this time, technological advancements have enabled cost-efficient, easily operated, simple and effective systems.

MANNED LIMITATIONS

In this model, aerial surveillance incorporates two basic co-existing systems. The first uses small piston-engine manned aircraft (such as the Cessna 172), a traditional tool used by wildlife rangers for flying at 200ft to view and identify animals and poachers. The major limitations of this form of surveillance include creating excessive noise and depending solely on the ranger's eyesight or binoculars.

Upgrading this traditional manned aircraft method by installing a camera with an airborne control system provides several important benefits. It enables rangers to fly higher, thus not disturbing animals, facilitates viewing ➤

The use of UAVs can give park rangers a vital advantage against armed and dangerous poachers. *(Photo: WWF)*

over longer distances and allows the use of both day and IR cameras, thus enabling operations 24 hours a day.

The added value of the system is that it is GPS-oriented, giving the ranger immediate co-ordinates of the observed objects (eg animal or poacher), which may then be transmitted to teams on the ground. Further, data can be transmitted in real time to portable ground units in the vicinity to optimise collaboration and enhance efficiency in response to an animal in distress or poachers in the compound.

The MUAV, including UAVs up to 15kg, is the leading technology for field-level aerial surveillance. The appropriateness for wildlife surveillance lies in the nimble and cost-effective characteristics of these systems. On-the-ground teams can launch and land MUAVs from almost any unprepared location (land and sea).

They are simple to operate by automatic navigation systems and autopilot programs, may be operated by small teams and require a short training period for operators.

MUAVs can operate for up to four hours using a quiet electrical motor, over long distances – more than 30km – and endure a wide temperature range (-20°C to +50°C). The type can also carry various payloads, ranging from high-end optical ones (day and night) to specialised packages for toxin and radiation detection. The data and video from the MUAV can then be transmitted to the ground station, recorded and distributed as needed.

ON THE GROUND

Ground surveillance is commonly used for the purpose of managing or protecting wildlife. Benefits of this system include the potential for long hours of operation, minimal influence by weather, such as strong winds that would preclude the use of aerial surveillance, ease of operation and cost-efficiency.

Over the past decade, such surveillance systems have also advanced technologically, enabling ground units to monitor areas much larger than previously possible during day and night, and even atomise detection.

The defence solution model incorporates three aspects of ground surveillance technology. The first builds upon a classic tool that has been used for many years in wildlife conservation – monitoring or tracking collars. Tracking is a practice that allows researchers, as well as security forces and conservation agencies, to remotely observe movements of animals using transmission technologies, such as electrical radio, mobile phone, remote satellite and GPS.

Tracking collars are not commonly trusted as security devices, but are often used to aid scientific research, rather than protect wildlife or employ 'geo-fencing' (a virtual perimeter defined for a geographic area , usually by digital systems). When the location-aware device is inside or enters a geo-fence, it automatically alerts a controller station, thus enabling response.

GPS tracking collars can be used for geo-fencing by placing them on 'herd leaders' or a select sample from each group. Then, data may be transmitted 24/7 to a command centre, alerting on-the-ground teams to both normal and suspicious activities. The geo-fence is particularly valuable in preventing migration to undesired locations, and can be simultaneously used to collect scientific data.

The second system component, surface movement radar (SMR), detects ground movements of large objects and is a tool similar to those used in airports and other security areas. A version of it can be further modified with appropriate infrastructure for wildlife monitoring and protection.

Using a single-detection radar, the SMR operator can detect any movement (such as human, vehicles or boats) in an area a few kilometres in radius. In addition to monitoring movements of large herds and animals, SMR can also detect any intruders moving into the protected area.

IN THE AIR

The third system is an outwardly simple tool, but with many capabilities. Aerostats involve a mobile helium-filled surveillance balloon that can be lifted to 650ft (or more) with day and night cameras, enabling visual monitoring and control of wide areas for long periods of time.

Observation balloons, such as the SkyStar 180, are proven, cost-effective, tactical surveillance systems. The balloons consist of a stabilised day/night EO payload suspended from a helium-filled aerostat that is tethered to a ground system.

These systems are durable, highly mobile and easy to operate, requiring minimal personnel. They can operate up to 72 hours before requiring a helium recharge, persist in extreme weather conditions, require no terrain preparation and produce 360° day/night images of superior quality, with automatic scanning and data recording.

The aerostat is a preventative measure that can be easily deployed and moved to hot spots as needed to increase wildlife crime deterrence, while enhancing other monitoring operations during day and night.

The complete model consists of a third component, which is indirectly linked to field protection, but integrates all the systems together. The command/networking system coordinates system operations and synergises the capabilities of field teams with commanders in local command posts.

While air and ground surveillance alone can significantly enhance wildlife protection strategies, two final components of the defence solution model are needed –

a networked system and a common control station.

Given that cooperation is often the key to success, especially in conservation, the aim of the defence solution model is that almost all system components will transmit data or video images to and from units, and then mobile units within each ranger team in the field.

Teams can view the data in real time, day or night, and react immediately and with more complete information, either to help a wounded animal, react to a migrating herd or arrest an intruding poacher before the damage is done. An additional benefit of this networked system is that there is no technological barrier when the systems transmit. The field units need to have only the appropriate equipment in order to receive the data.

STAYING CONNECTED

The final complementary component of this model is the C2 capability, allowing system components to interact and connect for best results. By linking each system to command posts, together with their connection to ranger units in the field, the defence solution model enables decision-makers to react consciously, swiftly and effectively in real time.

This is but a glimpse of the many great possibilities offered by technology and innovation that may be applied to the field of wildlife protection. The conservation challenge will be everlasting, but it is now possible to harness human ingenuity in favour of conservation, realising the role of the defence sector in this global issue and adapting advanced solutions to known, specific challenges of wildlife management, law enforcement and habitat control, wherever needed, either on land or at sea.

The solution is here – it is simple, proactive and efficient. It is only a matter of decision and dedication, allocating the funds to start turning the wheel. UV

Dr Tenenbaum is an independent advisor and recently founded 'Wildeas' (www.wildeas.org), dedicated to aid global conservation and wildlife protection efforts by advising governments, directors of NGOs and national parks on the proper use of defence technology for conservation.