



# Research Program 1 Reconnaissance and Surveillance



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**The Reconnaissance and Surveillance research program being undertaken by the specialist Science and Technology competence sector at armasuisse is working on five capability-oriented areas of expertise within the overall sphere of ISTAR (Intelligence, Surveillance, Target Acquisition and Reconnaissance). To this end, new ways of acquiring information are being identified and the technical and scientific expertise needed to fill the armed forces capability gaps is being developed. This will be achieved with the aid of a multilateral collaborative network.**

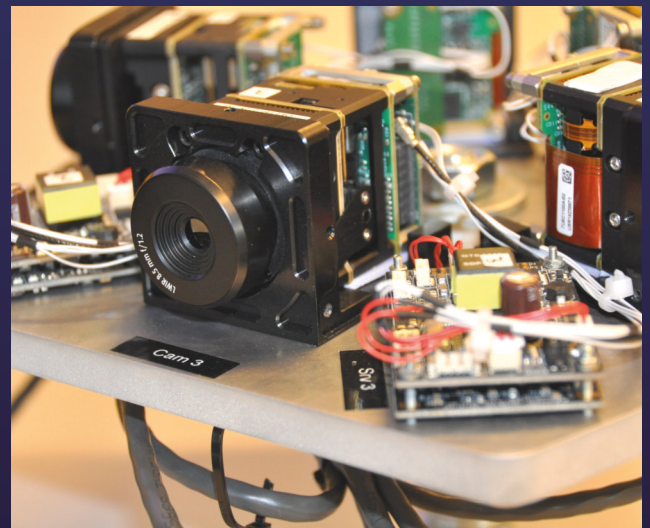
In future, information essential for decision-making will be acquired closer to real time and with greater precision, and also under adverse conditions such as rain and cloud cover. There are many reasons for this. Compared with today, advances in intelligent algorithms will allow targets to be identified and classified more effectively. This applies to the further development of radar technology for airspace surveillance, for example. The latest developments in cognitive and multi-static radar technologies improve detection of air targets by using information obtained from the environment. Intelligent algorithms also play an important role in amalgamating data from a variety of sensors and consolidating information to form a suitably accurate situation picture.

Because of the advances in electronics, data from detectors can increasingly be digitized and further processed. This can be seen in image-based reconnaissance, for example. Wide-angle, very high resolution images based on multi-camera systems can be taken in real time. Other developments in electronics and semiconductor technology are resulting in the miniaturization of sensor components, the potential applications of which include micro- and mini-drones. Continuing developments in electronics are opening up spectral ranges that the sensors used today are not yet able to exploit; this offers

the prospect of improvements in target reconnaissance in poor weather conditions or against camouflaged targets.

Current technological developments are having an impact on the performance limits of future reconnaissance and surveillance tools. Accordingly, the central tasks of the research program are

- a) to identify the relevant technologies and their trends in relation to intelligence acquisition (IMINT, RADINT, MASINT, ACCOUSTINT, SAR, GEOINT)
- b) to illustrate new technical opportunities
- c) to safeguard basic principles and specialist knowledge in order to be able to advise, conduct trials and produce expert assessments



# Competence areas



## Future airspace surveillance

Progress in antenna and high-frequency technologies and in algorithmics will allow the development of new applications in future. The topics being researched are cognitive, multi-static and passive radar systems. Account also needs to be taken of disruptive effects such as topography-related echo signals and the backscatter pattern from flying objects. New approaches to detecting drones are being evaluated.



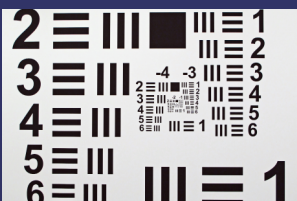
## Cutting-edge IMINT technologies for standoff reconnaissance

Compared with traditional systems, technological progress promises better detection of ground targets by using hyperspectral sensors, for example. Important information can be captured using imaging radar sensors (SAR) even in bad weather. Further developments in SAR technology on multi-channel systems hold out the promise of being able to record human activity on the ground in real time.



## Intelligent and networked surveillance of activity on the ground

Because of the constant increase in the volume of data captured, intelligent pre-analysis close to the sensor is gaining in importance. In addition, the trend towards networking offers the prospect of carrying out surveillance tasks with less human input. The goal of this area of expertise is to identify and assess the trends and limits of intelligent and networked surveillance.



## The current limits to sensor performance

Improvements to detectors and sensors are being evaluated as regards their performance limits. This affects multi-sensory systems, miniaturization and sensors which make use of new spectral bands, and new possibilities for wide-angle reconnaissance. New approaches to extending sensor operating distances or to employing them in built-up areas (e.g. 'through wall sensing') are also being explored.



## Target detection and camoufl age analysis

The characteristics of targets and their backgrounds are recorded for radar, visual, hyperspectral, infrared-based and acoustic sensors. The main priorities are signature analysis and analysis of the human impact on evaluation. In addition, this area of expertise is surveying and assessing progress towards multi-spectral, mobile and adaptive camouflage.

# Network

The requisite professional skills build on a broad network of partners from business, universities (including universities of applied science) and other research units in Switzerland and abroad. To ensure that these skills are properly developed, there is close contact and an ongoing exchange of information with users and with planning, procurement and testing units within the DDPS.

### State partners / federal government

- Swiss Armed Forces
- armasuisse - Procurement
- Wehrtechnische Dienststelle für Informationstechnologie und Elektronik, Greding, GER
- Wehrtechnische Dienststelle für Schutz und Sondertechnik, Oberjettenberg, GER
- NATO/PfP research organization
- swisstopo, Wabern

### Universities, universities of applied sciences/ industry

- ETHZ, Zurich
- EPFL, Lausanne
- University of Zurich
- University of Bern
- ZHAW, Winterthur
- Fraunhofer FHR, Wachtberg, GER
- Fraunhofer IOSB, Ettlingen, GER
- CSIR, Pretoria, SAF
- RUAG Schweiz AG, Thun