DEFENCE R&D DÉFENSE

Defence R&D Canada – Ottawa

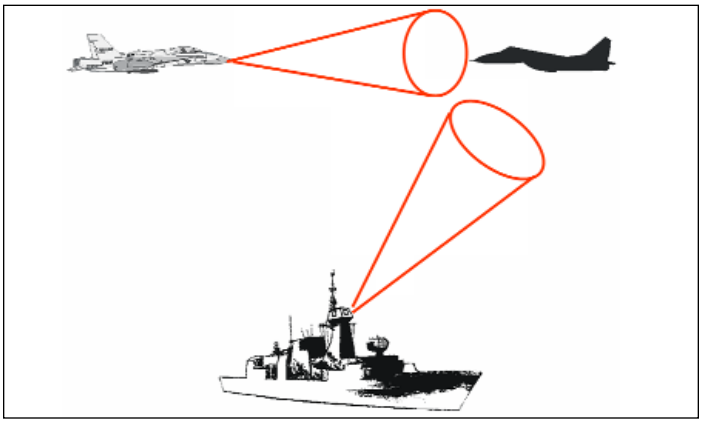
Non-Cooperative Target Recognition (NCTR)

NCTR may provide positive identification of friendly, hostile or neutral targets.

"Friendly fire" incidents in military operations bring attention to the need for target identification capabilities in both command-and-control systems and weapon fire-control systems.

Rapid and reliable identification of targets at maximum surveillance systems range and maximum weapon systems range is a challenging problem. Cooperative techniques, such as Identification Friend or Foe (IFF), are already operational in the field. Although these techniques work for friendly targets, positive identification of hostile or neutral targets is still not possible. This void may be filled by NCTR techniques.

NCTR capability can be added to most existing military radar systems such as those deployed onboard the Canadian Patrol Frigates and CF-18 jet fighters.



NCTR air and sea applications

Military engagement rules require positive identification of a target before allowing active weapons engagement.

High Range Resolution Radar Imaging

DRDC Ottawa is conducting a research program based on High Range Resolution (HRR) radar images. HRR is a one dimensional radar image useful for identifying moving/maneuvering targets. Different target types have distinct HRR signatures. Identification can hence be made by detecting and comparing a target signature and a reference database that contains signatures from different targets.

Radar Waveform for High Range Resolution Signatures

Both the stepped-frequency waveform and the pulse compression waveform can be used for generating HRR target signatures. The resolution of a HRR image is dependent on the effective bandwidth of the radar waveform. A resolution of 0.3 m is readily achievable and is sufficient for target recognition application. The stepped-frequency waveform is particularly suitable for implementation in phased array radar systems.

Target Classifier

A target classifier is comprised of an identification algorithm and a target signature reference database. DRDC Ottawa has developed a robust, accurate target identification algorithm based on a statistical template-matching technique. A correct identification rate of over 99% and a very low false alarm rate have been achieved. The algorithm has been validated extensively using two large independent sets of measured data, one covering in-flight aircraft and the other one covering ground vehicles.

Reference Database

DRDC Ottawa is also conducting research on generating synthetic target signatures to be used as a database in target classifiers. The rationale for using synthetic signatures is that it would be very difficult, to compile a large number of target signatures by measurement. There are also different target configurations that have to be taken into consideration. Thus,

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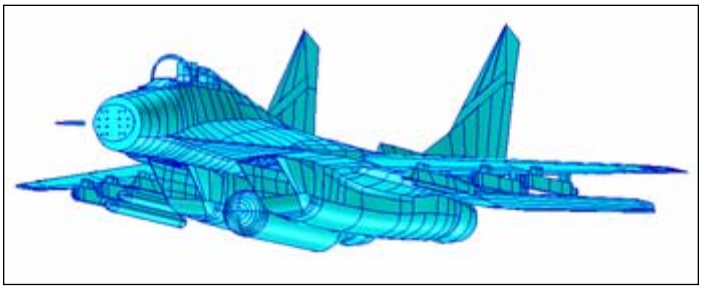
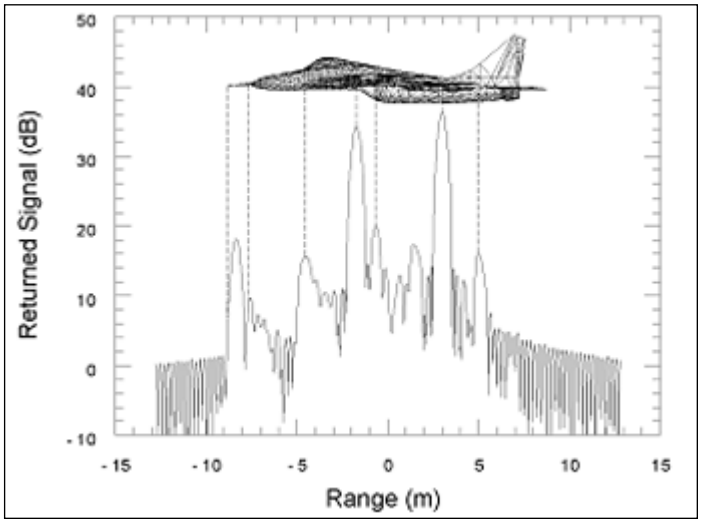
a practical target classifier is envisioned to have a synthetic target signature database.

Target signatures can be generated using radar cross-section computational code and computer-aided design (CAD) models. An example of a CAD model of an aircraft is shown below. Details such as engine air inlets, afterburner jet pipes, fans and turbine stages of turbofan engines, air borne radar antenna, wing pylons and external fuel tank are included in the CAD model. These details provide a more realistic and accurate target signature computation. A computed HRR profile is also illustrated.



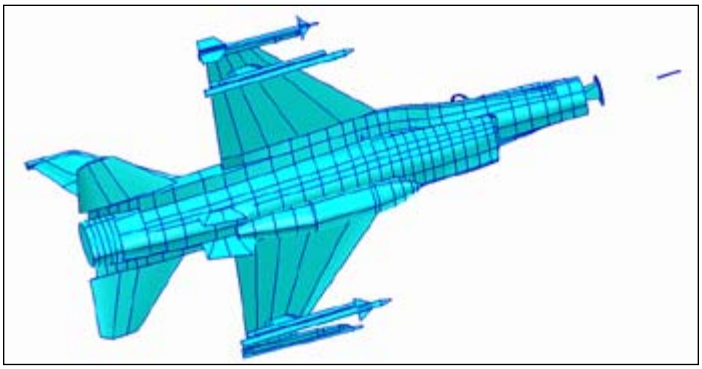
Detailed CAD model of an aircraft to be used in a radar cross-section computational code.



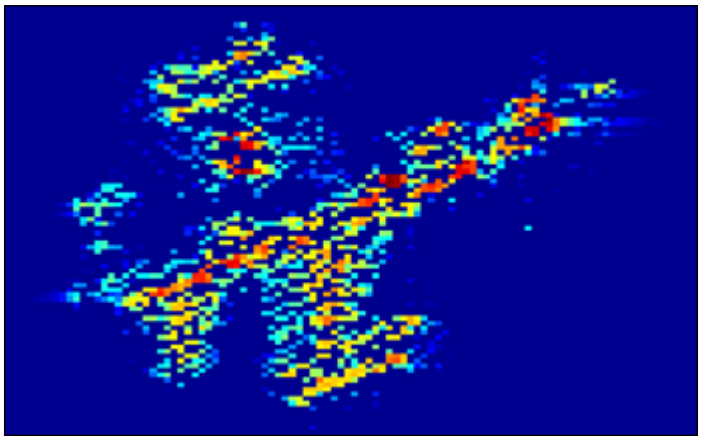
HRR signature of an aircraft generated by a radar cross-section computational code using a CAD model of the aircraft.

Radar Image Generation

DRDC Ottawa has established a synthetic target signature generation facility that is capable of generating High Range Resolution (HRR) profiles and Inverse Synthetic Aperture Radar (ISAR) images. An example of a synthetically generated ISAR image of an aircraft from a CAD model is shown here. Both HRR and ISAR can be used as target signatures for NCTR.



CAD model of an aircraft.



A synthetically-generated ISAR image of an aircraft.

Business Opportunity

This technology is available to the Department of National Defence and other Canadian government departments, as well as allied nations, industry and academia through a variety of business models. For information, please contact the Technology Exploitation Office.

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Fact Sheet RAST 309