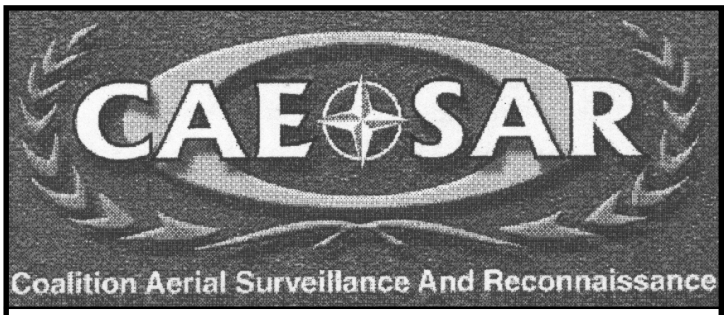
From CAESAR to MAJIIC:
How RADARSAT plugs Canada in to future NATO-led wars

For about ten years now, a NATO-led coalition of countries have been pooling their technical and human resources to improve their ability to wage war using new Aerospace Ground Surveillance and Reconnaissance (AGSR) technologies. These emerging technologies include sophisticated sensor systems aboard platforms high in the sky that collect images and data about movements either on, or just above, the earth's surface.

"AGSR assets are part of an overall Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) Architecture. ISTAR architectures can include a variety of platforms supporting sensor[s] that make use of a wide range of the electromagnetic spectrum, from optical wavelengths to radar."[1]

What's in a Name?

The project came to be known by the aptly-crafted acronym, CAESAR. To aficionados of the program, this stands for Coalition Aerial Surveillance and Reconnaissance. Using the title of the Roman empire's supreme ruler (a term whose meaning has since broadened to refer to any emperor, autocrat or absolute dictator), symbolically reflects the importance that participating states attribute to this project. CAESAR was seen as crucial to NATO's ability to rule future battles from on high and thus to command and control the business of waging and winning wars.



CAESAR had its origins in 1995 (the year RADARSAT-1 was launched) when a few NATO members began integrating their SAR and GMTI technologies for effective use during Theater Missile Defense operations of the near future.

At first, the participating states focused on the task of integrating two particular AGSR technologies; Ground Moving Target Indicator (GMTI) and Synthetic Aperture Radar (SAR). SAR is a sensor hardware that uses microwaves, instead of electro-optical light-sensing devices, to generate photo-like images of the earth's surface. Although SAR sensors can be placed on platforms at sea, or on the ground, the scope of this project was to use SAR sensors based on platforms flying high above the earth.

The other ingredient in this lethal mix, GMTI, is a process that uses mathematical algorithms to track the changed location of objects, like vehicles, that are detected by airborne or space-borne sensors.

Although these two newly-emerging military assets are certainly of overall assistance to NATO's Intelligence, Surveillance and Reconnaissance (ISR) efforts, the nations collaborating on this effort hoped to use their new technologies for specific warfighting purposes, including the creation of a working Theater Missile Defense (TMD) system. (See pp.24-26.)

After researching TMD for at least ten years, NATO finally announced its intentions to spend 650 million euros to build its own

"deployable theatre missile defense capability to give protections to troops against incoming missiles."[2]

NATO sees the use of AGSR assets as central to its goal of making TMD a standard operating procedure in battlefields of the near future.

Military leaders have long recognised the crucial importance of gathering information, particularly about enemy strengths and movements. The need for such intelligence has lead to increasingly elaborate military sensors placed aboard "platforms" like specialised warplanes and small uninhabited drone aircraft. (See pp.3-9.)

In 1995, NATO's Supreme Headquarters Allied Powers Europe, through the NATO Consultation, Command and Control Agency (NC3A), created an Advanced Capability Testbed in The Hague, Netherlands.[3] (That was the year Canada's SAR-equipped satellite, RADARSAT-1, was launched.)

By that time, the U.S. and France had developed their own independent airborne intelligence-gathering systems with SAR/GMTI capabilities, while Italy and Britain were not far behind. Meanwhile, Germany and Norway had been busily developing ground stations to process and exploit this kind of sensor data.

These nations came together in the NC3A laboratory as a first step toward achieving interoperability. They wanted to ensure that their military personnel could all function together as efficiently as possible when using these new airborne sensor technologies to gather data and then relay it to command centres and weapons systems. At first, scientists from the six participating nations held lab exercises using electronic simulations to set the stage for real use of SAR and GMTI in future wars.

Emerging from the Lab

Military scientists and soldiers were, however, soon moving their research efforts into the light of the real world. They moved out of the "testbed" and began integrating their experiments into "live-fly" military exercises that used warplanes and uninhabited aerial vehicles. During such wargames as the Paris Interoperability Experiment (1997),[4] Central Enterprise (1998),[5] Joint Project Optic Windmill/ Clean Hunter (2000),[6] a mix of computer-simulated data and actual sensor

data from warplanes and drones, was used.

One of the most important functions of these exercises was to prepare NATO forces to engage in Theater Missile Defense operations in future wars. Scientists tested their SAR/GMTI equipment and military users learned and practised new skills by operating the systems in phoney war scenarios.[7,8,9]

SAR and GMTI systems were so new that participants had to create user-friendly protocols for warfighters to exchange

> "ISR data and information ...[via] local and wide area networks, tactical data link, instant messaging and storage/retrieval from web-enabled data bases."[10]

One of the project's central goals was to enhance the "interoperability" of the equipment and its users. Because the state members of CAESAR had independently developed their own individual SAR sensors and GMTI processing systems, they needed to create new rules and routines for getting these various pieces of equipment, and their operators, to work seamlessly together as one integrated, cohesive warfighting whole.

By 1999, seven nations (Canada, France, Germany, Italy, Norway, the UK and U.S.) were working closely together "to achieve operational and technical interoperability among the MTI and SAR platforms."[11]

For the next two years, each of these governments engaged teams of lawyers to develop a legal framework for CAESAR. The result was a Memorandum of Understanding with two side documents: a Project Arrangement and a Technical Agreement. These covered the project's purpose, timeframe, what each nation would contribute, and the delicate issue of transferring technology between nations and corporations. The NC3A managed the project and allowed members to use its labs.[12]

Collage by Richard Sanders.

Many Eyes in the Sky

Because air-to-ground sensors are positioned high above the earth, they occupy the most strategic positions possible. They can oversee multiple battle zones and conduct intelligence gathering operations that are essential for many reasons, not least of which is the targeting of weapons systems.

NATO does not yet possess its own air-to-ground surveillance systems. It is however planning to purchase such technology and expects "an initial operational capability" by 2010.[13]

To bridge the gap, NATO's CAESAR project pulled together the national assets of seven countries. Each of these states had already excelled in the research, design and production of some unique sensor or sensor-data processing system. This was in fact a condition of their membership in the CAESAR project. Only nations with some SAR/GMTI technology to contribute were allowed to join the club.

Some nations provided CAESAR with powerful sensor systems aboard aircraft or drones (France, Italy, UK and U.S.). These are the airborne eyes and ears of the modern warfighting machine. Others, like Germany and Norway, provided mobile "exploitation stations" designed to receive, process and transmit sensor data for use by weapons systems.

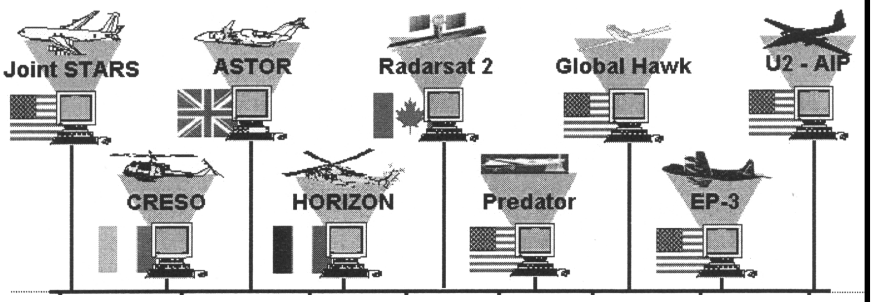
However, only one nation provided CAESAR with a space-based sensor. That nation was Canada!

Canada's Gift to CAESAR

Canada's part in this NATO effort to perfect specialised ISR technologies for warfighting and "missile defense" operations of the 21st century, was very significant indeed. Being an ever-loyal and leading partner in this alliance of the world's richest and most militarily powerful nations, Canada generously provided what can be described as the jewel in the apogee of CAESAR's crown. The Canadian asset is a unique sensor system whose platform rides at altitudes far higher than any other in the CAESAR pantheon.

Canada's gifts unto CAESAR were listed under "Participating Sys-

Of the seven participating nations, only four had air-based sensor systems to offer CAESAR. However, only one nation supplied a space-based sensor. That nation is Canada.



Graphic source: Joseph Ross, Table 5, 2002 (see Reference 5).

CAESAR has now grown into an even bigger NATO-led coalition called MAJIIC which is integrating several new ISR sensors systems. Canada's contribution has also grown.

tems" by Stephen Bond in the *Military Intelligence Professional Bulletin*:

> Canadian Radar Satellite (RADARSAT) system and associated ground stations. RADARSAT 1 is an operational commercial satellite providing 7- to 100-meters resolution SAR imagery, depending on the radar beam mode and incidence angle. RADARSAT 2 is currently in development; when operational, it will provide radar images at better than 3-meter resolution and have an experimental ground MTI capability.[14]

Other military sources clarify that Canada provided CAESAR with "live" RADARSAT-1 data and "simulated" RADARSAT-2 GMTI data.[15]

As Bond mentioned, Canada's contribution also included "associated ground stations." MacDonald, Dettwiler and Assoc. has built or upgraded RADARSAT ground stations in many countries, including: Brazil, Canada, China, Italy, Korea, Saudi Arabia and Thailand.[16] There are also five U.S. military "Eagle Vision" stations that directly control RADARSAT operations and downlink its data. (See pp.36-38.)

During the CAESAR project (2001-2005), various national assets took part in huge annual NATO air force exercises, including Clean Hunter (2001) and Strong Resolve (2002). (See pp.24-27.) RADARSAT-1 was used in these war games that involved hundreds of warplanes and ground vehicles, tens of thousands of troops and preparations for future TMD operations.

Meanwhile, CAESAR work also continued with "simulation exercises" such as Dynamic Mix 2002, and TMD-focused Cannon Cloud 2002.[17]

Besides personnel, Canada contributed simulated RADARSAT-2 data for integration into weapons-targeting systems for computer simulations, like SIMEX 2003[18] and Technical Interoperability Experiment (TIE) 2004.[19] These exercises are in preparation for the day when RADARSAT-2 will give data to U.S. and NATO forces engaged in war.

A 2003 talk by Dr. Judith A.Daly, director of NC3A's Operations Research Division, noted that Canada's RADARSAT-2 data had been used by CAESAR in "Four major Military Utility Assessments since 2000. Two live-fly [and]...two simulation."[20] She also listed some military "firsts" achieved by CAESAR. Primary among these was that for the first time ever, a "Space Based MTI sensor (Canada)" was used "in a NATO exercise."[21]

The Canadian government's perception of the CAESAR project and its place in NATO's vision of wars to come, is enlightening. The government's Science and Technology Report for 2002, which then-Industry Minister Allan Rock said "demonstrates the vitality of federal science and technology,"[22] highlighted the work of various government bodies. CAESAR is mentioned in the context of Defence R&D Canada, under "Enhanced Collaboration with Partners":

> "The special relationships that exist between Canada and the U.S. have seen the successful development, commercialization and exploitation of many technologies and systems. The unique position that Canada enjoys in defence science creates favourable conditions for Canadian industry to access defence programs in the United States.
>
> Examples...include:....
>
> • Coalition Aerial Surveillance and Reconnaissance [CAESAR] ...which integrates different forms of surveillance information and processes to provide an improved coalition operational picture to the war fighter and ensure interoperability among allied nations."[23]

CAESAR is Dead, Long Live MAJIIC!

In recognition of CAESAR's great success in building weapon/sensor/user interoperability among the world's leading warfighters, the U.S. Air Force's Materiel Command gave its International Award for Armaments Cooperation to the project in June 2003.[24]

War planners, military scientists, technicians and warfighters from the participating nations, all proclaimed CAESAR to be a fantastic success. One commentator noted that "On completion, the programme was called the 'hidden jewel of NATO.'"[25]

Although the CAESAR project ended in March 2005, it was immediately reborn as an even bigger NATO-led project. The new and improved incarnation was also dubbed with a clever acronym to match the symbolic power of CAESAR. It's now called MAJIIC, or Multi-sensor Aerospace-Ground Joint ISR Interoperability Coalition.

While CAESAR integrated two emerging aerospace-based ground-surveillance/reconnaissance technologies, (SAR and GMTI), its successor has the more ambitious task of fusing data from these and other sources, including:

- Electro-Optical sensors
- Infrared sensors
- Motion Video sensors
- processed Electronic Support Measure data.[26]

MAJIIC was also expanded beyond the seven original CAESAR nations by adding two new state participants: Spain and the Netherlands.[27] Other countries may also join MAJIIC, including Australia, Belgium, Turkey[28] and Sweden.[29] And, at a MAJIIC "Bidders Conference" other potential participants were named, including: South Korea, Japan and Singapore.[30]

Who's Waving the MAJIIC Wand?

There is no doubt that the state with the strongest grip on the MAJIIC wand is the U.S. Afterall, the world's rogue superpower spends as much on the military as the rest of the world combined.[31]

While other MAJIIC members give one or two types of sensor hardware, the U.S. supplies more than two dozen, including six types of Uninhabited Aerial Vehicles (UAVs), seven kinds of aircraft with ISR sensors and ten ground-based "exploitation workstations" to process sensor data. Here's a veritable alphabet soup of ISR-related assets provided to MAJIIC by the U.S.:

> "**USAF:** DCGS-AF [Distributed Common Ground System-Air Force], DGS-X [Distributed Ground System-Experimental], JSTARS [aircraft], U2 [aircraft], Predator [UAV], Global Hawk [UAV], MC2A [E10A Multi-sensor Command and Control Aircraft], NCCT [Net-Centric Collaborative Targeting].
> **U.S. Army:** DCGS-A[rmy], TES [Tactical Exploitation System], JSWS [Joint STARS workstation]/ CGS [Common Ground System], ARL-M [Army Reconnaissance Low- Multi-function aircraft], ACS [Aerial Common Sensor UAV], T[Tactical] UAV.
> **U.S. Navy:** DCGS-N[avy], AIP [Anti-surface warfare Improvement Program for P-3 Orion aircraft], P-3 [aircraft], MMA [Multi-Mission Maritime Aircraft], BAMS [Broad Area Maritime Surveillance] UAV, GHMD [Global Hawk Maritime Demonstration - UAV], TES-N [Tactical Exploitation System-Navy], TCS [Tactical Control System].
> **U.S. Marine Corps:** MAGIS [Marine Air Ground Intelligence System]."[32]

MAJIIC originated to solve data-collection and management problems encountered during the U.S.-led bombing of Iraq in 2003.[33,34,35]

The U.S. military stands to benefit more from MAJIIC because it will likely be during U.S.-led wars that the MAJIIC toolkit will be put to use. One of many military-produced articles praising MAJIIC's contribution to the work of U.S. warfighters, was written for the American Forces Press Service. Its author begins by saying:

> "U.S. forces operating in Iraq, Afghanistan and elsewhere may soon be able to use 'MAJIIC' to locate an enemy position on the battlefield and share intelligence information and imagery with coalition allies."[36]

That day may be coming soon. MAJIIC has already held at least one training exercise during which live data from a U.S. Predator UAV flying over Iraq was fed into the MAJIIC system.[37]

To gauge the degree to which the U.S. controls MAJIIC, one can also peruse the cornucopia of U.S. "unified combatant command units" that have their fingers in the MAJIIC pie: "JFCOM [Joint Forces Command], CENTCOM [Central Command], EUCOM [European Command], PACOM [Pacific Command], STRATCOM [Strategic Command], SOCOM [Special Operations Command]."[38]

MAJIIC is subsumed under the U.S. Department of Defense as a five-year Advanced Concept Technology Demonstration project. It was requested by Admiral Edmund Giambastiani[39] who heads the U.S. Joint Forces Command. It has integrated MAJIIC into a much more broadly-defined war plan called the ISR Troika Project. This three-pronged effort is designed to give frontline soldiers access to the widest possible array of sensor data.[40]

Besides RADARSAT, Canada is now giving MAJIIC the use of a Tactical Unmanned Aerial Vehicle (TUAC) for "target acquisition and surveillance." The Sperwer has been Canada's TUAC of choice in the Afghan war since Oct. 2003.

Canada Ups its Ante

The Canadian government is now giving more to MAJIIC, than it gave to its predecessor, CAESAR. Here are some examples of Canada's enhanced collaboration in this new NATO-led effort:

Money:

Canada's officially-recorded spending on CAESAR (2001-2005) was a mere $4 million.[41] (Not to mention giving access to the $1.145 billion RADARSAT system.) However, Canada's projected spending on MAJIIC (2006 onwards) is ten times more, i.e., $40 million.[42]

RADARSAT:

When RADARSAT-2 is launched later this year, Canada will begin providing MAJIIC with data from the world's most advanced commercial satellite. RADARSAT's earth images, and more importantly its GMTI data, will be used in MAJIIC preparations for war, including Theater Missile Defense roles.

Tactical UAV:

According to John Kane, the MAJIIC Joint Technical Manager, for the U.S. Joint Forces Command, Canada has added a whole new sensor platform to MAJIIC's sensor toolkit, a "Tactical UAV."[43]

However, the type of Tactical Uninhabited Aerial Vehicle (TUAV) that Canada has turned over to MAJIIC has not been publicly disclosed. It may be the CU-161 Sperwer drone which has been Canada's TUAV of choice in the Afghan war since October 2003. That's when Canada's Sperwer detachment began supplying Intelligence, Surveillance, Target Acquisition and Reconnaissance data for use in that war.[44]

The Quebec-based Oerlikon-Contraves corporation, is the prime contractor for the Sperwer.[45] This Canadian-built "Little Hawk" has been exported to the militaries of Denmark, France, Greece, Sweden and The Netherlands.[46] The Sperwer has an electro-optical sensor in a ball-shaped turret under its nose. Its flight path, and the movement of its video camera, are controlled by soldiers in a mobile Ground Control Station.[46]

Alberta War Game, June 2006:

According to an NC3A report "Experimentation Activities with Aerospace Ground Surveillance," Canada will likely host a MAJIIC war game. This "live flying exercise with all MAJIIC nations in June 2006 [will] probably [be] held in Alberta, Canada."[47] Although this event is not named, there is little doubt it is "Maple Flag." For almost 40 years, this annual 'Top Gun' weapons-firing competition has been held at Alberta's Cold Lake Air Force Base. This year, between May 14 (Mothers' Day) and June 23, it will host more than 5,000 NATO and allied warfighters. Troops and warplanes will converge on Alberta to take advantage of "the vast, unrestricted airspace and more than 640 targets of the Cold Lake Air Weapons Range."[48]

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