FROM CLOSE AIR SUPPORT TO JOINT OPERATIONS OTHER THAN WAR

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Abstract

This paper provides a case study for the realisation of a joint Network Centric Defence[1] capability by merging existing information and communication infrastructure with new network enabling concepts. This capability was achieved by gaining access to the sensor, Command & Control and effecting functions of the SAAF JAS-39 Gripen fighter aircraft through utilising its Tactical Data Link (TDL). By making TDL information available to systems from other Arms of Services in a Services Orientated manner, the traditional functionality of the Gripen in the Close Air Support[2](CAS) role can be extended to perform roles currently required in joint Operations Other Than War (OOTW).

Introduction

The use of platforms developed for conventional air defence roles such as CAS requires a re-evaluation for use in the context of OOTW. In order to provide resilience for different military and non-military roles, modern defence forces are moving towards the employment of multi-role platforms in a network enabled environment. This is done in order to create interoperable, joint, flexible and efficient military capabilities.

In order to pursue network enablement, traditional interoperability establishment strategies, as illustrated in Figure 1 have been found impractical since these approaches are:

- overly complex to manage
- does not allow for flexibility and resilience
- mostly not re-configurable since configurations are role specific
- does not allow for emerging properties to improve capabilities

[1] Network Centric Defence (NCD) is defined in the South African Department of Defence (DoD) Information Strategy [3] as the capability inherent in the Defence Information and Communication Infrastructure to store, process and move essential data in planning, directing, coordinating and executing operations in digital format.

[2] Close Air Support (CAS) can be defined as air action by fixed or rotary winged aircraft against hostile targets that are close to friendly forces, and which requires detailed integration of each air mission with fire and movement of these forces [1].

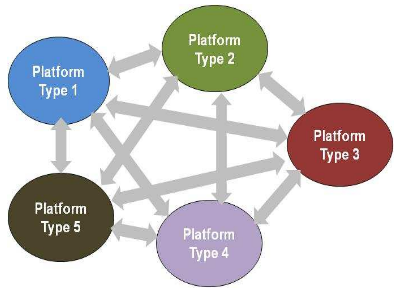

Figure 1: Traditional Interoperability Strategy

It is for this reason that interoperability gateways have become a necessity to provide the necessary interoperability, flexibility and network re-configurability required for the modern battlespace that could span requirements for conventional warfare, irregular warfare, OOTW and more. This approach is illustrated in Figure 2.

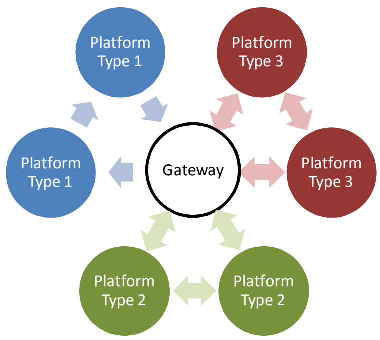

Figure 2: Gateway Interoperability Strategies

The aim of this study was to evaluate the contribution that can be made through a gateway interoperability approach which was evaluated through the establishment of an experimental mobile JAS-39 Gripen Ground Station (GGS) with gateway capabilities for Command & Control (C2) and situational awareness distribution to platforms and systems of other Arms of Service.

Requirements for OOTW

Military Operations Other Than War (OOTW) can be defined as military missions that encompass the use of military capabilities across the range of military operations short of war [2].

Such military missions could include border protection, peace support operations, counter crime, civil operations and disaster relief [7].

Based on [7], the following generic technologies are required to support such missions:

- Information Sharing, Handling & Dissemination with Identification

- Sensor capabilities in Day/Night/All weather
- Non-Lethal Weapons

The capabilities required to support OOTW can thus be summarised as [2], [7]:

- Multi-disciplined, all-source, fused situational awareness and intelligence. (A single source approach cannot support all requirements.)
- Command and Control (C^2). (Joint forces are required to be flexible in arrangements to meet specific requirements for each situation.)
- Non-lethal effectors (The concept does not mean "no casualties" but rather an attempt to avoid fatalities)

It thus becomes clear that OOTW require the interoperability, jointness, flexibility and efficiency provided by network enabled capabilities. This case study will elaborate on the use of a gateway interoperability strategy to achieve such network enabled capability.

SAAB JAS-39 Gripen Platform

The SAAB JAS-39 Gripen is a multirole fighter aircraft that has been in service since 2010.

Sensors

The Gripen is fitted with a modern PS-05/A pulse-doppler X-band radar that is capable of detecting, locating, identifying and automatically tracking multiple targets in the upper and lower spheres, on ground, sea or in air, and in all weather conditions.

The Gripen includes a powerful Radar Warning Receiver (RWR) that can provide Signal Intelligence information concerning Radio Frequency (RF) emitters at a considerable range in the air and on ground.

In future, the Gripen shall also be equipped with a reconnaissance capability to take reconnaissance photography.

Command and Control (C2)

The Gripen Tactical Data Link provides a C2 link to a potential ground station from where the Gripen can receive steering commands, engagement targets and additional tracking as well as situational awareness information.

The Radar and RWR information from the Gripen can also be relayed to the potential ground station.

Tactical Data Link (TDL)

The Gripen aircraft has been developed to accommodate three data link modes; Tactical Intralink C2, Tactical Intralink Tactical unit and Data Transfer Link modes.

Experimentation Methodology

The system concept for this network enabling experiment is depicted in Figure 3. In this concept, a three phase approach is envisaged to expand the experiment. An experimental Gripen Ground Station (GGS) was developed to receive and send Gripen information via the Gripen TDL:

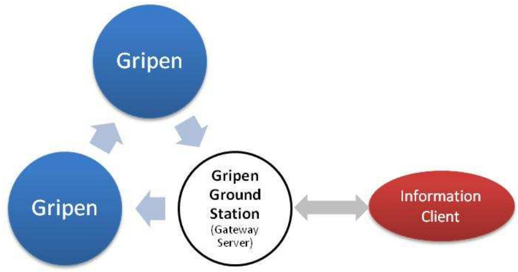

Figure 3: Gripen Gateway Experimentation Concept

Phase 1: Situational awareness distribution

This entailed the use of the Gripen Tactical Intralink to receive situational awareness information from all Gripens in the data link network. This information included:

- the own position of all Gripen aircraft in the network
- the radar tracks of detected land and air targets of all Gripen aircraft in the network as detected by their doppler radar system.
- the SIGINT tracks of detected emitters on land or in the air of all Gripen aircraft in the network as detected by their RWRs.

Phase 2: Command and Control

Phase two will entail extending the Tactical Intralink to allow the mobile GGS to provide specific C^2 information and commands to a specific Gripen aircraft in the network.

This information will include:

- Scramble command
- Veto command

- Go to a specific altitude, heading, speed, or geographic position
- Provide track information of a potential target

In this phase the following additional aircraft status information will be received from each Gripen:

- Remaining fuel
- Stores status
- Bomb release information

Phase 3: Tactical Imagery

Once the Gripen has been fully cleared to carry its reconnaissance pod, the mobile GGS will be extended to receive information in its Data Transfer Link mode. This will enable the GGS to receive tactical images from any Gripen aircraft in the network.

Experimental Mobile Gripen Ground Station

This Gripen Ground Station (GGS) is an experimental system to develop interoperability concepts and to assist the SANDF to develop joint doctrine for CAS and OOTW operations related to traditional fighter aircraft.

The ground station developed includes the use of Military of the Shelve (MOTS) communications infrastructure to enable the ground station to receive and transmit information utilising the Link-ZA protocol and message model.

The communications infrastructure was interfaced to an Interoperability Gateway (IG) that could manage the distribution of information to and from the Gripen. This was done in order to facilitate information links to other applications that could require information from the Gripen or would like to send information to the Gripen. This is illustrated in Figure 4 .

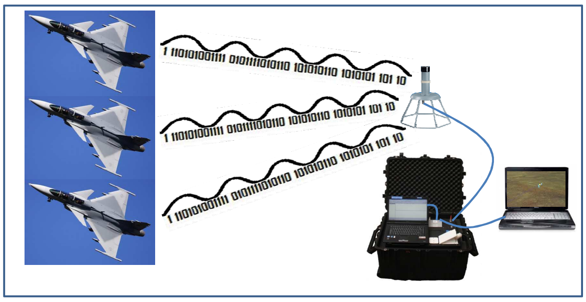

Figure 4: Gripen Ground Station

Experiment Status

Currently phase 1 has been successfully achieved and efforts are being put on developments for the achievement of phase 2.

The system was first successfully demonstrated at the African Aerospace & Defence (AAD) show at Ysterplaat Air force Base (AFB) in September 2010.

The system has furthermore successfully been demonstrated with an information distribution function at the SAAF Air Capability Demonstration at Roodeval bombing range in May and September 2011.

Situational awareness through own position and radar information from numerous Gripen aircraft in the same TDL has been achieved and typical visualisations are depicted in Figure 5 and Figure 6.

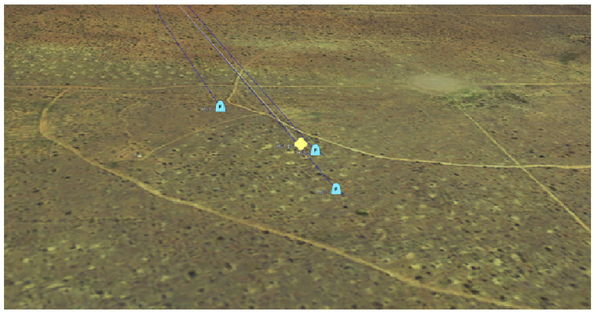

Figure 5: Three ship Gripen formation with radar plot

A three ship configuration is illustrated above with a radar track from the aircraft at the back detecting the aircraft in front of it. In the background Charley coke of the Roodeval bombing range can be seen.

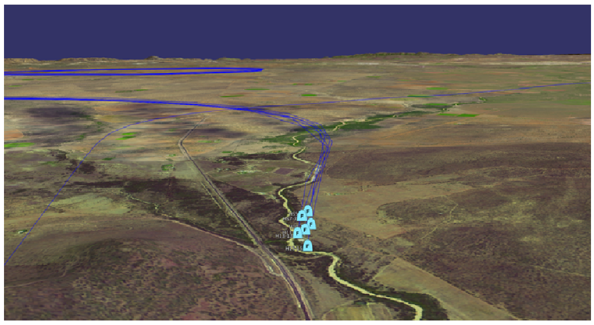

Figure 6: Six ship Gripen formation flight

A rare six ship configuration can be seen above for a final fly past over the Roodeval bombing range after the Air Capability Demonstration in May 2011.

The information distribution function also demonstrated at the Air Capability Demo illustrated how Gripen situational awareness information could be distributed to other users by providing this information to spectators on handheld tablet computers as well as on a big screen in front of the audience.

Preliminary Results

In view of the current requirements for OOTW manifested in a need for rapid deployable joint airborne situational awareness, it is foreseen that the mobile GGS would be able to provide the SANDF with just such a capability.

In addition it is believed that the aspects of flexibility, jointness, interoperability, and mobility incorporated in the GGS will make joint airborne situational awareness a service that the SAAF can provide to any Arms of Service in the SANDF on demand.

This service will be quick to deploy from the view of the service provider (SAAF aircraft) as well as from the view of the client (Joint Operations).

The GGS currently only weighs 35kg and requires a single antenna to communicate to a Gripen. Limitations however include Line of Sight (LOS) operation.

The information from the GGS will be available to any of the Arms of Service in a fashion that can provide compatibility to their service specific systems and applications through the translation capabilities of the Interoperability Gateway.

In future the GGS will additionally provide direct means to perform C2 with specific Gripen aircraft. This should allow for smaller deployment infrastructure for joint air deployments and provide more accurate and efficient means to exchange C2 information to the Gripen.

Utilisation of the GGS is however still at an experimental level and no official doctrine has been developed for use of the system. Future activities will include providing a deployable system to the SAAF for mission control doctrine development.

The future of Information Distribution

As mentioned before, Gripen information is provided to the Interoperability Gateway (IG).

The IG is being develop to test concepts of interoperability can be extended to include multiple communication methods. It is foreseen that the IG will be able to access information utilising a number of different communications means, including High Frequency, Very High and Ultra High Frequency, Wifi, WiMax, Global Systems for Mobile Communications (GSM), Ethernet fixed infrastructure, Satellite Communications and more.

Testing the utilisation of such links has been successfully performed and illustrates the viability of interfacing the IG with other SANDF systems. Tests have been performed on the following SANDF systems; SAAF Air Picture Display System (APDS), the SA Army Tactical Intelligence System (TIS) and SA Army Operationally Urgent Command and Control System (OUCCS).

The IG is also planned to be extended to provide links to other platforms such as the Hawk LIFT aircraft, Oryx helicopter, Navy Frigates and Navy Submarines.

In general, the utilisation of the IG for the facilitation of network enabled operations will be flexible and scalable as illustrated in Figure 7.

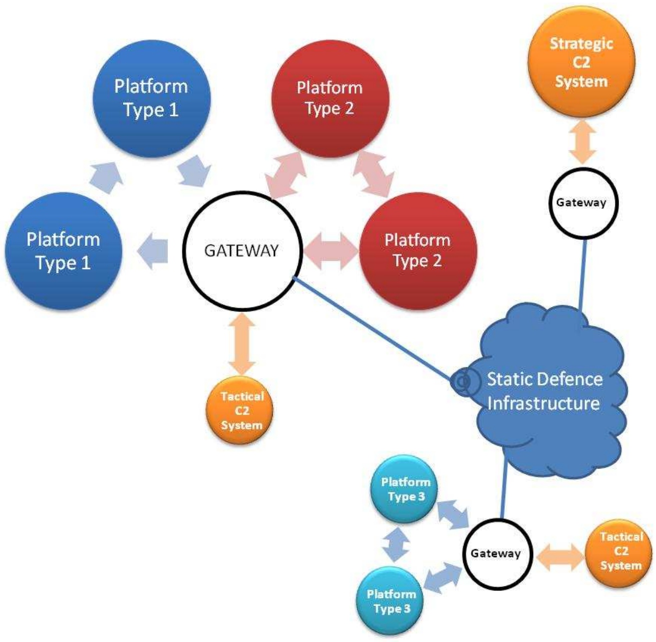

Figure 7: Concept for Future Network Enabling

The IG can translate information to different data model standards that would otherwise not be compatible. This is done by utilising decision rules to support multi link operations, multi system track management and might in future include track correlation and network management functions and more.

The IG can also be duplicated at different locations and information can be exchanged between multiple IG's.

Going From Concepts to Deployable Systems

The IG is currently only an experimental tool to derive interoperability requirements for interoperability building blocks and to experiment with the gateway interoperability strategy.

Interoperability building blocks will enable the SANDF to manage ICT architectures to facilitate systems interoperability.

Some of these building blocks are foreseen to become MOTS systems that will be employed throughout the SANDF to facilitate interoperable, joint, flexible and efficient deployment structures.

In relation to TDL interoperability at a tactical C2 applications and platforms level, it is foreseen that an interoperability building block named the Data Link Processor (DLP) will be specified for development by South African industry. The DLP will perform many of the functions of the IG and will be a deployable MOTS system that facilitates TDL interoperability. The DLP and its strategic value for interoperability is described in [4].

Conclusion

In conclusion it has been shown that OOTW require network enabled capabilities with properties that include interoperability, flexibility and network re-configurability.

This study has shown that employing a gateway interoperability strategy to the Gripen fighter, through the use of a mobile GGS can extend the roles of the Gripen from traditional CAS roles to OOTW.

This has been achieved through creating a mobile, information distributable and rapid deployable Gripen Ground Station that can provide a service of situational awareness information to any of the systems in the SANDF Arms of Service which are integrated to the gateway.

This has been achieved through the employment of network enabling concepts.

As more and more platform developments and Arms of Service join in tackling the challenges of interoperability it is believed the objectives of jointness can be achieved as a force multiplier and tool for resilience of SANDF systems for multi-role operations.

References

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