IFF, Combat ID and the Information Domino Effect
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Department of National Defence, Canada

Briefing Outline

1. IFF Mode 5
2. Combat ID
3. Information Domino Effect
4. Summary/Conclusions
Identification Friend or Foe (IFF)

Increasing Combat Effectiveness and Minimizing Risk of Fratricide

IFF Mk XII
STANAG 5017
Mode 4
New Standard!
IFF Mk XIIA
STANAG 4193
Mode 5

Over 30 yrs since we have last upgraded!

Basic IFF System Operation

Co-operative Target Identification (TI)

Interrogator
Asks Question
1030 Mhz
Basic IFF System Operation

2. **Transponder**
   - Reply/Answer
   - 1090 Mhz

3. Receive Reply, Process and Report
Scope of IFF Mode 4/5

IFF Mode 4/5 Traditionally “Not Used”

<table>
<thead>
<tr>
<th></th>
<th>Air</th>
<th>Surface</th>
<th>Ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>Air - Air</td>
<td>Air - Surface</td>
<td>Air-Ground</td>
</tr>
<tr>
<td>Surface</td>
<td>Surface - Air</td>
<td>Surface - Surface</td>
<td>Surface-Ground</td>
</tr>
<tr>
<td>Ground</td>
<td>Ground - Air</td>
<td>Ground-Surface</td>
<td>Ground-Ground</td>
</tr>
</tbody>
</table>

IFF Mode 4/5 traditionally “not used” in the “Air-Ground” and “Ground-Ground”
### IFF Feature Improvements

<table>
<thead>
<tr>
<th>Mode 4</th>
<th>Mode 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 year old algorithm, using red key with manual switchover</td>
<td>New encryption algorithm using black key with auto switchover</td>
</tr>
<tr>
<td>Pulse Position Modulation waveform</td>
<td>Spread spectrum waveform (formatted messages)</td>
</tr>
<tr>
<td>No Platform Identification Number (PIN)</td>
<td>New Platform Identification Number (PIN)</td>
</tr>
<tr>
<td>Basic Interrogation Only</td>
<td>Level 1 Basic Interrogation with Lethal Interrogation Override Level 2 Squitter Broadcasts</td>
</tr>
</tbody>
</table>

### IFF Mode 5 Level 2 - Squitter

Squitter supports the new emerging operational paradigm…

… sharing your position information as opposed to giving it up only when challenged.

Transponder Broadcasts Message

1. Maybe 5 - 9 times per second
Mode 5 Level 2 - Squitter

Listen, Receive, Process and Report

IFF Building Blocks

1. Command and Control Systems
   (Data fusion/weapons integration/display functionality on a plane, ship, vehicle, etc)

2. Sensor Systems
   (Active/Passive)
   (interrogator/receiver functionality)

3. Multiple Warfighter Platforms
   (Transponder/transmitter functionality)

Planes
Ships
Tanks
Platform Information

1. **Multiple Warfighter Platforms**
   (transponder/transmitter functionality)

2. **Sensor Systems**
   (Active/Passive)
   (interrogator/receiver functionality)

3. **Command and Control Systems**
   (data fusion/weapons integration/display functionality on a plane, ship, vehicle, etc)

Minimum Platform Data

1. **Platform ID** *(Unique ID)*
   (positive ID to sort everyone out)

2. **Position** *(LAT, LONG and ALT)*
   (to identify where they are)

3. **Time** *(Day/Hour/Second)*
   (for currency of information)
### Warfighter Platform Information

<table>
<thead>
<tr>
<th>Platform Data Required</th>
<th>Mode 5 Level 1 (Interrogation)</th>
<th>Mode 5 Level 2 (Broadcast)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique Platform Identifier</td>
<td>Provided in reply</td>
<td>Provided in broadcast</td>
</tr>
<tr>
<td>Altitude</td>
<td>Provided in reply (100 ft baro/25 ft GPS)</td>
<td>Provided in broadcast (25 ft GPS)</td>
</tr>
<tr>
<td>LAT/LONG</td>
<td>Slant range calculated from time to reply Azimuth from antenna boresight/beamwidth</td>
<td>Provided in broadcast (GPS)</td>
</tr>
<tr>
<td>Day/Time</td>
<td>Time stamped at Interrogator</td>
<td>Time stamped at receiver</td>
</tr>
</tbody>
</table>

### Mode 5 Unique Platform Identifier

A combination of Platform Identification Number (PIN) and National Origin (NO) will provide a Mode 5 unique identifier for the transponder.

Mode 5 Unique = PIN + NO Identifier
Stove Pipe Paradigm

Each C2 system has a dedicated sensor which each detect the aircraft and identify as friendly but do not share the information.

Network Enabled Paradigm

Here we see the centre C2 system having the same aircraft platform data show up 5 different times.
Unique NO + PIN

1. Assists in the Elimination of Duplicate and Old Data

2. Assists in Prevention of Incorrect Data Fusion

Briefing Outline

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### NATO Combat ID

<table>
<thead>
<tr>
<th>Mode 5 <strong>Does</strong> Target Identification (TI)</th>
<th>Mode 5 <strong>Supports</strong> Situation Awareness (SA)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>The process of determining the friendly, neutral, or enemy character of a detected entity.</em></td>
<td><em>The knowledge and understanding of the relationship between forces and their status and intent in the battle space.</em></td>
</tr>
<tr>
<td>Single Entity</td>
<td>Multiple Entities</td>
</tr>
<tr>
<td>Perform IFF interrogation on a radar detected unknown. The unknown transponder responds as friendly.</td>
<td>Perform IFF continuous scan of battlespace and builds up tracks of all broadcasting and replying entities.</td>
</tr>
</tbody>
</table>

### Mode 5 and Combat ID

**Mode 4 to Mode 5 Level 1 Interrogation**

*Provides Improved Target Identification*

**Mode 5 Level 1 to Mode 5 Level 2 Squitter Broadcast**

*Provides Improved Situation Awareness*
Core Combat ID Activities

1. Characterize and Report
2. Combine and Integrate
3. Distribute and Disseminate

Source: US Joint Forces Command (JFCOM)
Concept of Operations for Combat ID and BFT
Version 1 dated 26 Jun 2008

IFF Building Blocks

Command and Control Systems
(Active/Passive)
(interrogator/receiver functionality)

Sensor Systems
(data fusion/weapons integration/display functionality on a plane, ship, vehicle, etc)

Multiple Warfighter Platforms
(transponder/transmitter functionality)
**IFF Building Blocks**

1. **Multiple Warfighter Platforms**
   - (transponder/transmitter functionality)

2. **Sensor Systems**
   - (Active/Passive)
   - (interrogator/receiver functionality)

3. **Command and Control Systems**
   - (data fusion/weapons integration/display functionality on a plane, ship, vehicle, etc)

**C4ISR Functions**

**CID Activities**

**Product and System Impacts**

Introducing Mode 5 has the potential to impact many products and systems which conduct Combat ID Activities.
Product A: Air Defense Interrogator

1. Characterize and Report
   - Interrogation Management
   - Friendly/Unknown Characterization
   - Detection/Tracking Management

2. Combine and Integrate

3. Distribute and Disseminate
   - Eurocontrol ASTRIX Messages

Product B: Squitter Receptor

1. Characterize and Report
   - Squitter Management
   - Friendly Characterization
   - Detection/Tracking Management

2. Combine and Integrate

3. Distribute and Disseminate
   - NATO Friendly Force Information (NFFI) Messages
## Product C: Combat ID Integrator

**C4ISR Functions**

### 1. Characterize and Report
- Friendly, Enemy, Neutral and Non-Combatant (FEEN) Characterization

### 2. Combine and Integrate
- Multi Source Integration
- Sector/Area Specific Processing
- NATO Friendly Force Tracking (FFT) of Ground Forces

### 3. Distribute and Disseminate
- US DOD GCCS (OTH Gold Messages)
- NATO Friendly Force Tracking (FFT) Ground to Air Gateway (Link 16)
- NFFI Messages

### CID Activities

<table>
<thead>
<tr>
<th>Interrogator</th>
<th>Receiver</th>
</tr>
</thead>
</table>

## Product D: Weapons Targeting System

**C4ISR Functions**

### 1. Characterize and Report

### 2. Combine and Integrate
- Multi Source Integration
- Sector/Area Specific Processing
- FEEN Tracking Management

### 3. Distribute and Disseminate
- Common Operating Picture (COP)
Integrated Products = System Solution

Product A
Air Defense Interrogator

Product B
Squitter Receptor

Product C
Combat ID Integrator

Product D
Integrated Weapons Targeted System

Example: Littoral Operation

Product A
Air Defense Interrogator

Product B
Squitter Receptor

Product C
Combat ID Integrator

Product D
Integrated Weapons Targeted System

Link 16
GCCS
ASTRIX
NFFI
Combat ID Standards

Building a mission specific Combat ID solution will be aided with standards in each of the Core Combat ID activity areas.

Expose Combat ID Service Interfaces

Ease of integration

Product A
Air Defense Interrogator

Product B
Squitter Receptor

Product C
Combat ID Integrator

Product D
Integrated Weapons Assignment System
Network Enabled Abstraction

Ideally some Combat ID service gets standardized.

Publish Combat ID Interfaces in a Directory.

Product A
Air Defense Interrogator

Product B
Squitter Receiver

Product C
Combat ID Integrator

Product D
Integrated Weapons Targeting System

Combat ID Services

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Transition Dependencies

C4ISR Applications
- Distribute and Disseminate
- Combine and Integrate
- Characterize and Report
- Interrogators/Squitter
- Transponders

Capability Transition Timelines

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transponder</td>
<td>some</td>
<td>most</td>
</tr>
<tr>
<td>Interrogator Squitter Receiver</td>
<td>some upgraded</td>
<td>more network enabled</td>
</tr>
<tr>
<td>Combat ID Services</td>
<td>stove pipe</td>
<td>some open standards</td>
</tr>
<tr>
<td>C4ISR Applications</td>
<td>dumb down</td>
<td>more new or upgraded</td>
</tr>
</tbody>
</table>
### IFF Mode 5 Goals Essential

<table>
<thead>
<tr>
<th></th>
<th>IOC</th>
<th>FOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your Nation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NATO (MMR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US JFCOM</td>
<td></td>
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</tr>
</tbody>
</table>

Setting IOC/FOC Dates Are Essential to Keeping the Dominos Falling

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Summary

1. IFF Mode 5 delivers data for a network enabled battlespace, namely a Unique ID, Time and GeoPosition.

2. The first domino falls with the delivery of Mode 5 Level 1 transponders.

3. “Dumbing Down” will become the path of least resistance for existing stovepipe solutions.

4. Mode 5 Level 2 squitter transponders support the emerging paradigm of sharing your position information.

5. Product integration remains a critical aspect of building out a mission centric Combat ID solution especially in a network enabled world.

6. Standards are essential in aiding in a timely evolution of delivering products with updated Combat ID services.
Conclusion

The IFF Mode 5 information domino will be a long slow execution.

Those timelines will shorten by developing standards in the core Combat ID activity areas and establishing related IOC and FOC dates.

Conclusion

Thanks for your attention