Simulating Information Warfare

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Conducting Information Operations means...

Integrating and synchronizing traditionally independent capabilities and activities in support of the commander’s mission.
### Simulating Information Warfare

#### Evolving IO M&S Requirements

- Represent information as a commodity
- Represent tasking assets and collection of information
- Represent the realistic flow of information to units around the battlefield
- Represent processing information
- Represent perceptions built from information flowing into the unit
- Base commander’s decisions on the unit perception
- Enable the protection of friendly and attack of enemy decisions, information, and information systems

#### IO Modeling Approaches

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<td>- Independent of Software Developers</td>
<td>- Cooperation of Software Developers</td>
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All examples in this paper and presentation are entirely conceptual.
They do not represent specific IO/IW capabilities.

- Deny
- Delay
- Deceive

Exploit, Shape, Deny, Inspire, Influence, Coerce, Destroy, Deceive, Degrade
Manual IO in Exercises

Manual Intervention
Assisted by Intuition, Analysis, and Tools
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IO Prototype Tool

- The competing scenario objectives are between:
  - Red OPLAN to establish an integrated air defense network, and
  - Blue objectives to detect and disrupt Red’s air defenses to support an air strike against a Red command center

- Scenario Elements:
  - SAM command elements and components
  - U-2, Rivet Joint, GRCS platforms & sensors
  - Four (4) F-15E strike package
  - Flexible IO exploit & attack options
  - Doctrinal information

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Notional IADS Network

- Computer Data Link
- Land Line
- RF (secondary)
- Commander Interactions
- Early Warning Radar
- Target Acquisition Radar
- Fire Control Radar
- Missile TEL
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Sample IO Attack

- Exploitation
  - Situation Awareness & Intelligence
  - Access to target data
- Offensive Operations
  - Influence target perception, action, orders
  - Apply IO Technique
- Impacts
  - Disruption of Red operations
  - Blue opportunity to exploit disruption

IO Against the Simulation

Concepts for IO Federates and IO Models within Federates
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Spring 2000 SIW Discussions

- Brute Force
  - DIS PDUs
  - Publish Misleading Information
- Corruption
  - Modify RTI Source Code
  - Intervene in Operations of other Federates
- Evolution of Concept
  - Roger Smith, BTG
  - Zach Furness, MITRE
  - Marnie Salisbury, MITRE
  - Frank Hodom, SAIC

Evolution of Concept
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IO Conceptual Position

Challenge
Configure federation topology with IO hub.
Define a FOM that can direct data this way.

Challenge
Create a Library that others can integrate.
Motivate others to create internal IO models.
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Federation Surveillance
Publish and Subscribe Topology

RequestPublications
RequestSubscriptions
ReportInteractionPublication
ReportObjectPublication
ReportInteractionSubscription
ReportObjectSubscription

P: (Aircraft1, True Location)
S: (Aircraft1, True Location)

Deny Access to Information
Method 1: Terminate Subscription

SubscribeObjectClassAttributes(Aircraft1, NULL)
UnsubscribeInteractionClass(MissileFire)

Where Did He Go?

NOTE: RTI Service calls are simplified for presentation. See the HLA I/F Specification for the exact format.
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Deny Access to Information
Method 2: Terminate Publication

Where Did He Go?

RTI

Network

RTI

RTI

Deny Delay Deceive

UnpublishObjectClass(Aircraft1)

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Characteristics of Technique

- Applies to objects by class
  - All instances of the “Aircraft1” class will disappear
- Can not be focused geographically
  - MOM does not apply to routing spaces
- MOM can be used to turn the IO attack On and Off
  - Focusing on a specific time period mitigates the global impacts of this
  - Reinstantiate Subscription or Publication when finished
- If the target federate is a constructive wargame controlling hundreds of objects, then this attack is very excessive

Limitation
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**Delay Access to Information**

Why Didn’t He Report That Sooner?

- S: (TacticalMessage)
- P: (TacticalMessage)

UnsubscribeInteractionClass(TacticalMessage)
SubscribeInteractionClass(TacticalMessage2)

- P: (TacticalMessage2)
- S: (TacticalMessage)

[Delay Content: t(n) to t(n+m)]

**Deceive Perception of Information**

I could of sworn he was more to the North?

- S: (Aircraft1, True Location)
- P: (Aircraft1, True Location)

SubscribeObjectClassAttributes(Aircraft1, NULL)
SubscribeObjectClassAttributes(Aircraft2, TrueLocation)

- P: (Aircraft2, TrueLocation)
- S: (Aircraft1, True Location)

[Change Content]
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Information Operations Explorer

Characteristics of Technique

- Significant improvement over simple Deny technique
- IO Federate can process each message and apply delay as appropriate
  - Not blanket application like the Deny attack
- Since the IO federate controls the traffic this approach will work for Deny as well
  - It can be applied selectively as desired - frequency, location, etc.

Limitation

- IO Federate becomes a hub for intercepted network traffic
- Influenced message traffic is doubled
  - Original and Delayed versions are copies of each other
Modeling Information Warfare

The Information Environment:
A Necessary Foundation for IO/IW Modeling

EME Relationship to Models

- Combat Models
- Intel Models
- IO Models
- Synthetic Natural Environment
- Information Environment
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Information Environment
Similar to Synthetic Natural Environment

- Scalable Grid of Info Cells
- Static & Dynamic Info Attributes
- Info Models Maintain/Update Info Cells
- IO Operations Influence State of Info Environment
- State of Info Envir Impacts Performance of Combat/Comms Models

Info CELL

Info Data Content and API
Accessible to all Federates

Info Services
- Get_Detectable
- Get_RF_LOS
- Get_Power
- Get_SignalNoise
- Get_InformationIndex
- Update_Power
- Update_Modulation
- Update_InformationIndex

Info Data Cell
- Geographic Grid
- Frequency Indexed
- RF Power
- Signal Modulation
- Information Indices
- Variable Sized Grid
- Hierarchical Quad-Trees
- Filtered Content
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**Information Models**
Initial Set of Capabilities

<table>
<thead>
<tr>
<th>EM Enhancer</th>
<th>RF Integration</th>
<th>Ambient Noise Gen</th>
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<tr>
<td>• Adds EM Details to Combat Simulation Data</td>
<td>• Combines Multiple Sources in Same Geo Area, Freq, &amp; Mod</td>
<td>• Integrates Ambient Noise from Cities, Power Lines, Power Generation, etc.</td>
</tr>
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<td>• Associates Sim Events with Realistic Sources</td>
<td>• Generates Integrated Source Environment</td>
<td>• Strongly Correlated with SNE Features</td>
</tr>
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<td>• Operates from Validated Internal Data</td>
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<th>Terrain Effects</th>
<th>Implicit Comms</th>
<th>Weather Effects</th>
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<td>• Propagates EM Energy across different Terrain Types - Mountains, Forests, Fields, Oceans, Lakes, etc.</td>
<td>• Adds Effects of Realistic Comms That Are Not Explicitly Included in Combat Simulation (e.g., man-portable radios)</td>
<td>• Adds Effects of Solar Activity and Thunderstorms as Represented in SNE or Internal Schedules</td>
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<td>Strongly Correlated with SNE Surface Data</td>
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Example in JSIMS Alliance

**IO Federate**
- Enhance Available Data
- Integrate Multiple Assets
- Add Ambient Noise
- Add Implicit Sources
- Calculate Terrain Effects

**Info Models**
- Update Local Info Data
- Locate Cells
- Identify Frequency
- Update RF Power

**Info Services**
- Update Local Info Data

**Air & Space**
- Subscribe to EW Assets & Events
  - Consult Info Data
  - Jam ADA Frequencies
  - Degrade Comms

**Land**
- Propagate Changes to Remote Info Data
  - Consult Info Data
  - Degrade ADA Performance
  - Degrade Comms

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Potential IO Insertion Steps

- IO is a Manual Process Now
  - Intuition, Analysis, and Tools
- HLA IO Federate is Immediately Attainable for HLA Federations
  - Tool leverages shared services of the RTI
- Integrated IO Modeling Can be Added to Next Generation of Models/Systems
  - Fits JSIMS Architecture
  - Applicable to Federates Using Common SNE