Modeling and Simulation
Resource Reuse
Business Model

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Outline

- Problem statement
  - Inefficient use of M&S resources
  - Barriers to reuse
  - Multiple perspectives on reuse
- Study approach
- Review federal laws, DoD regulations and policies on intra-government business transactions
- M&S may contain intellectual property
- Proprietary M&S and reuse
- Lessons learned from successful M&S reuse
- Framework for a business model
- Business model actions to spur reuse
**The Problem:**

Inefficient Use of M&S Resources

**Few M&S resources are reused** – either during a single program’s lifecycle or across acquisition programs.

<table>
<thead>
<tr>
<th>Tools</th>
<th>Data</th>
<th>Environment</th>
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<tbody>
<tr>
<td>- Models</td>
<td>- Input datasets</td>
<td>- Architectures</td>
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<tr>
<td>- Simulations</td>
<td>- Scenarios</td>
<td>- Network resources</td>
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<td>- Federations</td>
<td>- Threat data</td>
<td>- Interfaces</td>
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<tr>
<td>- Utilities (post-processors)</td>
<td>- Algorithms</td>
<td>- SME expertise</td>
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<td></td>
<td>- Environmental info</td>
<td>- Protocols</td>
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Absence of incentives for Gov’t M&S managers and industry developers
Reuse doesn't mean necking down to a single model or database.
Barriers to M&S Resource Reuse

• Users lack awareness of reusable resources
• Insufficient details about reusable resources
• Hard to assess the true capabilities and limitations of existing resources
• Resources not in a form suitable for reuse
• Users lack trust in resources developed by others/ NIH
• Model is available but not the data
• M&S components don’t work well together

• Repositories are incomplete and not current
• Little insight into how resources have been used in the past, including successfully and failures
• Difficult to access the actual resource
• Difficult to adapt existing resources to new problems
• No mechanism to compensate developer for resource investment and guidance on use
• No mechanism to protect developer from mischievous uses
Multiple perspectives on M&S reuse

Program Manager

Deadlines
Budget pressures
Short time horizon
Specific requirements

Warfighting Capabilities
Innovation
Reduced risk, cost and time

Industry

Promote COTS
Shortening product lifecycles
Compete for business
Profit
Protect IP

DoD (writ large)

Efficient investments
Longer time horizon
Promote competition
Uncertain threats/scenarios
Objective

• Develop an economic business model that will make the reuse of M&S resources an attractive option for both consumers and providers of resources
  – Puts the best M&S resources in the hands of users
  – Fosters collaboration and sharing
  – Leads to cost efficiency and minimal duplication of effort
  – Protects IP rights of industry
  – Ensures profitability of M&S industry
M&S Reuse Puzzle

Protection of IP
Open Business Models
IP Intermediary
Repositories
COTS
Open Source
Strong Scientific Practices
Full Resource Registration
Standards
Contracting Practices
Approach

• Reviewed existing policy documents, DoD instructions, guidance, interagency agreements, FAR, DFARS, prior reports, …
• Prepared case studies
  – SIMDIS, Linux, EADSIM, ICT, NIH/OTT, …
• Used a variety of survey instruments, interviews, e-mail dialogue with industry and government
  – Where is reuse occurring today?
  – What “business factors” help to motivate reuse?
  – What are the challenges to reuse and how might these be overcome?
**Who we have spoken to:**

<table>
<thead>
<tr>
<th>Company/Initiative</th>
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<tr>
<td>Northrop Grumman</td>
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<tr>
<td>Aegis Technology</td>
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<td>MAK Technologies</td>
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<td>PM FCS AD M&amp;S</td>
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<tr>
<td>NGA</td>
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<td>NAVAIR Portable Source Initiative</td>
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<td>OSD-JDS</td>
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<tr>
<td>BreakAway, LTD</td>
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<td>MSIC, DIA TMAP</td>
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<tr>
<td>USJFCOM J9</td>
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<tr>
<td>USAF Common Data Set</td>
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<tr>
<td>M&amp;S EA (Ocean, Air&amp;Space, Terrain)</td>
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<tr>
<td>IWS General Council (SEA00)</td>
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<tr>
<td>Pitch Technologies</td>
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<td>MMA M&amp;S</td>
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<tr>
<td>Boeing</td>
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<td>Soar Technology</td>
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<tr>
<td>Lockheed Martin</td>
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<td>MOVES/NPS</td>
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<tr>
<td>Metron</td>
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<td>NAVMSMO</td>
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<td>JSF M&amp;S</td>
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<td>IWS M&amp;S</td>
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<td>USN IWS SHARE</td>
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<tr>
<td>SAF/XC</td>
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<tr>
<td>OPNAV N814</td>
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<td>NRL</td>
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<tr>
<td>JASP</td>
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<td>MSIAC</td>
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Key issue for a business model

Under what conditions can a DoD program manager or other government official invest in M&S today

– to satisfy both current and future requirements,
– including perhaps requirements of another yet unknown government user,
– Including additional investment to make the M&S resource reusable,
– and be compensated in a future intra-government business exchange?
Federal laws and DoD regulations affecting intra-government business transactions

Assessment

- Can’t use current year funds for future anticipated, but unrealized requirements
- Can’t use appropriations for costs to be reimbursed through business transactions
- Can’t charge for costs built into budget
- Reimbursement only for marginal costs
- May charge only to recover cost of dissemination
- May transfer asset to a working capital fund and subsequently charge fully loaded costs
# Interagency Acquisition of M&S

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<tr>
<th><strong>Servicing agency</strong></th>
<th><strong>Requesting agency</strong></th>
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| (1) Existing GOTS or COTS with Gov’t Purpose Rights | (1) No compensation allowed  
  -- Congress has appropriated funds to servicing agency  
  -- No increase in support supplier’s costs |
| (2) Same as (1) + Gov personnel or contract support | (2) Fund incremental cost of labor |
| (3) Same as (1) + model enhancements | (3) Fund model enhancements |
| (4) COTS M&S with license requirements | (4) Fund incremental license fees |
| (5) New M&S with joint requirements | (5) Jointly fund new M&S |
M&S resources often contain valuable intellectual property

- Intellectual property refers to *creations of the mind*: inventions, literary and artistic works, and symbols, names, and images used in commerce.
  - In M&S the IP is often encapsulated in the source code and data sets
- DOD’s access to M&S IP developed under contract is governed by both copyright law, patent law, and the procurement regulations contained in the DFARS
  - These laws affect the Government’s ability to use, reproduce, modify, and release the resource to one or more potential users
- Control of IP is determined, in part, by who funded development
  - Government, Industry, or Mixed
  - But formal title is generally retained by the contractor-developer regardless of funding source
  - DoD acquisitions that involve a mix of government and IRAD funded technologies pose a challenge in determining control “rights”
Proprietary M&S and reuse

- COTS provides DoD with access to leading-edge M&S that otherwise would not be available
- COTS supports a broader market than DoD and thus capabilities should continue to improve over time
  - But a challenge to maintain legacy systems
- COTS enables “agile” M&S investment decisions by eliminating long-term O&M
- Developer may earn a short-term monopoly
  - Until the next wave of innovation
- Decouple the M&S from the original developer?
  - Yes-- a source license and/or tech data rights will promote 3rd party competition and encourage DoD to develop in-house talent to extend the M&S
- DoD may also require source license simply to “look under the hood”
- Enterprise license may reduce overall DoD costs of COTS
- Decision on negotiating for source or enterprise license depends on reuse potential (and willingness of developer)
Lessons learned from successful M&S reuse

- Discover
- Assess
- Access
- Employ
- Compensate
- Avoid misuse

User/Provider relationship

Keep within a small, well-informed community
- V&V guides use
- MOU if needed

Rely on standards
- V&V
- database formats (OpenFlight, Shape, GeoTIFF)

Government Purpose Rights

GPR license and proper Sys Eng to reduce costs

MIPR to cover Additional costs:
- Personnel
- Model enhancements
- Incremental license fee

Assume knowledgeable user
- User funds integration

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- User funds integration

Keep within a small, well-informed community
M&S Resource Reuse Business Model

M&S Suppliers & Support Infrastructure

Core capabilities
- H/W & S/W
- System information
- Org & Op Knowledge
- Conceptual models

Value activities
- Develop
- Test
- Validate
- Prototype

Partner network
- Gov’t agencies
- Labs
- Industry
- International

Value Proposition
- Savings (time/$$)
- Authoritative
- Joint context
- Interoperability

Distribution channel
- Access control
- IP Intermediaries
- MOUs

Compensation
- Licensing
- Royalties
- Support $$
- Purchase options

Customer

Target Mkt
- PEOs, PMs
- Dir Training
- Hd Analysis
- Service/Component

Customer Relationships
- Discovery tools
- Trust/ MOUs
Business model actions to spur M&S reuse

- Broadly Used Tools
  - Centrally fund
  - Life Cycle Manage
- License Rights
  - Track development history
  - Assess reuse potential early
  - Manage licenses
- Open Business Models
  - M&S intermediary
  - Negotiate licenses
  - Registry w/user wiki
- IP
  - Provide volume license
  - NDA to provide visibility
- Contracting
  - Specify reuse as objective
  - Fund full development cost
  - Specify deliverables
  - Transfer resource to WCF
  - Best practices
- Open Standards
  - Interoperability
  - Network effects
- Open Source
  - Field initial version, then OSS
  - Rapid test

Government

Industry
Backup
Business model actions that will spur M&S reuse (1 of 7)

- Improved contracting practices
  - Specify software, tech data, documentation as a deliverable
  - Price contract to include full cost of making M&S reusable (licenses, documentation, V&V, interfaces, …)
  - Include expectations for software reuse in solicitations (and incentives for achieving reuse)
  - Implement stronger oversight of M&S development process
    - When was it developed and who paid for it?
    - Is contractor entitled to restricted or limited rights?
    - Standard contract language requiring GPR on all datasets
  - Require registration of all M&S resources (with metadata)
Business model actions that will spur M&S reuse (2 of 7)

• Implement improved training for contract officers and program managers

Contract Officers
-- Goals and strategies for M&S reuse
-- Form and function of alternative deliverables:
  - Computer programs, source code, object code, algorithms, flow charts, computer databases, documentation, etc.

Program managers / DoD decision makers
-- Goals and strategies for M&S reuse
-- Software licenses and tech data rights:
  - Unlimited, limited, restricted, government purpose, commercial license, nonstandard rights
-- Negotiating strategies

• Develop a “Best Practices Guide” for contracting M&S resources
Business model actions that will spur M&S reuse (3 of 7)

- For broadly used GOTS M&S, use central funding to make the resource reusable and to manage Life Cycle Costs
  - No single organization can be responsible
- Similar approach for common databases
  - Environment, threat models, scenarios, current and future forces (Blue, Red, White)
- Negotiate volume or enterprise license for proprietary M&S
Emerging tenets for an M&S business model (4 of 7)

M&S intermediary to create a secondary market

- Patterned after IP intermediary (Innovation Xchange, InnoCentive)
- Functions as an honest broker
  - Helps PMs locate suitable M&S resources
  - Helps developers find a market for established M&S resources
  - Independent of developers and users – Free to sign NDAs
- Documents legal status of each M&S resource within DoD
- Facilitates license agreements
- Manages tiers of licenses across DoD
- Builds and maintains the knowledge base
  - How resources have been used in the past
  - V&V histories
- Handles MOUs to guide appropriate use and avoid liability

Virtual collaboration through electronic registries alone will be insufficient to achieve desired levels of reuse
Business model actions that will spur M&S reuse (5 of 7)

• Establish enablers for open business model transactions for both government and industry
  – Register reusable M&S assets (Gov’t and industry)
  – Include license rights
  – Include info on previous applications
  – Allow user-wiki comments on experiences with the M&S
Business model actions that will spur M&S reuse (6 of 7)

- Explore the transfer of reusable M&S resources to a working capital fund (e.g., major test range)
  - Compensate M&S provider with test range services
- Develop methods to assess downstream and cross-program reuse potential
- Adopt strong scientific practices to ensure credibility of M&S products
Business model actions that will spur M&S reuse (7 of 7)

- Promote the use of open source software
- Grant industry access to approved government models and databases
- Add reuse as performance objective for Gov’t stewards of M&S funds
  - Examine registry/repository first
  - Fund to make new M&S reusable for others
- Pursue balanced acquisition strategy
  - M&S COTS with tier-based licenses, GOTS, GPR, and proprietary non-commercial where needed
- Publicize DoD M&S reuse objectives and strategy
  - Use keynote address at conferences/ articles in trade journals and professional societies