DHS Office of University Programs
Arctic Domain Awareness Center
Annual Meeting
November 29-30, 2017
Agenda

1. Research Portfolio Selection
2. Expectation Setting
3. Pathways and Decision Making
Research vs. Technology and Capability Development?
Definitions Revisited- Words Matter

- The Association of University of Technology Managers (AUTM) describes a recent 2014 study that identified and analyzed **60 different definitions of innovation.**
- The diverse interpretations of these terms create challenges for technology developers and customers to sync research, development, and subsequent business activities.
- The DHS Lexicon defines transition as “**the transfer of responsibility for a product or system from a research and development organization to a receiving activity, with subsequent integration of the product or system into the receiving activity’s operations.**”
- It defines technology commercialization as the “**process of developing markets and producing and delivering products and/or services to address the needs of those targeted markets.**”

Because OUP works with a variety of customers including DHS Components, other Federal Agencies, industry, academia, and international partners, any differences in customer definitions **MUST** be addressed through close and continuous interaction with those partnering institutions to ensure that customer expectations are clear and programs are managed appropriately.
Research Portfolio Selection Drives Transition Pathways

Good Practices in Portfolio Development:

• The portfolio has an intentional focus or balance (long-versus short-term, high-versus low-risk, across markets and technologies, etc.)

• The breakdown of spending (resources) in the portfolio reflects the Center strategy and Center business model.

• The portfolio is created through proficient ranking and prioritization of new and continuation projects.

• Appropriate balance between the number of new projects undertaken at any one time and the resources available.

• A formal and systematic portfolio management system in place to select the right projects and to allocate development resources to projects

As of 2009, majority of firms (76%) have too many projects and an overloaded product development pipeline. Further, a vast amount of firms (78%) lack a systematic portfolio management methodology to help them select and prioritize development projects.

What is the appropriate Mix of ‘Project Types’?

The selection of ‘the types of projects’ is critical to establishing expectations for project outputs, potential of COE contributions to the field and articulating the development pathways.

- 15-25%?
- 15-30%?
- 20-30%?
- 20-30%?

What are the intellectual property considerations for each grouping in order to realize the end goal?

What are the technical development steps for each type of project?
Example COE Portfolio
Road Map for COE Project/Technology

1. Expressed need by DHS Component
2. End user expressed interest
3. Center Vision and core competency evaluation
4. Access to facilities and information
5. Capacity and Staffing – project management and research execution
6. Preliminary market analysis
   Supply alternatives – what is already out there or could be modified
   Demand for technology – potential applications and dual use
     Ex ante CBA/CEA - Will it be it worth it?
     R&D cost, schedule, deliverables - quality expectations
7. Legal – intellectual property issues
8. Special focus on software, if applicable
   Identify type: start up vs. licensing/sale to integrator
9. Technology development plan - Go/no-go decision points mapped out
10. Test and evaluation process
    Bench/lab
    Modeling/simulation
    Operational exercise
11. Adoption decisions
12. Sourcing process
13. Implementation
14. Revisions/adaptations
15. Ex Post CBA/CEA - Was it worth it?
Example: Software Project Types

**Algorithm**
- Unambiguous set of rules that precisely defines a sequence of operations that provide information or help to solve a problem
- Expect a defined set of inputs (pre-conditions) and are guaranteed to terminate and produce a defined set of outputs (results)
- Could be developed into a software application, or delivered as documentation describing the functions performed by the algorithm from COE to others
- For internal COE use, no software expected

**Software Tool Used by COE**
- Smaller, less complex development effort as compared to deployed software
- Used to perform one or more tasks, such as automating algorithms or supporting mission functions

**Web Application**
- Client/server software, where the client side (including the user interface) runs in a web browser of the client computer
- Generally leverages web technologies such as Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript
- Delivered from COE to others

**Software Deployed to Field**
- Covers the creation of mobile apps or embedded software (such as sensors or appliances) that are planned for deployment to select fields

**Software Deployed On Customer’s Network**
- Covers software to be delivered to DHS customers (including other DHS components), Non-DHS customers (other agencies, industry partners, universities)
- Typically involves the creation of mission-focused/critical applications
Example: Software Methodology Decision Tree

Start

- Is the project small, and only producing a throwaway prototype or proof of concept?
  - Yes → Build & Fix
  - No

- Are the stakeholder(s) / PMs available for bi-weekly meetings?
  - Yes → Agile
  - No

- Are all requirements clearly known?
  - Yes → Waterfall
  - No

- Are requirements stable / well understood?
  - Yes → Spiral
  - No

- Does the project include high risk software (safety-critical, cybersecurity, or information assurance)?
  - Yes → Incremental
  - No
Examples: Financial Drivers

- Cyber Security Market was valued at $52.05 billion in 2015. It is projected to grow to $114.08 billion by 2024 with a compound annual growth rate (CAGR) of 9.1%.
- The airport, oil and gas, banking, and government segments will exhibit maximum growth during the forecast period. North America, Europe, APAC, and the Middle East (in the same order) will have the highest CAGRs during 2015 to 2024 (10.7%, 10.1%, 8.9%, and 7.1%).
- Increases in partnerships between traditional IT cyber security providers and infrastructure control system firms.
- Legislation.
Since 2013, over 150 research grants have been issued relating to critical infrastructure protection. An estimated 2,500 companies and institutions are conducting research in critical infrastructure resiliency.
OUP COE Portfolio Considerations for Long Term Sustainability

What Value will we create?

Do we have the organizational capabilities to deliver it?

Which customers and geographic markets will we serve?
What will be our range of products/services?

Can we Capture this value in the face of competition?

What is our central source of competitive advantage?

How will we organize both now & in the future:
What shall we do inside, what outside?
Can we grow using this plan?

Credit: Dr. Pierre Azoulay, Massachusetts Institute of Technology, Sloan School of Management
Choosing an Effective Commercialization Strategy

| Do Incumbent’s Complementary Assets Contribute to the Value Proposition from the New Technology? |
|-----------------|-----------------|
| Can Innovation by the Start-up Preclude Effective Development by the Incumbent? | Can Innovation by the Start-up Preclude Effective Development by the Incumbent? |
| No | Yes |
| No | Disruptive Strategies | Value Chain Strategies |
| Yes | Platform Strategies | Intellectual Property Strategies |

**EXAMPLES: Do Incumbent’s Complementary Assets Contribute to Value Proposition from the New Technology?**

<table>
<thead>
<tr>
<th>No</th>
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<tr>
<td>No</td>
<td>Disk Drives</td>
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<td>Yes</td>
<td>UBER, Tesla, Standard-setting</td>
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Market Analysis - Capability/Product Vision

Considerations/Market Drivers

- Tech Scouting
- Customers
- Incumbents
- IP and Regulations
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<tr>
<th>Tech Scouting</th>
<th>Customers</th>
<th>Competitors/Potential Partners</th>
<th>IP and Regulations</th>
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<tr>
<td>Research existing, emerging, and phased out technologies</td>
<td>Develop customer profiles</td>
<td>Analyze incumbent companies’ services</td>
<td>What IP and regulations exist in the specific space?</td>
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<td>Identify companies in the specific space</td>
<td>Identify what industry/mission space they are in</td>
<td>Include what companies are large vs small, which companies could be potential partners; financial information to determine percentage of market share and possible top competitor and partner company snapshots</td>
<td>How do these affect development?</td>
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<td>Understand trends in the market</td>
<td>Capture budget and financial information</td>
<td>Update annually</td>
<td>Develop contingency plans if needed</td>
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<td>Forecast/Anticipate market direction</td>
<td>How are buying decisions made/who writes the check?</td>
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What Is the Appropriate Process to use and when?

Staged Development Process

Planning → Concept Design → System-Level Design → Detailed Design → Integration & Test → Launch

Reviews

Cross-Phase Iterations (unplanned)

Within-Phase Iterations (planned)


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<th>Key Objectives</th>
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**Key Deliverables**

- **TRL 1** Basic manufacturing implications identified
- **TRL 2** Analysis of the current S&T landscape
- **TRL 3** Technology Readiness Assessment
- **TRL 4** Technology Maturity Assessment
- **TRL 5** Program Definition Document (PDD)
- **TRL 6** Program Definition Document (PDD)
- **TRL 7** Program Definition Document (PDD)
- **TRL 8** Program Definition Document (PDD)
- **TRL 9** Program Definition Document (PDD)

**Management Review**

- **TRL 1** Initial technical review of the preliminary production plans
- **TRL 2** Initial technical review of the preliminary production plans
- **TRL 3** Initial technical review of the preliminary production plans
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- **TRL 9** Initial technical review of the preliminary production plans

**Technology Readiness Level (TRL)**

- TRL 1 – TRL 3
- TRL 4 – TRL 6
- TRL 7 – TRL 9
- TRL 10

**Technology Phase**

- Basic Research
- Technology Development
- Innovation and Transition
- Product Development

**DHS S&T Portfolio**

- **Technological Readiness**
- **Manufacturing Readiness Level (MRL)**

**Technical Readiness Level (TRL)**

- TRL 1
  - Back of the envelope environment – new approach
- TRL 2
  - Propose a new approach
- TRL 3
  - Identify a new approach
- TRL 4
  - Demonstrate feasibility
- TRL 5
  - Analyze feasibility
- TRL 6
  - Conduct a feasibility study
- TRL 7
  - Carry out a feasibility study
- TRL 8
  - Conduct a feasibility study
- TRL 9
  - Conduct a feasibility study

**Manufacturing Readiness Level (MRL)**

- MRL 1 – MRL 3
- MRL 4 – MRL 6
- MRL 7 – MRL 9
- MRL 10

**Management Review**

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**Evaluation and Review**

- TRL 1
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- TRL 2
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- TRL 3
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**Evaluation and Review**

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- TRL 8
  - Management Review
- TRL 9
  - Management Review
Managing the timeline for this decision to occur is critical
## Responsibilities and Expectations

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<th>Example Question</th>
<th>DHS PM</th>
<th>COE</th>
<th>University</th>
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<td>Center Vision Creation</td>
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<td>Project Selection</td>
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<td>Customer Participation</td>
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<td>Testing and Evaluation</td>
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<td>Transfer/Transition</td>
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<td>Internal/External</td>
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<td>Implementation</td>
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Timeframe: ?