International Collaboration in Fuze R&D: Opportunities and Perspectives

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Outline

- International R&D: challenges & opportunities
- Fuze IPT perspective on int'l collaboration
- Building blocks & programs for cooperation
- Case study: US-UK partnership for fuze R&D
  - UK comments
- Summary

Challenges for International R&D

- Information exchange
  - Foreign disclosure, etc.
- Non-synchronized budget, planning cycles
  - Fiscal year example: US (1 Oct) & UK (1 Apr)
- Dissimilar R&D and acquisition approaches
  - Gov't labs, gov't-funded non-profits, and/or industry
- Export control
  - ITAR, superset of legal requirements
- Difficult bureaucracy w/ long timelines, etc.
  - Well beyond business cycles
- And many, many more…

Opportunities for International R&D

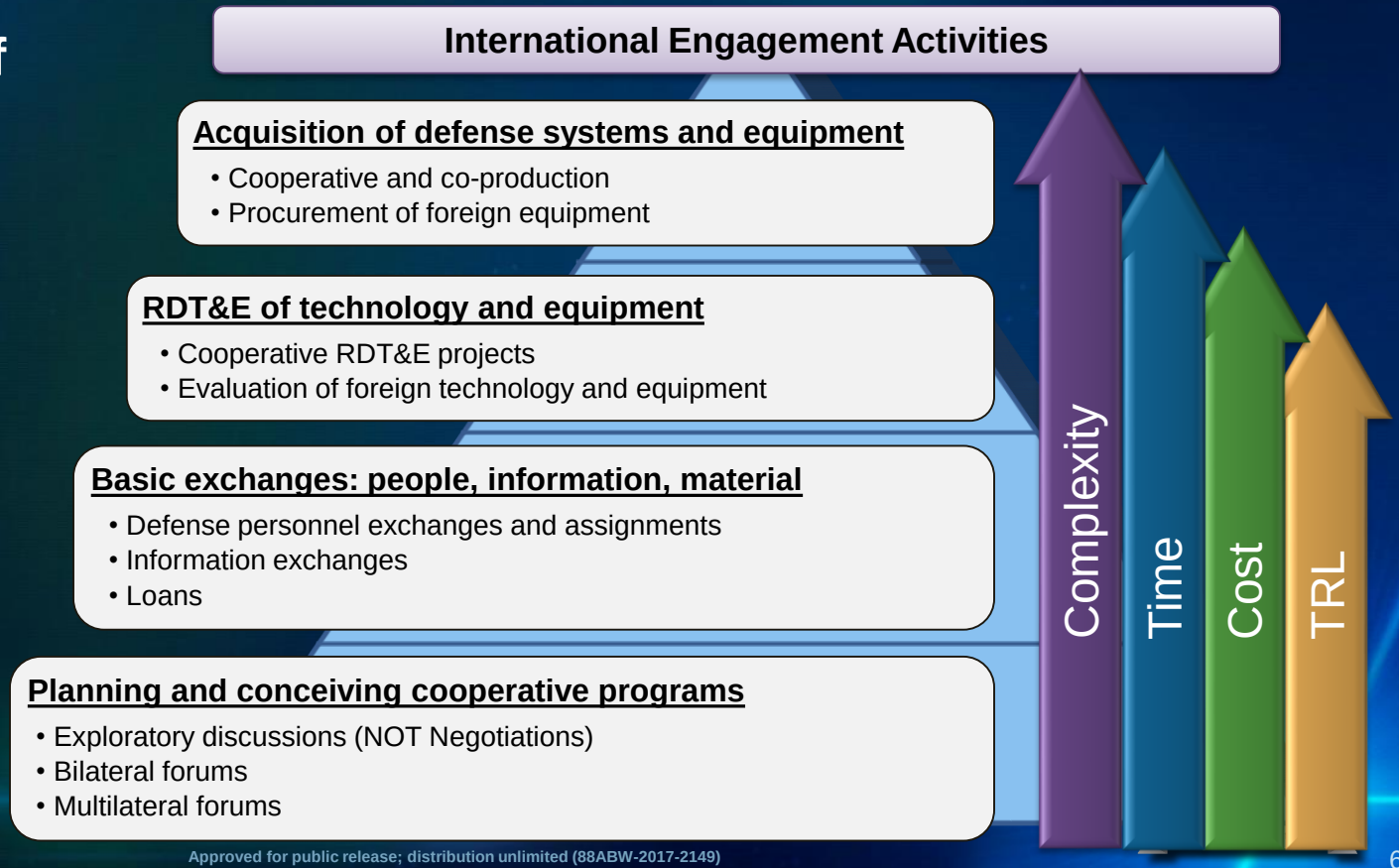
- Research & development cost-sharing importance
  - Mitigates defense budget declines, industry consolidation
  - US represents <30% of global R&D funding (and falling), *but* US industry funds 18% of R&D outside of US
- New technology, ideas, solutions, approaches…
- Cooperative definition of requirements, gaps, etc.
- *Eventual* access to acquisition process(es)
  - e.g., address tech transfer/export issues early in process
- Did I mention cost-sharing?
  - ***1T'$ ₹€A££¥ 1M₱0RTAN₺!***

Fuze IPT Perspective

- **International Collaboration is part of Strategic Plan**
  - **Engagement with allied governments and fuze industrial community of partner nations is a critical part of this plan**
- **Desire to break down barriers to collaboration**
  - **Individual services have many existing agreements, etc., with many countries**
  - **Strong desire to facilitate interactions**
- **Balance between specific and general**
  - **Realistic, well-defined, and common goals are key**

Building Blocks of Cooperation

- A spectrum of engagement opportunities
- Nature of the collaboration, technology drives level
- Necessarily sequential…
  - Agreements are a pre-requisite



Types of RDT&E Cooperation

Basic Research	Applied Research	Advanced Technology Development	Prototype Demo and Validation	Test & Evaluation
• Study, understand phenomena without specific applications • Results in joint papers, analyses	• Gain knowledge and determine means to meet a specific need • Results in components & early proof-of-concept prototypes	• Development and integration of hardware for field experiments and tests • Results in representative prototypes	• Develop knowledge/ collect data to meet a specific need • Results in defined capability	• Determine the acceptability of a system, subsystem, or component • Results in joint assessment of interoperability & performance
6.1	*S&T Activities*			*6.5+*
1	*TRL*			*7+*

- **Agreements can cover any or all of the RDT&E spectrum**
- **DoD programs exist at each stage to facilitate collaboration…**

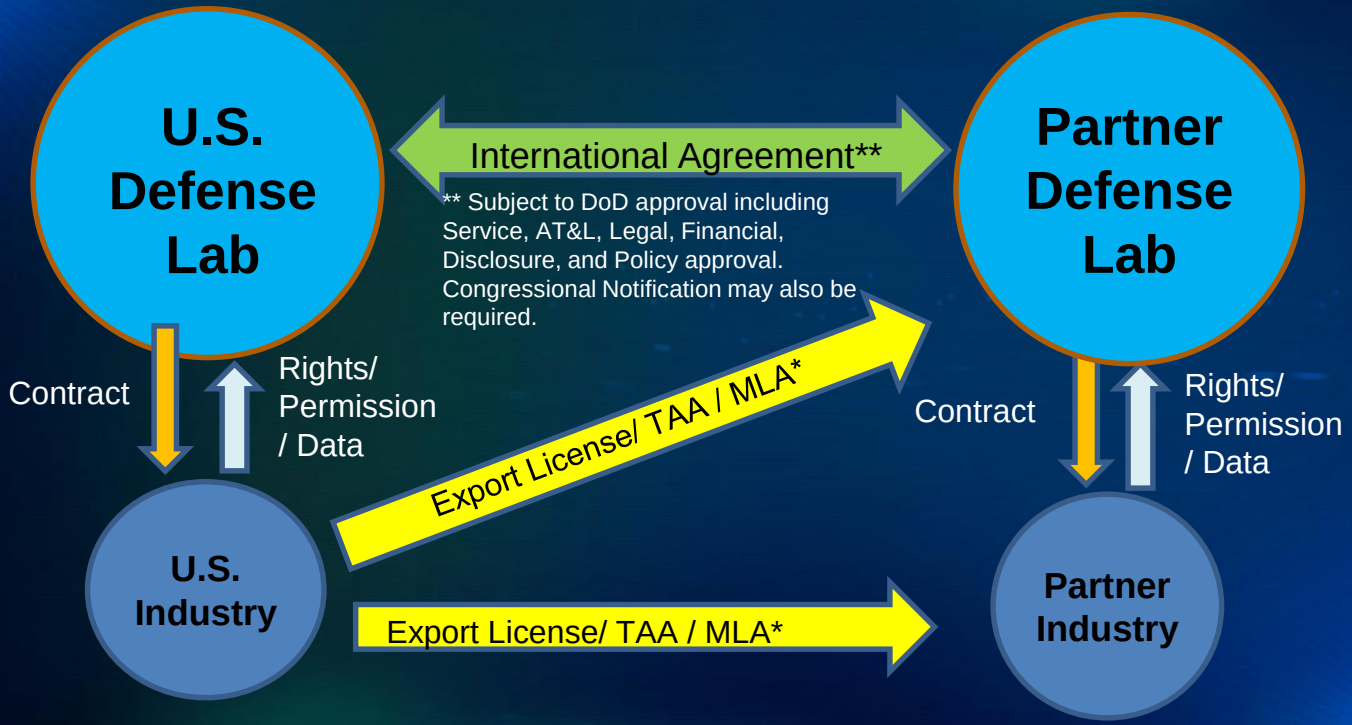
Sources: OMB Circular A-11, DOD Financial Management Regulation (Volume 2B, Chapter 5)

DoD International Collaboration Programs

Build Relationships	Cooperative Development			Integration of Systems	Prototype Evaluation	Test Interoperability
Science and Technology (S&T) Grants	**Coalition Warfare Program (CWP)**	**Nunn / Service International Cooperative R&D Funding**	**Combatant Command RDT&E Funding**	**Emerging Capability and Prototyping Demonstrations (formerly JCTDs)**	**Foreign Comparative Testing (FCT)**	**Joint Test and Evaluation (JT&E)**
Provides financial support to foreign partners to promote S&T cooperation • International workshops and/or conferences • Visiting scientists • Short-term visits of international scientists • Competitive and non-competitive processes • Basic research grants	Provides 2-3 years of seed funding to DoD organizations that conduct cooperative RDT&E projects with foreign partners Goals: • Increase capability through advanced capabilities, improved interoperability, and strengthened partnerships • Annual competitive process	Provide seed funding to DoD organizations to conduct cooperative RDT&E projects with foreign partners • AF selects project competitively; Army and Navy non-competitive Goal: Encourage cooperative RDT&E to increase DoD and partner capabilities	TRANSCOM and SOCOM also have RDT&E funding that can be used for projects with international partners Goal: Support specific goals identified by organization • TRANSCOM process is competitive	Provides support funding to DoD organizations to exploit mature and maturing technologies and to introduce operational concepts through the execution of operational prototypes Goal: Identify, develop, demonstrate operational prototypes that address key strategic capability gaps facing the Department.	Provides funding to Services & SOCOM for acquisition and testing of articles developed by foreign industry Goal: Find, assess, and field world-class products to enhance military capabilities • Annual competitive process • OSD Selects proposals • Services/SOCOM execute projects	Assesses Service interoperability in joint operations, and explore potential solutions to identified problems Goal: Provide non-materiel solutions to solve joint operational issues • Annual competitive process
Army: ITC/FAST Air Force: AFOSR/IO Navy: ONR/ ONR-G	OUSD AT&L/ International Cooperation	Army – DASA(DE&C) Navy – NIPO AF – SAF/IAPQ	SOCOM (SORDAC) TRANSCOM (J5/8)	OUSD AT&L/R&E/ Emerging Capability and Prototyping	OUSD AT&L/R&E/ Emerging Capability and Prototyping	OSD DOT&E

Increasing Complexity, Time, Cost, TRL

Can We Work with Industry? Yes!

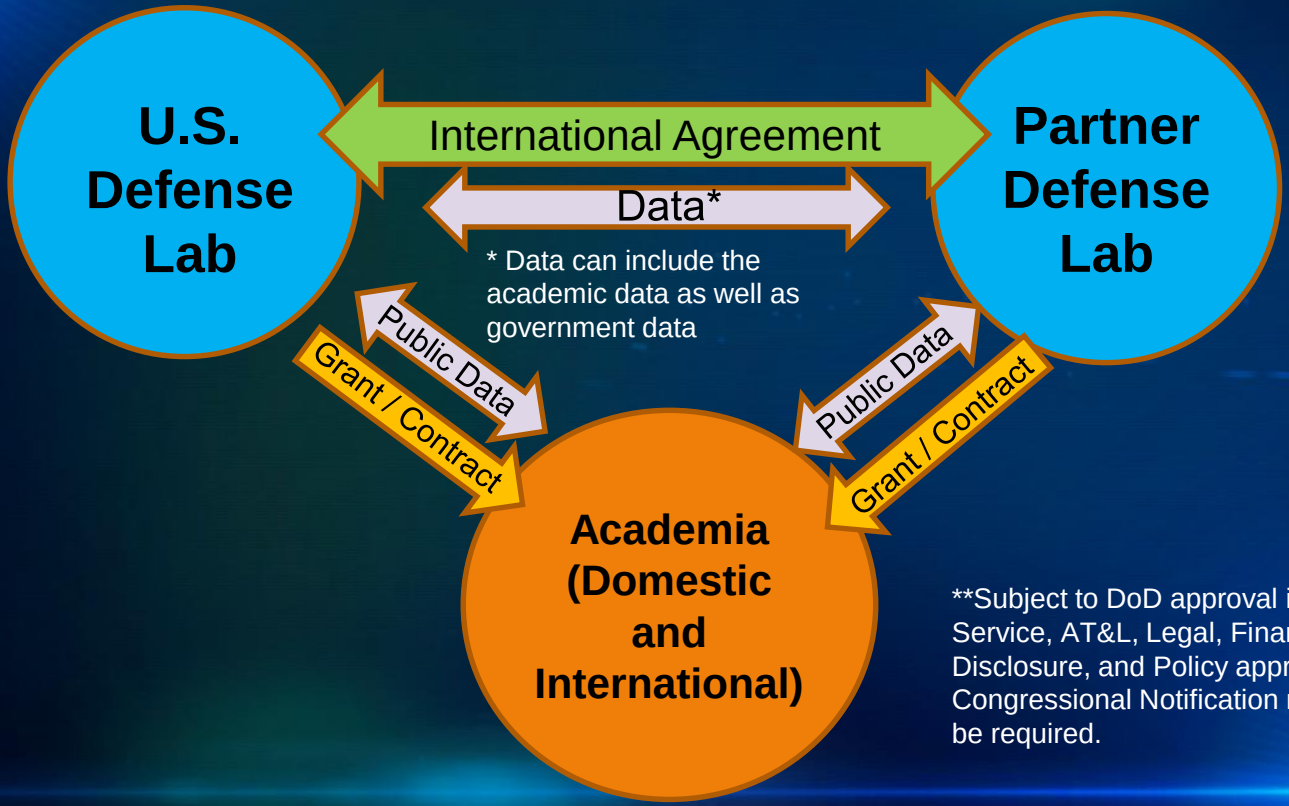


* Subject to State Dept. Approval if AECA/ITAR controlled; Subject to Dept. of Commerce Approval if EAA/EAR controlled

* Can be linked to International Agreements as the rationale for export

TAA = Technical Assistance Agreement
MLA = Manufacturing License Agreement

Can We Work with Academia? Yes!



**Subject to DoD approval including Service, AT&L, Legal, Financial, Disclosure, and Policy approval. Congressional Notification may also be required.

Three Basic Steps to an Agreement

1. Identify specifically ***what*** you want to do through ***exploratory discussions****
2. Develop a strategy and draft Project Plan, and ensure it is ***mutually beneficial*** and has an ***equitable level of contribution***
3. Submit it for approval (***and wait!***)

* Assuming appropriate agreement (e.g., MOU) is in place…

Case Study: Cooperative Fuze R&D w/UK

- **Process began with informal discussions**
  - **Fuze Conference in 2015**
- **Two workshops held…**
  - **Participants: SMEs from US DoD labs, UK MOD, UK industry**
  - **May 2016: US-UK Workshop at Fuze Conference (Charleston, SC)**
    - **Identified areas of mutual interest**
  - **Oct 2016: US-UK Workshop hosted by JFTP (Arlington, VA)**
    - **Identified key technical challenges, scoped two CWP projects…**

Case Study: Cooperative Fuze R&D w/UK

Continued

- **Two FY19 Coalition Warfare Program proposals resulted…**
  - ***(CWP Proposal 1)*** **FIGHTALL: Fireset Integration & General Hardening for Tactical Advanced Lethality at Long Range**
    - **Objective: Cooperatively develop common modular, miniaturized fuze firesets to improve reliability, lethality, and affordability of wide range of weapons**
  - ***(CWP Proposal 2)*** **CRAFTY: Compact, Reconfigurable, and Adaptive Fuze-Sensor Technology**
    - **Objective: Cooperatively evaluate fuze technology performance against emerging target sets**
- **Current status:**
  - **FIGHTALL not selected for FY18, invited to reapply for FY19**
  - **CRAFTY is in "budget-contingent" status**
  - **Both being considered for USAF ICR&D funding**

US Comments

- Imperative to identify “champions” and have their support… applies to both R&D requirements and also international agreements process
- Biggest difficulty is synchronizing support and commitments
- Also difficult to “right size” the effort (cost, schedule, etc.)
- Finding “in kind” value is really important in establishing equity

UK Comments

Provided by Charlie Clark, Land Platform Systems, DSTL (MOD)

- Vital to have early engagement with:
  - User community and wide group of stakeholders
  - Operational analysts and doctrine/warfighting specialists
  - Research and development / industry experts
  - S&T experts w/understanding of novel and innovative concepts in order to “workshop” and discuss concepts
- This process sets a good example of how to build a collaboration from the “ground up”
- Also note that two UK industry presentations will be presented in limited session after lunch, and two more in open session

Summary

- International collaboration in fuze R&D is simultaneously challenging and rewarding
- Collaboration can span a range of activities from information sharing to cooperative T&E
- Several programs exist to facilitate engagement between international & US DoD R&D community
- We have also learned much, and possibly developed good/best(?) practices, in our work with UK's DSTL
- Developing enduring collaborations requires committed and patient partners!

Questions

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Useful Links

- **OSD International Collaboration:**
  - http://www.acq.osd.mil/ic/index.html
- **Coalition Warfare Program:**
  - http://www.acq.osd.mil/ic/CWP.html
- **International Collaboration Handbook:**
  - http://www.acq.osd.mil/ic/Links/IChandbook.pdf
- **International Agreements Database (IADB)**
  - **(US DTIC users only) https://www.dtic.mil/IA**

Backup Slides

Acronyms

CWP	Coalition Warfare Program
FCT	Foreign Comparative Testing
IPT	Integrated Product Team
ITAR	International Trafficking in Arms Regulation
MLA	Manufacturing License Agreement
MOU	Memorandum of Understanding
PA	Project Agreement
RDT&E	Research, Development, Test, and Evaluation
S&T	Science & Technology
TAA	Technical Assistance Agreement
TRL	Technology Readiness Level

TRL Assessment Background

from “Technology Readiness Assessment (TRA) Guidance”, April 2011, DoD ASD(R&E)

TRL	Definition	Description	Supporting Information
1	Basic principles observed and reported.	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development (R&D). Examples might include paper studies of a technology’s basic properties.	Published research that identifies the principles that underlie this technology. References to who, where, when.
2	Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.	Publications or other references that outline the application being considered and that provide analysis to support the concept.
3	Analytical and experimental critical function and/or characteristic proof of concept.	Active R&D is initiated. This includes analytical studies and laboratory studies to physically validate the analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.	Results of laboratory tests performed to measure parameters of interest and comparison to analytical predictions for critical subsystems. References to who, where, and when these tests and comparisons were performed.
4	Component and/or breadboard validation in a laboratory environment.	Basic technological components are integrated to establish that they will work together. This is relatively “low fidelity” compared with the eventual system. Examples include integration of “ad hoc” hardware in the laboratory.	System concepts that have been considered and results from testing laboratory-scale breadboard(s). References to who did this work and when. Provide an estimate of how breadboard hardware and test results differ from the expected system goals.
5	Component and/or breadboard validation in a relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment. Examples include “high-fidelity” laboratory integration of components.	Results from testing laboratory breadboard system are integrated with other supporting elements in a simulated operational environment. How does the “relevant environment” differ from the expected operational environment? How do the test results compare with expectations? What problems, if any, were encountered? Was the breadboard system refined to more nearly match the expected system goals?
6	System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology’s demonstrated readiness. Examples include testing a prototype in a high-fidelity laboratory environment or in a simulated operational environment.	Results from laboratory testing of a prototype system that is near the desired configuration in terms of performance, weight, and volume. How did the test environment differ from the operational environment? Who performed the tests? How did the test compare with expectations? What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems before moving to the next level?
7	System prototype demonstration in an operational environment.	Prototype near or at planned operational system. Represents a major step up from TRL 6 by requiring demonstration of an actual system prototype in an operational environment (e.g., in an aircraft, in a vehicle, or in space).	Results from testing a prototype system in an operational environment. Who performed the tests? How did the test compare with expectations? What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems before moving to the next level?
8	Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation (DT&E) of the system in its intended weapon system to determine if it meets design specifications.	Results of testing the system in its final configuration under the expected range of environmental conditions in which it will be expected to operate. Assessment of whether it will meet its operational requirements. What problems, if any, were encountered? What are/were the plans, options, or actions to resolve problems before finalizing the design?
9	Actual system proven through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation (OT&E). Examples include using the system under operational mission conditions.	OT&E reports.

What else can the RDT&E Agreement do?

Equipment & Material Transfer (E&MTA) Agreements

- Allows for the transfer Equipment and/or Material solely for testing , evaluation, and analysis purposes
- Items can be loaned and returned, or loaned and consumed depending on the type of testing needed
- Typically, one partner loans the equipment/material and the other partner returns data from their analysis
- Annex B in the RDT&E Agreement is the template to use to develop an E&MTA. The E&MTA must be signed by both partners to make it valid.
- Definition of Equipment & Material: Any material, equipment, end item, subsystem, component, special tooling, or test equipment jointly acquired or provided

Cooperative Project Personnel (CPP)

- Project Agreements (PAs) can authorize CPPs to work in the facilities of the other Partner, or in a joint project office.
- Follows Appendix 1 in Annex A of the RDT&E Agreement
- Definition of CPP: Military members or civilian employees who perform managerial, engineering, technical, administrative, contracting, logistics, financial, planning, or other functions in furtherance of the Project.

Working Groups

- Allows both partners to explore/ conduct studies on specific RDT&E issues that may lead ot future PAs or E&MTAs
- Follows Annex C of the RDT&E Agreement