CREATE Proposers' Day
IARPA

Dr. Steven Rieber

June 30, 2015

Agenda

Time	Topic	Speaker
9:00am – 9:15am	Welcome Remarks	Dr. Steven Rieber Program Manager, IARPA
9:15am – 9:45am	IARPA Overview and Remarks	Dr. Jason Matheny Office Director, IARPA
9:45am – 10:30am	CREATE Program Overview	Steven Rieber Program Manager, IARPA
10:30am – 10:45am	Break	
10:45am – 11:15am	Doing Business with IARPA	Mr. Tarek Abboushi IARPA Acquisitions
11:15am – 11:45am	CREATE Program Questions & Answers	Steven Rieber Program Manager, IARPA
11:45am – 1:00pm	No-Host Lunch	
1:00pm – 2:30pm	5-minute Capability Presentations	Attendees (**No Government**)
2:30pm – 4:00pm	Networking and Teaming Discussions	Attendees (**No Government**)

Proposers' Day Goals

- Familiarize participants with IARPA's interest in research on crowdsourcing structured analytic methods to improve reasoning.

- Ask questions and provide feedback; this is your chance to alter the course of events.

- Foster discussion of synergistic capabilities among potential program participants, i.e., facilitate teaming. Take a chance: someone might have a missing piece of your puzzle.

Disclaimer

- This Conference is provided solely for information and planning purposes.

- The Proposers' Day Conference does not constitute a formal solicitation for proposals or proposal abstracts.

- Nothing said at Proposers' Day changes the requirements set forth in a BAA.

Schedule

- Full proposals are due ~45 days after BAA is published.

- Once BAA is published, questions can only be submitted and answered in writing via the BAA guidance.

OFFICE OF THE DIRECTOR OF NATIONAL INTELLIGENCE

IARPA Overview

Dr. Jason Matheny

June 30, 2015

Office of the Director of National Intelligence

Central Intelligence Agency

Defense Intelligence Agency

Department of State

National Security Agency

Department of Energy

National Geospatial-Intelligence Agency

Department of the Treasury

National Reconnaissance Office

Drug Enforcement Administration

Army

Federal Bureau of Investigation

Navy

Department of Homeland Security

Air Force

Coast Guard

Marine Corps

IARPA Mission and Method

> IARPA's mission is to invest in high-risk/high-payoff research that has the potential to provide the U.S. with an overwhelming intelligence advantage over our future adversaries

- **Bring the best minds to bear on our problems**
  - Full and open competition to the greatest possible extent
  - World-class, rotational, Program Managers

- **Define and execute research programs that:**
  - Have goals that are clear, measureable, ambitious and credible
  - Employ independent and rigorous Test & Evaluation
  - Involve IC partners from inception to finish
  - Run from three to five years

Office of Incisive Analysis

"Maximizing Insight from the Information We Collect, in a Timely Fashion"

Large Data Volumes and Varieties	**Social-Cultural and Linguistic Factors**	**Improving Analytic Processes**
Providing powerful new sources of information from massive, noisy data that currently overwhelm analysts.	Analyzing language and speech to produce insights into groups and organizations.	Dramatic enhancements to the analytic process at the individual and group level.

Office of Smart Collection

"Dramatically Improve the Value of Collected Data"

Novel Access

Asset Validation and Identity Intelligence

Tracking and Locating

Provide technologies for reaching hard targets in denied areas

Detect the trustworthiness of others

Advance biometrics in real-world conditions

Accurately locate HF emitters and low-power, moving emitters with a factor of ten improvement in geolocation accuracy

Office of Safe and Secure Operations

"Counter Emerging Adversary Potential to Deny our Ability to Operate Effectively in a Globally-Interdependent and Networked Environment"

Computational Power	**Trustworthy Components**	**Safe and Secure Systems**
Revolutionary advances in science and engineering to solve problems intractable with today's computers	Getting the benefits of leading-edge hardware and software without compromising security	Safeguarding mission integrity in a hostile world

Office for Anticipating Surprise

"Detecting and Forecasting Significant Events"

S & T Intelligence	Indications & Warnings	Strategic Forecasting
Detecting and forecasting the emergence of new technical capabilities.	Early warning of social and economic crises, disease outbreaks, insider threats, and cyber attacks.	Probabilistic forecasts of major geopolitical trends and rare events.

How to engage with IARPA

- **Website: www.IARPA.gov**
  - Reach out to us, especially the IARPA PMs. Contact information on the website.
  - Schedule a visit if you are in the DC area or invite us to visit you.

- **Opportunities to Engage:**
  - **Research Programs**
    - Multi-year research funding opportunities on specific topics
    - Proposers' Days are a great opportunity to learn what is coming, and to influence the program
  - **"Seedlings"**
    - Allow you to contact us with your research ideas at any time
    - Funding is typically 9-12 months; IARPA funds to see whether a research program is warranted
    - IARPA periodically updates the topics of interest
  - **Requests for Information (RFIs) and Workshops**
    - Often lead to new research programs, opportunities for you to provide input while IARPA is planning new programs

Concluding Thoughts

- **Our problems are complex and truly multidisciplinary**

- **Technical excellence & technical truth**

  - Scientific Method

  - Peer/independent review

  - Full and open competition

- **We are always looking for outstanding PMs**

- **How to find out more about IARPA:**

  www.IARPA.gov

- **Contact Information**

  Phone: 301-851-7500

CREATE Overview

- CREATE is a multi-year research and development program. It will develop and test methods to make better arguments, by enabling dispersed groups of individuals to identify and evaluate reasons, evidence, and assumptions in relation to alternative hypotheses.

- CREATE will develop:
  - Structured methods to elicit and aggregate the elements of an argument.
  - Approaches to crowdsource these methods, so that many individuals can collectively develop and refine an argument.

Background

Intelligence analysis involves making and evaluating **arguments**.

Example:

Opposing Reason

Main Claim

Supporting Reasons

"Despite real improvements, the Iraqi Security Forces (ISF)—particularly the Iraqi police—will be hard pressed in the next 12-18 months to execute significantly increased security responsibilities, and particularly to operate independently against Shia militias with success. Sectarian divisions erode the dependability of many units, many are hampered by personnel and equipment shortfalls, and a number of Iraqi units have refused to serve outside of the areas where they were recruited."

- "Prospects for Iraq's Stability: A Challenging Road Ahead," National Intelligence Estimate, January 2007

Background

- Analytic arguments have been produced in much the same way for over 60 years.
  - Written as narratives; generally no formal representation
  - Emphasis on consensus, disagreements usually resolved privately
  - Prose can mask argument complexity

- WMD Commission: "Perhaps most troubling, we found an Intelligence Community in which analysts have a difficult time stating their assumptions up front, explicitly explaining their logic, and, in the end, identifying unambiguously for policymakers what they *do not know*."
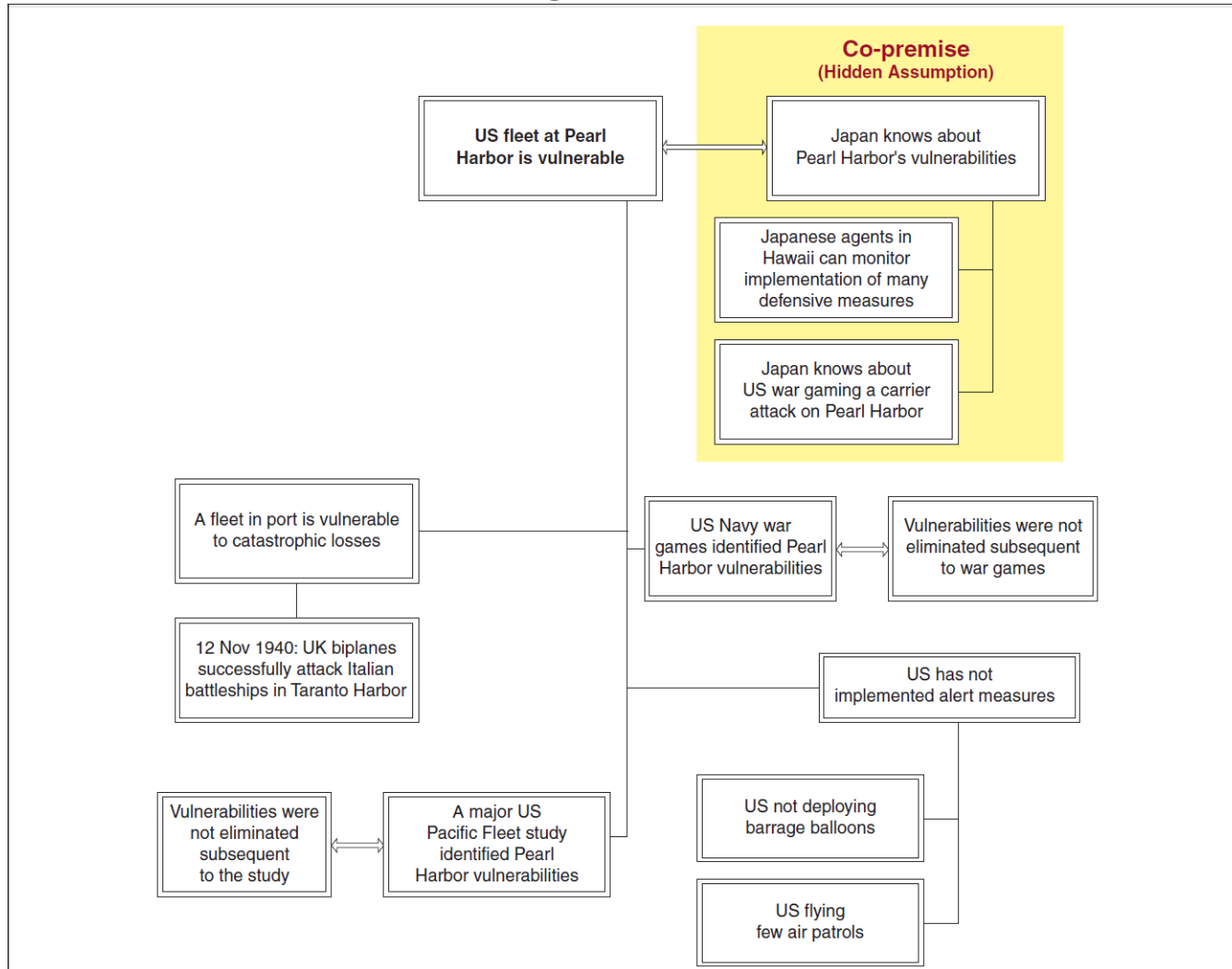
Background

- Clearly representing an argument's structure makes it easier to identify unstated assumptions, introduce objections and rebuttals, and see how much support each claim has.

- Such representations are seldom used because they are time-consuming to produce.

Background

Argument Map

Co-premise
(Hidden Assumption)

US fleet at Pearl Harbor is vulnerable

Japan knows about Pearl Harbor's vulnerabilities

Japanese agents in Hawaii can monitor implementation of many defensive measures

Japan knows about US war gaming a carrier attack on Pearl Harbor

A fleet in port is vulnerable to catastrophic losses

US Navy war games identified Pearl Harbor vulnerabilities

Vulnerabilities were not eliminated subsequent to war games

12 Nov 1940: UK biplanes successfully attack Italian battleships in Taranto Harbor

US has not implemented alert measures

Vulnerabilities were not eliminated subsequent to the study

A major US Pacific Fleet study identified Pearl Harbor vulnerabilities

US not deploying barrage balloons

US flying few air patrols

Background

Analysis of
Competing
Hypotheses

Figure 15

Question: Will Iraq Retaliate for US Bombing of Its Intelligence Headquarters?

Hypotheses:
H1 - Iraq will not retaliate.
H2 - It will sponsor some minor terrorist actions.
H3 - Iraq is planning a major terrorist attack, perhaps against one or more CIA installations.
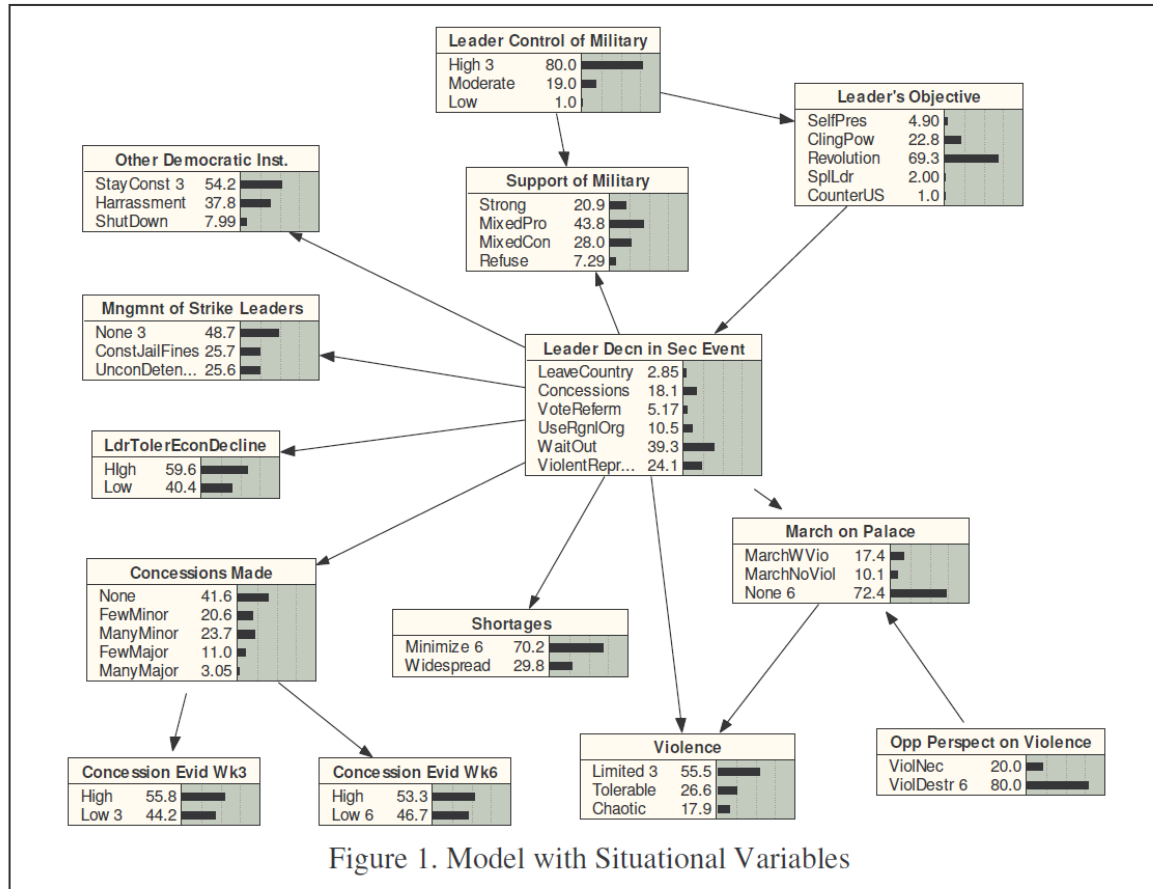
	H1	H2	H3
E1. Saddam public statement of intent not to retaliate.	+	+	+
E2. Absence of terrorist offensive during the 1991 Gulf War.	+	+	−
E3. Assumption that Iraq would not want to provoke another US attack.	+	+	−
E4. Increase in frequency/length of monitored Iraqi agent radio broadcasts.	−	+	+
E5. Iraqi embassies instructed to take increased security precautions.	−	+	+
E6. Assumption that failure to retaliate would be unacceptable loss of face for Saddam.	− −	+	+

Source:
https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/books-and-monographs/psychology-of-intelligence-analysis/art11.html

Background

BAYESIAN MODEL OF THE EFFECT OF PERSONALITY IN PREDICTING DECISIONMAKER BEHAVIOR

Bayesian Network

Figure 1. Model with Situational Variables

Source: http://www.cs.uu.nl/groups/DSS/UAI-workshop/Sticha.pdf

Background

IARPA's Aggregative Contingent Estimation (ACE) Research Program

- **Team Good Judgment**, led by Philip Tetlock and Barbara Mellers of the University of Pennsylvania, beat the control groups by more than 50%.
- This is the largest improvement in judgmental forecasting accuracy observed in the literature.
- ACE generates accurate, precise, continually updated forecasts on key intelligence questions by "crowdsourcing" the forecasts and experimenting with better ways to elicit and aggregate people's judgments.

Related Research

- Little research exists on the effectiveness of structured analytic methods (National Academy of Sciences).
  - Sedlmeier and Gigerenzer: Tree diagrams and frequency grids enable people to reason in accord with Bayes' Theorem on simple problems.
  - Lehner et al.: Analysis of Competing Hypotheses has mixed effects in reducing confirmation bias.
  - Rider and Thomason: Some studies show that learning argument mapping improves critical thinking.

Related Research

- Abundant research shows that crowd wisdom improves forecasts and other numerical judgments.

- Very little research has applied crowd wisdom to arguments and graphs.

Related Research

	Analysis of Competing Hypotheses	Bayesian Methods	Argument Mapping
Indicate which reasons/evidence are most **diagnostic**.	✓	✓	
Accurately **update the probability** of analytic judgments in light of new evidence.		✓	
Accurately identify **assumptions** that are crucial to the reasoning.			✓
Accurately identify strong **objections** to the argument.			✓

CREATE methods will do all of these.

CREATE Approach

- Crowdsourcing can make structured analytic methods much easier to use. Each analyst can contribute just where s/he wishes.

- Crowdsourcing argument representations can make it possible to link claims across representations, enabling analysts and decision-makers to see how the judgments in one piece of analysis depend on evidence and assumptions in another.

- As new evidence is added, dynamic links can enable changes in one representation to propagate through others.

CREATE vs. Existing Methods

Identifies Assumptions and Objections

| Argument Maps | | CREATE |

| Analysis of Competing Hypotheses | | Bayesian Methods |
| | | ACE |

Assigns Clear, Accurate Probabilities

Technical Challenges

Develop elicitation methods that:

- Allow users to selectively and anonymously participate

- Elicit reasons, evidence, and assumptions, and the weights that each user assigns to these

- Show the provenance of underlying data

- Are easy and engaging to use

- Allow continuous edits by any user, with each edit dynamically updating the argument

Technical Challenges

Develop aggregation methods that:

- Combine reasons, evidence and assumptions from multiple users into a single, coherent argument

- Produce both (1) an interactive visual representation of the argument and (2) a traditional written narrative representation

- Characterize the diagnosticity or relative importance of different reasons and/or pieces of evidence

- Identify key assumptions and characterize their impact on the probability of each hypothesis being true

- Assign numerical probabilities to the hypotheses/conclusions

- Incentivize users who make good arguments or correct bad ones

- Work across diverse arguments, and are accepted by diverse groups of users

User's View—Notional

Analytic Question

What does Iraq intend to use the aluminum tubes for?

Probabilities of Hypotheses

45%   45%   10%

Hypotheses   Centrifuges   Conventional rockets   Other

Evidence   The tubes are made of 7075-T6 aluminum.

Assumption   7075-T6 aluminum is not suitable for rockets.

Objection   15 other countries, including Iraq, have used 7075-T6 aluminum for rockets.

Evaluation

- IARPA will run a multi-year "Argumentation Tournament"

- Teams will be given real-world and possibly fictional analytic questions or scenarios.

- Each analytic question will be associated with two or more hypotheses (competing possible conclusions).

- Some (possibly all) real-world questions will be forecasting questions.

Evaluation

- The CREATE evaluation methodology is under development and subject to revision. This includes:
  - Stimuli and stimulus classes (analytic question types),
  - Metrics and milestone targets (e.g., argument evaluation criteria, effect size targets)
  - Research participant recruitment (e.g., centrally managed vs. Performer-managed)
  - High-level research/analytic design (e.g., centrally managed randomized experiment, quasi-experiment)
- The following Evaluation slides reflect likely broad directions for the evaluation approach

Evaluation

Core T&E criteria are likely to include:

- Forecast accuracy (for real-world forecast questions)

  - Notional Example: Brier score

- Quality of reasoning/argumentation (for all questions)

  - Example: Argument quality ratings obtained via multiple independent, rubric-based ratings

- System Usability

  - Examples: Subjective ease-of-use, objective engagement, attrition, trials-to-complete, time-on-task, etc.

Evaluation

- T&E benchmark groups may consist of individuals or groups using established structured methods (e.g., those cited above) or no structured method.

- Overall Program evaluation design may employ true, centrally randomized experiment; within-team controls (e.g., random assignment to conditions within teams); or more quasi-experimental approaches.

- Although centrally managed recruitment is possible, teams initially should be prepared to manage robust recruitment and user retention efforts.

Out of Scope

CREATE is:

- Not a program focused on U.S. events

- Not a program on advanced natural language processing

- Not a program on data visualization

Team Composition

- Given the combination of technical challenges, we anticipate that teams will possess expertise in:
  - Behavioral and social sciences
  - Informal logic and critical thinking
  - Mathematics and statistics
  - Computer science
  - Software rapid prototype development

Teaming

- Because of the many challenges presented by this program, both depth and diversity will be beneficial.
  - Throughput. Consider all that you will need to do, all the ideas you will need to test.
    - Make sure you have enough people and expertise to do the job.
    - Sufficient resources to follow critical path while still exploring alternatives – risk mitigation.
  - Completeness. Teams should not lack any capability necessary for success, e.g. should not rely on enabling technology to be developed elsewhere.
  - Tightly knit teams
    - Clear, strong management, and single point of contact.
    - No loose confederations.
    - Each team member should be contributing significantly to the program goals. Explain why each member is important, i.e., if you didn't have them, what wouldn't get done?

  Remember, you may be very accomplished, but can you do it all?

Summary

- CREATE seeks to develop methods that enable groups to rapidly produce accurate, insightful representations of reasons, evidence and assumptions in relation to alternative hypotheses.

- We are looking for well-executed, creative ideas.

- The BAA supersedes anything presented or said by IARPA at the Proposers' Day.

References

Lehner, Paul, Leonard Adelman, Brant Cheikes, and Mark Brown, "Confirmation Bias in Complex Analyses," IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans, 2008, 38(3), 584-592.

National Academy of Sciences, "Field Evaluation in the Intelligence and Counterintelligence Context," 2010.

Rider, Yanna, and Neil Thomason. "Cognitive and pedagogical benefits of argument mapping: LAMP guides the way to better thinking." *Knowledge Cartography*. Springer London, 2008. 113-130.

Sedlmeier, Peter, and Gerd Gigerenzer, "Teaching Bayesian Reasoning in Less Than Two Hours," *Journal of experimental psychology: general* 130.3 (2001): 380-400.

OFFICE OF THE DIRECTOR OF NATIONAL INTELLIGENCE

Q&A

LEADING INTELLIGENCE INTEGRATION

dni-iarpa-baa-15-11@iarpa.gov

OFFICE OF THE DIRECTOR OF NATIONAL INTELLIGENCE

Doing Business with IARPA

Mr. Tarek Abboushi

June 30, 2015

Doing Business with IARPA - Recurring Questions

- Questions and Answers (**http://www.iarpa.gov/index.php/faqs**)
- Eligibility Info
- Intellectual Property
- Pre-Publication Review
- Preparing the Proposal (Broad Agency Announcement (BAA) Section 4)
  - Electronic Proposal Delivery (**https://iarpa-ideas.gov**)
- Organizational Conflicts of Interest (**http://www.iarpa.gov/index.php/working-with-iarpa/iarpas-approach-to-oci**)
- Streamlining the Award Process
  - Accounting system
  - Key Personnel
- IARPA Funds Applied Research
- RECOMMENDATION: Please read the entire BAA

Responding to Q&As

- Please read entire BAA before submitting questions

- Pay attention to Section 4 (Application & Submission Info)

- Read Frequently Asked Questions on the IARPA @

    http://www.iarpa.gov/index.php/faqs

- Send your questions as soon as possible
  - CREATE BAA: **dni-iarpa-baa-15-11@iarpa.gov**
  - Write questions as clearly as possible
  - Do <u>NOT</u> include proprietary information

Eligible Applicants

- Collaborative efforts/teaming strongly encouraged
  - Content, communications, networking, and team formation are the <u>responsibility of Proposers</u>
- Foreign organizations and/or individuals may participate
  - Must comply with Non-Disclosure Agreements, Security Regulations, Export Control Laws, etc., as appropriate, as identified in the BAA

Ineligible Organizations

Other Government Agencies, Federally Funded Research and Development Centers (FFRDCs), University Affiliated Research Centers (UARCs), and any organizations that have a special relationship with the Government, including access to privileged and/or proprietary information, or access to Government equipment or real property, are <u>not</u> eligible to submit proposals under this BAA or participate as team members under proposals submitted by eligible entities.

Intellectual Property (IP)

- Unless otherwise requested, Government rights for data first produced under IARPA contracts will be <u>UNLIMITED</u>.

- At a minimum, IARPA requires <u>Government Purpose Rights (GPR)</u> for data developed with mixed funding

- Exceptions to GPR
  - State in the proposal any restrictions on deliverables relating to existing materials (data, software, tools, etc.)

- If selected for negotiations, you must provide the terms relating to any restricted data or software, to the Contracting Officer

Pre-Publication Review

- Funded Applied Research efforts, IARPA encourages:
  - Publication for Peer Review of **<u>UNCLASSIFIED</u>** research

- Prior to public release of any work submitted for publication, the Performer will:
  - Provide copies to the IARPA PM and Contracting Officer Representative (COR/COTR)
  - Ensure shared understanding of applied research implications between IARPA and Performers
  - Obtain IARPA PM approval for release

Preparing the Proposal

- Note restrictions in BAA Section 4 on proposal submissions
  - Interested Offerors must register electronically IAW instructions on: **https://iarpa-ideas.gov**
  - Interested Offerors are strongly encouraged to register in IDEAS at least 1 week prior to proposal "Due Date"
  - Offerors must ensure the version submitted to IDEAS is the "Final Version"
  - Classified proposals – Contact IARPA Chief of Security
- BAA format is established to answer most questions
- Check FBO for amendments & IARPA website for Q&As
- BAA Section 5 – Read Evaluation Criteria carefully
  - e.g. "The technical approach is credible, and includes a clear assessment of primary risks and a means to address them"

Preparing the Proposal (BAA Sect 4)

- Read IARPA's Organizational Conflict of Interest (OCI) policy: **http://www.iarpa.gov/index.php/working-with-iarpa/iarpas-approach-to-oci**

- See also eligibility restrictions on use of Federally Funded Research and Development Centers, University Affiliated Research Centers, and other similar organizations that have a special relationship with the Government

  – Focus on possible OCIs of your institution as well as the personnel on your team

  – See Section 4: It specifies the non-Government (e.g., SETA, FFRDC, UARC, etc.) support we will be using. If you have a potential or _perceived_ conflict, request waiver as soon as possible

Organizational Conflict of Interest (OCI)

- If a prospective offeror, or any of its proposed subcontractor teammates, believes that a potential conflict of interest exists or may exist (whether organizational or otherwise), the offeror should promptly raise the issue with IARPA and submit a waiver request by e-mail to the mailbox address for this BAA at **dni-iarpa-baa-15-11@iarpa.gov**.

- A potential conflict of interest includes but is not limited to any instance where an offeror, or any of its proposed subcontractor teammates, is providing either scientific, engineering and technical assistance (SETA) or technical consultation to IARPA. In all cases, the offeror shall identify the contract under which the SETA or consultant support is being provided.

- Without a waiver from the IARPA Director, neither an offeror, nor its proposed subcontractor teammates, can simultaneously provide SETA support or technical consultation to IARPA and compete or perform as a Performer under this solicitation.

Streamlining the Award Process

- Cost Proposal – we only need what we ask for in BAA

- Approved accounting system needed for Cost Reimbursable contracts

  - Must be able to accumulate costs on job-order basis

  - DCAA (or cognizant auditor) must approve system

  - See **http://www.dcaa.mil** , "Audit Process Overview - Information for Contractors" under the "Guidance" tab

- Statements of Work (format) may need to be revised

- Key Personnel

  - Expectations of time, note the Evaluation Criteria requiring relevant experience and expertise

- Following selection, Contracting Officer may request your review of subcontractor proposals

IARPA Funding

- IARPA funds <u>Applied Research</u> for the Intelligence Community (IC)

  - IARPA cannot waive the requirements of Export Administrative Regulation (EAR) or International Traffic in Arms Regulation (ITAR)

  - Not subject to DoD funding restrictions for R&D related to overhead rates

- IARPA is <u>not</u> DOD

Disclaimer

- This is Applied Research for the Intelligence Community
- Content of the Final BAA will be specific to this program
  - The Final BAA is being developed
  - Following issuance, look for Amendments and Q&As
  - There will likely be changes
- The information conveyed in this brief and discussion is for planning purposes and is subject to change prior to the release of the <u>Final BAA</u>.

QUESTIONS ?