

**DARPA-SN-17-10**  
**Gamifying the Search for Strategic Surprise (GS3)**  
**Call for Submissions**

**Executive Summaries Requested by:** 4:00 PM on December 6, 2016

**Full Proposals Requested by:** 4:00 PM on January 6, 2017

**Point of Contact:** John Main, Program Manager, DARPA/DSO

**Email address:** [DARPA-BAA-16-46@darpa.mil](mailto:DARPA-BAA-16-46@darpa.mil)

**URL:** <http://www.darpa.mil/work-with-us/opportunities>

The Defense Advanced Research Projects Agency (DARPA), Defense Sciences Office (DSO), invites executive summaries and full proposals for a research and development project to deliver an online environment that will enable productive collaboration among large numbers of experts and thinkers. The shared task of this group is to rigorously explore the trends and possible applications of emerging science and technology. All executive summaries and full proposals should be submitted in response to DSO's Office-wide Broad Agency Announcement (BAA), DARPA-BAA-16-46, under the Human-Machine Systems Technical Area of Interest.

The purpose of this Special Notice (SN) is to provide greater detail on the "human-machine team-based approaches to accelerate discovery" subtopic within the DSO Office-wide BAA and to inform interested parties that executive summaries and full proposals addressing this area should be submitted to that BAA. The BAA is available on the DSO Opportunities page at <http://www.darpa.mil/work-with-us/opportunities>. All times listed in this SN and DARPA-BAA-16-46 are Eastern Time.

### **OBJECTIVE AND DESCRIPTION**

National security challenges today are increasingly complex and multi-dimensional, demanding technological solutions that reflect the combined expertise of a broad diversity of professionals. Even when such experts are available and engaged, progress towards an integrated solution can be slowed by the lack of a versatile, domain-agnostic, collaborative platform, where innovation can happen because of the disparate mix of participants' perspectives and experiences.

GS3 aims to apply a unique combination of online game and social media technologies and techniques to engage a large number of experts and deep thinkers in a shared analytic process to rapidly identify, understand, and expand upon the potential implications and applications of emerging science and technology. The program will also develop a mechanism to identify and quickly fund research opportunities that emerge from this collaborative process.

Under DARPA-BAA-14-46, DSO funded a small design study to examine ways to improve on the state of the art in exploring and understanding the potential applications of emerging science and technology, specifically by improving the quality and speed of analyses. The results of this study indicated that it may be possible to accelerate and improve science and technology analysis through the application of a well-structured and well-executed online discussion.

The performer submitted a report at the conclusion of the study effort. Key, non-proprietary information from that report is presented in this Special Notice to provide a common and fair

starting point for all parties interested in development of such an online discussion environment.

The final report described a platform composed of a unique combination of online gaming and social media technologies and techniques that is designed to facilitate productive interactions between knowledgeable individuals as they explore the possible applications of emerging science and technology. The platform includes but is not limited to the following general attributes:

- A user system that supports 100s to 1000s of users
- A user communication system
- An interaction system that supports evidence-based analysis (for example, *Analysis of Evidence* by Anderson, Schum, and Twining, Cambridge University Press, 2005)
- Gamification strategies that attract, maintain, encourage, and motivate the participants
- Interaction with participants on a variety of platforms, including mobile phones, tablets, and desktop/laptop browsers
- A mechanism that allows participants to aggregate the evidence and analyses from other participants with their own to identify areas of significant current activity or collaboration opportunities
- Appropriate user management, security, data protection, and database infrastructure

## **SUBMISSION INFORMATION**

Executive summaries and full proposals for an online collaboration environment as described above must be submitted to DARPA-BAA-16-46 in accordance with the requirements outlined therein. Per Section I.C of the BAA, proposers are strongly encouraged to submit an executive summary in advance of a full proposal to minimize effort and reduce the potential expense of preparing an out of scope proposal.

### Executive Summaries

In addition to the content requested in Section IV.B.1.a of DARPA-BAA-16-46, proposers submitting executive summaries in response to this area should include the following information:

- Reference “GS3” on the Cover Sheet
- A description of the overall environment concept
- An outline of how rigor is maintained within the environment (the participant interactions are part of an analysis process as opposed to an unconstrained discussion)
- A catalogue of the team skills and relevant experience

GS3 executive summaries are requested by 4:00 PM on December 6, 2016. Within one week, DARPA anticipates responding with a brief statement either encouraging or discouraging submission of a full proposal in this area. See Section IV.B.1 of the BAA for additional information.

### Full Proposals

All proposals submitted in response to this area should include the following information in addition to the content requested in Section IV.B.3 of DARPA-BAA-16-46:

- An outline of a plan for attracting and recruiting a participant pool for alpha, beta, and

release iterations of all software

- An outline of a plan for managing security, Intellectual Property (IP) issues, copyright issues, and participant behavior issues given that the environment itself is a public forum
- An outline of a plan for developing the environment in 2 years or less
- An outline of a plan for hosting and operating the environment from the completion of development to 4 years from the date that development commenced

GS3 proposals are requested on or before 4:00 PM, January 6, 2017. DARPA-BAA-16-46's full proposal submission deadline is June 30, 2017; however, proposers are warned that the likelihood of available funding in the targeted area outlined in this Special Notice is greatly reduced for proposals submitted after 4:00 PM on January 6, 2017.

#### **POINT OF CONTACT**

All questions regarding this notice should be emailed to [DARPA-BAA-16-46@darpa.mil](mailto:DARPA-BAA-16-46@darpa.mil). Questions sent to any other address may result in delayed or no response. Please reference this GS3 SN in the subject line of all correspondence.

**Dr. John A. Main**

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**Biosketch:**

Dr. John Main has spent his career developing new technologies and businesses. He is currently a Program Manager in the Defense Sciences Office at DARPA where he is responsible for initiating new DARPA programs in the physical sciences and fostering the R&D communities that will support those programs. This is Dr. Main's second tour as a DARPA Program Manager. His first tour at DARPA began in 2002 and resulted in programs in a broad range of technical areas including biologically inspired materials, fast and efficient human-powered swimming, rapid rooftop access, small-scale power generation, GPS-denied underwater navigation, and human exoskeletons for increased warfighter endurance.

After his initial DARPA tour of duty, Dr. Main worked at technology startup Intific Inc., initially as an Executive Producer developing software products, and ultimately as the company's first Chief Operating Officer. In the COO role he led teams performing general business operations, initial design of software products, proposal development, and contracting. He served in this role through Intific's merger with Cubic Corporation and after the merger took on the role of Vice President and Chief Scientist. Earlier in his career he was an Assistant Professor of Mechanical Engineering at the University of Maine and Associate Professor of Mechanical Engineering at the University of Kentucky where he started research laboratories devoted to precision control of adaptive optical systems.

Dr. Main founded Precision Systems and Instrumentation LLC in 2001, which is a company that designs, manufactures, sells, and supports instrument systems used in spinal cord and head trauma injury research.

Career accomplishments include over 75 technical articles, three edited volumes, nine invited lectures, six awarded patents, and 32 externally funded research efforts. In 2008, Dr. Main was awarded the Office of Secretary of Defense Medal for Exceptional Public Service.

**Education**

PhD and MS in mechanical engineering from Vanderbilt University in 1993  
BS in physics and mathematics from Western Kentucky University in 1984

**Program:**

General approach is to focus on tools. Tools can be virtually anything – mechanical test machines, processing systems, visualization systems, software, whatever you need to get the job done.

- Leveraging new science to provide better tools – New scientific discoveries underpin breakthrough products and capabilities. Rapid exploitation of emerging science to build tools is critical.
- Creating tools to facilitate new science – The next step in scientific discovery frequently requires new investigative tools.

### Big Ideas

How do we leverage nanoscale material properties in real devices?

Can we break the water purification/power linkage for small-scale water purification?

What science and technology should we be developing right now to support the projection of power for the next 50 years?

Understanding human-technology systems

Identifying surprises by accelerating innovation – combinations of math, materials, biology

### 2016 Open House

I'm John Main. I'm an engineer, and I probably became an engineer because one of mankind's greatest achievements unfolded in front of me as I grew up. I was six years old and it was past my bedtime when very blurry images showing the first humans on the moon appeared on our black and white TV. I was hooked. During the Apollo 13 rescue I built a mission control in my back yard.

So, fast forward just a few years and I find myself at DARPA, where I'm part of something that is every bit as big and exciting as Apollo, because DARPA has an Apollo scale mission. That mission is to prevent and create technological surprise.

Finding and creating surprises is every DARPA program manager's job, but we all look for those surprises in different ways—ways informed by our technical specialty, experience, and creativity. One common element is that we are all taking technical risks in the hope of uncovering something great.

To me, surprises arise when two disparate technologies or specialties grind together and something new arises. My first program, Atoms to Product, looked at the intersection between assembly technology and nanoscale devices. In the process of grinding these two specialties together we are learning how to build things the way nature does—one atom or one molecule at a time.

One of the things I've been thinking about recently is grinding conventional textile weaving and braiding against superfine filament technology to see if we could weave fabrics with unique optical, chemical, biological, or electrical functionality.

I'd also like to grind modern social media and communication technology against reasoning about science and technology to see if we can accelerate the rate of technical ideation. I'm interested in these areas but also many, many others. My personal goal is to create as much technical surprise as I can in my very short time at DARPA.

## Existing Projects

### Gamifying the Search for Strategic Surprise DARPA SN-17-10

GS3 aims to apply a unique combination of online game and social media technologies and techniques to engage a large number of experts and deep thinkers in a shared analytic process to rapidly identify, understand, and expand upon the potential implications and applications of emerging science and technology. The program will also develop a mechanism to identify and quickly fund research opportunities that emerge from this collaborative process.

### Nanoweaving, DARPA-SN-16-38

Data on the state of the art in nanoscale weaving and braiding. For the purposes of this RFI, the definition of “thread” is a fiber, wire, yarn, filament, long chain molecule, or similar structure with diameter less than 500 nanometers. “Nanoweaving” is interlacing long threads in a repeated pattern to form two-dimensional fabric. “Nanobraiding” is interlacing three or more threads in a repeated pattern to produce a rope. Characterization approaches and modeling methods for nanowoven or nanobraided products are also of interest.

### Atoms to Product (A2P)

#### Improv DARPA BAA-16-22

Innovative research proposals for prototype products and systems that have the potential to threaten current military operations, equipment, or personnel and are assembled primarily from commercially available technology. The program definition of “commercially available technology” is largely unrestricted and ranges from generic and widely available technology such as cell phones, to highly specialized, domain-specific technology such as construction, salvage, or surveying equipment. The technology scope of Improv is broad, and the program is structured to encourage participation by a wide range of technical specialists, researchers, developers, and skilled hobbyists. Proposers are free to reconfigure, repurpose, program, reprogram, modify, combine, or recombine commercially available technology in any way within the bounds of local, state, and federal laws and regulations. Use of components, products, and systems from non-military technical specialties (e.g., transportation, construction, maritime, and communications) is of particular interest.

## **Illustrative Publications Reflecting Personal Research Interests:**

Dynamic testing of an inflatable, self-supporting, unpressurized thin-film torus

Song, Haiping; Smith, Suzanne Weaver; Main, John A.

Journal of Guidance Control and Dynamics 29(4), 839-845 JUL-AUG 2006

An anthropomorphic hand exoskeleton to prevent astronaut hand fatigue during extravehicular activities

Shields, BL; Main, JA; Peterson, SW; et al.

IEEE Trans on Systems Man and Cybernetics Part A 27(5), 668-673 SEP 1997

Piezoelectric stack actuators and control system design: Strategies and pitfalls

Main, JA; Garcia, E

J of Guidance Control and Dynamics 20(3), 479-485 MAY-JUN 1997

Load-Deflection Behavior of Space-Based Inflatable Fabric Beams

Main, JA; Peterson, SW; Strauss, AM

J of Aerospace Engineering 7(2), 225-238 APR 1994

Flexible Device For Vertebral Body Replacement

Main, JA; Wells, ME; Spengler, DM; et al.

J of Biomedical Engineering 11(2), 113-117 MAR 1989

Analysis and design of inflatable aerospace structures

Main, John Alan

PhD Dissertation, Vanderbilt University, 1993.