Opportunity Title: Nexus of machine learning, design optimization, advanced manufacturing, and smart materials
Opportunity Reference Code: IC-18-06

Organization	Office of the Director of National Intelligence (ODNI)
Reference Code	IC-18-06
How to Apply	**Create and release your Profile on Zintellect** – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 2 pages.** **Complete your application** – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant. Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at: https://orau.org/icpostdoc/. If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.
Application Deadline	3/12/2018 11:59:00 PM Eastern Time Zone
Description	**Research Topic Description, including Problem Statement:** • Systems are conventionally designed around existing components that are likely not optimized for the particular system in which they will be used. Furthermore, optimization of the resulting system is limited by the form, weight, performance, and energy requirements of those components. This topic deals with combining emerging advanced manufacturing capabilities with smart, lightweight, and multifunctional materials and machine learning to realize radically smaller, lighter, more efficient, and capable systems by inserting the optimization process at the beginning and continuously throughout the design problem. • The purpose of this research is to challenge researchers to adopt holistic, iterative, and synergistic approaches to design optimization in order to realize radical improvements to mechanical systems. This project seeks to create abrupt, simultaneous, and cascading improvements in multiple system components and characteristics (i.e. payload, economy, cost, weight, volume, speed, range, endurance, ecological impact, and/or materials consumption) by testing the limits of synergistically combining 1) self-optimizing, self-learning design algorithms; 2) advanced materials and structures; and 3) 3D printing. This project is not about a

single vector approach to improving a single component or material, but rather an attempt to harvest potential synergies that exist at the intersection of divergent disciplines that will maximize the combined benefit that might be obtained from the use of novel materials, designs modalities, and additive manufacturing.

Example Approaches:

Proposals may consider:

- How can machine learning and integrated design principles be combined with advanced materials and manufacturing to optimize system capabilities?
- Research into 3D printable ultralight and smart structures, including experimenting with or developing novel 3d printer materials, especially smart or multifunctional materials.
- Multifunctional material feedstock, which could include the use of metamaterials, piezoelectric, magnetorestrictive, multiferroic, or other advanced materials.
- Machine learning for integrated advanced design optimization such as the use or design of self-learning algorithms, evolutionary computing, or existing automated design tools to optimize choice of components, materials, and overall system design against a set of metrics. It may also include optimization of the shapes of the individual components, choice of materials, efficient arrangement of components, and the shape and form of the overall system. It may consider cost of materials and whether one material can serve multiple purposes. It may also take inspiration from nature as in biomimetics and should value the use of materials that would alleviate supply shortages or geopolitical supply chain vulnerabilities.
- Rapid prototyping of optimized components for optimized systems, how materials are configured to make up the components of the system, or how the material-structure might be designed to serve more than one purpose.

Qualifications

Postdoc Eligibility

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the application deadline
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory

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- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program.

Research Advisor Eligibility

- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12 👁)
  - **Communications and Graphics Design** (6 👁)
  - **Computer, Information, and Data Sciences** (16 👁)
  - **Earth and Geosciences** (21 👁)
  - **Engineering** (27 👁)
  - **Environmental and Marine Sciences** (14 👁)
  - **Life Health and Medical Sciences** (45 👁)
  - **Mathematics and Statistics** (10 👁)
  - **Other Non-Science & Engineering** (5 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (28 👁)