Opportunity Title: Innovative Antennas for Space Platforms
Opportunity Reference Code: ICPD-2023-45

Organization	Office of the Director of National Intelligence (ODNI)
Reference Code	ICPD-2023-45
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://orise.orau.gov/icpostdoc/index.html. If you have questions, send an email to ICPostdoc@orau.org. Please include the reference code for this opportunity in your email.
Application Deadline	2/28/2023 6:00:00 PM Eastern Time Zone
Description	**Research Topic Description, including Problem Statement:**

Space is an increasingly important domain for the UK as has been highlighted in the Integrated Review and the importance endorsed by publication of the UK Space Strategy. The Space sector is also changing rapidly with much more activity in the sector focusing on smaller platforms (CubeSats) that are cheaper to develop and launch through innovations such as rideshare arrangements. Although the CubeSat platform and associated electronic systems have developed rapidly and have been to a large extent commoditized one area that has not seen the same level of progress is CubeSat antenna technology.

User requirements often call for high gain, wide bandwidth and directionality but these are difficult to achieve when the host platform is relatively small and constrained, this is especially true in the <1GHz region, where the antenna size/weight is appreciable compared to the spacecraft platform itself. Similarly launch requirements often mean that the antenna must be stowed and compacted to fit into the available volume.

This research topic is to progress the state of the art of satellite antennas for small CubeSat applications. The goals will be to maximize gain and bandwidth by advanced materials and/or novel mechanical geometries. It is acknowledged that it is unlikely a single configuration will cover a very broad frequency range therefore the research topic may wish to focus on one or more of the sub frequency bands 100MHz to 1GHz, 1GHz to 3GHz, 3GHz to 6GHz, 6GHz to 18GHz where it is accepted that the potential solution may be different for each sub band.

Challenges include:

- Simultaneous constraints on electromagnetic, thermal and mechanical design goals, such as:
  - Limited choice of materials that will survive in Space.
  - Optimizing RF performance operating near the link budget limit and the need for circular polarization
  - Constrained spacecraft payload weight
  - Constrained spacecraft launch size
- Mutually exclusive design goals, such as:
  - Mechanical complexity of designs versus the reliability of deployment in the space environment
  - Antenna size/weight versus spacecraft stability (asymmetry of mass)

Assumptions that can be made:

- Deployment on a small CubeSat e.g., 3U or 6U spacecraft having stabilized attitude.

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- The coexistence of other antennas (such as S or X band command and control)
- RF antennas operating in the 1 to 5 GHz spectrum with TX power of no more than +33dBm, but with scope for high gain in the ground station

Example Approaches:

The following potential approaches are suggested (but should not be taken as prerequisites or constraints):

- Direction-dependent modulation schemes and other novel super-positioning techniques
- Reconfigurable/tunable antenna designs
- Low loss lens antennas (artificial dielectrics, Fresnel/Zoned material lens, lightweight Luneburg lens)
- Low loss ceramic/dielectric resonator antenna designs, such as
  - Substrate Integrated Waveguide (SIW) antennas (planar waveguide antenna)
  - Polyrod arrays
- Novel use of smart materials, laminar materials and composites
- Solid-state plasma antennas (e.g. plasma silicon)
- Novel inflatable (precision reflector) designs for sub 2 GHz
- Origami and flexible substrate antenna designs for sub 2 GHz

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
- 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

Key Words: Space Strategy, Electronic Systems, Satellite Antennas, Mechanical Geometries, Frequency Ranges

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** (17 👁)
  - **Earth and Geosciences** (21 👁)
  - **Engineering** (27 👁)
  - **Environmental and Marine Sciences** (14 👁)
  - **Life Health and Medical Sciences** (48 👁)
  - **Mathematics and Statistics** (11 👁)
  - **Other Non-Science & Engineering** (2 👁)
  - **Physics** (16 👁)
  - **Science & Engineering-related** (1 👁)
  - **Social and Behavioral Sciences** (29 👁)