Proposed FY18 Research Topic

1. **Research Title**: Readout Integrated Circuit (ROIC) Analysis, Simulation & Design

2. **Individual Sponsor**:
   
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3. **Academic Area/Field and Education Level**: Electrical Engineering/Electro-optics (MS or Ph.D. level)

4. **Objectives**: ROICs are a key enabler for a variety of Air Force imaging applications, but research in this area has been limited. Despite similarity in architecture, a capability and performance disparity exists between ROICs and visible CMOS image sensors. The objective of this program is to identify these disparities and propose solutions tailored to infrared imaging applications. Scope of the research includes: literature review of advanced CMOS imaging architecture, modeling/simulation and design. Promising approaches may be demonstrated in hardware fabricated at a commercial CMOS foundry. Improvements to the unit cell and overall architecture should be explored.

5. **Description**: Infrared imaging performance is often limited by the ROIC for both active (e.g. LIDAR) and passive (e.g. IRST) subsystems. Performance metrics of interest include: noise, dynamic range, frame rate, power consumption, and low power on-chip signal conditioning/processing. As pixel pitch shrinks to improve system resolution, techniques such as pixel-sharing may be of interest to fit the required circuitry into a limited footprint. Logarithmic amplifiers, multiple exposure architectures, and digital pixel designs are a few of the potential approaches to improving dynamic range. The relative merits between analog-to-digital conversion at the pixel, row/column, and corner should be considered. Application-specific capability such as return pulse triggering, Geiger-mode quenching, or color processing are also of interest. These potential avenues of research are, but shouldn’t be considered an exhaustive or restrictive list.

6. **Research Classification/Restrictions**: This research has ITAR restrictions.

7. **Eligible Research Institutions**: Indicate to what organizations this topic should be provided

   - [X] DAGSI
   - [ ] AFIT (only)
☐ USAFA (only)

If you are submitting a topic for the USAFA, indicate if you are also interested in sponsoring a USAF Cadet in summer 2015 (Average cost for USAF Cadet for 33 days is $5000)

☐ Yes ☐ No