

1. **Research Title:** Avalanche Photodiodes for LIDAR
2. **Individual Sponsor:**  
Dr. Charles Reyner  
AFRL/RVDH  
2241 Avionics Circle  
WPAFB, OH 45433  
charles.reyner.1@us.af.mil
3. **Academic Area/Field and Education Level:**  
MS or PhD level degree program in Electrical Engineering, Electro-Optics, Material Science, or Physics
4. **Objectives:** The objective of this research is to improve the sensitivity of III/V avalanche photodiodes (APDs) at wavelengths greater than 1.7  $\mu\text{m}$  through modeling, fabrication, and/or testing.
5. **Description:** Avalanche photodiodes (APDs) are among the most sensitive light detectors. They are routinely used in scientific research, long-haul telecommunications, and LIDAR receivers. The principal goal of every APD is to absorb a photon, multiply the photo-generated carriers via impact ionization, and minimize the total noise. While gain and noise processes are well understood in mature APD materials – e.g. InP, InAlAs, Si – these materials limit the overall APD absorption range to approximately 0.4 – 1.7  $\mu\text{m}$ . The scope of this research is to improve the understanding of gain and noise in longer wavelength APDs using III/V semiconductors. This goal can be accomplished through modeling, fabrication, and/or testing. AFRL has in-house capabilities to support this work, including device modeling software, cleanroom fabrication facilities, and extensive optoelectronic testing equipment. Additional capabilities exist for novel device characterization, including temporal studies and integrated photonics solutions.
6. **Research Classification/Restriction:** Unclassified/U.S. Citizenship required.
7. **Eligible Research Institutions:** Universities (DAGSI)

Distribution Statement A: Approved for public release. Distribution is unlimited. 88ABW-2020-2203