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# **Infrared Scene Projection (IRSP) Technology for Hypersonic Sensors T&E**

**To: The University Innovation Summit**

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# Background

- The DoD test community has, for greater than three decades, pursued a variety of technologies for application to dynamic, two-dimensional infrared scene projectors (IRSPs). Ever increasing sensor focal plan array formats and frame rates, along with the continuous evolution in the sophistication of adversary threats, has presented constant pressure on the test community to maintain a rapid pace of development in test technologies
- Technology developments are needed to enhance Hardware-in-the-Loop (HWIL) capability to test sensor systems to:
  - Assess sensor/seeker performance under simulated hypersonic aerothermal and aerodynamic conditions
  - Accommodate space and weapon tracking applications for hypersonic and ballistic threats
    - Multi-spectral (MS)
    - Hyper-spectral (HS)
    - Wide Field-of-View (WFOV) sensor systems



# Applications of IRSP System Technology

- **Infrared light sources**
- **Infrared Emitter Arrays**
- **Beam steering aperture components**
- **Read-IN integrated circuits (RIIC)**
- **Infrared LEDs (IRLED) emitters**
- **Digital micro-mirrors**
- **Carbon nanotubes**



# Current HWIL Capabilities

- **Spatial Resolution/Format:** Existing facilities which have 512x512 projection capability cannot meet Wide Field of View (WFOV) needs
- **Temporal Response:** Current Infrared Scene Generators (IRSG) are ~ 200Hz with 8 – 14 bits of radiance quantization
- **Spectral Range:** Current IRSGs are single band (long-wave infrared, middle-wave infrared, or short-wave infrared)
- **Spectral Resolution:** Currently most projectors span across a band
- **Dynamic Range:** Maximum apparent temperatures are < 1000 degrees K



# Potential Future HWIL Capabilities

- **IRSP HWIL technology to encompass range of space / weapon sensor capabilities:**
  - **Spatial Resolution/Format:** An ability to test wide field of view sensors with apertures up to 10"; an ability to test sensor arrays approaching 8k x 8k (64M pixel)
  - **Temporal Response:** 1 kHz (objective); > 200 Hz (threshold);  
**Radiance quantization:** 14 bits (threshold) 16 bits (objective)
  - **Spectral Range:** Accommodates Dual-Band operation
  - **Spectral Resolution:** Accommodates wavelength selectively with spectral resolution < 0.15 micrometers for each pixel
  - **Dynamic Range:** Necessary maximum apparent temperatures need to be > 1000 degrees K (threshold); > 1300 K (objective)





# Summary

- **Next-generation Electro-Optical/Infrared (EO/IR) sensor systems associated with these platforms challenge existing HWIL test and evaluation capabilities**
- **Multiple IRSP technologies continue to advance but lag these challenging requirements. A significant technology gap exists for supporting these new programs in the near future. Investments towards a next-generation technology advancement are required to maintain pace with these new surveillance and interceptor sensors**