

SAPhotonics 

AgileBeam™

**Free-Space Optical Communications in
an RF-Denied Environment**

Topic: N181-027 – NAVAIR

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SA Photonics History / Background

- **SA Photonics principals background is a combination of space/military, commercial, and venture capital startup:**
 - > 120 technical staff members: 12 PhDs and 22 Sr. Engineers
- **Established in 2002**
- **Consists of two main technology areas**
 - **Communication and Sensors Group** - specialized in optical, RF and high performance mixed signal communication and sensing systems
 - **Vision Systems Group** – specialized in human factors and developing leading edge augmented reality and high vision systems
- **Over 40,000 square feet of mixed office/laboratory space in Bay Area**
 - New 10,000 sq. ft. clean room facility recently leased to support space system test, assembly and manufacturing
 - Establishing 13,000 sq. ft. manufacturing facility in Florida to support OISL volume production
- **Proven record of product development from concept generation through qualification and manufacturing general availability**
 - Over \$10M invested in 2020-2021 to enhance OISL manufacturing capabilities



Electro-optical R&D lab & assembly Area



Environmental Testing



3800 sq. ft. Clean Room

Navy Challenge



F/A-18F Super Hornet (Credit: U.S. Navy)

- **Strong demand to provide robust communication capabilities in RF denied environments**
- **Free-space optical communication enhances signal security, is harder to intercept and increases the amount of data delivered in a low size, weight and power (SWaP) package**

Operational Need and Improvement

- **Navy Aircraft require a high data rate communication capability that is**
 - Resilient to RF interference and jamming
 - LPI/LPD (low probability of intercept/detection)
 - Extremely low SWaP
- **AgileBeam FSO communications system provides these capabilities and is suitable for air-to-air, air-to-ground and air-to-space applications**

AgileBeam™

AgileBeam is a fully integrated FSO solution

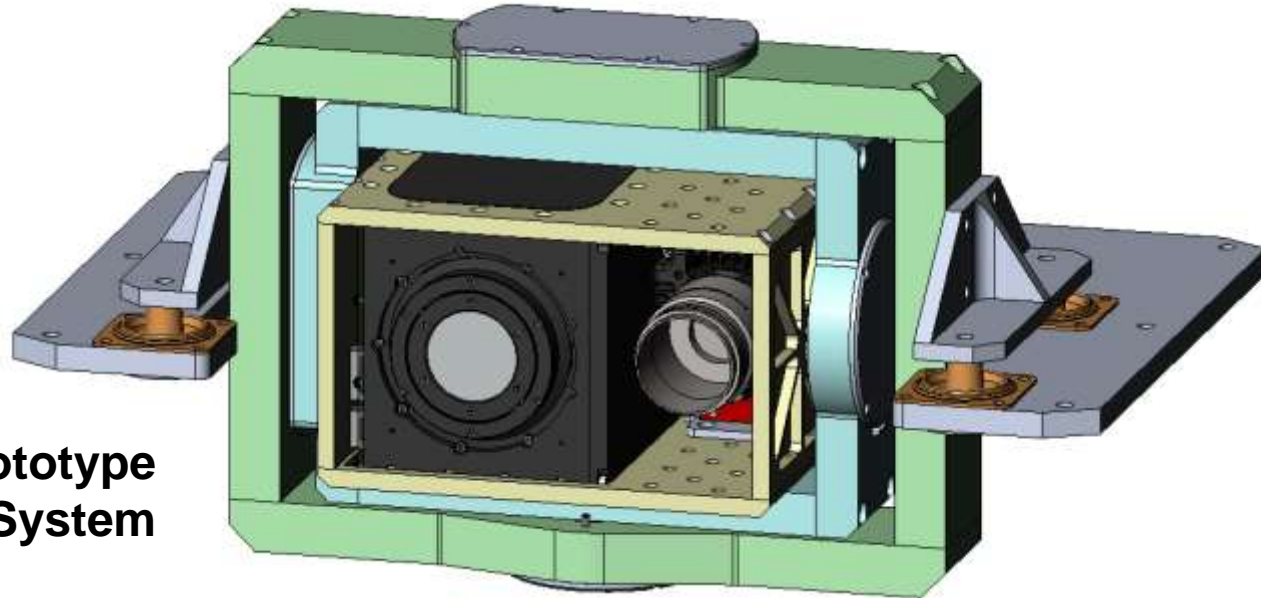
- Conformal aperture allows use on high velocity aircraft without introducing turbulence or drag
- 50 degree Risyey Prism based beam steering provides wide field-of-regard operation
- Integrated platform stabilization to support operation on F-18 centerline pod
- Wide Field-of-View acquisition sensor provides rapid autonomous acquisition in RF denied environments.
- 100 Mbps data rate – can be increased to 1+ Gbps



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- SA Photonics' field proven HARQ Physical Layer retransmission overcomes both atmospheric scintillation and aero-optic effects
- Supports link distances up to 125 nmi

Current Status



Phase II Prototype System

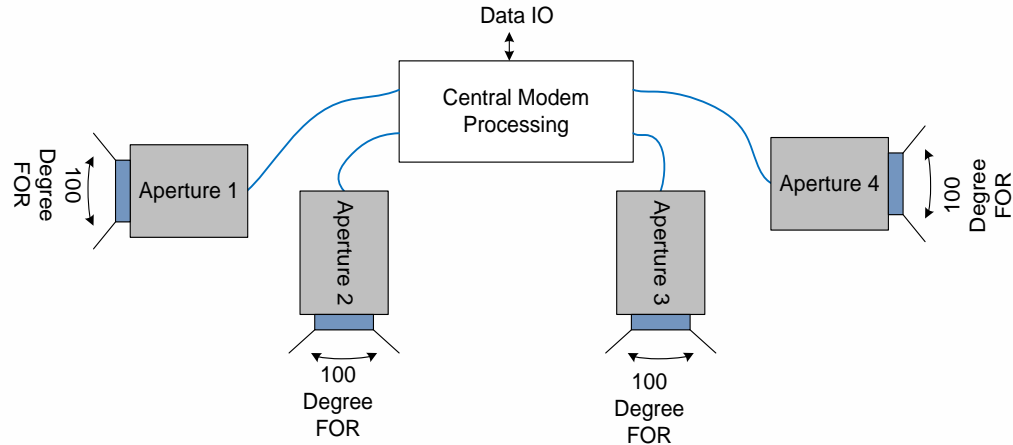
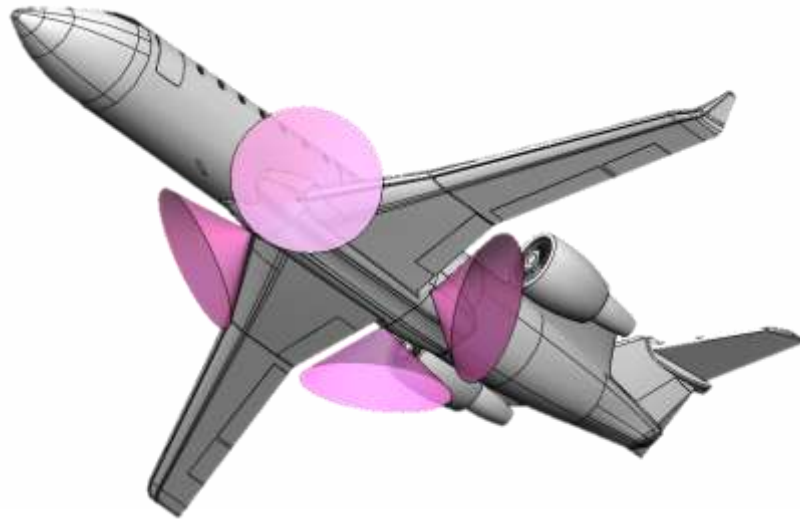
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- **Program started September 2019**
- **Prototype system complete July 2021**
- **Outdoor Testing complete in September 2021**

Key Features / Advantages / Benefits

- Up to 40x increase in data rates compared to CDL based systems, with data rates up to 10 Gbps
- Link distances up to 125 nmi and beyond
- Extremely low probability of interception and detection
- Ability to operate in RF-denied environments with complete resistance to jamming
 - Provides communications without RF emissions, allowing use during Emissions Control (EMCON) conditions
- Eliminates spectrum allocation restrictions
- Very low Size, Weight and Power compared to RF solutions
- Accurate range and time-transfer capability can be used to provide “GPS-free” alternative PNT to distribute position, velocity and time to optically connected platforms

Multi-Aperture Operation



- **Multiple conformal apertures provide the ability to provide full hemispherical link coverage, as well as support multi-link mesh networking**
- **Each aperture can support independent links, or can be used for spatial diversity when field-of-regard overlap**
 - Spatial diversity can help overcome atmospheric effects
- **Handoff of established link will be “hitless” between apertures as aircraft maneuverers**
 - Each Tx wavelength has dedicated beacon AM modulation that is detected by quad cell

Transition to Fleet

- Strong interest from multiple agencies (Navy, Air Force, MDA, DARPA, SDA, Army, etc..) for low SWaP resilient communications
- Key technology can be scaled to support wide range of applications
 - Airborne
 - Ground
 - Space
 - Maritime
- Related system has been transitioned to provide air-to-space communication and A-PNT to DARPA's Blackjack and SDA T0 proliferated LEO constellations

Types of Partners Sought/Transition

- **Organizations or companies looking for low SWaP-C resilient communications**
- **FSO also provides multiple mission critical functions**
 - High data rate communications
 - LPI/LPD
 - Operate in RF denied environments
 - Ranging can be used to provide relative and/or absolute navigation and time transfer
- **Likely path forward**
 - 1) Manufacture and sell AgileBeam systems
 - 2) Also able to license design

Contact Information

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