

WHO

SYSCOM: NAVAIR
Sponsoring Program: PMA-263, PMA-266, PMA-231
Transition Target: MQ-8C Fire Scout
TPOC: (904) 460-4494

Other Transition Opportunities:
USN ship-ship communications, Commercial 5G/6G fronthaul

Notes:
This program is developing a new laser and detector for long-wave infrared (LWIR) laser communications near 10-micron wavelength. Laser communications greatly exceed the capacity of radio communications and are generally more difficult to intercept or jam. LWIR laser communication suffers less degradation in fog and turbulence than existing short-wave infrared (SWIR) systems.

The MQ-8C Fire Scout pictured here is one possible target for the new communication system.

Intraband has already demonstrated 5 Gb/s data transmission with similar laser and detector technology in the mid-wave infrared (MWIR). The company has also demonstrated 1-W continuous wave (CW) quantum cascade laser (QCL) operation at 8-micron wavelength in the LWIR.



U.S. Navy image 220105-N-GF955-1213, available at <https://media.defense.gov/2022/Jan/21/2002925787/-1/-1/0/220105-N-GF955-1213.JPG>

WHAT

Operational Need and Improvement:
Ship-ship and UAV/USV communications are needed having:
Low latency, high data-rate, wireless, mobile
Resistant to jamming, and difficult to intercept
Works in radio-frequency interference (RFI), RF congested, and RF-denied environment
Operation in haze, fog, clouds, and turbulence
Range up to 100 km in the upper atmosphere

Specifications Required:
1-W output power, ~ 10-micron wavelength
< 10-nm laser linewidth
5E9 Jones receiver detectivity
1 Gb/s in worst case conditions, up to 40 Gb/s best case, with 1E-12 bit error ratio (BER)

Technology Developed:
MWIR Distributed feedback (DFB) quantum cascade lasers and resonant-cavity infrared detectors (RCID)s capable of 5 Gb/s transmission (in a prior program)
LWIR (8-micron) QCLs having 3.7 W, 10.6% wall-plug efficiency (WPE) pulsed and 1 W, 6% WPE CW
Designs in process:
* DFB QCL emitting 1.9 W CW with 14% WPE at 10-micron wavelength with < 5 nm linewidth
* Capacitance reduction for 5 GHz bandwidth
* RCID with 14% quantum efficiency and 525-nm optical bandwidth near 10-micron wavelength

Warfighter Value:
Secure, high-capacity, low-latency data link for sensor and control communications
More covert than radio
Lower outage probability than other laser communication links in adverse weather
Data link that can't be RF-denied

WHEN

Contract Number: N68936-23-C-0002 **Ending on:** Nov 22, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
DFB QCW with continuous wave (CW) operation	Medium	100 mW CW power	3	3rd QTR FY23
RCID detector fabrication	Medium	10% QE, 2.25E9 Jones	3	4th QTR FY23
Link demonstration	Medium	1E-9 BER, -18 dBm sensitivity, 1 Gb/s	4	1st QTR FY24
If Option exercised, high-power DFB QCL	Medium	0.5 W CW at 10-micron wavelength	4	1st QTR FY25
If Option exercised, Link test in relevant environment	Medium	1E-12 BER, -18 dBm sensitivity, 10 Gb/s	5	1st QTR FY26

HOW

Projected Business Model:
Direct sales of laser and detector communication devices or modules to system integrators
Intraband is looking for a manufacturing partner

Company Objectives:
Speak with potential manufacturing partners and system integrators interested in high-speed optical communications technologies

Potential Commercial Applications:
5G/6G front-haul: connect remote radio head (RRH) to the base station where fiber is not practical
* Increase data rate to 40 Gb/s via WDM, complex modulation
* Most applicable to more arid or dense metropolitan areas
LIDAR: better coverage in adverse weather
* SWIR is blinded by fog
* Need to better understand LWIR performance for imaging