Sustainable Land Imaging – Technology: Integrated Photonic Imaging Spectrometer

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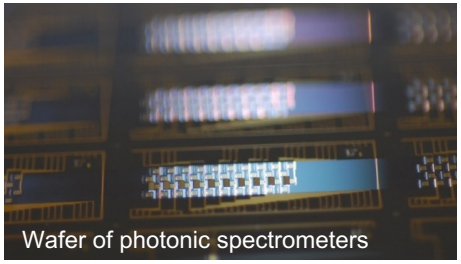
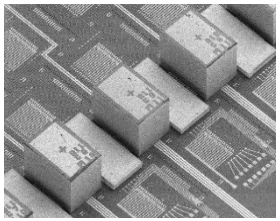
Objective

- Develop next-generation compact SLI instrument based on NGAS photonic waveguides
- Reduce instrument volume by x25, mass by x7 compared to current multispectral approach
- Enable new science and data products through hyperspectral imaging (HSI) while preserving SLI data continuity through band aggregation
- Build and test a heterogeneously integrated photonic instrument covering two SLI bands: Band 9 (1.36 – 1.39μm at 3nm resolution) and Band 6 (1.56 – 1.66μm at 6nm resolution) with scalability to all SLI VNIR and SWIR bands
- Demonstrate integrated instrument performance in a relevant environment

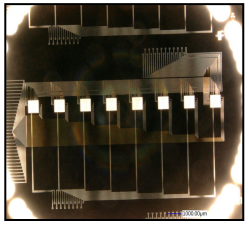


Wafer of photonic spectrometers

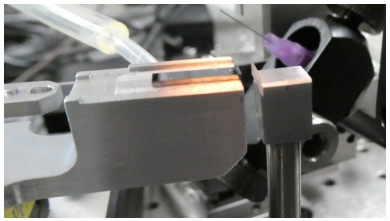
Optical and environmental testing on prototype photonic spectrometer has been completed. Integration-ready ROICs have been fabricated.



Integrated photonic circuit details



Integrated ROIC test circuit



Spectrometer/lenslet alignment

Approach

- Leverage NGAS technical investments to execute prototype instrument development in SWIR wavelengths – Advance TRL 3 waveguide and detector designs
- Evaluate multiple ROIC approaches including NGAS photons-to-bits technique – downselect and fabricate custom ROIC for integration with detection layers
- Integrate Waveguides, Detectors, and ROIC arrays into Photonic Spectrometer Elements (PSEs) and stack multiple PSEs to form a photonic HSI instrument
- Procure lenslet array and align with PSEs
- Integrate foreoptic and demonstrate instrument performance; test instrument in a relevant environment

Key Milestones

• Demonstrate spectrometer with integrated detectors	09/17
• Demonstrate functional spectrometer with integrated mechanical ROIC	11/19
• Complete waveguide photolithography process dev	09/20
• Complete lenslet design, fabrication, and thinning	04/21
• Complete preliminary env testing of integrated device	09/21
• Complete integration-ready ROIC fab (Round 2)	04/22
• Complete optimized waveguide/filter fabrication	06/22
• Complete ROIC test circuit integration	10/23
• Demonstrate ROIC functionality	12/23
• Demonstrate spectrometer with integrated ROICs	02/24
• Optimize and fabricate updated waveguides and filters	05/24
• Demonstrate integrated spectrometer with updated design	09/24

$TRL_{in} = 3$ **$TRL_{current} = 4$**