



# PENNSTATE



## Integrated FSO & Sensor System Networks

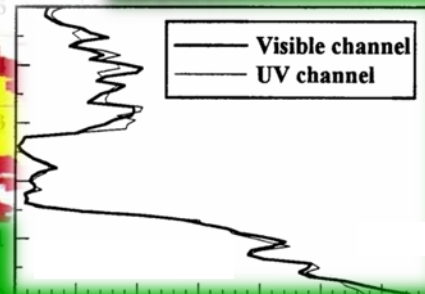
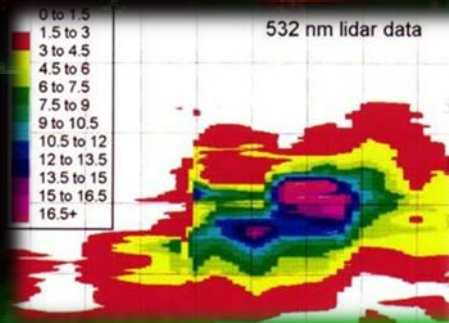
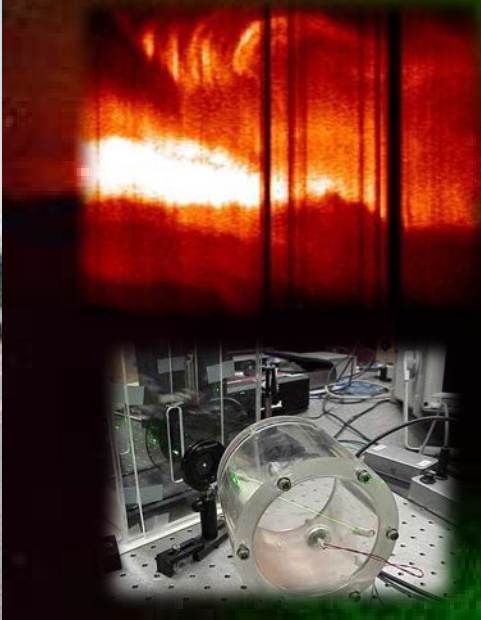
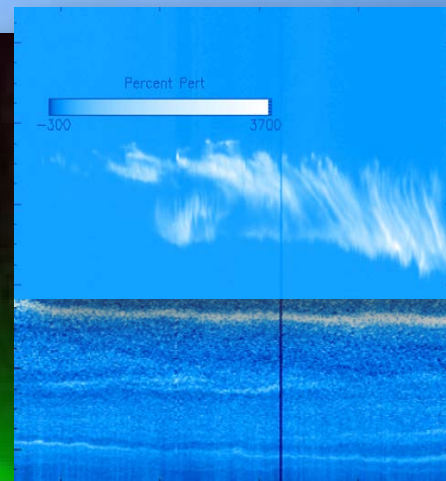
Penn State ELECTRICAL	ENGINEERING
Tim Kane <i>tjk7@psu.edu</i>	PENNSTATE  department of meteorology
PENNSTATE  ARL	Applied Research Laboratory The Pennsylvania State University

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Arlington*

<http://photonics.psu.edu/>

NSF NeTS Workshop 2017

# Environmental Sensing



- Lidar
- Imagers
- Spectrometers
- *In situ*

etc.

- Wind
- Aerosols
- Turbulence
- Surfaces & Interfaces

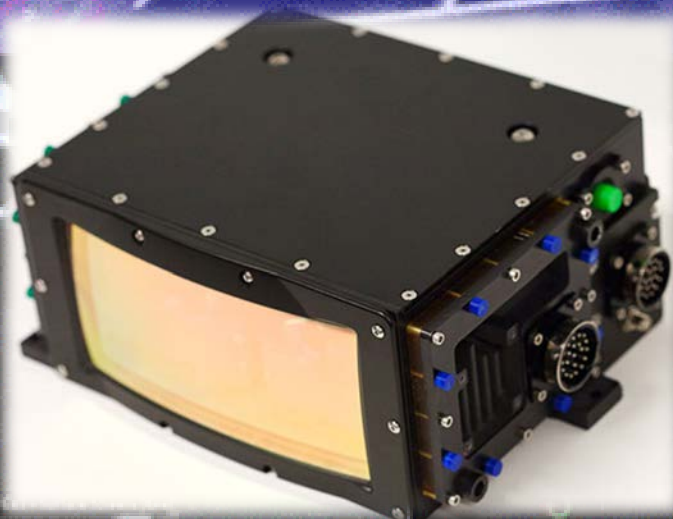
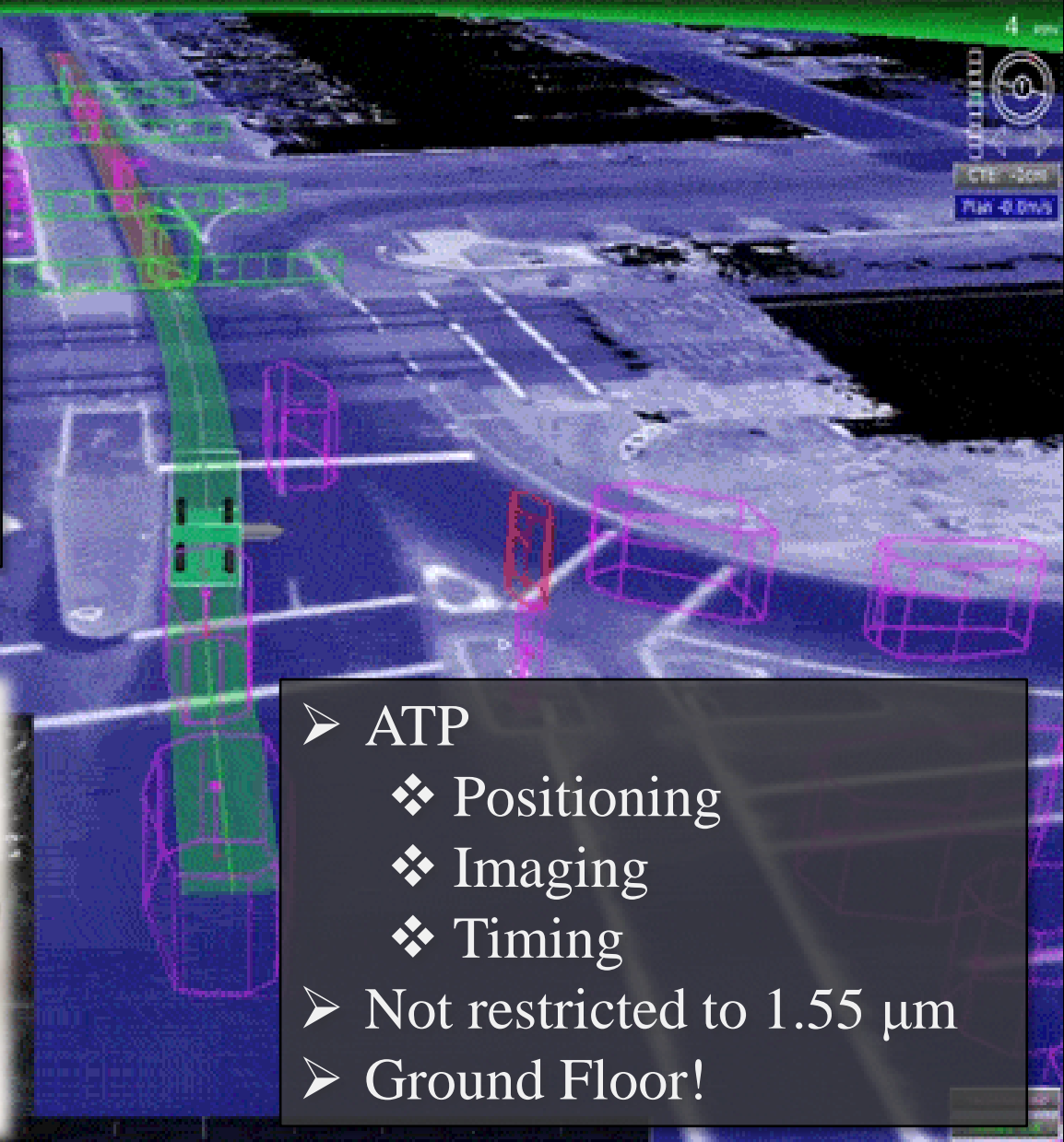
# Integrated Sensors and FSO

- The *complete* optical channel impacts FSO system design and operation!
- Integrated Sensing
- Adaptive Operation (i.e., variable rates, etc.)
- *Ad hoc* networks

- Photonics
  - ❖ Mid-IR (Quantum cascade, 4  $\mu\text{m}$ ?)
  - ❖ MEMS
  - ❖ etc.
- Integrate PEOPLE!

# Example: Autonomous Swarms

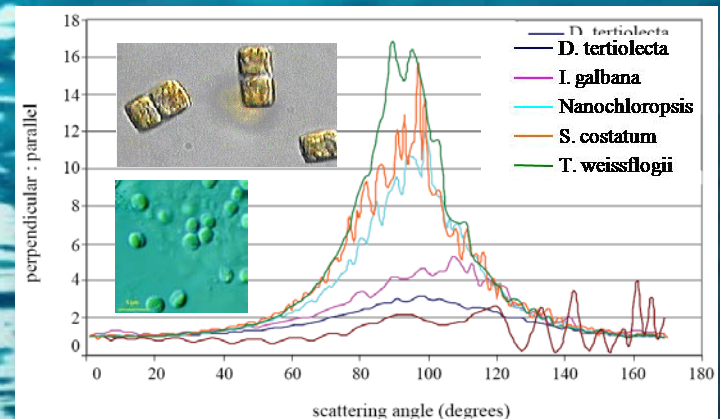
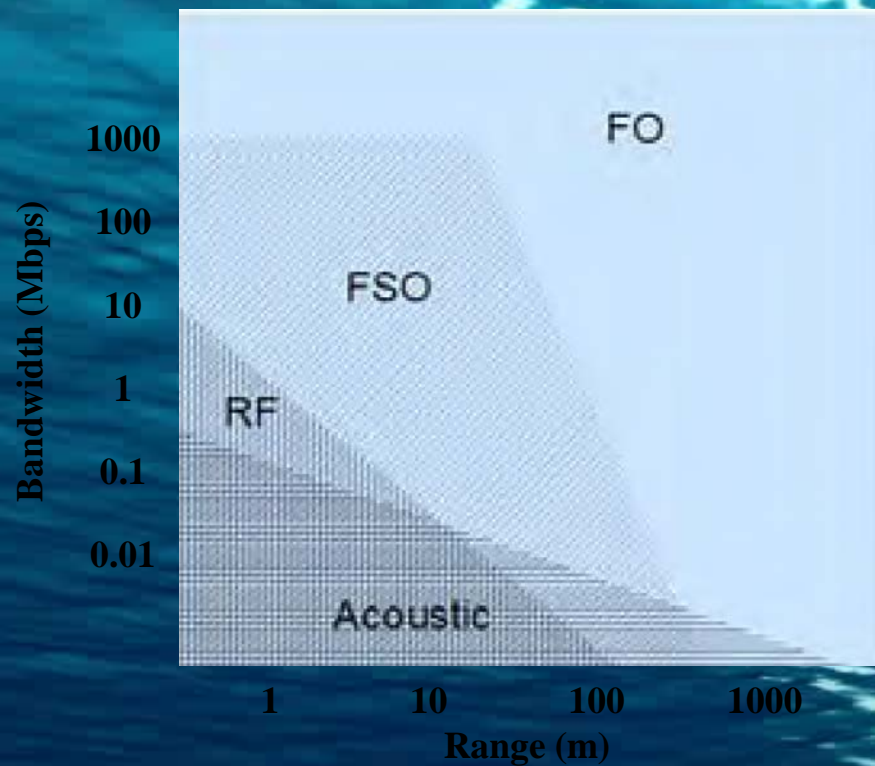
- RF
  - ❖ Cluttered Environs
  - ❖ Space Weather
- V2V
- I2V
- Integrate remote data and models



- ATP
  - ❖ Positioning
  - ❖ Imaging
  - ❖ Timing
- Not restricted to  $1.55 \mu\text{m}$
- Ground Floor!

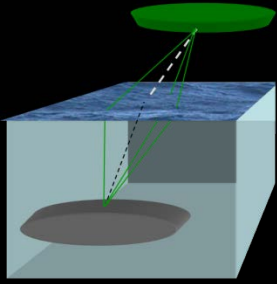
# Example: uFSO

- Burst Comm
- Hybrid Approach
- Need better Radiative Transfer Modeling →



- Bubbles
- Hydrosols
- Internal Waves
- Surface Dyn. & Comp. →

# Example: Interfaces & Unique FSO Scenarios



- Monitoring
- 2-D Turbulence
- Aero-Optics and AO

- Unfriendly RF environs.
- Industry
- DoD
- etc.

