From Tim Kane at Penn State:

There are many challenges to deploying integrated FSO/Sensor systems, and subsequently novel research opportunities abound. These range from basic physics, to photonics/hardware needs, as well as communication and networking protocols. Tying these different pieces together is the enabling concept/challenge: treating FSO/Sensor networks as **systems**.

Several examples using integrated FSO/Sensor approaches were discussed:

- *Self-Driving Urban Fleets:* Lidar systems fast became a necessity for the autonomous revolution. Unfortunately, in crowded (i.e., RF-cluttered) settings, robust alternatives for traditional wireless Comms and GPS become necessary. Integrating FSO and optical positioning into the existing Lidar sensor suites will enable pico-nets of comm/sensor grids, enabling efficient vehicle "swarms."

- *Air to Submerged Vehicle Communications:* FSO holds promise, but surface effects and water turbidity, along with moving platforms, offer intriguing challenges. Concurrent/integrated environmental monitoring should enable at least partial mitigation. Underwater (**and** air to underwater through an interface) comm is important; both for military aspects as well as harbor safety monitoring.

- *Interrogation and IoT:*

Note that integrated FSO/Sensors can't do it all. A ***hybrid*** (multi-modal) approach will almost always be preferred (i.e. acousto-optics in water, RF-FSO in air, Optical positioning/GPS, etc.). In addition, efforts will have to be made on all levels (e.g., development of 4 micron sources and detectors, etc.).