

## Unmanned Surface Vehicles (USVs)

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### **Unmanned Surface Vehicles (USVs)**

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## Unmanned





















# Optionally Unmanned





















# Minimally Manned









## **Conversion to Optionally Unmanned**

#### **Example Conversion Vendors:**

- Dynautics
- Kongsberg Maritime
- L3 Harris / ASV Global
- LSA Autonomy
- Sea Machines
- Sea Robotics



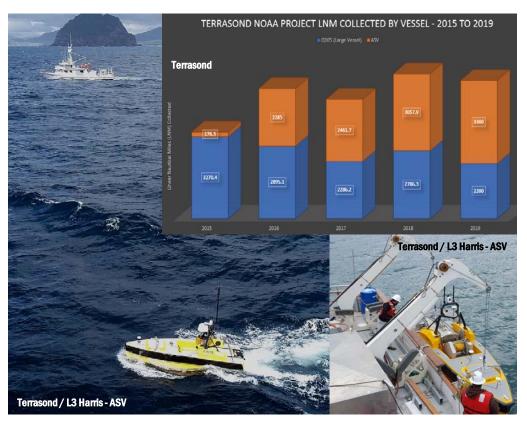








## Force Multiplier Examples



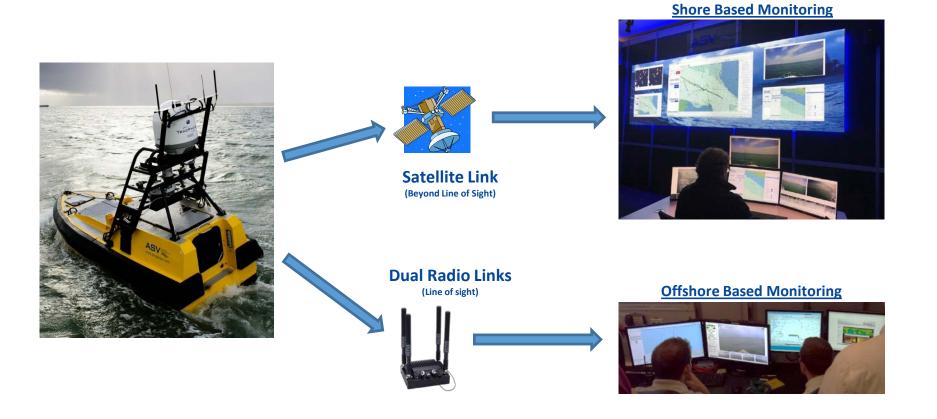




### Line of Sight (LOS) vs Beyond Line of Sight (BLOS)

- Waypoint Navigation / Collision Avoidance
- Payload Deployment

- Supervise & Control ASV Movements
- Control Payload, Monitor Data



## **Spectrum of USV Applications (non-Defense)**

Autonomy, COLREG Compliant, and OTH

**Smaller Inland Vessels Inland Ships** Large AUV Deployment & Retrieval Large Tugs Mid-Sized Freight **Transport** Nearshore **Ferries** Hydrography OTH 3000m Inspection **ROV OTH** Seismic Acoustic Fish Water **Operations Detection OTH Quality OTH Drift Buoy** Offshore 300m Inspection **Deployment OTH** Wind Farm Mid-Frea **Security Patrol ROV OTH** Multibeam OTH Inspection Oil Dispersant **Passive Acoustic** Current OTH Monitoring OTH **Monitoring OTH** Meteorological Fire Fighting FM **Acoustic Comms** Station Keeper Relay OTH Shallow Seismic Oil Spill Boom **Node Positioning** 500m Tow FM FΜ Inspection **ROV FM Only Non-Defense Bottom Moored** Beacon Oil Dispersant **Applications Shown** Positioning FM FM Offshore Hydrographic Note: FM = Force Multiplier

Line Running, No Collision Avoidance, Radio Link Monitoring

Surveys FM

OTH = Over the Horizon

### **Observations / Concerns Going Forward**

- USV autonomous navigation is ITAR controlled = Industry constraint
- Autonomy has not been perfected, you must supervise
   Rope in props, kid in kayak, spray on camera, piling, thieves...
- Inland / nearshore operations much more challenging
- For large USVs with complex payloads, start minimally manned
- Regulations are evolving / undermines investment "Proper Lookout"
- A cheap USV can be very expensive to operate
- Batteries, wind, solar, and waves generally don't cut it, go with diesel
- Do not expect that a USV will work like a calculator from Walgreens
- Buy one USV, have the supplier debug, then buy more of same
- Satcoms is a weak link (Starlink, OneWeb, Telesat, Amazon, LeoSat)
- Small USV launch & retrieval from mothership is non-trivial
- Start with simple applications & benign routes
- Don't confuse great USV graphics with years of USV experience
- Make sure USV manufacturer has extensive maritime experience
- US is now far behind Scandinavia / Huge & long lasting market lost



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