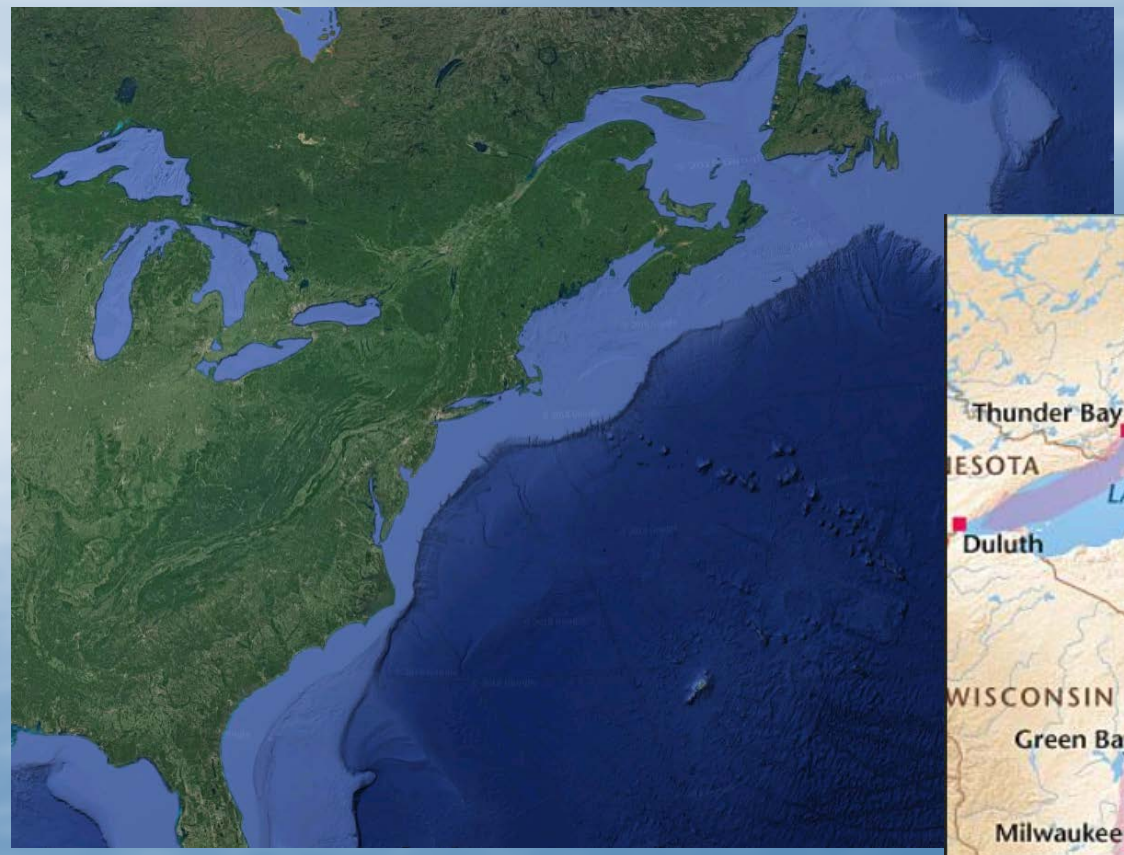
PROPOSED GREAT LAKES TEST BED – KEWEENAW WATERWAY AREA

Michael Beaulac

Michigan Office of the Great Lakes

GREAT LAKES–ST. LAWRENCE RIVER SYSTEM



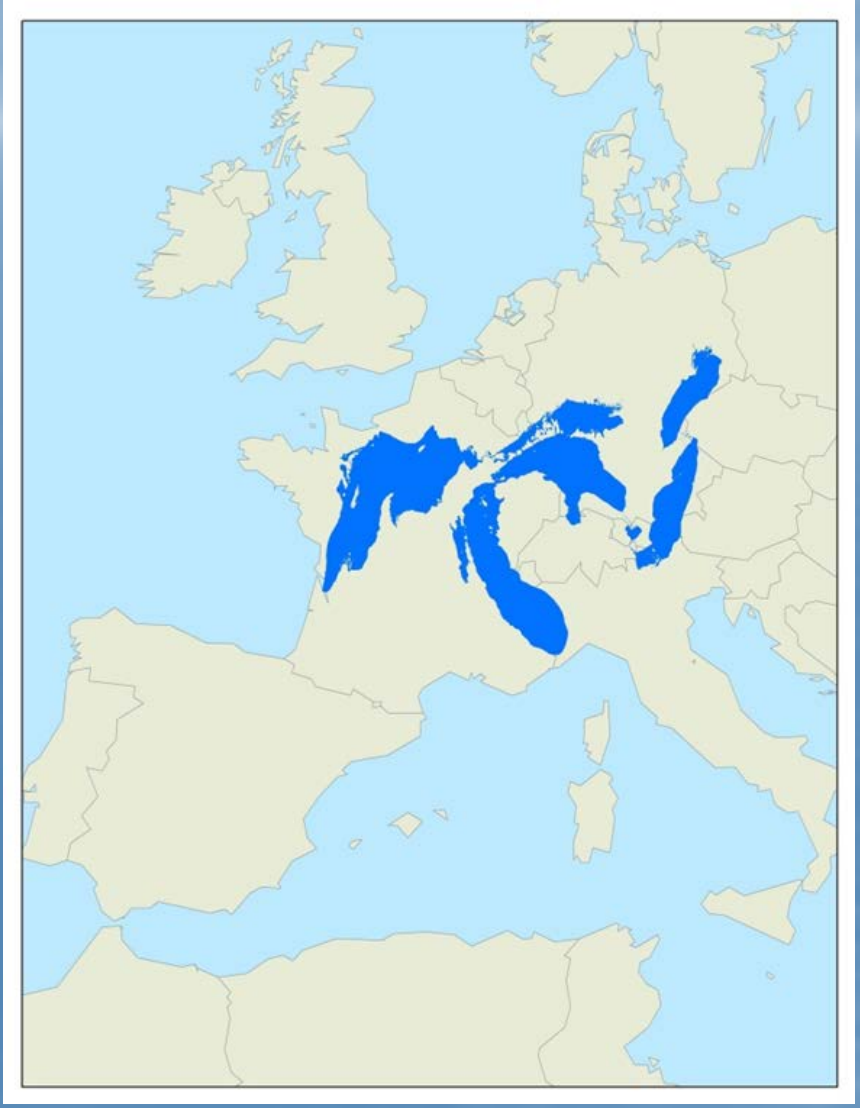
GREAT LAKES – ST. LAWRENCE REGION

Economy

- Population: > **107 million** people
- US$6 trillion regional economy
- Per capita GDP ~ US$50,000
- ~ **30% US/Canadian economic activity & workforce**
- **World's 3rd largest economy** … (if the Great Lakes Region was its own country)

Environment

- ~ **20% world's surface fresh water**
- ~ 17,000 km of beaches & coastline
- $7 billion fishery
- Drinking water: > 40 million people
- World's largest inland waterway: > **3,800 kilometers**, **100+ commercial ports**



GREAT LAKES-ST. LAWRENCE MARITIME STRATEGY

- **Governors' & Premiers' Maritime Initiative** - multi-year effort to double maritime trade.
- **Focus** includes port infrastructure, **autonomous vessels**, related efficiencies
- **Regional strengths** - maritime, automobile manufacturing, IT
- **Smart Ships** Coalition launched:
  - Collaborations w/Norwegian Forum for Autonomous Ships (**NFAS**)
  - Establish Great Lakes **Test Bed**
- Develop **recommendations** w/in one year - improve technology, safety & public acceptance

GREAT LAKES COMMERCIAL FLEET

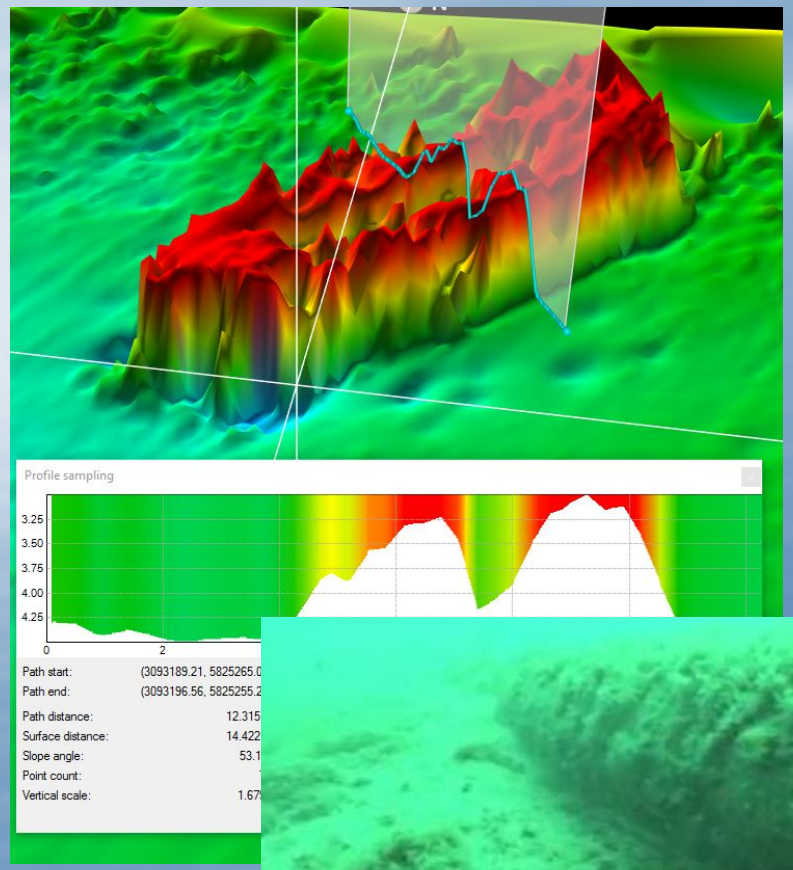
Median Fleet Age:

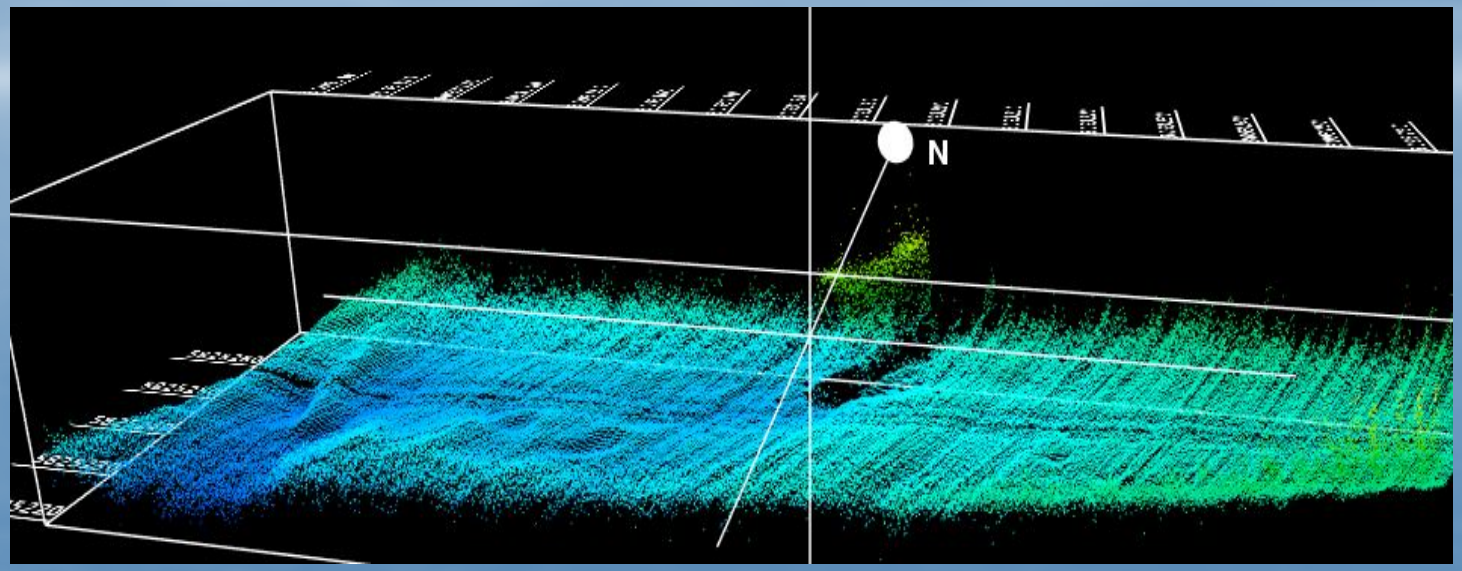
- **US: 1973, n = 55**
- **Canadian: 1993, n = 81**

- **Bulk cargo, tankers**
- **Container potential**
- **Short-sea potential (avoid congestion via trucks)**

GREAT LAKES AUTONOMOUS VEHICLES NICHE

DRIVER: RESEARCH, SURVEYING & ADVANCED 3-D MAPPING (BATHYMETRY, HABITAT)

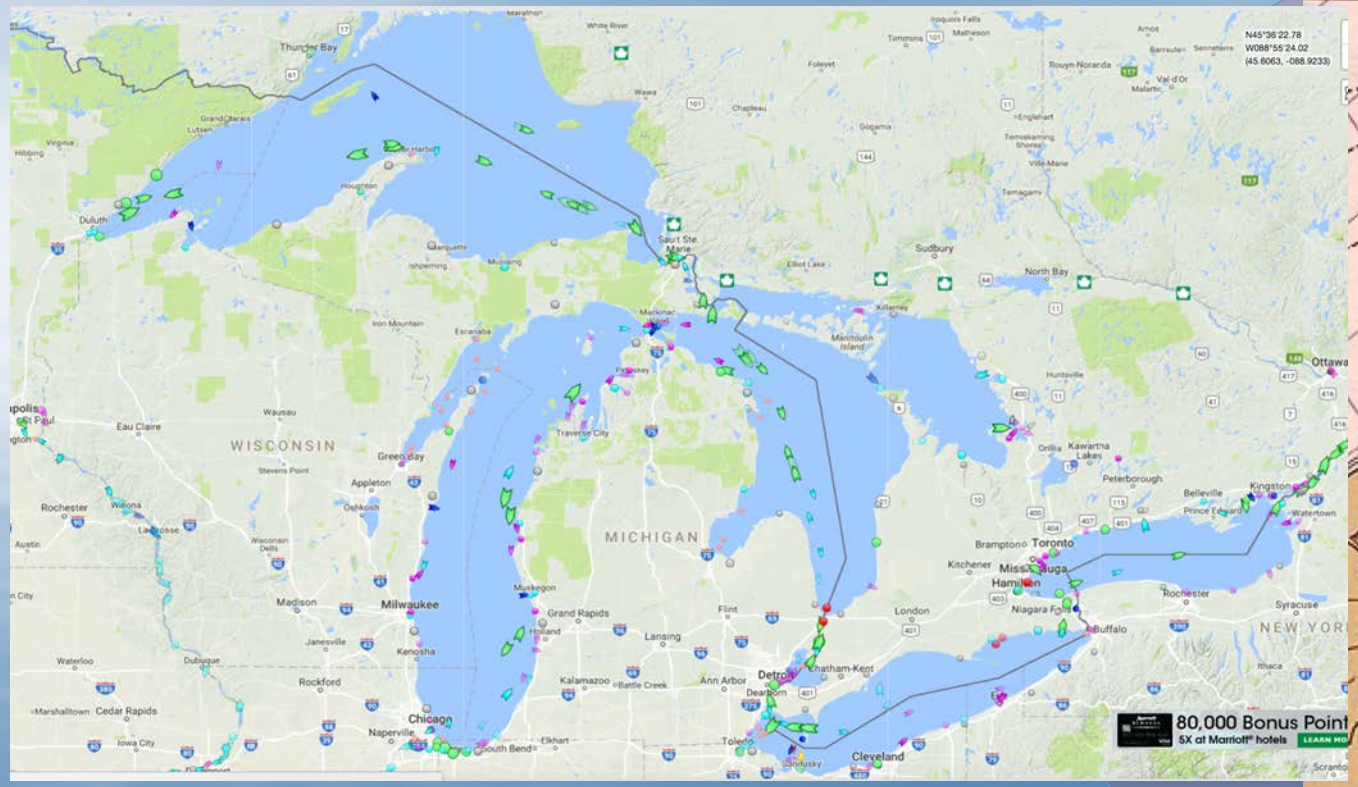


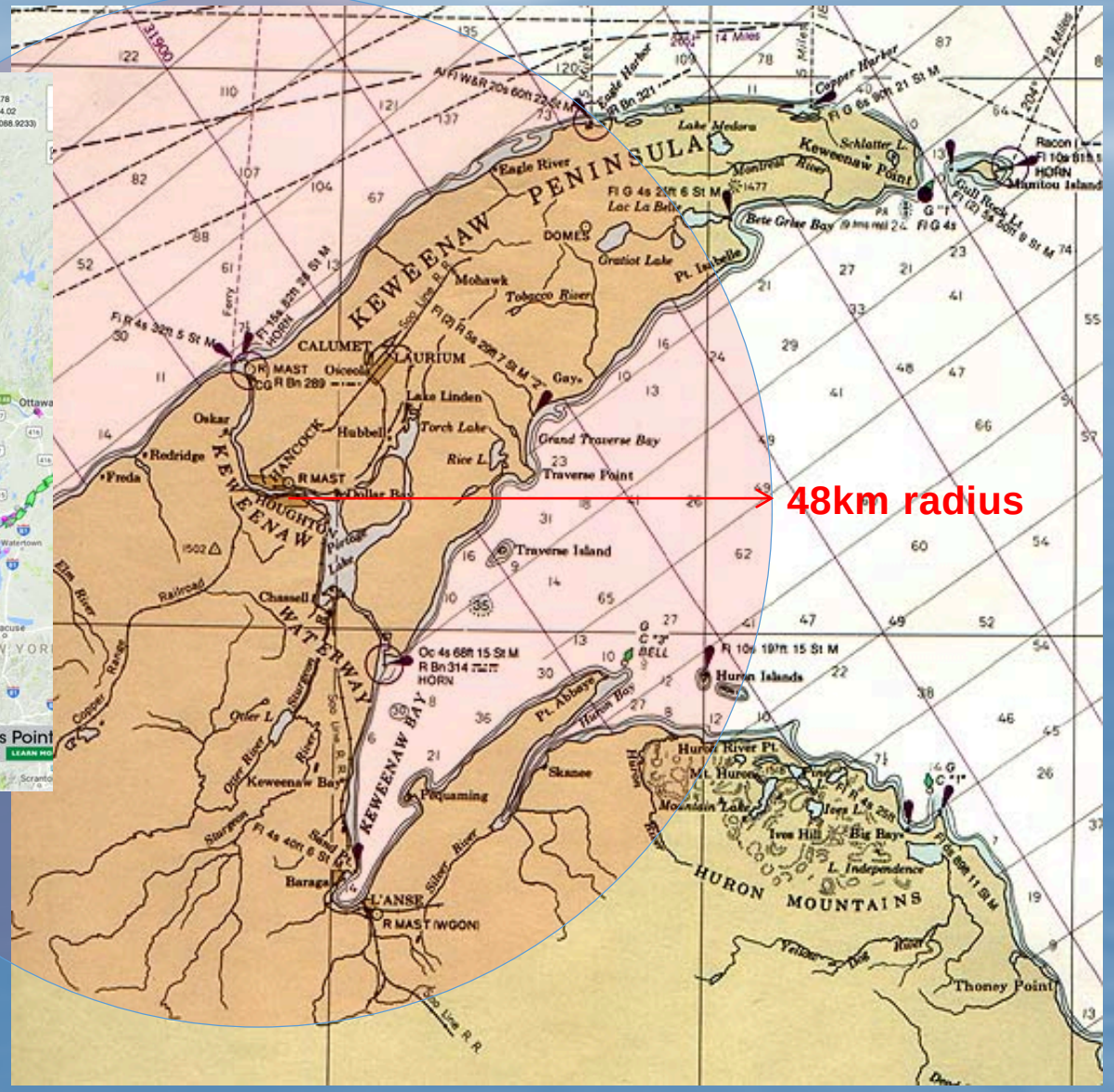


GREAT LAKES SMART SHIP TEST BED NEEDS

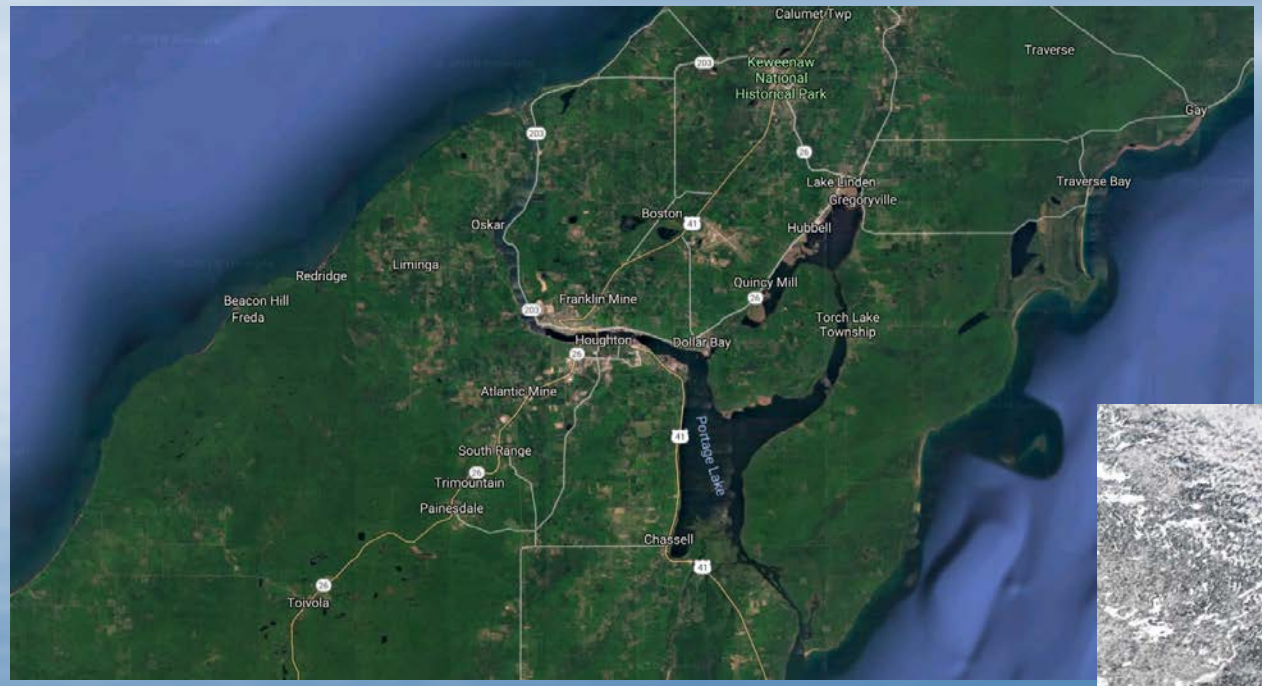
- American Center for Mobility **linkage**
  - Cybersecurity
  - Sensors, sensor fusion, etc.
- Contribute to **port infrastructure** (harbor bathymetry)
- Incident response
- **Cost saving** assessments (personnel, fuel)
- Workforce development - training & education
- Coast Guard collaboration - ***Risk-based approach to decision-making***, safety, liability and compensation

PROPOSED GREAT LAKES TEST BED: RTK AND VRS GPS/GNSS COVERAGE REGION



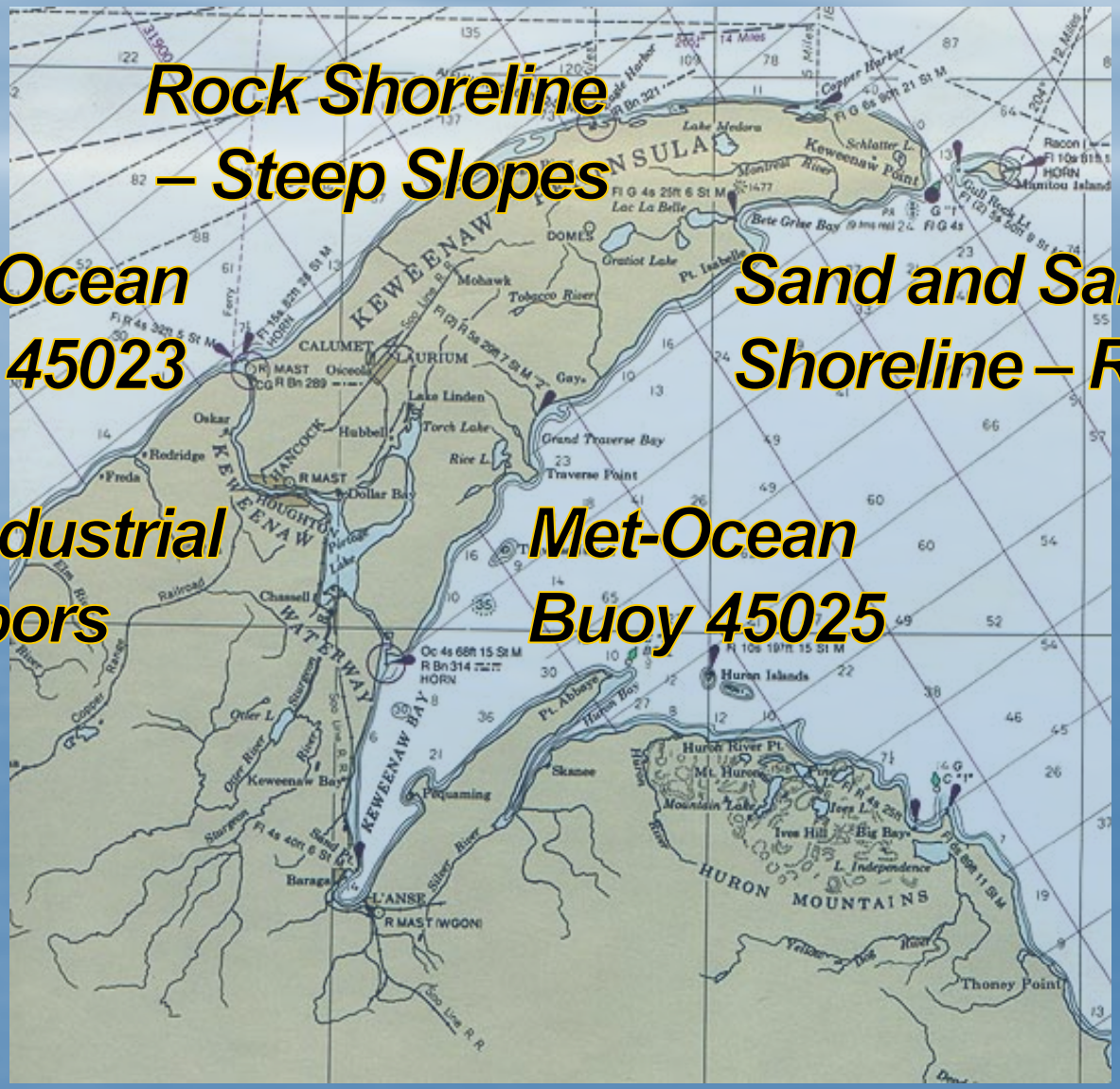


VARYING TYPES OF SURVEY ENVIRONMENTS



- Open “sea” conditions
- Fjord-like environments
- Sub-arctic conditions

VARYING TYPES OF SURVEY ENVIRONMENTS



TEST BED OBJECTIVES

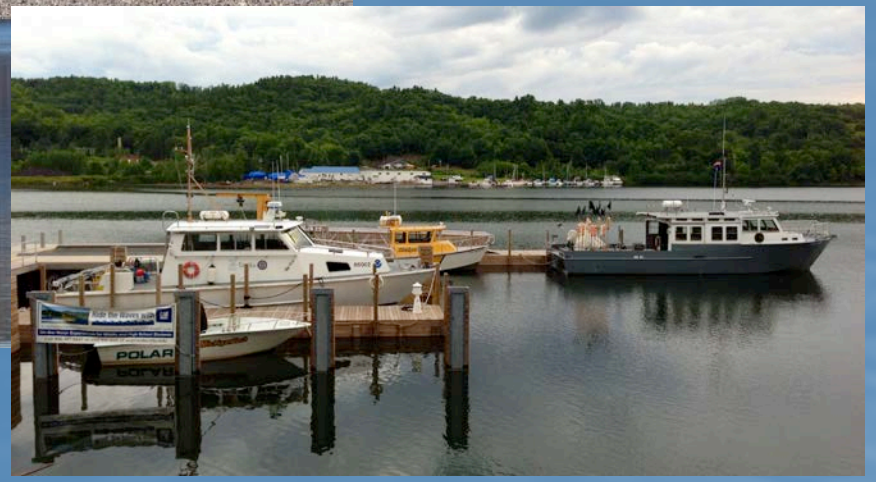
- Demonstrate how autonomous vehicles operate on Great Lakes-St. Lawrence system In our environment) via **testing/proof of concept**
- Move region forward in adoption of autonomous technologies that **enable smarter marine operations** providing **knowledge & opportunities (programming, cybersecurity)**
- Stimulate **entrepreneurial advancements** leading to efficiencies, greater stewardship, and **positive economic impacts** for Great Lakes coastal communities
- Catalyze **regional partnerships**, **leverage advancements in other commercial sectors**, (i.e. self-driving cars, unmanned aerial systems), to benefit marine environment with technology, application, workforce development

AUTONOMOUS VESSEL TEST BED REQUIREMENTS?

- **Waterfront University Campus** w/deep water docking/Test & Evaluation Center
- Real-Time Kinematic (RTK) and Virtual Reference Stations (VRS) GPS/GNSS **technology**
- Typical underwater landscapes of coastal survey areas of operation
- Access to:
  - “sandy” & “rocky” coastlines
  - **“urban” waterways** - mixed commercial and recreational traffic
  - acoustic test range
  - **“Arctic like” environments**: shore fast ice, “bergy bits,” marginal ice zones
- Ability to visualize bottom signature types
- ABET **Accredited Surveying** Engineering Program
- **Computational** Facilities (programming, cybersecurity)
- **Collaborations**: NOAA, USGS, USCOE, UofM, other universities

Michigan Technological University

Great Lakes Research Center



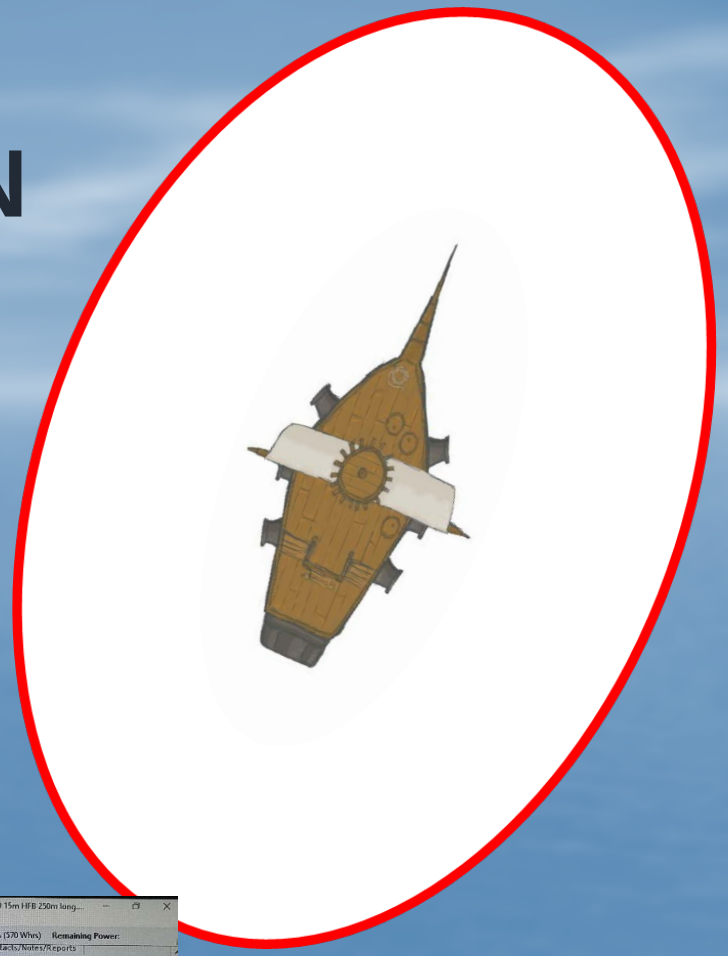
STATE TEST BED DESIGNATION

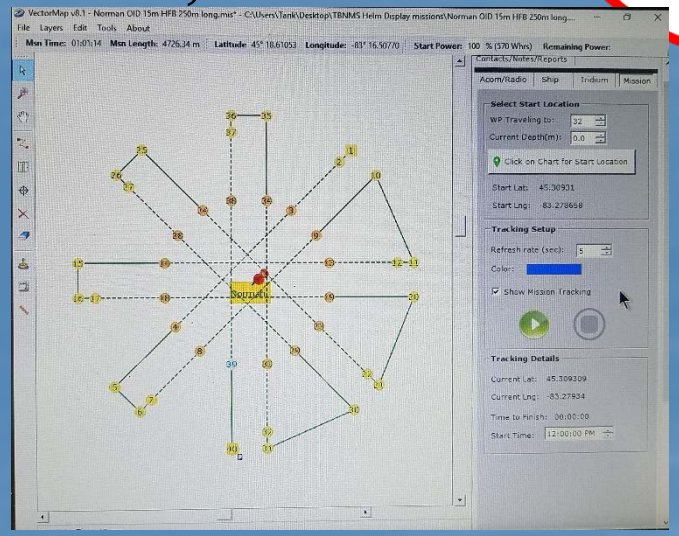
- Formal designation (Michigan Office of the Great Lakes => Michigan Technological University) - in process
  - Kick-off - August 2018
- Two years funding – May 2018
- Incorporate rules (safety zone, other) imposed by US Coast Guard
- Host entity (MTU) & community acceptance/commitment
  - staff, financial resources: support (monitoring, tracking, reporting, etc.)

MICHIGAN OFFICE OF THE GREAT LAKES

TEST BED DESIGNATION

- Coast Guard driver: Hazards to public & environment
  - Test bed by itself is **not** a hazard
  - Autonomous vehicle/vessel = potential hazard
- Vessel **safety zone** (“proximity” zone, “danger” zone)
- **Licensed mariner presence**
- **Joint testing** (collision avoidance, COLREGS, sensor fusion, human interaction)
- Navigation rules, legal issues, **harmonization** w/Transport Canada
- Training





UNITED STATES COAST GUARD
SEMPER PARATUS
1790

QUESTIONS?

Michael N. Beaulac
beaulacm@Michigan.gov
517-284-6701