

CAREER: Autonomous Underwater Power Distribution System for Continuous Operation

PI: Nina Mahmoudian, Purdue University, ninam@purdue.edu
<https://engineering.purdue.edu/Mahmoudian/>

Challenge

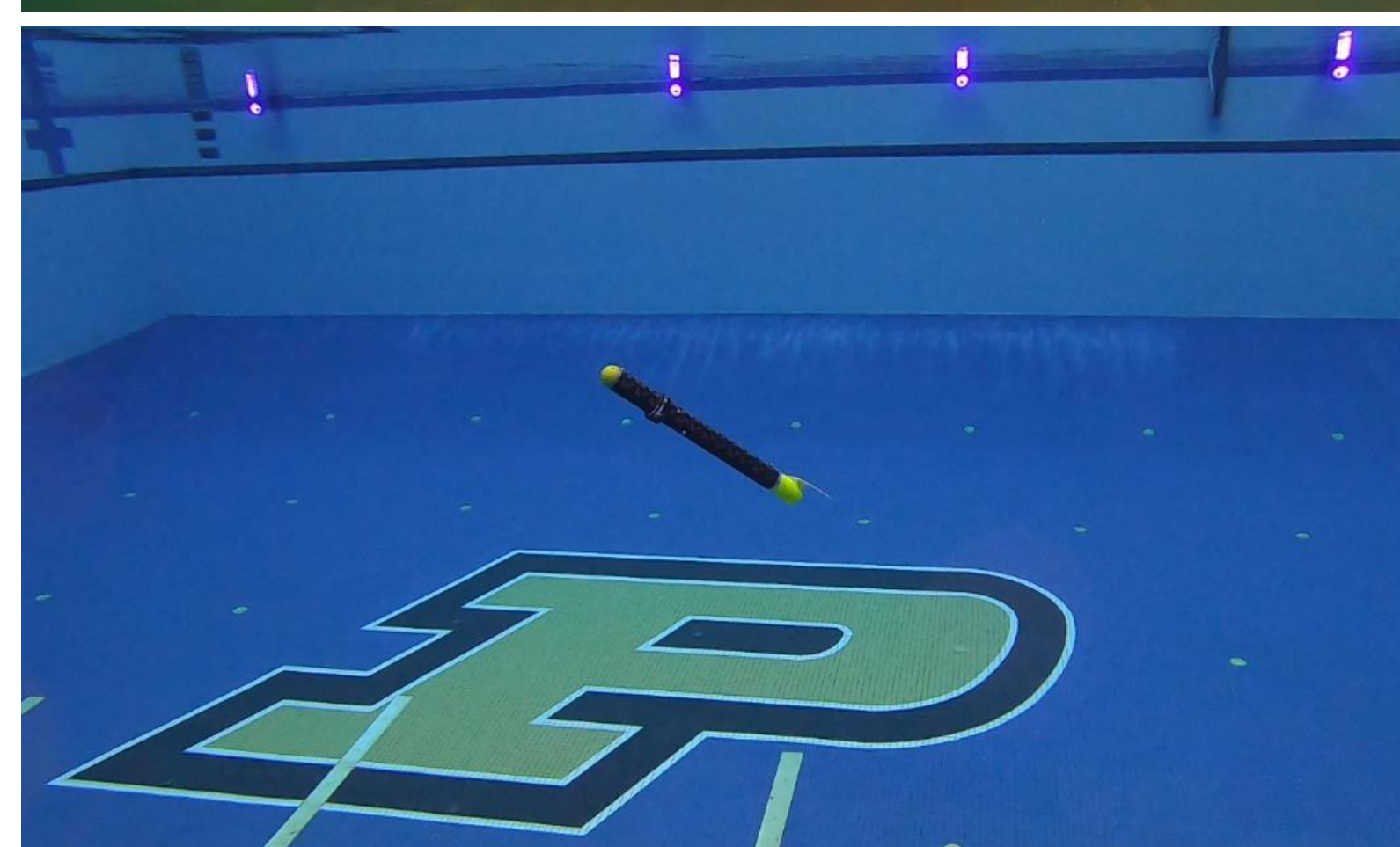
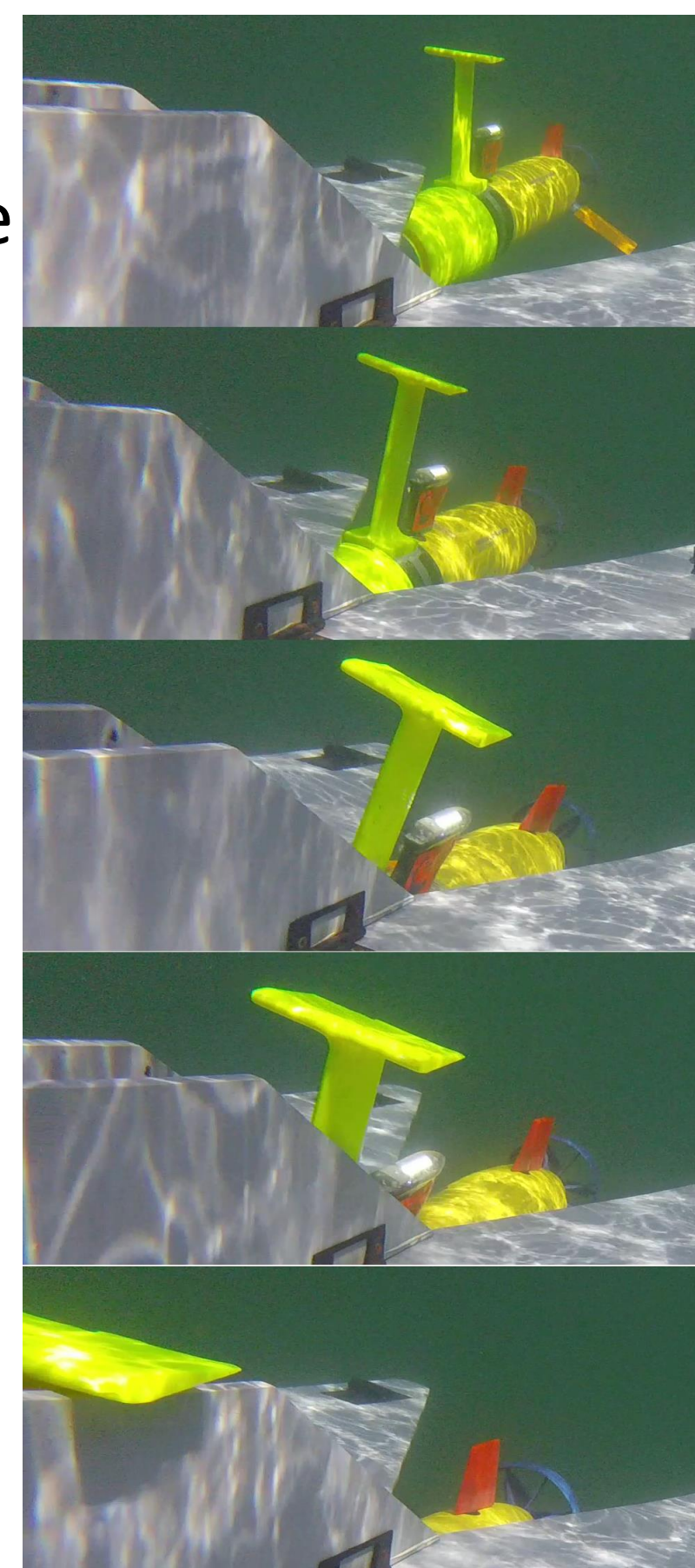
Long-term operation of mobile robots in all domains are challenged by limited battery life. The goal is to effectively respond to energy needs in the presence of dynamic conditions and environmental uncertainty.

Solution

To enable persistence, both infrastructure as well as planning and control methods need to be developed.

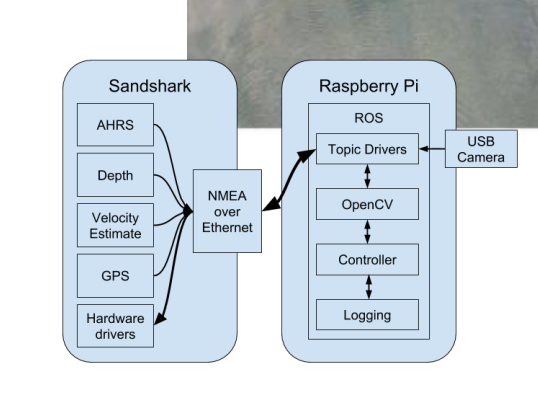
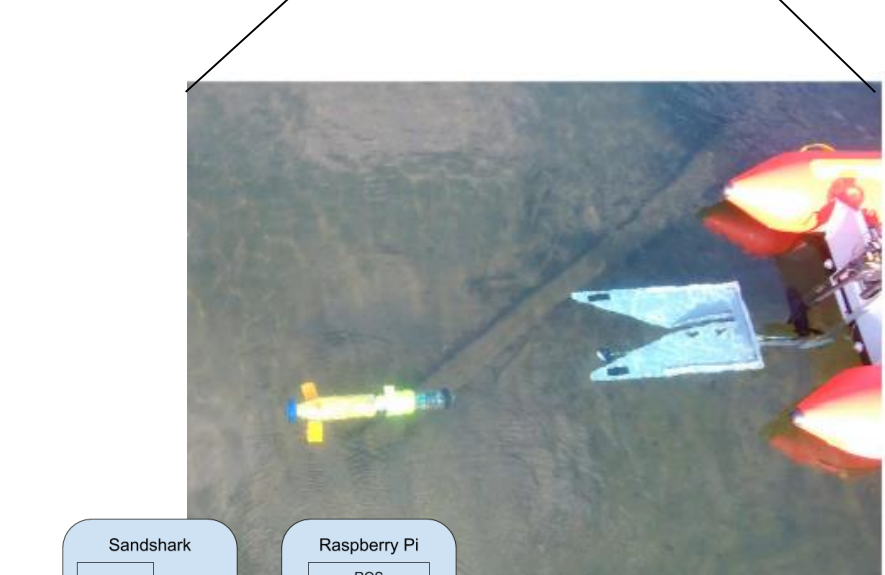
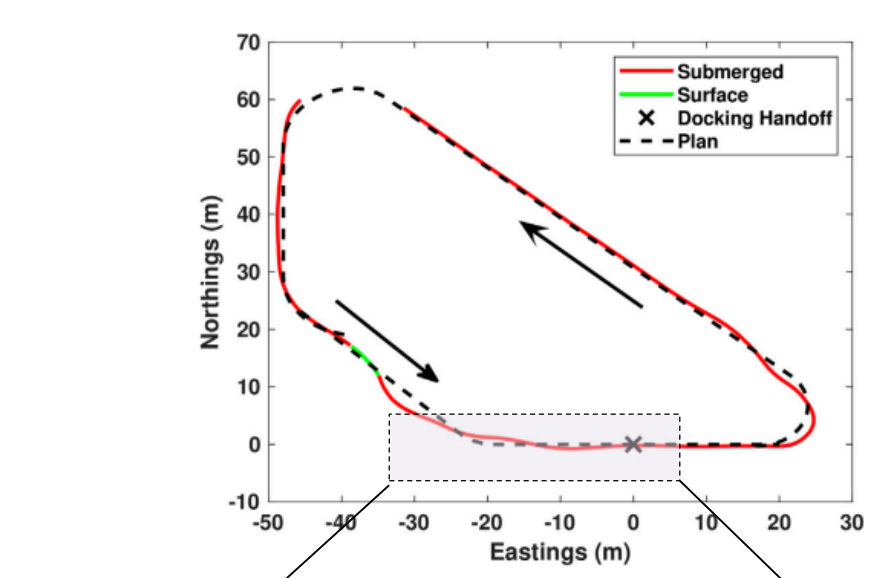
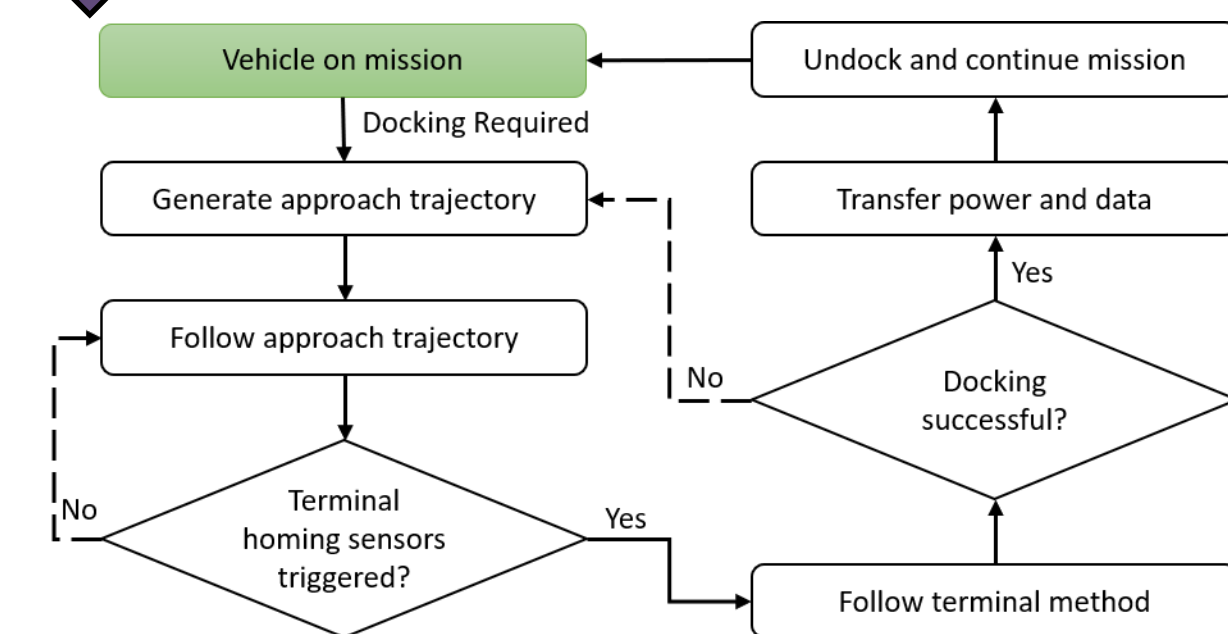
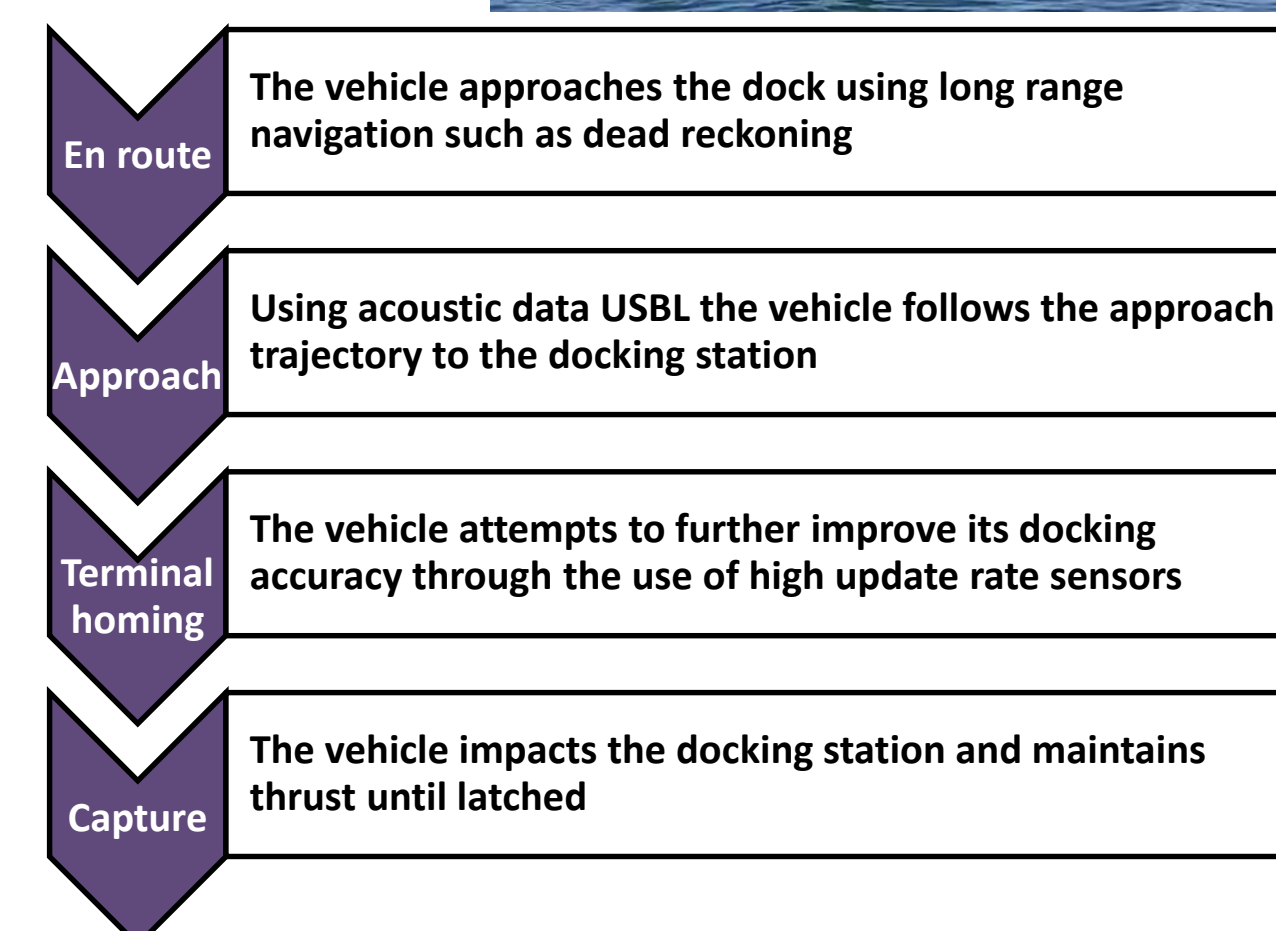
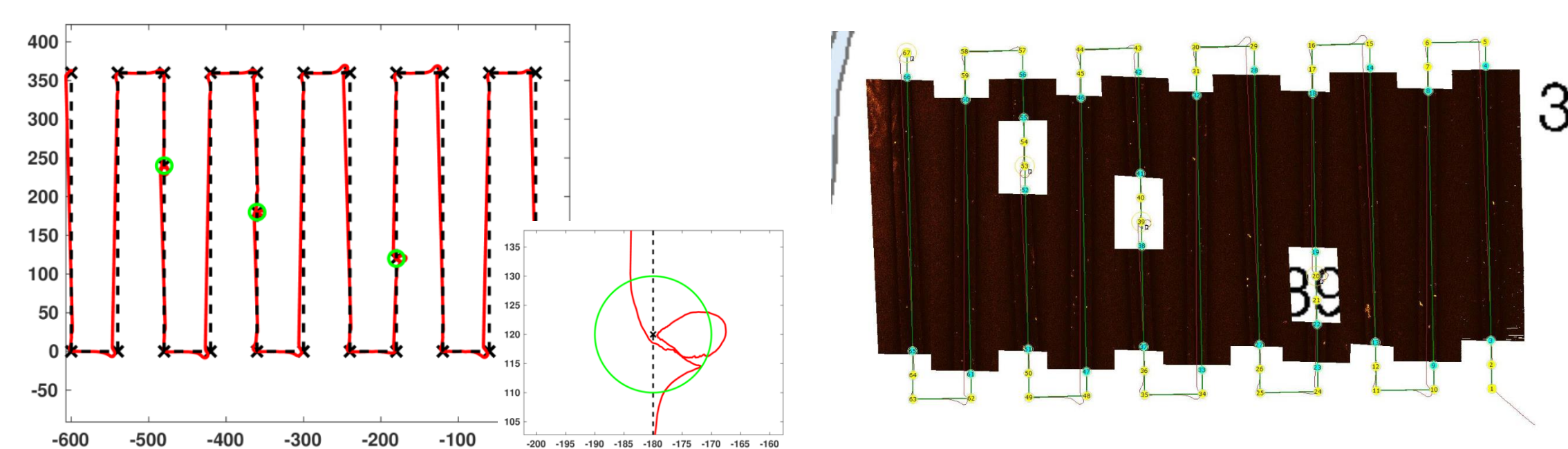
Infrastructure developments:

- ❑ Adaptable Underwater Docking Station
- ❑ Agile Underwater Glider (ROUGHIE)
- ❑ Low-cost Autonomous Surface Vehicle
- ❑ Cross-domain autonomy package



Scientific Impact

- ❑ A multi-vehicle mission planning that considers power and environmental constraints to ensure robustness of robotic network performance in long-term missions.
- ❑ Theoretical, computational, and experimental tools for universal and scalable power delivery system.
- ❑ Efficient path planning coordination strategy for performing mission tasks and mobile power delivery to ensure persistent operation.



Broader Impact

- ❑ Permanent deployment of large-scale network systems, extending the life from days to months.
- ❑ Expedited search and rescue missions with long-term operation of mobile robots.
- ❑ Developed project-based senior elective undergraduate and graduate level Autonomous Systems course and offered it to 78 undergraduates and 44 graduate students at two institutions.
- ❑ Developed professional development material for pre-college technology teachers. Offered one-day workshop for 20 teachers and week-long workshop for 4 teachers.
- ❑ Engaged 201 high school and middle school students in week-long robotics summer youth program utilizing GUPPIE including 106 female students.
- ❑ Offered one-day activity to over 2100 pre-college students through KSEF and Water Festival in Upper Peninsula Michigan.

