Collaborative Research: NRI: Ocean-Powered Robots for Autonomous Offshore Aquaculture Project Introduction and Year 1 Development

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Motivation

Offshore Aquaculture
- The fastest-growing source of animal protein since 1990
- Yields 10-100 times the fish production (compared w. inshore)
- **United States** remains a minor aquaculture producer (ranked **16th** in 2018)

Issues Identified in Offshore Aquaculture
- Labor-intensive and high-risk tasks (Cleaning; Dead fish removal)
- Offshore environment is subject to high waves and aggressive sea creatures

Limitations of Existing Technologies
- **Power Supply**: Battery or Diesel-powered at surface, limited electricity production.
- **Cleaning Performance**: high-pressure water blasting introduces waste into fish pens.
- **Dead Fish Removal by Divers**: Daily cleaning by human divers, unnecessary human danger.
- **Lack of Autonomy**: Skilled operation and careful monitoring are necessary.
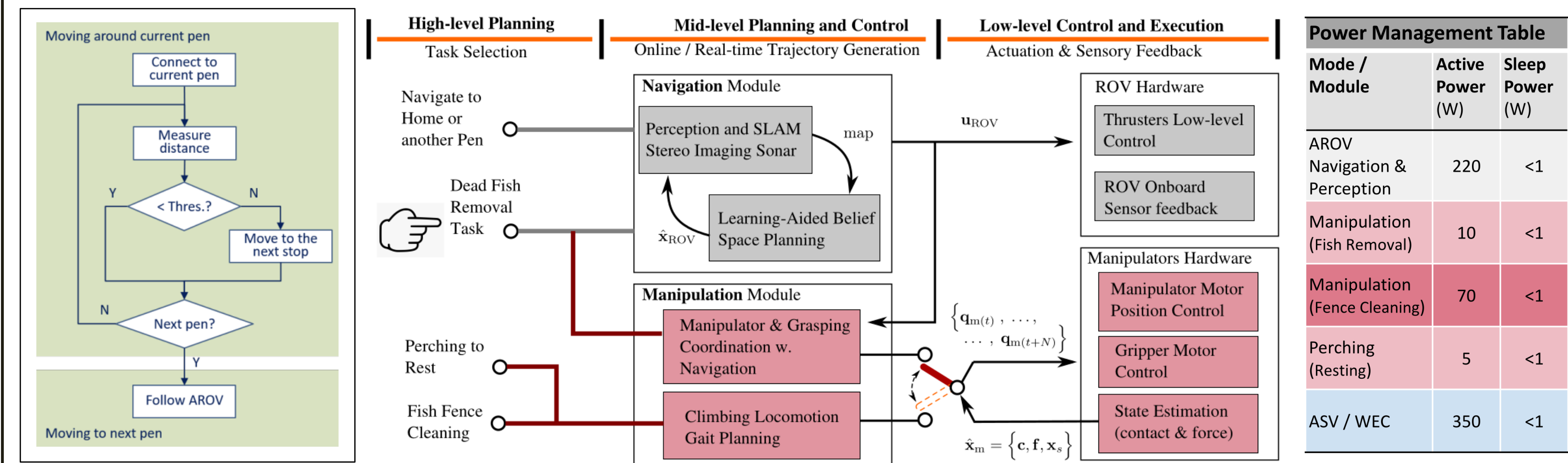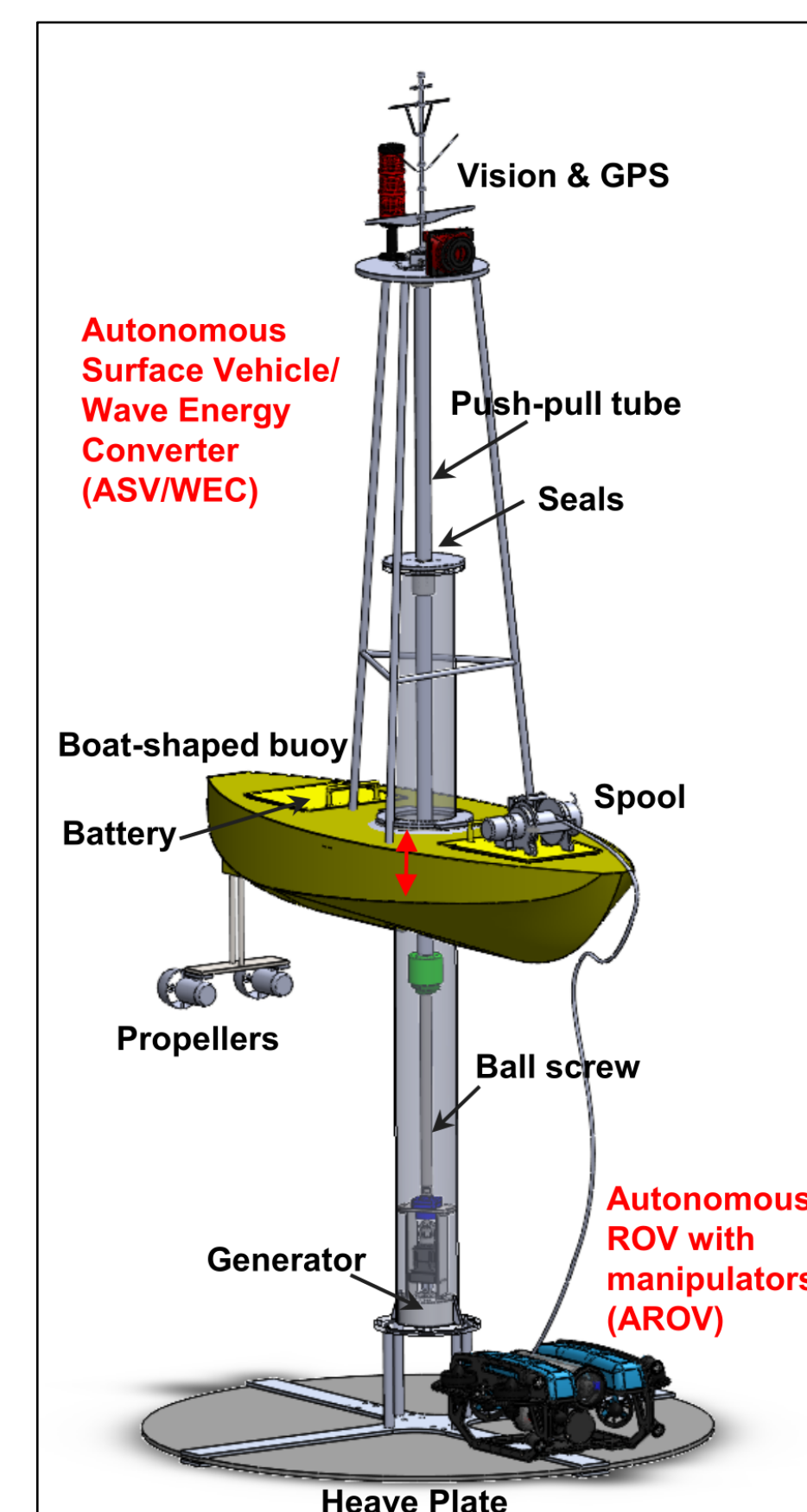
Proposed Solution
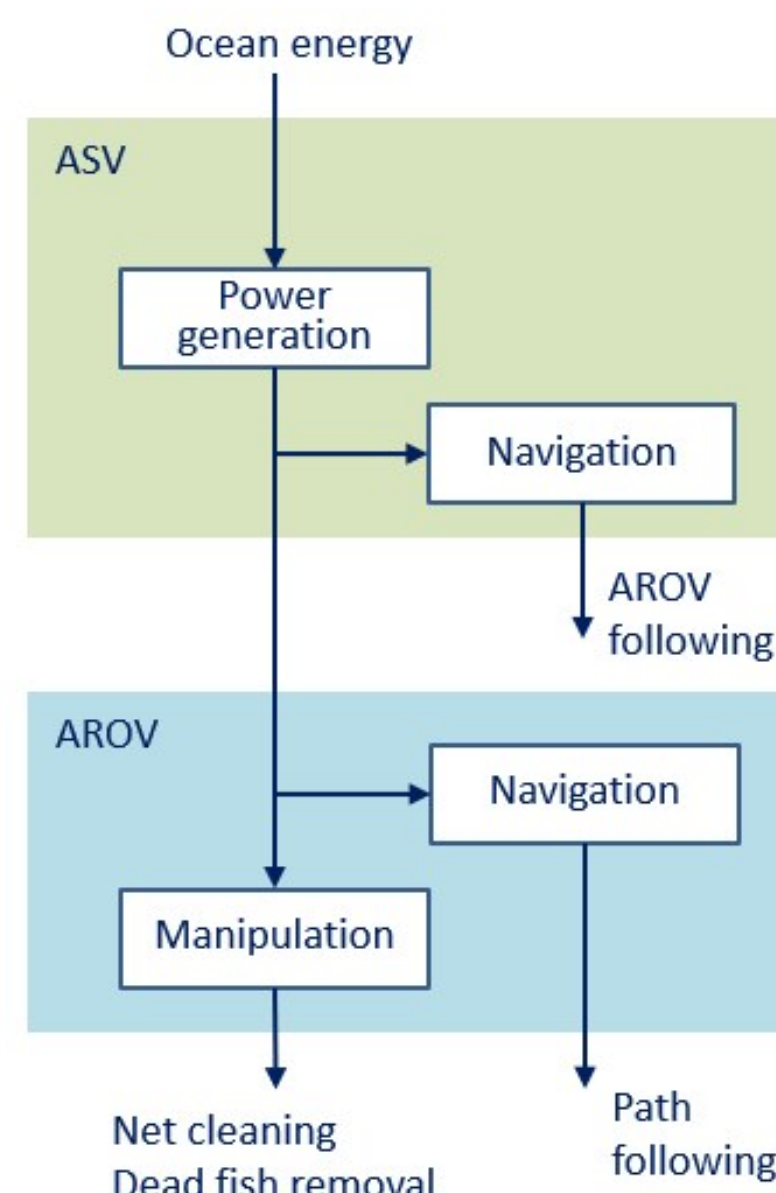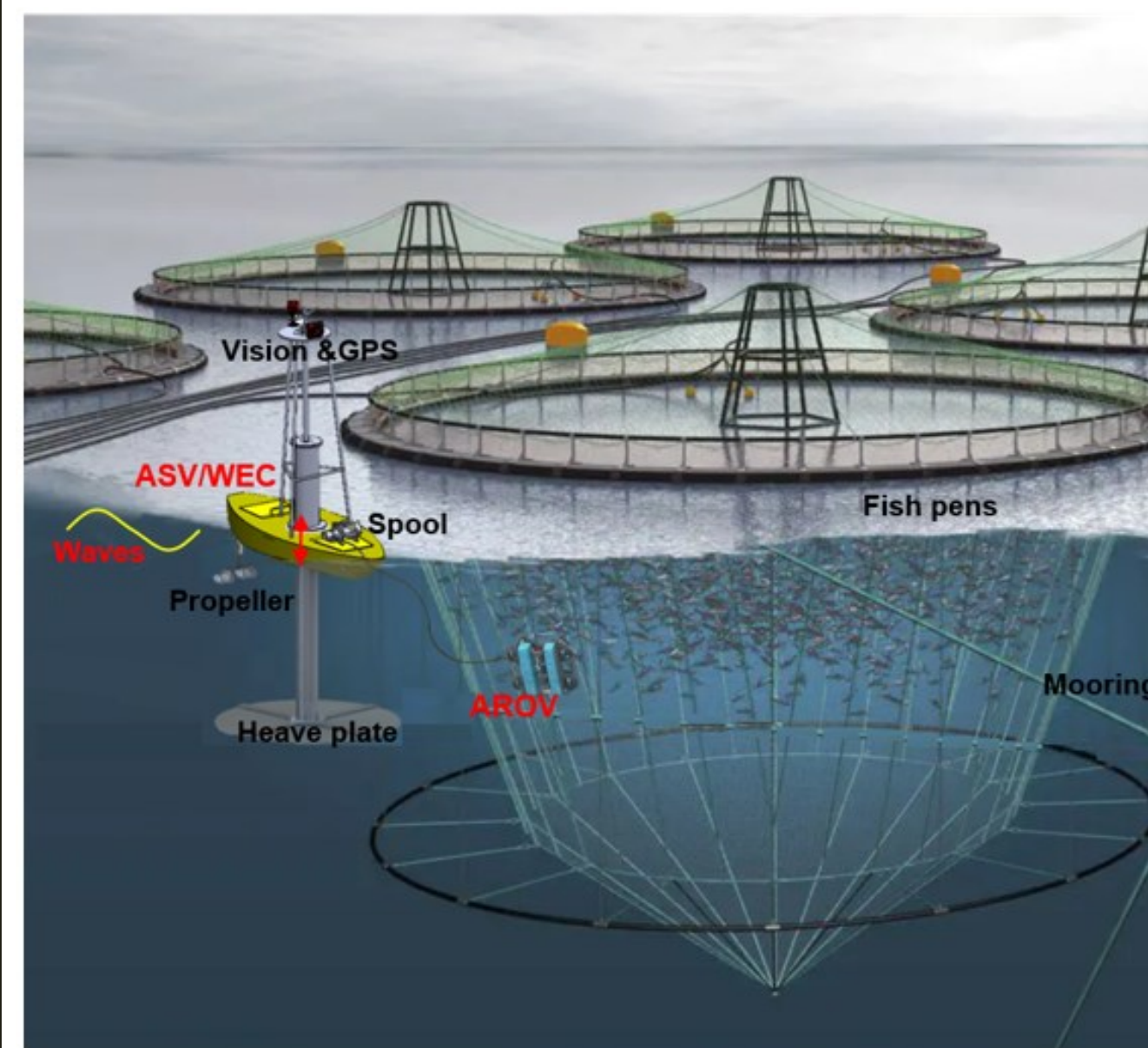
Autonomous **S**urface **V**ehicle (**ASV**) with **W**ave **E**nergy **C**onverter (**WEC**) – *Harvests energy*

Autonomous **R**emotely **O**perated **V**ehicle (**AROV**) – *Consumes energy* and does cleaning / dead fish removal.

Autonomous Surface Vehicle (ASV) & Main Task Planning / Controls

Power Management Table		
Mode / Module	Active Power (W)	Sleep Power (W)
AROV Navigation & Perception	220	<1
Manipulation (Fish Removal)	10	<1
Manipulation (Fence Cleaning)	70	<1
Perching (Resting)	5	<1
ASV / WEC	350	<1

Wave Energy Converter

Autonomous ROV (AROV)

Navigation

Manipulation

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