SOME CURRENT RESEARCH RELATED TO APPLIED ROBOTICS AND AUTOMATION FOR FISHERIES & SEAFOOD

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CENTER FOR ADVANCED FOOD TECHNOLOGY

• Joint Venture formed by combining the Food Science Departments of Washington State University and the University of Idaho

• Robotics and Automated Manufacturing Effort is a joint project of
  • CAFT
  • WSU-Everett STEM Center – ME, EE, Computer Science
  • WSU Hospitality Business Management Program
  • Federal and State Government Agencies
  • Private Sector
    • Fisheries/Seafood
    • Food Sector
    • Equipment Industry
    • Food and Refrigeration Construction
    • Electronics
    • Ocean Research
SEAFOOD - A GROWING SECTOR, BUT A DECLINING DOMESTIC WORKFORCE

• The US now imports 80% of the seafood it consumes
  • Much of this (32%) is reimported US catch that is processed overseas
• The industry continues to update its fleet & processing facilities
• Production activities expanding vertically along the value chain
• Unfortunately, the sector lacks a stable workforce
  • a condition experienced in the fisheries harvest and processing sectors of several developed economies
  • a problem shared by agriculture and aquaculture
  • younger folks choose to seek less strenuous and safer livelihoods
  • not limited to food/seafood, but industry in general
• Response is to turn to robotics and automation for processing/manufacturing
CAFT PROGRAM OBJECTIVES

• REPLACING WORKERS

• Eliminating Jobs For Which We Can Not Find Workers

• Permitting the Uneconomical to be Economical - Small Business Survival

• Making A Dangerous Catch A Little Less Dangerous

• Efficiently Employing Energy

• Supporting Sustainability
SOME BASICS

• Robotic and Automation Definition

• Food Processing will be the primary growth area for robotics in the next 10 years

• Many efforts attempt to replicate human activities
  • Often just a portion of the a manufacturing system i.e. Case Up
  • Results can be successful but often are hampered by communications incompatibility
  • Some approaches tend to force manufacturer to use only their equipment
  • Better approach is to develop common communications and use the best modules

• Our approach:
  • Approach each application from a systems approach
  • May not replicate human activities directly
  • May start with just one or two unit operations, but activities are integrated
ROBOTICS AND AUTOMATION AN ONGOING PROCESS
1968 WILD WEASEL            2019 REPLACEMENT
Seafood Processing

Yesterday,
BENEFITS OF AUTOMATED FOOD MANUFACTURING APPLICATIONS

• Improved labor efficiencies and effectiveness

• Reduces risks and opportunities for microbiological contamination and other unsafe food conditions

• Improves recoveries and therefore greater utilization of resources

• Often also results in reduced energy requirements

• Enables better traceability

• Improves overall process safety

• Key is determining how far down the value chain one should go to maximize ROI
SMALL TO MEDIUM AUTOMATED PROCESSING FACILITIES

• Permitting smaller operators and fishers to enjoy returns further down the value chain.

• Food safety considerations are not reduced

• In fact, they can exceed those of larger operations

• Freezing systems can be an integral part of this
  • Cryogenics can provide faster, simpler, and less expensive systems
  • Challenge is to economically produce cryogenics on site
ALTERNATIVE ENERGY APPLICATIONS

- Developing systems that are practical for Alaska Manufacturing Applications
  - Often multiple system types provide the most efficient sources
  - A number of systems are now practical for small scale applications
- Key to this is the development of effective energy source management
  - Working with Schweitzer Engineering Laboratories to adapt a system they developed for DOD to at-sea and on-shore processing
- Affordable plant energy leakage and facility inspections using off the shelf aerial vehicles
HARVEST TARGETING – CLEAN FISHERIES

• Developing Harvest Methods that do not capture non-targeted species

• Most systems employ mechanical devices

• We are working toward electronic or other systems that will discourage non-targeted species from even entering the net or be harvested

• Approaches include the use of Autonomous Underwater Vehicles to directly harvest species such as crab, sea cucumbers, sea urchins,
HARVEST TARGETING – CLEAN FISHERIES
SALMON EXCLUDERS

Pollock Trawl Salmon Excluders
AUTONOMOUS UNDERWATER VEHICLE (AUV)

- Surveys and accurate population determinations
- Harvest diver augmentation –
- Ghost pot and gear detection and removal
- Lost gear retrieval
- Deep Submersible Augmentation
- Key element is developing practical, broad band, wireless, underwater communications
SMALL BOAT INTEGRATED HARVEST SYSTEMS

• Reduce crew requirement
• Jig Fishing
• Trolling
• In-shore longlining
• Pot fisheries
AT-SEA PROCESSING VESSELS

• Greatest opportunity for applications of robotics and automation
• Harvest – Improving selectivity and efficiency of current systems
• Eliminating need to bring cod ends aboard the vessel
• High speed weighing and sorting
• Automated processing
  • Primary product processing
  • Freezing
  • Product traceability, identification and sorting
  • By-product utilization
• Maximizing on-board freezer holds and expediting off-loading
MARINE RESCUE SYSTEM

• Heart of the system is an affordable personal transponder

• Self Rescue – Man Overboard (MOB)
  • Envisioned to pair with robotic rescue vessel on board that will launch and come to MOB
  • MOB can then deploy an on-board raft

• Same system could be used for Air Sea Rescue
  • Individuals wearing the transponder
  • Multiple Air launched robotic rescue vessels could be launched to rescue scattered crewmembers from manned or unmanned aircraft
  • Able to function when it is unsafe for rescue swimmers
AUTONOMOUS SUPPORT VESSELS

- Aquaculture Applications
- Servicing off-shore power generating facilities
- Providing product shuttling from processing vessels to port
- Cargo shipping from manufacturing point to prime ports
QUESTIONS

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