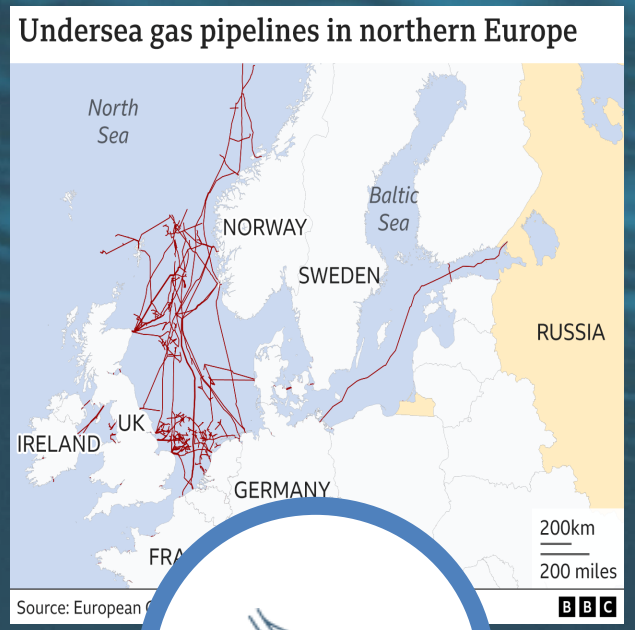
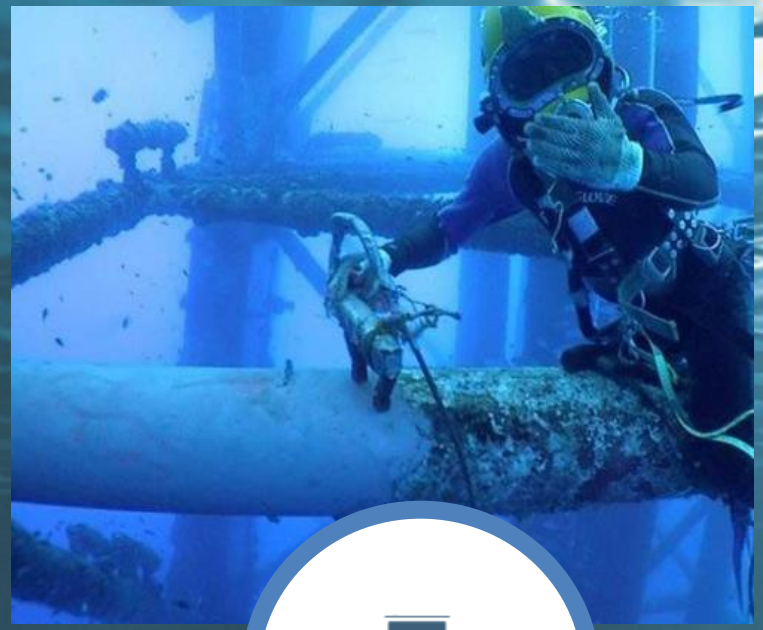
INVESTOR PRESENTATION

BRAC ROBOTICS

Biomimetic Remote Aquatic Company

Problem Outline





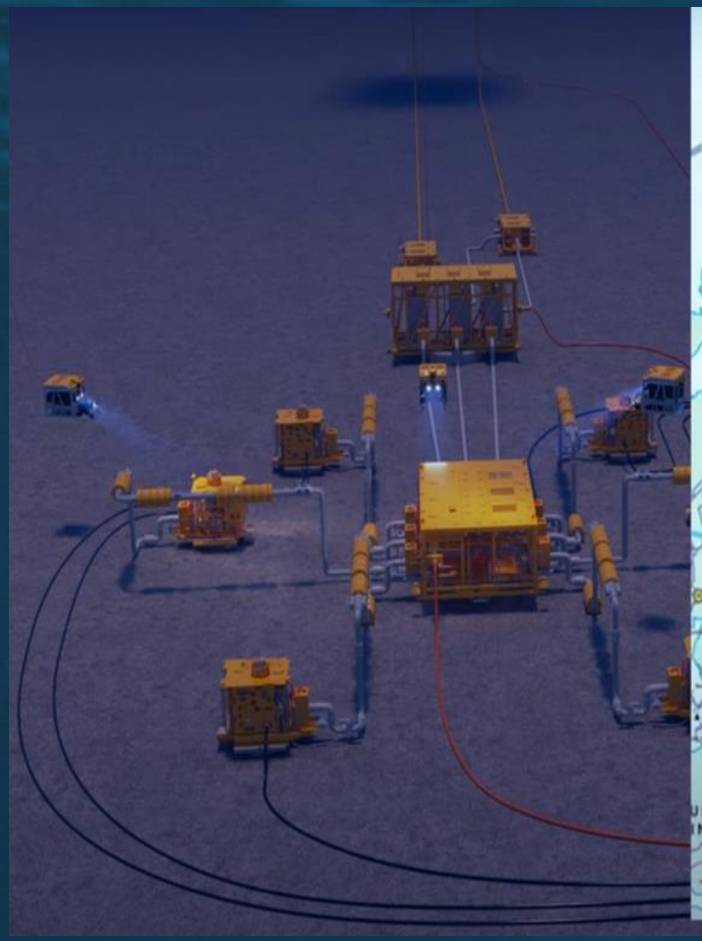
Surge in offshore energy infrastructure projects.

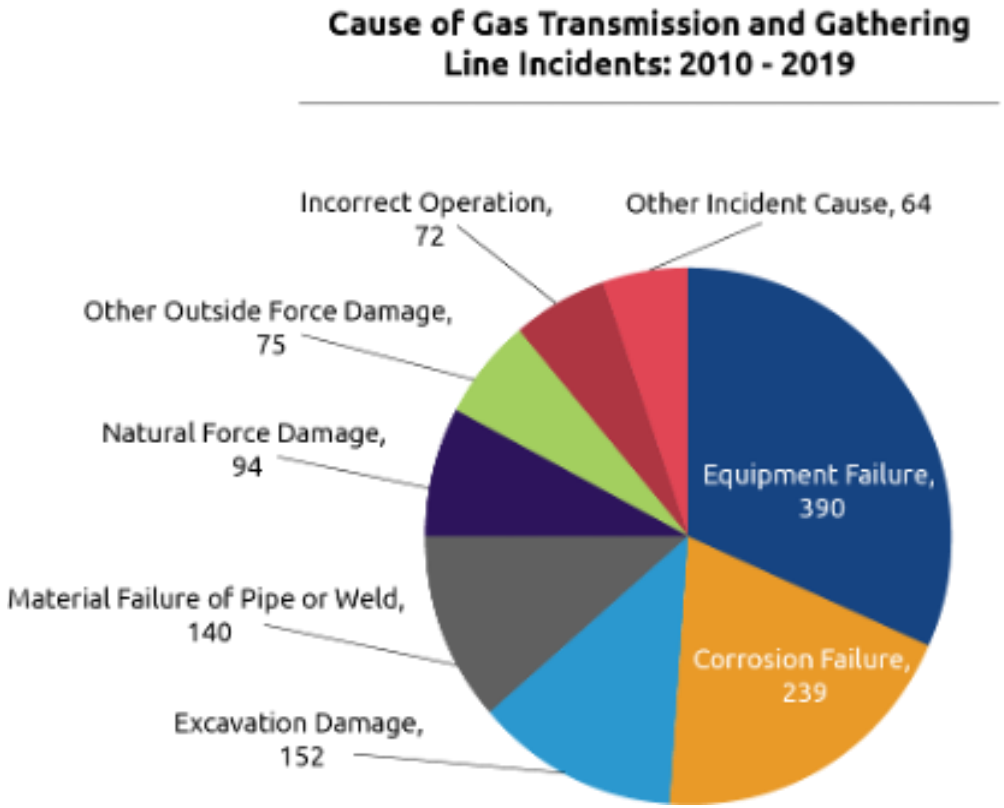
Concerns with existing risks and pipeline lifespan.

Issues such as 2022's incident of Nord Stream gas leaks.

WE NEED TO TAKE ACTION!

Problem Outline





- Numerous industrial problems are due to equipment failure, with corrosion as the second leading cause.
- The prominence of these two categories indicates a critical need for improved maintenance protocols and enhanced durability of materials used in industrial settings.

M. K. BA, 'Pipelines Continue to Catch Fire and Explode', FracTracker Alliance. Accessed: Apr. 22, 2024. [Online]. Available: https://www.fractracker.org/2020/02/pipelines-continue-to-catch-fire-and-explode/

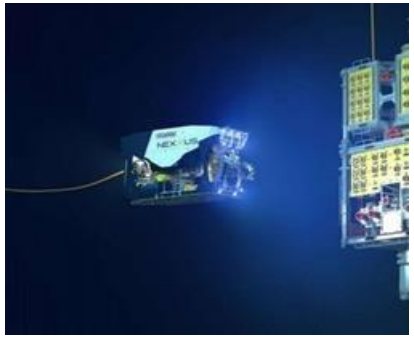
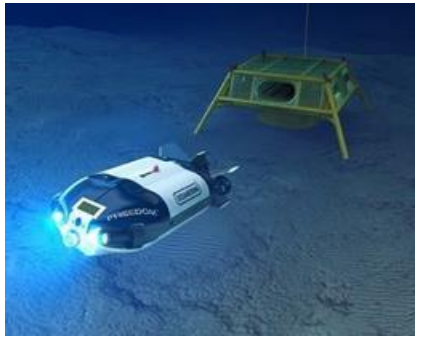
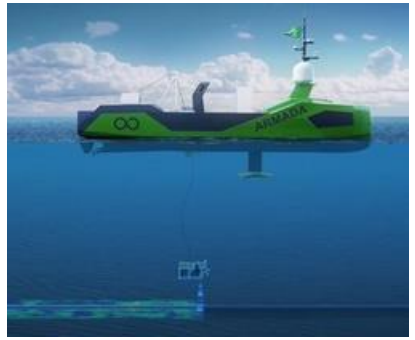
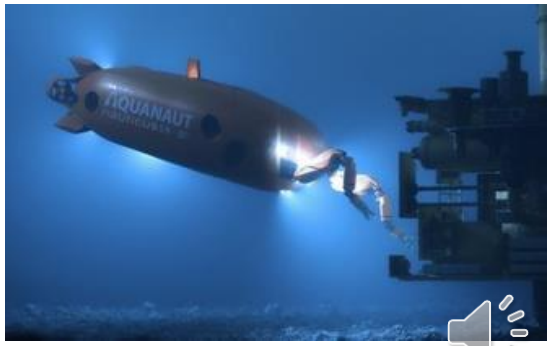
- Harsh marine environment of the North Sea accelerates the corrosion of pipeline materials.
- This degradation can lead to leaks, ruptures, and ultimately, the failure of the pipeline, creating environmental risks and threatening the supply of gas.

- Difficulty in identifying leaks is due to the vastness and complexity of the area to be monitored.
- Traditional methods, such as manned inspections and remotely operated vehicles, are costly and limited in scope and frequency.

- Difficulty in carrying out maintenance and repairs due to requirement of specialized equipment, skilled personnel, high costs and risks associated with diver-based operations.
- Causes prolonged periods between inspections and repairs.

ST-256-L
DEEPOCEAN

Competitive Landscape

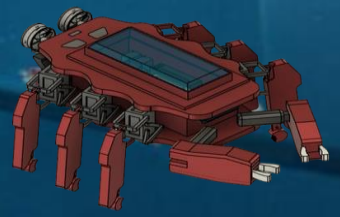
WORKCLASS ROV	SURVEY AUV	HYBRID DRONE	ASV WITH ROV	ASV WITH AQUANAUT
				
Tethered Manipulation	Non-hovering Survey	Hovering Inspection	Tethered ASV Solutions	Untethered Manipulation
				

System Overview

Krabby Dives, Safety Thrives

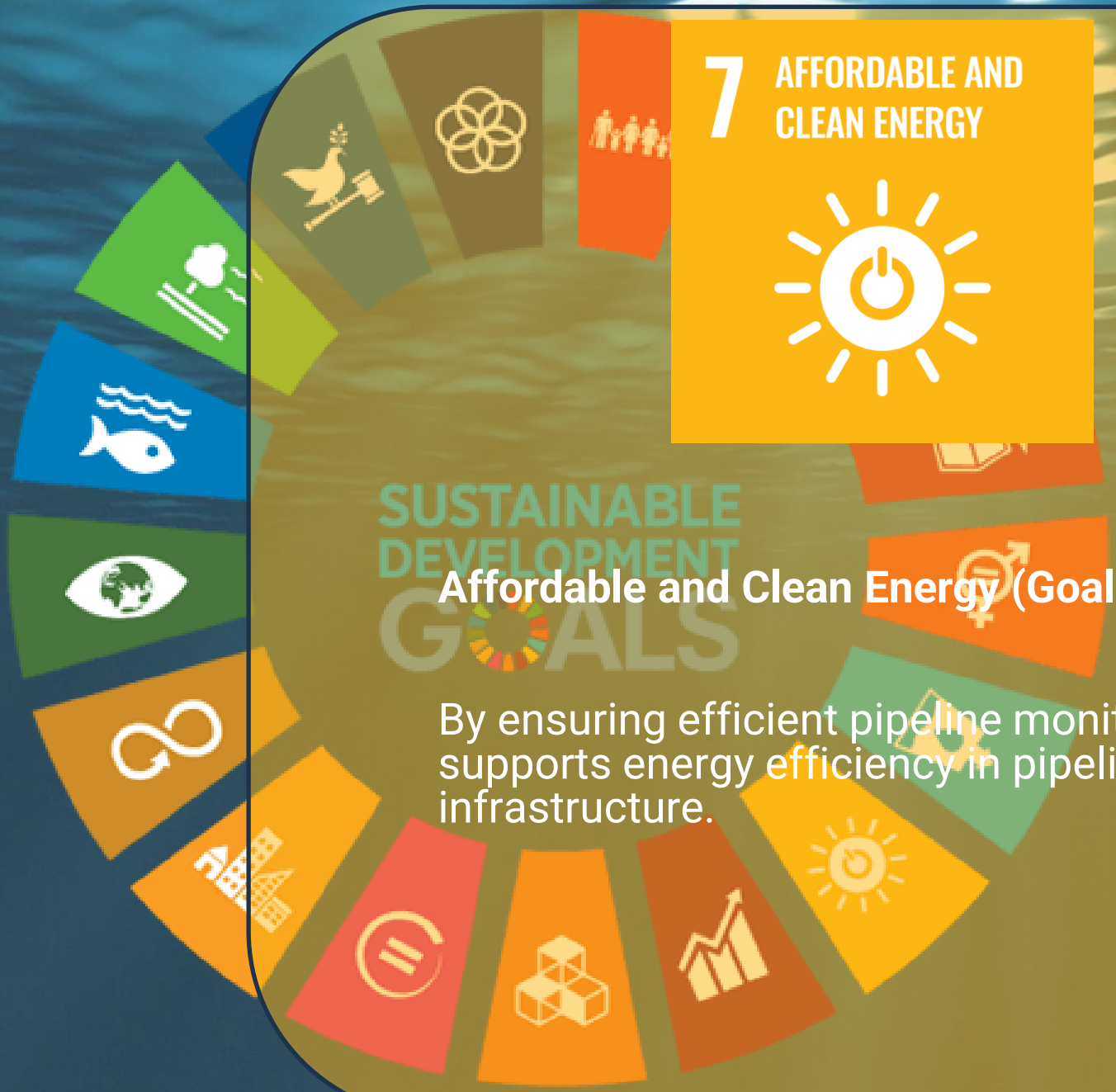
"A High-Tech Guardian for Ocean Pipes."

Beta Testing Features:



- **Lightweight & Nimble -** weighing just 20-25 kg
- **Enduring Power-**1000Wh lithium-ion battery, our robots deliver up to 10 hours of continuous, high-performance operation
- **Efficient Inspection Speeds:** each unit efficiently covers 20 miles of pipeline
- **Swift Comprehensive Coverage:** A team of 7 Krabby units can swiftly inspect a standard 200 km pipeline in under 7 hours
- **Integrated Communication Tech:** Leverages existing communication networks, utilizing an innovative sensor network for seamless data sharing

SUSTAINABLE
DEVELOPMENT
GOALS



Affordable and Clean Energy (Goal 7):

By ensuring efficient pipeline monitoring, Krabby supports energy efficiency in pipeline infrastructure.

Decent Work and Economic Growth (Goal 8):

By enhancing safety and preventing oil spills, Krabby promotes economic growth and decent work.

Industry, Innovation, and Infrastructure (Goal 9):

Krabby's innovative robotics solutions contribute to infrastructure development and advance underwater maintenance efforts

Responsible Consumption and Production (Goal 12):

The early detection of leaks enables actions to be taken promptly minimising resource wastage and environmental damage therefore allowing responsible consumption and production.

Climate Action (Goal 13):

Oil spill prevention supports climate action efforts through maintaining biodiversity and sustainability of natural habitats.

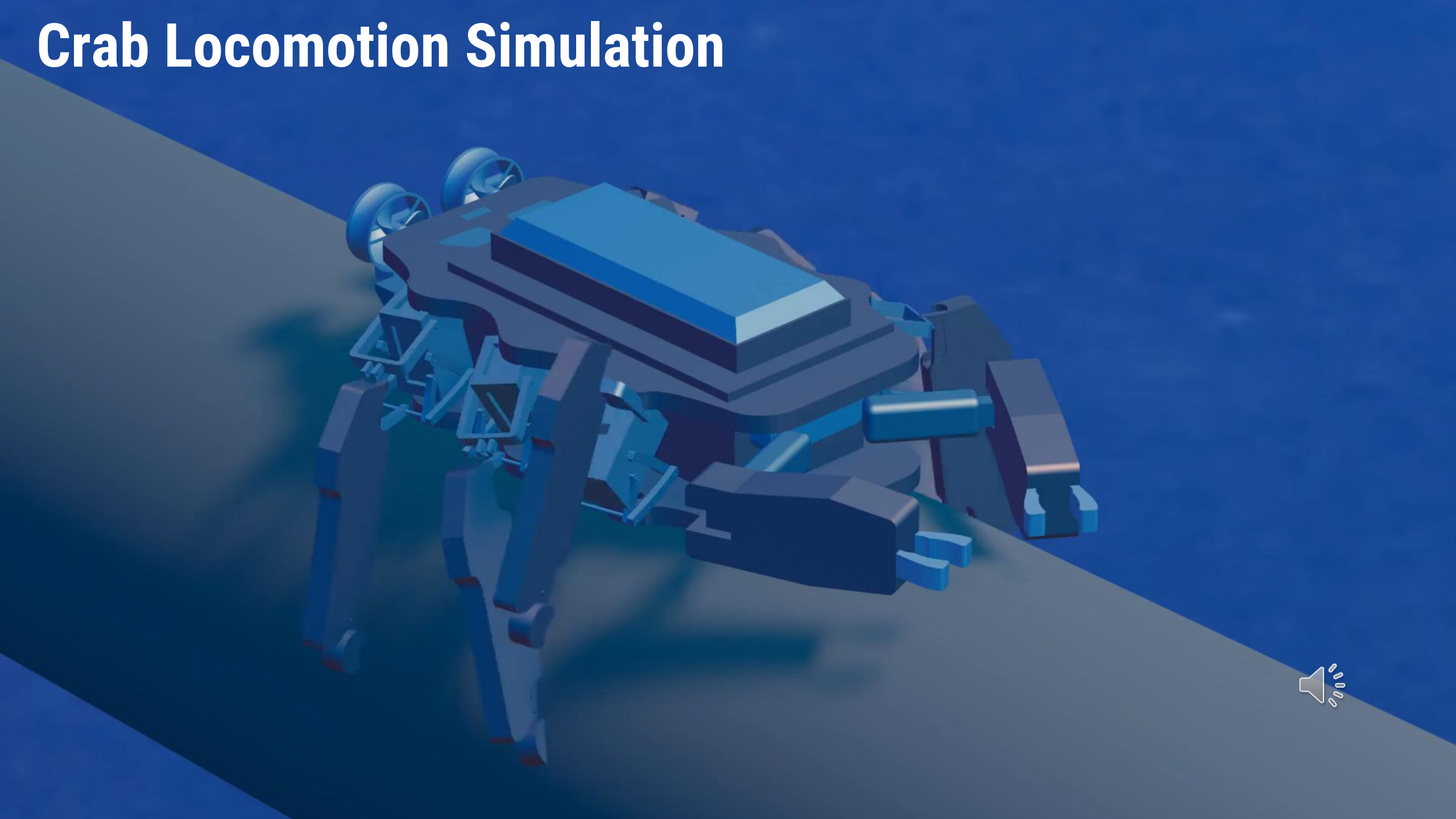
Life Below Water (Goal 14):

The monitoring of underwater infrastructure helps to safeguard marine ecosystems by ensuring the integrity of pipelines, cables, and other submerged structures.

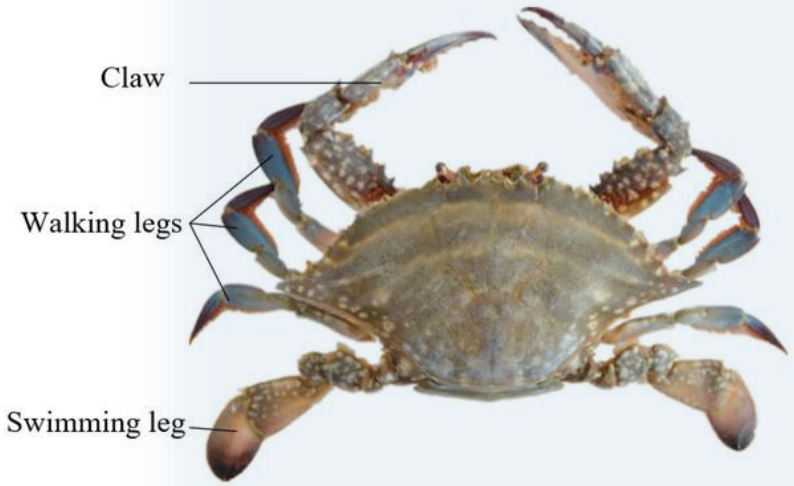
Partnerships for the Goals (Goal 17):

Partnerships for sustainable energy development are facilitated by collaborating with industry stakeholders to address pipeline maintenance challenges, promoting safety and environmental protection.

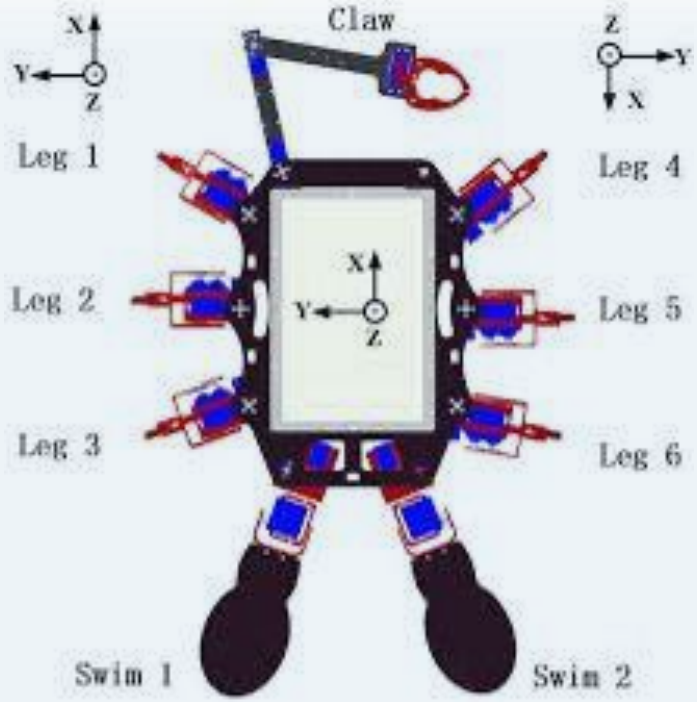
Crab Locomotion Simulation



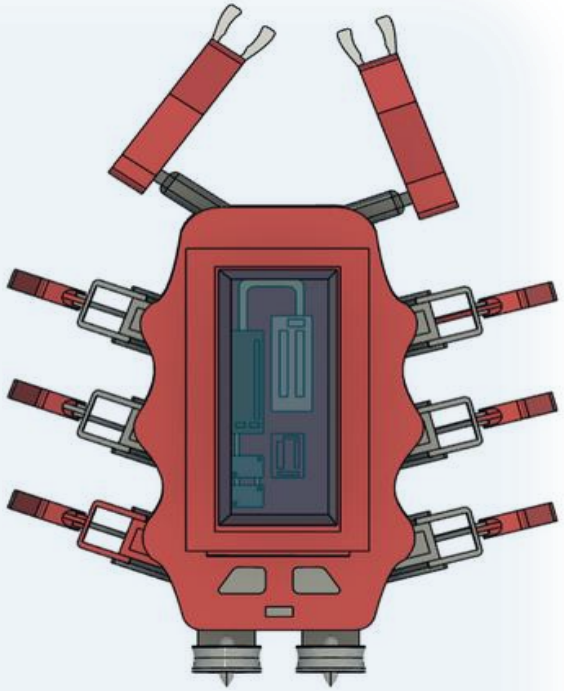
Bio- Inspired Morphological Development



Real Life crab locomotion



Crab Inspired Design Concept

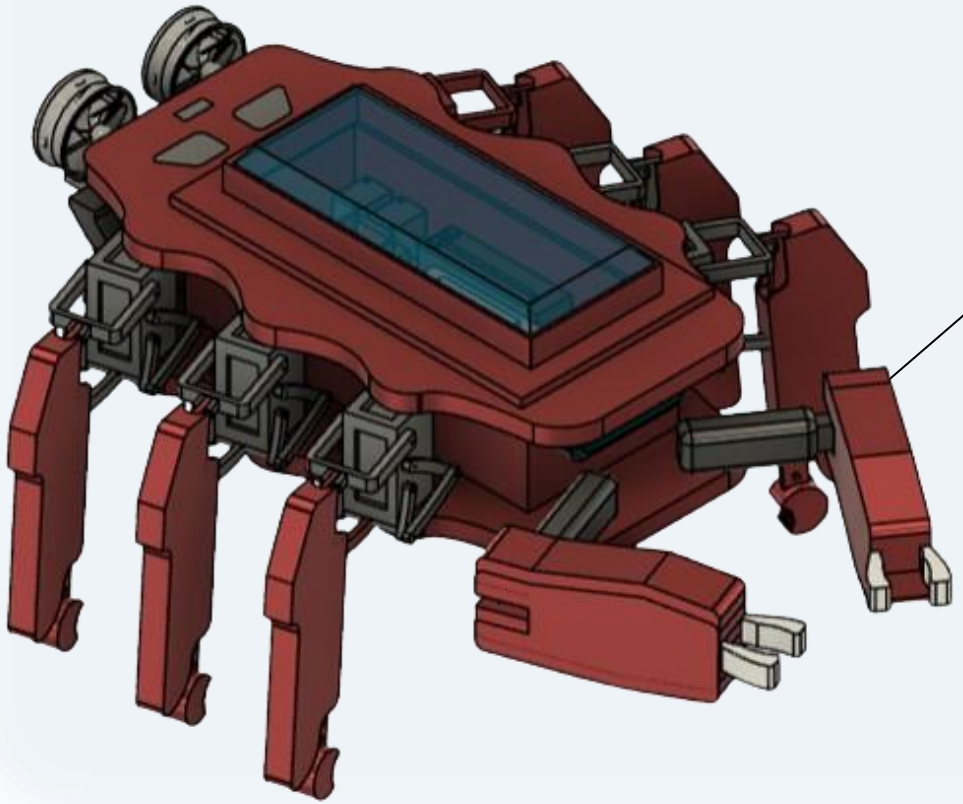


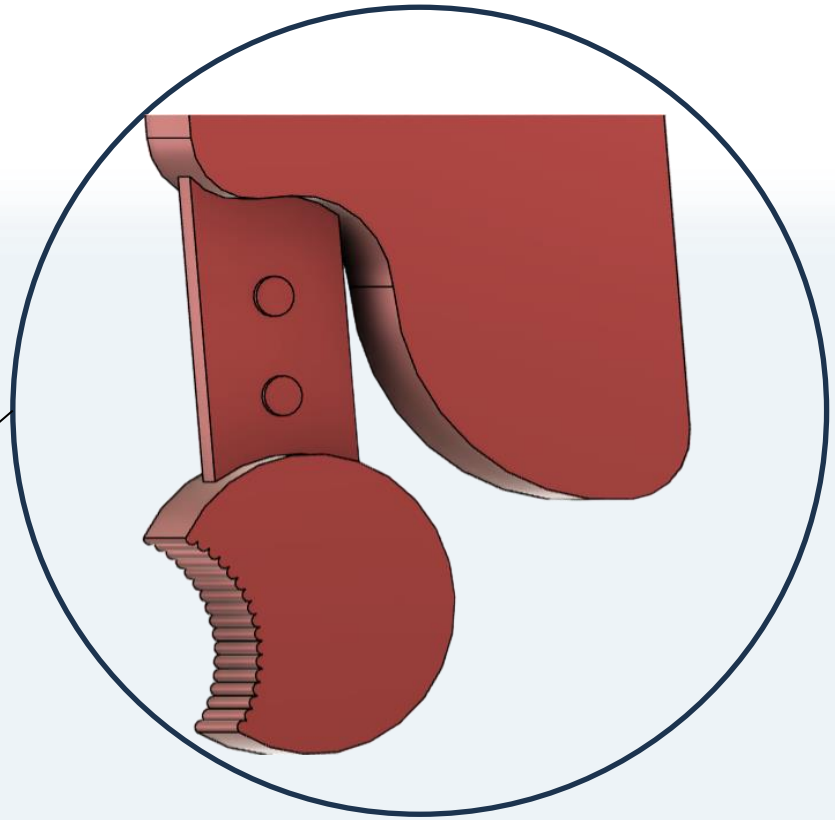
Prototype CAD model

1 — 2 — 3

X. Chen *et al.*, ‘Study on the Design and Experimental Research on a Bionic Crab Robot with Amphibious Multi-Modal Movement’, *Journal of Marine Science and Engineering*, vol. 10, no. 12, Art. no. 12, Dec. 2022, doi: 10.3390/jmse10121804.

Physical Capabilities of Krabby

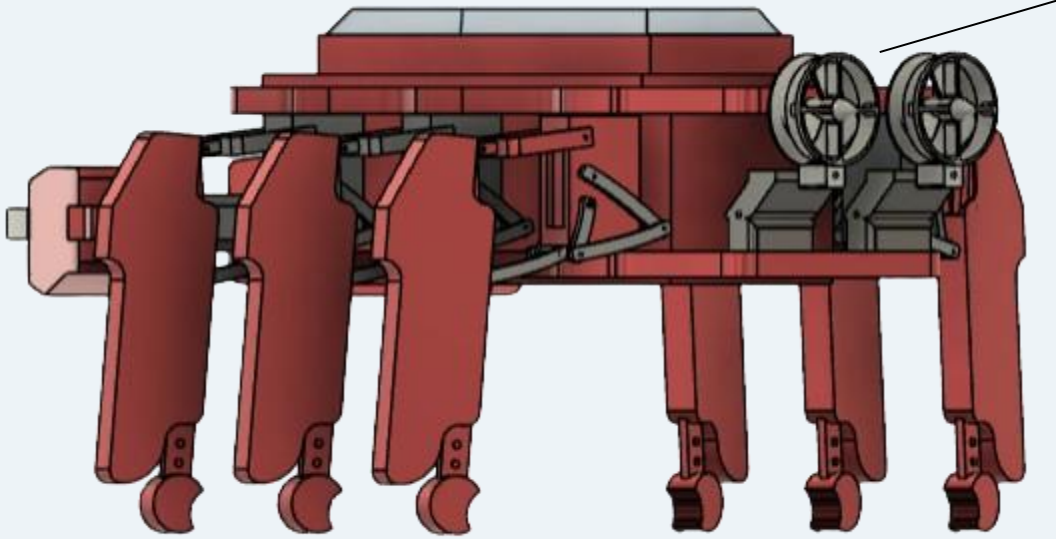


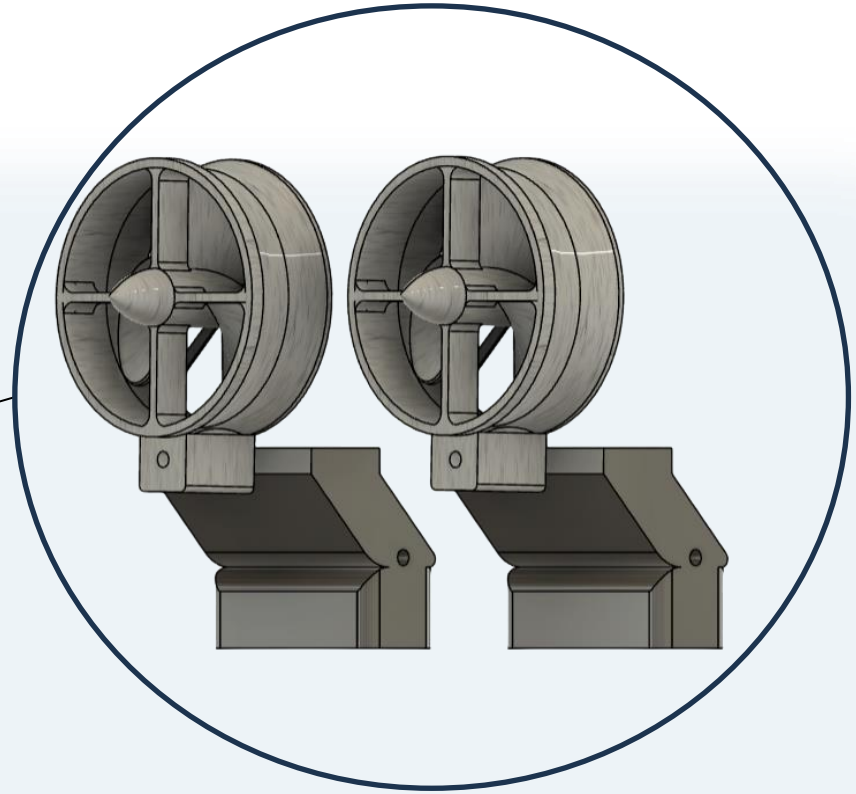


Gripper design:

- **Conformal Contact:** The gripper's rounded shape ensures optimal contact with any sized cylindrical pipes, maximizing grip strength.
- **Increased Friction:** The concentric ridges enhance surface area and friction, reducing slippage on smooth / slippery underwater pipes.

Physical Capabilities of Krabby

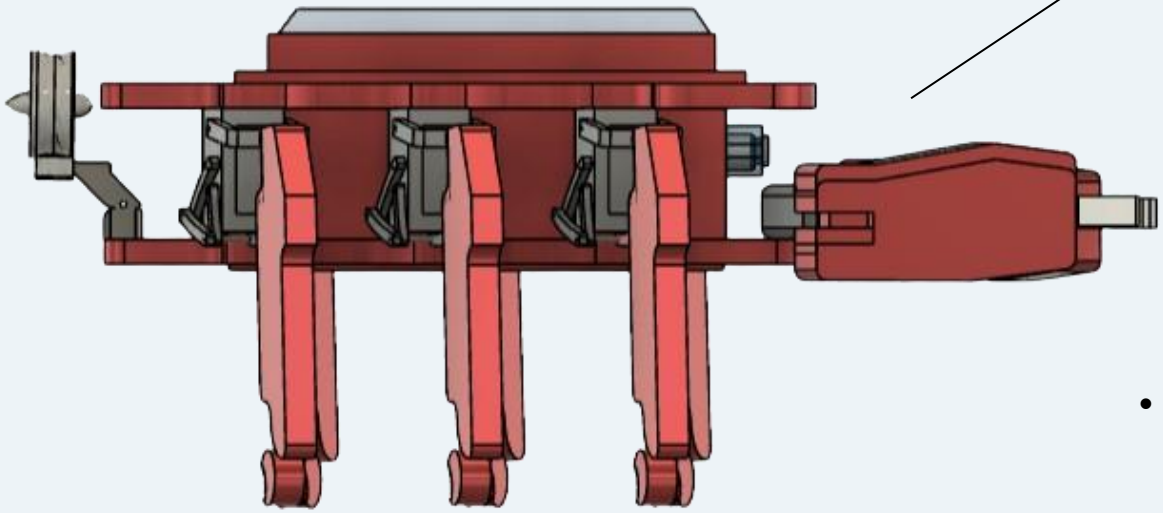


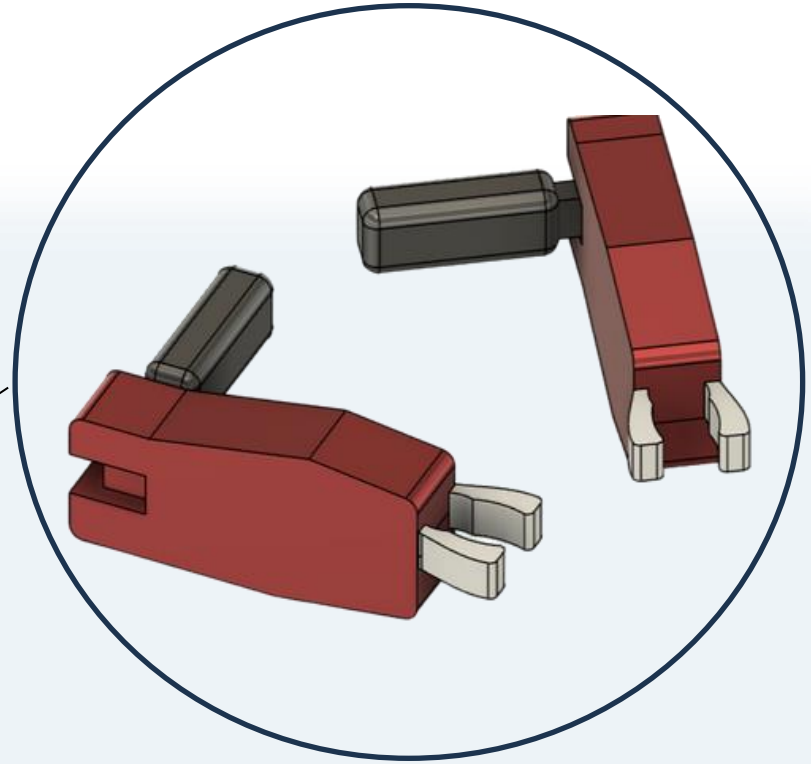


Propellor design:

- **Position Recovery:** The pan-tilt design enables the robot to return to its position on the pipe if obstructed or falls off.
- **Stability:** The propellors can add additional stability in the face of strong underwater current.

Physical Capabilities of Krabby

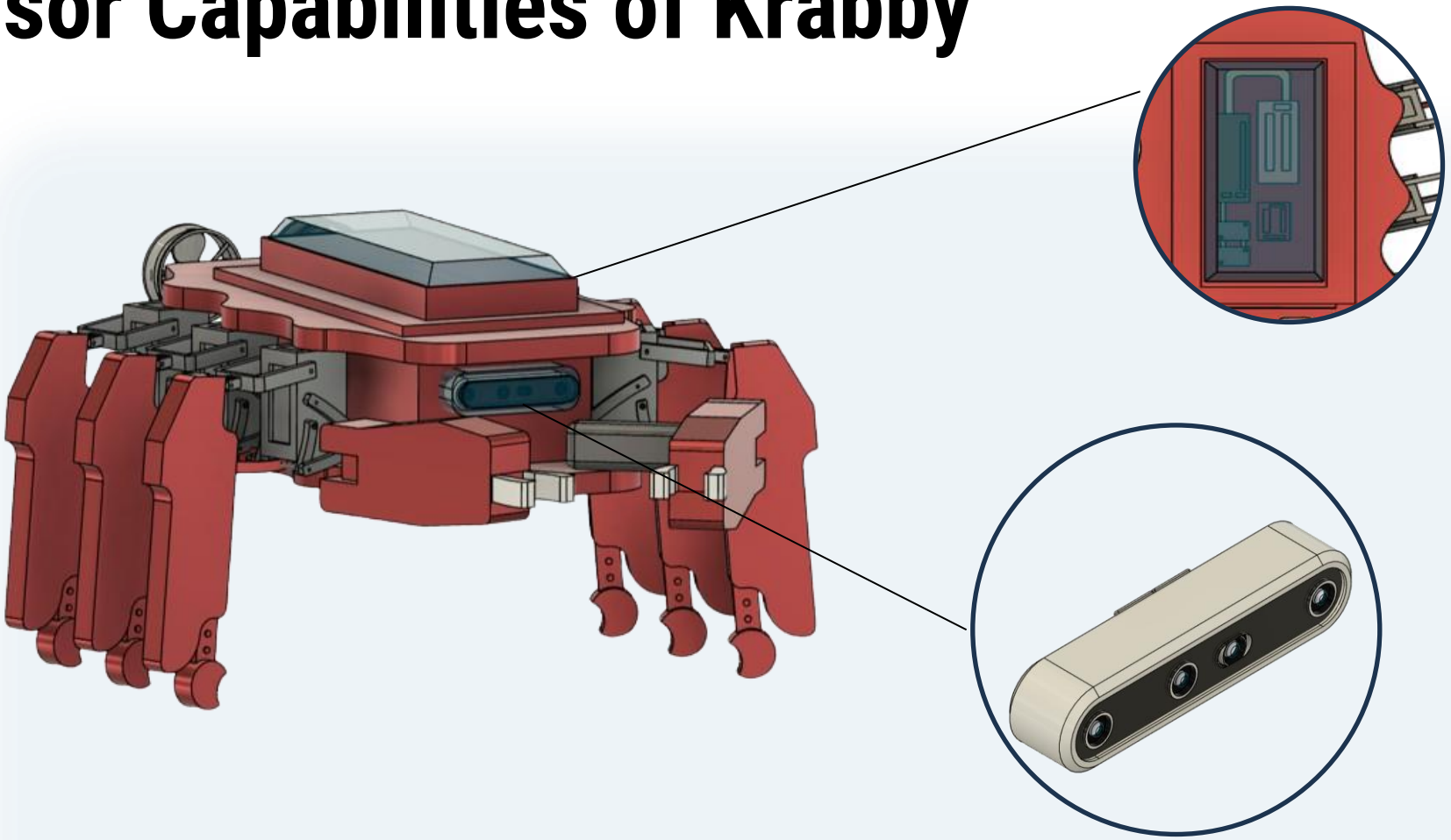




Arms

- **Rotational Joints:** Rotational freedom enables versatile and precise operation on the pipes.
- **Controlled Actuation:** The precision actuation mechanism, likely hydraulically or servo-powered, enables the robot to adjust grip strength for secure pipe operation without damage.

Sensor Capabilities of Krabby

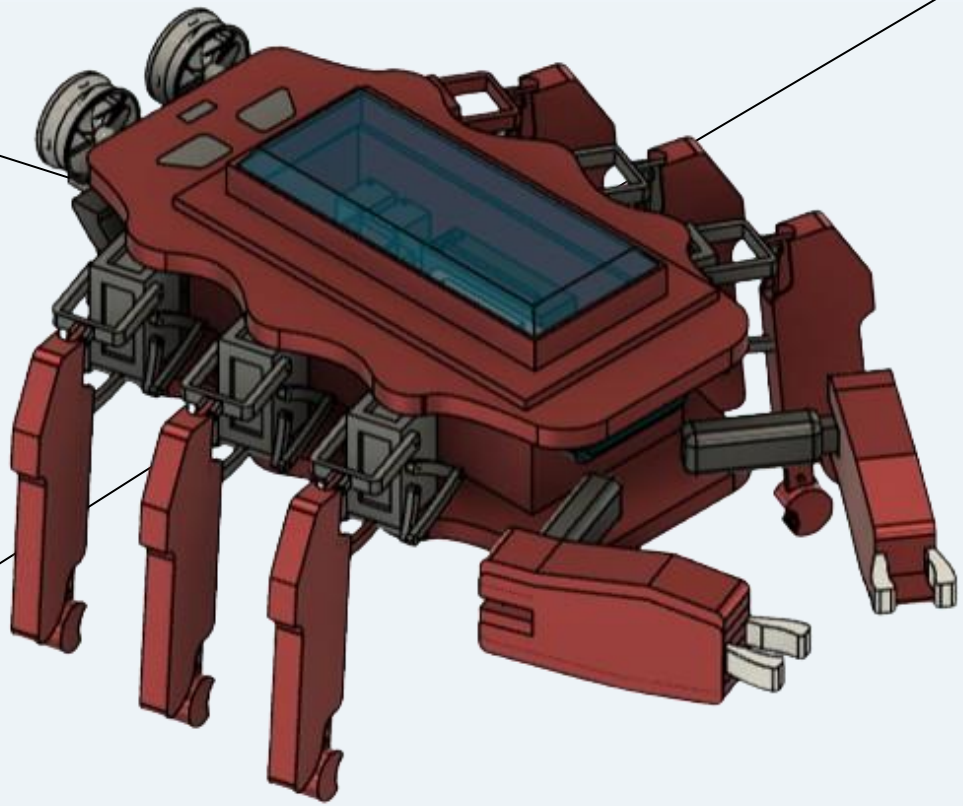


- **Electronic components** including wireless receiver, battery, voltage regulators etc.

- **3D Depth Cameras:** Provide high-resolution, three-dimensional images of the pipeline, enabling detailed structural analysis and anomaly detection.

Sensor Capabilities of Krabby

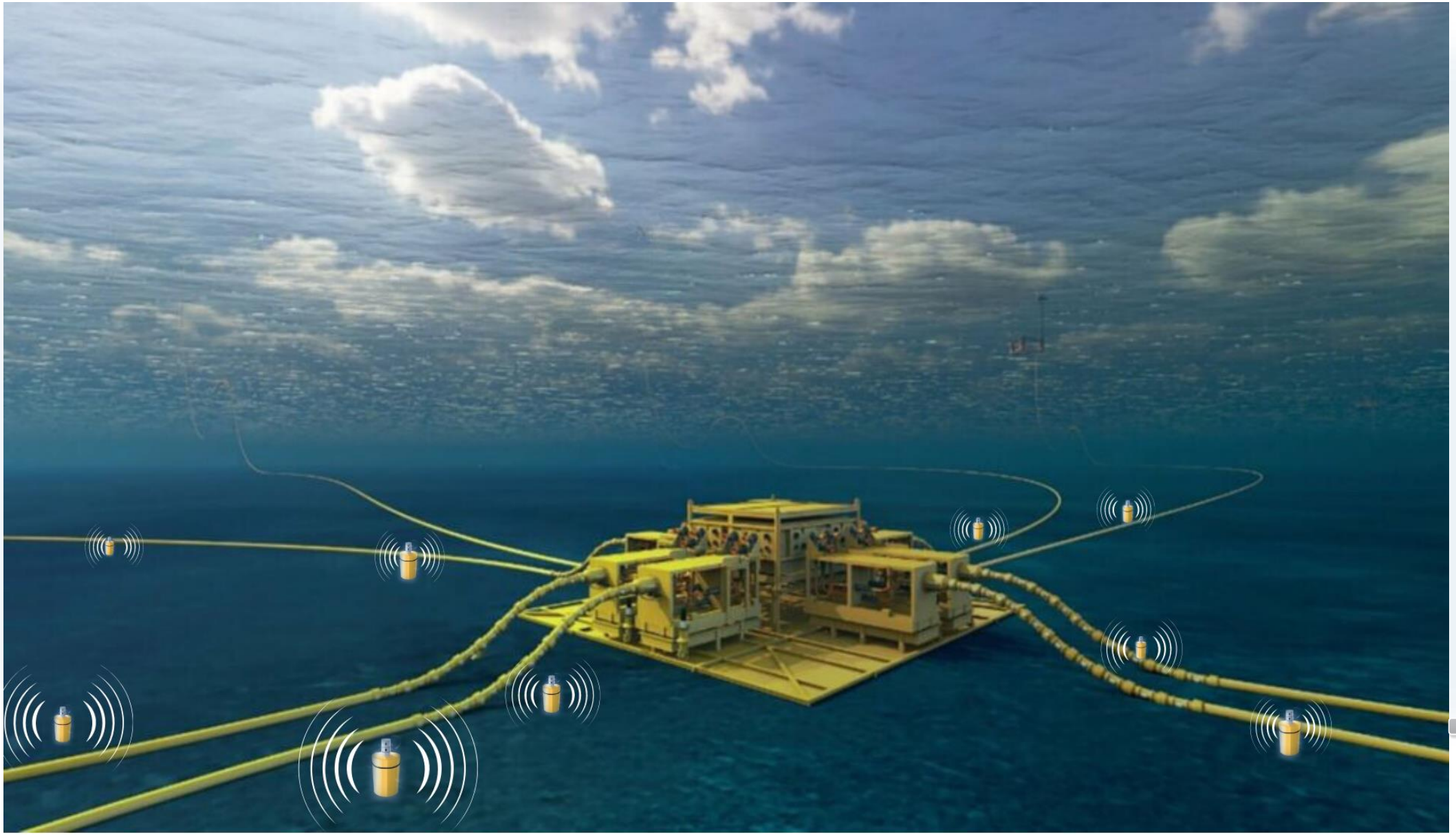
- **Cathodic Protection Probes:** Monitor the effectiveness of cathodic protection systems in preventing corrosion.
- **Electrochemical Sensors:** Detect changes in water chemistry that can indicate corrosion, especially for metal pipelines.



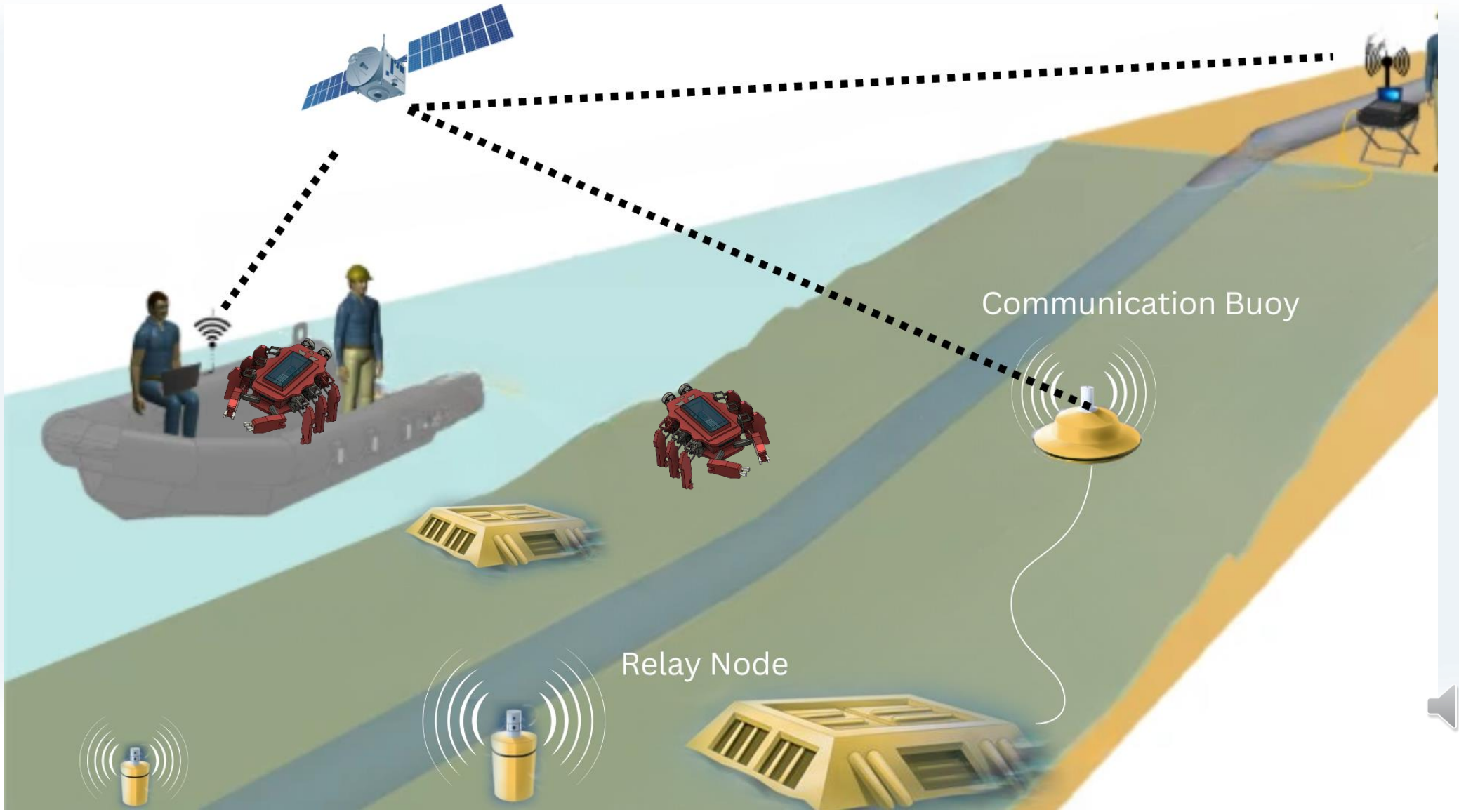
- **Ultrasonic Sensors:** Measure the thickness of pipeline walls to detect thinning due to corrosion.

- **Acoustic Emission Sensors:** Listen for the high-frequency sounds emitted by materials under stress, which can indicate crack propagation due to corrosion

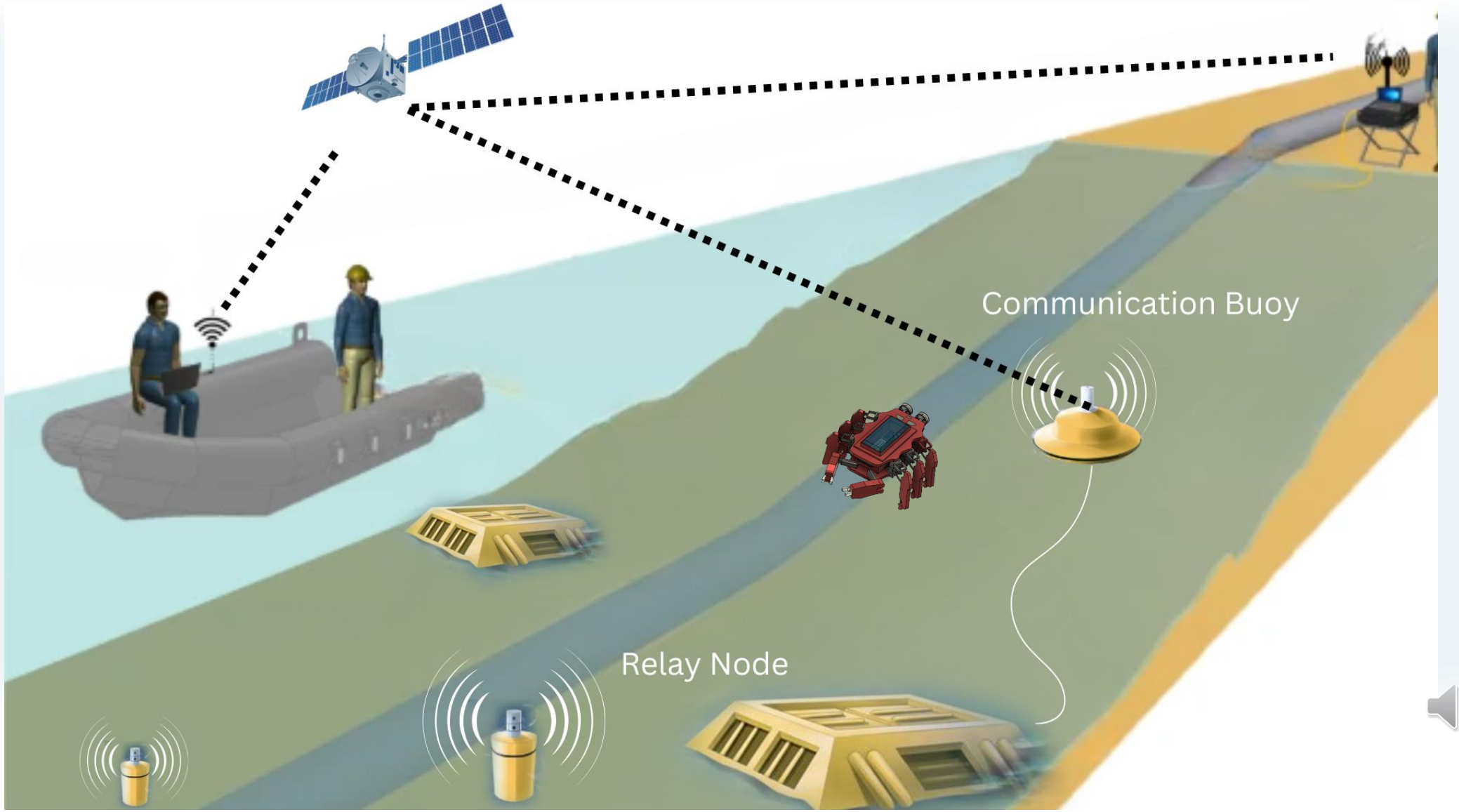
Deployment and Beta Testing Strategies



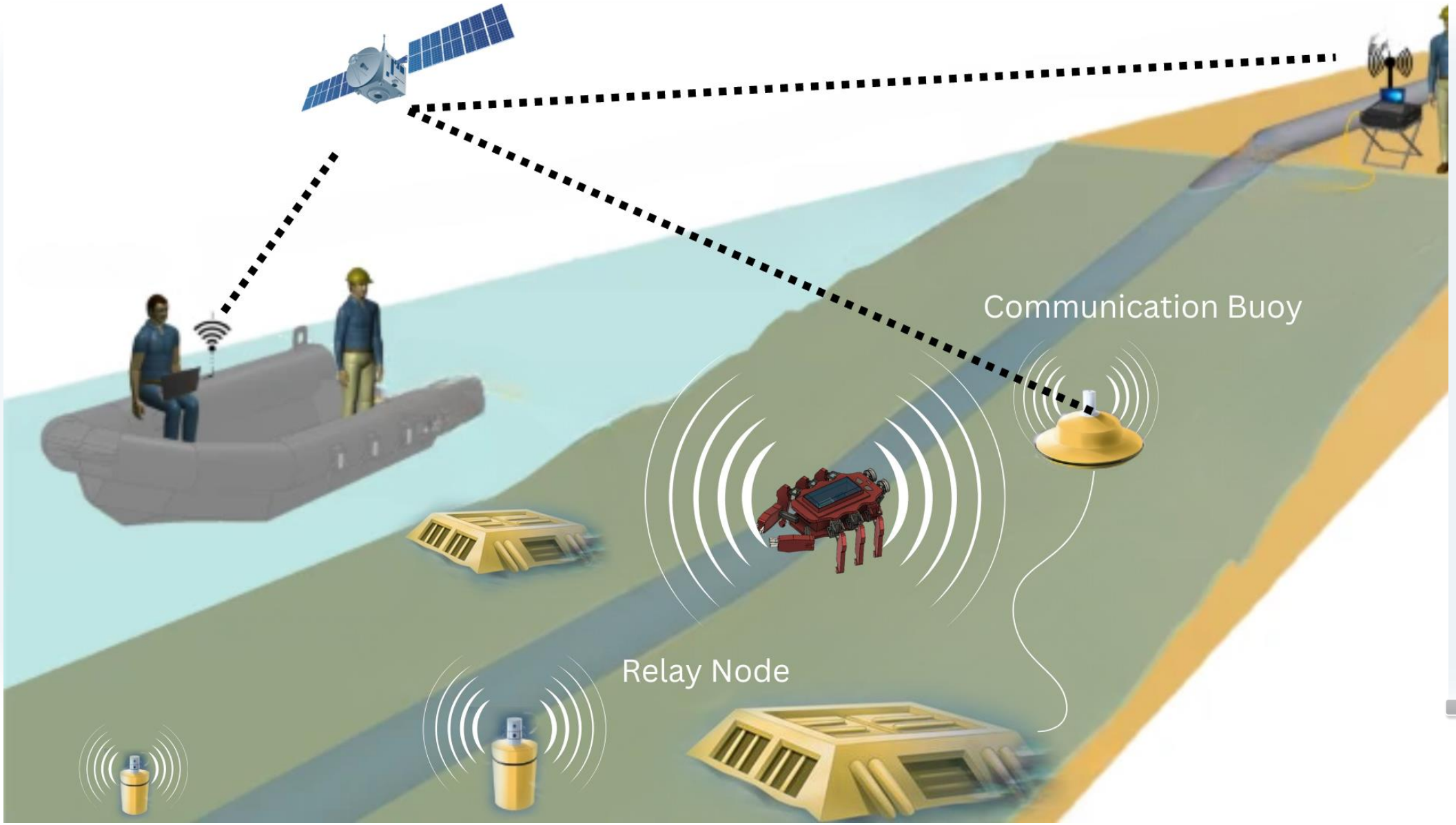
Stage 1: Deployment



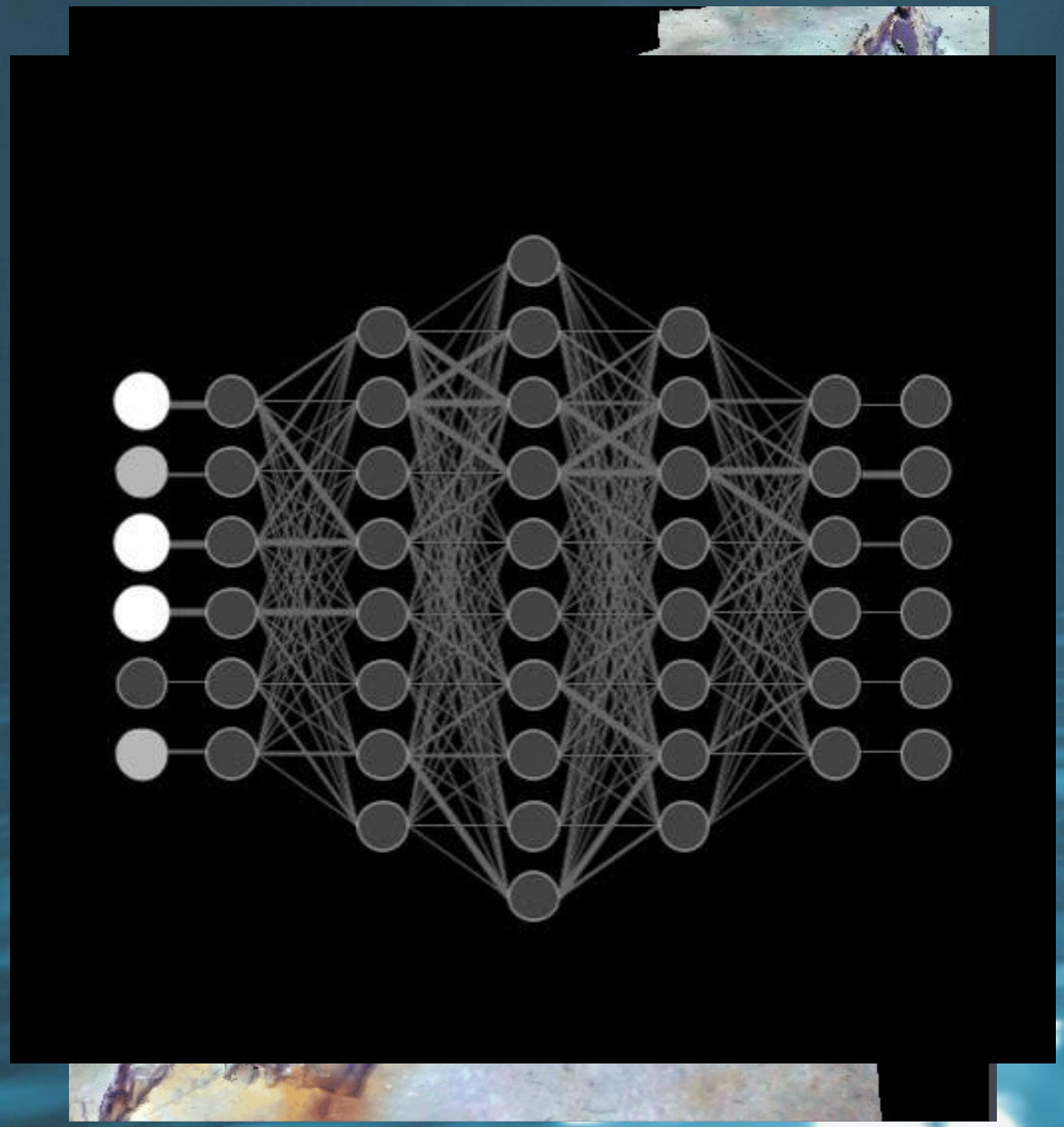
Stage 2: Surveillance and Detection

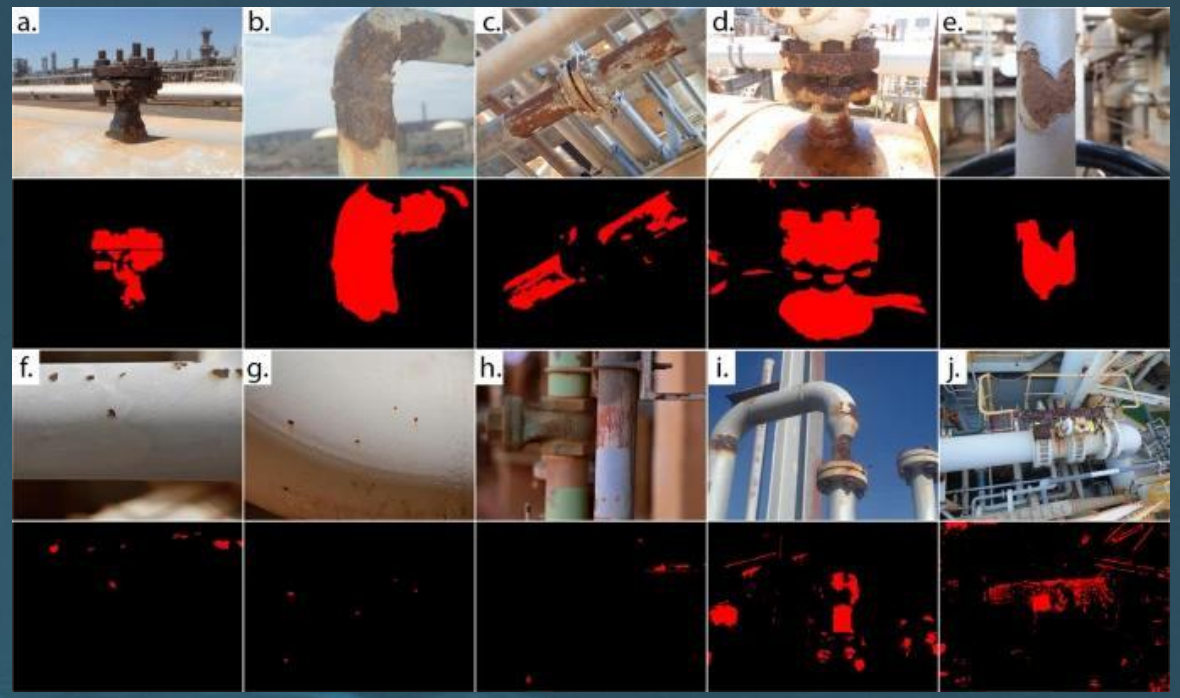


Stage 3: Data Transfer



Stage 4: Neural Networks and Deep Learning for Corrosion Detection





O'Byrne, M., Schoefs, F., Pakrashi, V., & Ghosh, B. (2018). An underwater lighting and turbidity image repository for analysing the performance of image-based non-destructive techniques. *Structure and Infrastructure Engineering*, *14*(1), 104–123. https://doi.org/10.1080/15732479.2017.1330890

A. Smith, J. Coffelt, and K. Lingemann, 'A Deep Learning Framework for Semantic Segmentation of Underwater Environments', in *OCEANS 2022, Hampton Roads*, Oct. 2022, pp. 1–7. doi: 10.1109/OCEANS47191.2022.9977212.

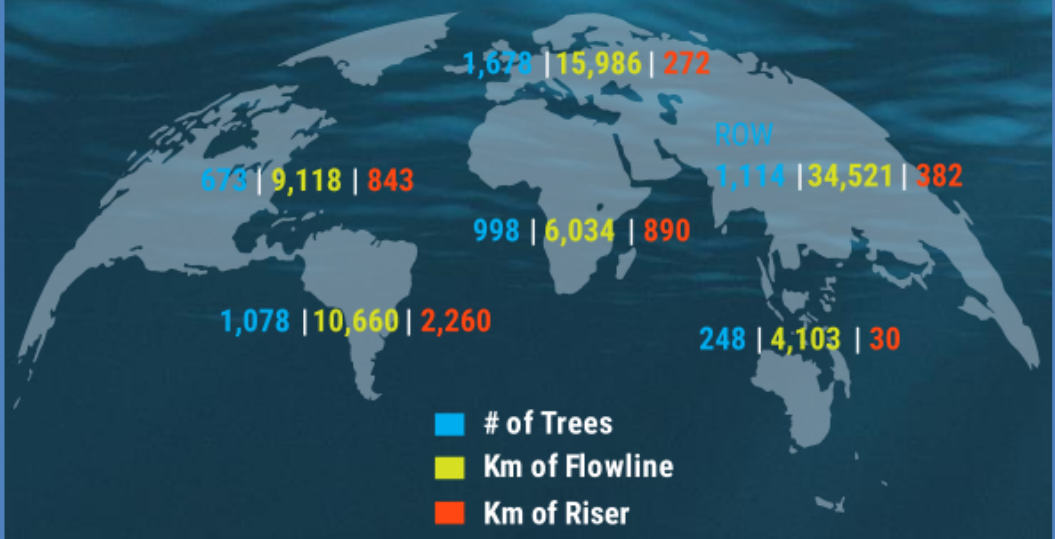
Y. Xie, Y. Xiao, X. Liu, G. Liu, W. Jiang, and J. Qin, 'Time-Frequency Distribution Map-Based Convolutional Neural Network (CNN) Model for Underwater Pipeline Leakage Detection Using Acoustic Signals', *Sensors*, vol. 20, no. 18, Art. no. 18, Jan. 2020, doi: 10.3390/s20185040.

M. Martin-Abadal, M. Piñar-Molina, A. Martorell-Torres, G. Oliver-Codina, and Y. Gonzalez-Cid, 'Underwater Pipe and Valve 3D Recognition Using Deep Learning Segmentation', *Journal of Marine Science and Engineering*, vol. 9, no. 1, Art. no. 1, Jan. 2021, doi: 10.3390/jmse9010005.

C.-L. Tsui, D. Schipf, K.-R. Lin, J. Leang, F.-J. Hsieh, and W.-C. Wang, 'Using a Time of Flight method for underwater 3-dimensional depth measurements and point cloud imaging', in *OCEANS 2014 - TAIPEI*, Apr. 2014, pp. 1–6. doi: 10.1109/OCEANS-TAIPEI.2014.6964471.

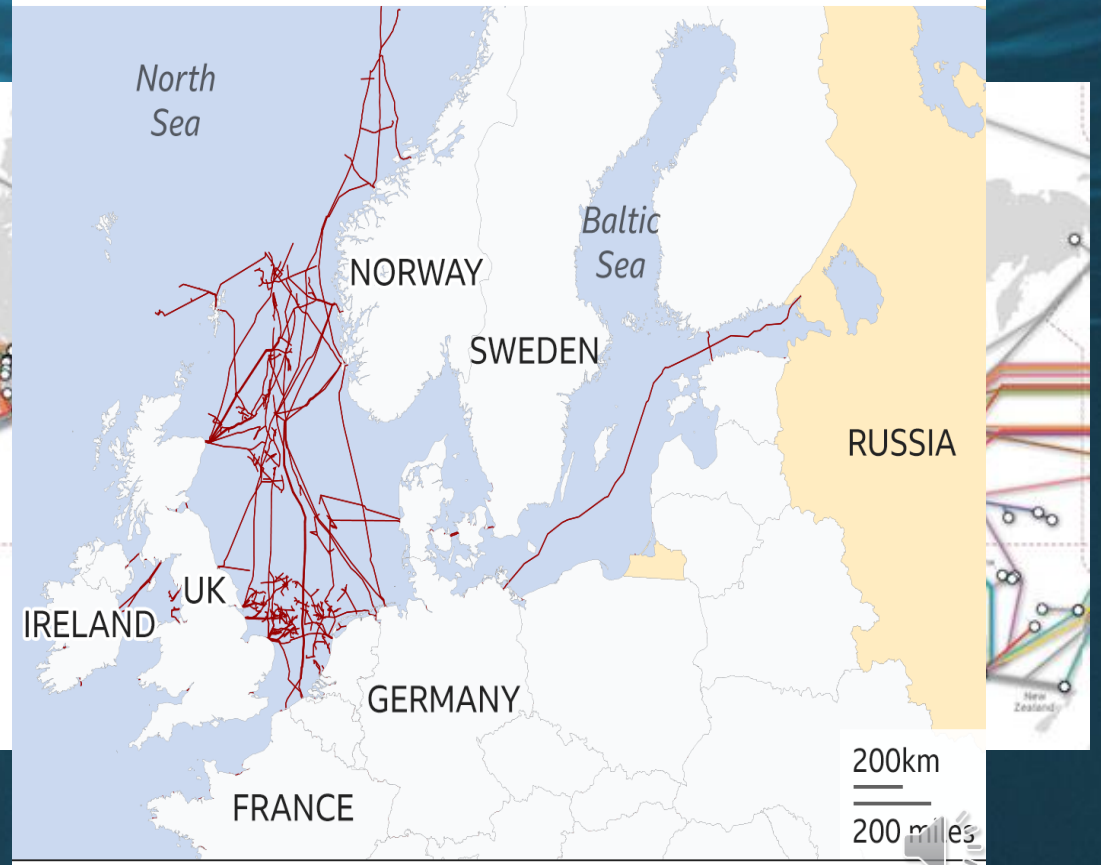
Immediate Opportunity Oil & Gas

Worldwide Offshore O&G Asset Base



Focusing on the North Sea and UK region

- Offshore O&G Testing need: 50 Krabby
- Longer term needs: 150 Krabby



Target Customers

COMMERCIAL

SCOTTISHPOWER
equinor
PETROBRAS
VATTENFALL
bp
GOVTECH SINGAPORE
Transocean
Microsoft
TechnipFMC
Ørsted
wood.
SSE
leidos
STINGER technology
SALMAR Passion for Salmon
SMD
IKM Subsea
OCEANEERING
VideoRay

Target Customers

Governments All Around the World

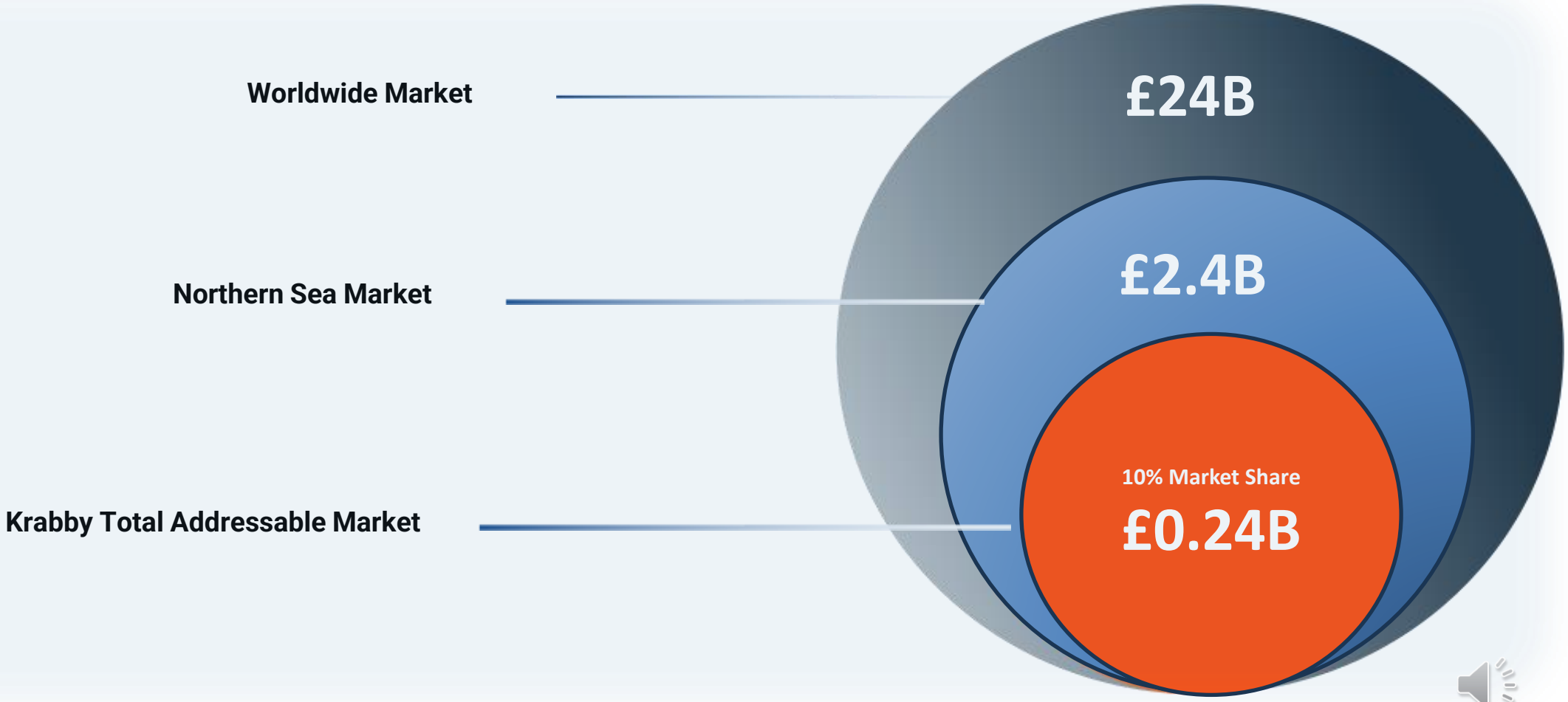
- **Strategic Government Partnerships :**

Partner with governments using Krabby robots for efficient underwater pipeline monitoring, ensuring robust marine ecosystem preservation and energy infrastructure integrity.

- **Proactive Ecological Monitoring :**

Include our robot in government programs for vigilant pipeline monitoring and environmental protection to support ocean conservation and resource stewardship

Market Potential Analysis for Krabby in Offshore Pipelines

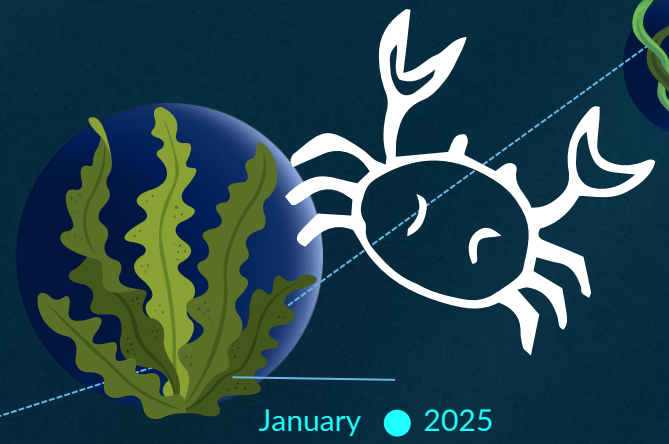


Reference: “Offshore Pipeline Market - Growth, Trends & Size,” www.mordorintelligence.com. https://www.mordorintelligence.com/industry-reports/offshore-pipeline-market (accessed Apr. 18, 2024).

Roadmap

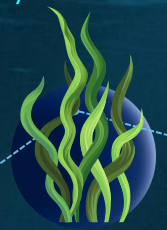
Stage 1 January 2025

- Q1-Q2: Market research, concept development, initial design, and team assembly.
- Q3-Q4: Development of MVP (Minimum Viable Product), initial user feedback, and business plan refinement.

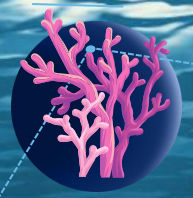


January 2025
Stage 1

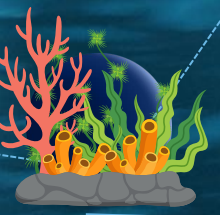
Stage 2
January 2026



January 2027
Stage 3



Stage 4
January 2028

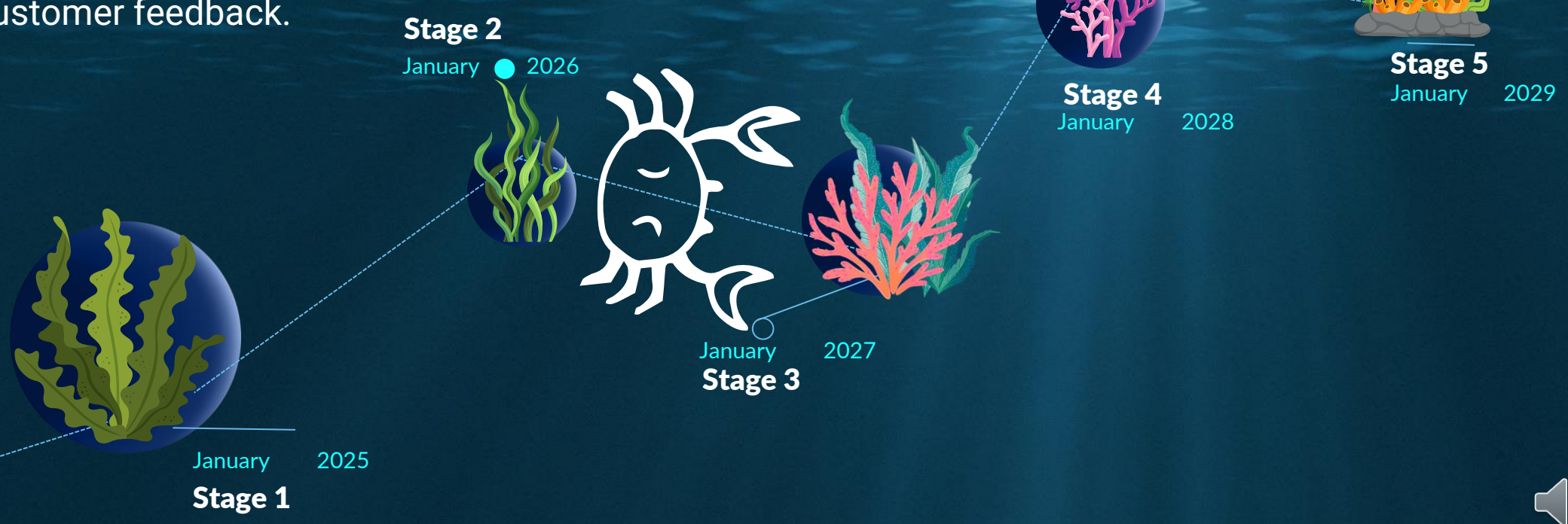


Stage 5
January 2029

Roadmap

Stage 2 January 2026

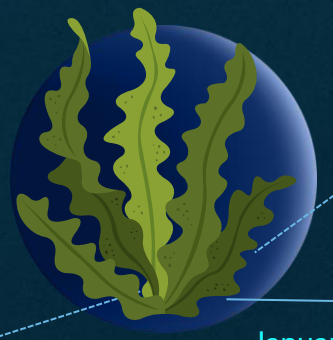
- Q1-Q2: Beta testing, product refinement based on user feedback, and development of marketing strategy.
- Q3-Q4: Launch of the product, initiation of sales, and continuous monitoring and product updates based on customer feedback.



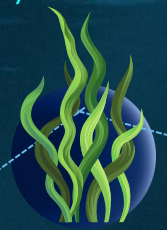
Roadmap

Stage 3 January 2027

- Q1-Q4: Expansion of sales channels, market reach, and customer base. Refinement of product and customer support services. Begin scaling operations.

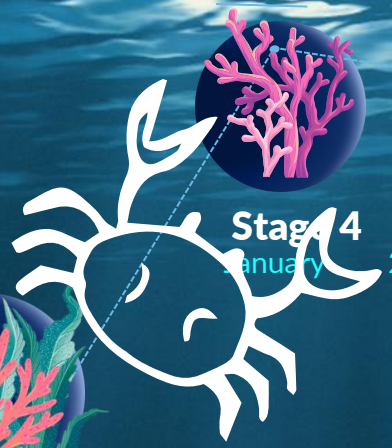


January 2025
Stage 1

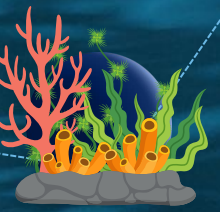


Stage 2
January 2026

January 2027
Stage 3



Stage 4
January 2028

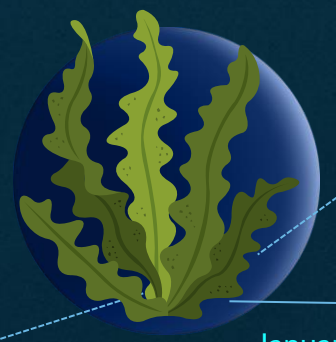


Stage 5
January 2029

Roadmap

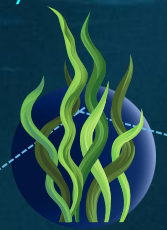
Stage 4 January 2028

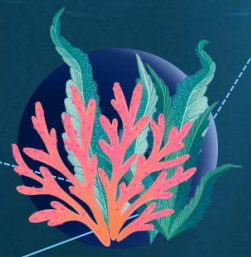
- Q1-Q4: Focus on scaling up the business, entering new markets, and strengthening brand position. Begin research and development for new products or features.



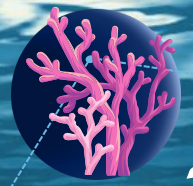
January 2025
Stage 1

Stage 2
January 2026

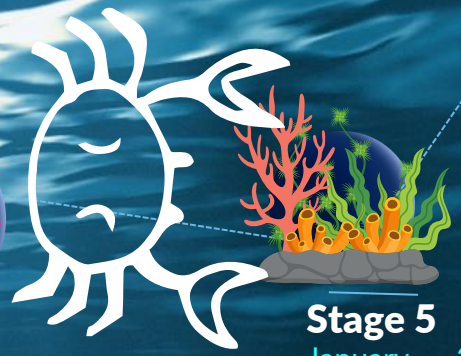




January 2027
Stage 3



Stage 4
January 2028

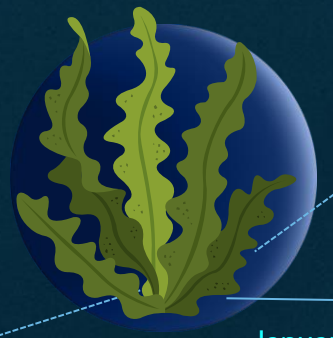


Stage 5
January 2029

Roadmap

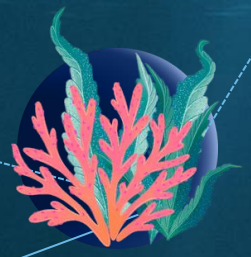
Stage 5 January 2029

- Q1-Q2: Launch of new products or features. Expansion into new markets or segments.
- Q3-Q4: Evaluation of business performance, strategic review, and planning for the next phases.

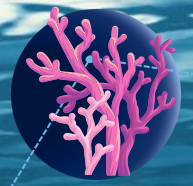


January 2025
Stage 1

Stage 2
January 2026



January 2027
Stage 3



Stage 4
January 2028

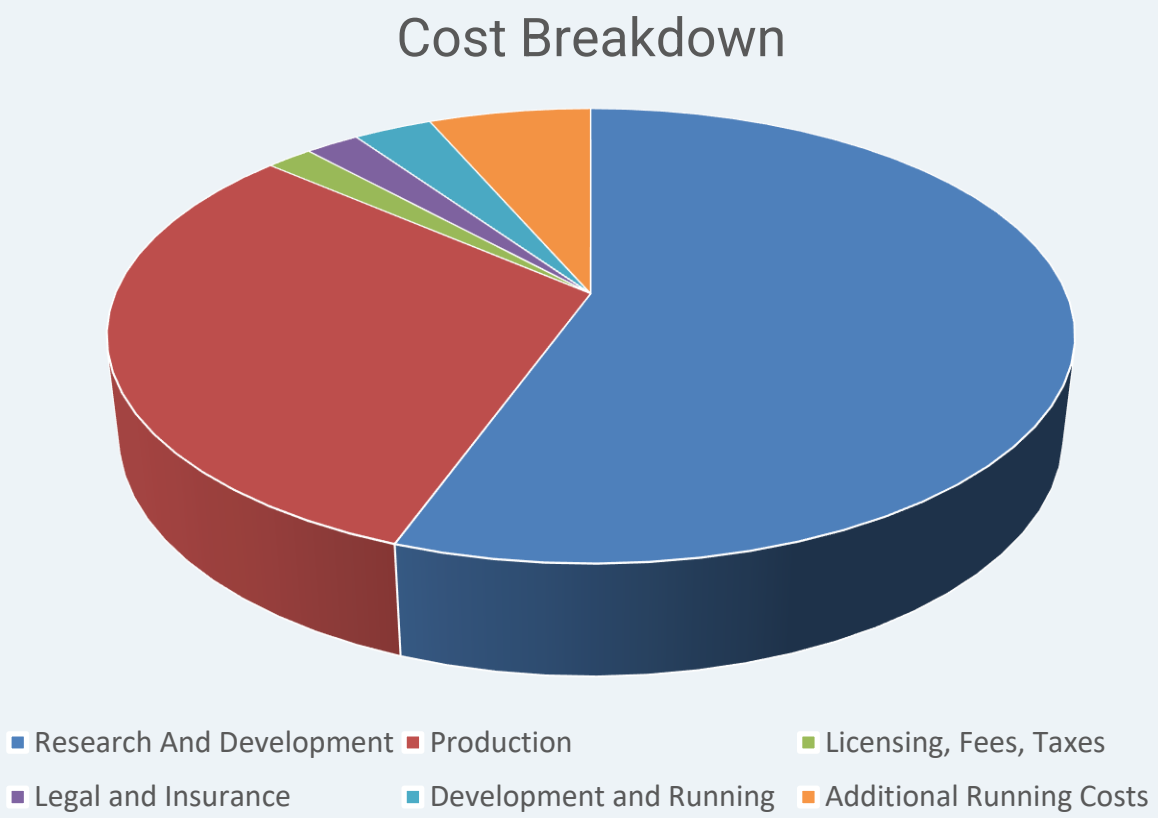
Stage 5
January 2029

Krabby Cost Breakdown

Production, Deployment Running cost For 3 Year for 20 Krabby

- Research and Development - £ 900,000
- Production - £ 500,000
- Licensing, Fees, Taxes - £ 30,000
- Legal and Insurance - £ 35,000
- Deployment and Running - £ 51,000
- Additional Running Costs - £ 105,000

Total - £ 1,621,000



Projected Detailed Cost

Breakdown

- **Deployment and Running Costs Over 3 Years:**
- Deployment: £3,000
- Maintenance and Repairs: £15,000 (£5,000/year)
- Energy Costs: £3,600 (£1,200/year)
- Data Management: £9,000 (£3,000/year)
- Personnel: £180,000 (£60,000/year)
- Training: £10,000
- Software Updates: £15,000 (£5,000/year)
- End-of-Life Disposal: £2,000

- **Legal and Insurance:**
- Legal Fees: £15,000
- Insurance: £10,000

- **Additional Running Costs:**
- Marketing: £30,000
- Customer Support: £45,000 (£15,000/year)

Projected Detailed Cost

Breakdown

- **Research and Development:**
- Initial Research: £50,000
- Prototype Development: £200,000
- Testing and Refinement: £100,000
- Design Software Licenses: £20,000
- Salaries for R&D Team: £500,000
- Consultation Fees: £30,000

- **Production:**
- Materials and Components: £15,000
- Manufacturing Labor: £5,000
- Equipment Depreciation: £8,000
- Facility Costs: £5,000
- Packaging and Shipping: £2,000

- **Licensing, Fees, Taxes:**
- Regulatory Compliance: £5,000
- Licensing Fees: £5,000
- Taxes: £10,000

3-Year Running Cost Analysis for ROV vs. KRABBY

Metric	KRABBY	ROV	Notes
Operator Costs (excluded for KRABBY)	Autonomous (No cost)	Estimated at £270,000	KRABBY operates autonomously
Maintenance and Repairs	Higher	Typically higher	ROV has greater complexity
Energy Costs	Lower	Higher	ROV has greater power requirements
Operating Hours (over 3 years)	1,800 hours	1,800 hours	Same operating hours for both
Travel Speed (mph)	Less than 2 mph	2 mph	ROV is faster
Maintenance Costs (3 Years)	Estimated at £25,000	Estimated at £100,000	Lower Maintenance cost for Krabby
Operator Costs (3 Years)	None	Estimated at £270,000	Cost included only for ROV
Cost Per Mile	£56.67	£103.03	KRABBY is more cost-effective per mile
Cost Efficiency Percentage	47%	ROV is less efficient	KRABBY is more cost-efficient compared to ROV

47%* COST EFFICIENT

KRABY IS 47% COST EFFICIENT ON OPPERATIONAL COST COMPARED TO ANY ON MARKET SURVEYING DEVICE

* This is just predicted values and real time data can be different

3-Year Energy Consumption Analysis for ROV vs. KRABBY

Metric	KRABBY	ROV	Notes
Energy Consumption per hour (kWh)	0.5	1.4375000000000000	KRABBY requires less energy per hour, reflecting its lower power requirements.
Operating Hours (over 3 years)	1800	1565.217391304350	Operating hours adjusted for ROV to match the same distance as KRABBY.
Travel Speed (mph/knots)	2 mph	2 knots (~2.3 mph)	Travel speed for ROV is converted from knots to mph for comparison.
Total Energy Consumed (3 Years) (kWh)	900	2250.0	Total energy is a product of operating hours and energy consumption rate.
Total Distance Travelled (3 Years) (miles)	3600	3600	Both vehicles are set to travel the same total distance for a direct comparison.
Energy Consumption per Mile (kWh/mile)	0.25	0.625	This metric directly shows the energy efficiency of each vehicle per mile traveled.
Energy Efficiency Improvement (%)	60%	N/A	KRABBY is 60% more energy efficient per mile than ROV based on ROV's consumption.

60%* ENERGY EFFICIENT

AS COMPARED TO ANY AVAILABE ALTERNATIVE METHODS

* This is just predicted values and real time data can be different

Krabby As-a-service Model

Pricing Plans

£50000

One Time Survey

Service for once time

- 1 pipeline survey
- Detailed Feedback
- Suggested Solutions and issues
- Survey Reports for future use
- Post survey assistance

£90000

One Year Survey

3 pipeline survey per year

- 3 pipeline survey
- Detailed Feedback
- Suggested Solutions and issues
- Survey Reports for future use
- Post survey assistance

£Custom

Custom Contract Survey

Presentations are communication tools that can be used as lectures.

- Multiple pipeline survey
- Detailed Feedback
- Suggested Solutions and issues
- Survey Reports for future use
- Post survey assistance

Krabby As-a-service Model

Projected Revenue Generation

YEAR 1

- End of Year 1: Pre contracts for beta testing
  - Cumulative Revenue: £572,220
  - Cumulative Costs: £1,079,600

  - **Year 1 Operational Cash Flow Positive:** £410,400

YEAR 2

- End of Year 2: Individual service sales long term contracts
  - Cumulative Revenue: £1,134,036
  - Cumulative Costs: £1,119,584

  - **Year 2 Operational Cash Flow Positive:** £1,479,816

YEAR 3

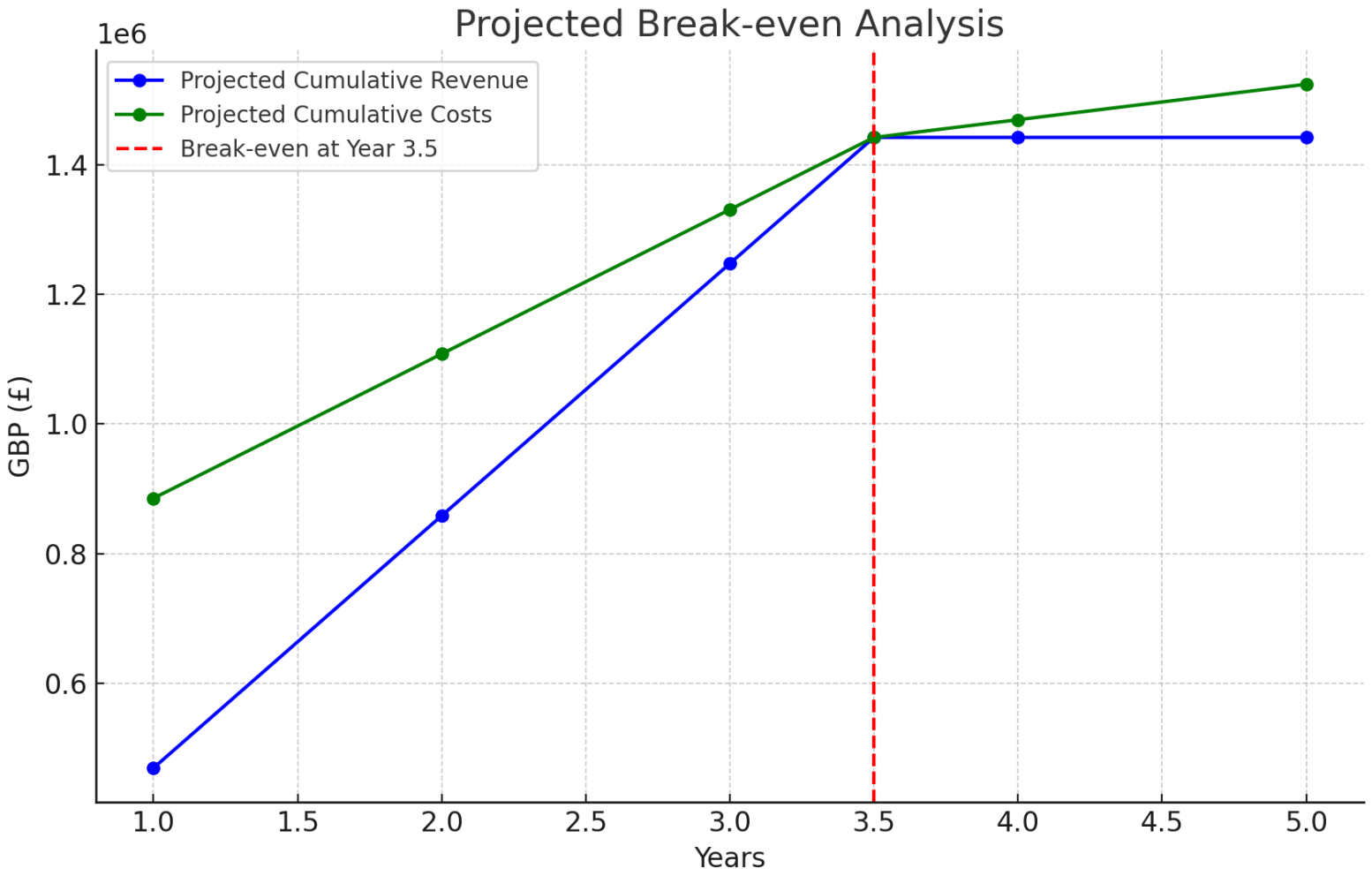
- End of Year 3: Individual service sales long term contracts
  - Cumulative Revenue: £1,550,196
  - Cumulative Costs: £1,160,367.68

  - **Year 3 Operational Cash Flow Positive:** £1,509,412.32

Break Even Analysis

To break even on your costs of £1,621,000 over three and half years:

- Approximately **32 one-time surveys** at £50,000 each.
- Approximately **18 one-year surveys** at £90,000 each.



Impact Assessment

PROS

- Reduced Carbon Footprint
- Environmental Monitoring
- Positive Impacts on Marine Life
- Safety Improvements
- Economic Efficiency
- Job Creation

CONS

- Noise Pollution
- Difficulty in Robot Retrieval

Societal Implications

Commitment to responsible innovation ensures sustainable and safe technological advancements in marine environments.

NEXT STEPS

Projected Feature Development after 5 years

STEP 1

Underwater Infrastructure

STEP 2

Maintenance and Repairs.

STEP 3

Complete Autonomous Detection

STEP 4

Wireless Charging*

[*]- J. Manikandan, A. Vishwanath, and M. Korulla, 'Design of a 1kW Underwater Wireless Charging Station for Underwater Data Gathering Systems', in 2018 International Conference on Advances in Computing, Communications and Informatics (ICACCI), Sep. 2018, pp. 211–216. doi: 10.1109/ICACCI.2018.8554936.

Potential Use cases of Deployment of Krabby in the Future

- Data Centers
- Autonomous Shipping
- Aquaculture
- Telecommunication
- Subsea Mining
- Biotechnology

Secure the Depths: Propel Gas Pipe Safety with Your Investment

£500,000

How will you benefit as an Investor:

- **Lucrative Early Bird Advantage:** Be among the first to capitalize on an emerging disruptor in the [industry/field]. Your foresight can lead to significant rewards as we grow.
- **Profitable Equity Stake:** Secure a valuable equity stake in a company on the cusp of rapid expansion and market penetration. Witness the growth of your investment as we scale.
- **Strategic Influence & Financial Gain:** Play a pivotal role in steering a pioneering venture. Your investment not only offers you a say in our innovative trajectory but also the potential for substantial financial returns.

THANK YOU