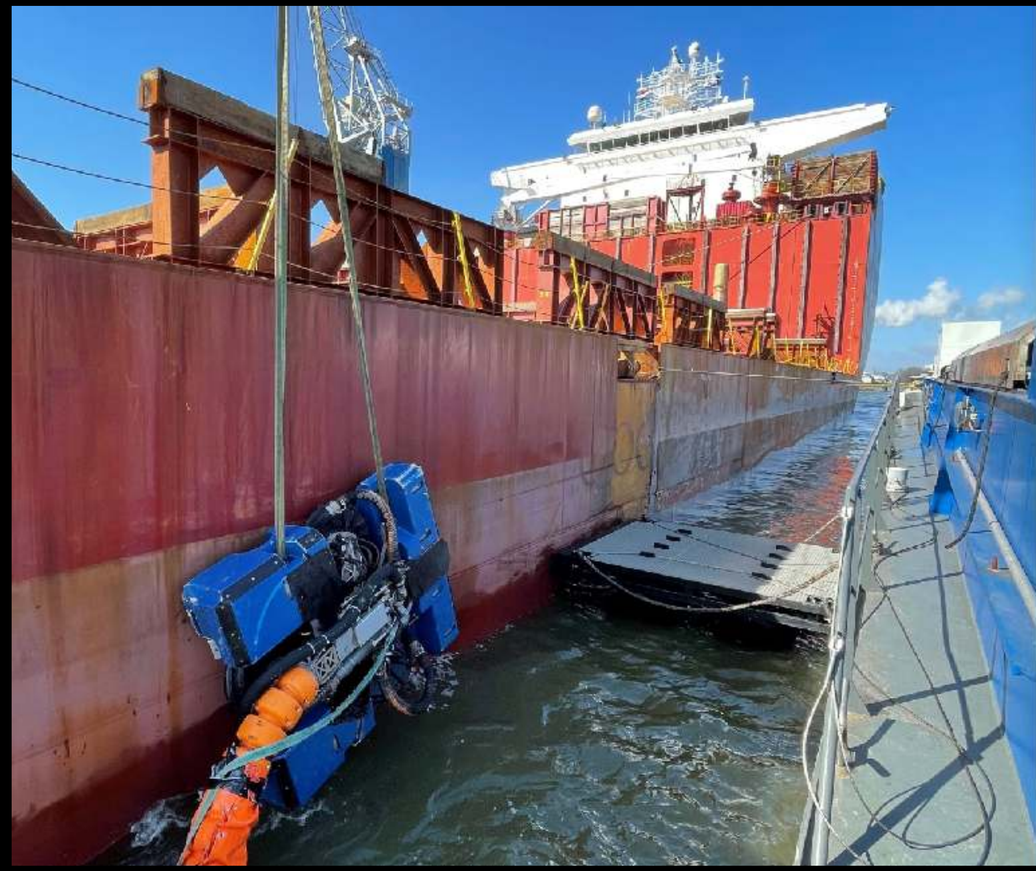
CHALLENGE :
REDUCING MARINE CO2 EMISSIONS



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NEPTUNE

DEEP TECH IMPACT SHAPERS

Introducing

NEPTUNE ROBOTICS

targeting

BIOFOULING RELATED EMISSIONS

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SDGs TACKLED

https://sdgs.un.org/

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KEY FACTS

INDUSTRY:	**AI / ROBOTICS**
FORMATION:	**2019 in Shenzhen**
FUNDING STAGE:	**Series A**
URL:	https://neptune-robotics.com
CHINESE NAME:	Shenzhen Nabai Information Technology Co., Ltd. 深圳纳百信息技术有限公司

SOLUTION

PRODUCT:	**ship cleaning robots and predictive maintenance** for the shipping industry
VALUE PROPOSITION:	**cost reductions and life-cycle extension of ship hulls** through improved maintenance **reduced fuel consumption**, reduced emissions and improved carbon footprint
MONETIZATION:	**RaaS model** (robotics-as-a-service)

USP

- **patented** cavitational waterjet technology which makes it possible to see and **operate in zero-visibility waters**
- **broad cleaning area** above/below the water draught (20 m)
- **best possible cleaning effect** without damaging the surface
- **advanced image processing** making it possible to take clear images in zero visibility muddy water
- **predictive maintenance via big data analytics and AI** for optimised planning, maximum cleaning efficiency and minimum left-out areas

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FUNDING

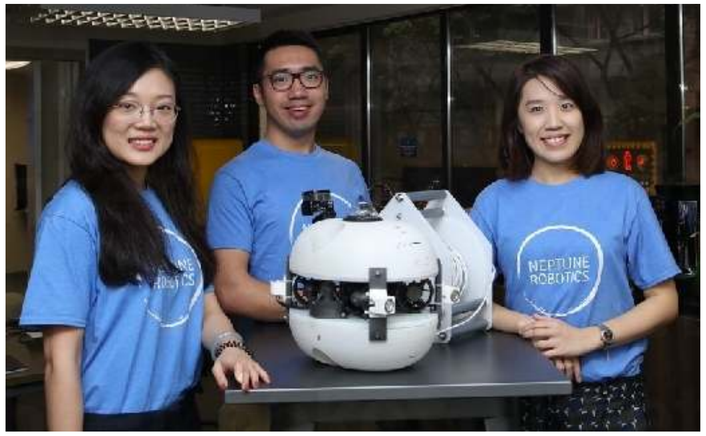
FUNDING STAGE:	Series A
LAST ROUND:	April 20th, 2022
FUNDING RAISED:	ca. $ 17,250,000 (Series A)[1]
REGISTERED CAPITAL:	$ 10,000,000[2]

MAJOR INVESTORS

- LEAD: SEQUOIA CAPITAL CHINA (红杉中国领投)
- MATRIX PARTNERS CHINA (经纬创投)
- SOSV et al.

TEAM

- **Elizabeth Chan (Chen Siying), CEO & Co-founder:**
  Master & Bachelor of Economics at **University of Cambridge**
- **Jacky Im (Yan Zhuoquan), CTO & Co-founder:**
  Bachelor of Physics & Mechanical Engineering at **Hong Kong University of Science & Technology**, once led the team to win the MATE Intern. Underwater Robot Competition
- **Kate Ma (Ma Hongqian), COO & Co-founder:**
  Master of Mathematics at **London School of Economics & Political Science** (LSE), Bachelor of Mathematics from **Imperial College London**, former Certified Actuary of Deloitte Touche Tohmatsu (UK)
- **60 headcount (April 2022),** to be increased to 120 in 2023



DATE: JUNE 2023 URL: HTTPS//NEPTUNE-ROBOTICS.COM 1: acc.to intl. sources 2 acc. to 天眼查 TianYanCha (Chinese company register)

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REMARKS

PROBLEM EXPLAINED: Biofouling on ship hulls **increases fuel consumption around 15%** on average. The term specifically refers to a build-up of microorganisms and other life. That includes a wide range of different creatures, like algae and barnacles, often referred to as **invasive aquatic species** which may pose **threats to human, animal and plant life**.

COSTS: Fouled hulls cost the shipping industry as much as **$30 billion per year.** Biofouling can also cause significant maintenance issues for vessels and reduce overall performance.

RELATED CARBON EMISSIONS: Marine Biofouling on vessel hulls is believed to add approximately **110M tons of excess carbon emissions** annually across the shipping industry. With around **90,000 ships** sailing ocean waters and transporting nearly **90% of world trade**, vessels not only emit a significant amount of GHG emissions but also carry and release other ecologically harmful pollutants along their voyage.

MARKET: 90,000 international vessels and **9,535 container ships** registered as of 2022: average draught/draft: 8.3 meters for a 1,000 TEU containership; can reach **16 meters for ships above 14,000 TEU.**

REGULATORY STATUS: **Existing guidelines and regulation by the EU and IMO** (The International Maritime Organization), shipping industry is aware of the problem and searching for solutions. The IMO has committed to **reducing greenhouse gas (GHG) emissions** from international shipping **by at least 50% by 2050** (compared to 2008 emissions), with a strong emphasis on reaching zero emissions.

SCALABILITY: Can be applied to **multiple underwater scenarios** like off-shore plants, tankers, petroleum terminals etc.

IMPACT TIMELINE: Unlike many other climate tech companies, Neptune can **immediately** make a meaningful climate impact.

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PILOTS

WORLD

<u>NO</u> global pilots yet

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CONCLUSION

COMPETITIVE ADVANTAGE (TODAY):

I. SERVICE SPECTRUM:

Inspection + documentation + maintenance

NEPTUNE ROBOTICS covers the full service spectrum of ship hull cleaning with a fully remote approach, outperforming competitors in most fields.

We therefore assume that the startup will be able to

- **operate at a fraction of costs**,
- **access new revenue streams,**
  (recurring revenues (MRR/ARR) via RaaS)

II. TECHNOLOGY:

NEPTUNE ROBOTICS has profound experience in future key technologies such as **computer vision, big data analytics and AI.** Closing up in these fields should not be an easy task for competitors & take a considerable time.

We therefore assume that the startup will be able to **outperform competitors in the long run** if it further extends their technological advantage, tech expertise and stack with focus and speed.

OUTLOOK

CHALLENGE — MEASURABLE VALUE PROP. & USP:

Advantages should further be proven & communicated via measurable KPIs. The goal should be to outperform competition in every dimension. Key metrics include:

- **cleaning speed** (benchmark: >2000 m²/h),
- **cleaning impact** (benchmark: lasts 3+ times longer),
- **reduction of CO2 emissions** (benchmark: 17,600 tons (12.5%)),
- **reduction of fuel consumption** (no benchmarks),
- **cost savings** (benchmark: $50K/months),
- **increase of ship life cycle** (no benchmarks).

OPPORTUNITY — DAMAGE DETECTION:

Given the backing of top-notch VCs, we assume NR is targeting **further opportunities beyond the obvious**.

Our hypothesis is that the startup will continue training their algorithms to further **cover the detection of damages** (e.g. holes, rupture, cracks, scrapes, deformations like indents, damage of paint or coating). This would give the startup **access to even higher annual recurring revenue** (ARR) opportunities and could lead to sky rocketing growth.

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IMPACT ANALYSIS

IMPACT FACTOR	local market excellence	global scalability	sustainable business model	actionable solution	educational & transformative
	TACKLED				PART. TACKLED
YES / NO	IN CHINA	FROM CHINA TO GLOBAL	MEASURABLE IMPACT FACTORS	STAKEHOLDER AGNOSTIC	DISRUPTIVE MODEL
	▶ Technological leadership in China is given; market penetration is still low due to the startup's early stage.	▶ The solution can be applied in any other market with immediate effect. ▶ Expected international rollout (short/mid-term): • Asia & U.S. • Europe	▶ The economic and ecological impact of the solution is substantial and measurable. ▶ The business model seems feasible and sustainable.	▶ Startup seems to tackle all key players with actionable solutions (short/mid/long-term).	✓ Concepts exist to disruptively transform the tech space via big data and AI. ⊗ At present, the startup does not further educate on the global challenge it is solving.

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> **The startup is solving a problem of high global impact with immediate effect.**
> **Educational campaigns should be installed to further increase the outreach of the project.**

ANNEX

> ADDITIONAL RESEARCH <

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INTERNATIONAL COMPETITION

ROBOTIC SOLUTIONS:

Mainly **massive, hard to operate** cleaning robots with the following characteristics:

- limited cleaning effect
- narrow coverage of ship hull surfaces (not able to cover draughts/drafts of 10m and above)
- no fully remote operation possible
- no AI / predictive maintenance

> **limited applicability** *beyond* small and medium vessels (ca. 50% of the 90K international vessels not covered)

> **limited capability to close up** in the AI / predictive maintenance field —> key advantage of NEPTUNE ROBOTICS

BRUSH / KART METHOD:

High-powered brushes clamp down on the hull and dislodge the thick sludge of biofilm.
Process offers **(-) no form of filtration** as removed marine organisms contaminate local port waters, abrasive bristles **(-) damage expensive antifouling paint** and plastics from the cleaning brushes can get introduced to the water column.

MANUAL REMOVAL:

Direct removal of marine fouling by **(-) divers** through the use of cloths, brushes or scraping devices.
Impossible to remove and collect all of the invasive aquatic species that accumulate, **(-) nearly 40% of the species remain attached.** Zero-visibility waters pose significant **(-) health and life risks** to divers.

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EXEMPLARY COMPETITORS

- **FLEET CLEANER** (www.fleetcleaner.com/): High pressure waterjet technology;
  (+) **measurable performance** (cleans up to 90% of the hull of a vessel; cleans up to 1200m²/hr)
  (+) **covers zero-visibility water conditions**
  (+) **adapts cleaning pressure** to the type of fouling, minimizing fouling damage; (+) compact design (2m x 1.8m x 0.6m);
  (-) operated from a work boat

- **HullWiper** (www.hullwiper.co): Remotely Operated Vehicle (ROV);
  (+) **measurable performance** (cleans up to 2000 m²/h and 96-97% of submerged areas faster than traditional cleaning methods with a cleaning impact that lasts 2 - 3 times longer);
  (-) not applicable in all weather conditions

- **Jotun HullSkater** (www.jotun.com):
  (+) **measurable performance** (Bulk Carrier using the cleaning robot for 60 months will save $2,830,000 as compared to market average and reduce CO2 emissions by 17,600 tons (12.5%); cleaning takes 2 to 8 hours depending on size and condition)
  (+) **cloud-based data collection** through high definition inspection capabilities

- **TECHULLCLEAN** (techullclean.com): Cleaning robot;
  (+) **inspection services** available such as inspection of general hull condition and propeller blade inspections
  (-) diver-operated

- **ITCH** (shipshave.no): semi-autonomous hull cleaning robotic arm;
  (+) **documentation services** available such as hull condition before and after (status info on hull integrity and paint);
  (-) manually operated by the crew; (-) no automatic data interpretation

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“ ***NEPTUNE ROBOTICS***
will likely become a key player
in reducing marine emissions
on a global scale,
the best part being they can start today
for a maximum impact now and tomorrow. ”