TEKNOFEST

AEROSPACE AND TECHNOLOGY FESTIVAL

TECHNOLOGY FOR HUMANİTY COMPETITION

PROJECT DETAIL REPORT

PROJECT CATEGORY: **Disaster Management**

PROJECT NAME: **Truva**

TEAM NAME: **Heron**

TEAM ID: **78884**

TEAM LEVEL: **Primary School**

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. **Rayan Ali**

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Project Detail Report

1. Project Summary:

Our proposal is the development of a humanless rescue boat, Truva, that will help save people who are drowning or unconscious in the water more quickly and without risking others lives. Lifeguards risk their own lives everyday to save others, so the development of this 'lifesaver' boat will help to make their job easier without the added risk of them injuring themselves or loosing their own lives.

Our proposed lifesaving boat will be fully equipped with the latest technology in cameras and sonars to assist in detecting the victims more quickly. A laptop/tablet assisted software will allow the lifeguards to control the boat safely from ashore. Once the victim is detected the lifeguard will then be able to use the remote controlled net arms on the boat to safely catch the victim and place them onto the boat to then bring back to shore where the victim can be managed promptly. While on the boat there will also be a quick medical screening of the victim (for heart and breathing rate).

2. Problem/ Issue:

Most people around the world think 'beach' when they think holiday. An online statistical report conducted in 2020, using 'Trip Advisor' data, showed that 57% of global travellers using that website were choosing a beach holiday. Here in Australia we have over 10000 beaches and 85% of Australians live very close to at least one beach. This means that Australian's can enjoy many hours at the beach not only during holidays but even on the weekend. While this can be great fun for the family it means more people at risk of water accidents.

The World Health Organisation (WHO) states that drowning is "the world's third leading cause of unintentional injury death world wide, accounting for 7% of all injury related deaths" (WHO, 2020). In Australia 2018 there were 249 drownings, 147 of which were in the beach, ocean or rivers (SMH, 2018). This is a very big percentage.

The Australian Lifeguards Service (ALS) employs over 700 lifeguards nation wide as well as thousands of trained volunteers. These guards are trained with many devices to assist in life saving, varying from rescue tubes, rescue boards, reaching poles, ring buoys and rescue boats. While lifeguards are very well trained in all these devices, they need to go out into the water to save lives and are risking their lives to save others.

If we had humanless boats that had the technology to detect people in the water and the ability to take them out without the assistance of a human being on the boat, we may be able to find victims in the water before they die and also would not be risking lifesaver's lives in the process. We have conducted a media research and have seen other 'unmanned surface vessel-USV' rescue boats already on the market. However they all require a victim that is conscious so that they can either climb onboard or hold onto the vessel. Unfortunately none of the rescue boats on the market account for a victim who is unconscious. Until 'Truva' that is.

3. **Solution**

Lifesavers have a difficult and riskful job. However it does not need to be this way as we are living in a time that has humanless technology and technology with the highest sophistication. So why not use that to our advantage when rescuing victims in the beach? Our solution is a humanless rescue boat armed with 360 degree cameras, sonars, medical monitors and remote technology to: 1) find and get to victims alot faster, 2) do a quick remote medical check on the unconscious victim before arrival to shore and 3) do all of this by not risking lifesavers' lives.

The rescue boat will be remotely controlled offshore by the lifeguards. It will have the latest technology to assist in locating the victim (which will be explained in detail in the methods section) and have a rescue net linked to mechanical arms to take the victim out of the water, even if unconscious. When the victim is taken out they will be placed on a mattress that will have a medical monitor above it to detect the victim's pulse and blood pressure, which will be sent directly to the lifeguards' laptop/tablet. This will allow the lifeguards to get prepared for medical assistance even before the victim arrives. The lifeguards, with the assistance of the onboard locating technology, will have control over where the boat goes and will be able to manually control the rescue net in order to take the victim out of the water without harming them.

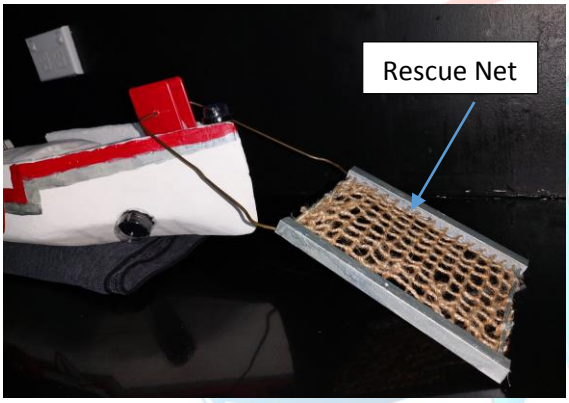
4. **Method**

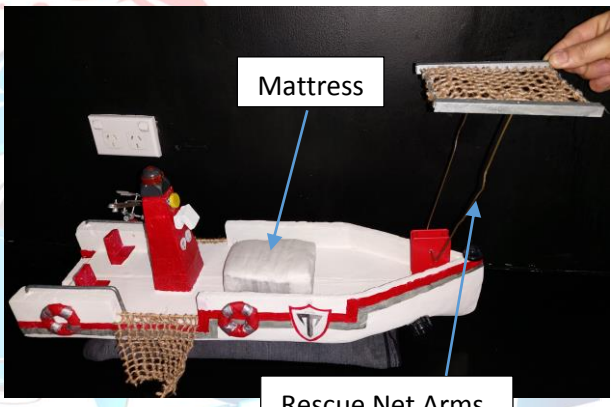
Boat Design & Control:

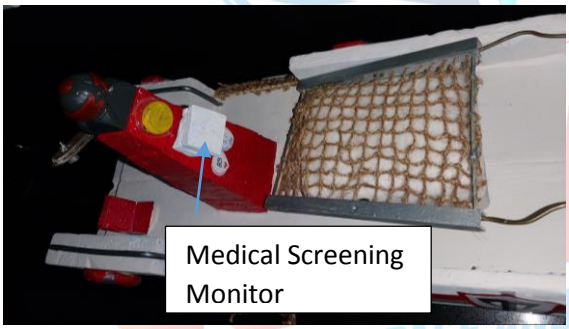
In designing our lifesaver boat, 'Truva', we will start by determining the design and material of the boat. Our proposed humanless boat will need to be designed in a way that will allow it to be fast (to quickly get to the victim and bring them back to shore), strong enough to carry the victim and boat gear and durable in saltwater. Therefore we have decided on a boat that is medium in size (8-9 metres) and made from fibroglass (Fibroglass is durable and lightweight). It will also be made to handle sea disturbance degree of 4 (Beaufort number 5), which is for moderate waves.

Rescuing net:

Next the boat will need to have a feature that will be used to rescue the unconscious person in the water. In order to not hurt the person in the process, we are thinking of using a rescue net like that used by fisherman to catch fish. It will be a net (2 metres x 3metres to be able to support most people) stretched over two long poles that will have the ability to go up and down in the water as well as fold (or curl) to a certain extent to keep the person from falling back. The arms will also have an 'in-out' feature so that the victim can be pulled into the boat and be placed safely on a mattress located on the deck for a quick medical monitor and for safer transport of the victim. The ropes for these nets will need to be strong to carry the victim as well as light weight and durable. For this reason ultra-high-molecular-weight polyethylene ropes (e.g. Dyneema) will be used as they are over ten times stronger than steel and much lighter than steel or nylon ropes.







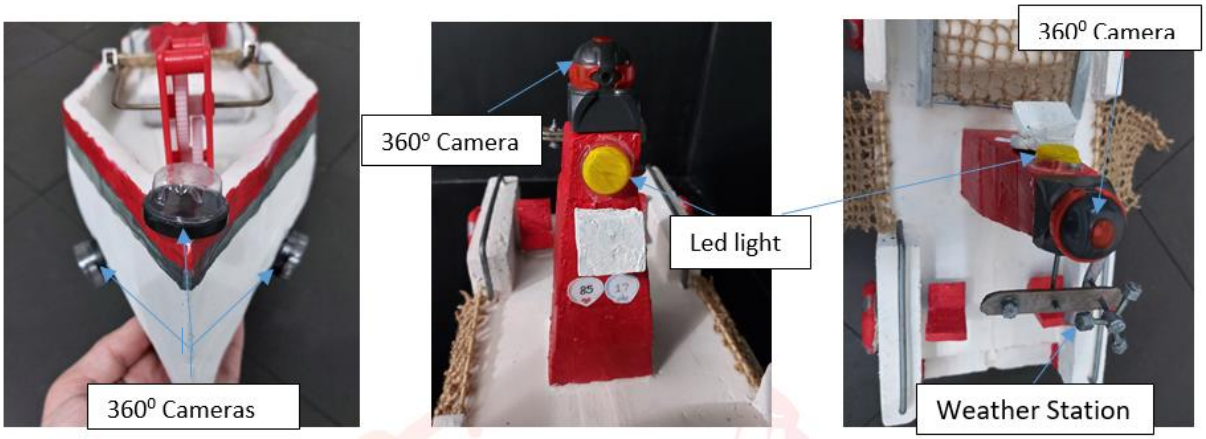
Techology:

Truva will be loaded with sophisticated technology to assist in victim location, medical screening and remote control. These will include the following:

360 degree cameras-The boat will be installed with four 360 degree cameras with fisheye lense so that wide areas can be viewed at the one time. There will be one at the top of the boat as well as two on the sides (under the water) and one at the front to monitor what the net is doing. The cameras will be linked to and be controlled by a PC software that can be used by lifeguards from ashore.

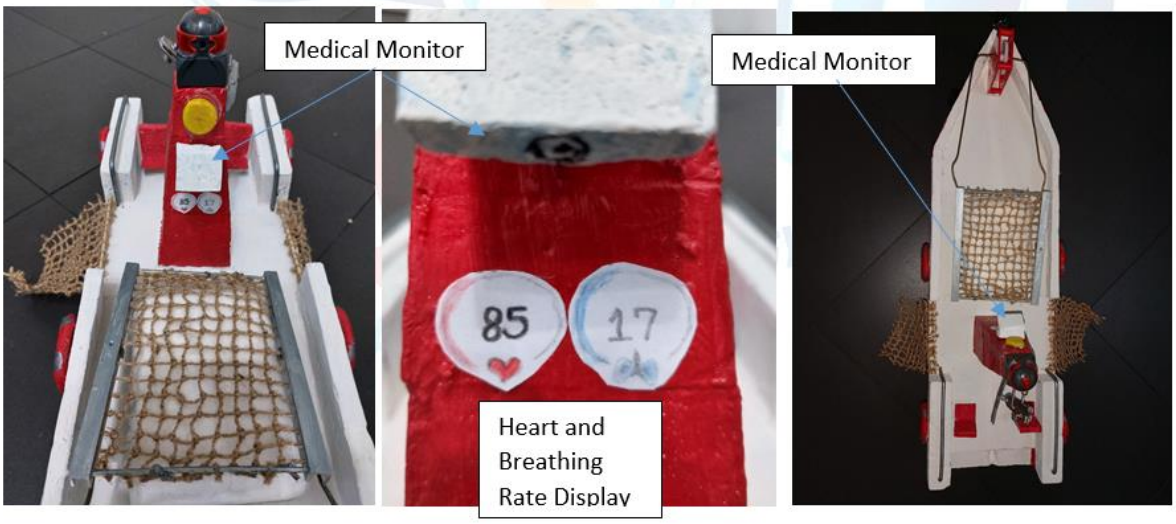
Led Light- A long range led light will also be attached to assist in detecting victims in the dark.

Meteorological Weather Station- A weather sensor will be required to notify the lifeguards of any weather warnings. The boat will only be able to tolerate moderate waves so this sensor will be able to provide information on any risk of having this boat out at sea.



Sonar- In order to be able to help detect and localise victims faster we will also need a sonar (a system that detects via sound emission refections in the water).

Medical monitor- To determine if the victim is still living or breathing we will also attach a 'Cardi/io' monitor above the mattress, which is an application based monitor that assesses a person's heart and respiratory rate and displays it on an Android or Apple device. This will allow the lifeguards to get a quick health check of the victim before they arrive and be able to prepare for medical management.

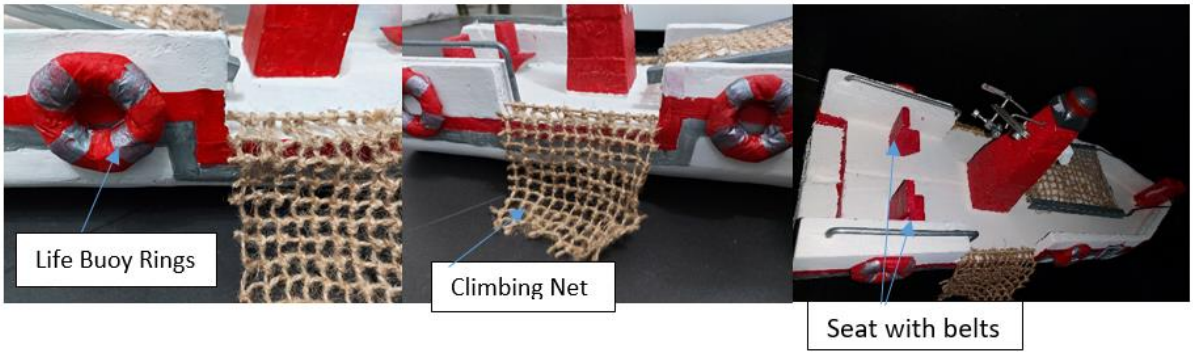


Control software- As it will be a humanless boat it will also need a romote control that can be controlled by a laptop/tablet based software. All technology features will be able to be controlled through this software.

Self-Using Gear:

As a precautionary measure we will also have life buoy rings and climbing nets attached to the surroundings of the boat for in case the boats electronic arms don't work in cases where the

victim is still conscious. This way the victim can at least climb up to the boat themselves or hold on until they are brought back to shore.



5. **Innovative Aspect**

While similar ideas are readily available on the market (e.g. Zhejiang Jialan Maritime Electronics Co. Ltd's Mono-hull rescue USV boat and Hydronalix's EMILY), these boats are designed for victims who are conscious and have the energy to hold onto the boat. USA's robotic rescue robot 'EMILY' is very small (only as big as a rescue board) and requires the victim to put lifesaving gear on on their own and then to hold on to the boat. It also can only run for 14 minutes at a time. China's Mono-Hull rescue USV is a big boat and can run for alot longer but requires the victim to be able to climb a rescue net. Truva's biggest innovative features are its ability to rescue victims who are even unconscious or fatigued and the medical screening that we have added to our design.

6. **Applicability**

While the prototype of Truva will initially appear costly, once produced in bulk the cost will be significantly reduced. Also, as our boat will allow quicker access and quicker medical attention to the drowning victim, we are hoping this will also mean less or shorter hospital admissions. This will save the health industry and local goverments alot of money in the long run.

7. **Estimated Cost and Project Scheduling**

Table 1: Estimated Project Costs

Material/Technology	Estimated Cost	Notes
360^{o} Cameras	$11100	The top camera will be Ultra Wide Angle 'Fisheye Lense' to see a very wide range ($8100). The other three (the two in the water and one over the net) will be a manually moving 360 cameras for long distance cameras ($1000 each).
Sonar	$6400	We can get one for $1900 however that is for shorter distances. The estimated cost brand is a 3D sonar with up to 1km Chirp.

Led Light	$100	
Meteorological Weather Station	$950	
Rescue Net	$ 1020	This is the cost for Dyneema which is the best brand for strong ropes, costing $170/m^2. We will need about 6m^2.
Rescue Net Arms	$25 000*	These arms need to be able to go up and down and in and out to catch the victim and place them safely into the boat. The nearest device that has a similar mechanism is a folklift. This estimate is for a folklifts that can move up and down by 5 metres.
Boat	$100 000*	This is only an estimated mid-range for custom boats.
Software Development	$40 000*	This is only an estimated mid-range for software development.
Life Buoy Rings	$428	At $107 each x 4.
Cardio Monitor	$1000	'Cardi/io' brand has a more sophisticated monitor. There are also smartphone-based apps that are free but less accurate.
TOTAL:	**$185998**	

**As the boat and software will need to be custom made for our desired service it is difficult to estimate the price of some of the parts needed to make the boat. We are therefore over estimating the prices based on known equipment that have similar parts.*

Note: It should also be noted that these prices were calculated according to the Australian market. Prices are likely to decrease if manufactured or bought from overseas and will decrease even more when made if made in bulks.

Table 2: Project Estimated Schedule

Planned Development	Planned Timeframe
'Boat' part	3 months
Rescue Net Arms & Net	1-2 month
Software	4-5 months
Trials	3 months

8. **Target Group of the Project Idea (Users):**

We aim to target this project initially at Mayors of local areas that have beaches, lakes or rivers and in particularly at lifeguards who can use this boat to save lives without having to risk their own. However, these boats can also be used to rescue assylum seekers or fisherman who have gone overboard in the ocean/sea. Therefore the target group may not be limited to local areas

but can also be directed at the goverment bodies, not just in the manufacturing country but government bodies all around the world.

9. **Risks**

One risk, like with any boat, is the risk of it crashing or sinking. As it will be equipped with high technology 360 degree cameras and sonars this risk will be very minimal. The users will also need to check the weather and sea disturbance conditions before using as it will only be able to reliably handle moderate waves.

Another risk is that the mechanical arms of the rescue net may not work after a certain time. However given the boats will be regularly serviced and checked this is only a very small risk. To account for such risks however the boat will also be fully equipped with safety gear and equipment such as life jackets, buoy life rings and climbing nets in case the arms don't work and the victim has to climb up instead.

10. **Resources**

http://www.blog.accessdevelopment.com/tourism-and-travel-statistics-the-ultimate-collection

https://www.lifeguards.com.au/

https://www.shmgroup.com/blog/the-complete-list-of-safety-equipment-used-by-lifeguards

https://www.who.int/news-room/fact-sheets/detail/drowning

http://www.smh.com.au/national/nsw/on-the-piss-in-the-water-sydney-s-most-dangerous-day-on-the-beach-20190115-p50rez.html

http://www.ropegalore.com.au/dyneema-r-high-strength-rope/

http://www.agriexpo.online/agricultural-manufacturer/dyneema-aquaculture-net-8309.html

http://www.theboatwarehouse.com.au/categories/pfds-lifebuoys-survival-gear.html?sort=featured&page=2

http://www.cardio.io/pages/product-and-solutions

http://www.tradewheel.com/co/zhejiang-jialan-maritime-electronics-323942/about-us/

http://www.emilyrobot.com

http://www.anbg.gov.au/jrc/kayak/beaufort.html