Cape Peninsula University of Technology

Industrial Design Project 3
DES370S

Project Title: Blue OpenOcean Explorer (BOO-E)
Subtitle: Project Management Presentation

Student Initial and Surname: JF Williams
Student Number: 221343687
Lecturer: Dr M. Mnguni

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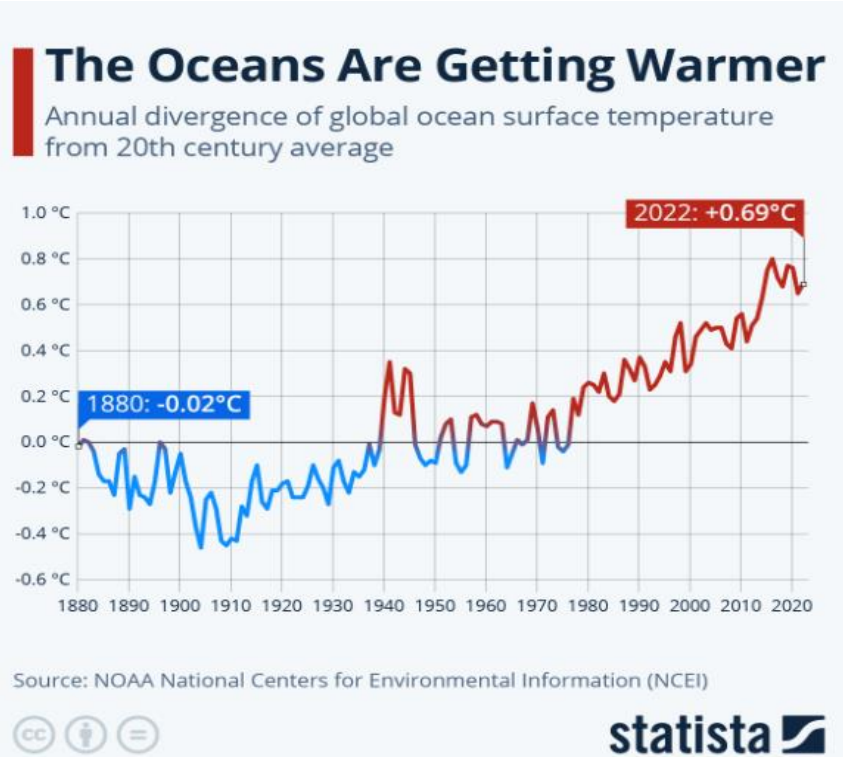
Outline

- Introduction
- Proposed Plan
- System overview
- Benefits of Open-source Technology
- Budget Management
- Risk Analysis
- Time and Change Management
- Quality Assurance
- Economics Principles
- Evaluation of Project Outcomes
- Conclusion

Introduction



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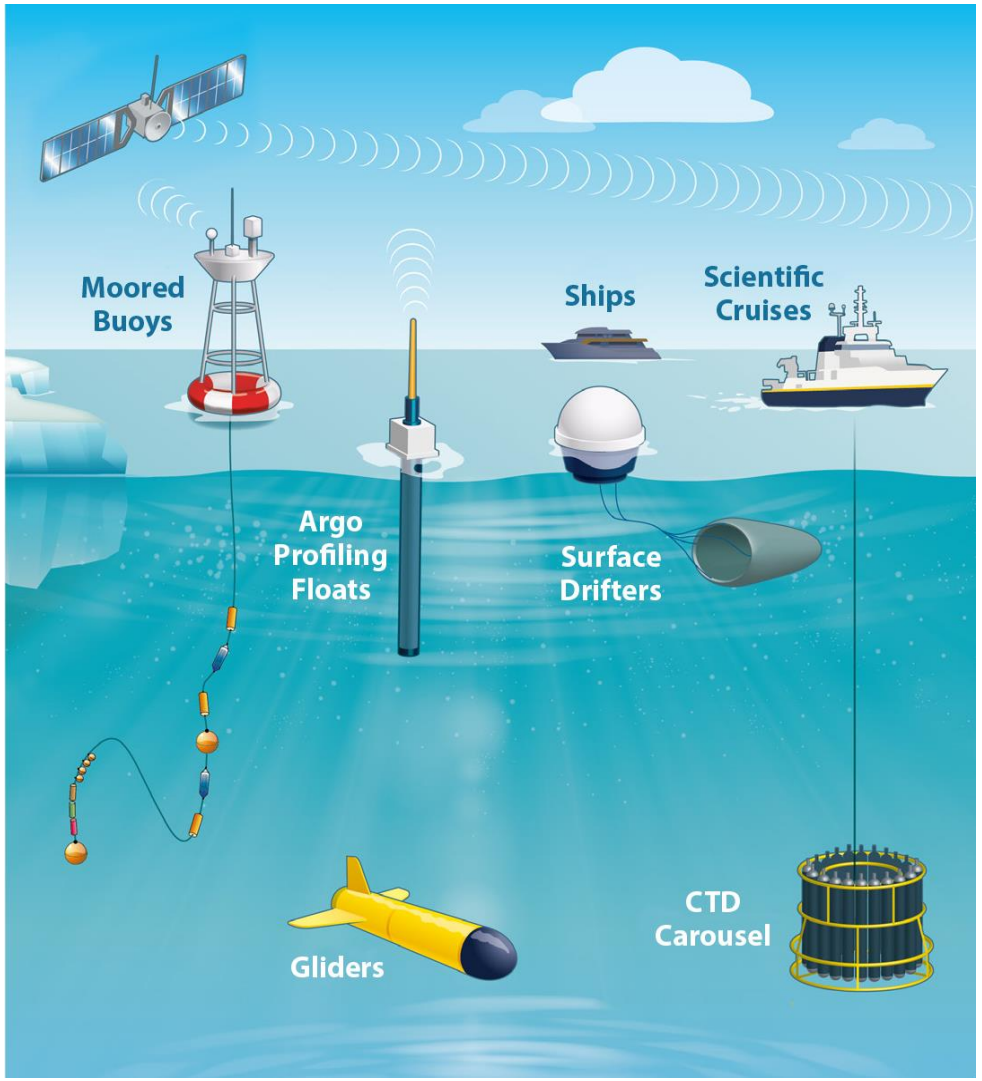

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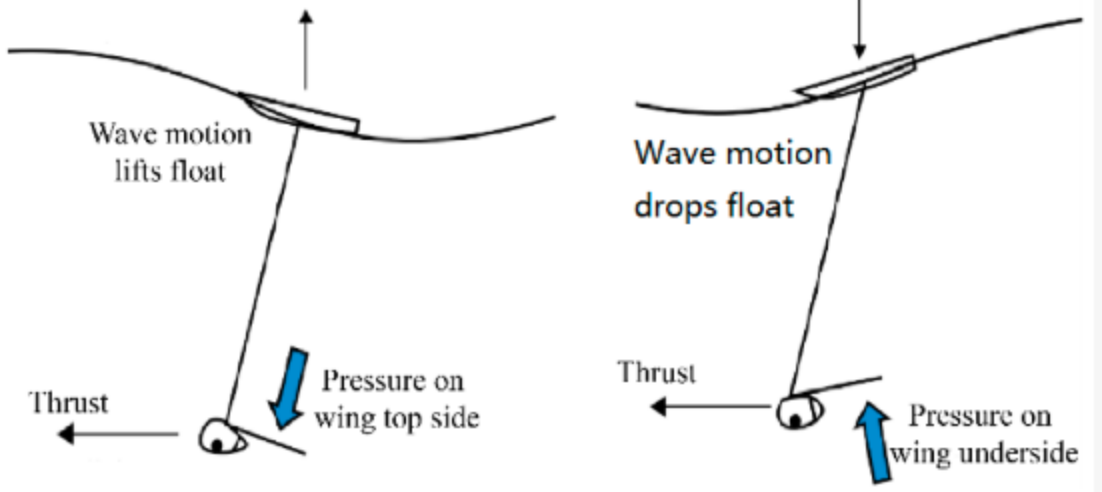
Proposed Plan
Blue OpenOcean Explorer (BOO-E)



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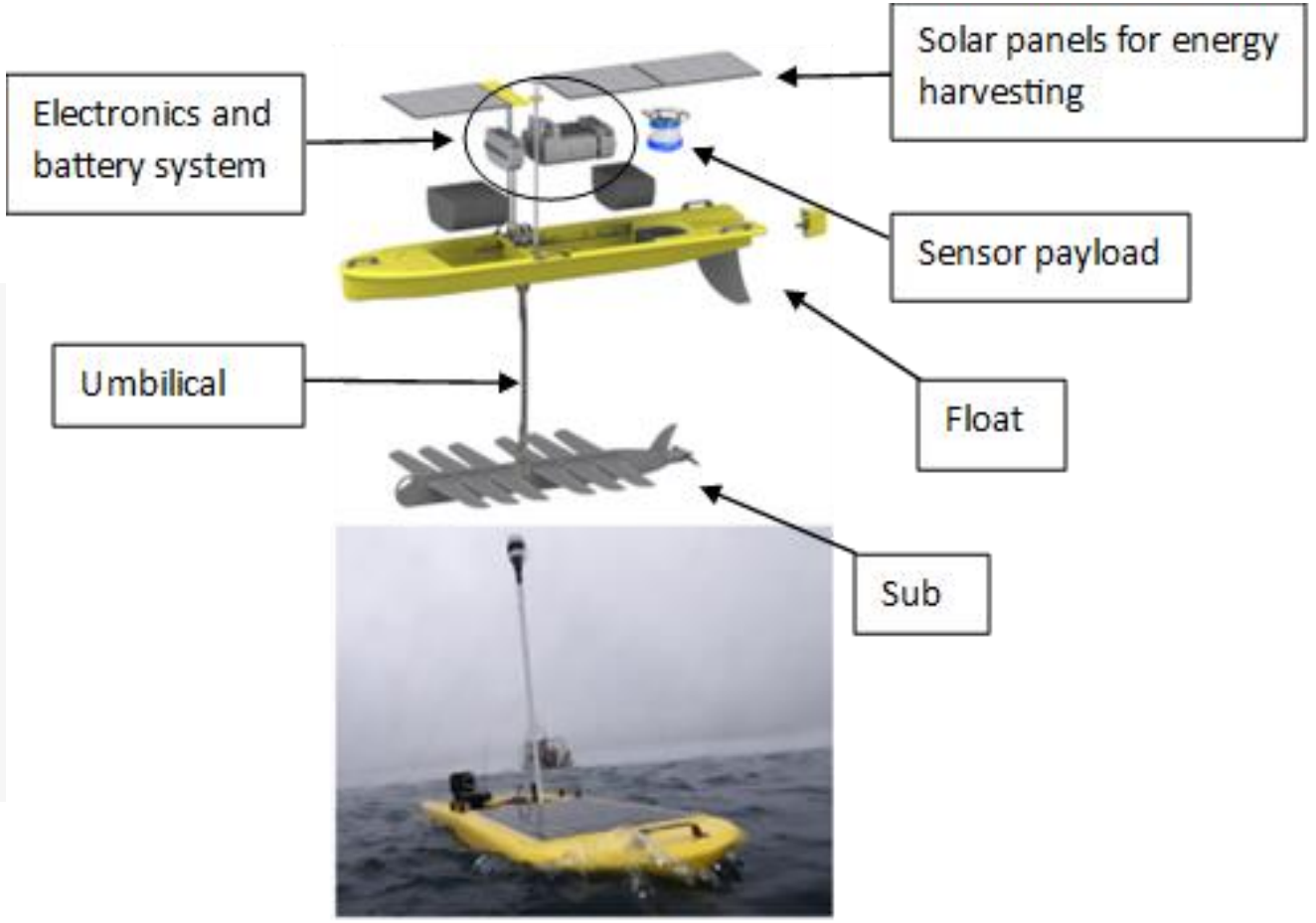

Liquid Robotics SV2 Wave Glider [6]

System overview

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Open-source based ASV project

Power management

Harvesting: Solar and battery storage

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Management: PDB's, DC-DC regulators

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Data collection

Sensors:

Temp

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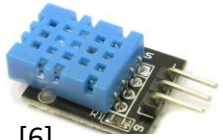
Salinity



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Atmospheric data

Logging and storage

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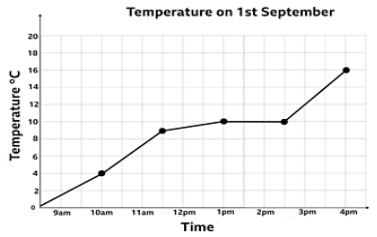

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Navigation

Inputs: GPS, Compass, IMU, Pilot

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Flight controller

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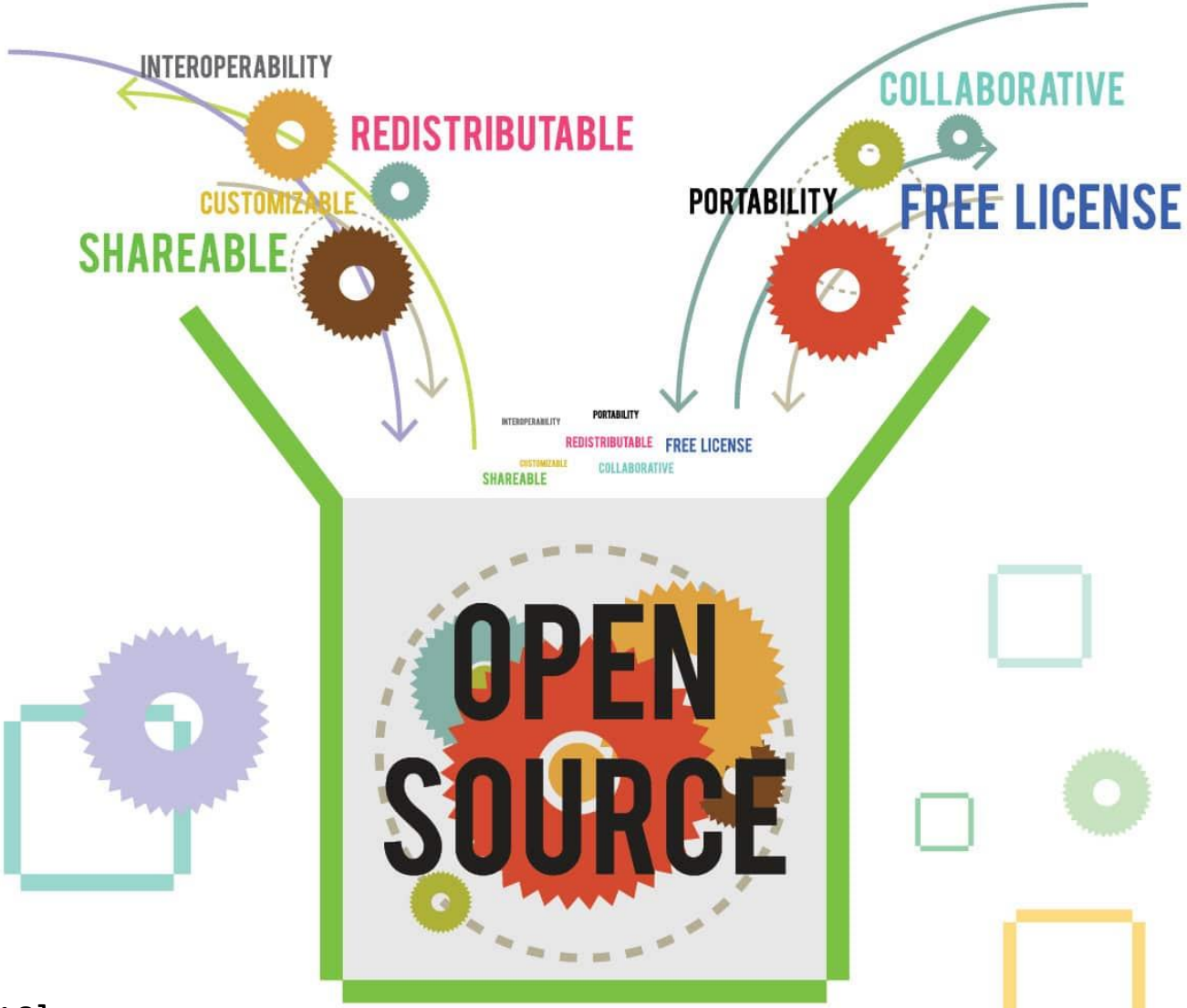
Outputs: Rudder angle

Thruster control

Sail angle

Benefits of Open-Source technology

- Cost reduction
- Collaboration
- Flexibility
- Sustainability



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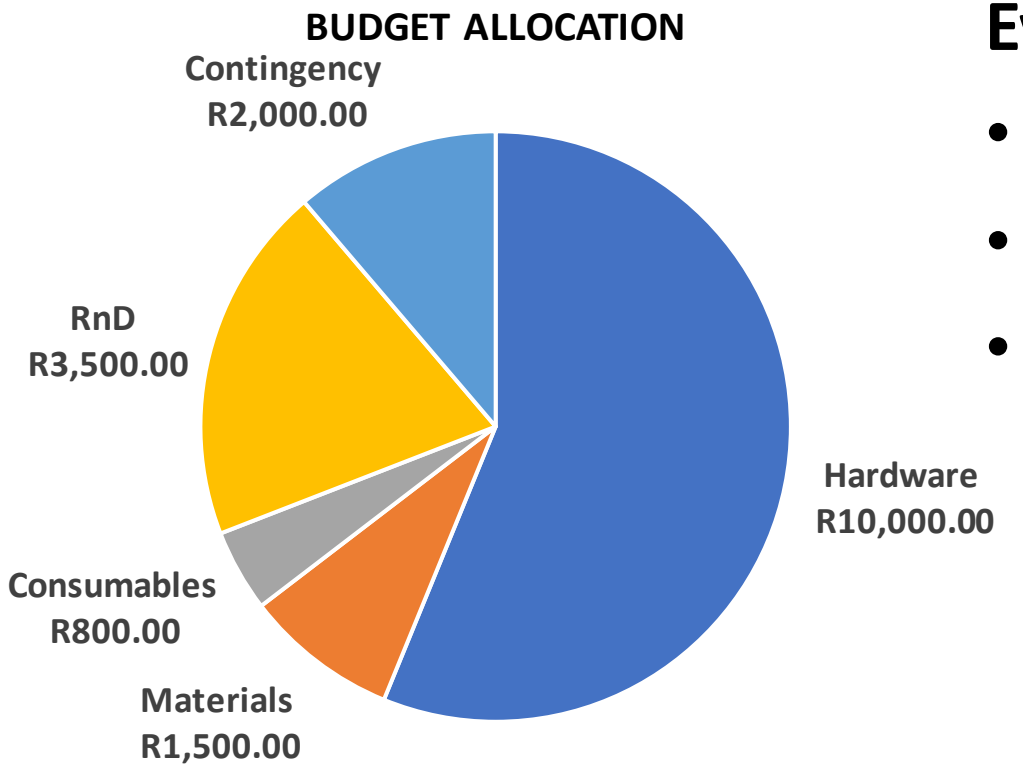
Budget Management



Budget total: R17,800.00

Evaluation of Adherence to Budget

- Securing sponsorships for companies (4, 7)
- Use inhouse resources
- Eliminate unnecessary expenses through risk assessment

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Hardware cost breakdown

System	Hardware	description	Quantity	price	link
Navigation	Pixhawk pro flight controller	Pixhawk flight controlller set	1	R3,999.00	https://microbotsa.co.za/index.php?route=product/product&path=97&product_id=96
	GPS and Compass				https://neotronics.co.za/index.php?route=product/product&path=104&product_id=565
	RF telemetry	Communication and manual contr	1	R1,483.50	https://neotronics.co.za/index.php?route=product/product&path=104&product_id=260
	VHF antenna	AIS antenna	1	-	In house
	AIS	Automatic Identification	1	R2,100.00	https://shop.wegmatt.com/collections/frontpage/products/daisy-2-dual-channel-ais-receiver-with-nmea-0183
Power	Solar regulator	Regulate battery charge	1	R180.00	https://www.communica.co.za/products/bdd-dc-dc-buck-mppt-solar-5a-dis?variant=45944865849644
	Lithium ion Batteries	12V battery packs	2	R680.00	https://www.communica.co.za/products/batt-12-8v7-scp
	DC-DC regulator	Regulate input power	2	R60.00	https://www.communica.co.za/products/hkd-dc-dc-buck-boost-1-25-35v-4a?variant=44293669519660
Data	ESP32	Controller	1	R 160.00	https://www.communica.co.za/products/hkd-esp-32-wifi-b-t-dev-board
	MicroSD card module	Data logging	1	R 25.00	https://www.communica.co.za/products/hkd-d1-mini-micro-sd-card-modul?variant=39341863960649
	SD card 16GB		1	R 55.00	https://www.communica.co.za/products/hkv-hs-tfc1-16gb-adpt
	Anodes (Salinity test)	in house design	2	R -	2 conductive rods (ie copper)
	Temperature sensor	temperature probe. DS18B20	2	R27.00	https://www.communica.co.za/products/hkd-temperature-probe-ds18b20-1m
Safety	Leak detectors	detect water (In house design)	4	R20.00	In house
	4ch 5V/36V relay	power control	3	R82.00	https://www.communica.co.za/products/bdd-relay-board-4ch-3-3v?variant=47620050485548
	LDR	Light dependent resistor	2	R5.00	Componnet shop
	Strobe light	safety light	1	R382.00	https://www.communica.co.za/products/0550ydwlh
	Strobe light mounting bracket	Mounting plate	1	R135.00	https://www.communica.co.za/products/0550tbpkh?variant=20112145907785

RISK ANALYSIS

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Catagory	Risk	Assesment	Likelihood rating	Mitigation plan	Priority rating
Technical	Component failure	Component failure could cause a malfunction and loss of operations	2	Rigorously test the components before final mounting	4
	Navigation error	Unable to navigate and could cause damage	3	Calibrate GPS before use and add redundancy	5
	Electrical faults	Components shorting out can destroy controllers and cause loss of operations	2	Use protection devices to mitigate potential damage	5
	Software intergration	Software bugs and communication issues	3	Rigorously test and scan for bugs before final version release	4
Resource	Funds	Limited personal funds	4	Seek sponsorships and/or partners	5
	Available time	Limited free time alongside full time studies	3	Use any availalbe time to make progress with the project	3
	Component availability	Some components are not commonly available or need to be shipped in	1	Request quotes with lead time well in advance to plan around	3
	Access to labs and testing facilities	Access to labs requires a supervisor present. Thus access is dependent on someone else	2	Create a schedule for when the labs will be available	3
Operational	Operating Environment	Exposed to harsh conditions, corrosive sea water, direct UV rays, wave impacts	5	Mount components in IP68 rugged enclosure with waterproofing techniques	5
	External interferance	Human and animal interferance	3	Place warning stickers to stop people from interfering with the vehicle.	2
	Communication loss	Loss of communication or sight of vehicle	3	Mount antennas on a mast to improve range and use a flashing warning light to improve visibility	3
Environment and safety	Collision	Other vessels could collide with it if they don't see it	1	Use a method of vessel identification such as AIS	4
	personal safety	Handling equipment, testing, exposed to electric currents	2	Take precaution when working and use PPE	2
	Environmental impact	Little to no interference with environment	1	Secure all items so nothing falls off while in operation	1

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Time and Change Management

- Monitoring Progress
- Time Estimation for Each Task
- Milestones and Deadlines

Monitoring Progress

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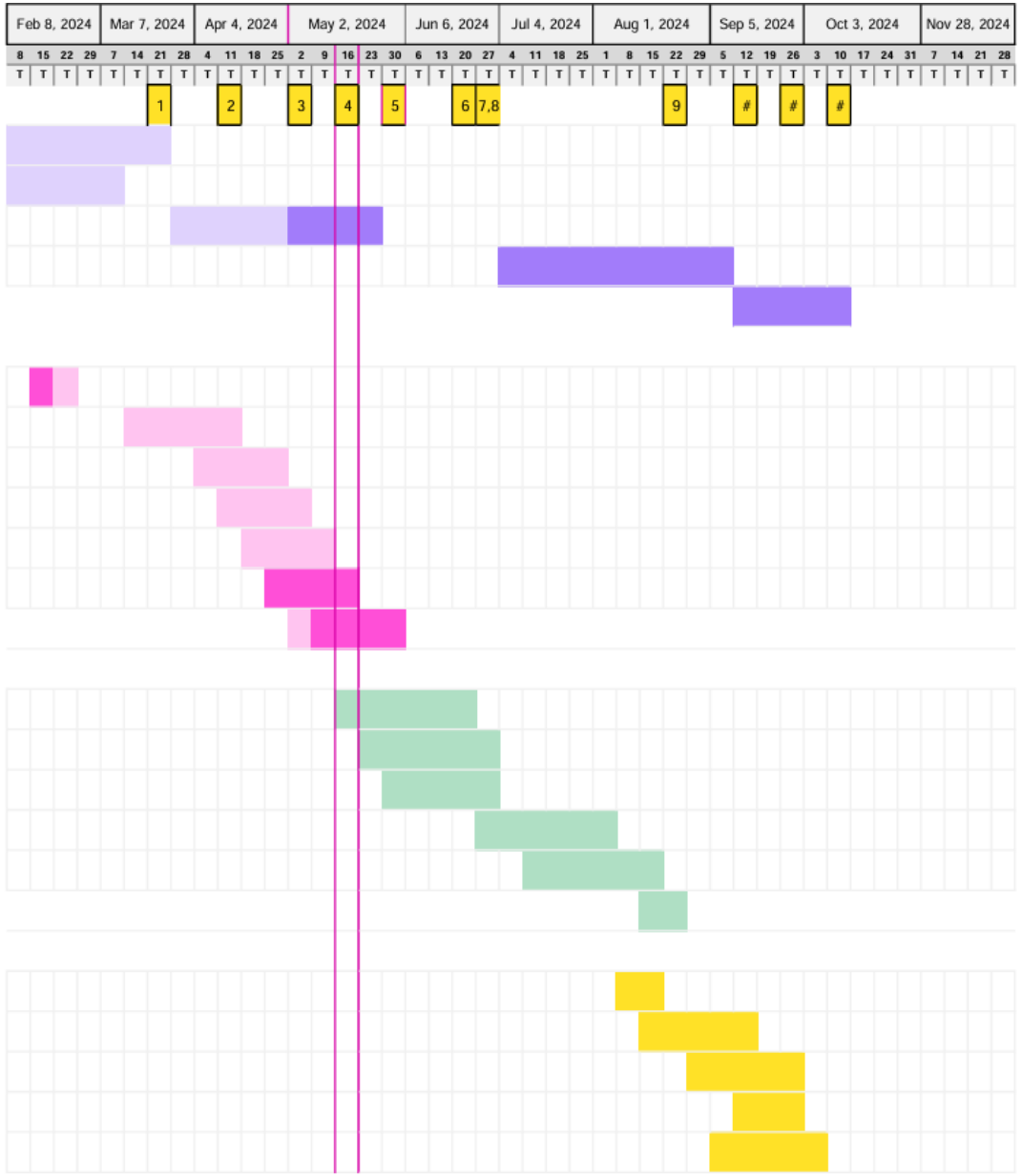
TASK	Next step	PROGRESS	START	END
Initial planing and management		65%		
Create project proposal	completed	100%	8-Feb-24	21-Mar-24
Initial research	completed	100%	7-Feb-24	7-Mar-24
Management Presentation	25/04 lecture	60%	28-Mar-24	23-May-24
Progress Presentation		0%	5-Jul-24	5-Sep-24
Final report			12-Sep-24	10-Oct-24
Planning and design		73%		
System overview	Completed	100%	21-Feb-24	28-Feb-24
List of components	completed	100%	14-Mar-24	12-Apr-24
Develop budget	Finalise with Supervisor	100%	4-Apr-24	25-Apr-24
Define milestones and time lines	Finalise with Supervisor	100%	11-Apr-24	2-May-24
Identify risks	Finalise with Supervisor	100%	18-Apr-24	9-May-24
Quality and economical assuraty	Finalise with Supervisor	0%	25-Apr-24	16-May-24
circuit and wiring diagrams		10%	2-May-24	30-May-24
Prototyping and testing		0%		
Navigation system initial setup and calibration	Speak to supervisor about purchasing	0%	16-May-24	21-Jun-24
Data collection system initial setup and testing		0%	23-May-24	27-Jun-24
Power system setup and testing		0%	30-May-24	27-Jun-24
Integrate navigation and data system with sensors and test/simulate		0%	27-Jun-24	1-Aug-24
Integrate data retrieval method		0%	16-Jul-24	15-Aug-24
Bench test entire system		0%	15-Aug-24	22-Aug-24
Vehicle intergration and final testing		0%		
Install navigation and data logging system into the vehicle		0%	8-Aug-24	20-Aug-24
Test overall system and find improvements		0%	16-Aug-24	12-Sep-24
Field test vehicle and gather real-world data		0%	29-Aug-24	26-Sep-24
Final changes		0%	12-Sep-24	26-Sep-24
Gather feedback		0%	5-Sep-24	4-Oct-24



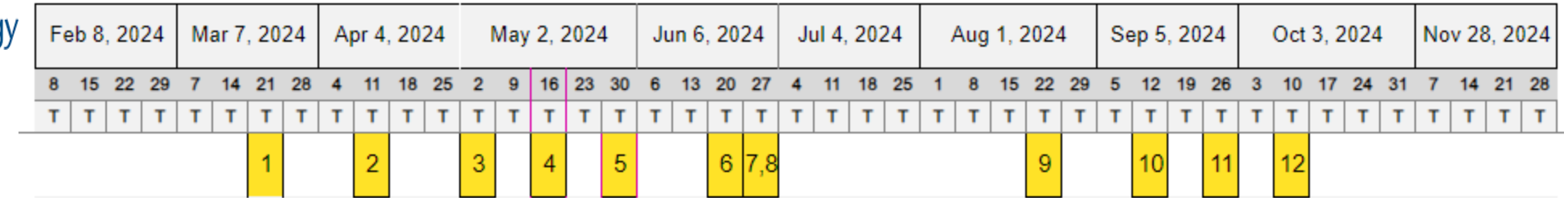
MILESTONE	DEADLINE
1. Submit proposal	21-Mar
2. Submit list of hardware	11-Apr
3. Implement management system	2-May
4. Order majority of components	16-May
5. conceptual and circuit designs	30-May
6. Establish comms with GNS, GPS and flight controller	21-Jun
7. Establish first successful sample and log of data	27-Jun
8. Establish steady power supply	27-Jun
9. Bench test and simulate system	22-Aug
10. Marry electronics and chassis and overall systems tests	12-Sep
11. Real world test	26-Sep
12: Final presentation	10-Oct

Time Estimation for Each Task

TASK	Next step	PROGRESS	START	END
Initial planing and management		75%		
Create project proposal	completed	100%	8-Feb-24	21-Mar-24
Initial research	completed	100%	7-Feb-24	7-Mar-24
Management Presentation	Completed	100%	28-Mar-24	23-May-24
Progress Presentation		0%	5-Jul-24	5-Sep-24
Final report			12-Sep-24	10-Oct-24
Planning and design		80%		
System overview	Completed	100%	21-Feb-24	28-Feb-24
List of components	completed	100%	14-Mar-24	12-Apr-24
Develop budget	completed	100%	4-Apr-24	25-Apr-24
Define milestones and time lines	completed	100%	11-Apr-24	2-May-24
Identify risks	completed	100%	18-Apr-24	9-May-24
Quality and economical assuraty	completed	0%	25-Apr-24	16-May-24
circuit and wiring diagrams	Transfer to CAD	60%	2-May-24	30-May-24

TASK	Next step	PROGRESS	START	END
Prototyping and testing		0%		
Navigation system initial setup and calibration	Waiting for parts to arrive	0%	16-May-24	21-Jun-24
Data collection system initial setup and testing	Waiting for parts to arrive	0%	23-May-24	27-Jun-24
Power system setup and testing	Waiting for parts to arrive	0%	30-May-24	27-Jun-24
Integrate navigation and data system with sensors and test/simulate		0%	27-Jun-24	1-Aug-24
Integrate data retrieval method		0%	16-Jul-24	15-Aug-24
Bench test entire system		0%	15-Aug-24	22-Aug-24
Vehicle intergration and final testing		0%		
Install navigation and data logging system into the vehicle		0%	8-Aug-24	20-Aug-24
Test overall system and find improvements		0%	16-Aug-24	12-Sep-24
Field test vehicle and gather real-world data		0%	29-Aug-24	26-Sep-24
Gather feedback		0%	5-Sep-24	4-Oct-24
Final changes		0%	12-Sep-24	26-Sep-24

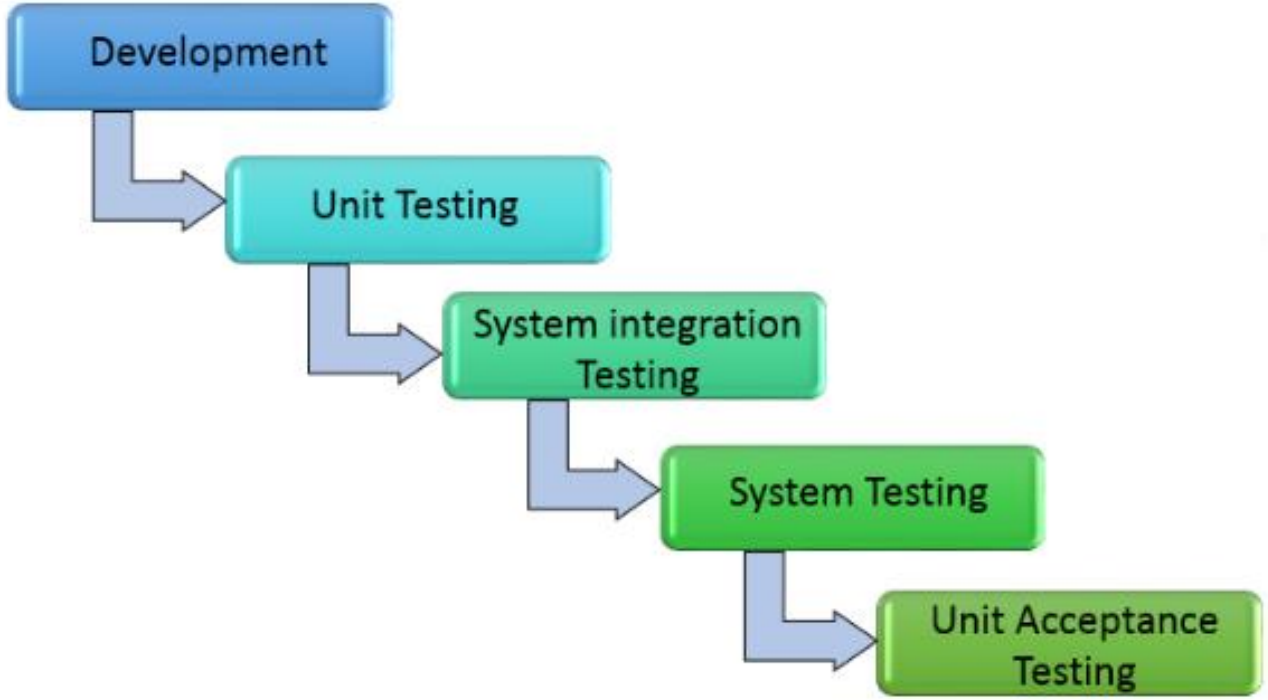
Milestones and deadlines



MILESTONE	DEADLINE	Status
1. Submit proposal	21-Mar	Done
2. Submit list of hardware	11-Apr	Done
3. Implement management system	2-May	Done
4. Order majority of components	16-May	Done
5. conceptual and circuit designs	30-May	In progress
6. Establish comms with GNS, GPS and flight controller	21-Jun	
7. Establish first successful sample and log of data	27-Jun	
8. Establish steady power supply	27-Jun	
9. Bench test and simulate system	22-Aug	
10. Marry electronics and chassis and overall systems tests	12-Sep	
11. Real world test	26-Sep	
12: Final presentation	10-Oct	

Quality Assurance

Systematic procedure of testing and integrating components



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Detailed documentation

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Staying within Industry standards

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Economics Principles

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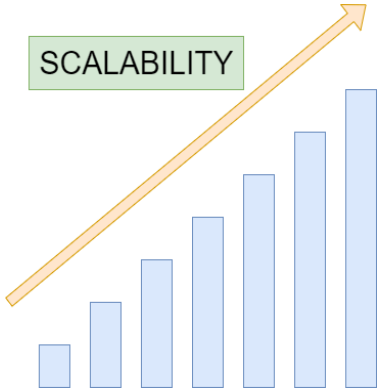

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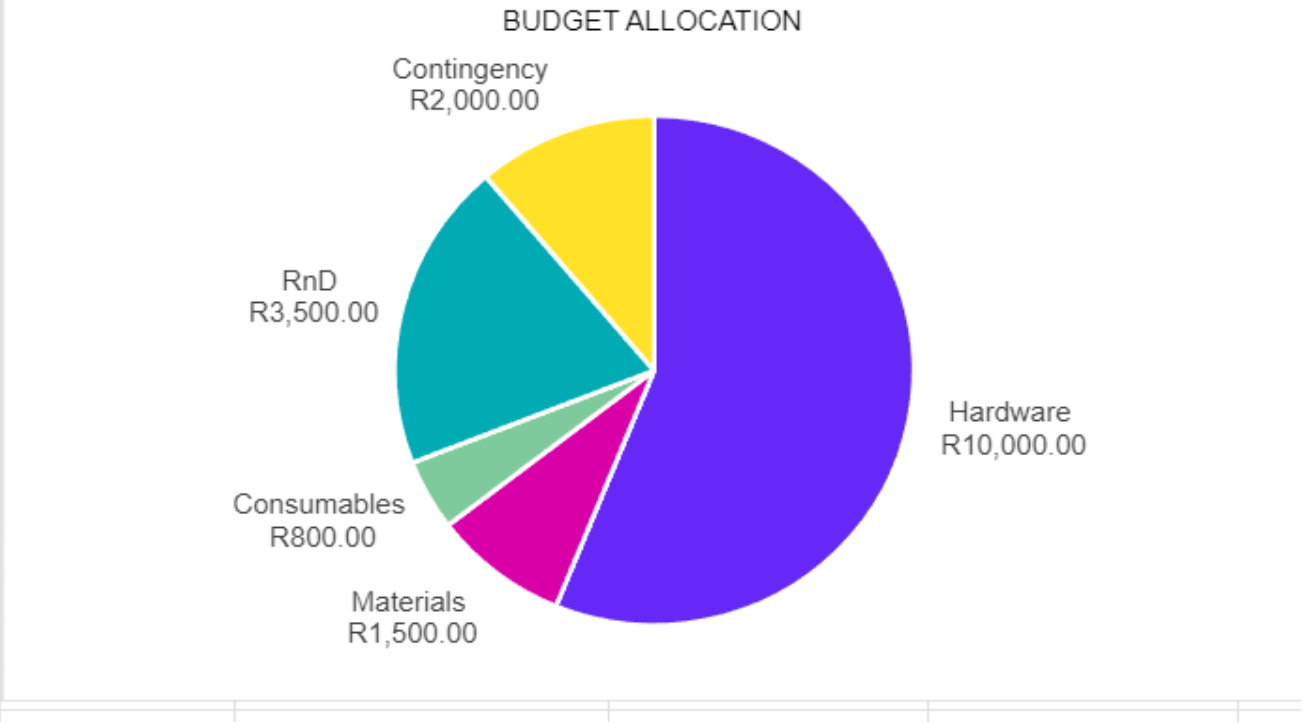
Item	Sum of Actual spend	Sum of difference	Sum of Allocated
Hardware	R 8,565.00	R 1,435.00	R 10,000.00
RnD			R 3,500.00
Materials			R 1,500.00
Contingency			R 2,000.00
Consumables			R 800.00
Grand Total	**R 8,565.00**	**R 1,435.00**	**R 17,800.00**



COST

	• Branded hardware • AIS system • Pixhawk controller • PV system
• Hardware clones • Legacy components	• Open-Source resources • Decommissioned glider chassis • Microcontrollers

VALUE

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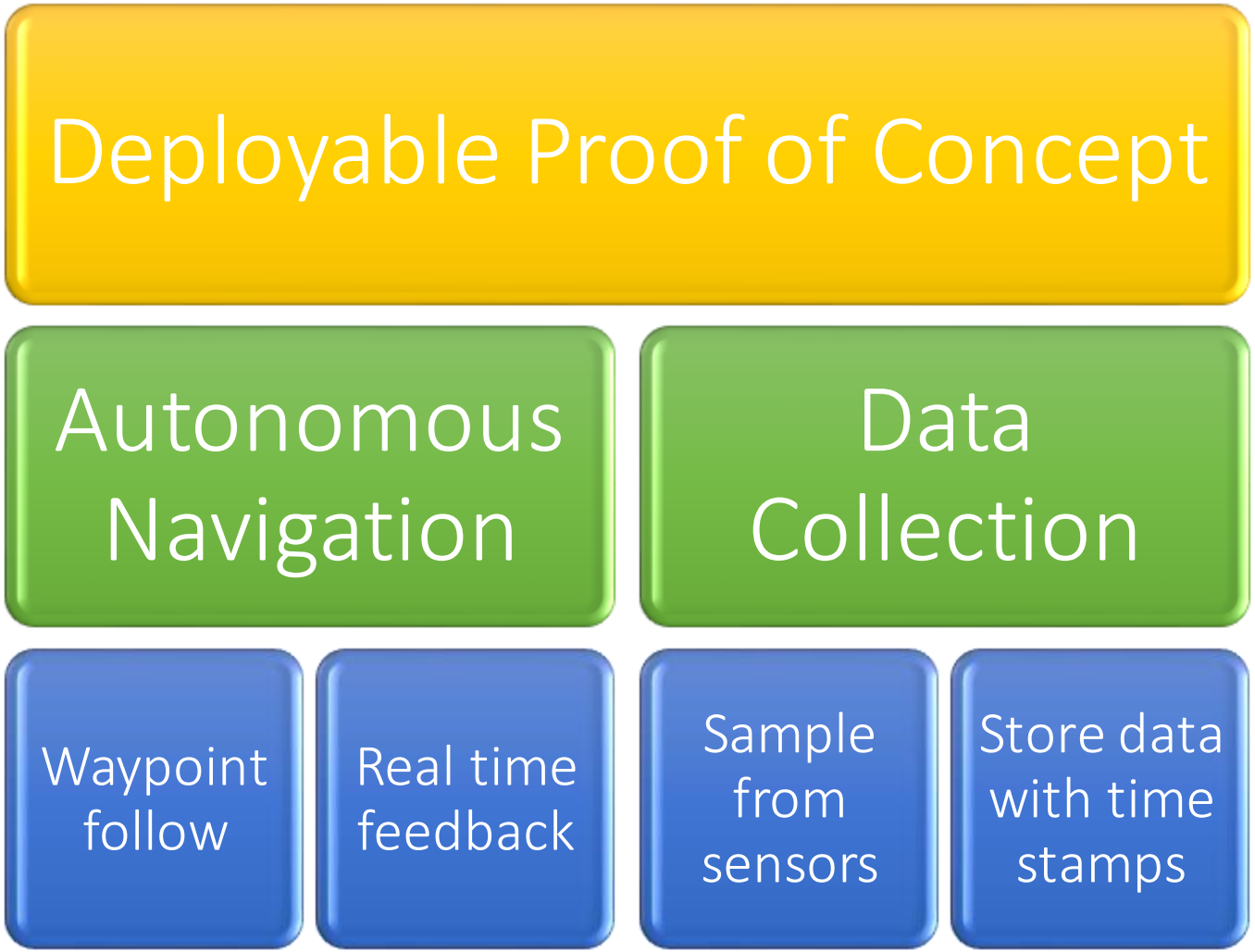
Expected Outcomes



Conclusion

Proprietary < Open-Source

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- The more we understand the behaviour of our oceans the better we can plan for our future.

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Thank you for you attention.

Any questions?

Contact details: Jordan Williams
Cell: +27 78 136 7086
Email: 221343687@mycput.ac.za / jordanwilliaams12@gmail.com

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References

- [1] K. Buchholz, “Infographic: The Oceans Are Getting Warmer,” *Statista Infographics*, Jan. 15, 2021. https://www.statista.com/chart/19418/divergence-of-ocean-temperatures-from-20th-century-average/
- [2] Sonardyne, “Redirect Notice,” *Google.com*, 2024. https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.sonardyne.com%2Fapplications%2Focean-currents%2F&psig=AOvVaw3xA_cL7y7ZwGIrjGevBaFK&ust=1716401004345000&source=images&cd=vfe&opi=89978449&ved=0CBIQjRxqFwoTCJDbzZiqn4YDFQAAAAAdAAAAABAE (accessed May 21, 2024).
- [3] Clipart library , https://clipart-library.com/
- [4] Sea Technology Services, “Sea Technology Services,” *Sea Technology Services*. https://www.seatechnology.co.za/ (accessed May 21, 2024).
- [5] Ardupilot, “Open Source Drone Software. Versatile, Trusted, Open. ArduPilot.,” *ardupilot.org*. https://ardupilot.org/
- [6] Communica south aftrica, “Communica South Africa,” *Communica South Africa*. https://www.communica.co.za/
- [7] “Council for Scientific and Industrial Research (CSIR) - Overview,” *nationalgovernment.co.za*. https://nationalgovernment.co.za/units/view/212/council-for-scientific-and-industrial-research-csir
- [8] T. Morris *et al.*, “Monitoring Boundary Currents Using Ocean Observing Infrastructure | Oceanography,” *Frontiers in Ocean Observing: Documenting Ecosystems, Understanding Environmental Changes, Forecasting Hazards*, vol. 34, no. 4, Jan. 2022, doi: https://doi.org/10.5670/oceanog.2021..
- [9] X. Chen, M. Hong, S. Wu, K. Liu, and K. Mao, “Design of Wave Glider Optimal Parameters Suitable for the Northwest Pacific Ocean, the North Indian Ocean, and the South China Sea,” *Journal of Marine Science and Engineering*, vol. 9, no. 4, p. 408, Apr. 2021, doi: https://doi.org/10.3390/jmse9040408.
- [10] S. Kolhe, “The Benefits of Open Source Products,” *opensourceforu*, Sep. 20, 2015. https://www.opensourceforu.com/2015/09/the-benefits-of-open-source-products/?amp (accessed May 21, 2024).
- [11] Van Lancker and M. Baeye, “Wave Glider Monitoring of Sediment Transport and Dredge Plumes in a Shallow Marine Sandbank Environment,” PLOS ONE, vol. 10, no. 6, p. 5/15, Jun. 2015, doi: https://doi.org/10.1371/journal.pone.0128948.