Novel technologies to boost the shipyard industry

RPAS application in shipbuilding industry

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ORGANIZED BY THE EU HORIZON 2020 PROJECTS:

FIBRE4YARDS SHIPYARD FOR THE FUTURE

RESURGAM

MARI4YARD MARI4ALLIANCE

30th and 31st May 2023, RTD Innovation Dock, Rotterdam

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements n° 101006860 (FIBRE4YARDS), n° 101007005 (RESURGAM), and n° 101006798 (Mari4_YARD).

GHENOVA

- Engineering company with more than 1000 employees

- Based on Spain with offices worldwide

GHENOVA

- Main business shipbuilding

- Other business lines:
  - Industry & energy
  - Infrastructure
  - Digital transformation
  - Research & development

GHENOVA

- Jonatan Moya Rubio
- Naval Architect & Marine Engineer
  - More than 15 years experience in shipbuilding
- RPAS Professional Pilot
  - More than 10 years designing, building & piloting drones
- RPAS Instructor & Examinator

MARI4 YARD

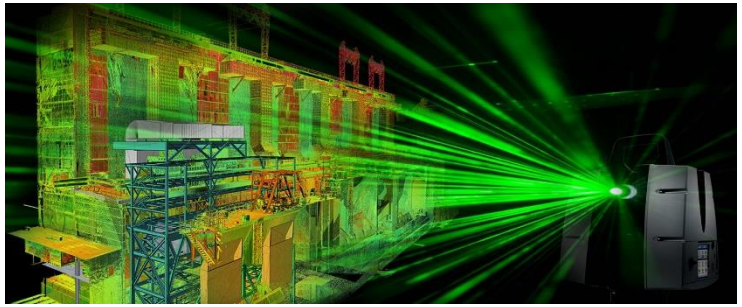
- Main objective of the project

- How can be shipbuilding improved using RPAS?

MARI4 YARD

- Main objective of the project
- Technologies
- How can be shipbuilding improved using RPAS?



METHODOLOGY

- End user centered
- Analysis of the input based on experience in shipbuilding
- Other fields (drones, laser scanning) experience

INPUT FROM USERS

- Partners
- Proposals
- Filtering proposals
  - Derives in tasks

nodosa shipyard

BRODOSPLIT Member of DIV GROUP

		Technology groups	ROBOT	EXOSKELETON	AR/VR	LASER SCANNING	DRONE
	Tasks						
1	Remove gas from confined spaces		X				X
2	Clean tanks		X	X			
3	Welding to assembly parts		X				
4	Weld piping		X				
5	Water jet cleaning		X				X
6	Works in difficult positions			X			
7	Transport of heavy parts		X	X			
8	Locate workers within the vessel				X		
9	Position elements and equipment				X	X	
10	Progress monitoring				X	X	
11	Position/Cut openings		X		X		
12	Maintenance and installation operations				X		
13	Reverse engineering for non-modelled pipes					X	
14	Project documentation updating					X	
15	Inspect areas with difficult access						X
16	Logistic operations				X		X

TASKS I

Remove gas from confined spaces

- Current methodology is sounding the entrance area
- Small drone to enter confined spaces and check air quality
- Safety improvement
- Safety equipment savings

TASKS II

Water jet cleaning

- Currently made by using blasting or crawler robot
- Big drone required to do the job
- Safety improvement
- Safety equipment saving
- Improved cleaning time
- Not viable

TASKS III

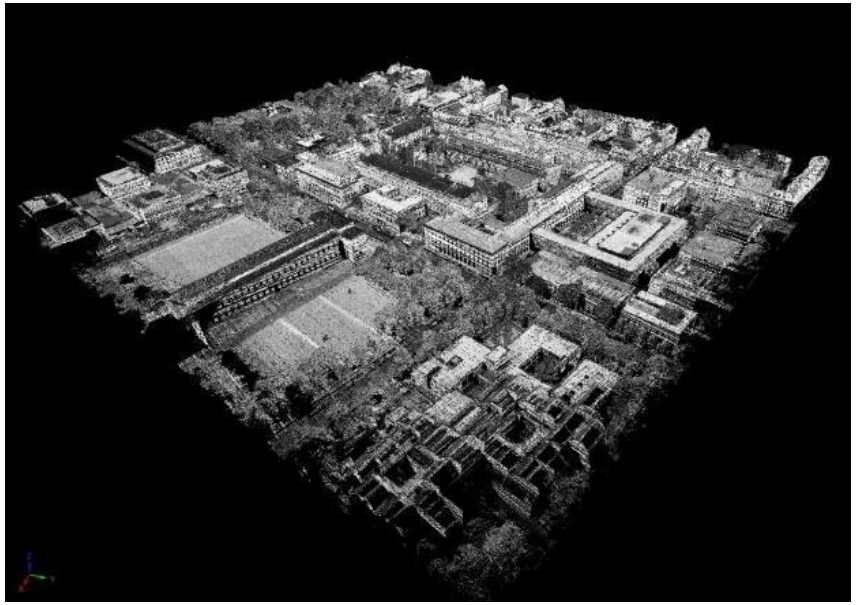
Inspection of areas with difficult access

- Currently made manually
- Two cases:
  - Indoor inspection with small drone
  - Outdoor inspection
- Safety improvement
- Safety equipment saving
- Scaffolding saving
- Time saving

TASKS IV

Logistic operations

- Currently made with very little or no planification at all
- Obtaining a point cloud of the shipyard to be used as a tool for planning
- Use of drone to speed up the task
- Improved planning time
- Possibility of automation

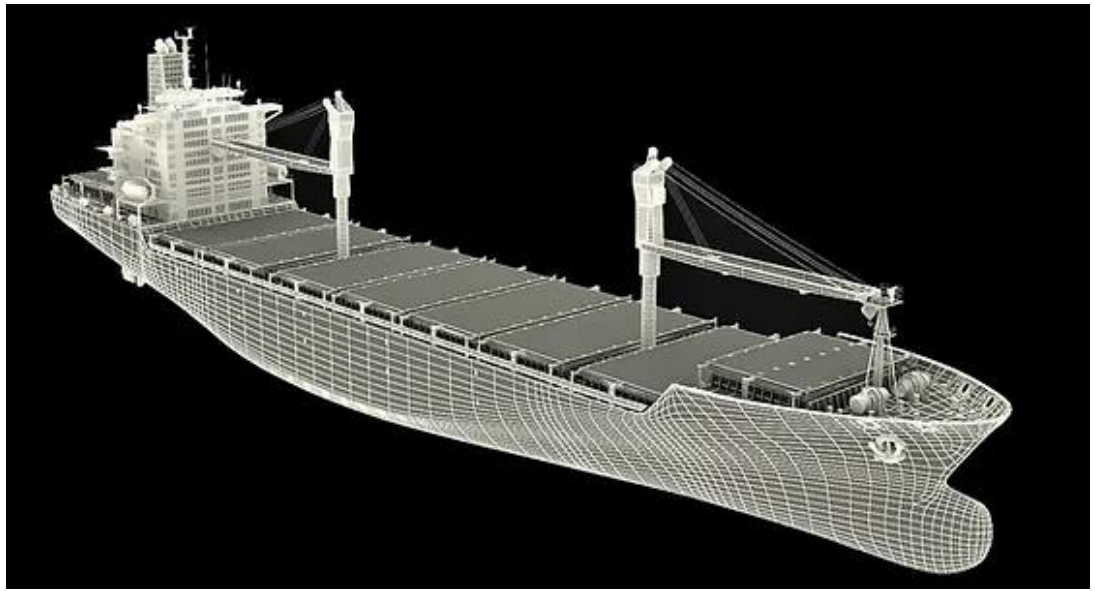


TASKS V

Reverse engineering

- New task derived from the potential of solutions

- Use of LIDAR to make reverse engineering of ships for repair and/or maintenance



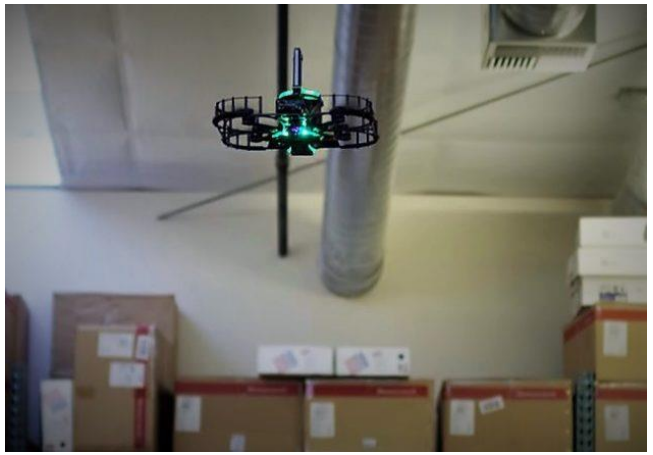
REQUIREMENTS

- Requirements matrix for each task
- Analysis of the operating conditions of the aircraft on each environment
- Lead to solutions development and acquisition

Proposal	Task	Size	Payload	Int / Ext	Considerations	Possible solutions	Requirements
Double bottom degasificatio n	Air quality check	Small	Gas sensor + camera	Indoors	Difficult signal transmission	Low frequency transmission	Can fly through a manhole
					Risk of fire/explosion	Spark suffocator	Payload:
					Limited maneouverabilit y	External sealing	-Lighting
					Reduced visibility	Assisted flight	-Gas sensor
					Narrow space (limits size)	Obstacle detection	-Infrarred sensors
					Possibility of propeller crash	Lighting	-Camera
						Infrarred sensors	-Jail
						Protective jail	
						Propeller guard	
Difficult access zones inspection	Visual inspection in small indoors spaces	Small	Camera	Indoors	Difficult signal transmission	Low frequency transmission	Can fly through a normalized door
			LIDAR		Limited maneuverability	Assisted flight	Payload:
					Reduced visibility	Obstacle detection	-LIDAR
					Narrow space (limits size)	Lighting	-Camera
					Possibility of propeller crash	Infrarred sensors	-Jail
						Protective jail	
						Propeller guard	
	Visual inspection of difficult access zones (unaccessibl e zones such as chimneys, masts, power lines, etc.)	Small	Camera	Outdoors	Weather conditioning	Big motors	Payload:
		Big	LIDAR	Indoors			-LIDAR
							-Camera
Logistic planification	Shipyard LIDAR scanning	Big	Camera	Outdoors	Weather conditioning	Big motors	Payload:
			LIDAR				-LIDAR
							-Camera

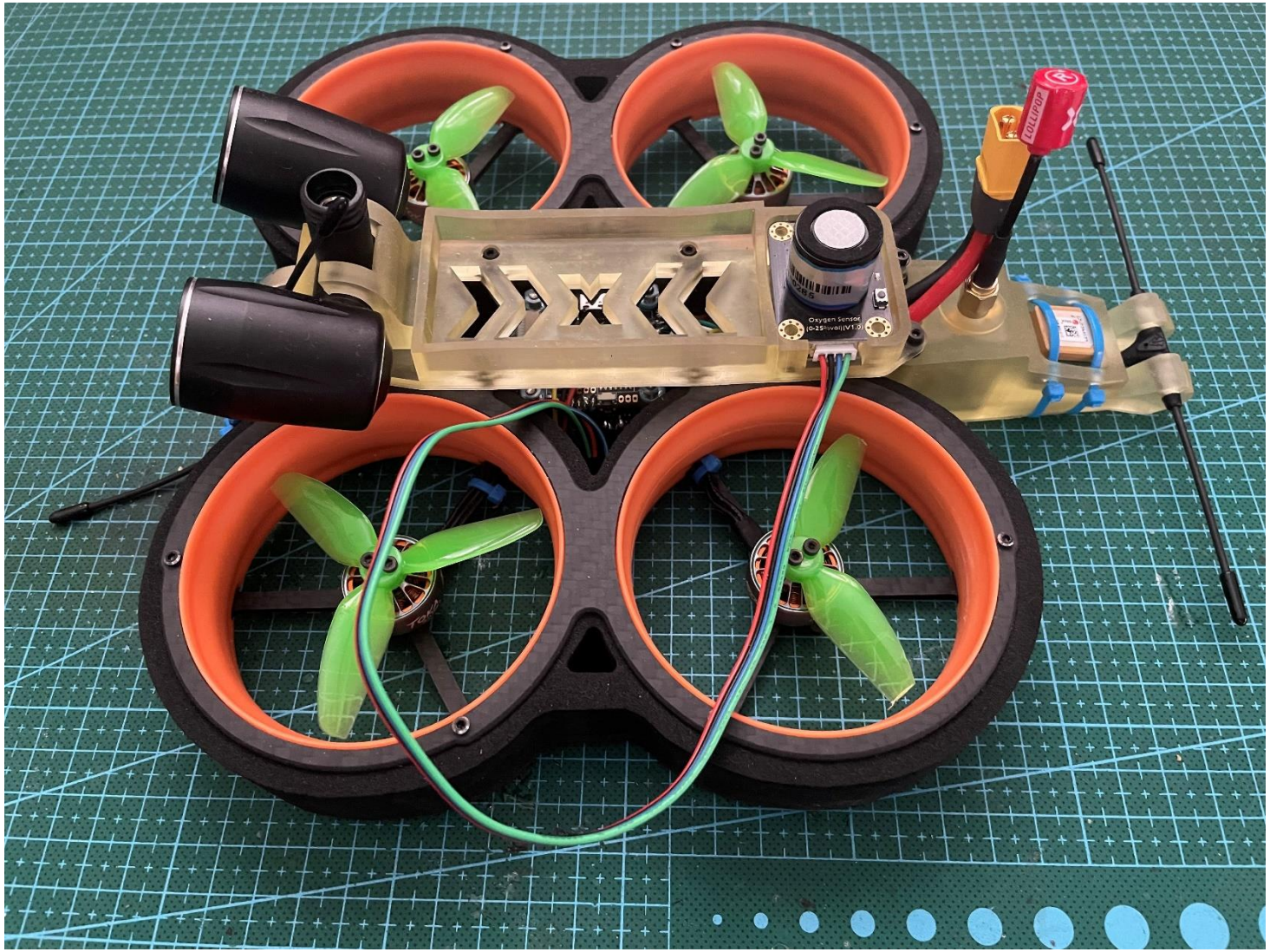
SOLUTIONS

- 2 drones required
  - Big drone for exteriors
  - Small drone for interiors
- Small drone built
- Big drone acquired
- Additionally, RPAS operator registering, pilot licenses and insurance required



SOLUTIONS I

- Small drone – GH Taycan
  - Able to go through manhole
- Gas sensor onboard
- Modification to radio system to get telemetry from gas sensor on the controller
- Not ex-proof, future development



SOLUTIONS II

- Big drone – DJI M300 RTK
  - Able to carry LIDAR and other payloads
- Environment resistant
  - Wind resistance up to 16m/s
  - Water resistant
- Requires licensing for flying on some places
- Inspection industry reference
  - Liability

TESTS I

Remove gas from confined spaces

TESTS II

Indoors inspection

TESTS III

Outdoors inspection

TESTS IV

Logistic operations

- Planned to make LIDAR scanning of the NODOSA Shipyard

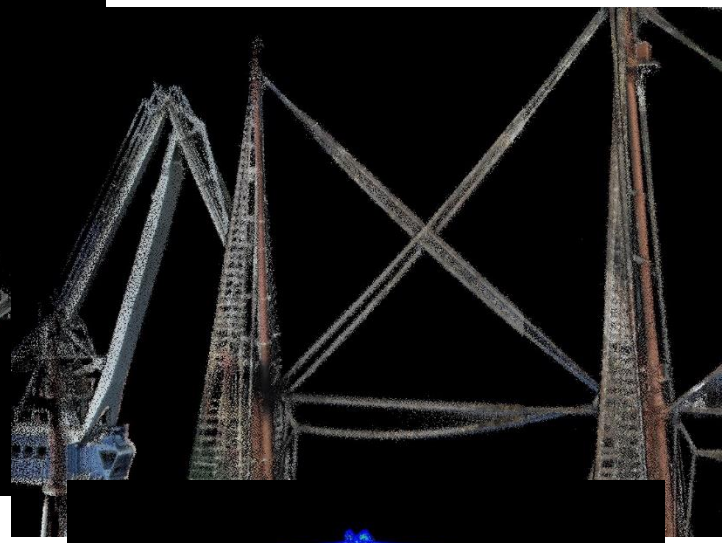
- Impossible due to seagulls attack to the RPAS

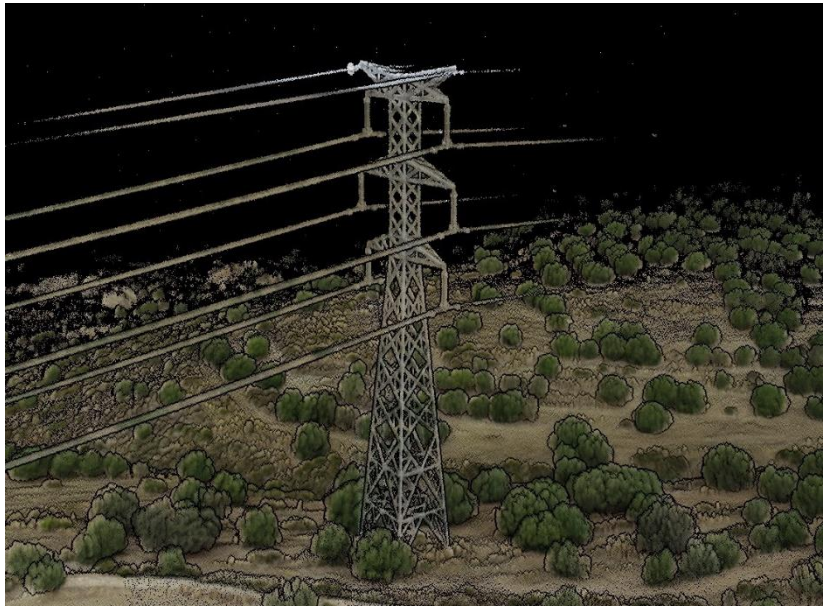
TESTS V

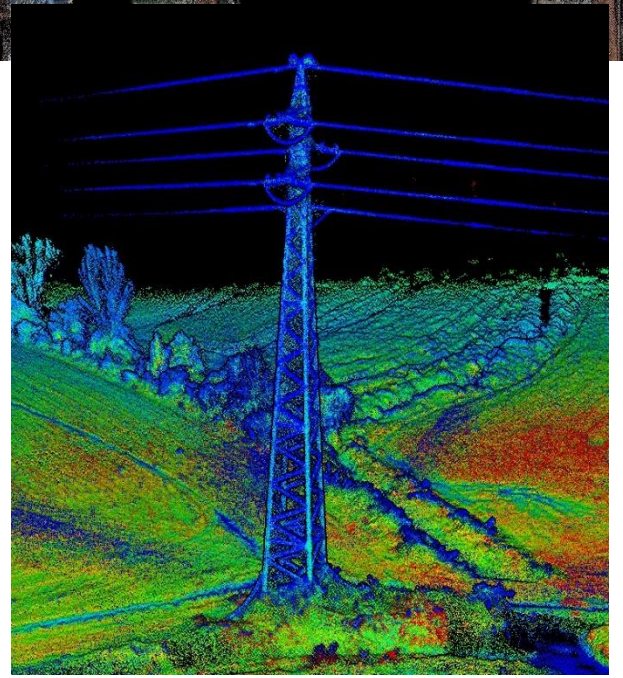
Reverse engineering

- Made LIDAR scanning of Juan Sebastian Elcano ship

- Further tests made on powerlines towers
- Accuracy of LIDAR systems for RPAS is good enough for topography but not for reverse engineering







CONCLUSIONS

- Improve stability of small drone on indoor scenarios
- Improve video quality on small drone
- Improve methodology for air quality checking testing
- Take into account the birds breeding period for flights
- It is necessary to perform more tests in the future
- Nowadays LIDAR technology on RPAS is not accurate for reverse engineering

QUESTIONS

THANKS
FOR YOUR ATTENTION

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