

Digital maintenance management for tidal arrays



### Johannes van Urk

CEO at MaraSoft



jvanurk@marasoft.nl

n jo

johannesvanurk

# Introduction

Learn how we leverage software and data to identify the most optimal maintenance window for performing maintenance on tidal arrays.



# Marad Tidal | About Us

### Company

MaraSoft develops Marad, an advanced maritime fleet management application designed for maritime administration. Utilized by over 4,500 vessels and marine installations worldwide, our user-friendly software simplifies operations and administration.

### Application

- Start
- Maintenance
- Inventory
- Purchase
- Certificates

- Crewing
- FLGO
- Safety
- QHSE
- Tidal New!



# Marad Tidal | Challenges

The tidal energy sector encounters unique challenges in maintaining tidal arrays:

### Harsh weather conditions

Operating conditions are challenging and highly unpredictable, affecting reliability and performance.





### Lack of specialized software

Tidal array projects lack specialized software and maintenance tools, creating operational challenges.



### Short maintenance windows

Environmental constraints and other variables significantly limit the available maintenance windows.

### **Downtime and financial loss**

Inefficiencies or downtime cause significant financial losses by halting energy generation.

# Marad Tidal | Solution

Our solution is a tailored maintenance planning tool for tidal arrays.



### 1) Tidal prediction

Integrated tidal analysis and prediction tool to accurately plan around tidal conditions.

### 2) Maintenance planning

Complete control over planned and corrective maintenance, ensuring efficiency and minimal downtime.

### 3) Advanced data analytics

A single platform to easily find the most optimal maintenance window and make informed decisions.

# Marad Tidal | Collecting Data

#### **Data Sources**

Marad gathers, analyzes, and converts data into actionable insights to identify the optimal maintenance window.



**Seabed Sensors** Collect tidal data using ADCPs



Maintenance Resource availability and planning.



**External APIs** Third-party data such as the weather.



#### Variables

Predictions, user input, and requirements.

#### **Data Layers**

Data layers are used to determine the ideal maintenance window, for example low tidal speeds, a calm sea, and no wind.

- Lost revenue
- Site entry safety

• Tidal speed and direction

Maintenance tasks

Weather and waves

• Availability of engineers

• Daylight accessibility

### Marad Tidal | Examples



## Marad Tidal | Scope

### Summary

The most significant improvement that will be implemented in Marad is a tidal cycle function and operations planning. In essence, this will allow operators of tidal arrays plan operations ahead based around the state of the tide, weather, and more. The primary goal is to maximize productivity and efficiency by utilizing favourable conditions, as well as improving the safety of engineers.



Planned and corrective maintenance



# Marad Tidal | Layers

#### Low Requirements

The ideal maintenance window is calculated using the tidal speed and planning.

### Variables

- Tidal speed
- Availability of engineers

**Medium Requirements** 

The window is calculated based on variables such as weather and waves.

### Variables

- Tidal speed
- Availability of engineers
- Weather

### **High Requirements**

All layers are used and the number of ideal windows is drastically reduced.

### Variables

- Tidal speed
- Availability of engineers
- Weather
- Waves
- Daylight hours
- Lost revenue

# Marad Tidal | Maintenance Window

Low Requirements

Due to the low requirements, maintenance can easily be planned at regular intervals.

#### **Medium Requirements**

Due to the addition of multiple constraints, the number of optimal windows is reduced.

#### **High Requirements**

The high number of requirements severely reduces the frequency of maintenance windows.



September

# Marad Tidal | Planning Maintenance Windows

	marad		■ Location: Tid	E Location: Tidall														
	OVER	VIEW	View type Day			•	٩	Go to cur	rent tim	e	₩,	<u>a</u> 🌾	탕	a				
		Dashboard										Thu 1	12/05					
	ත්	FleetView	Search		4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM
	MODULES																	
~										/	T							
^	*	Maintenance	Tidal Data						/									
	8	Components																
	ίΞ	Worklists																77
	ŵ <sub>@</sub>	Counter	Wind Data		3.53	4		1.52	4		2.60	<		1.33			3.68	
	Ð	Project Planning			m/s			m/s			m/s			m/s			m/s	
	ö	Week remarks	Jasper Delacroix Captain															
	≋	Tidal																
	٢	Logs	Lucian Voss Chief Mate															
	5	History																
	~	Finance	Nyla Rivers Electrician															
	¢	TMSA/OVMSA																
	ŝ	Settings	Ethan Reynolds Cook															
	*	Tidal Settings																
		Library	SJ Samantha Johnes Chief Engineer															
	<b>%</b>	Pareto																



# Marad Tidal | Planned Maintenance System

Y	≡	Moder	n 📕 🕸	
00		Filters	Inklappen/Uitkl	appen
අ	Nam	ie		
^			Ţ	
Ш		0	All Systems [read all remarks please]	
*		+ 🔴	Auxiliary Systems (29)	
		+ 🥚	Cooling Systems (58)	
!!!		+ 🥚	HV (>1000V) Elec. Equip. / Distr. (6)	
		+ 🥚	Hydraulic Systems (19)	
ગ		+ 🥚	LV (< 1000V), DC & control Elec. Equip / Distr. (46)	
പ്പ		+	Network, C&I, Support Software (73)	
		•	Power Take-Off System and Pitch System (80)	
(+)			A SB-Nacelle PTO System (34)	
ы		+	SB-MSU (11)	
_		+	SB-Gearbox (2)	
ŝ		+	🛛 🥚 SB-Brake, High Speed Shaft Coupling, Slipring (4)	
$\bigcirc$		+	SB-Generator (11)	
0			🔒 Low Speed Shaft Coupling	
			A SIMPLEX Ring Anode MSU	
~		+	A PS-Nacelle PTO System (24)	
<b>%</b>		+	PS - Hub Pitch System (7)	
~~		+	SB - Hub Pitch System (7)	
វទិវ			🛕 PS - Blade 2 (outboard)	
			🛕 PS - Blade 1 (inboard)	
			🛕 SB - Blade 2 (outboard)	
			A SB - Blade 1 (inboard)	
		+ 🥚	Caldale substation (8)	
		+ 🔵	Offshore Assets (126)	
	***	+ 🔵	Structural Systems (138)	
		+	Safety Systems (38)	
	***	+ 🥥	Turbine Operational Safety (14)	
		+	Spares Needing Maintenance (10)	

3/

		Jobs	Data card 🛛 🕅 Documents 🛛 H	istory	P	arts	Logs QHSE	Reports	Certificates						
pen	1	+ Add	d Search job	٩		SB-Gear	box						Nume	eric	🗌 Inclu
	Г													Last	mainten
		Nan	ne		JC	Docs	Due date	Week	Interval	Due	Postponed wi	Duration	Rank	Week	k Da
				T				T	T	T	<b>T</b>	T	T	<b>T</b>	T
_ 1	E	- Maint	enance (2)												
_	0		On-scheduled maintenance			-						0 hours	Maintenance Tea		
_			🛕 Daily inspection info (MARAD,	SCA		-						0 hours	Admin, Maintenan		
_	E	Onsit	e within O2's nacelles,hull(raised)	(4)											
_	0		🚹 18 monthly inspection, shaft s	eal re			18-09-202	5 38	18 mont	. 384 days		3 hours	Maintenance Tea	12	18-
_	0		🛕 4 yearly preventive maintenar	ıce			01-06-202	5 22	48 mon	275 days		4 hours	Admin, Engineerin		
_	0		🛕 6 monthly service inspection			-	18-09-202	4 38	6 mont	19 days		2 hours	Maintenance Tea	12	18-
_	0		🛕 3 monthly: breather cleaning,	relui		-	18-06-202	4 25	3 mont	-73 days		2 hours	Admin, Engineerin	12	18-

Job	Job card	Documents	Templa
Werkka	art		
<b>n</b> c	Size	▼ Font	

#### List of permits/checks needed to handle

At any maintenance and repair work, the equi trained personnel.

- When performing repairs
- proceed systematically following the assemble
- Do not use excessive force
- · Before disassembly, mark the components
- · Clean the components by a cleaning agent
- · Lubricate the functional parts before assemi
- Check function of assembled groups
- Check the moving parts are not jammed
- Check specified clearances have been achies

Work Order Created on 16-04-2021 door Ca

	- 13	Q)	<b>i</b>	() m	aradad	min															
Numeric			lusief sub	compo	onente	n															
	Last	mainte	enance																		
	Weel	< C	ate/Cou	nter	Date/C	oun															
T		T		T																	
re Tea																					
ntenan																					
ce Tea	12	1	8-03-2024	4 1	65 day	/s ag															
gineerin	12	1	8-03-202	4 1	65 day	(5 a)															
gineerin	12	1	8-03-2024	4 1	65 day	/s ag															
																					×
uments	Т	empla	ite	Part	٦	ime/0	Costs	Lo	gs	Histor	ry										
ont			- E	3	I 4	s <u>L</u>	≣	Ξ	Э	₽	Ĩ	≣ Щ	$\mathbb{F}_{\!x}$	Norma	le tekst		- A	4° .	S	÷	:
n the da <b>needed</b> epair wo	ata ca d to l ork, t	ard of hand he eq	this co le syst uipmer	ems	onent 5 / II	r, con n <b>forn</b> e sec	tains i natio	mport	ant in occup t inad	oformation	tion. al s t sta	afety ar	nd env	/ironme	ntal pr	otecti	on:			only by	well
ce k the co y a clea parts be bled gro are not	the ompo ning efore oups jamn	assen nents agent asser ned	nbly dra relativ before nbly.	awin e po e ass	g sitior æmbl	ı İy		ganis				i engr / a		vork must	: be per	formed	d thor	roughly	and c	, .,	ļ

## Marad Tidal | Orbital Marine's O2 Turbine



## Marad Tidal | Development Status

#### **Progress**

The beta version includes features such as tidal cycle visualizers, wind and wave data displays, maintenance task management, engineer availability tracking, and tools for planning and signing off maintenance tasks.

	marad	E Location: 02 Turk	oine			•	Statu	s:	In Use			•				
ඛ	FleetView	Save	Go	to currei	nt time	View t	ype	Day			•					
Ö	Tasks							Sat 0	2/20							
MOD	ULES		AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7
습	Start 🗸															
*	Maintenance ^															
æ	Components	Tidal Data	ſ													
¥⊒	Worklists															
ŵg	Counter															
Ö	Week remarks	Mirjam van Urk								Inspec	t nacelle			•		
<b></b>	Tidal	Chief Engineer														
Ĉ	Logs	Demo Admin														
5	History	Admit														

								8		Q	) (j	🎒 Demo
								Unpla	nned tasks	T	Durat <b>T</b>	Due
PM	8 PM	9 PM	10 PM	11 PM	12 AM	1 AM	2 A	Q			٩	۹
									Replace bre	eaker	4 h	12/07/2024
									Inspect blac	des	5 h	26/01/2025
									Clean blade	s	5 h	26/01/2025
									Lubricate ro	otor p	0 h	26/01/2025

# Marad Tidal | Future Improvements

#### **Development**

We are approaching the final stages of completing the tasks specified in the 4.1 work package of the MAXBlade project, co-funded by the EU. Any additional items beyond the initial scope will be addressed later.

#### Backlog

- Display wave data in the planning.
- Create an analysis and report section.
- Integrate a lost revenue calculator.
- Enhance the display of consumable activity.
- Enhance tidal data visualization features.

![](_page_14_Picture_9.jpeg)