



Advanced AI Solutions for Asset-Intensive Industries

Keeping your Facilities in Shape with AI-Enabled Solutions.



METALS
& MINING



ENERGY



OIL
& GAS



PULP
& PAPER

ABOUT MODEC

ABOUT SHAPE

SHAPE'S SOLUTIONS

SUCCESS CASES

LIGHTHOUSE IN A BOX

VALUE ASSURANCE

GET IN TOUCH



About **MODEC**

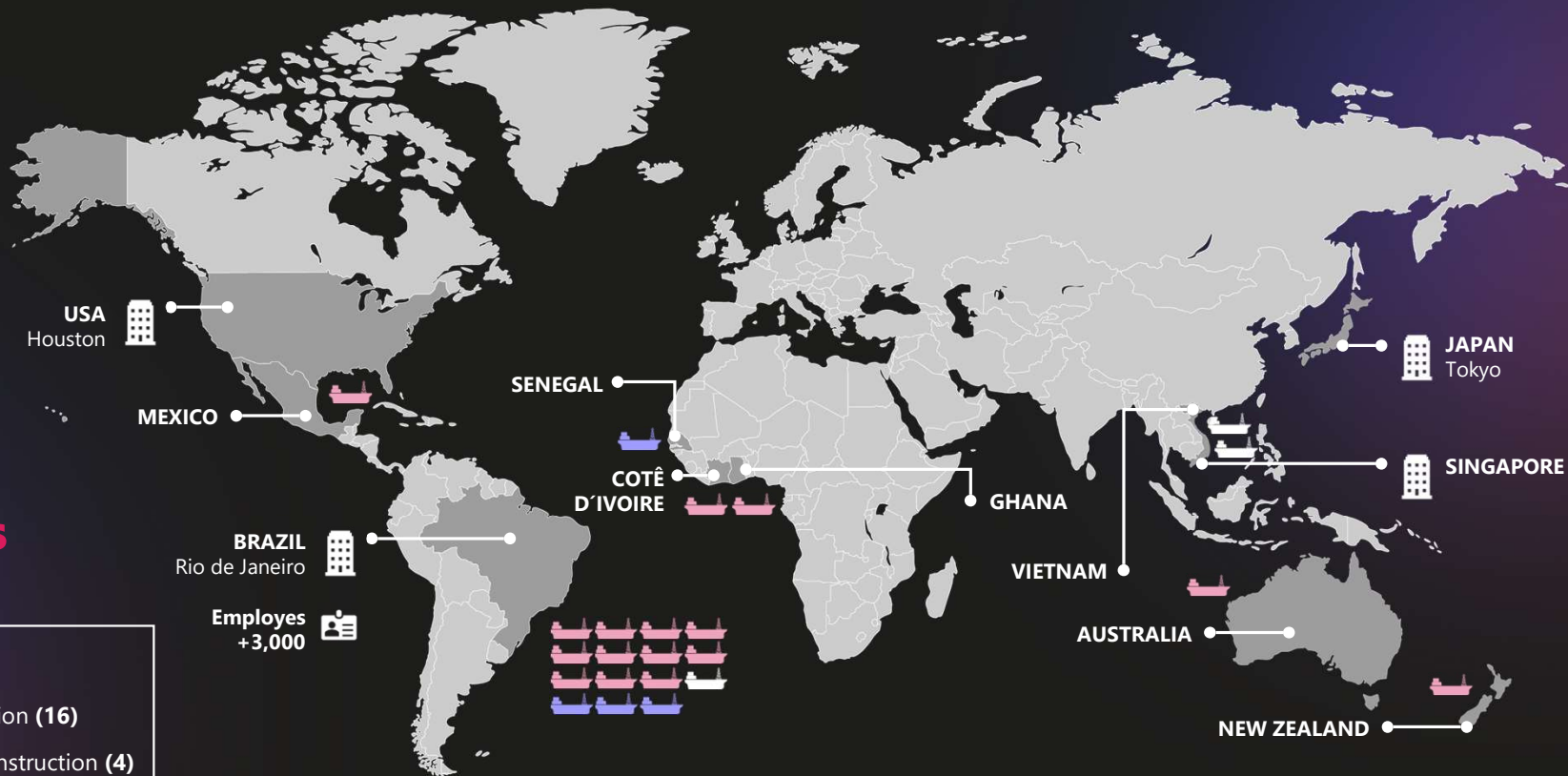
Global presence

+ 280 years of
operational &
maintenance
experience

Global
employees
+6,000

Total
portfolio
23 vessels

	Main Offices
	FPSO in operation (16)
	FPSO under construction (4)
	FSO in operation (3)



EPCI EXPERIENCE = 53 PROJECTS (~30% TO BRAZIL)



36 FPSO

Brazil (16)

Bacalhau	FPSO Bacalhau
Marlim 1	FPSO Anita Garibaldi MV33
Buzios 5	FPSO Almirante Barroso MV32
	FPSO Guanabara MV31
	FPSO Carioca MV30
	FPSO Cidade de Campos dos Goytacazes MV29
	FPSO Cidade de Caraguatatuba MV27
	FPSO Cidade de Itaguaí MV26
	FPSO Cidade de Mangaratiba MV24
	FPSO OSX-3
	FPSO Cidade de São Paulo MV23
	FPSO Cidade de Angra dos Reis MV22
	FPSO Cidade de Santos MV20
	FPSO Cidade de Niterói MV18
	FPSO Cidade do Rio de Janeiro MV14
	FPSO Fluminense

Southeast Asia (7)

	FPSO Song Doc Pride MV19
	FPSO Cuulong MV9
	FPSO Jasmine Venture MV7
	FPSO Langsa Venture MV 8
	FPSO Nanhai Sheng Li
	FPSO Anoa Natuna
	FPSO Kakap Natuna

Pacific (6)

	FPSO Pyrenees Venture
	FPSO Stybarrow Venture MV16
	FPSO MODEC Venture 11
	FPSO Buffalo Venture
	FPSO MODEC Venture 1
	FPSO Whakaaropai

West Africa (5)

Sangomar	FPSO Sangomar Phase 1
	FPSO Prof. John Evans Atta Mills
	FPSO PSVM
	FPSO Kwame Nkrumah MV21
	FPSO Baobab Ivoirien MV10

Gulf of Mexico (1)

	FPSO Miami MV34
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11 FSO

Southeast Asia (5)

	FSO Rang Dong MV17
	FSO Rang Doi MV12
	FSO Pathumabaha
	FSO Vietsovpetro 01
	FSO Nanhai Sheng Kai

West Africa (3)

	FSO Kome Kribi 1
	Esgravos LPG FSO
	FSO Madiela

Brazil (1)

	FSO Cidade de Macaé MV15
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North Sea/Europe (1)

	FSO Maersk Culzean
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Gulf of Mexico (1)

	FSO Ta Kuntah
--	---------------

6 TLP

Gulf of Mexico (4)

	Stampede TLP
	Shenzi TLP
	Marco Polo TLP
	Prince TLP

West Africa (2)

	Oveng TLP
	Okume/Ebano TLP

1 MOPU

West Africa (1)

	Tchatamba A MOPU
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TOTAL

17 BRAZIL

12 SOUTHEAST ASIA

11 WEST AFRICA

6 PACIFIC

6 GULF OF MEXICO

1 NORTH SEA EUROPE

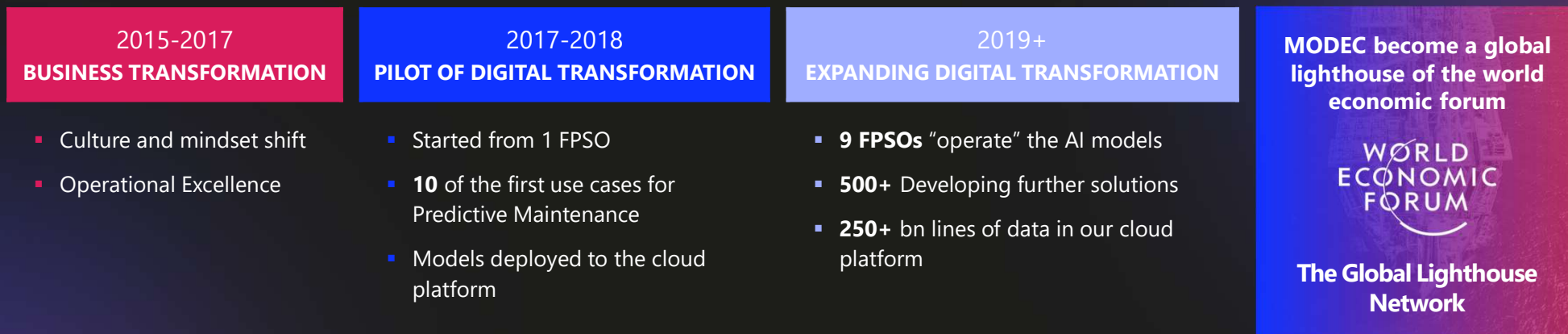


About **Shape**

Who is Shape?



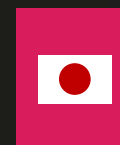
History of MODEC's Digital Transformation:



1st Oil upstream company



1st Site in Latam



1st Japanese company

Who is Shape?

Shape is a spin-off of MODEC

After its successful Digital Transformation journey, **MODEC** had the components for the next logical step with a clear business opportunity based on its long experience managing the construction and operations of large infrastructure assets.

Shape was born!

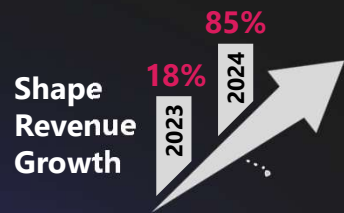
IN PARTNERSHIP WITH:



McKinsey
& Company



Global presence



Global employees
~100

- OIL & GAS
- POWER GEN.
- METALS & MINING
- PULP & PAPER
- SHAPE'S OFFICES
- SHAPE'S PROJECTS

Mexico

Guyana

Senegal

BRASIL
Rio de Janeiro
São Paulo

BRASIL

- Minas Gerais
- Pará
- Alagoas
- Rio Grande do Sul
- Mato Grosso do Sul
- Rondônia
- Paraná
- Sergipe
- Rio de Janeiro

Japan

Singapore

Australia

Who is Shape?



Shape's mission is to create sustainable business value through the combination of data, technology, and real-world industry experience.



MARKET*

- Oil & Gas
- Metals & Mining
- Pulp & Paper
- Power Generation



CUSTOMER PAINS

- Production Downtime
- Operational Costs
- Safety Risks
- Energy efficiency
- Sustainability



SHAPE'S DNA

- One-stop shop for innovative digital solutions

* major industries where Shape already provide solutions and support.

Who is Shape?

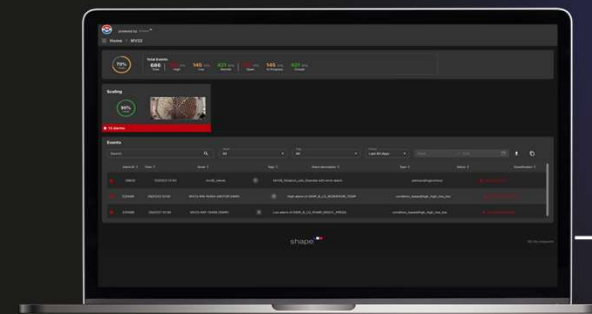


Shape's integrated solutions:

Fully dialogues with the Client's assets, by using Advanced Analytics.



Lighthouse:
Reliability Suite



Sylph:
Sustainability Suite



DBMS:
Safety & Integrity



VET:
AI-Based Engineering

Value proposition



Shape's value proposition drives business impact by serving clients in three key pillars.

INTEGRATED DATA PLATFORM

Integrate available data into a single source of truth

- Integrate
- Transform
- Export

APPLICATIONS SUITE

Transform data into insights that address business needs

- KPI Tracking
- Data & model integrity
- Asset health monitoring

VALUE ASSURANCE

Close the gap between digital solutions and front liners

- Modeling services
- Engineering support
- Process transformation
- Application training

Shape's solutions



RELIABILITY
LIGHTHOUSE

SUSTAINABILITY
SYLPH

SAFETY & INTEGRITY
DBMS

AI-BASED ENGINEERING
VET



RELIABILITY

Lighthouse

Lighthouse: value proposition



Maximize the performance of your facilities, ensuring current and future competitiveness.



IMPROVE
RELIABILITY



INCREASE ASSET AVAILABILITY
AND OVERALL PRODUCTION



REDUCE MAINTENANCE
& REPAIR COST



REDUCE GHG
EMISSIONS



MITIGATE HUMAN
RISK EXPOSURE



IMPROVE RESOURCE
MANAGEMENT

Lighthouse: potential impacts



Shape track record:

\$160M

Additional Production
estimated per year

* Based on average production
in Brazil and Brent @\$90

up to
\$1,3M

Repair Cost Saving per plant/year

15%

Overall Downtime Reduction
estimated

Network effect:

The tool is continuously expanding. New models' creation and new failure modes!

11 FPSO's

fully connected and powered by
Shape Asset Management Health

8.500+

sensors tags connected
to AI models

370 million hours

of structured data analyzed

800+

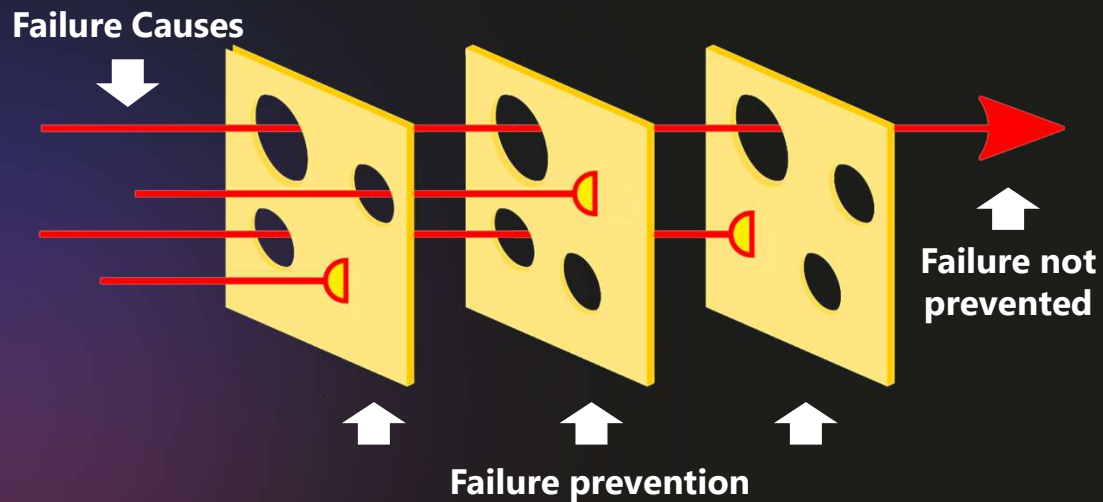
equipment models
developed

Lighthouse: problem statement



The solution support on asset-intensive industries surveillance to ensure asset health and safety.

SWISS CHEESE MODEL FOR RELIABILITY MANAGEMENT



All downtimes in an asset (e.g., equipment failures and pre-failures) happen through a combination of multiple operational and processes variables at the same time;

The Lighthouse solution reduces the gaps in reliability management, improving equipment and process health.

Digital Solution Platform for Reliability



Lighthouse is a growing platform to provide **digital solutions for the industry**, primarily focused on reliability.

From detecting a possible failure to monitoring sensors, the platform allows the user to monitor the conditions of their assets in intuitive panels.



FAILURE PREDICTION

Alert failures in advance based on levels of control, engineering equations, or AI.



ALARMS CONFIGURATION

Allows the user to create condition monitoring alarms and control the history of alarms issued.



DIAGNOSIS

Identify failure mode or key fault-related variables.



FEEDBACK CYCLE

Allows the user to record and change alarm status and sort according to diagnosis.

Lighthouse



A powerful tool that enables decision-making based on data analysis.

ASSET HEALTH VIEW

The Home screen allows the integration of multiple plants into a single platform for quick identification of potential failure risks.

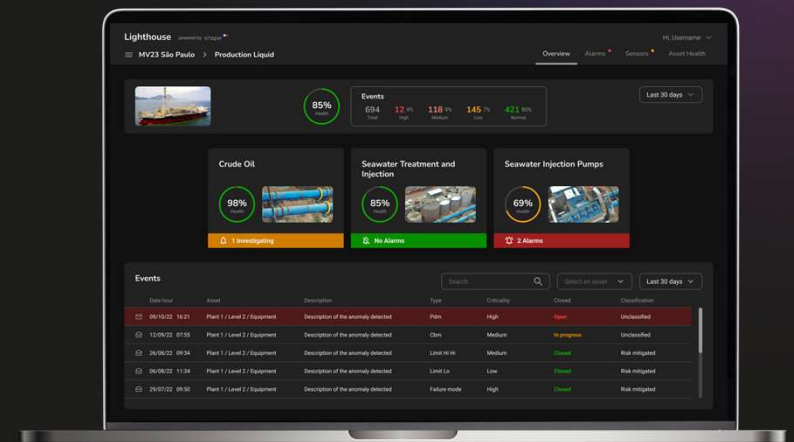
On a single screen, the management team can oversee and compare the health performance of multiple assets.



A powerful tool that enables decision-making based on data analysis.

SYSTEM VIEW

The analysis follows with a view of **systems and subsystems**, where the operator checks in an illustrated way the systems that need more attention.



Lighthouse

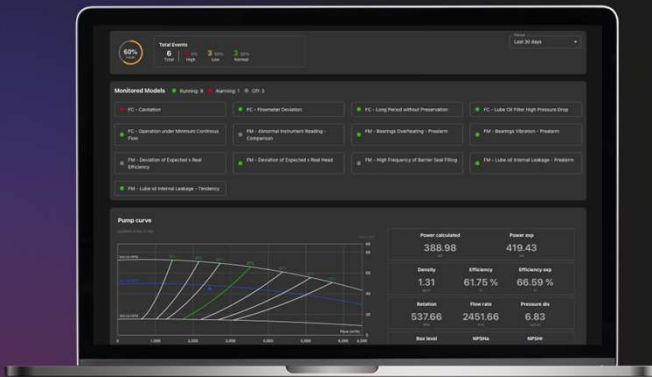
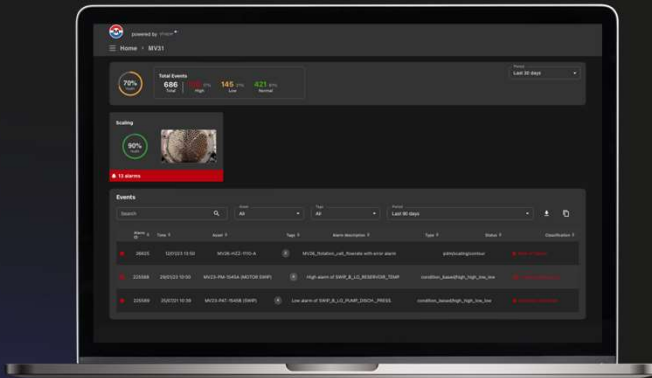


EQUIPMENT VIEW

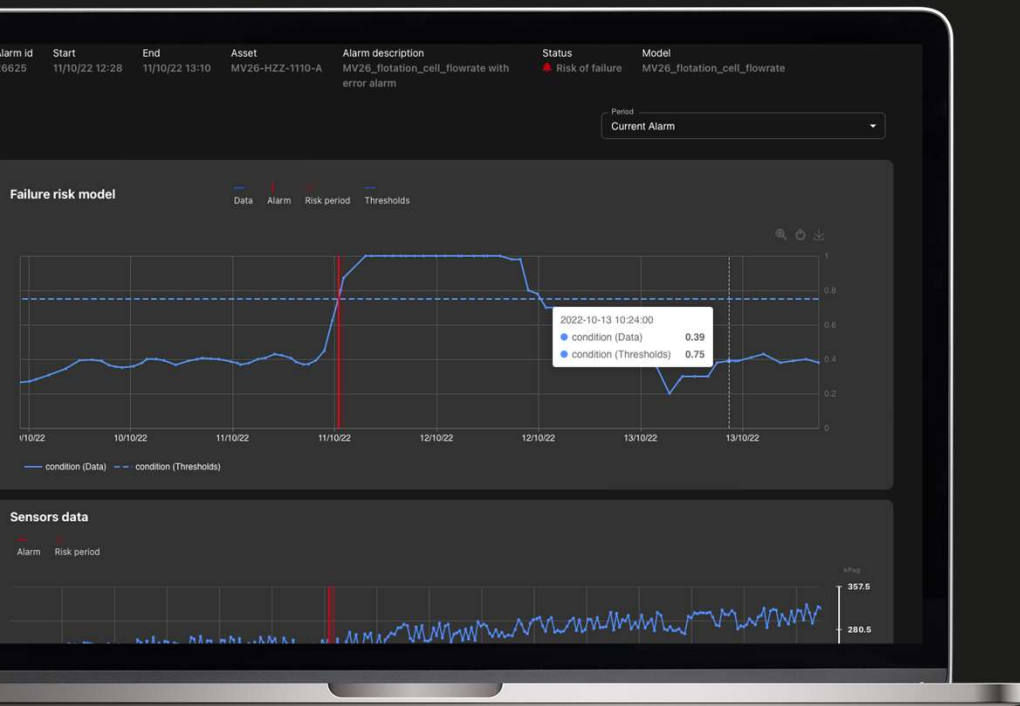
Next, the operator has access to vision by equipment, making maintenance prioritization decisions based on data.

The detailing screen by equipment aggregates all the information of the same, discarding the main information for classification of the health of the equipment.

- Notes, Orders and Maintenance Plans; Oil Analysis Reports, Vibration, Thermography; Equipment Attributes.



Lighthouse



RISK MONITOR

The alarm response monitor displays the analysis graph of the risk model. The model is developed to identify possible failure trends and generates an alarm when the risk reaches a predefined limit.

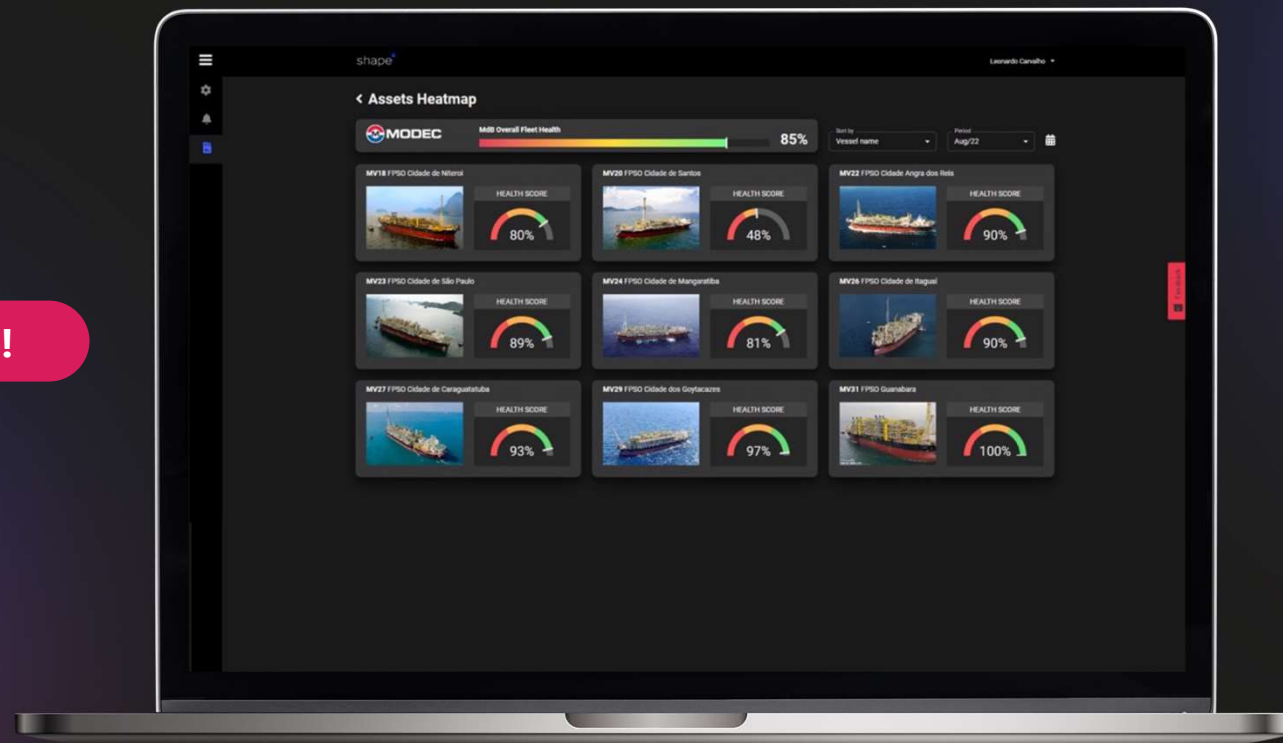
CONTRIBUTION OF VARIABLES

The model identifies the contribution of variables to the risk of failure. Giving the user a quick diagnosis of where to act to prevent failure.

Lighthouse: Go Live!



Go Live!



Success Cases



SAFETY & INTEGRITY

DBMS

Shape's Digital Barrier Management System

allows seamless and online monitoring of safety barriers



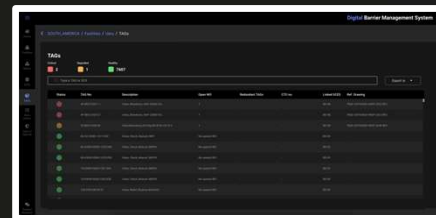
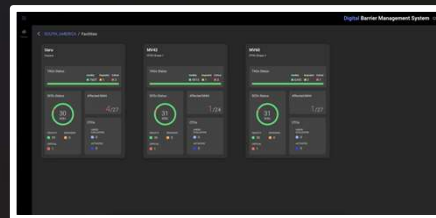
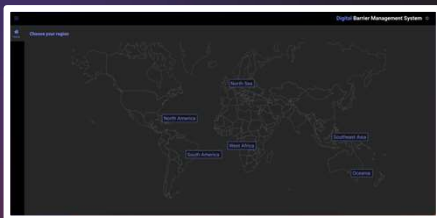
Digital Barrier Management System (DBMS)
currently use as data sources...



...to generate and update critical information to
stakeholders across assets.

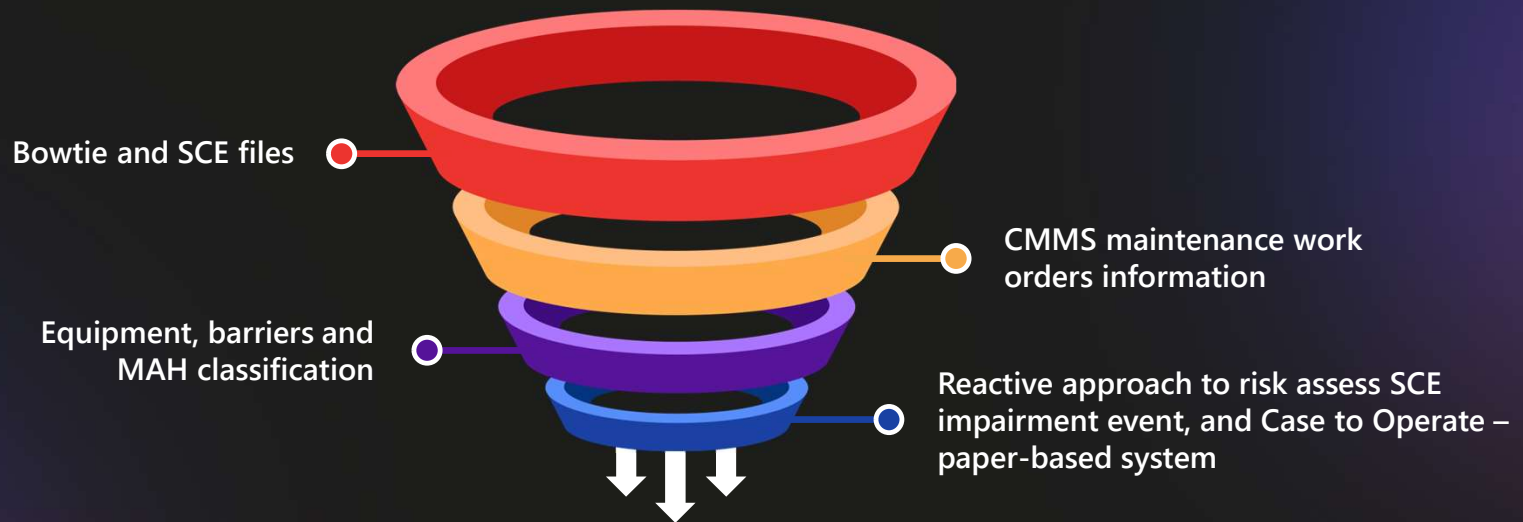
- CMMS (Computerized Maintenance Management System) data for equipment – SAP or AMOS;

- DBMS calculates the status of each barrier and displays that in live **bow-tie diagrams**;
- **Operations team and relevant stakeholders** are well-informed to make **data-driven decisions** to, for instance, prioritize maintenance;
- **Stakeholders** can act upon the most critical barriers.





BASE CASE



DIGITAL BARRIER MANAGEMENT SYSTEM

ONLINE BOWTIE

GUIDED RISK ASSESSMENT PROCESS

SAP AND AMOS DATA INTEGRATED

INTEGRATED CASE TO OPERATE

DBMS Routine

Vessel Owner & Vessel Operator



Vessel Owner and **Vessel Operator** main areas involved in the project will have **access according to permit level**.



Operator Team

- Offshore: FPSO
- Focal point/User: OIM



Operator Headquarter

- Europa Office: Portugal
- Focal point/User: Process Safety Engineer



Operator Support team

- Onshore: Local Office
- Focal point/User: Asset Management Coordinator



Vessel Owner

- Headquarter Office

DBMS

development roadmap



DBMS tool holds a huge flexibility capacity to reflect an asset safety process methodology and routine elected. Shape works in a collaborative environment with local Process Safety and Operation teams, and with MODEC's Global Process Safety area.

ONLINE NOW

7 VESSELS ONLINE IN BRAZIL AND MEXICO

MOMEX | MV34: First version deployed
32 SCEs and 31 MAHs monitored

MdB | MV24, MV26, MV27, MV29, MV30 and MV31: First version deployed
182 SCEs and 158 MAHs monitored

READY IN Q4/2023

CtO Applications:

CtO functional into DBMS tool with
Change Management on course

Installed base:

New vessel in Africa online being supervised
by DBMS

POTENTIAL FUTURE DEVELOPMENTS*

New Data Sources:

Sensor data for inhibition risk
Safety Training Compliance

Quantitative Intelligence:

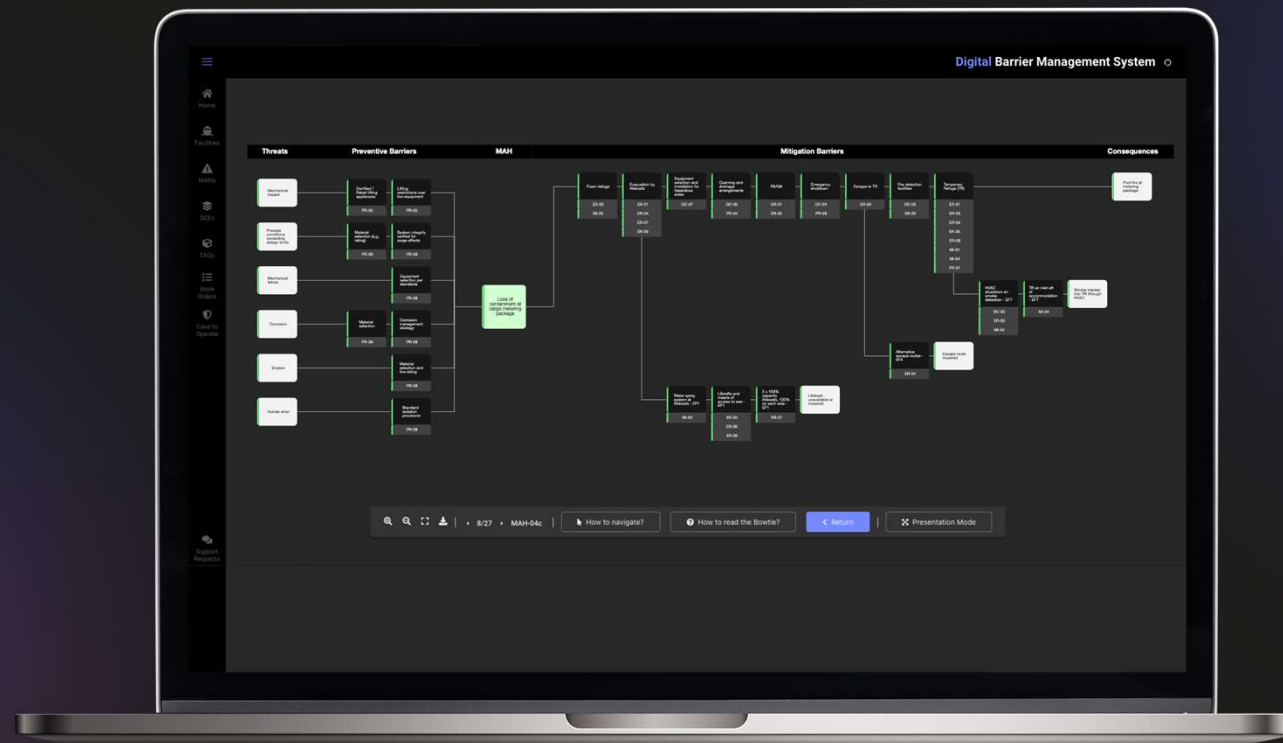
Revised dynamic MAH risk calculation

New Processes:

MOC
Preventive maintenance deferment

* We are continuously striving to identify the most effective enhancements for our tool, and we are receptive to new concepts and proposals for DBMS.

Demo DBMS



DEMO



SUSTAINABILITY

Sylph

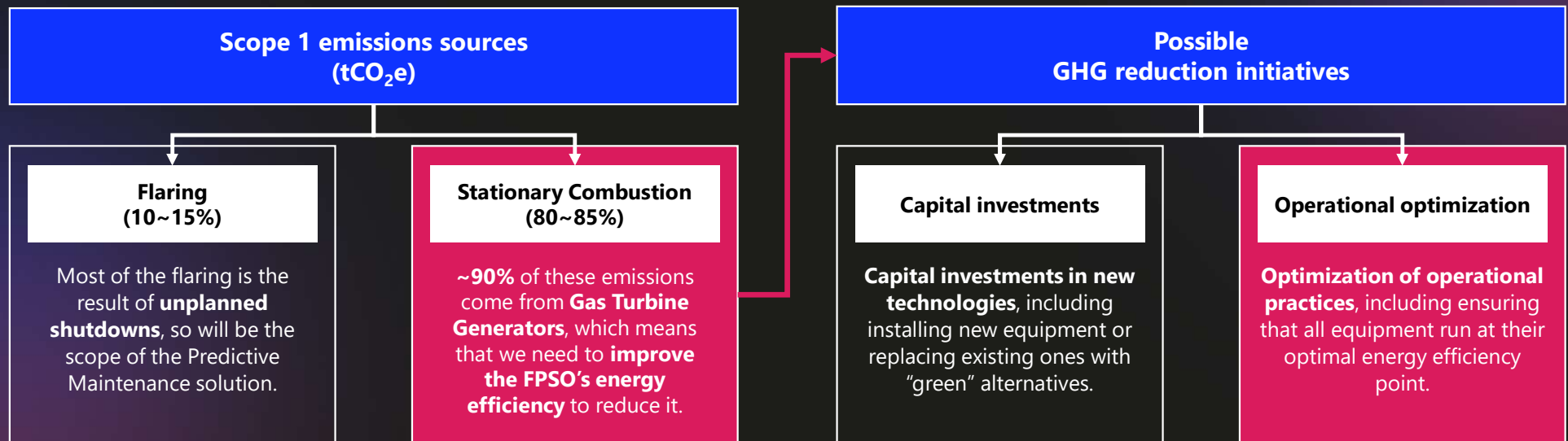
Sylph: Problem Statement



Help operators to track and reduce scope 1 GHG emissions of industrial plants, striking a balance between production and sustainability by optimizing operational practices.

FPSO example:

 Sylph's focus



Recap: Problem Statement



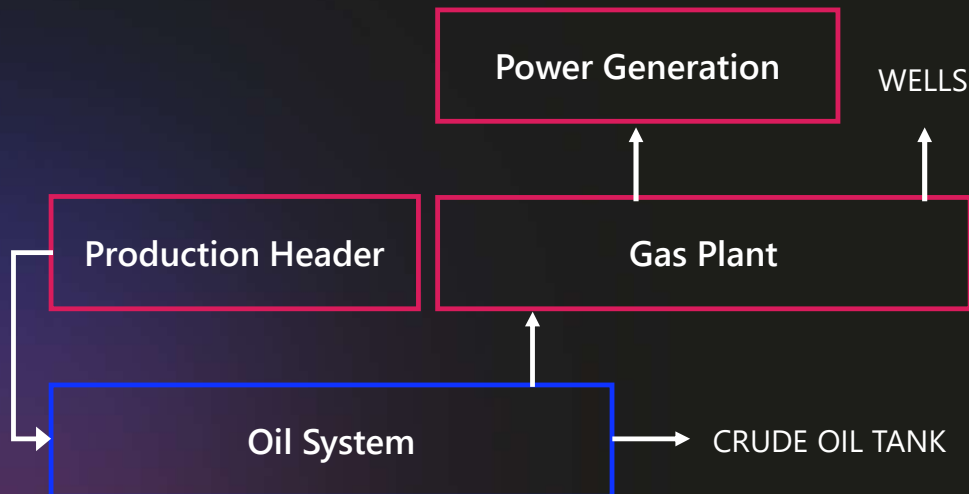
To improve the energy efficiency of FPSOs, we propose to focus on GTGs and the Gas Plant¹, balancing with production requirements.

The tool's first stage is centered on optimizing the Gas Plant. Optimization levers that can be considered by the Gas Plant VET



Focus of the solution

SIMPLIFIED DIAGRAM



Recommend optimal pressures and flow rates for each compressor via **adjustment of throttle and anti-surge valves**, constrained by production, project specifications (e.g., Molsieve design pressure), and non-controllable variables (e.g., well pressure).



Recommend **turning redundant Main A compressors on and off** based on monitoring real vs. nominal flowrates.



Recommend **repairs or switch to redundancies** based on efficiency loss vs. theoretical performance curves provided by manufacturers.

¹ Responsible for ~70% of the energy consumption.

Sylph: potential impact



The initial estimation indicates a potential energy consumption reduction of at least ~5%.

POTENTIAL IN GAS PLANT

- Preliminary simulations indicate an average potential reduction of 5% in consumption from optimizing operational parameters of the Gas Plant
- Preliminary simulations, for the project-pilot, indicate an average reduction potential of 1MW in reinjection compressors by optimizing operational parameters.
- Considering the other compressors, for the project-pilot too, in the system, we estimate that this potential could reach a total of 2MW.



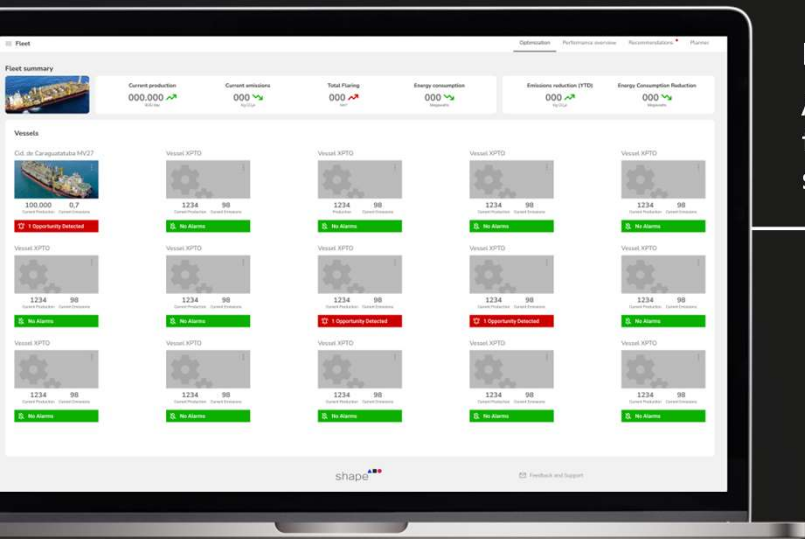
POTENTIAL OF FULL-SCALE SOLUTION

- Considering other optimization levers (e.g., turning redundancies on/off, repairing low-efficiency equipment) and systems, there is more potential to be captured by this tool beyond the 5% reduction.
- Improvements to GTG operation will also provide gains from the standpoint of energy generation efficiency.
- Depending on Carbon Tax policies, there is also the benefit of generating carbon credits - USD / tCO₂e.
- The total potential of this product is being refined as the development scope expands.

Sylph: look & feel



Tool user-journey, starts with fleet-wide coverage and full-scale vessel optimization.

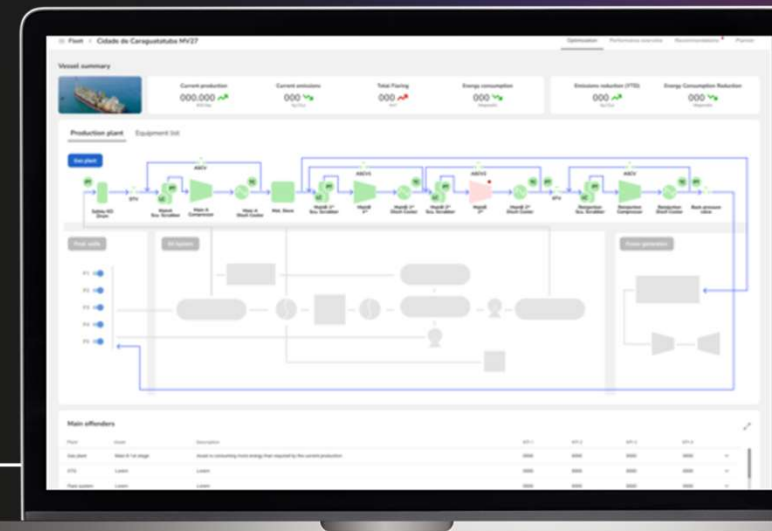


FLEET VIEW

A first visualization to support fleet surveillance

VESSEL VIEW

Expand vessel-level view with support for systems and their respective KPIs



Illustrative mockups

Sylph: look & feel



To contextualize each equipment virtual engineer module, we aim to include them in a vessel-level view.

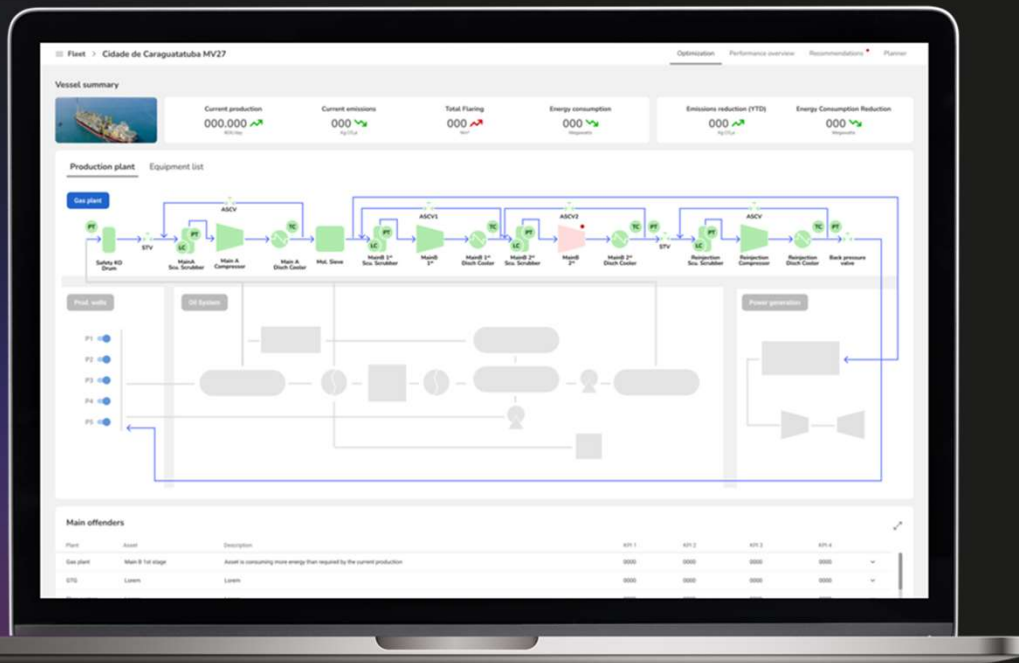
THIS VESSEL-LEVEL VIEW CAN CONTAIN ELEMENTS SUCH AS:

KPI tracking: Emissions and energy efficiency-related metrics, in addition to important metrics for each covered system (e.g., GTG and ISO50001 KPIs).

Consolidated results: Calculated impact of implemented recommendations.

System drill-down: Access to system-level opportunities for all developed virtual engineer module.

Illustrative mockups



Sylph: look & feel



The virtual engineer module, for each system, aims to provide recommendations for different proposed optimization levers. We may recommend starting with most offensive systems.

Equipment virtual engineer module:

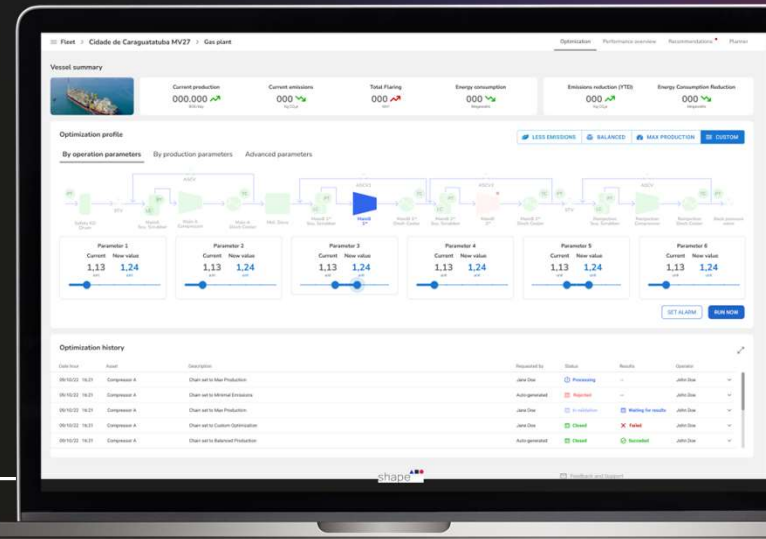
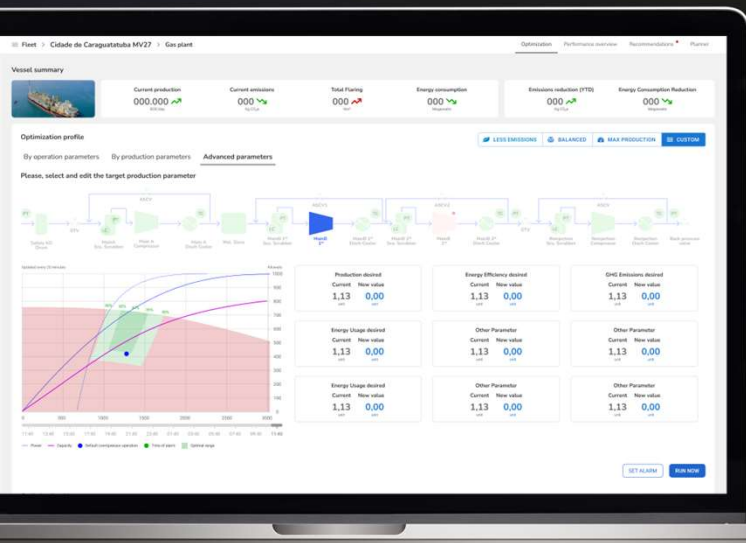
SURVEILLANCE VIEW

System - and equipment-level metrics will allow users to understand their current state

OPTIMIZATION VIEW

Users will be able to generate ad-hoc recommendations or configure alarms, customizing production and operational constraints

Illustrative mockups



1

Illustrative mockups

Sylph: capabilities summary



The first stage of this tool is centered on the optimization of a specific system.

- Fleet View
- Asset View
- Equipment & Process View

MONITORING

**RECOMMENDATION
SYSTEM**

● Sylph has an estimation of expected impact, so that operations teams can prioritize and execute them

● Expected impact could be used to estimate de ROI of investments

SURVEILLANCE

● Recommend optimal equipment setpoints – e.g., pressures and flowrates

● Recommend turning equipment On / Off based on real & nominal parameters

● Recommend repairs or switch to redundancies based on efficiency loss vs. theoretical performance

OPTIMIZATION



AI-BASED ENGINEERING

Virtual Engineering Tool - VET

SRU Virtual Engineer Tool



Using the knowledge gained from the operation, we can develop several virtual engineers trained specifically for the system.

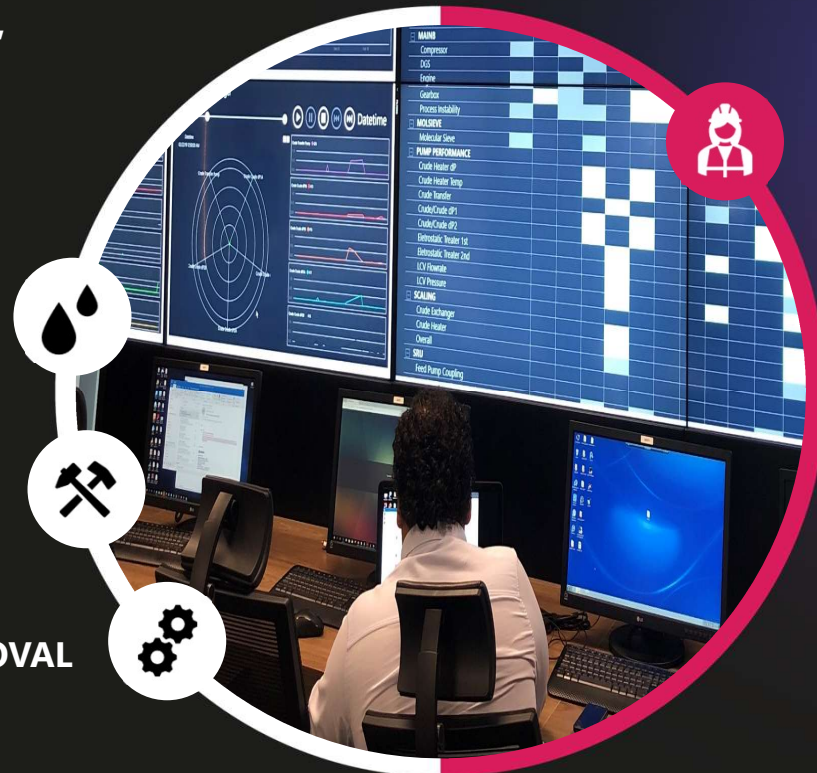
OIL TREATMENT



MOLSIEVE



CO₂ REMOVAL



SRU

SRU Virtual Engineer Tool



PROBLEM STATEMENT

The SRU membrane gradually clogs in operation and needs to be cleaned. Cleaning is expensive, takes time and consequently generates unavailability.

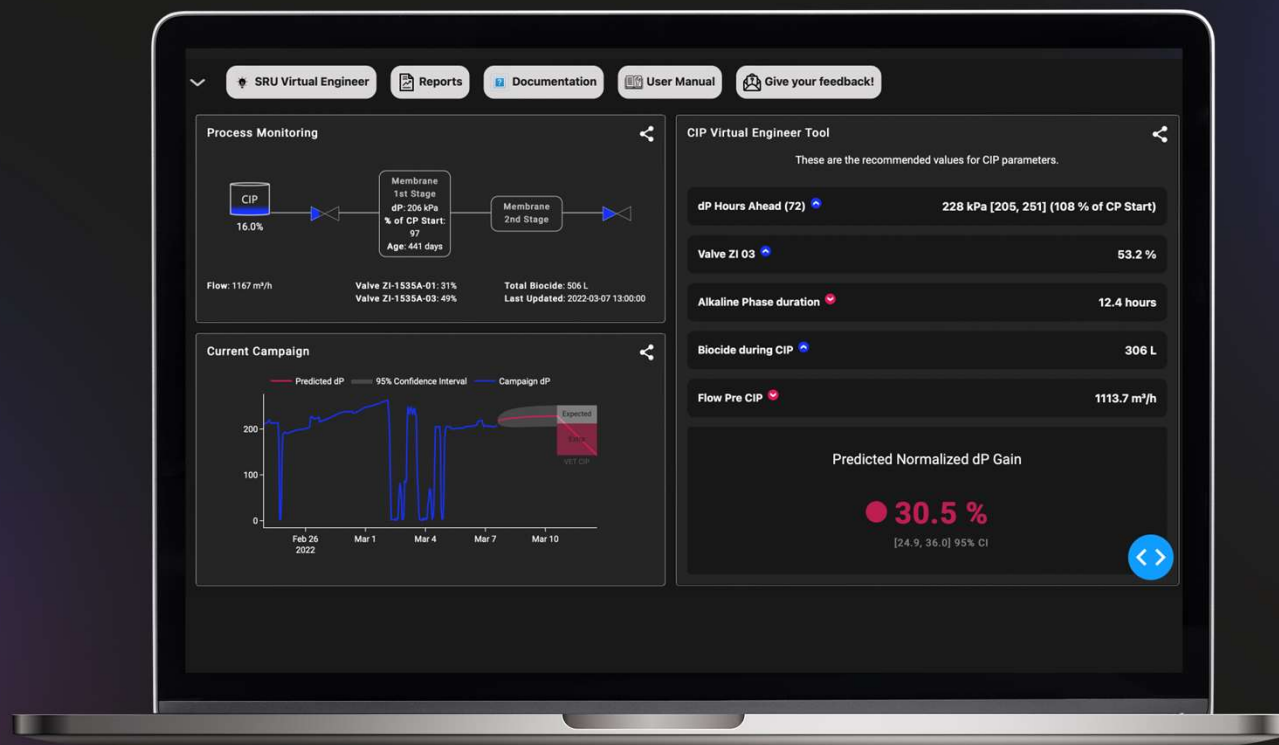
OBJECTIVE

Simulate the combination of CIP (Cleaning in Place) parameters to optimize the cleaning process, reduce the use of chemicals and provide longer campaigns, reducing downtime.

SOLUTION

A Virtual Engineering Tool that uses a CIP simulator to test various combinations of different parameter values and recommend an optimal combination. This will enable the user to improve the performance of the CIP, resulting in important financial results.

VET: look & feel



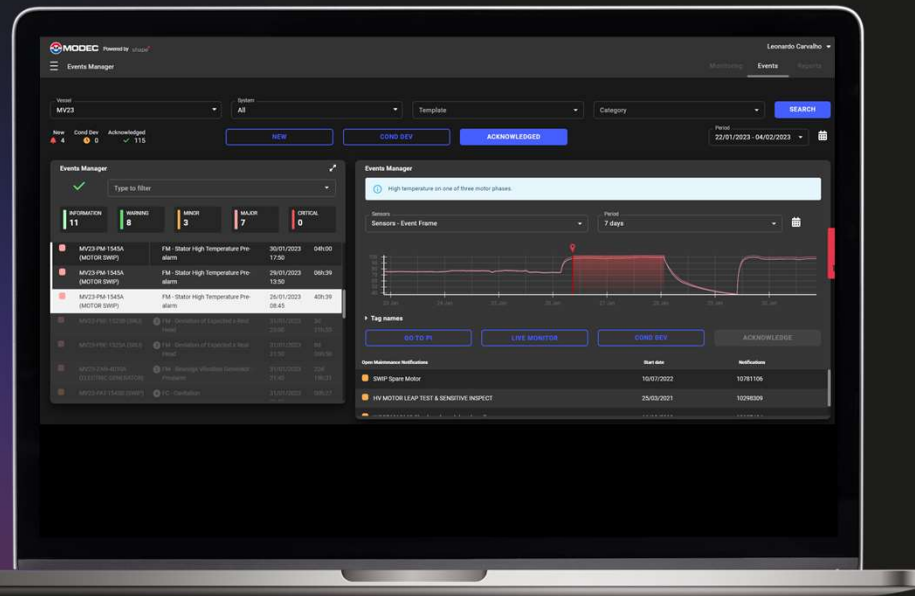
DEMO



Success Cases

Use Case: Electric Motor ✓✚

Electric motor internal component defect



EVENT DESCRIPTION

HV electrical motor presented an abnormal increase in the stator temperature without correlation with load increase. After troubleshooting, a fallen internal air deflector plate was found.

OPERATION ACTION

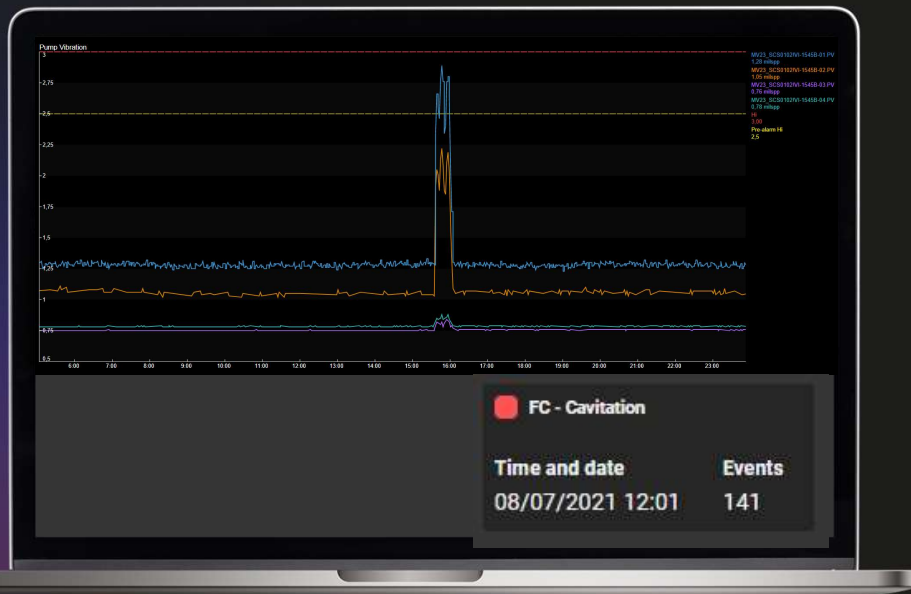
The Equipment Specialist asked the offshore team to inspect the electric parameters and the cooling water condition at the electric motor's heat exchange.

POTENTIAL SAVING

Risk scenario: Water injection system partial stop, and in a worst-case, a mechanical damage in the fan or a short-circuit on the stator due to overheating caused by non-uniform air flow, with a total repair estimated cost of USD 600,000 in a worst-case scenario.

Use Case: Sea Water Injection Pump ✓=

Seal failure on water injection pump



EVENT DESCRIPTION

Sea water injection pump with several historical events of seal failure and no clear root cause addressed before the PdM tool implementation. Just after the rollout for the MV23, several cavitation events were identified and associated as root cause of the seal problems.

OPERATION ACTION

The Equipment Specialist recommended an inspection of the thrust and journal bearing and the mechanical seal during the shutdown. Besides that, before, shutdown, adjust equipment setpoints (flowrates) and keep monitoring.

POTENTIAL SAVING

Risk scenario: Water injection system partial stop, and in a worst-case, a mechanical damage in the fan or a short-circuit on the stator due to overheating caused by non-uniform air flow, with a total repair estimated cost of USD 600,000 in a worst-case scenario.



Lighthouse **in a Box**

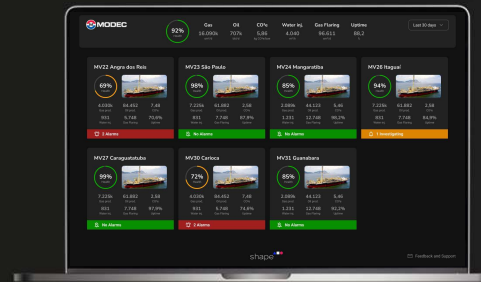
Lighthouse in a box

Accelerating the Time to Value with Out-of-Box Predictive Models.

Reliability Platform with
alarm Management

Equipment Surveillance
Downtime avoidance

Out-of-Box
Predictive
Models
On-Demand
(150+ Models)



CENTRIFUGAL COMPRESSOR

SCREW COMPRESSOR

CENTRIFUGAL PUMP

MOTOR

GTG

HEAT EXCHANGER VALVES

FAILURE MODE

FAILURE CAUSE

PERFORMANCE

SCALING



Complement the Solution with Specialized
fit-for-purpose Model Creation

Lighthouse in a box



Sample of Out-of-Box Predictive Models Matrix.

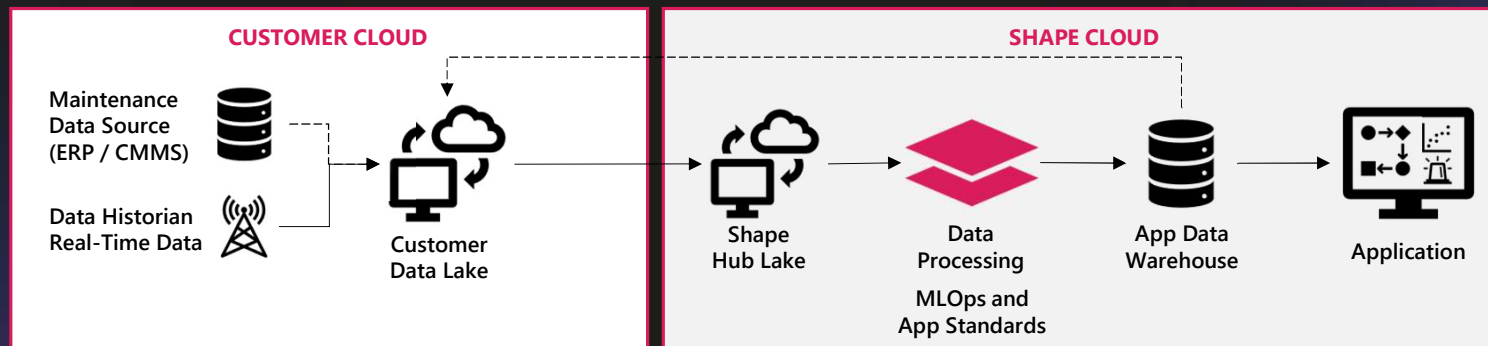
	CENTRIFUGAL COMPRESSOR	SCREW COMPRESSOR	CENTRIFUGAL PUMP	MOTOR	GTG
FAILURE MODE	- Compressor Low Performance - Compressor Surge Zone Oper. - Bearing High Vibration - Lub Oil Leakage - Seal Gas Leakage	- Bearing Overheating - Bearing High Vibration - Lub Oil Leakage - Abnormal Instrument Reading	- Pump Low Efficiency - Bearing Overheating - Bearing High Vibration - Lub Oil Leakage	- High Stator Temperature - Low Electrical Insulation - Bearing Overheating - Bearing High Vibration	- High temperature spread on turbine combustion chamber - Abnormal bearing wear - High vibration on radial bearings - Lub Oil Leakage
FAILURE CAUSE	- Low Suction Quality - Lube Oil Leakage Dry Seal - Lube Oil Filter Clogging - Bearing High Vibration	- Lub Oil Filter Clogging - Low Suction Quality - Long Period Without Preservation	- Insufficient NPSH / Cavitation - Measured Flow Under Minimum MCSF) - Lube Oil Filter Clogging	- Consecutive Starts - Ohmic Resistance - Overload	- Fuel Suction Quality - Gas - Fuel Suction Quality - Liquid - Lube Oil Filter Clogging - VSV Position Error
PERFORMANCE	- Polytropic Head - Polytropic Efficiency - Pressure and Temperature Ratio - Surge Protection Response Head Deviation	- Pressure and Temperature Ratio - Operation Insights - Changes in Position - Particle Count	- Discharge Pressure Ratio - Expected Discharge Pressure - NPSH Required/Available - Efficiency Deviation - Efficiency Expected	- Time to Overload % of Load - Ohmic Resistance Evaluation - Temperature Startor	

Lighthouse in a box



GENERAL ARCHITECTURE – SHAPE CLOUD:

Data lake at customer's cloud and model processing data visualization and diagnosis process at Shape's cloud.



HIGHLIGHTS

- Continuous Support and Maintenance
- Blueprint Architecture
- Cloud Costs Reduction (TCO)

Lighthouse in a box



Business Models:

	LIGHTHOUSE PLATFORM	PREDICTIVE MODELS <i>KNOWLEDGE / ENGINEERING BASED</i>		PREDICTIVE MODELS <i>DATA-DRIVEN BASED</i>	
		Market Place	New Models	Market Place	New Model
Subscription	 PaaS	 SaaS	 SaaS	 SaaS	 SaaS
Perpetual License					



Shape's Model Library

800+ Equipment Models Online

SAMPLE OF EQUIPMENT TYPES

- Centrifugal Compressors
- Screw Compressors
- Centrifugal Pumps
- Electric Motors
- Gas Turbines - GTG

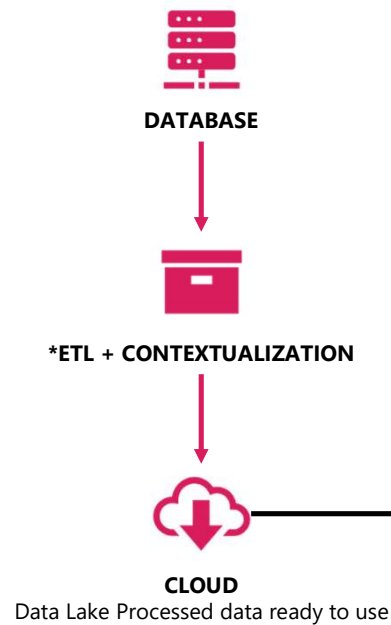


Value **Assurance**

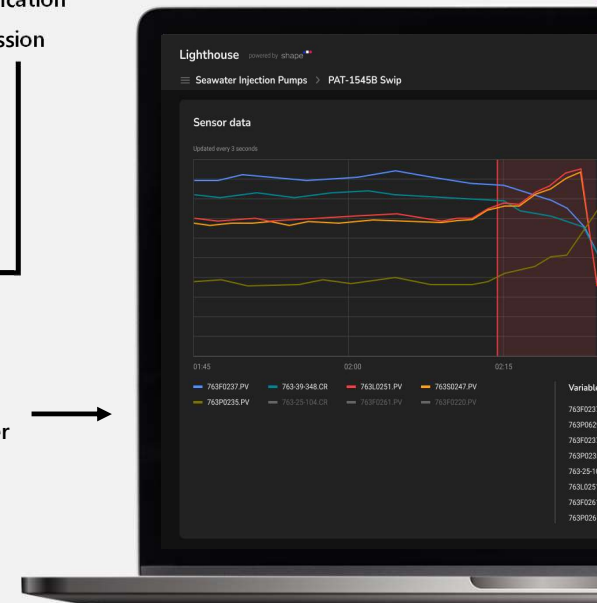
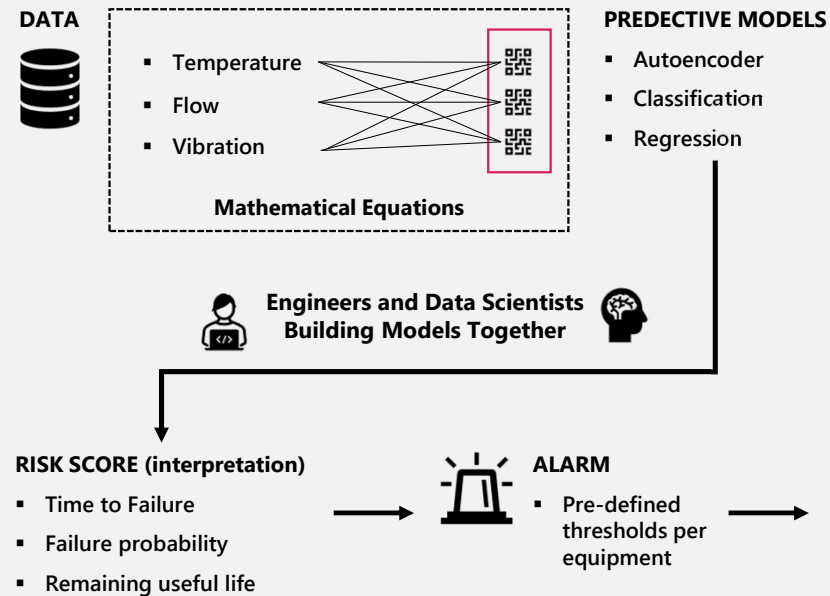
Shape Value Assurance



INTEGRATED DATA PLATFORM



APPLICATIONS SUITE

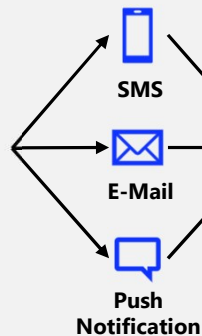
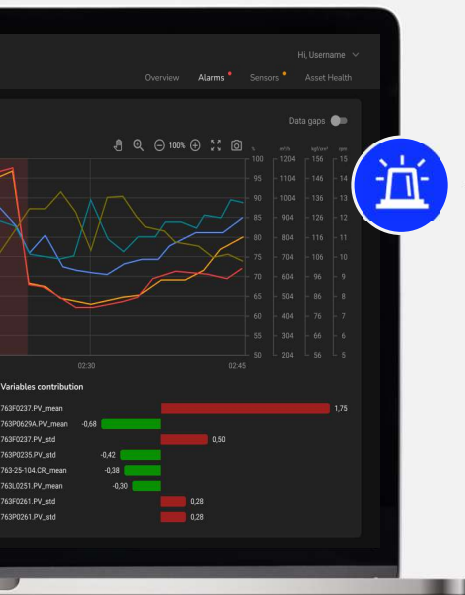


Shape Value Assurance



VALUE ASSURANCE

REMOTE CONTROL CENTER



OPERATIONS ENGINEER

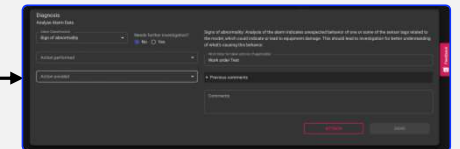


DIAGNOSTIC SCREEN IS CUSTOMIZABLE PER EQUIPMENT



Failure Mode Discovered

FEEDBACK



Execution Follow-up

- Prioritization
- Due date

Value Assurance

- Uptime increase
- Maintenance cost reduction
- CO² emission reduction

Shape provides engineering support + IT support since failure mode discover

Shape Value Assurance



We have Shape engineers working aside clients with AI-based technologies.



AI-MODELS POWERED BY ENGINEERING

Data Science team working side by side with engineers building **AI models leveraging industry knowledge.**



USER SUPPORT FOR FPSO OPERATOR

Our engineers work side-by-side with **clients' teams**, **supporting them to better** use the tools we provide.



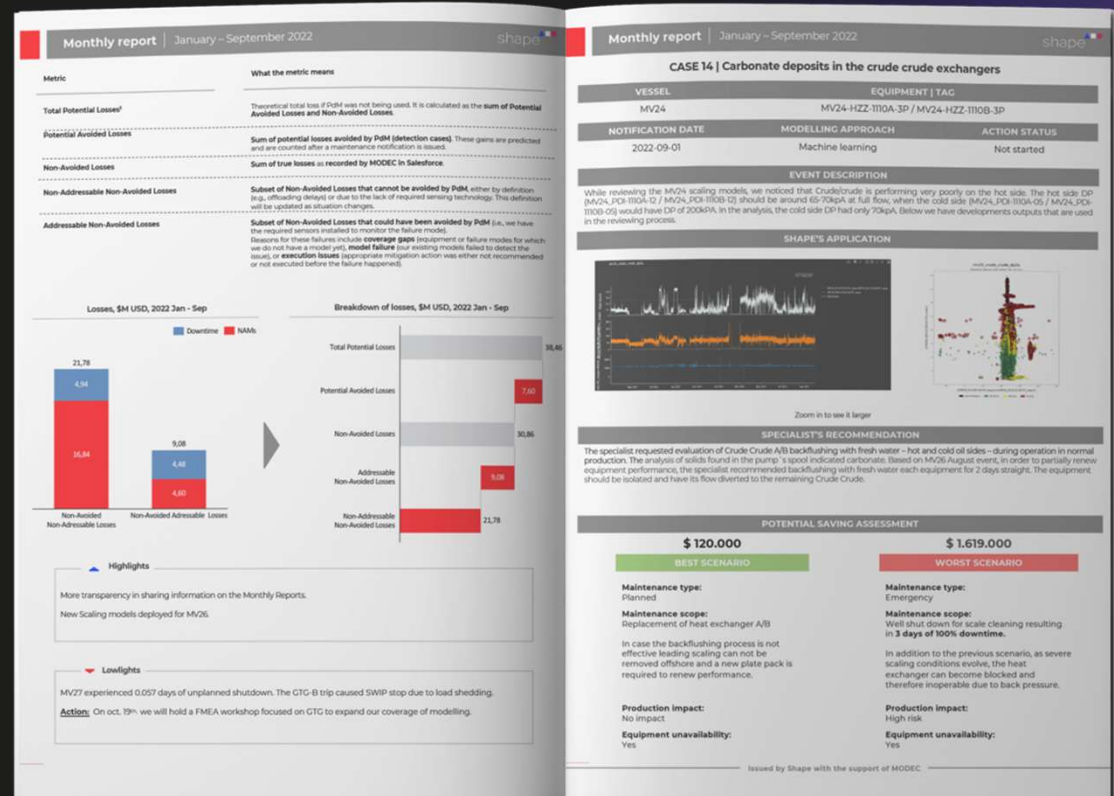
OPPORTUNITY IDENTIFICATION

Shape's team is constantly identifying **opportunities for new solutions and improvements** – models **network effect** within MODEC's fleet.

Shape's Performance Report

Reports will be delivered, detailing occurrences and the financial impact of Lighthouse.

Report



Get in touch



If you have any **questions, comments or just want to say hi**, feel free to get in touch.

Simply **scan one of the QR codes** on your screen using your smartphone's camera.



WEBSITE



E-MAIL



SOLUTIONS



LINKEDIN