

TotalEnergies

integrity management - Innovation Showcase

November 2024



FE Research Forum
Innovation for reliability and performance throughout the complete
lifetime in the floating energy sector

Pioneers
for
100
years

Disclaimer and copyright reservation



Definition - TotalEnergies / Company

The entities in which TotalEnergies SE directly or indirectly holds an interest are separate and independent legal entities. The terms "TotalEnergies", "TotalEnergies company" and "Company" used in this document are used to refer to TotalEnergies SE and its affiliates included in the scope of consolidation. Similarly, the terms "we", "us", "our" may also be used to refer to these entities or their employees. It cannot be inferred from the use of these expressions that TotalEnergies SE or any of its affiliates is involved in the business or management of any other company of the TotalEnergies company.

Disclaimer

This presentation may include forward-looking statement within the meaning of the Private Securities Litigation Reform Act of 1995 with respect to the financial condition, results of operations, business, strategy and plans of TotalEnergies that are subject to risk factors and uncertainties caused by changes in, without limitation, technological development and innovation, supply sources, legal framework, market conditions, political or economic events.

TotalEnergies does not assume any obligation to update publicly any forward-looking statement, whether as a result of new information, future events or otherwise. Further information on factors which could affect the company's financial results is provided in documents filed by TotalEnergies with the French *Autorité des Marchés Financiers* and the US Securities and Exchange Commission.

Accordingly, no reliance may be placed on the accuracy or correctness of any such statements.

Copyright

All rights are reserved and all material in this presentation may not be reproduced without the express written permission of TotalEnergies.





01

Innovation showcase

- SKIPE
- H3DDIP



Detection of the mooring failure

Skipe^{V2}

Introduction SKIPE* V2



On our “ageing” floating units, the mooring tension monitoring is not reliable and costly to maintain.

→ Need to adopt an overall strategy that address **Detection of mooring line failure**:



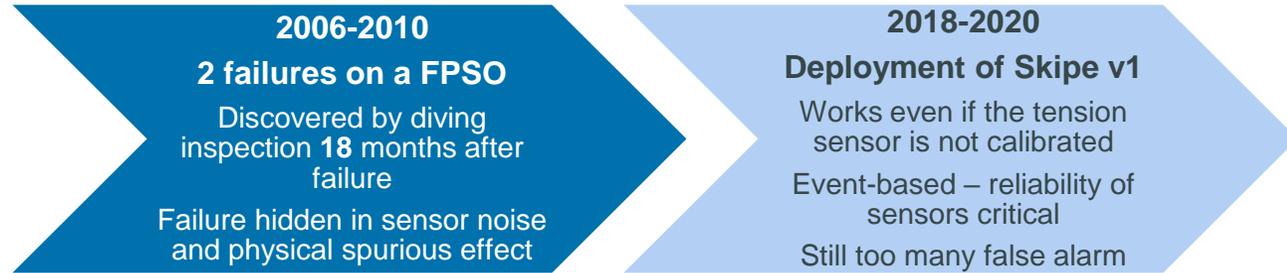
(*) Station keeping Indicator – Process & Equipment



Motivations & historical method: Skipe v1

Historical method: Skipe v1

- Submerged load sensors subject to **quick degradation**
- **Costly** to maintain/replace



Detection quality

- Event-based method ► **no detection** when data are **not transmitted**
- **Many false alarms** due to data quality issues

Number of false alarms since Feb-22
(average 5.7 per week)



Digital solution for mooring line failure detection

► monitoring of Company assets mooring



Status-based method

Hardware

Position equipment and wind sensor

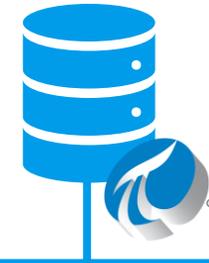


Position correction service

PPP correction **3k€/year / FPSO** 

Corrections

Wind loads: available for all F(P)SO
Hawser tension: for buoys and tandem offloading
Damaged watch circles
Centers at equilibrium position with broken line(s)
 Adjustable radius,



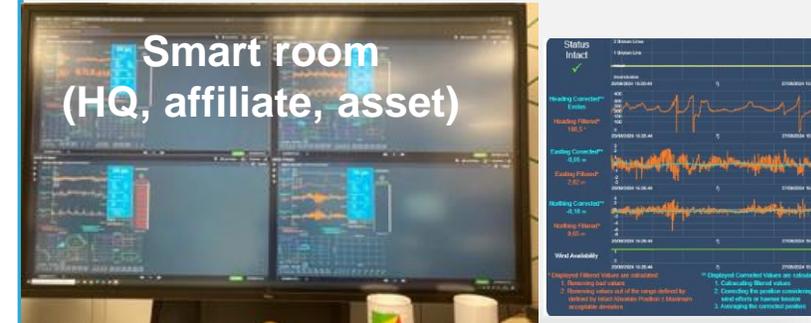
PI Server



For one FPSO:

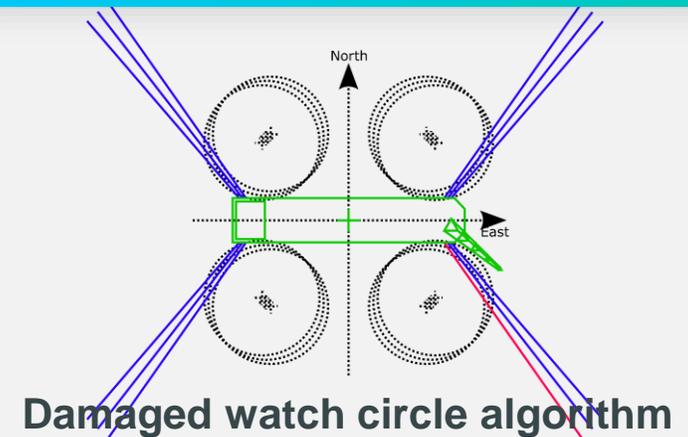
1M\$ CAPEX SAVING
1M\$/4y OPEX SAVING

Software: in-house



Performance standard

- 100% correct detection
- 0 false alarms
- 1 day max for detection of a broken line
- 2 broken lines detection in 1 hour
- 30,000+ synthetic failure simulations (per FPSO)



Deployment

38%



Objective to move to 100%



275 Mooring lines

7 LBU's

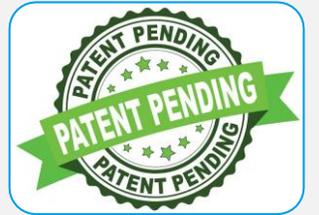
14 Units in Operation

2 Projects

6 OLT's



InnoTower



Patented algorithm

At the request of:

TotalEnergies

BUREAU VERITAS MARINE & OFFSHORE (hereinafter referred to as the "Society"), acting within the scope of the Bureau Veritas Marine & Offshore General Conditions ("GC"), declares hereunder that the design of:

SKIPE V2 FOR MOORING INTEGRITY MONITORING

is **Approved in Principle**, with respect of the aim of the classification as defined in Part A, Chapter 1 of the latest edition of our Rules and in the conditions stated in Annex 1. The present Approval in Principle (hereinafter referred as "AIP") is referring to the general options chosen by the designer, as described in the documents listed in Annex 2.

The validity of this AIP may have to be reconsidered, in case of any major modification likely to invalidate the principles shown on the documents listed in Annex 2. This AIP would become null and void should BUREAU VERITAS MARINE & OFFSHORE not be kept informed of such modifications.

This AIP is an opinion given by the Society at its sole discretion on a design or any technical element that would in principle be acceptable to the Society. This shall not presume on the final issuance of any Certificate or on its content in the event of the actual issuance of a Certificate. This AIP shall only be an estimate given by the Society which shall not be held liable for it.



Issued at Paris, on 13th February 2024

Approval in Principle by Classification Societies



Hull Digital inspection

H3DDIP



Introduction H3DDIP* V1

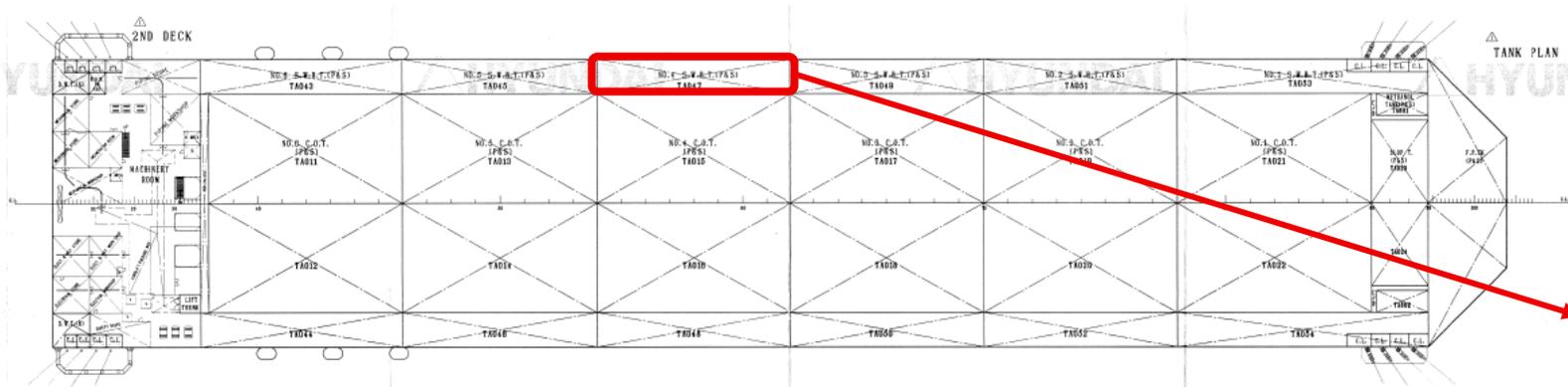


On our **ageing hull floating units**, corrosion & structural degradations are more & more frequent. **Life Extension** of our floating units is now a standard expectation in TotalEnergies.

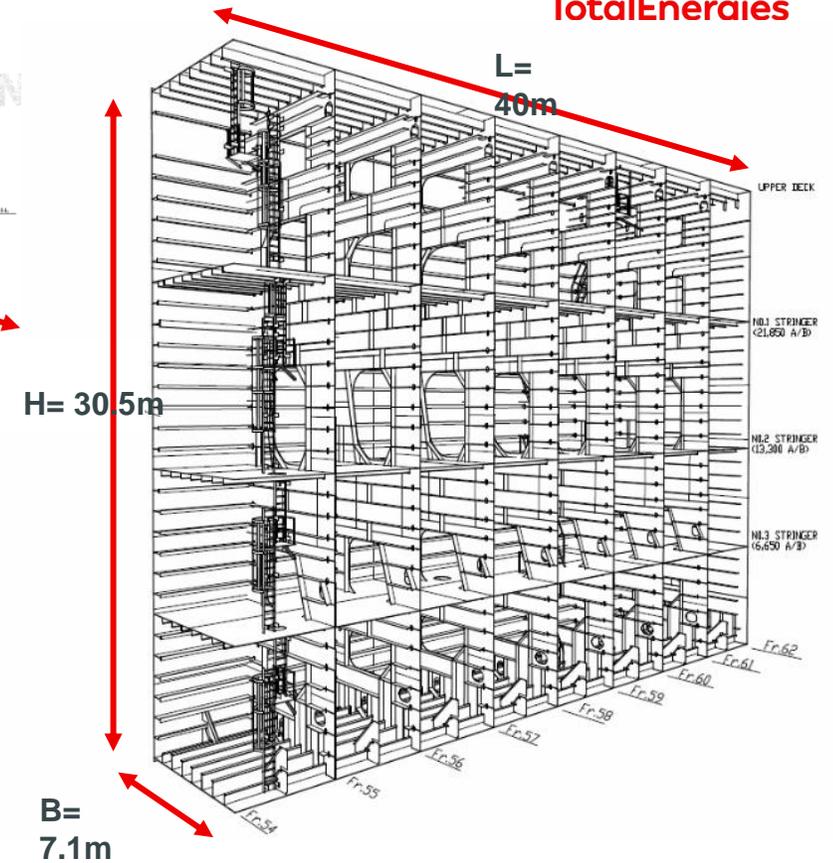
→ Need to adopt an overall strategy that address **Hull integrity management of our ageing assets**:



Motivations H3DDIP - How it was done previously



FPSO: Length: 300m / Breadth: 59.6m / Depth: 30.5m



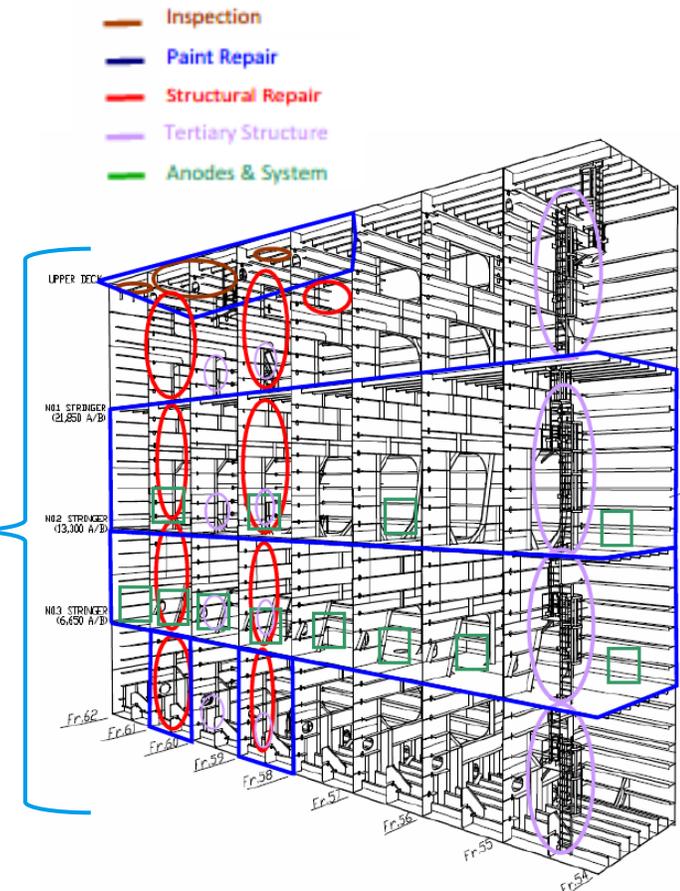
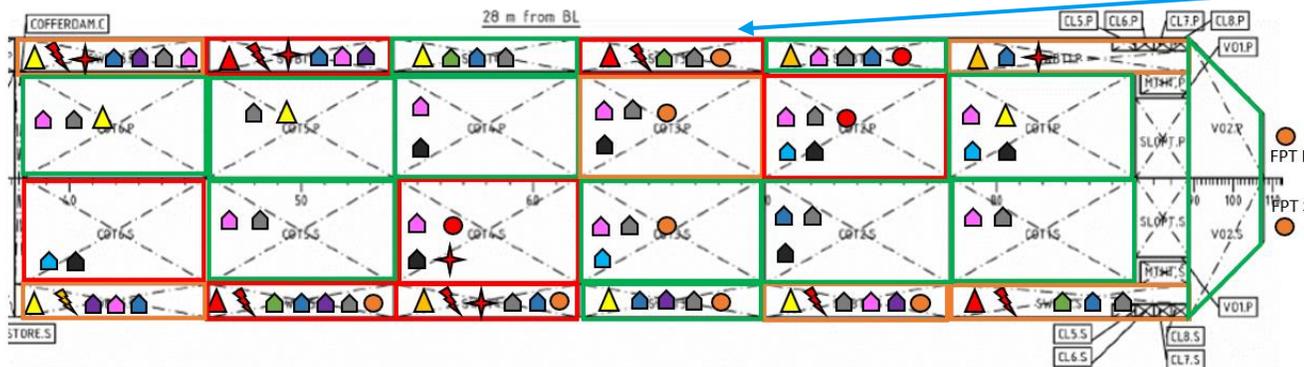
Characteristics & Constraints

- 16 WBT – confined spaces
- Several sub-compartments inside one WBT
- Manhole min size 600*800

Motivations H3DDIP - How it was done previously

- WBT inspection with confined space entry
- Inspection report (pdf files), & paper reporting on dwgs
- Identification of the integrity and coating notification
- Based on these information Tanks condition & work evaluation is prepared and maintained updated for all tanks
- Organize primary activities to be done at tank opening and plan for required manpower & material

Hull tank condition and maintenance repair Plan



inspection process and preparation/execution of repair works takes weeks/months



Motivations H3DDIP: implement innovation - scouting culture



Mitigate confined space hazard 

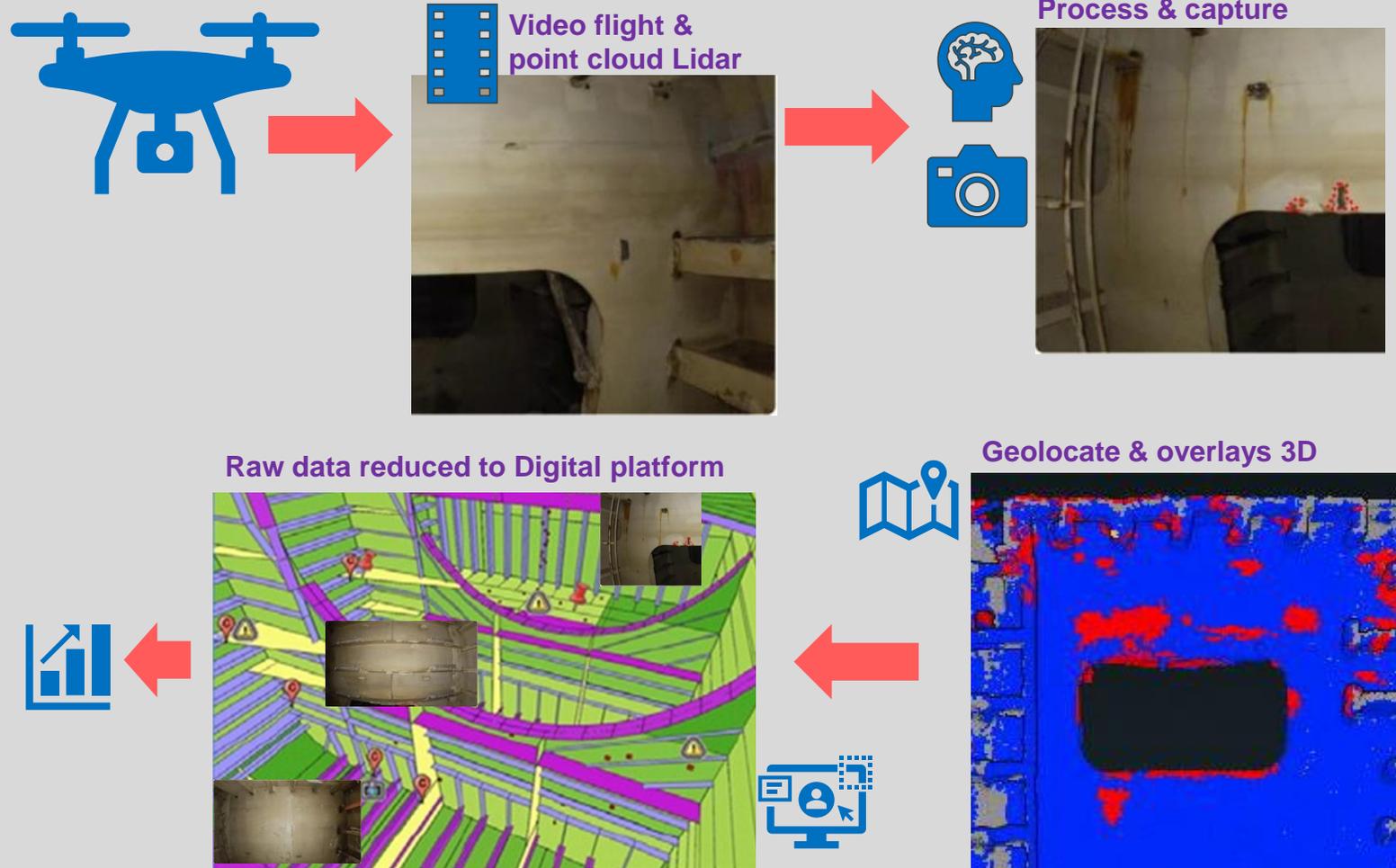
Upgrade the maintenance in opera. cond. of our ageing assets
Improve time to identify integrity threat
Meet the growing demand for inspection and repair. 

Be able to anticipate repair work, be efficient in the diagnostics, reduce the POB for intervention 

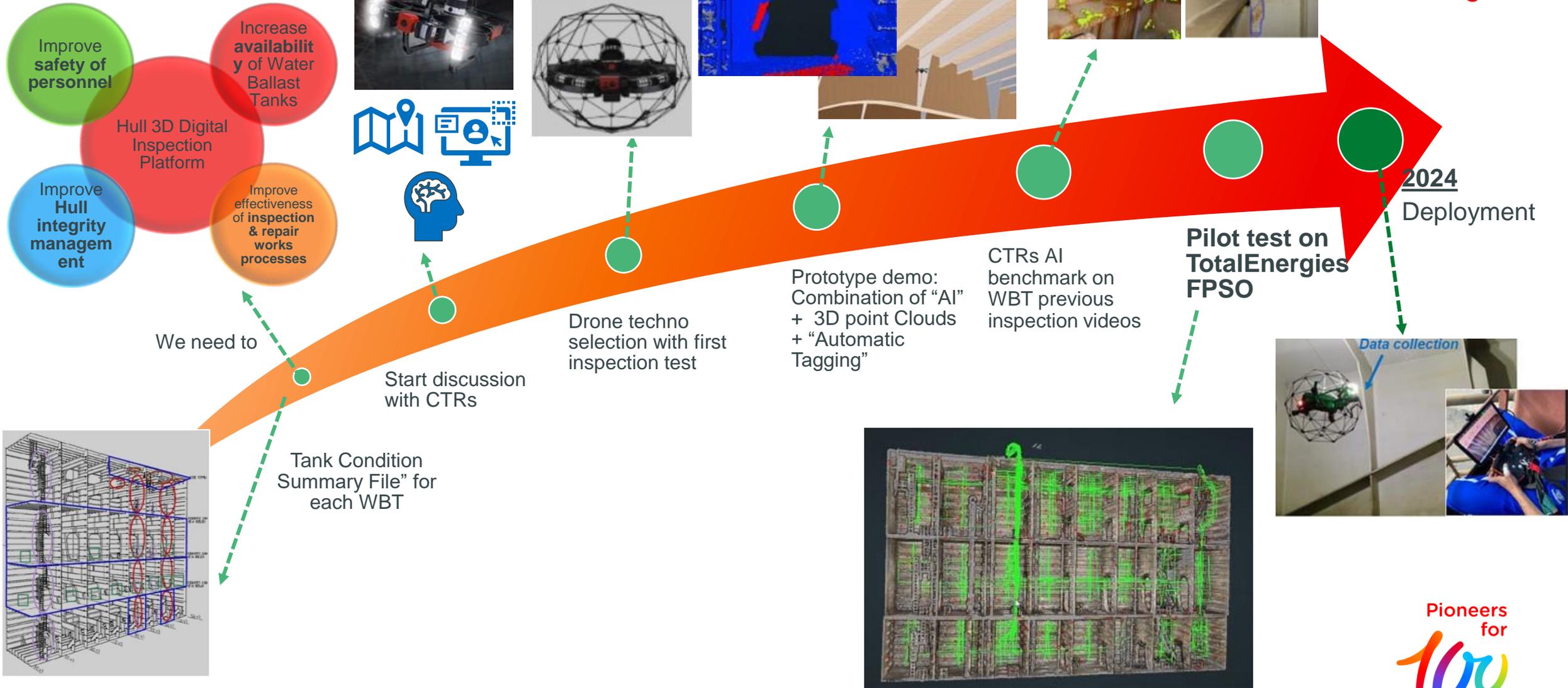
Digitalize our inspection and reporting techniques on Platform, control the evolution of integrity 

Extensibility – NEXT !
Scale your innovation in manageable increments for quick deployment 

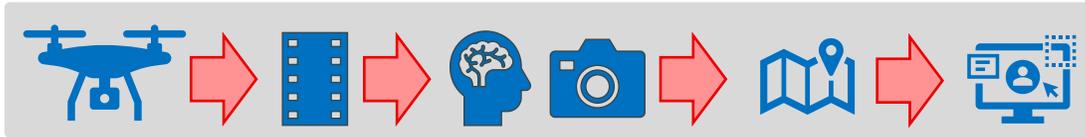
Combined Technologies -> Drone – Lidar – AI Virtual reality -> Corrosion detection + geovisualisation 3D point clouds



H3DDIP: From Scouting to deployment

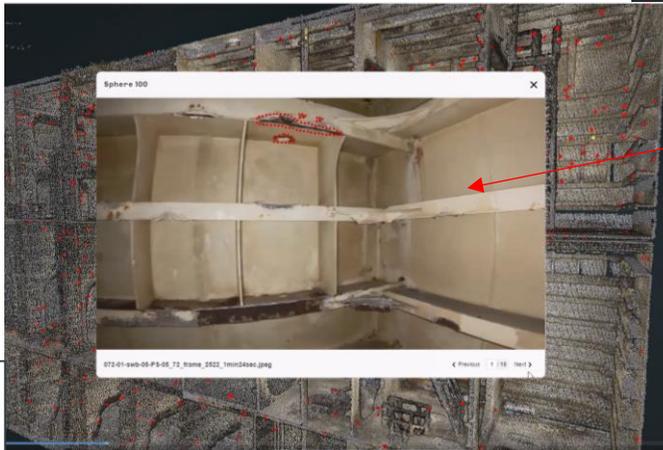
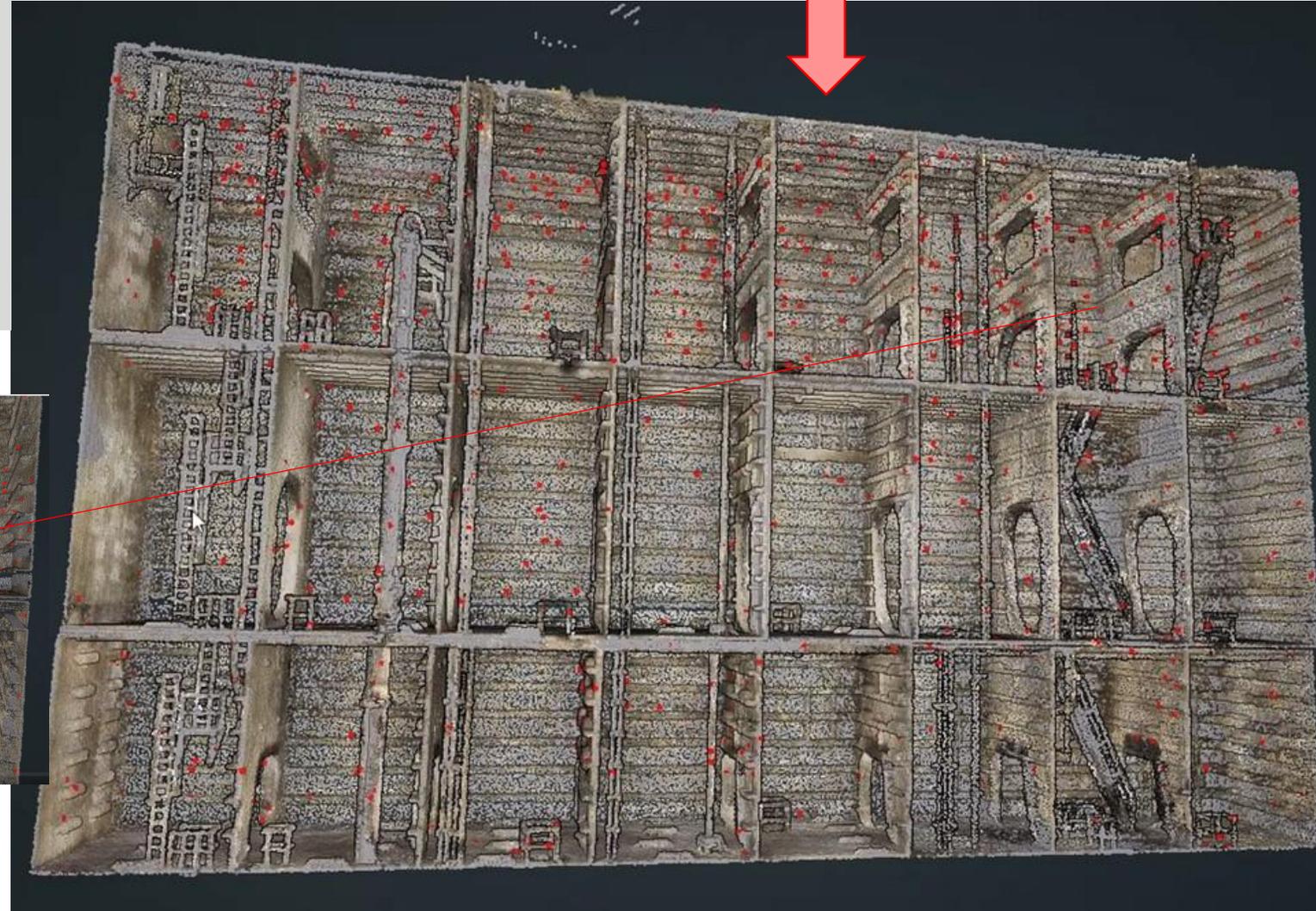


H3DDIP: Deployment



Deliverables – Digital platform :

- 3D viewer for general overview of corroded areas
 - AI data processing & 3D visualization to enhance:
 - Preliminary scope for coating/repairs
 - Areas of concerns for metal loss
 - Needs for scaffoldings, Steels ... etc
- **Available to all stakeholders** (improve decision-making, reduce errors, and automate manual tasks)



| 1. Principal Analytics by group | |
|---------------------------------|---------------------|
| Group | Number of anomalies |
| Group 1 | 100 |
| Group 2 | 200 |
| Group 3 | 300 |
| Group 4 | 400 |
| Group 5 | 500 |

| 2. Detailed Analytics by members | |
|----------------------------------|---------------------|
| Member | Number of anomalies |
| Member 1 | 100 |
| Member 2 | 200 |
| Member 3 | 300 |
| Member 4 | 400 |
| Member 5 | 500 |

| 3. Longitudinal sections | |
|--------------------------|---------------------|
| Section | Number of anomalies |
| Section 1 | 100 |
| Section 2 | 200 |
| Section 3 | 300 |
| Section 4 | 400 |
| Section 5 | 500 |

| 4. Upper deck & stringer Sections | |
|-----------------------------------|---------------------|
| Section | Number of anomalies |
| Section 1 | 100 |
| Section 2 | 200 |
| Section 3 | 300 |
| Section 4 | 400 |
| Section 5 | 500 |

| 5. Plates of access | |
|---------------------|---------------------|
| Plate | Number of anomalies |
| Plate 1 | 100 |
| Plate 2 | 200 |
| Plate 3 | 300 |
| Plate 4 | 400 |
| Plate 5 | 500 |





02

Innovation process focus

Think Big – Act small (products deployment steps)

• What processes do SKIPE and H3DDIP innovations share ?

12 months for project execution and deployment



Structured in Agile team to achieve its ambition



Innovation roadmap : deploy quickly & right to fail



Innovation

- The Innovation process used; is all about breaking down the barriers that slow down innovation, making it easy to identify and test new tech solutions to solve operational issues.

We need to :

- Identify, understand technical problem & Find a solution

- Test them rapidly

- Deploy proven solution

Main Objectives :

- Deliver innovative industrial solution in short term

- Accelerate projects by mobilizing teams, methodologies and tools

- Culture of innovation inspired by “right to fails”

turning failure into fuel for innovation & quick industrial deployment



Innovation is
one of the key
objectives of
the Company

03

Way Forward & Conclusion

Conclusion

Future Directions and Opportunities - Embrace change



- The discussion is to complement the current innovation efforts conducted through the FPSO/FER Forum rather than replace them.

To ensure reliability and performance of mature assets, the innovation cycle should focus on reducing project duration for quick deployment



SquallMoor
HITS
SCORTCH
MCA-mooring components
4D Fatigue
CrackGuard
MONITAS
Chain OPB fatigue
Etc



FER forum is a unique ecosystem comprising academic institutions, universities, laboratories, technology providers, engineering contractors, suppliers, Energy companies, etc...



Accelerate & Quick deployment ?

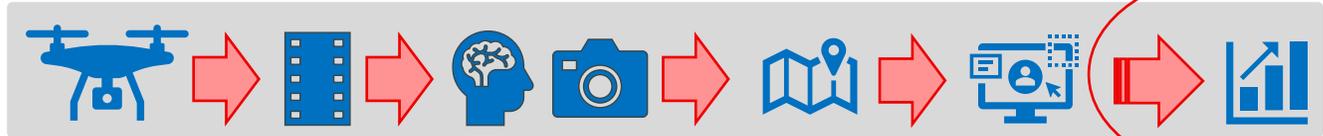


12 months



Digital Twin - Connect Real with Virtual

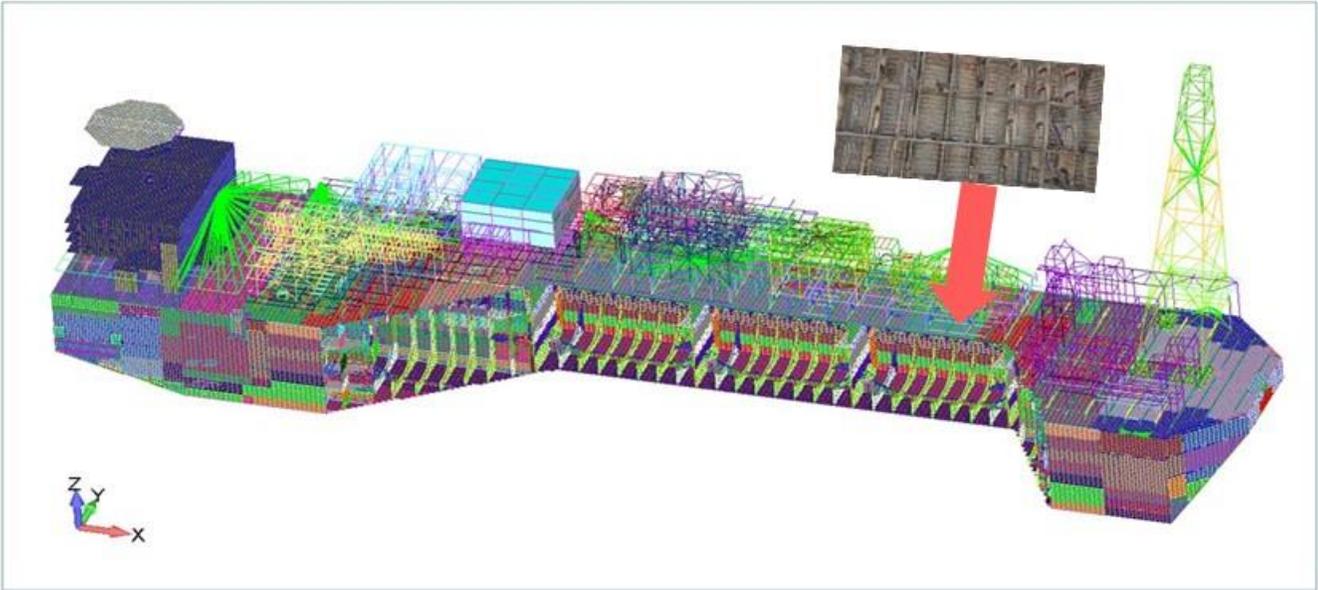
Digital Twin – Make it happen & Make it useful !



Let's take benefit from

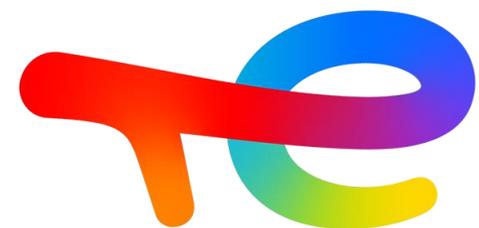
- Digital solution
- New technology,
- AI development (or Not !)

Extensibility : Drone can accommodate the UT in parallel with the LiDAR





Thank you!



TotalEnergies

Pioneers
for
100
years