



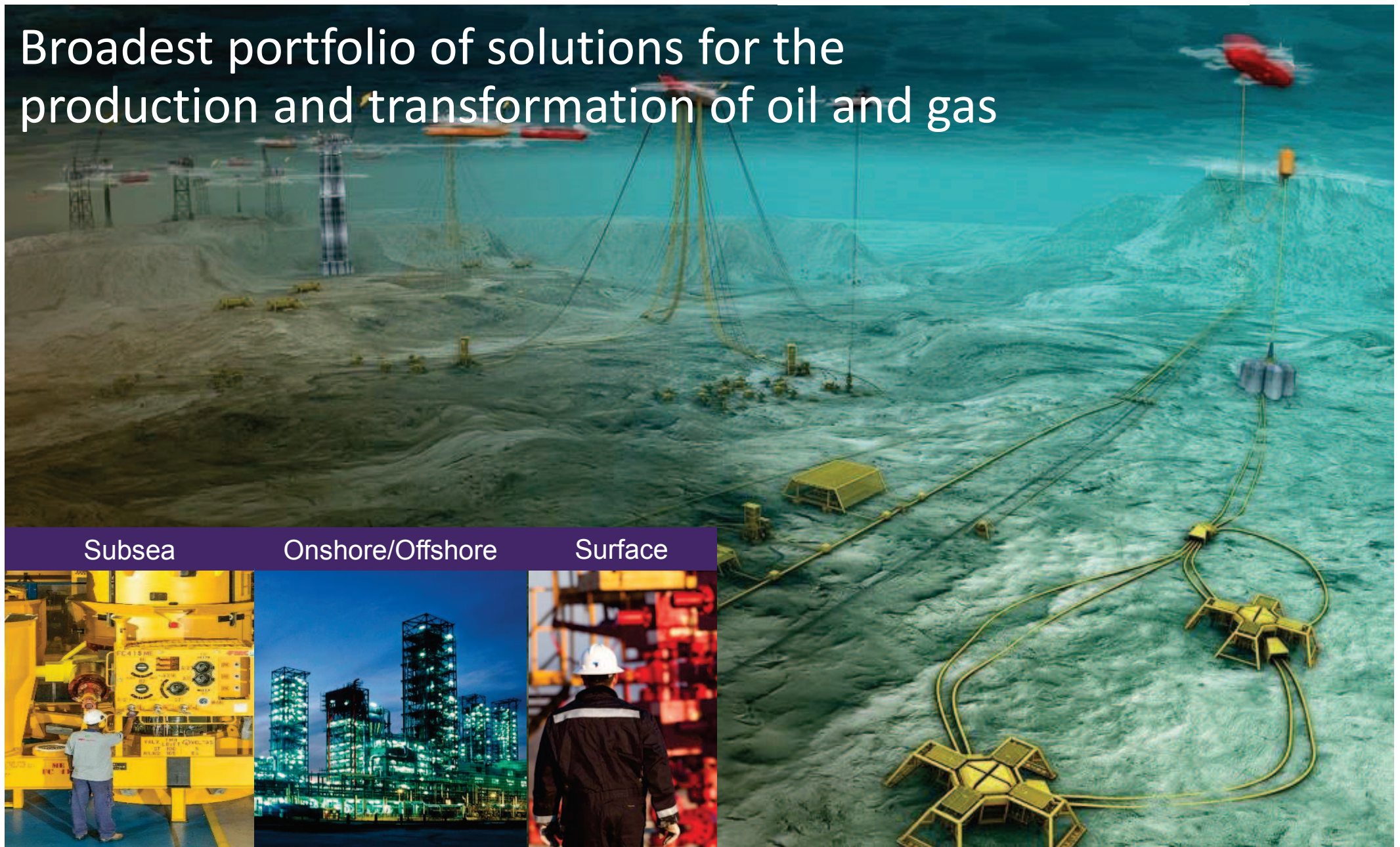
Solutions for a lean integration of Loading Systems on FLNGs

FLNG 2017 AMSTERDAM

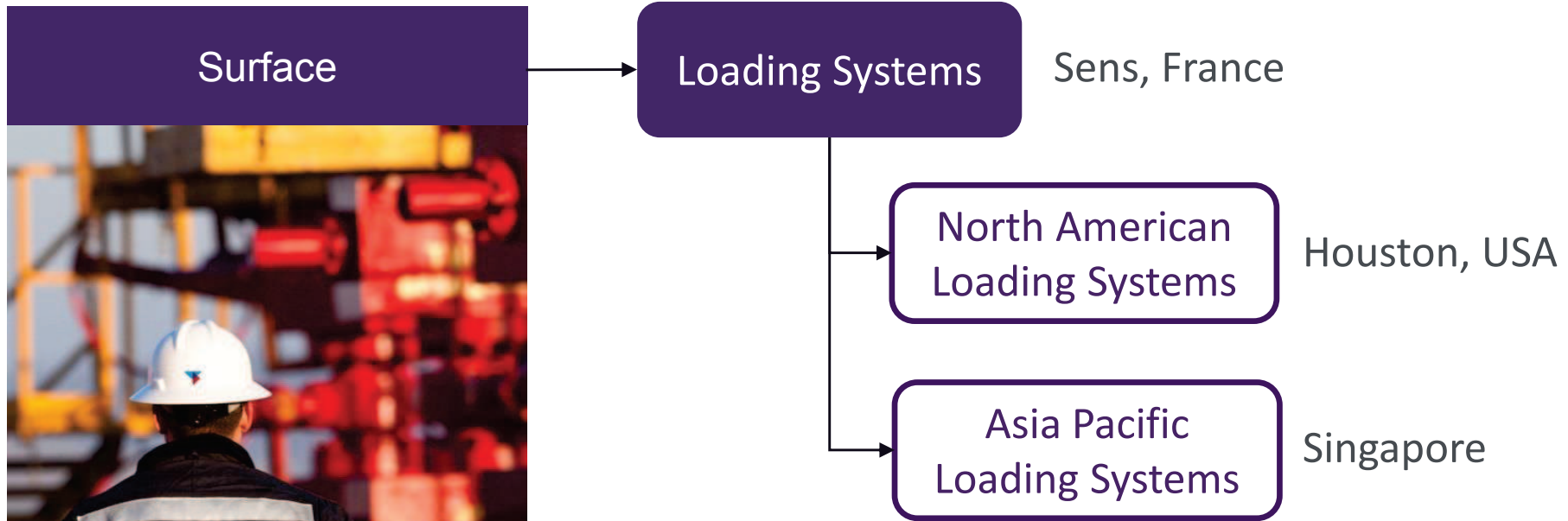
8th and 9th May, 2017

Since 17th, January 2017:  TechnipFMC

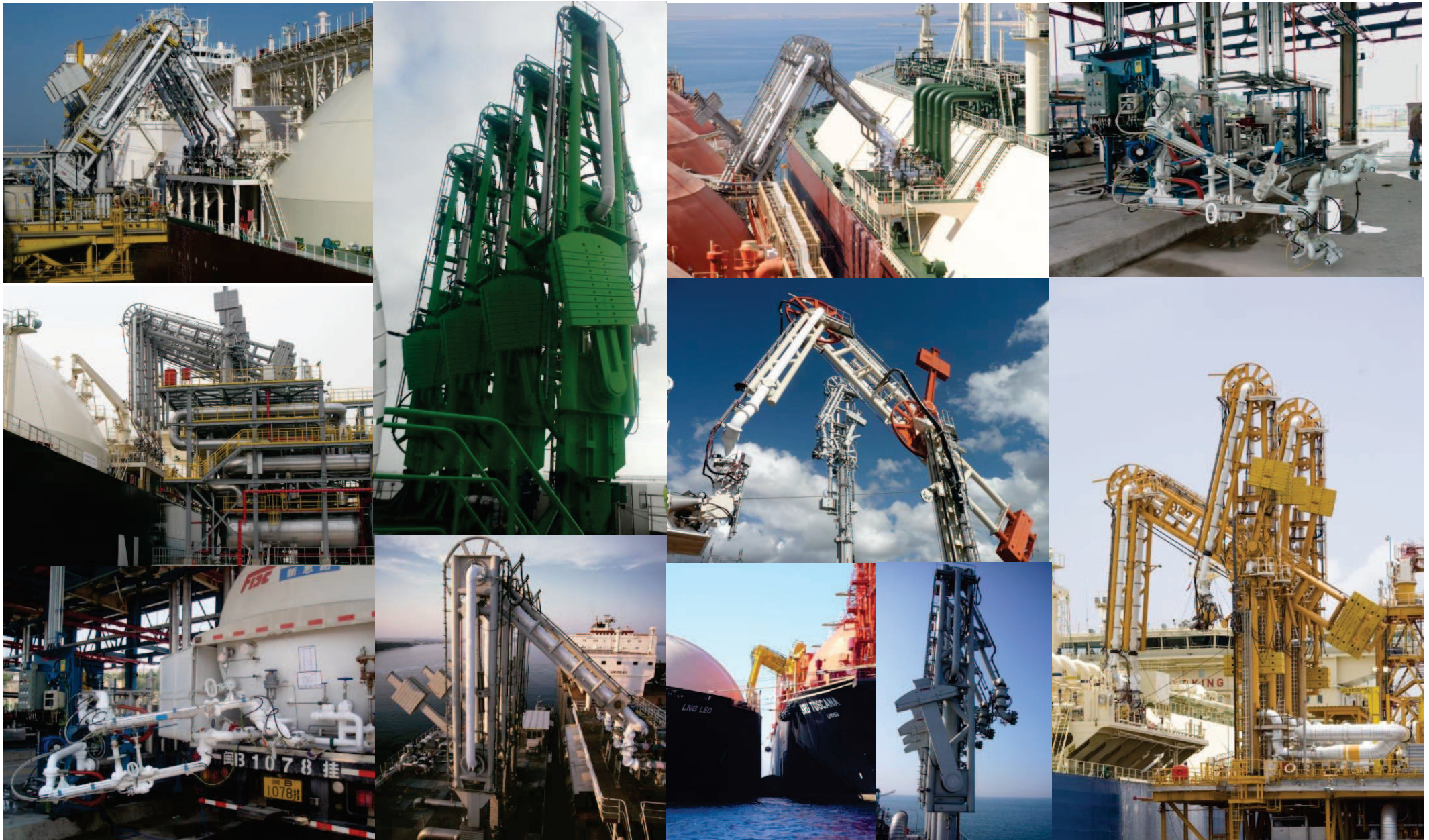
Broadest portfolio of solutions for the production and transformation of oil and gas



Loading Systems



Our LNG experience : more than 45 years



LNG Transfer - Product Range

LNG as cargo



Truck Loading & Metering



Ship - Shore



Ship to Ship - SBS



Ship to Ship - Tandem

LNG as a fuel



Land Vehicle



Ship - Shore



Ship to Ship

Background & Experience offshore and near shore loading arms

Project	Type	Application	Classification/ Certification	In operation from:
Exxon Mobil / Adriatic LNG	4 DCMA'S 16'' x 68' T.S.	Offshore SBS / GBS	DNV Certification	2009
Golar Freeze - Dubai	3 DCMA'S 16'' x 60'	Near shore SBS / FSRU	DNV Certification	2010
Golar Nusantara - West Java	3 DCMA'S 16'' x 60' T.S.	Offshore SBS / FSRU	DNV Certification	2012
E.on OLT Livorno	4 DCMA'S 16'' x 70' T.S.	Offshore SBS / FSRU	RINA Classification	2013
Golar Eskimo - Jordan	3 DCMA'S 16'' x 65'	Near shore SBS / FSRU	DNV Certification	2015
Petronas FLNG1	4 DCMA'S 16'' x 65' T.S.	FLNG	DNV Certification	2016
Shell Prelude	7 OLAF T.S.	FLNG	LR Certification	2017
Petronas FLNG2	4 DCMA'S 16'' x 70' T.S.	FLNG	ABS Certification	2017
Golar Hilli	4 DCMA'S 16'' x 70' T.S.	FLNG	DNV Classification	2017

Project References

FSRU Golar Freeze in Dubai



FSRU Toscana in Livorno



FSRU Jawa Barat in Indonesia



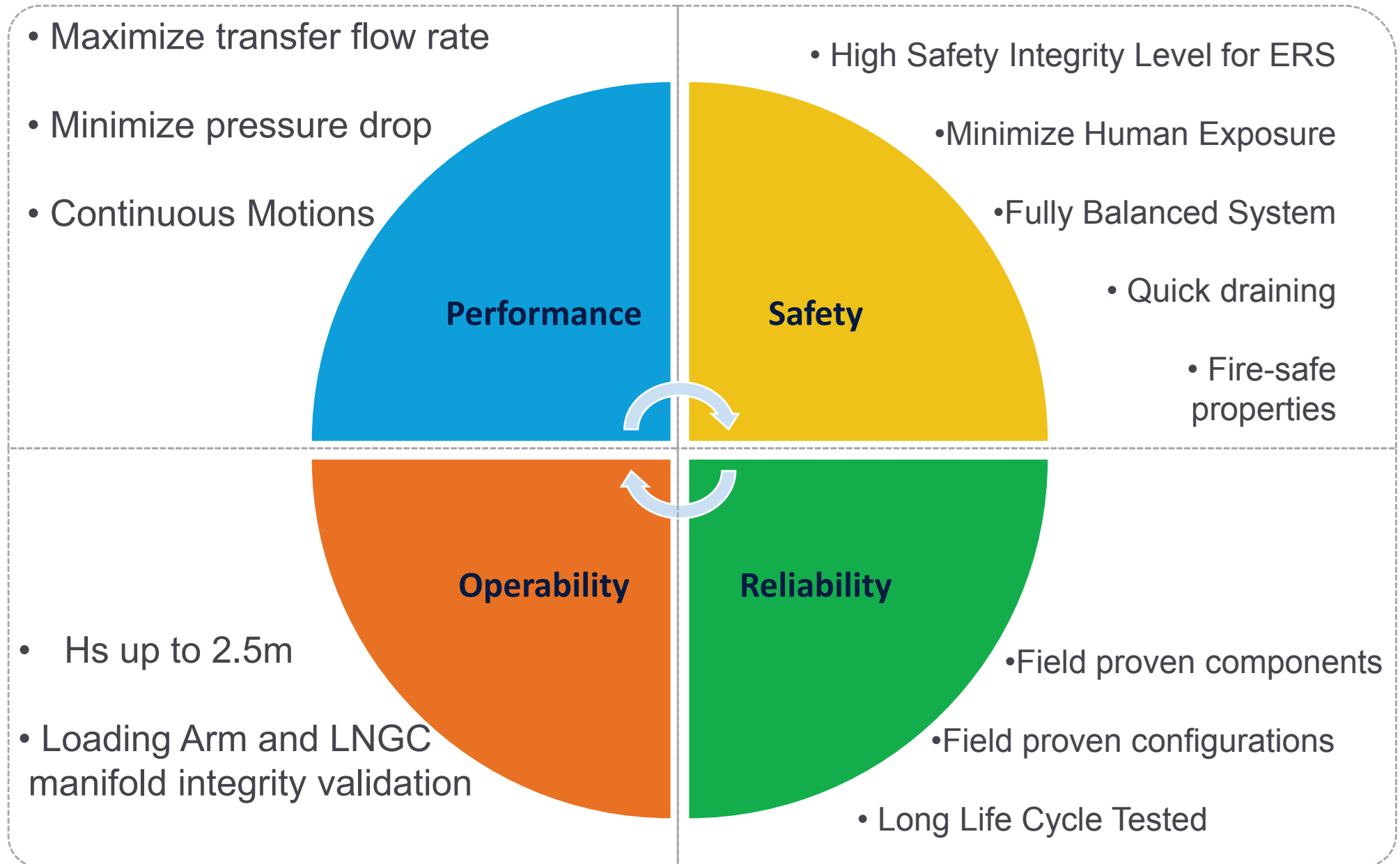
Prelude FLNG



Petronas FLNG Satu

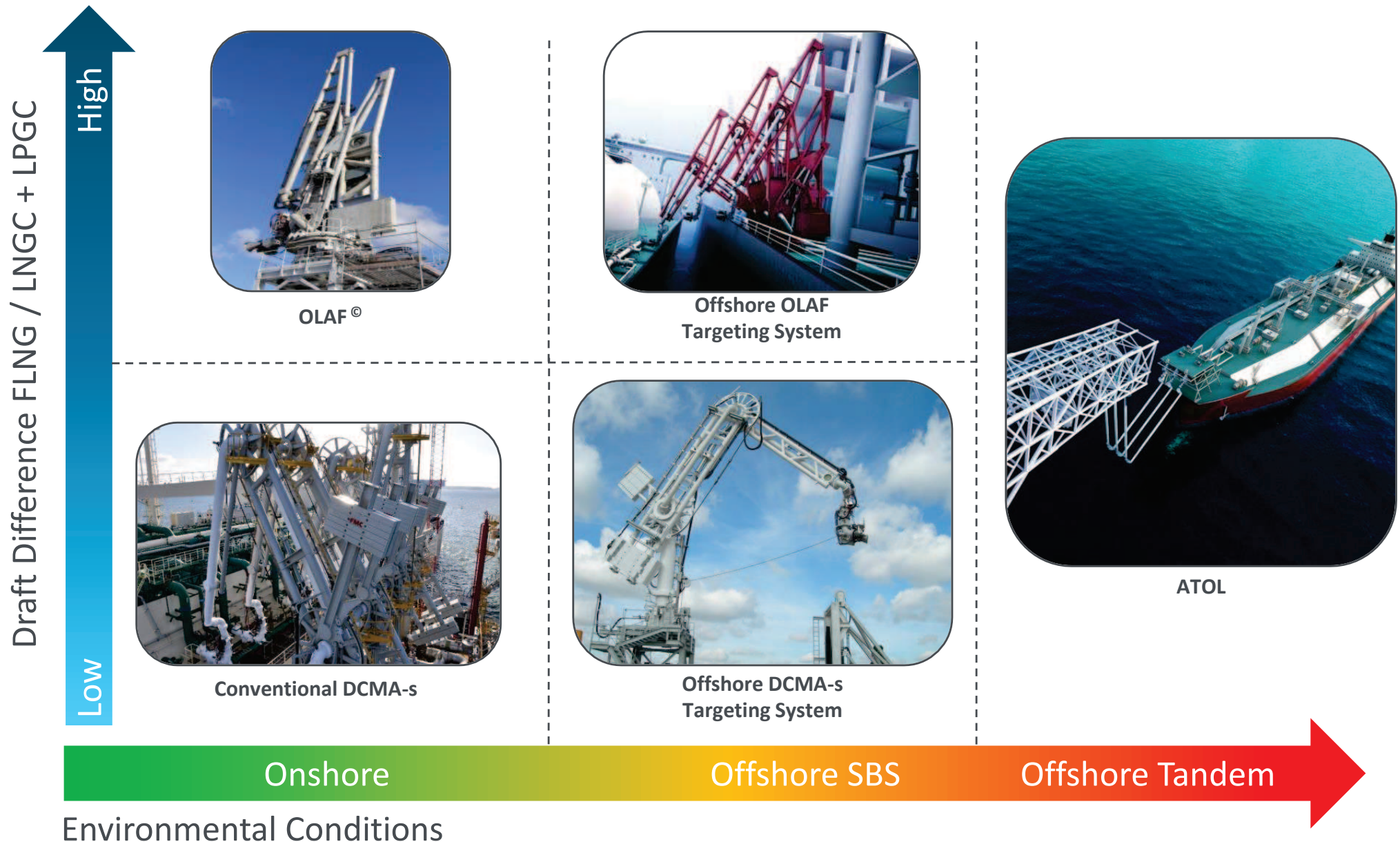
Offshore LNG Loading Arms

Key Features



Offshore LNG Loading Arms

Technology Key Selection Factors



Integration

The constraints for integration



20m
(typical)

x

10m
(typical)

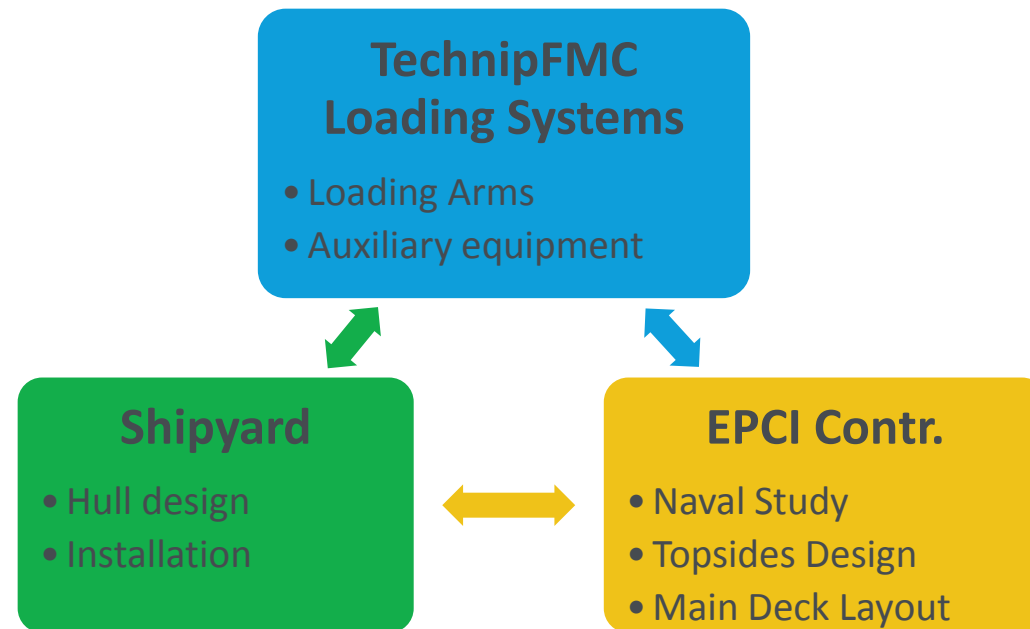


Petronas FLNG Satu (source: Petronas)



Integration

The Management of Interfaces



Lessons learned from actual projects:

- ▶ Finding spots for auxiliary equipment on a congested deck
- ▶ Space management with other topsides equipment
- ▶ Tubing and cable routing made onboard
- ▶ Tripartite Work TechnipFMC/ EPCIC/ Shipyard
- ▶ Various discipline interfaces: electrical/ hydraulic/ structural/ mechanical/ piping



Integration

Lessons Learned: The equipment set-up in a shipyard



Completing the installation in a shipyard means

- ▶ 3 to 4 pieces of equipment mounted independently
- ▶ Being dependent on:
 - ▶ Availability of shipyard manpower
 - ▶ Access restriction/ Permit to Work on board FLNG
- ▶ Constrains form concomitant activities onboard
- ▶ Pre-commissioning onboard
- ▶ The only topsides equipment not delivered as a module

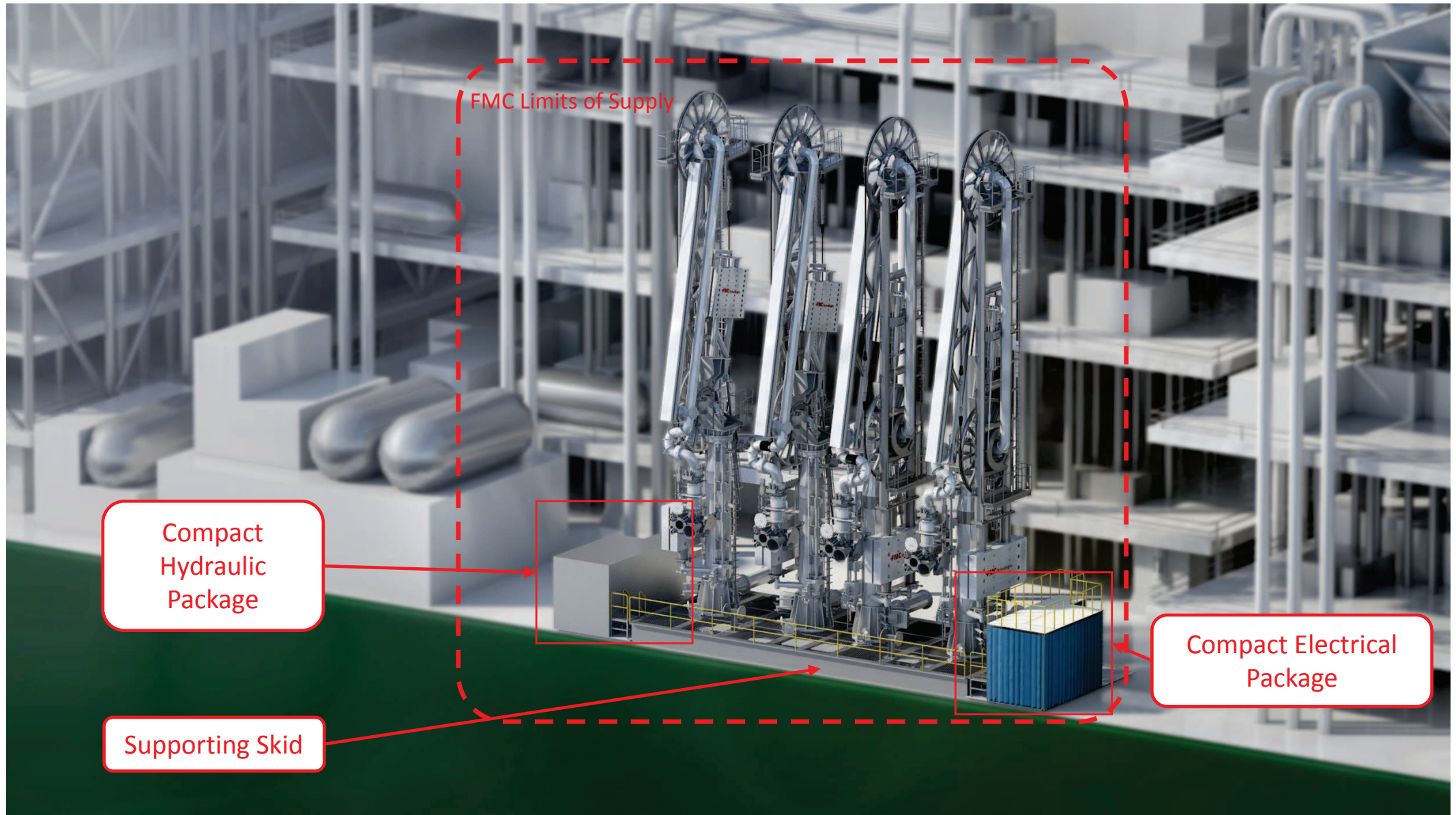
Further improving the model

- A new execution model will now optimize the project implementation phase including:
 - ✓ Project economic with drastic installation cost cutting
 - ✓ Considerable schedule shrinkage
 - ✓ Maintain our supply to the best performance level, as well as highest safety and quality standards

By redefining the scope boundaries, the logistic set-up, the interfaces and responsibility areas.

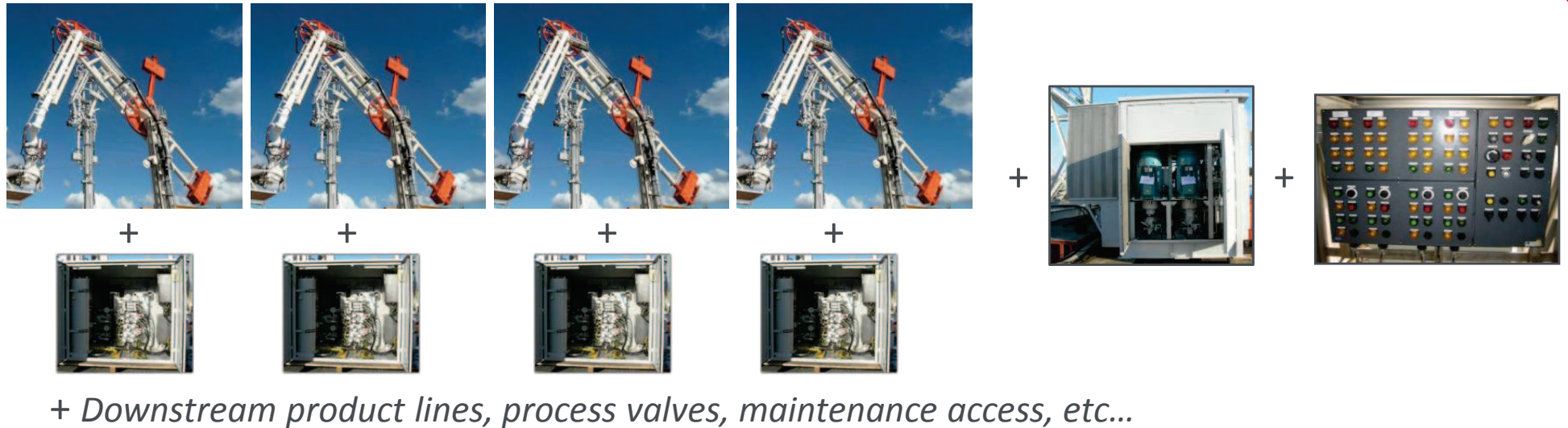


TECHNIPFMC Offloading Module



What does it mean for loading arms on FLNG?

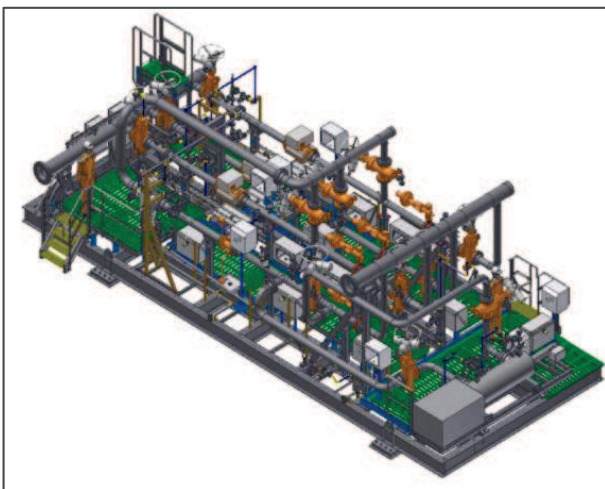
- ▶ Reduce and simplify boundary limits during engineering phase
- ▶ Rethink our supply and offer a more compact & optimized offloading solution
- ▶ Deliver a single topsides module to reduce integration time at FLNG shipyard
 - ✓ Piped
 - ✓ Cabled
 - ✓ Pre-Commissioned
 - ✓ One lift installation



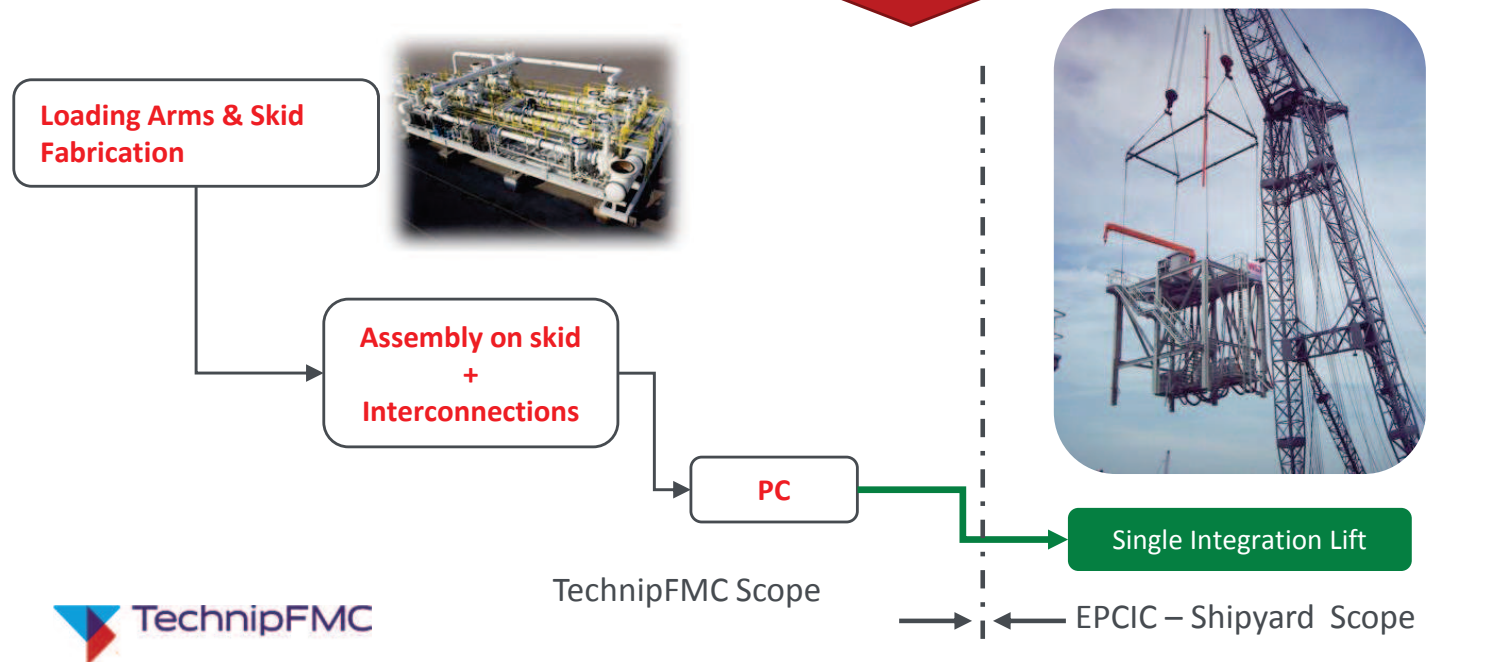
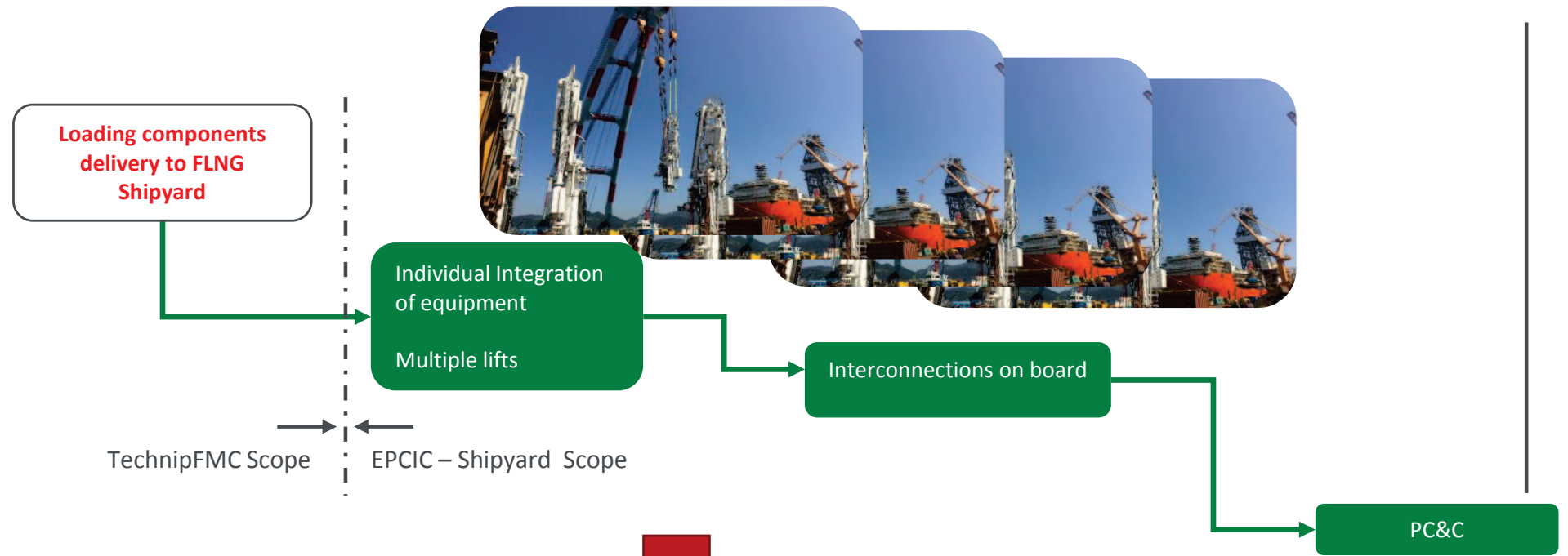
Offloading
Module

Completing the Offloading Function

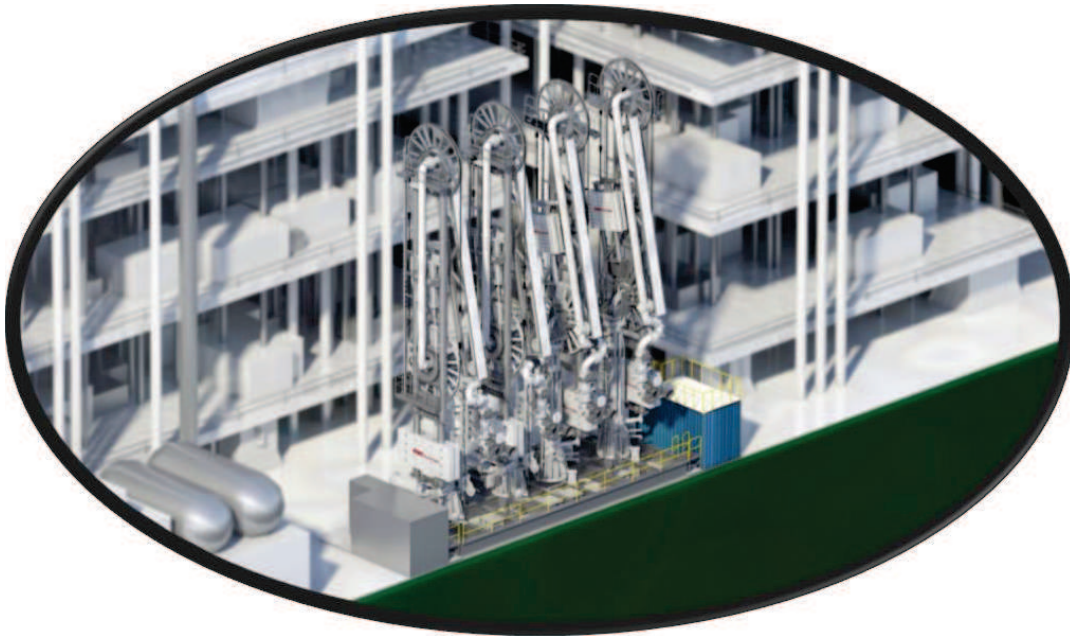
Potential Additional functions	
Water Curtain	Used to prevent LNG spillage damaging hull side
Removable Spool	Used to switch vapor arm
LNG/ NG Metering	In line metering of LNG transfer – TechnipFMC Measurement Solutions
Process Monitoring	In line pressure & temperature monitoring Communication with DCS
Motor Operated Valves	Open during offloading mode Closed during holding mode
Ship - Shore Link	Used between FSRU/ FLNG and LNG Carrier for SBS offloading: ESD link PAGA Telephone



Integration model evolution



Improving Execution – Reducing Cost

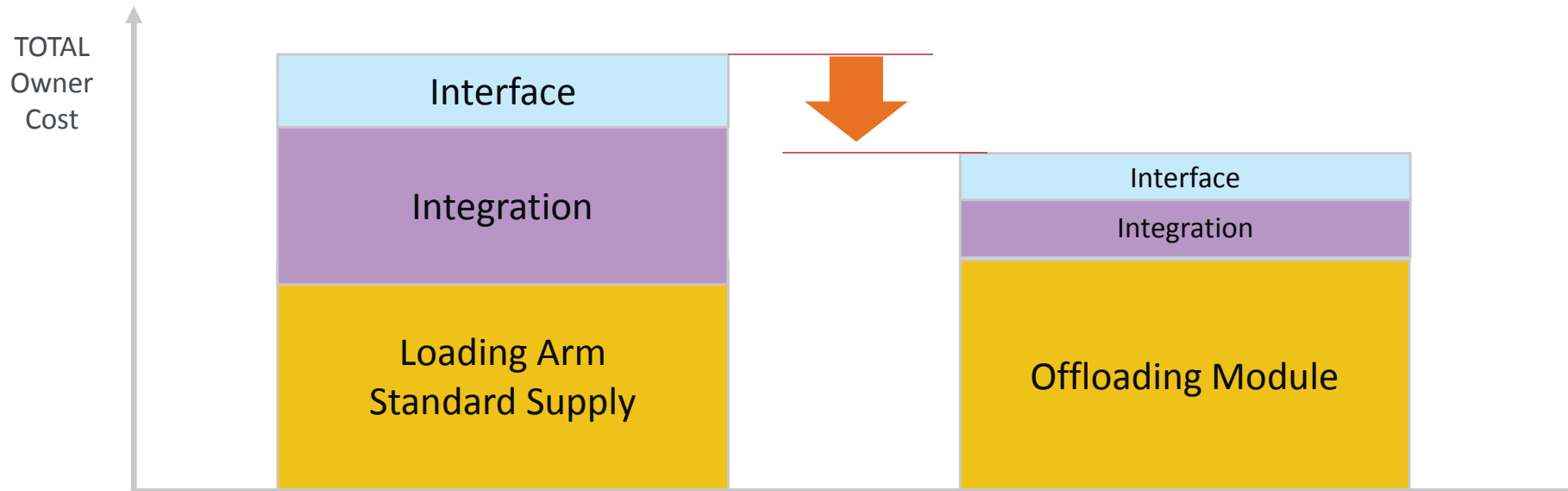


Benefits

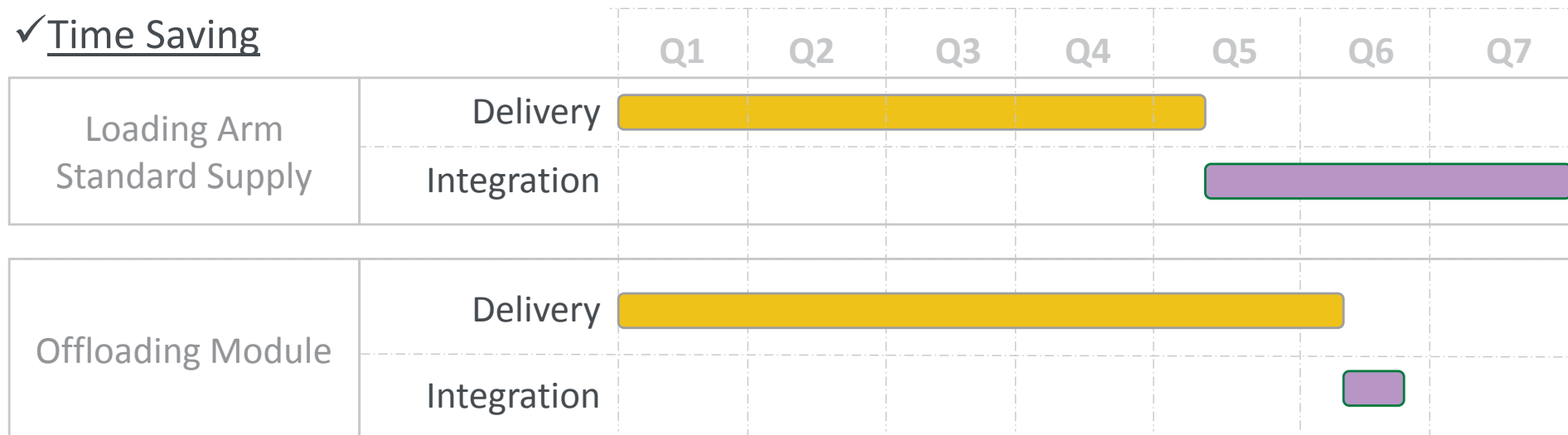
- ▶ Significant reduction of material interfaces with topsides
- ▶ Module construction optimized in an industrial construction environment
- ▶ A single party responsible for the offloading function delivery
- ▶ Single integration lift
- ▶ Better control on integration schedule

What Benefits?

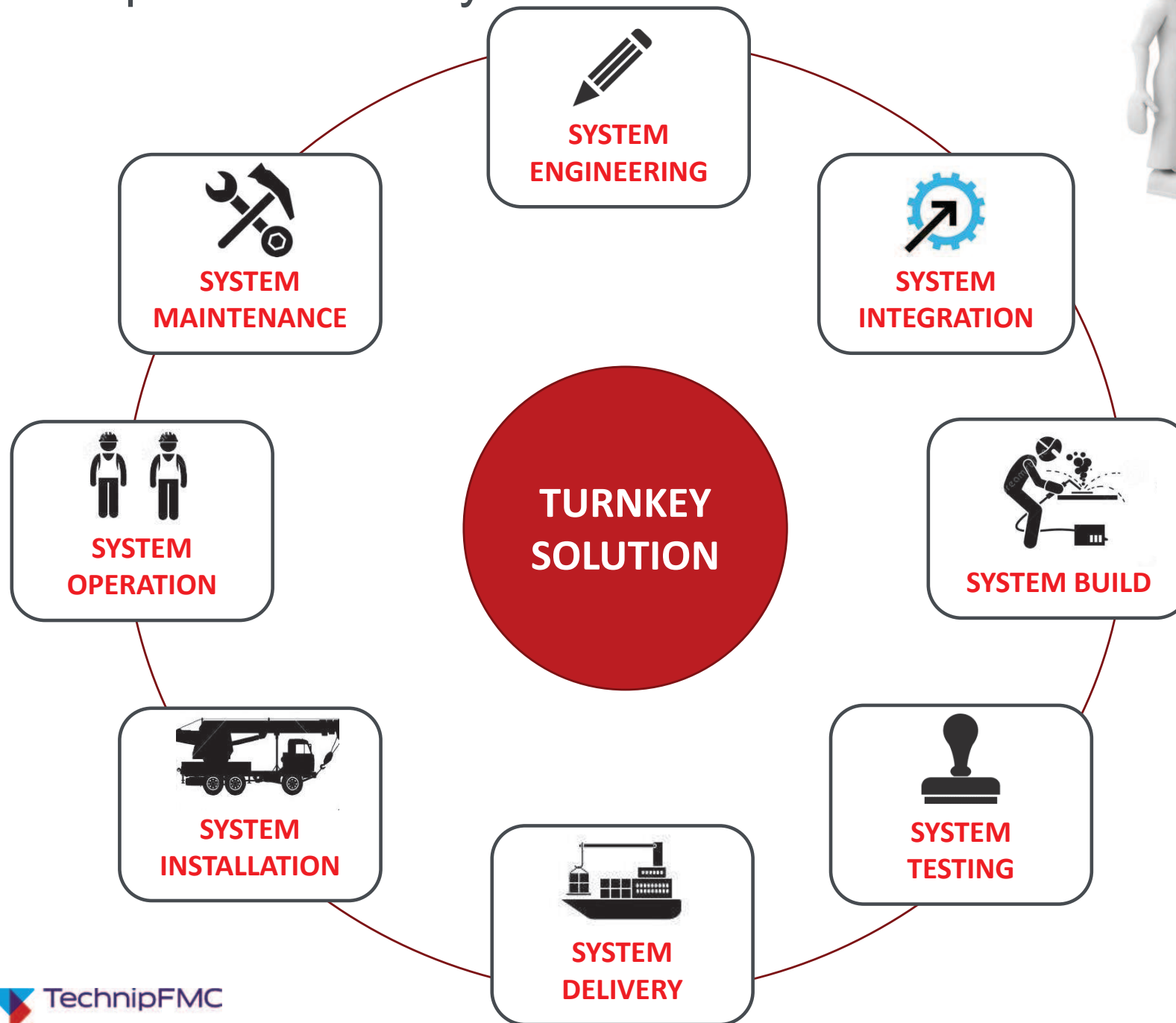
✓ Cost Saving



✓ Time Saving



TechnipFMC: Turnkey Solution Provider



Thank you for your attention

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