

Use of Semantic Technology and experiences with IDO in Aibel

Industrial Semantic Interoperability Summit
June 2026



Outline

- About Aibel
- How we use semantic technology
- Business value
- What we have learned
- Ideas for the future



This is Aibel



8

locations worldwide.
Headquarters in
Stavanger, Norway



3

yards in Norway
(Haugesund) and Thailand
(Laem Chabang and
Map Ta Phut)



3

business segments:
Offshore wind & electrification,
Field development and
Maintenance & modifications



4 700

employees globally



40

graduates
hired in 2025



113

apprentices
(year-end 2025)



63

different
nationalities



3

owners:
Ferd 50%, Ratos 32%
and Second AP Fund 18%



145

years of experience

We deliver the full scope of services

Studies

Engineering

Procurement

Construction

Installation

MC/
Commissioning

Operational
support

After-market
services

What we do

Offshore Wind



Maintenance & Modifications



Field Development



Modifications and Yard Services



How we use semantic technology

- Offshore plants *must* be engineered to comply with complex government regulations, customer requirements, engineering standards, and company best-practices
- Aibel is contractually obliged to ensure that every applicable requirement is fulfilled
- Standards and regulations are provided in *document form* – requires substantial manual effort by specialized and experienced engineers to interpret, apply, and verify

Aibel uses Semantic Technology to provide their engineers with computer support in application of complex requirements in the engineering and construction process



Material definitions for design and procurement

- When engineering an offshore plant, different requirements apply to different parts
- CAD design of a specific process line or a specific part of the plant structure must only use components which adhere to the applicable set of requirements
- When procuring components, it must be assured that the supplier delivers according to the applicable set of requirements

Aibel's Material Master Database (MMD) provides quality-controlled material catalogs to our EPCI projects, containing only valid components



Material Master Database (MMD)

- Aibel's Industrial Engineering Ontology, material database, and accompanying information system
- Provides Aibel's EPCI projects with high-quality material catalogs for Piping, Valves, and Structural
- The MMD ontology:
 - builds on W3C Standards: RDF, SPARQL, OWL
 - uses the Industrial Data Ontology (IDO) as upper ontology
 - incorporates «OWL-ified» engineering standards: ASTM, ASME, API, Norsok, ++
 - contains >300.000 classes, many with rich axiom sets
- Uses *semantic reasoning* and executable rules to validate ontologies, create project specifications, automatically build validated material catalogs, and eliminate duplicate definitions



Example: Piping Class Sheet (PCS)

- Piping Class Sheets (PCS) can be *precisely described* in the MMD ontology language:
 - Pressure/temperature curves, pipe size tables, pipe element tables with geometry and Material Data Sheets (MDS)
- The referred Dimension Standards are all modelled in MMD
- Machine interpretable representation allows for building the material catalog for a PCS using *semantic reasoning*

MMD **aibel**

ASME B16.5 Pipe Flange NPS 2 CL1500 Weld Neck Ring type joint

Class **ASME B16.5 Pipe Flange NPS 2 CL1500 Weld Neck Ring type joint** ID: <http://data.aibel.com/rdl/X101009102>

Annotations

Superclasses

- ASME B16.5 Pipe Flange NPS 2 CL 1500
- Pipe Flange Weld Neck
- has Flange Hub some ASME B16.5 Weld Neck Flange Hub
- has Flanged End some ASME B16.5 Ring type joint Flange Face NPS 2 CL1500
- has Pipe End some ASME B16.5 NPS 2 Butt welding end
- Metal Volume Based on Geometry dm³ value 1.746
- Raised face height mm value 7.92
- Specified Length Through Hub mm value 102.0
- Specified Outside Diameter of Flange mm value 215.0
- Specified Thickness of Pipe Flange mm value 38.1
- Surface Area dm² value 9.52
- Wall Thickness Base for Metal Volume mm value 5.16

MMD ontology: ASME B16.5 Flange NPS 2 CL1500 WN RTJ

Piping and valve specification

Johan Sverdrup P2

Doc.no.

TR2000

Plant

JSP2

Sec.no.

2

Equinor

Piping class sheet: ED120

CL900

Project.no.

Rev.no.

A

Rev.date

10.05.2021

Status:

O

Page:

1

Of:

1

DESIGN CODE:

ASME B31.3

TEST PRESSURE (Barg):

232.7

Maximum Design Pressure :

Barg

155.1

155.1

155.1

154.6

150.5

145.8

139.0

128.6

At Temperature :

°C

-46

38

50

100

150

200

250

300

See note 1,2

SERVICE CODE:

SUMMARY

VSM: TR3017

PIPE SIZE, WALL THICKNESS AND SUMMARY OF MINIMUM DESIGN FACTORS

Nom. Size(in)

0.5

0.75

1

1.5

2

3

4

6

8

10

12

14

16

18

20

24

28

30

Dia.(mm)

21.3

26.7

33.4

48.3

60.3

88.9

114.3

168.3

219.1

273.1

323.9

355.6

406.4

457.2

508

610

711

762

Wall th.(mm)

2.77

2.87

3.38

3.68

2.77

5.49

6.02

7.11

10.31

12.7

14.27

15.09

16.66

19.05

20.62

24.61

28

30

Schedule

40S

40S

40S

40S

10S

40S

40S

40S

60

80S

60

60

60

60

60

60

ISO

ISO

U.Tolerance*

12.5

12.5

12.5

12.5

12.5

12.5

12.5

12.5

12.5

12.5

12.5

12.5

0.3

0.3

0.3

0.3

0.3

0.3

Weld.Factor

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

1

Corr.Allowance(mm)

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

0

Nom. Size(in)

36

38

Dia.(mm)

914

965

Wall th.(mm)

36

38

Schedule

ISO

ISO

U.Tolerance*

0.3

0.3

Weld.Factor

1

1

Corr.Allowance(mm)

0

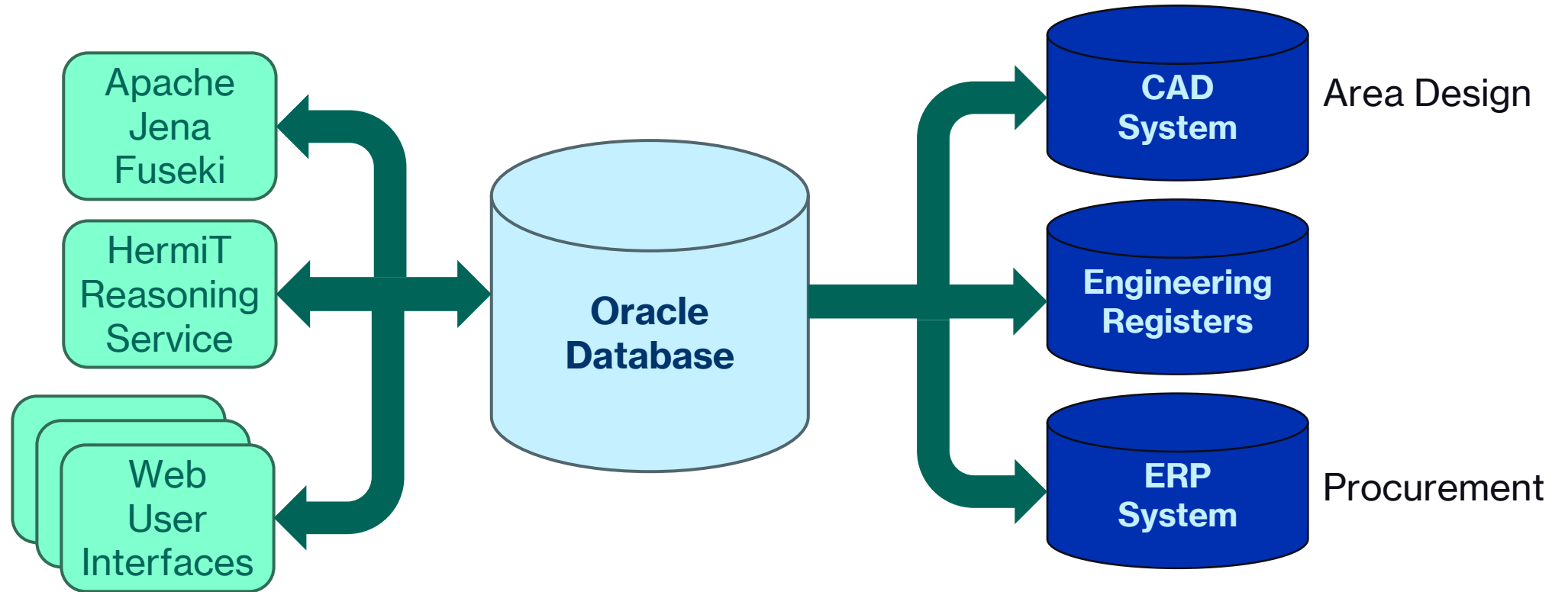
0

* Under tolerance abbreviations typical used in above table: 10 = 10.0%, 12.5 = 12.5%, 15 = 15.0%, 0.3 = 0.3mm and 0.5 = 0.5mm. The specified under tolerance and weld factor in this table, summaries only the minimum requirements for the piping items used in this piping class. As stricter requirement may apply for an individual piping item, this information shall be used for design only and not as part of the purchase specification.

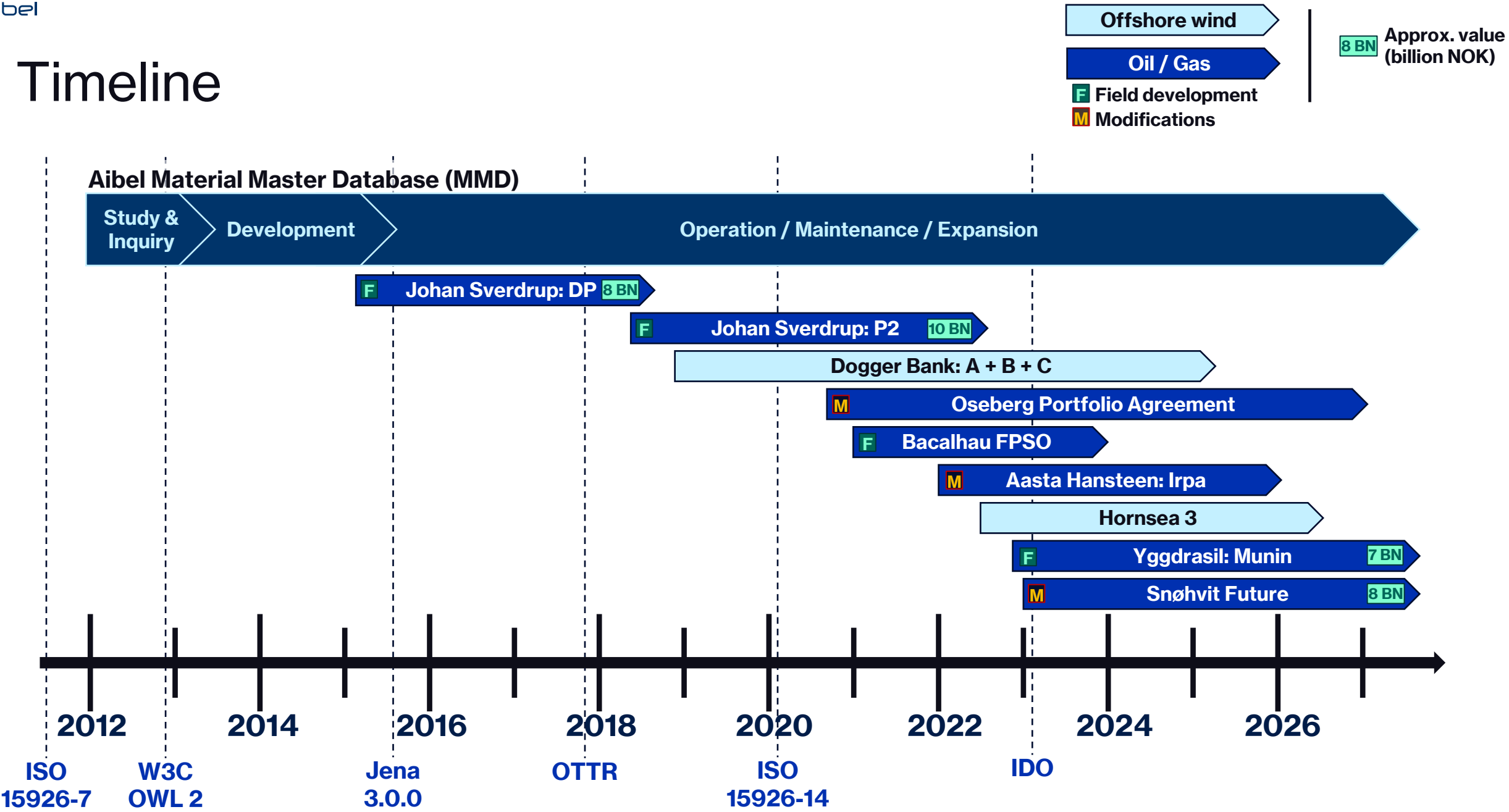
ELEMENT NAME	DIMENSION STANDARDS	NOM FROM	SIZE TO	TYPE	MATERIAL NAME	MDS	EDS	NOTE	ART SET
PIPE	ASME B36.10/19	0.5	14	Smls	A790 S31803	DP101			
	ASME B36.10-U03	16	24	Smls	A790 S31803	DP105			
	ISO 4200-U03	28	36	Smls	A790 S31803	DP105			
	ASME B36.10/19	1	14	Welded	A928 S31803 Cl.1 or 3	DP102			
	ASME B36.10-U03	16	24	Welded	A928 S31803 Cl.1 or 3	DP104			
	ISO 4200-U03	28	38	Welded	A928 S31803 Cl.1 or 3	DP104			
BENDING				Cold bending	S31803	DZ101			
FITTING	ASME B16.9	0.5	14	Smls	A815 S31803-S	DW101	SBR3		
	ASME B16.9-U03	16	38	Smls	A815 S31803-S	DW102	SBR3		
	ASME B16.9	1	14	Welded	A815 S31803-WX	DW108	SBR3		
	ASME B16.9-U03	16	38	Welded	A815 S31803-WX	DW109	SBR3		
		2	38	Olet	A182 F51	DF107	SBR3	3	
	ASME B16.9	2	2	3D bend smls	A815 S31803-S	DW103			
		6	38	Sweepolet	A182 F51	DF109		4	
FLANGE	ASME B16.5	0.5	2	CL1500 RTJ WN	A182 F51	DF101			
	ASME B16.5	3	24	CL900 RTJ WN	A182 F51	DF101			
	ASME B16.47A	28	36	CL900 RTJ WN	A182 F51	DF101			
	ASME B16.47A	38	38	CL900 RF WN	A182 F51	DF101		5	
	ASME B16.5	0.5	2	CL1500 RTJ TE RED	A182 F51	DF125		6	

Equinor TR2000 Piping Class Sheet (PCS)

MMD System Architecture



Timeline



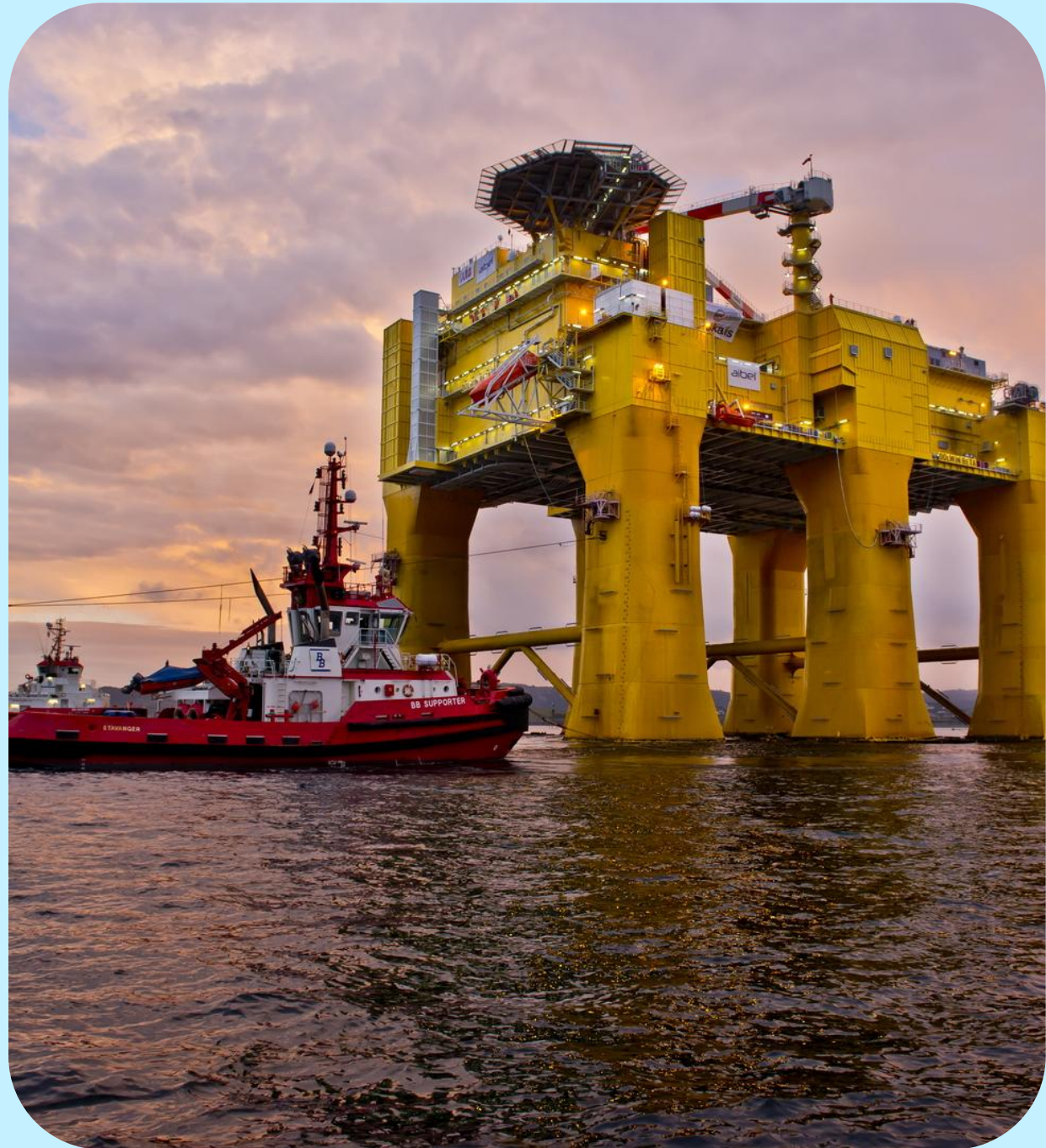
Business value

- Improved quality of material catalogs in 3D CAD design – fewer cases of use of incorrect components
- Improved quality of generated Isometric Drawings
- Improved quality of procurement process – fewer cases of ordering/delivery of incorrect components to the yard
- Improved re-use of stock items between projects (due better item descriptions and elimination of duplicate identifiers)



What we have learned

- Developing and maintaining a large and detailed industrial ontology is costly and time-consuming
- Software stack was (is?) partially immature and/or incomplete
 - Graph stores, OWL reasoners, collaborative ontology authoring tools
- QA procedures are *essential!*
- Handling combinatorial complexity: generate *by need* (in a controlled way) rather than up-front
- Scalability issues: often a long way from Semantic Technology standards to viable commercial solutions



Ideas for the future – Aibel

- Provide semantic engineering data in an earlier phase of engineering projects
 - Systems Engineering
 - Piping & Instrumentation Diagrams (P&ID)
- Increase utilization of existing MMD semantic data internally
 - Example: Automatically apply HS Codes with semantic reasoning
- Improve MMD ontology maintenance process & software tools



Ideas for the future – energy industry

- Make Engineering Standards available as ontologies (or at least as structured data!)
 - Open vs. proprietary standards, IP rights
- Cooperate on common semantic information models and data exchange formats



aibel