TIA 2019 - 474
Knowledge Provisioning to Improve and Simplify ABS Digital Compliance

2020 SDMT Panel
Virtual Meeting
October 29, 2020

Conrad Shipyard, LLC

American Bureau of Shipping (ABS)

Victoria Dlugokecki

Hepinstall Consulting Group, Inc.

Auros Knowledge Systems, LLC

Objective and Project Team

Project Team Members

Organization / Role	Name
Auros Knowledge Systems, LLC (Prime)	Steve Boisvert Greg Burek Brian Coch Sean McEvilly Venkata Yedida
ABS – American Bureau of Shipping	Jan Chow Dan Cronin Ramakrishnan (Ramki) Gudlooru Naveen Srivastava
Conrad Shipyard, LLC	Shaun Hunter Britt Zerengue Rene' Leonard
Hepinstall Consulting Group, Inc.	Lisa Elles
V. Dlugokecki, P.E.	Vicky Dlugokecki
Project Technical Representative (PTR)	John Walks, Ingalls
ATI Technical Manager (PM)	Nicholas Laney, ATI

Overall Project Objective

Improve and simplify the ABS compliance process through digital provisioning and compliance capture using Knowledge Aware techniques

Project Goals

- Deliver XML translator to automate digitization of ABS rules
- Streamline preliminary ABS compliance review process
- Shorten communication cycle between ABS / Shipyards
- Define potential future operating model
- Compare applicability for other external requirement sources (Mil-Stds)

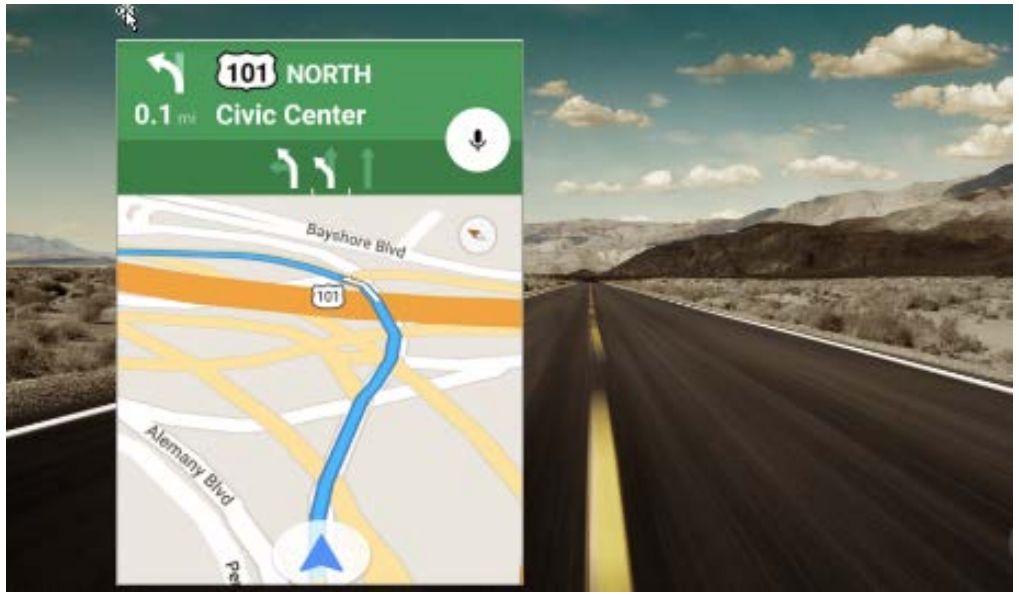
Knowledge Aware

Knowledge Aware (KA)

'Knowledge Aware' represents a fundamental shift in how knowledge is managed and provisioned.

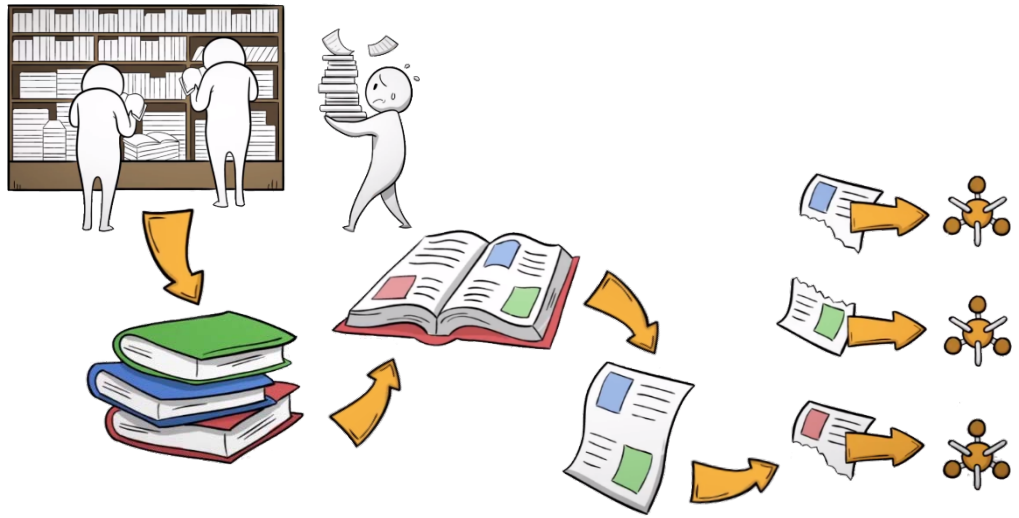
Static
Immediately out of date
Impossible to use while driving

Dynamic
Easy to use
Provisions directions as needed
Provide insights from other drivers



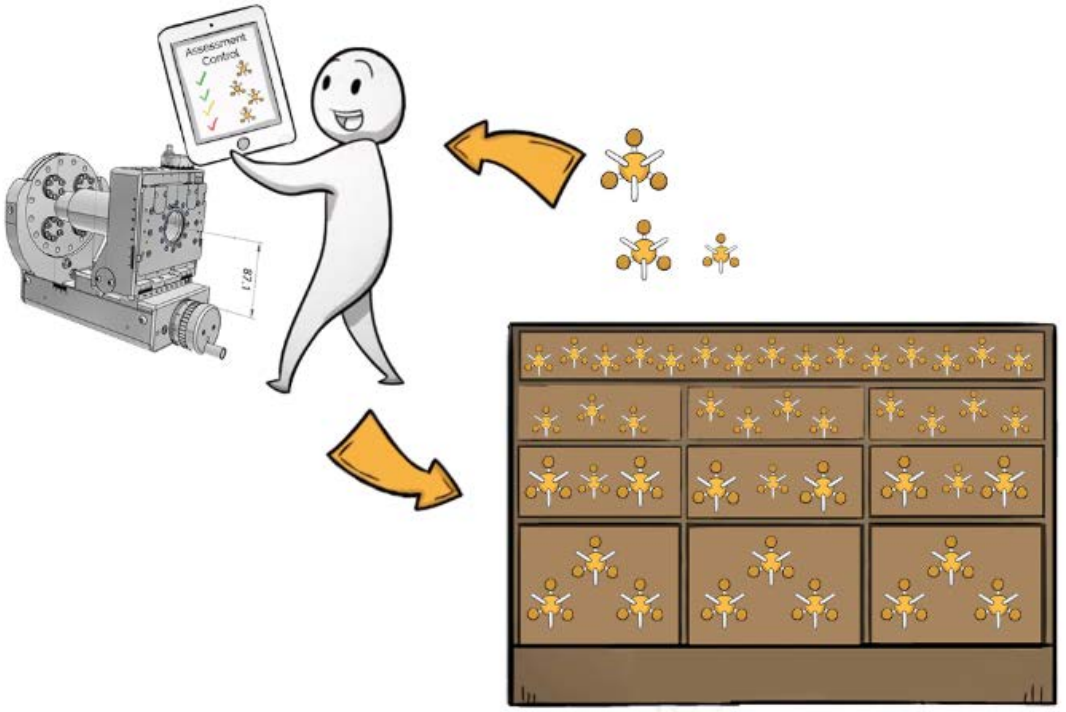
Knowledge Packets

Existing Documentation & Know-How



Knowledge Packets (K-PACs)

Assessment Controls



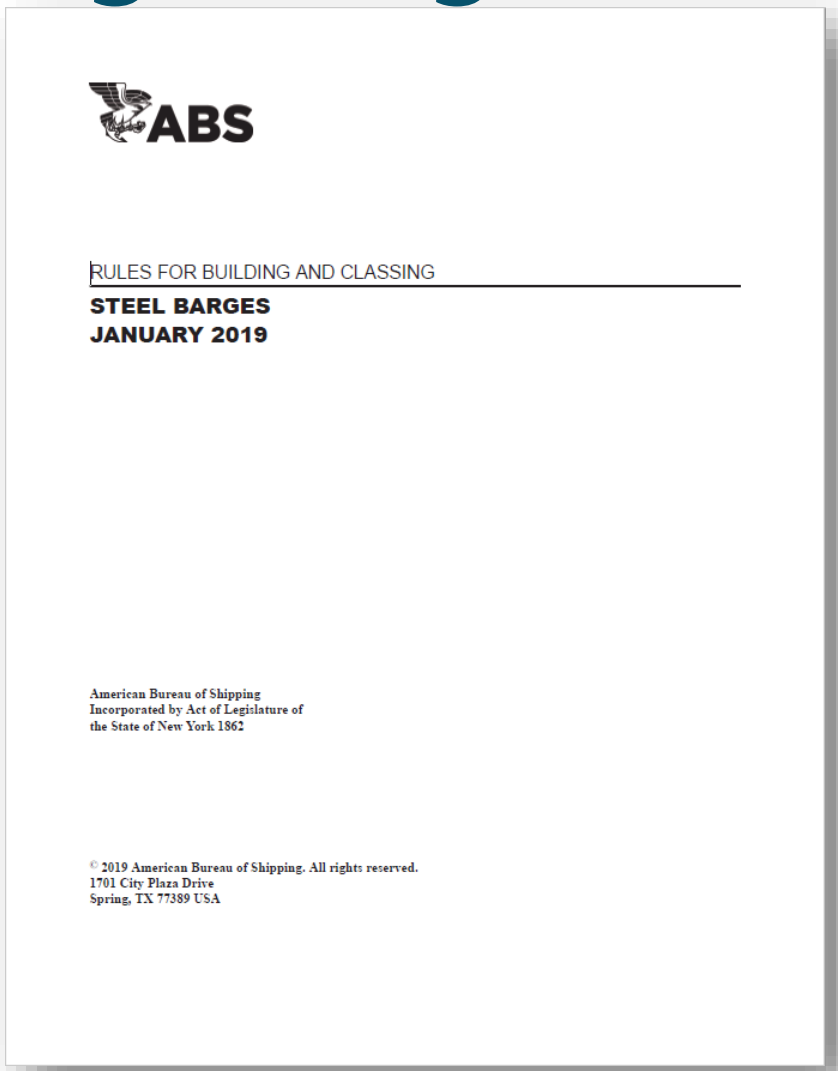
Knowledge Packet & Assessment Control Technologies

Knowledge Packets

Assessment Control

Digitizing ABS Rules as Knowledge Packets

Digitizing ABS Rules as Knowledge Packets



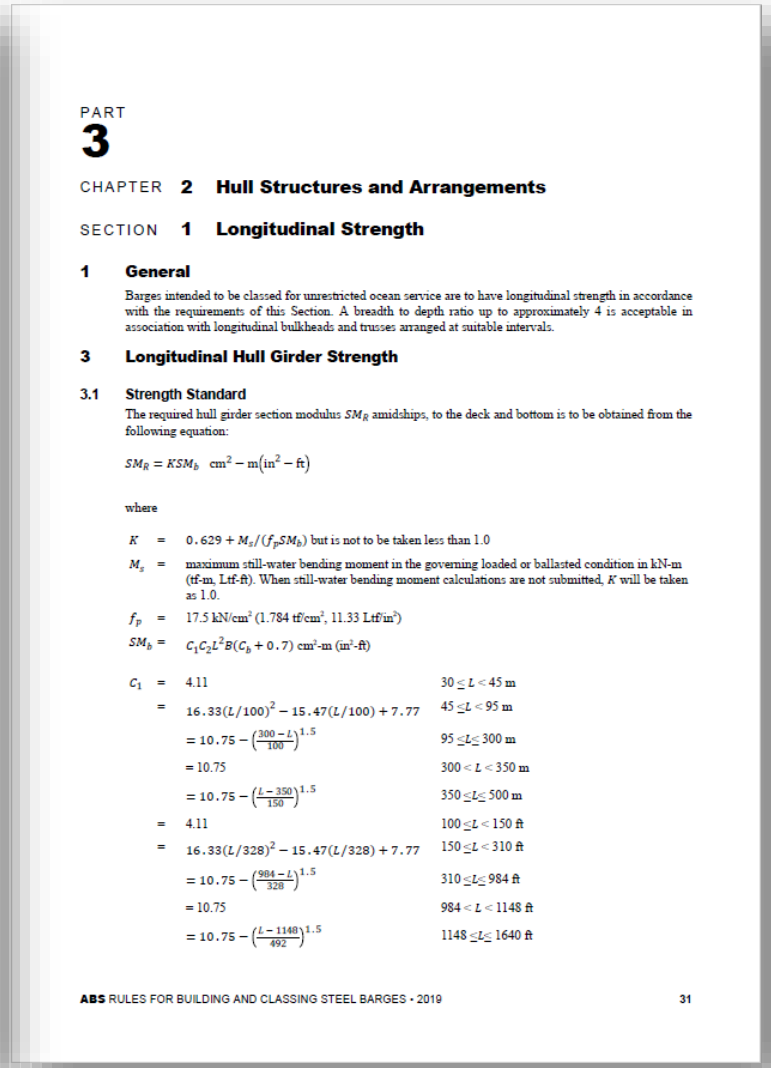
ABS

RULES FOR BUILDING AND CLASSING

STEEL BARGES
JANUARY 2019

American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862

1701 City Plaza Drive
Spring, TX 77389 USA



PART **3**

CHAPTER **2** **Hull Structures and Arrangements**

SECTION **1** **Longitudinal Strength**

1 General

Barges intended to be classed for unrestricted ocean service are to have longitudinal strength in accordance with the requirements of this Section. A breadth to depth ratio up to approximately 4 is acceptable in association with longitudinal bulkheads and trusses arranged at suitable intervals.

3 Longitudinal Hull Girder Strength

3.1 Strength Standard

The required hull girder section modulus SM_R amidships, to the deck and bottom is to be obtained from the following equation:

$$SM_R = KSM_b \quad \text{cm}^2 - \text{m}(\text{in}^2 - \text{ft})$$

where

K = $0.629 + M_s/(f_p SM_b)$ but is not to be taken less than 1.0

M_s = maximum still-water bending moment in the governing loaded or ballasted condition in kN-m (tf-m, Ltf-ft). When still-water bending moment calculations are not submitted, K will be taken as 1.0.

f_p = 17.5 kN/cm^2 (1.784 tf/cm^2, 11.33 Ltf/in^2)

SM_b = $C_1 C_2 L^2 B(C_b + 0.7)$ cm^2-m (in^2-ft)

C_1 = 4.11 for $30 \le L < 45$ m

= $16.33(L/100)^2 - 15.47(L/100) + 7.77$ for $45 \le L < 95$ m

= $10.75 - \left(\frac{300 - L}{100}\right)^{1.5}$ for $95 \le L \le 300$ m

= 10.75 for $300 < L < 350$ m

= $10.75 - \left(\frac{L - 350}{150}\right)^{1.5}$ for $350 \le L \le 500$ m

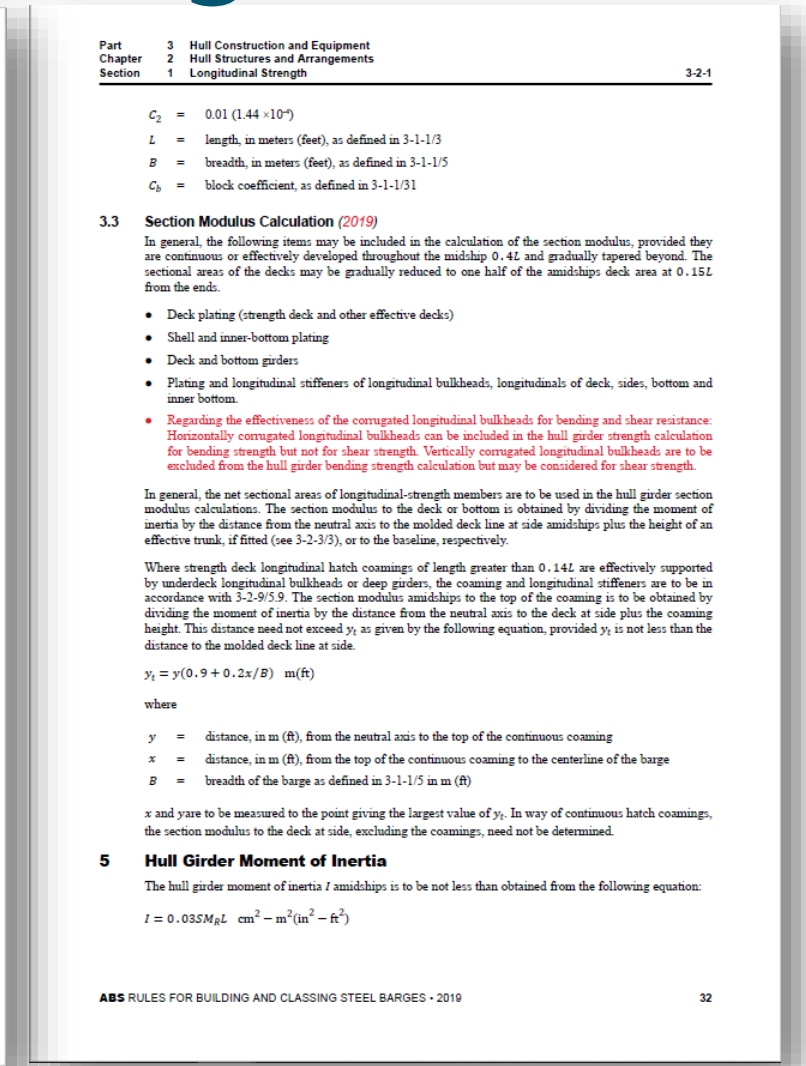
= 4.11 for $100 \le L < 150$ ft

= $16.33(L/328)^2 - 15.47(L/328) + 7.77$ for $150 \le L < 310$ ft

= $10.75 - \left(\frac{984 - L}{328}\right)^{1.5}$ for $310 \le L \le 984$ ft

= 10.75 for $984 < L < 1148$ ft

= $10.75 - \left(\frac{L - 1148}{492}\right)^{1.5}$ for $1148 \le L \le 1640$ ft



C_2 = 0.01 (1.44 ×10^{-4})

L = length, in meters (feet), as defined in 3-1-1/3

B = breadth, in meters (feet), as defined in 3-1-1/5

C_b = block coefficient, as defined in 3-1-1/31

3.3 Section Modulus Calculation *(2019)*

In general, the following items may be included in the calculation of the section modulus, provided they are continuous or effectively developed throughout the midship $0.4L$ and gradually tapered beyond. The sectional areas of the decks may be gradually reduced to one half of the amidships deck area at $0.15L$ from the ends.

- Deck plating (strength deck and other effective decks)
- Shell and inner-bottom plating
- Deck and bottom girders
- Plating and longitudinal stiffeners of longitudinal bulkheads, longitudinals of deck, sides, bottom and inner bottom.
- Regarding the effectiveness of the corrugated longitudinal bulkheads for bending and shear resistance: Horizontally corrugated longitudinal bulkheads can be included in the hull girder strength calculation for bending strength but not for shear strength. Vertically corrugated longitudinal bulkheads are to be excluded from the hull girder bending strength calculation but may be considered for shear strength.

In general, the net sectional areas of longitudinal-strength members are to be used in the hull girder section modulus calculations. The section modulus to the deck or bottom is obtained by dividing the moment of inertia by the distance from the neutral axis to the molded deck line at side amidships plus the height of an effective trunk, if fitted (see 3-2-3/3), or to the baseline, respectively.

Where strength deck longitudinal hatch coamings of length greater than $0.14L$ are effectively supported by underdeck longitudinal bulkheads or deep girders, the coaming and longitudinal stiffeners are to be in accordance with 3-2-9/5.9. The section modulus amidships to the top of the coaming is to be obtained by dividing the moment of inertia by the distance from the neutral axis to the deck at side plus the coaming height. This distance need not exceed y_t as given by the following equation, provided y_t is not less than the distance to the molded deck line at side.

$$y_t = y(0.9 + 0.2x/B) \quad \text{m(ft)}$$

where

y = distance, in m (ft), from the neutral axis to the top of the continuous coaming

x = distance, in m (ft), from the top of the continuous coaming to the centerline of the barge

B = breadth of the barge as defined in 3-1-1/5 in m (ft)

x and y are to be measured to the point giving the largest value of y_t. In way of continuous hatch coamings, the section modulus to the deck at side, excluding the coamings, need not be determined.

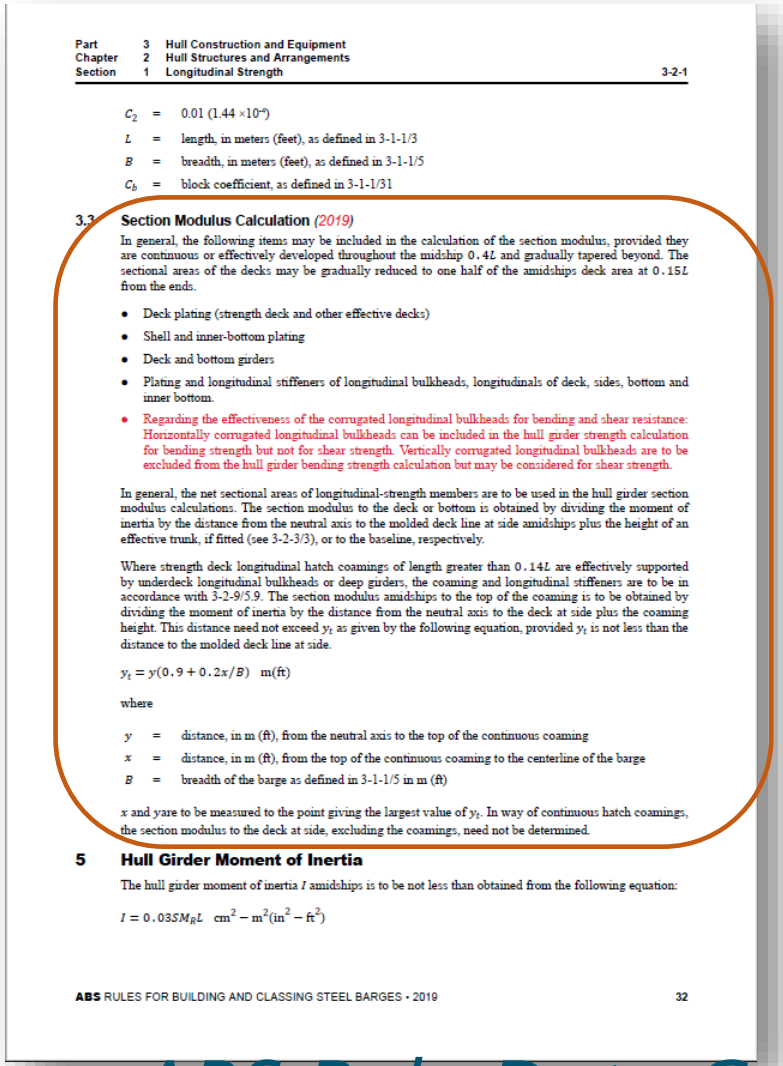
5 Hull Girder Moment of Inertia

The hull girder moment of inertia I amidships is to be not less than obtained from the following equation:

$$I = 0.03SM_R L \quad \text{cm}^2 - \text{m}^2(\text{in}^2 - \text{ft}^2)$$

Current Distribution Rule Method

Digitizing ABS Rules as Knowledge Packets



Part 3 Hull Construction and Equipment
Chapter 2 Hull Structures and Arrangements
Section 1 Longitudinal Strength 3-2-1

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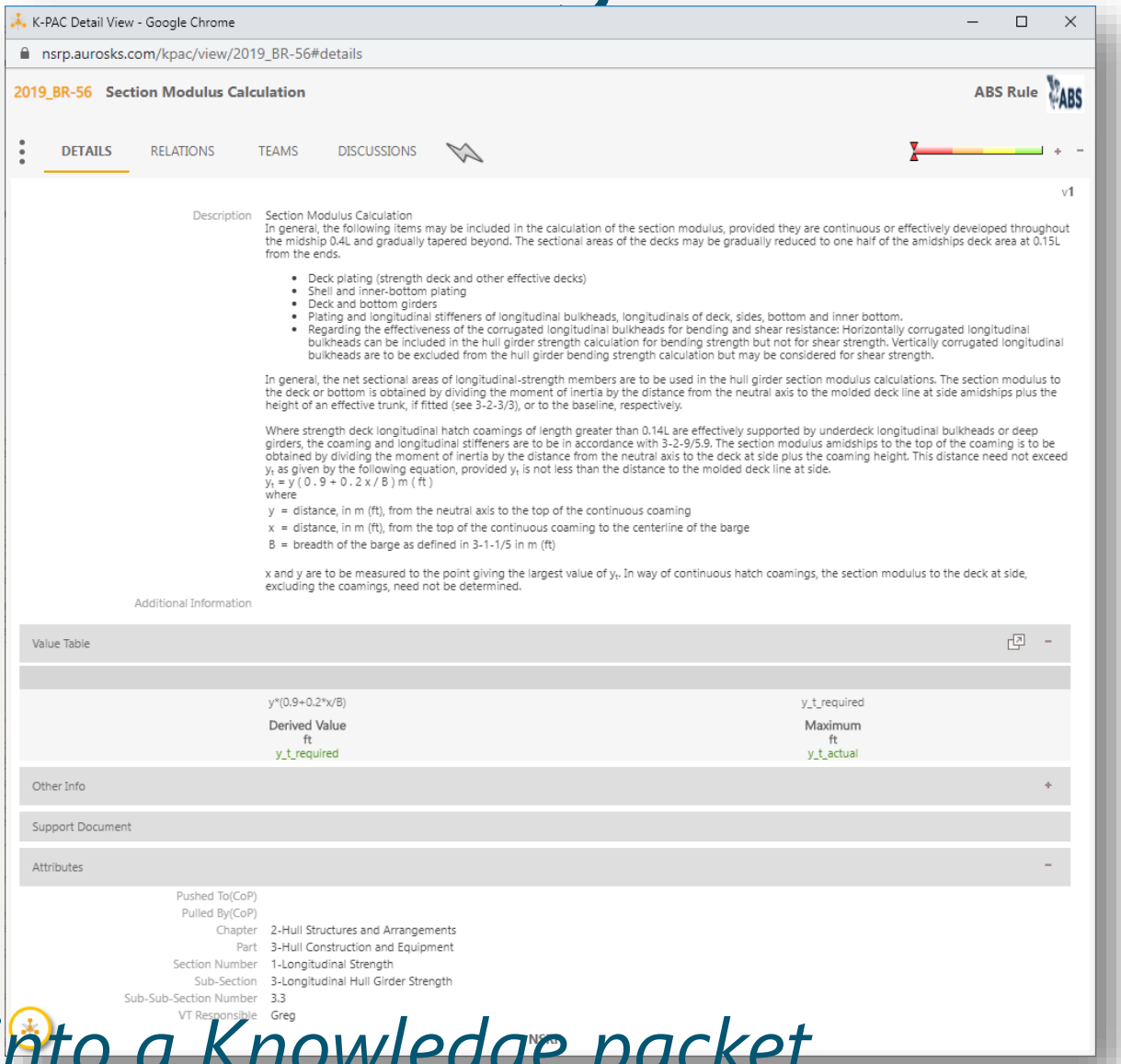
$I = 0.03SM_BL$ $cm^2 - m^2(in^2 - ft^2)$

ABS RULES FOR BUILDING AND CLASSING STEEL BARGES • 2019 32

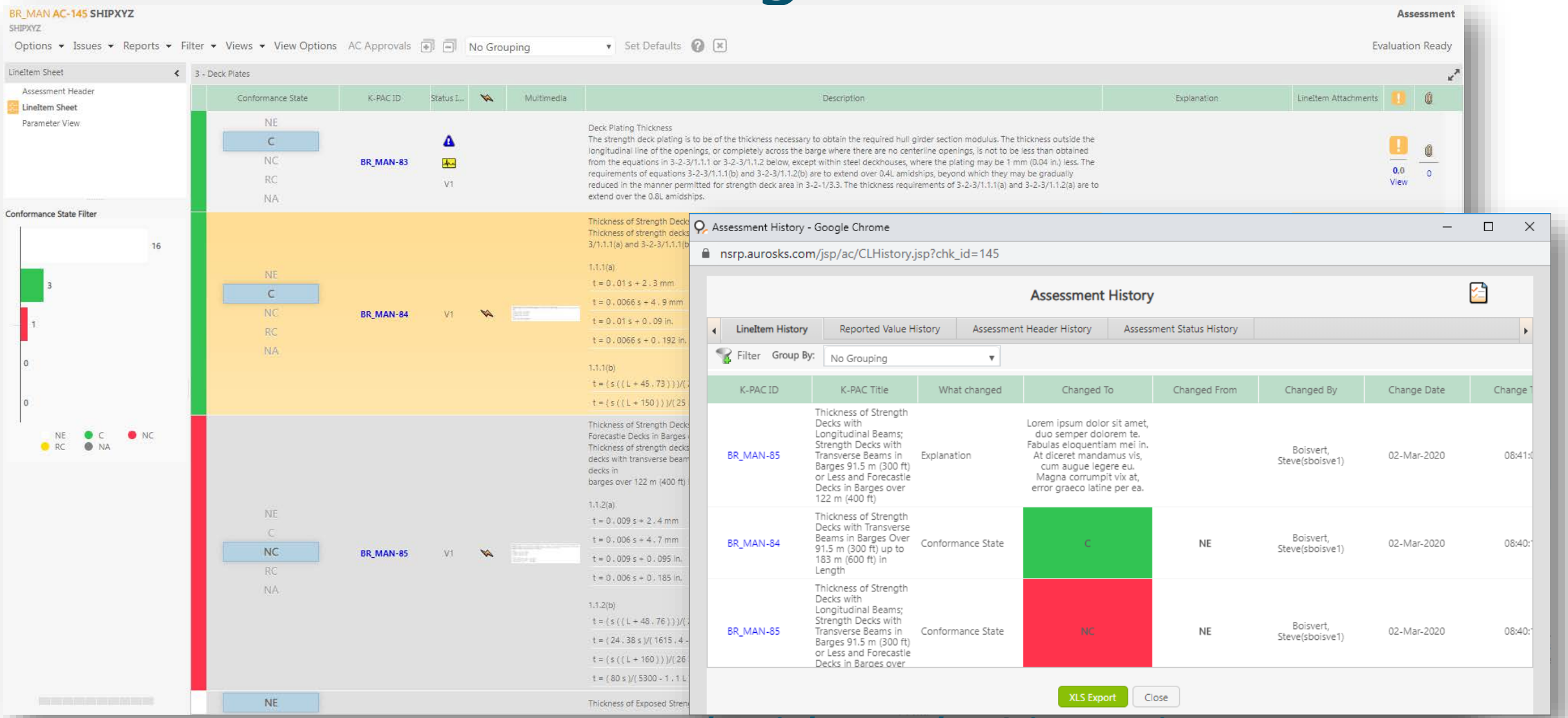


ABS Rule Data Converted into a Knowledge packet

Levels of Knowledge Packet Integration

- Tier 1
  - Rules converted into Knowledge Packets containing text and images
  - Non-executable
- Tier 2
  - Tier 1+
  - Executable equations (outside of CAD applications)
- Tier 3
  - Tier 2+
  - Executable equations with data exchange with CAD applications

ABS Rules Provisioning



Assessment with Evaluation History

Application for Mil Stds Provisioning

- Translator approach used for ABS rules (XML files) is not applicable to Mil-Stds
- Mil Stds Source Media includes:
  - Word Files
  - PDF
  - Hard Copy
  - Others
- Utilize recent advances in AI to parse and structure unstructured content – Approved RA Project (TOA 2020-302)
- 2021 Panel Project Proposal to Digitize Navy Standards

Project Results

Project Goal #1:

Deliver XML Translator to Automate Digitization of ABS Rules

- Production Version of Translator Released December 2019
- Translated “ABS Steel Barges – 2019”
  - Chapters 3 & 5 (238 pages)
- Statistics
  - Total of 507 Knowledge Packets
  - 75 Knowledge Packets included executable rules
  - Translator conversion time = 11 seconds

Project Goals #2 & 3:

- Streamline Preliminary ABS Compliance Review Process
- Shorten Communication Cycle Between ABS / Shipyards

- Current Process
  - Time to create shipyard XLS based calc sheet – 1 month (Barge Structure)

- Knowledge Provisioning Process
  - Time to create Auros assessments / quantity of assessments
    - ~1 Minute to Create and Provision 27 Assessments

Project Goal #4:
Define Potential Future Operating Model

- Categorization of Rules->K-PACs by Tiers
- Best Practices for Rule Structuring and Authoring
- Software Enhancements Implemented
- Memorandum of Understanding in Negotiations (Fall 2020)
  - Defining Support Model and Marketing Model
- NSRP RA Project Approved for 2021
  - Add Tagging to Digitize and Provision ABS Rule Sets
  - Apply Best Practices to enable Tier 2 and Tier 3 digitization

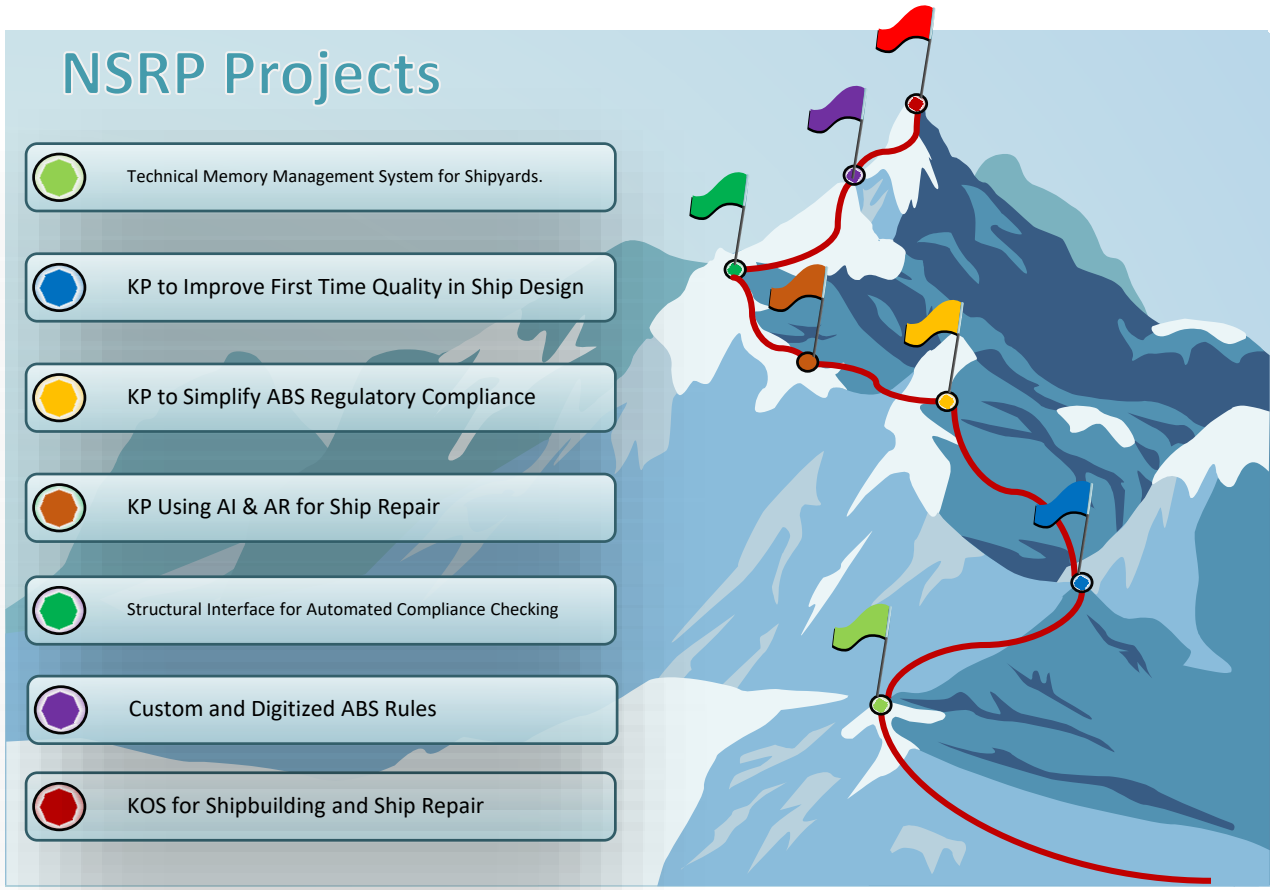
Project Goal #5:
Compare Applicability for Other External Req't Sources (Mil-Stds)

- Translator approach (XML files) not applicable to Mil-Stds
  - Mil Stds Source Media includes:
    - Word Files
    - PDF
    - Hard Copy
    - Others
- AI to Simplify Provisioning of Navy Std Req'ts
  - 2021 Panel Project Submission – Selected for ECB Review
  - 2020 Approved RA Project (TOA 2020-302) - Utilize recent advances in AI to parse and structure unstructured content

Knowledge Provisioning for Shipbuilding and Ship Repair – Where are we now…

NSRP Projects

- Technical Memory Management System for Shipyards.
- KP to Improve First Time Quality in Ship Design
- KP to Simplify ABS Regulatory Compliance
- KP Using AI & AR for Ship Repair
- Structural Interface for Automated Compliance Checking
- Custom and Digitized ABS Rules
- KOS for Shipbuilding and Ship Repair



auros
Knowledge Best Shared

D'ANGELO TECHNOLOGIES, LLC
Electronics with Application

ABS

SSI

Pacific Shipyards INTERNATIONAL

FINCANTIERI MARINETTE MARINE

GENERAL DYNAMICS Bath Iron Works

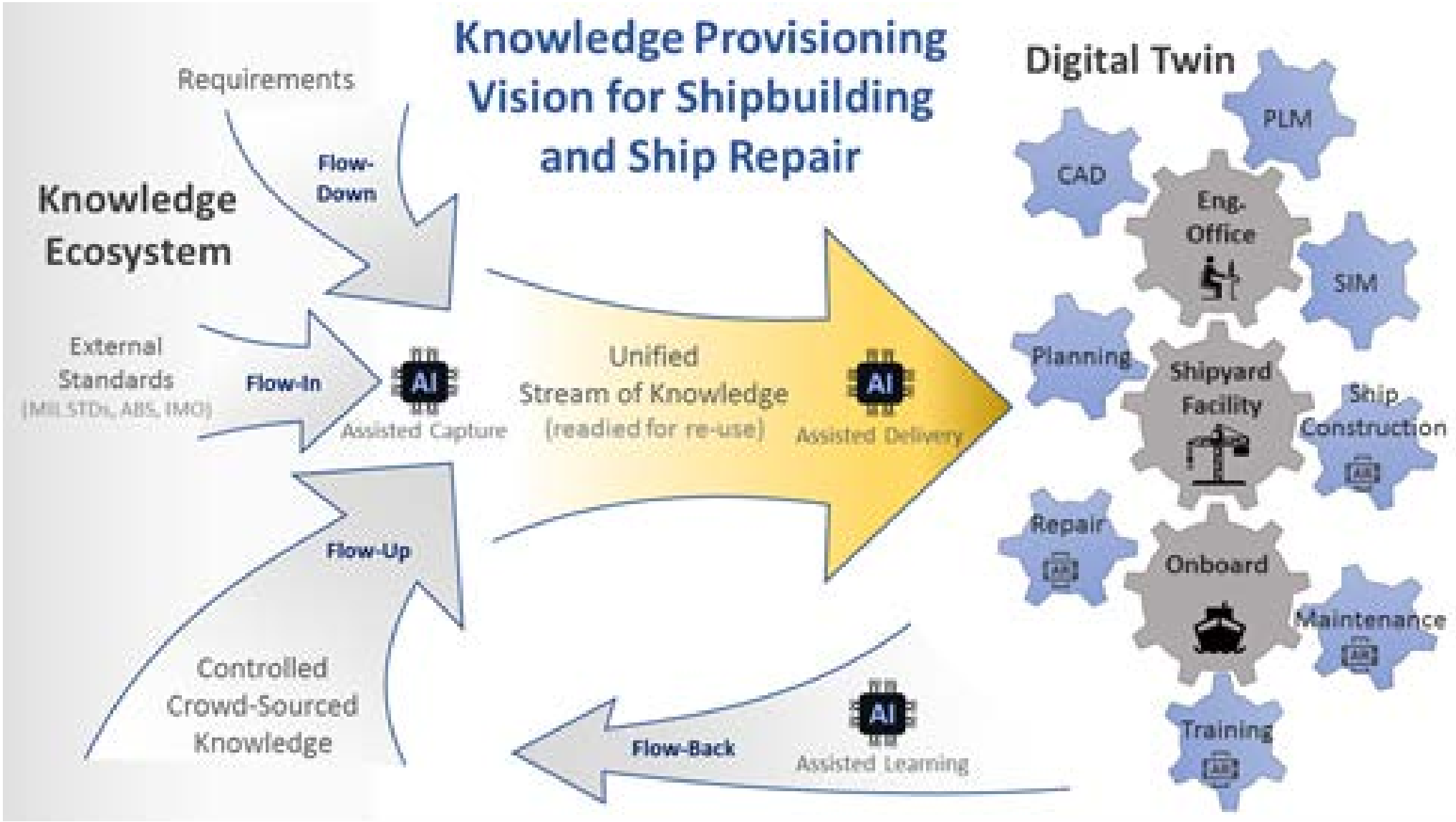
FINCANTIERI MARINE SYSTEMS N.A.

GENERAL DYNAMICS nassco

CONRAD SHIPYARD

Bollinger SHIPYARDS

Knowledge Operating System



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Questions?