

Integrating Manufacturing  
Information for the Marine  
Industry



# Common Parts Catalog Part Design Class Development

PDMT Panel Briefing  
September 22, 2005

***Topgallant®***

# Atlantec-es' CPC Related Projects



- Common Parts Catalog Information Management System
  - Phase II SBIR
- Common Parts Catalog Part Design Class
  - Phase I SBIR

# CPC Information Management System Project Objectives



- Develop an affordable and flexible Common Parts Catalog system geared towards 2<sup>nd</sup> Tier shipyards, marine parts manufacturers and suppliers, and design agents
- Develop legacy system translators to enable implementation of CPC interoperability features without interfering with existing shipyard functions
- Develop a secure web based interface to enable connectivity between CPC compliant catalogs at different shipyards, suppliers and design agents

# CPC Part Design Class Project Objectives



- Enable a direct link between the Common Parts Catalog and ship design software for rapid component modeling.
- Develop a methodology for describing components with the minimum required information to effectively model them for ship design and production purposes.
- Develop the taxonomy, data element dictionary and prototype database for the CPC Part Design Class – a STEP AP based description of components containing minimum geometry information
- Develop a mapping class that ties the Part Design Class to both the Part Class and Document Class in the Common Parts Catalog structure.

# CPC Part Design Class Approach



- Define minimum geometric attributes to effectively model component
- Develop a taxonomy and DED based on Product Modeling software input requirements and STEP Application Protocols
- Phase I Feasibility Study
  - Main Engine selected as prototype example
    - Complex system with multiple design interfaces
    - Data and drawings available on internet for Cummins N14-M diesel
  - Establish major equipment components as the target for Part Design Class CPC expansion

# Main Engine Modeling – Prototype Example



CPC  
Catalog  
Data for  
Main  
Engine

The screenshot shows the 'Catalog Editor' application window. The title bar reads 'Catalog Editor' and the menu bar includes 'File', 'View', and 'Help'. The main window is divided into three panes:

- Left Pane:** A tree view showing a classification schema. The path is 'catalog\CPC.Classification.Schema.RevA.111703-2-inc1-doc \'. The tree is expanded to 'MECHANICAL > MAJOR EQUIPMENT-MECHANICAL > MAIN ENGINE', which is highlighted in blue.
- Middle Pane:** A 'Catalog' pane with a search results area.
- Right Pane:** A detailed property form for the selected 'MAIN ENGINE' item. It contains several sections of fields:
  - General:** Special Condition, Standard Inspection Code, Type, Unit of Measure Buy, Unit of Measure Issue\*, Vendor Lead Time.
  - MECHANICAL:** 2-D/3-D CAD Sub Model, Assembly Required, GFE/GFI Code, Number Of Threads, Pattern Number, Range, Range U of M, Schedule A Item Number, Shock Grade, Thread Series.
  - MAJOR EQUIPMENT-MECHANICAL:** Depth, Height, Inside Diameter, Length, Outside Diameter, Pressure Rating, Pressure Rating U of M, Temperature Rating, Thickness, Weight, Width.

An 'Attach Documents' button is located at the bottom right of the right pane.

# Main Engine Modeling – Prototype Example



- Vendor Data provides most rudimentary geometric measurements
- Catalog Data set is not deep enough – no Main Engine specific entities

## Item Specification

- Common Parts Catalog
  - Mechanical
    - Major Equipment Mechanical
      - Main Engine

# Main Engine Modeling – Prototype Example



- Mechanical Attributes
  - None applicable to a main engine or most other major equipment items
  - Information useless for equipment modeling
  - Information partially useful for analysis

Number Of Threads

Thread Series

Range

Range U of M

Assembly Required

Shock Grade

Schedule A Item Number

GFE/GFI Code

Working Fluid

Pattern Number

# Main Engine Modeling – Prototype Example



- Major Equipment – Mechanical Attributes

- Some applicable to a main engine or most other major equipment items
- Not enough information or detail to model a component or perform system analysis
- Document Class link is expected to provide design information

Length

Length U of M

Width

Width U of M

Height

Height U of M

Depth

Depth U of M

Thickness

Thickness U of M

Outside Diameter

Outside Diameter U of M

Inside Diameter

Inside Diameter U of M

Pressure Rating

Pressure Rating U of M

Temperature Rating

Weight

Weight U of M

# Modeling a Main Engine



- What is important to the designer?
  - Origin Point and Vector
    - What do you use as the point of reference for inserting the equipment model into the ship model?
      - Main Engine = Centerline of shaft on face of shaft flange, pointing aft
  - Mounting points
    - Where does the equipment come into contact with ship's structure or a foundation?
  - Envelopes
    - Structural bounding box, referenced to the origin point
    - Maintenance envelopes, referenced to the origin point
  - Connection Points
    - Pipe, electrical, HVAC
      - Center point at face of flange or connector, vector, type of connection, size of connection

# CPC Part Design Class Data Storage



- Store the part data in STEP format using the Enterprise Reference Model schema

The screenshot shows a software interface with two main panels. The left panel is a scrollable list of schema entities, each followed by "(SCHEMA erm)". The right panel displays detailed information for the "catalogue\_item" entity.

**Left Panel (List of Schema Entities):**

- burner (SCHEMA erm)
- burning\_data (SCHEMA erm)
- burning\_task\_data (SCHEMA erm)
- calendar (SCHEMA erm)
- cargo (SCHEMA erm)
- cargo\_assignment (SCHEMA erm)
- cargo\_footprint (SCHEMA erm)
- cargo\_material (SCHEMA erm)
- cargo\_position (SCHEMA erm)
- catalogue (SCHEMA erm)
- catalogue\_item (SCHEMA erm)
- catalogue\_item\_class (SCHEMA erm)
- catalogue\_item\_instance (SCHEMA erm)
- catalogue\_part (SCHEMA erm)
- catalogue\_property (SCHEMA erm)
- class\_and\_statutory\_designation (SCHEM
- class\_compartment\_requirement (SCHEM
- class\_deck\_load\_requirement (SCHEMA e
- coating (SCHEMA erm)
- compartment (SCHEMA erm)
- compartment\_cargo\_assignment (SCHEM
- compartment\_property (SCHEMA erm)
- compressed\_air\_outlet (SCHEMA erm)
- connection (SCHEMA erm)
- connection\_implementation (SCHEMA er
- connector (SCHEMA erm)
- constant\_function (SCHEMA erm)
- contour (SCHEMA erm)
- corrosion\_protection (SCHEMA erm)
- country (SCHEMA erm)
- crane (SCHEMA erm)
- curve\_bounded\_surface (SCHEMA erm)
- curve\_definition (SCHEMA erm)
- curve\_geometry (SCHEMA erm)
- cutting\_equipment (SCHEMA erm)

**Right Panel (Entity Details for catalogue\_item):**

### 2.1.218. ENTITY catalogue\_item

**structure\_node catalogue\_item\_instance**  
+catalogue\_item

All Known Direct Subtypes:  
[catalogue\\_part](#)

**Definition:**  
ENTITY catalogue\_item SUBTYPE OF (catalogue\_item\_instance, structure\_node);

**Attributes Entity catalogue\_item**

**Attributes Entity catalogue\_item\_instance**

<a href="#">catalogue_item_class</a> type_code:	STRING;
supplier_code:	STRING;
properties:	LIST OF <a href="#">key_value</a> ;

**Attributes Entity erm\_object**

extended_attributes:	LIST OF <a href="#">key_value</a> ;
native_data:	OPTIONAL SET OF <a href="#">parameter_set</a> ;

**Attributes Entity information\_object**

common_name:	STRING;
description:	STRING;
parents:	LIST OF <a href="#">information_object</a> ;
targets:	LIST OF <a href="#">information_object</a> ;

# Part Design Class Attributes and Data Elements



- Taxonomy pre-determined by the CPC structure
  - Mechanical
  - Major Equipment – Mechanical
- Attributes determined by design details of specific component
- Data Elements common between mechanical components and their attributes
- Data elements structured as TYPES and ENTITIES





# Main Engine Design Documentation – Cummins N14-W



Entity Major\_Equipment

SubType of Catalog\_Part

Attribute Local\_Coordinate\_System

Center\_Shaft\_flange\_face

Attribute Bounding\_Box

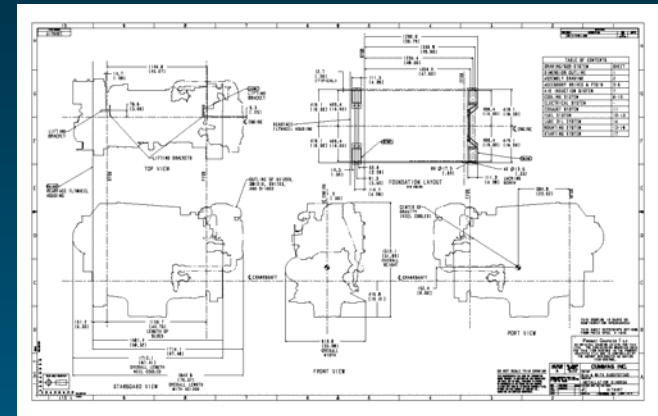
8 points (x,y,z) referenced to Local\_Coordinate\_System

Attribute Center\_of\_Gravity

x,y,z referenced to Local\_Coordinate\_System

Attribute Lifting\_Bracket

Attribute Foundation\_Bolt\_Hole





# Part Design Class Implementation



- Full set of descriptive types and attributes
  - Based on design drawing information
  - Allows direct input of data rather than drawing interpretation
- Types, entities, subtypes and attributes provided to design software vendors (ARL, Intergraph)
- Catalog structure provided to vendors
- Link between Part Class and Part Design Class

# Atlantec-es Contact Information



## For More Information:

Bryan Miller

Atlantec Enterprise Solutions, Inc.

175 Admiral Cochrane Drive

Suite 400

Annapolis, Maryland 21401

410-897-9909

[Bryan.Miller@atlantec-es.com](mailto:Bryan.Miller@atlantec-es.com)