



*ShipConstructor*<sup>®</sup>

Software

to Design, Build & Maintain





## **Constraint Based Design and Planning**

*NSRP ASE JOINT PANEL MEETING - SHIP PRODUCTION PROCESS  
TECHNOLOGY PANEL PROJECT BRIEF  
SEATTLE, WA  
APRIL 22<sup>ND</sup>, 2008*

*PRESENTATION BY: PATRICK D. ROBERTS  
DIRECTOR OF OPERATIONS*

## *Project Overview Outline*

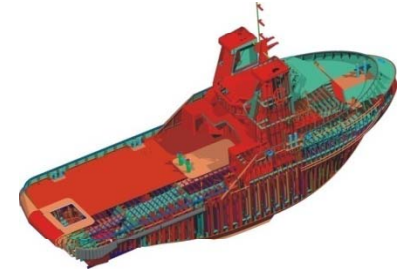
- Project Team Member Representatives
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- ShipConstructor 2008 Application Programming Interface Training Event
- CBDP Design and System Software Specification

## *Project Representatives*

- Deputy Technical Director
  - Project Technical Representative
  - Bollinger Shipyards - Lockport
  - Todd Pacific Shipyard
  - Atlantic Marine, Inc.
  - Knowledge Based Systems Inc.
  - Knowledge Based Systems Inc.
  - ShipConstructor Software USA
  - ShipConstructor Software USA
- Luke Blessinger (Advanced Technology Institute)  
Tonya Boney (Northrop Grumman Shipbuilding)  
Dennis Fanguy (VP of Quality Management)  
Bob Gilbreth (Senior Director, New Construction)  
Chuck Nugent (VP of Marine Manufacturing)  
Madhav Erraguntla (Program Manager)  
Neil Wu (Software Development)  
Patrick Roberts (Director of Operations)  
Patrick David (Research & Development Manager)



## *Introduction & Background*



- Design-for-Production (DFP) methodologies have proven to be effective in reducing excess design complexity in other industries and continue to be one of the US biggest challenges in building complex ships with different options and variations.
- Ship designers are tasked early on to design ships that can be effectively built.
- The ability of a ship designer to design a ship that can effectively be manufactured and constructed can only be done through an awareness of the facilities capabilities and workflow of the shipyard while also considering the production knowledge, techniques, and methods used within the shipyard.
- High turnover in many of the design departments within the mid tier US shipyards often means that the DFP knowledge that results in optimum production performance is often lost.
- As a result, Production Engineering groups in mid tier shipyards often produce fabrication drawings of structure and outfitting components that production is incapable of building.

## *Goals & Objectives*



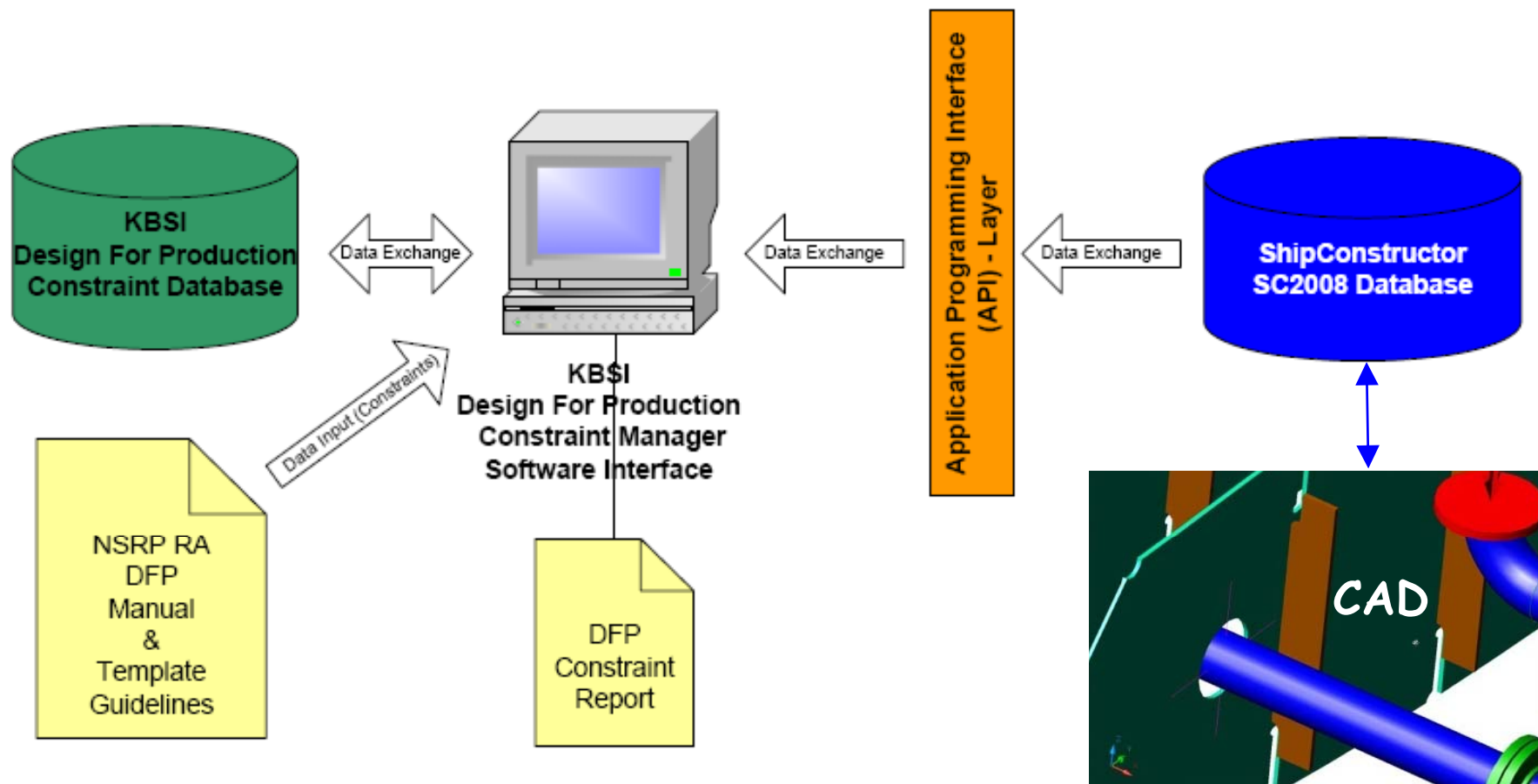
1. Incorporate preferences and associated design rules into a software package for analysis of DFP constraints.
2. Develop software to flag designers, planners, and production personnel as to when designed components are outside predetermined production capabilities.
3. Design a software package to instantiate facility constraints where designs coming out of a production engineering group will be guided by the current manufacturing and production capabilities.

## *Overall Concept*

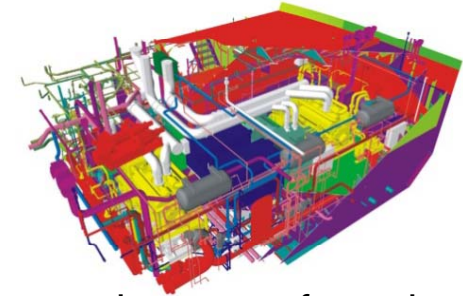


- Capture and utilize the DFP constraints that have been determined through the work performed on the 2007 NSRP RA project “Design for Producibility for Mid-Tier Shipyards” lead by Bollinger Shipyards - Lockport.
- Develop a third party software application (Design For Production Constraint Manager) that can accept 3D production model information from the ShipConstructor Software database through the Application Programming Interface (API) developed on the Second Tier Shipbuilding Design Enhancement Project II.
- Analyze the design against the DFP methods constraints and desired construction preferences.
- Generate Reports to flag specific design components that are not compliant with the DFP constraints.

## Overall Concept Diagram



## Methods & Procedures - SOW



- Study defined combinations of constraints within the steel and pipe spool process from the DFP manual.
- Study defined facility constraints from the DFP manual.
- Explore/Educate KBSI on the ShipConstructor Software API for extracting product model data.
- Determine data format necessary for the DFP application to receive the product model data.
- Develop application functionality for importing of SC2008 product model information.
- Generate SC2008 ShipConstructor test model data of a ship module/unit for the DFP application.
- Convert data to a format required for the DFP application to receive the product model data, if required.
- Pass DFP data from the ShipConstructor database through the SC2008 API using the DFP application.
- Develop coding for comparing the DFP constraints against the SC2008 product model data.
- Build, test and evaluate a system capable of analyzing the DFP constraints against the SC2008 product model.



## *Leveraging Previous & Current Related Work*

- **NSRP RA Project - Design for Producibility for Mid-Tier Shipyards”**

The shipyards on this project team have been actively involved in the 2007 NSRP RA project. This project work is focused on capturing the design for production methods in support of current US Navy and commercial contracts in the 2<sup>nd</sup> tier shipyards. The final DFP manual and template will provide the 2<sup>nd</sup> Tier shipyards and the shipbuilding industry with a standard document that can be used to capture facility constraints, build strategy methods, as well as good design production process guidelines.

- **NSRP RA Project - Second Tier Shipyard Design Enhancement Program.**

Each team member has worked on similar software module developments in order to enhance the ShipConstructor Software, and other software integration. KBSI will employ lessons learned from the Tier 2 CPC tool created and integrated with the ShipConstructor Software on the STSDEP program. The API layer that was developed on STSDEP II will be utilized in this integration development project.

- **NSRP Panel Project - Panel Line Optimization through Predictive Scheduling project (PLOPS)**

SSIUSA also participated on the 2006 NSRP SPPT panel project where a digital model created in a third party software package (Delmia) was able to import information through ShipConstructor’s API interface. Lessons learned in applying the API on that project will be use in the data exchange with the software application that will be developed on this proposed project. *Note: PLOPS II – Awarded as a 2008 NSRP SPPT Panel Project (Bender Shipbuilding)*

- **ONR SBIR Project – ShipLift.** The general methods and requirements needed to access particular ShipConstructor Product Model information utilizing the API have been determined under this project in order to assist in the generation of an FEA model for examining the lifting and handling of a ShipConstructor assemblies. It is anticipated that this product model information will be similar to those needed for DFP facility constraints.

## *Deliverables, Benefits, & ROI Target Areas*

### **Deliverables:**

- Pilot System Specification
- Pilot System Design
- Pilot System Application
- Final Report



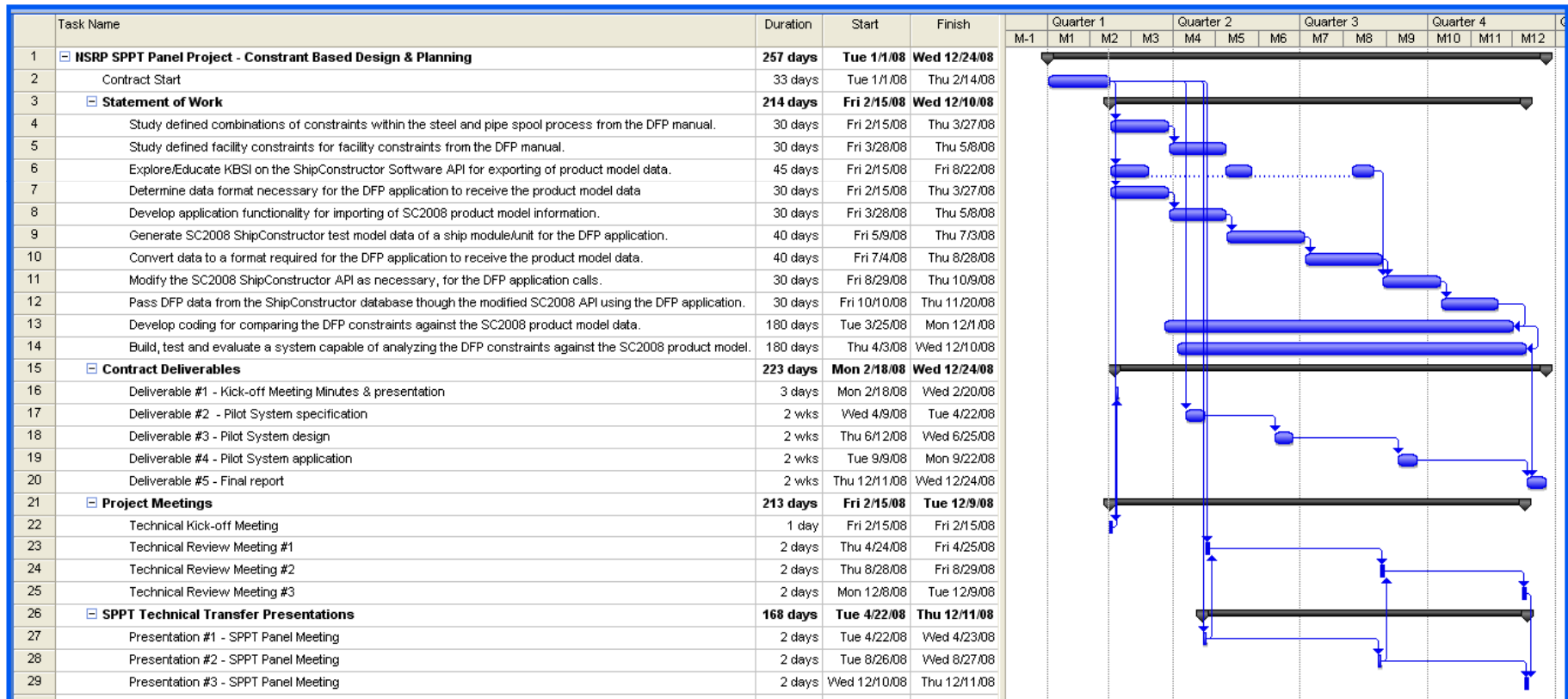
### **Benefit Areas:**

- Replaces manual method of checking production documentation within engineering, planning, and production departments.
- Allows for varying / production method changes as they arise for a quicker design impact assessments to be made.
- Provides a means for managing non-compliant design for production instances.
- Provides a means for cost avoidance associated with initial design and the re-design process.

### **ROI Target Areas:**

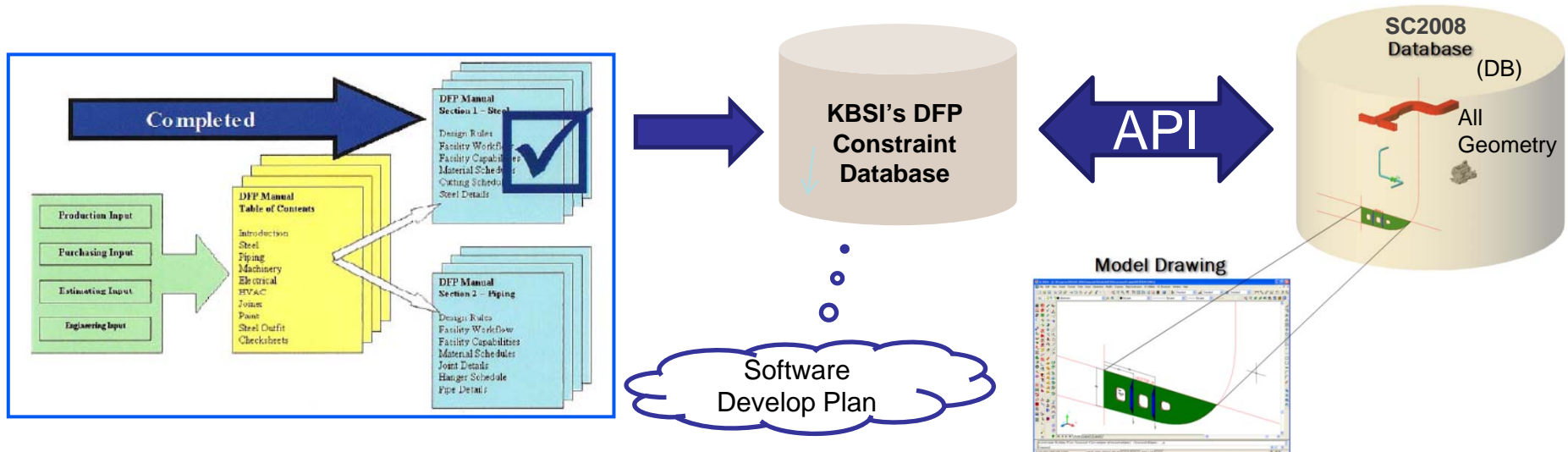
- Reduce labor hours in production design for checking and design rework.
- Improve the ability to notify designers and planners when constraints have been violated and therefore optimizing production.
- Reduce schedule interruptions due to design being in compliance with production processes.
- Reduce labor hours in planning.

# Project Plan & Schedule



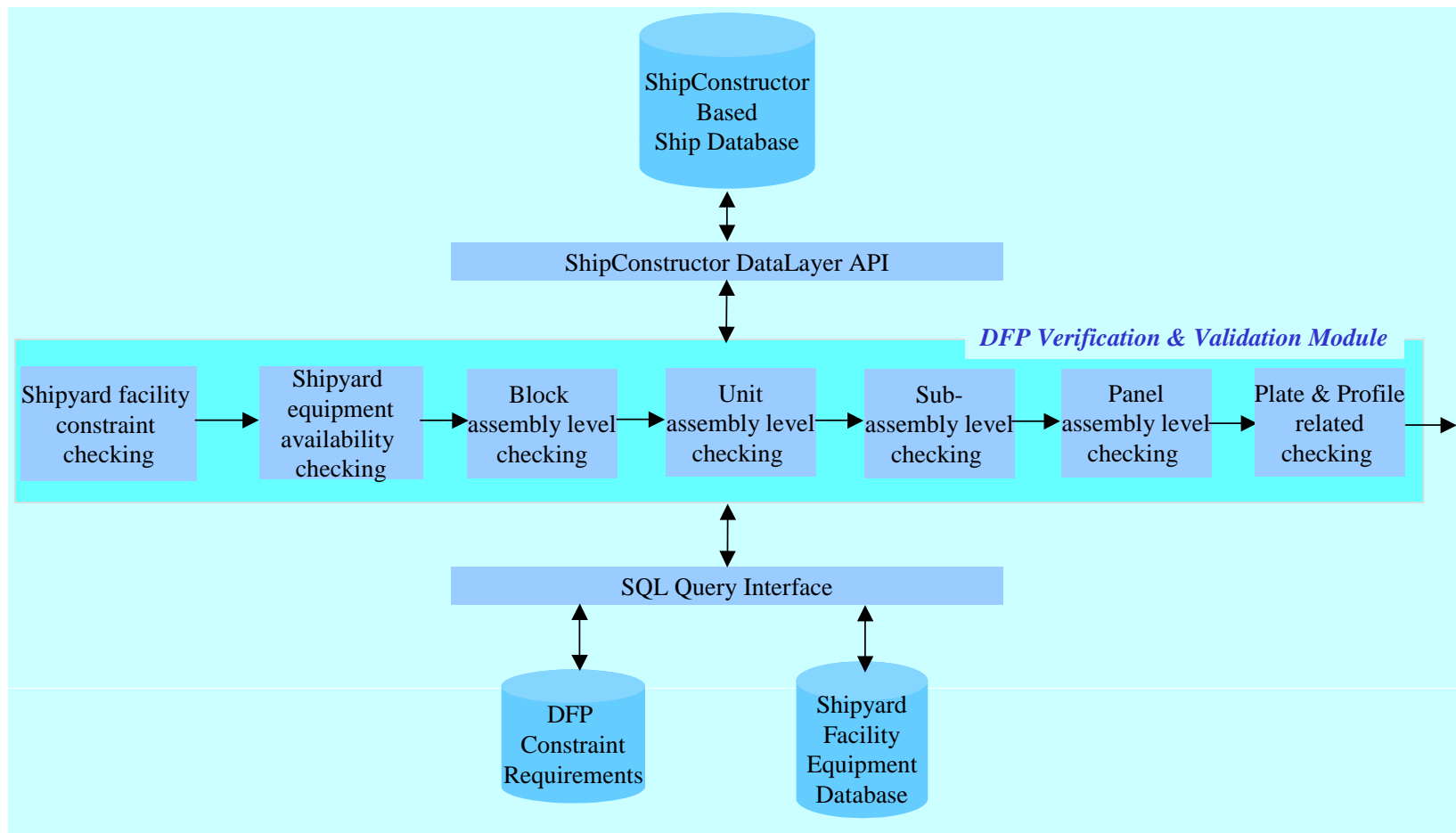
## SC2008 API Training & Preparations

- Bollinger cleared usage of the DFP documentation & provided their DFP documents to KBSI prior to event.
- KBSI and SSIUSA initially worked together to document a Software Development Plan and communicated that to the KBSI programming representative prior to attending the API Training.
- KBSI sent programming representative to the SC2008 Application Programming Interface (API) Training event held at SSIUSA in Mobile, AL on March 4<sup>th</sup> – 6<sup>th</sup>, 2008.
- KBSI sent a laptop with programming representative to the training so that SSIUSA could help in all SC2008 and AutoCAD 2008 software installations prior to leaving the API training event.



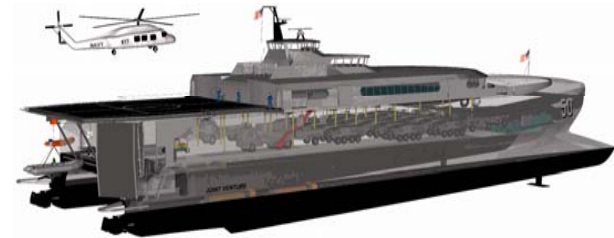
# CBDP Software System Design

- Functional relationship illustration



## *CBDP Design & System Specification*

- Create DFP Constraint Requirement Database
- Create Shipyard Facility and Equipment Database
- Collect Hierarchical Parts Information through SC API for DFP Verification
- Design and Implement DFP Verification and Validation Module



## *CBDP Project Deliverables Status*

- ***February 20, 2008*** – Project Kick-off meeting minutes /presentation materials. ***(Complete)***
- ***April 22, 2008*** – Pilot System Specification ***(Complete)***
- ***June 20, 2008*** – Pilot System Design
- ***September 20, 2008*** – Pilot System Application
- ***December 20, 2008*** – Final Report.