Modular Design and Benefits

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Presentation Overview

• What is Modularization?
• Challenges & Benefits of Modularization
• Modularization Examples
• Module Fabrication Facilities
Corporate Profile

The Shaw Group Inc.® is a leading global provider of technology, engineering, procurement, construction, maintenance, fabrication, manufacturing, consulting, remediation, and facilities management services to clients in the energy, chemicals, environmental, infrastructure, and emergency response industries.

- **Headquarters**: Baton Rouge, LA
- **Stock Ticker**: NYSE: SHAW
- **Number of employees**: 27,000
- **FY 2010 Revenues**: $7 billion
- **Backlog**: $20.6 billion (as of 2/28/11)
- **Website**: www.shawgrp.com
Shaw’s Power Group Overview

• Three divisions comprise Shaw’s Power Group:
  – Fossil Division
  – Nuclear Division
  – Plant Services Division

• Ranked No. 1 in Power on Engineering News-Record’s Top 500 Design Firms for three consecutive years (2008, 2009, 2010)

• Approximately 4,500 professional employees
What is Modularization?

A term used to describe the three levels of “off-site” or “on-site out of the hole” fabrication of piping, equipment and structures.
Philosophy: Modularization Allows Activities To Be Done in Parallel
Modularization Pros

• Streamline field installation
  – Reduces number and skills requirement
  – Facilitates remote site locations
  – Shortens/reduces multiple work fronts
  – Reduces risk of site conditions/weather
  – Breaks projects into manageable parts
  – Improves safety, quality, and productivity performance
  – Shortens duration of and reduces field staff
Modularization Construction Pros

- Reduce on-site fabrication
- Reduce temporary facilities
- Reduce scaffolding
- Reduce small tools and consumables
- Reduce staff and craft
- Reduce amount of dimensional control
- Reduce number of field welds
Modularization Construction Cons

- Committed execution sequence
- Committed module delivery schedule and routes
- Potential for design changes and rework
- Potential loss or damage during transport
- Heavier construction cranes
- More cranes earlier for large module assembly and outfitting
- More planning, communication, organization
- Less flexibility
Modularization Evaluation Attributes

- Construction Schedule
- Detailed Engineering (timeliness of deliverables)
- Labor Availability (welding, electricians, etc.)
- Procurement Risk (can materials/equipment be delivered on time?)
- Safety Impact (e.g., work areas, working at height)
- Quality
- Transportation & Lifting
- Site Attributes
Module Engineering Prerequisites

- **Engineering MUST BE DONE DONE!**
- EPC/Fabricator = Module Team
- Early Engineering and Construction Installation Details Development = Will be constructible
- Must Engineer Twice, i.e. design, fab, assemble to fit, ship, offload, assemble and outfit, and load to prime mover and lift into position
Pipe/Equipment Module
Modular Designed Pipe Rack
Modular Designed Boiler Feed Water Pumps and Piping
Modular Designed Cooling Water Skid
Modularized HRSG Shipped to Site via Ocean Ship and Barge from Indonesia
HRSGs Arrive @ Jobsite in NY City
Oil/Gas Platform
Purchaser Oversight

- Module fabrication at key facilities is seen as extensions of the Construction Projects and is expected to be treated as small EPC Projects with dedicated teams representing the Purchaser.

- Full time residency at fabrication facilities anticipated for Purchaser’s Quality Control and Expediting representatives with periodic surveillance by Quality Assurance.

- Purchaser’s Engineering staff may be assigned to fabrication facilities on a full time or part time basis to facilitate communication and resolution of design related issues.

- Purchaser’s Management representation to be assigned to fabrication facilities to interface with Fabricator Management and assure common goals are being met.
Owner Oversight

- Owners being the Licensees have ultimate responsibility for regulatory compliance of the plants
- Equipment and system reliability, quality, operability and maintainability are of significant interest
- Owner’s representatives expected to provide rigorous oversight of Purchaser’s and Fabricator’s activities
- Owners responsible for performing 100% of Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) verification during construction and documentation of inspection results
Regulator Oversight

• Regulator oversight at fabrication facilities responsible for safety related modules is expected

• Regulator inspections to encompass Owner, Purchaser and Fabricator Program implementation and effectiveness

• Regulator is responsible for witnessing a sample of Owner’s ITAAC related activities and documentation of inspection results
Shaw Modular Solutions Facility

- Located in Lake Charles, LA
- 410,000 sf under roof for fabrication, assembly and inspection
- 7 production bays
- 8,200 sf administrative building
- 10,000 sf training facility
- Truck, barge and rail access
- NQA-1 program
- Located on 120 acres of land with an option for 180 more acres
Shaw Modular Solutions Facility
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Module Fabrication
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Module Fabrication - CA20 Aux Building

CA20 comprised of 72 Sub-Modules:

Size (N x E x Height):
44’-0” x 68’-9” x 68’-0”
[13m x 21m x 20.7m]

Dry Weight:
1,712,000 lbs. [777 Mg]
Module Fabrication – CA20 Submodules

Sub-Module CA20_01
Module Fabrication –
Sub-Module CA20_01
Module Fabrication
Module Fabrication
Module Fabrication
Module Fabrication
Module Fabrication
Module Fabrication
Module Fabrication
Onsite Assembly
Module Assembly Building
Module Assembly - Upender
Module Platen
Module Assembly
Module Assembly
Module Assembly
Module Assembly
Module Assembly
Module Assembly
Module Assembly
Summary

• Modularization has been extensively used by the shipbuilding and chemical process industries resulting in significant value to the client.

• The Westinghouse AP1000 is utilizing modularization extensively in China and the U.S.

• Given the right business and project conditions, modularization should be strongly considered for fabrication and construction of the next generation of power plants.
Questions?