

Shaw® a world of **Solutions**™

ENR

Engineering News-Record

#1 Power
#1 Nuclear
#1 Fossil

FORTUNE
500

TOP LARGEST
500 US FIRMS
#357



 **Shaw** a world of **Solutions**™

The Shaw Group Inc.

International and U.S. Nuclear Construction Challenges and Developments

**Nuclear Construction Summit
Washington, D.C.
October 26-27, 2009**

**Jeffrey S. Merrifield
Senior Vice President
Shaw Power Group**

Shaw's Power Group

- Power Group comprised of three divisions
 - Nuclear Division
 - Fossil & Renewables Division
 - Maintenance Division
- Shaw ranked #1 in Power on ENR's list of Top 500 Design Firms for 2008 and 2009
- Approximately 5,000 professional employees
 - Charlotte
 - Philadelphia
 - Denver
 - Boston
 - Baton Rouge



Top 25 Power

1. The Shaw Group Inc.
2. URS
3. Black & Veatch
4. Sargent & Lundy
5. Bechtel

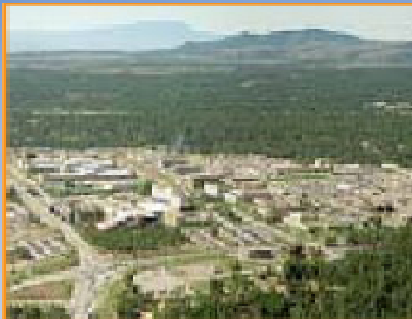
Top 25 Fossil Fuel*

1. The Shaw Group Inc.
2. URS Corp.
3. Black & Veatch

Top 10 Nuclear Plants*

1. The Shaw Group Inc.
2. Bechtel
3. Tetra Tech

Shaw Today – Major Nuclear Activities



**Los Alamos M&O
Support**



**AP1000 Contracts
for 10 Units**



**Fuel Enrichment LES
& AREVA**



**Nuclear Piping
Supply**



**China AP1000
Sanmen Site**



**Browns Ferry 1
Restart**



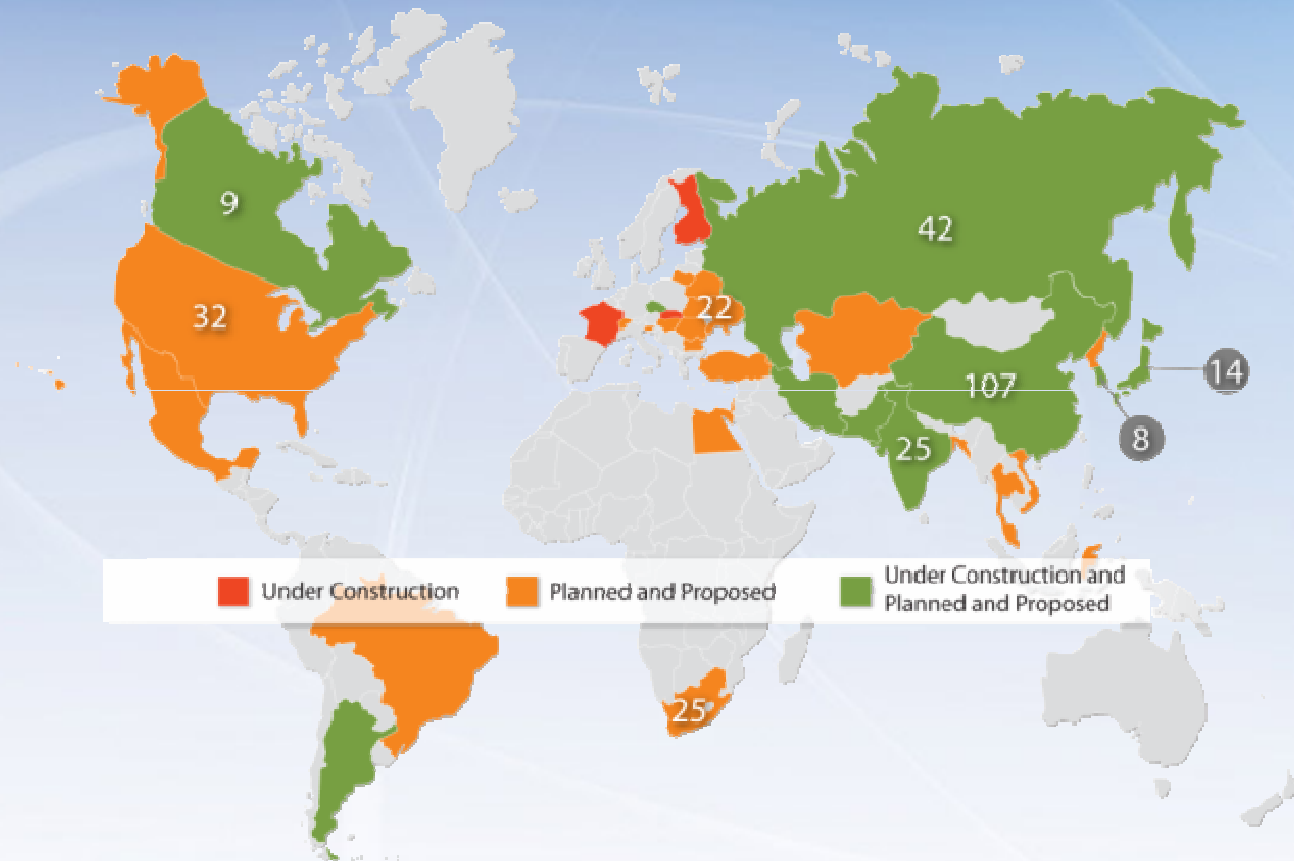
MOX Conversion



**China AP1000
Haiyang Site**





Nuclear Power Expansion Worldwide

36 Under Construction · 93 Planned · 219 Proposed

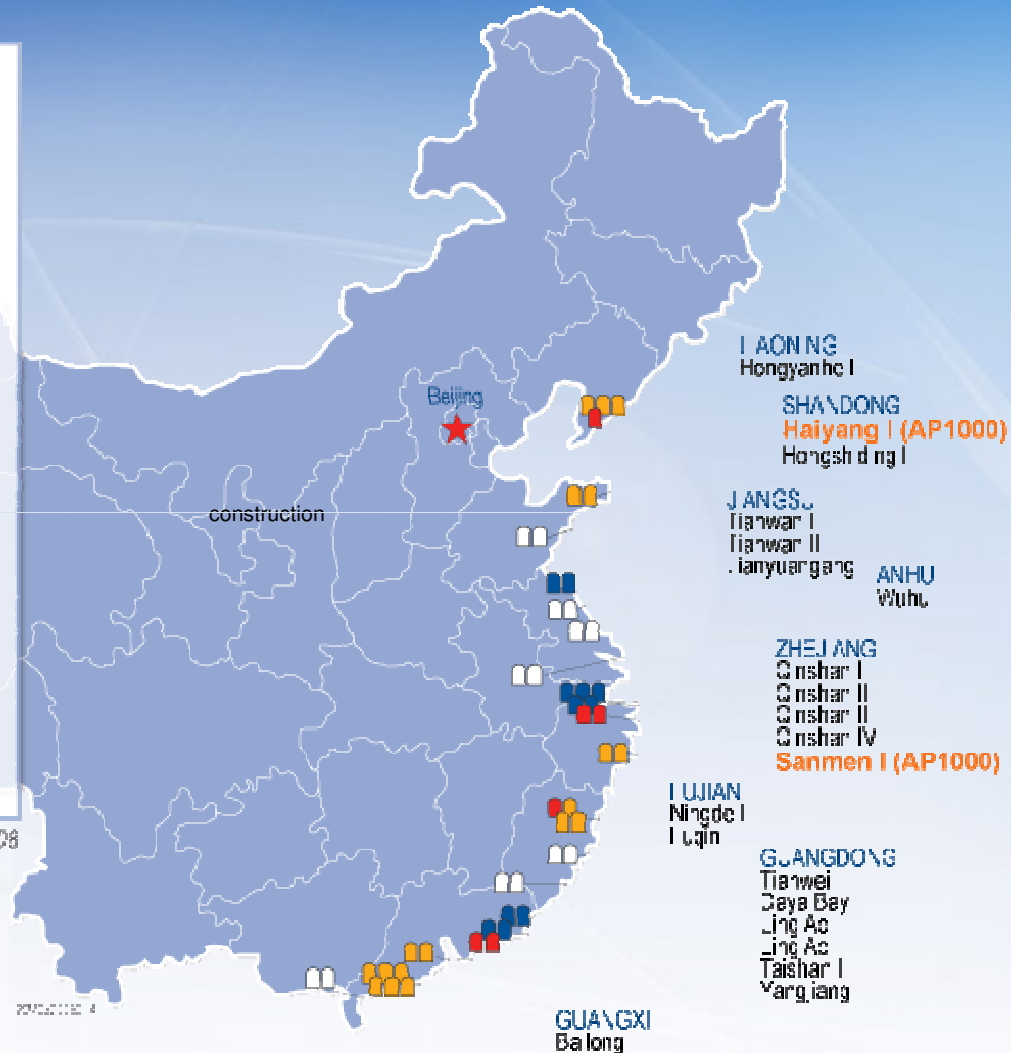


Energy Information Agency projects 44% growth in demand between 2006-2030 (U.S.EIA 2009)

China Nuclear Industry

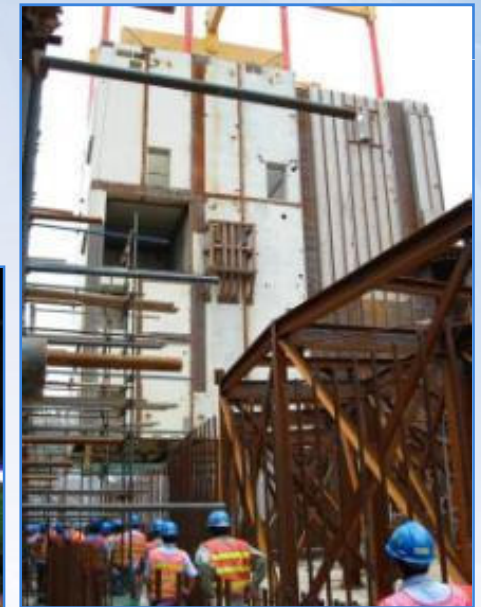
	NPP in operation
Tianwan I	2 x 1072MWe
Qinshan I	1 x 300MWe
Qinshan II	2 x 610MWe
Qinshan III	2 x 665MWe
Daya Bay	2 x 944MWe
Ling Ao I	2 x 935MWe
	NPP under construction
Qinshan IV	2 x 650MWe
Ningde I	4 x 1000MWe (Unit 1)
Ling Ao II	2 x 1000MWe
Hongyanhe II	4 x 1080MWe (Unit 1)
	NPP approved
*Haiyang I	2 x 1100MWe
*Sanmen I	2 x 1100MWe
Taishan I	2 x 1700MWe
Yangjiang	6 x 1000MWe
	NPP planned (2006—2011)
Hongshiding I	2 x 1000MWe
Tianwan II	2 x 1060MWe
Lianyuangang	2 x 1000MWe
Wuhu	2 x 1080MWe
Fuqin I	2 x 1000MWe
Tianwei	2 x 1080MWe
Bailong I	2 x 1080MWe

Source: Uranium Information Center, April 2008
*AP1000



Sanmen & Haiyang Projects

- Two Westinghouse AP1000 units per site
- Sanmen
 - Excavation began Feb. 26, 2008
 - First nuclear concrete placement completed March 31, 2009
 - Auxiliary Building Module CA-20 set June 29, 2009
 - Start of commercial operation: 2013
- Haiyang
 - Excavation began July 29, 2008
 - First nuclear concrete placement completed September 24, 2009
 - Start of commercial operation: 2013



Sanmen Nuclear Island Base Mat Completed March 31, 2009



23M012008D 01.14.08

Sanmen CA-20 Module Ready for Transport

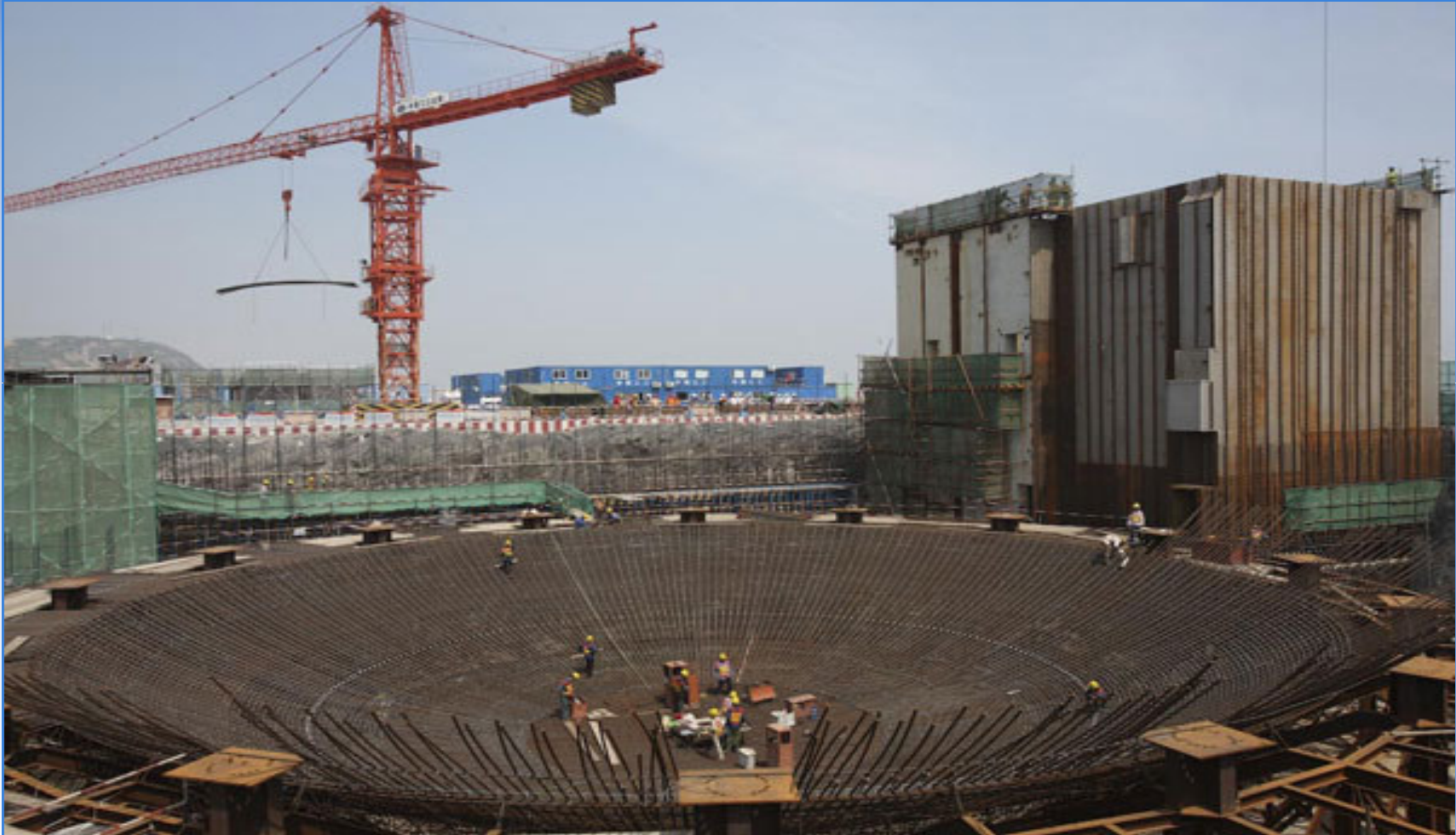


Transporting the Sanmen CA-20 Module



23M012008D 01.14.08

Sanmen Unit 1 CR-10 Rebar Installation with CA-20 in Background



23M012008D 01.14.08

Additional Progress at Sanmen and Haiyang



Sanmen - Bottom Mat and Drain Piping



Sanmen - Auxiliary Building Battery Rooms



Haiyang – CA20 Subassembly 1 Moved into Integrated Assembly Platform



Haiyang – Assembly of CA20 Subassembly 3

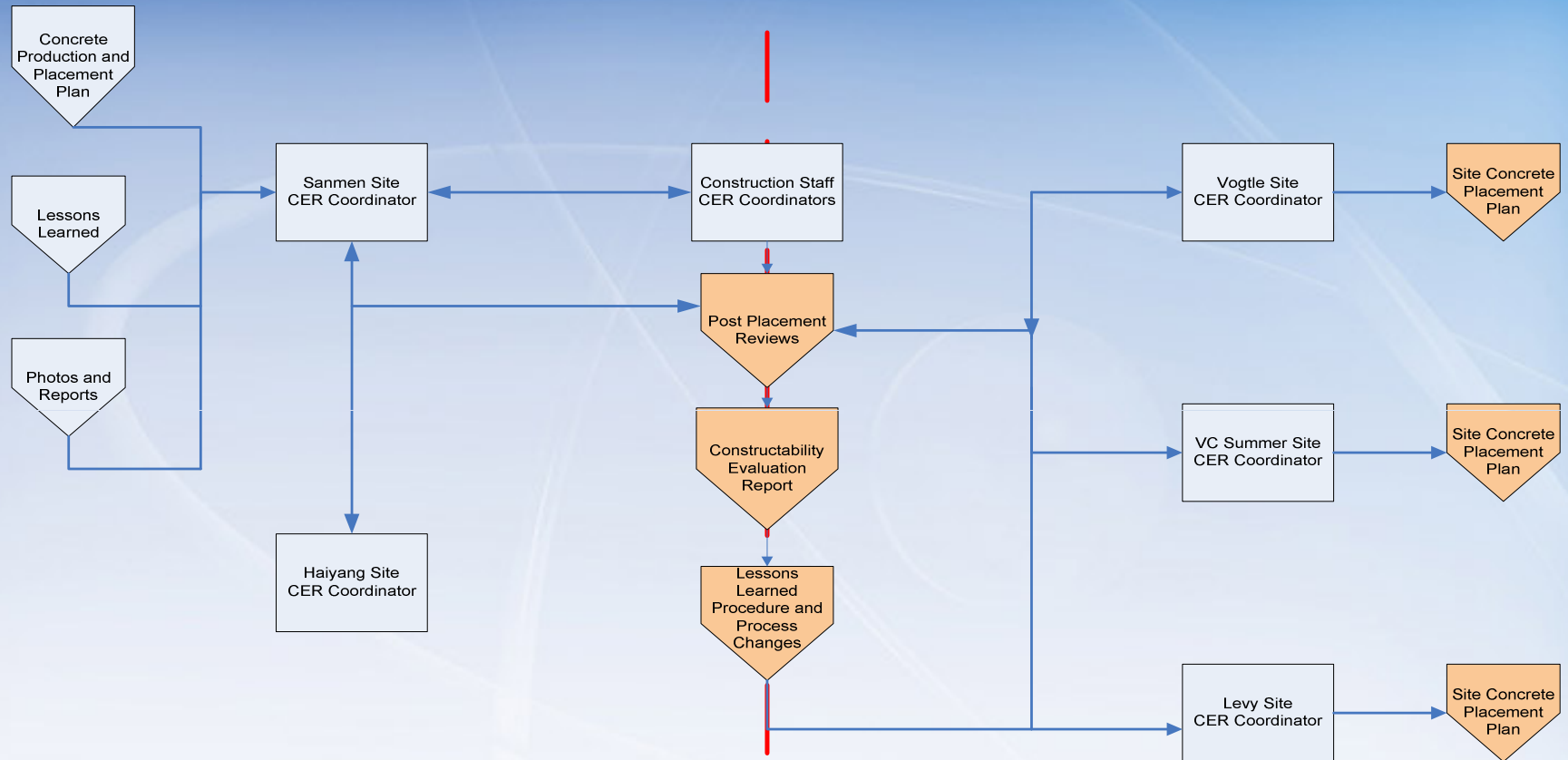
Shaw Construction China Lessons Learned and Benchmarking Program

- China will have performed all standard plant construction installation activities four times before activities are performed domestically
 - Establish benchmarking management team with China and U.S. participants
 - Select benchmarking activities
 - Assign U.S. subject matter expert to coordinate
 - Assign on- and off-shore teams by activity for China and domestic projects
 - Establish China construction management E-Room
 - Conduct Internet-based team meetings to review and share lessons learned

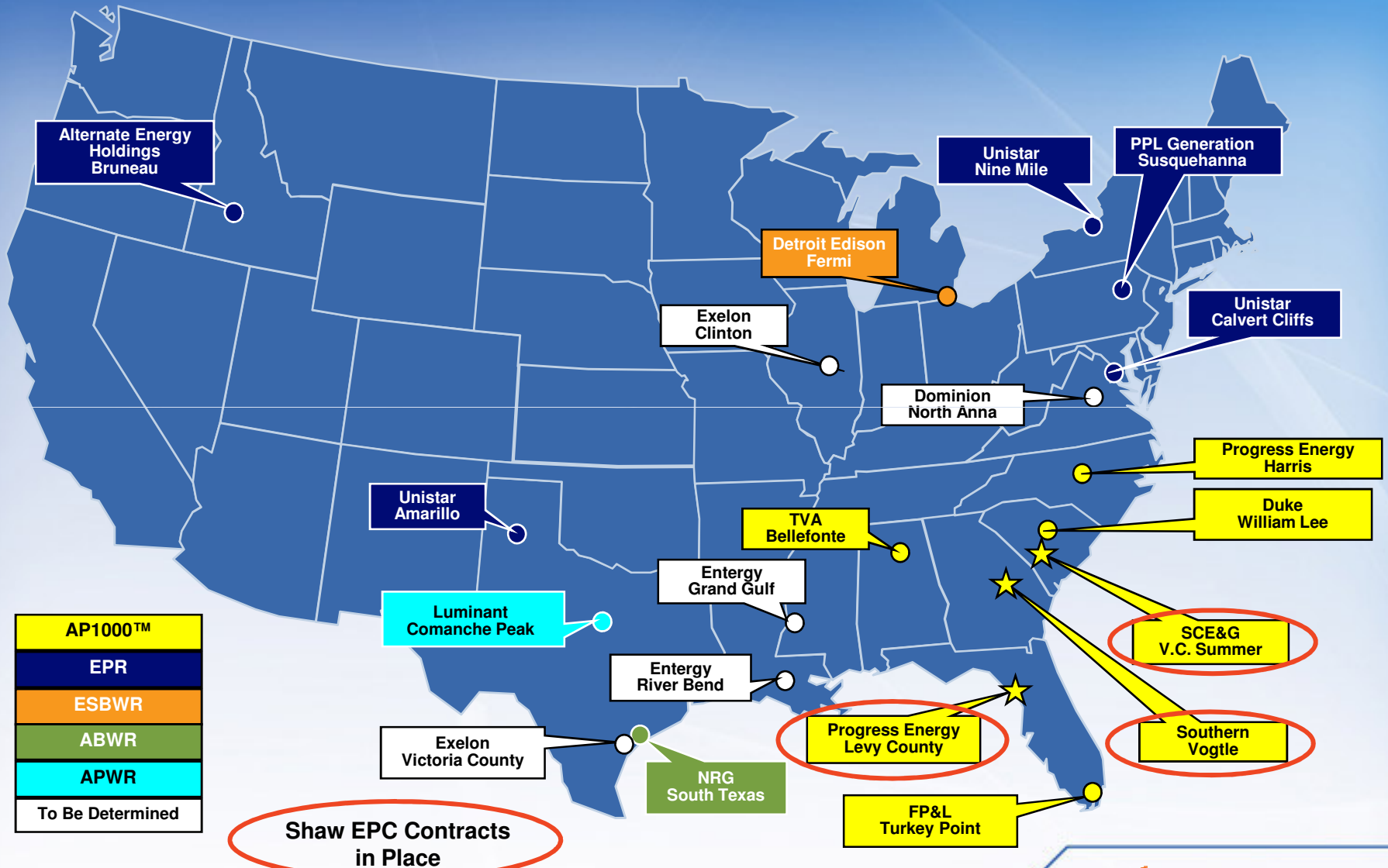
CHINA BENCHMARKING FIRST NUCLEAR CONCRETE (NUCLEAR ISLAND BASEMAT)

On-Shore

Off-Shore



Nuclear Renaissance First Movers



Vogtle & V.C. Summer Projects

- Shaw responsibilities:

- Engineering
- Procurement
- Turbine island/balance of plant
- Site-specific systems
- Yard work
- Construction

- Current status:

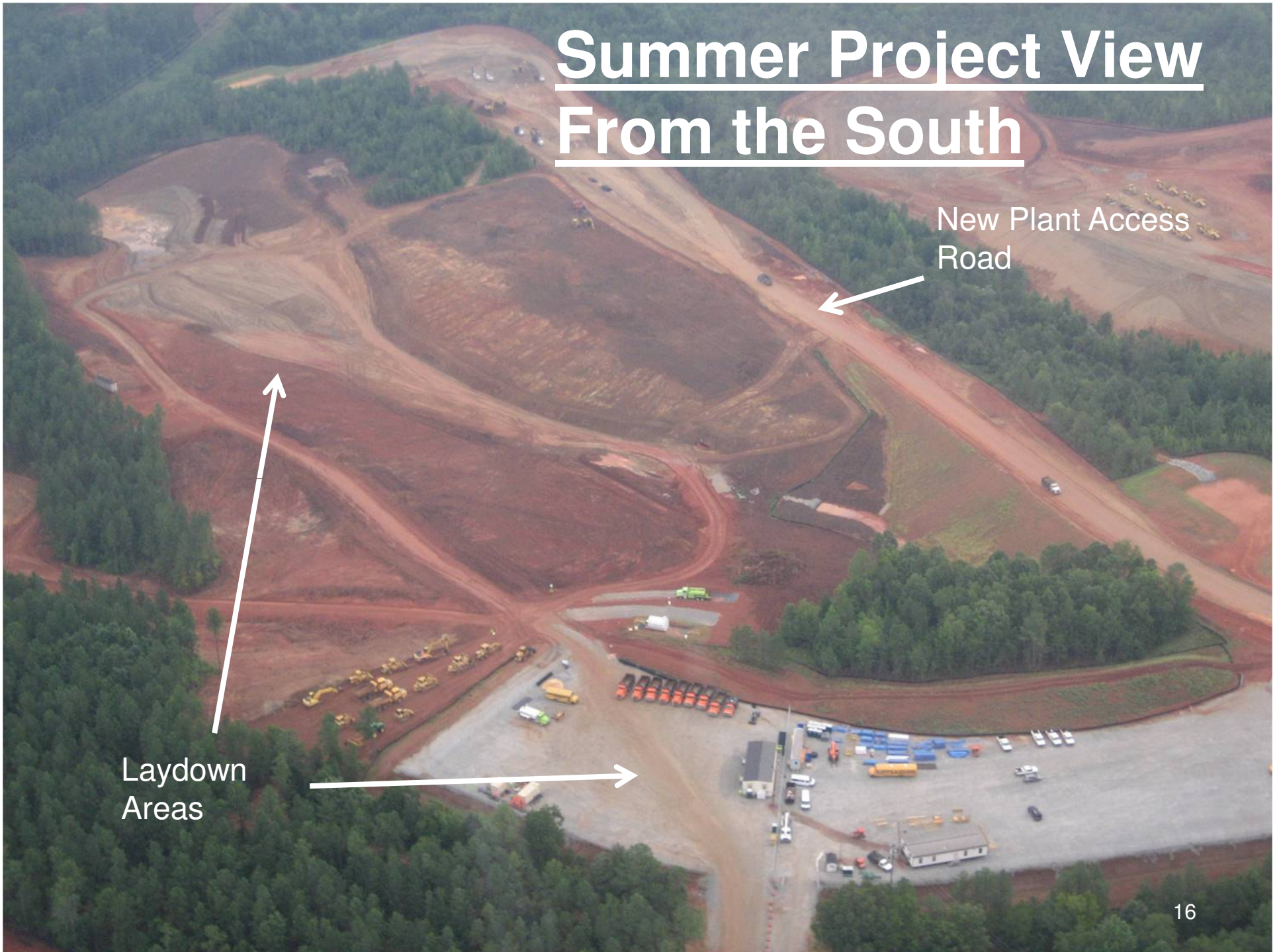
- Both projects have received state PSC certification to build two units
- Vogtle has received full notice to proceed from client
- Site-specific detailed design and excavation started
- On-site craft deployed at both projects



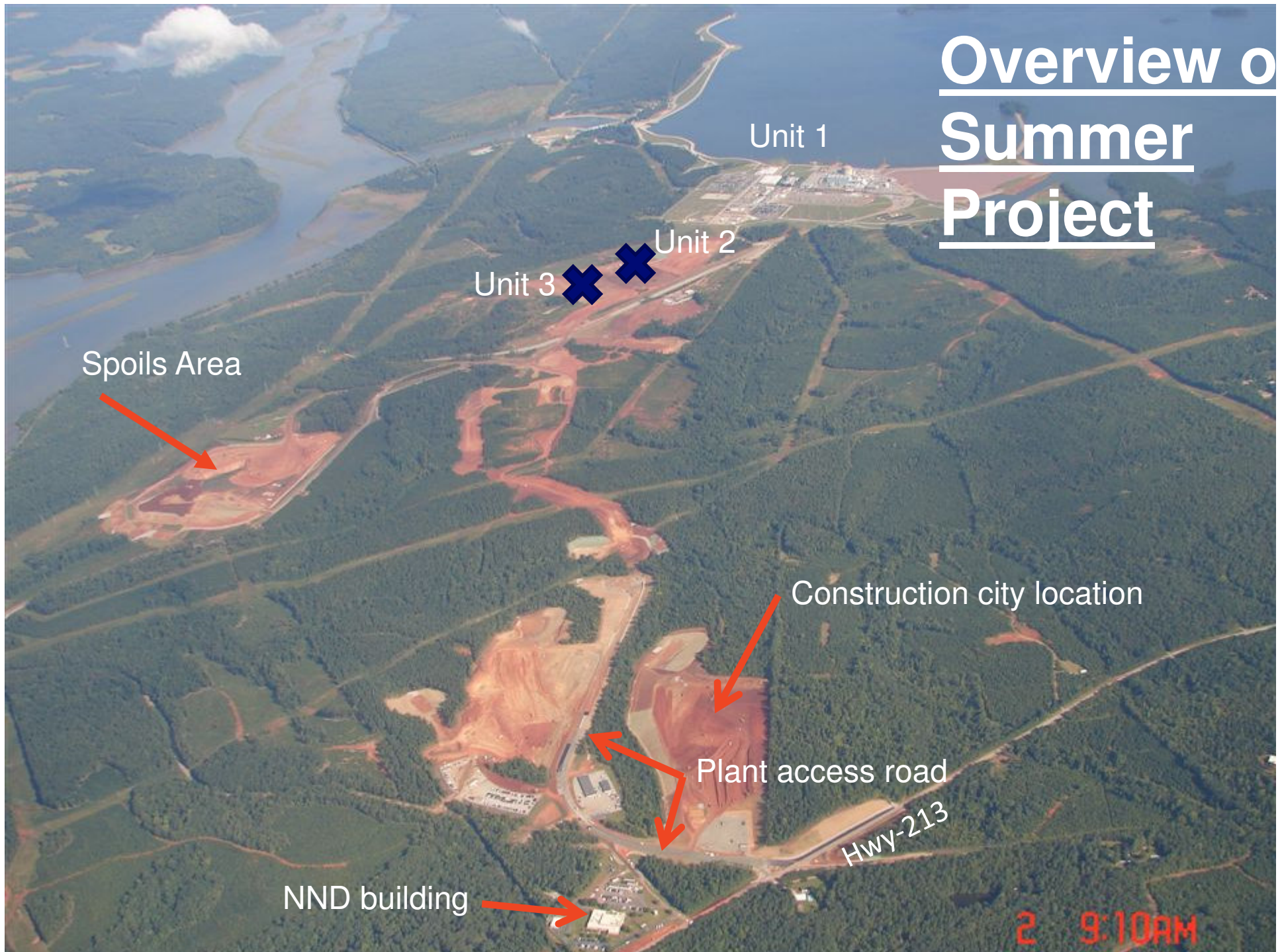
Summer Project View From the South

New Plant Access
Road

Laydown
Areas

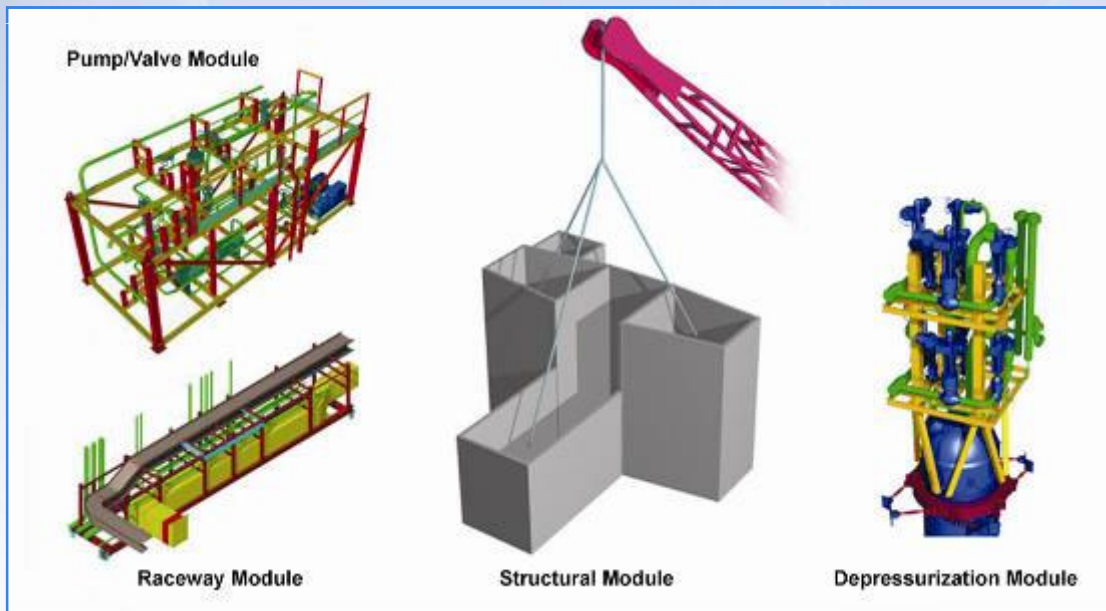


Overview of Summer Project



Shaw Modular Solutions (SMS) - Module Fabrication and Assembly Facility

- Work continues on the \$100 million/410,000 square foot facility located in Lake Charles, LA
- Will produce structural, piping and equipment modules for new nuclear power plants
- Shaw's three existing nuclear EPC contracts are expected to generate approximately \$1B in revenues for this facility



Shaw Modular Solutions (SMS), cont.

- 410,000 square feet under roof for fabrication, assembly and inspection
- 7 production bays
- 8,200 square foot administrative building
- 10,000 square foot training facility
- Truck, barge and rail access
- NQA-1 program
- Located on 120 acres of land with an option for 180 more acres

SMS Site Layout



23M012008D 01.14.08

SMS Overhead View



23M012008D 01.14.08

SMS Interior View



AP1000™ Structural Modules

148 structural modules

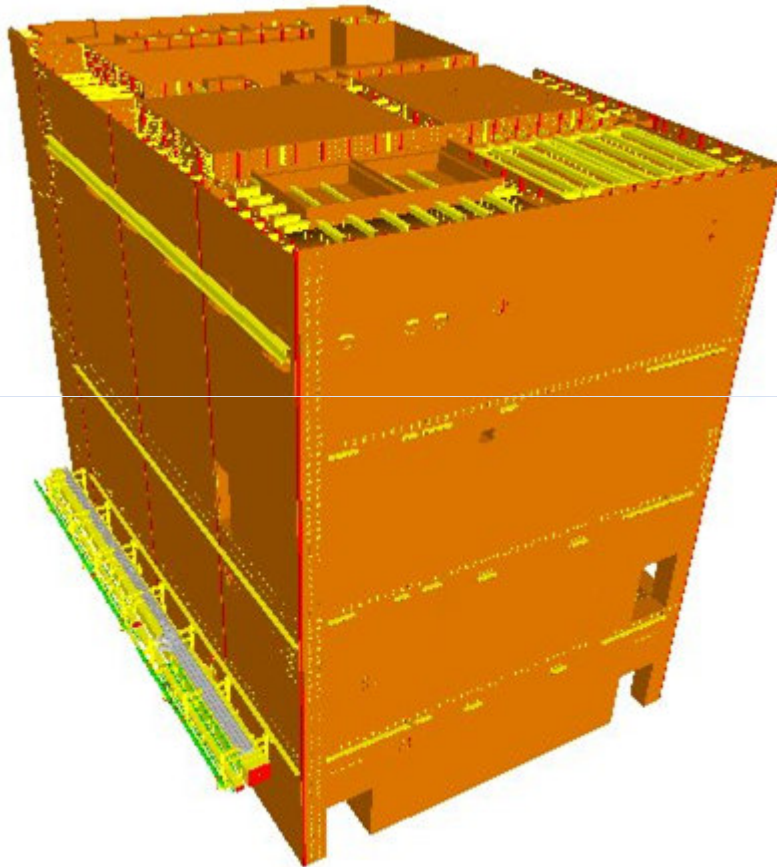
- CA Type (25): steel formwork modules with concrete filled in place; consists of walls (CA01, CA20) and floors (CA34)
- CB Type (35): remain-in-place steel formwork modules with concrete poured around them.
- CG Type (5): modules that are set into place to form part of a building structure and that are not outfitted with mechanical commodities (such as platforms and grating)
- CH Type (46): modules that are set into place to form part of a building structure and that are outfitted with commodities
- CS Type (37): modules that comprise steel stairways

AP1000™ Mechanical Modules

202 mechanical modules

- Equipment modules (51): consisting of equipment, valves and piping on a structural steel framework
- Piping and valve modules (22): consisting of piping, valves and in-line piping components on a structural steel framework
- Commodity modules (53): consisting of piping, cable tray and HVAC ductwork on a structural steel frame
- Standard service modules (76): as assembly of service utility connections in a frame to provide standard configuration

CA20 Aux Bldg Areas 5&6



CA20 comprises 72 sub-modules:

Size (N x E x Height):
44'-0" x 68'-9" x 68'-0"

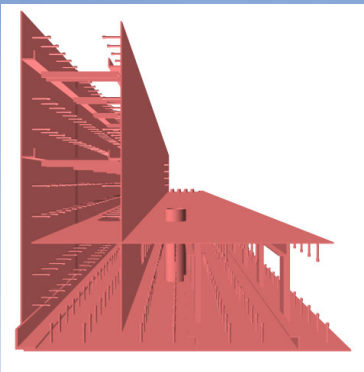
Dry Weight:
1,700,454 lbs.

Room (Area):
N/A

Plant Elevation:
66'-6"

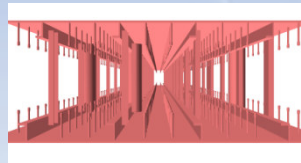
Classification:
Seismic Category I

CA20 Sub-Module Configurations



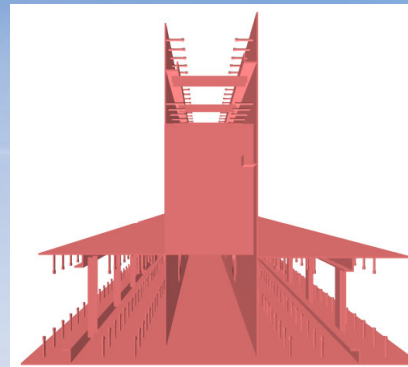
L-Shapes

CA20_01
CA20_05
CA20_10
CA20_14
CA20_18
CA20_22
CA20_26 (mod.)
CA20_30 (mod.)



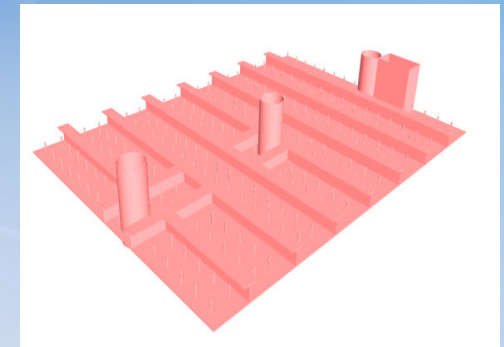
Flat Panels

CA20_02	CA20_04
CA20_06	CA20_07
CA20_08	CA20_11
CA20_13	CA20_15
CA20_16	CA20_17
CA20_19	CA20_21
CA20_23	CA20_24
CA20_27	CA20_28
CA20_29	



T-Shapes

CA20_03
CA20_12
CA20_20



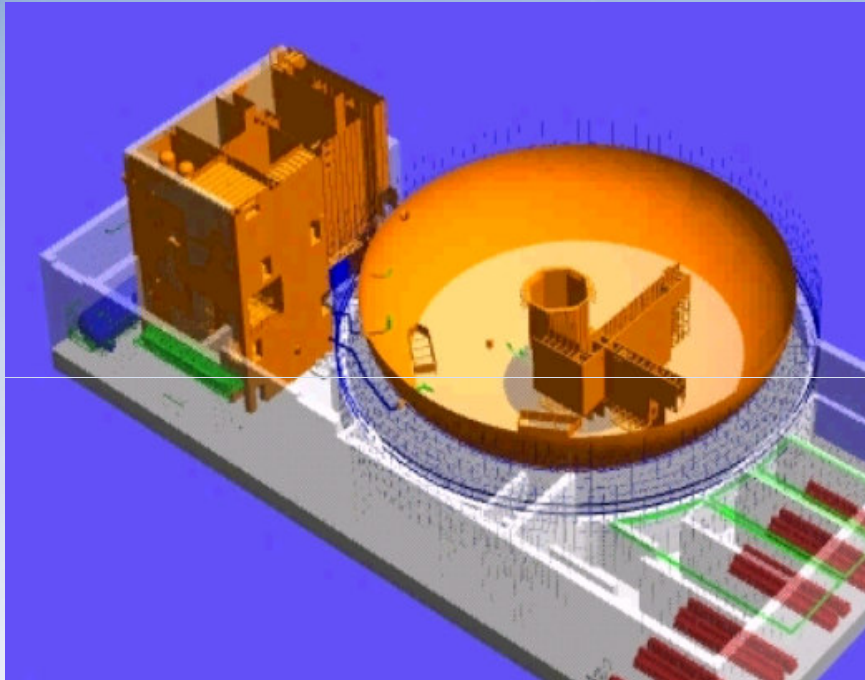
Floor Plates

CA20_31
CA20_32/33 CA20_34/35
CA20_36/37 CA20_38-42
CA20_43/44 CA20_45/46
CA20_47-50 CA20_51
CA20_52/53 CA20_54/55
CA20_56/57 CA20_58
CA20_59/60 CA20_61/62

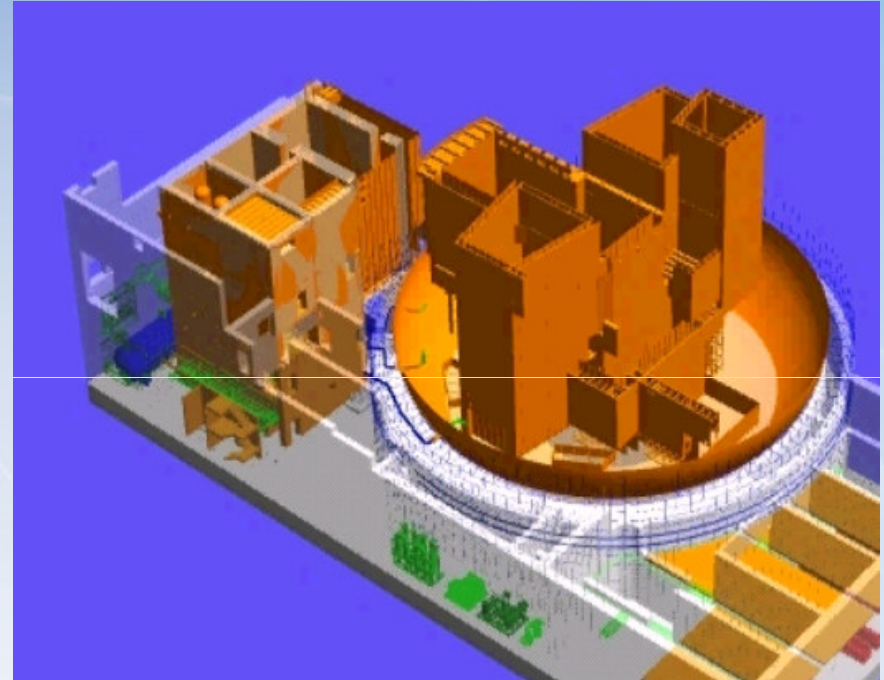
Miscellaneous

CA20_25	CA20_63
CA20_64	CA20_65
CA20_66	CA20_71
CA20_72	CA20_73
CA20_74	CA20_75
CA20_76	CA20_77

Installation Sequence



CA20-CA04,05



CA01 set on top

High Level Lessons Learned

Fully Integrated Schedule

- Key to identifying long-lead items and critical interdependencies that could hinder timely project completion



Subcontractor Qualification

- Subcontractor's skills must match project scope

Quality Assurance

- EPC contractor must have robust program for ensuring components' quality (especially critical in a nuclear environment)
- ASME certification does NOT relieve the supplier of a need to have a robust NQA-1 program

3-D Computer-Aided Engineering (CAE)

- Vendor and EPC contractor must commit to use of 3-D CAE to plan work and identify potential plant construction conflicts

Lessons Learned (cont.)

Workforce Planning

- EPC contractor must have systems and experience to attract, identify and retain appropriate sources of highly skilled tradesmen (welders, pipe fitters, etc.)
- Programs are needed to train workers where there are shortages

Problem Identification & Resolution

- EPC contractor must have ability to proactively identify, categorize and resolve arising issues

Regulatory Interface

- EPC contractor must have healthy and productive interaction with regulatory bodies



Challenges Unique to Nuclear Environment

Timing

- New nuclear unit delivery schedule approximately nine years (vs. seven for coal), with three-to four-year fabrication times for steam generators and vessels
- Early decision-making is necessary



Public Scrutiny

- Because nuclear power is such a high-profile technology, potential problems at any site become widely known

Uniqueness of Nuclear

- Nuclear power is among the most highly regulated activities in the world, so regulations are robust and closely followed

Collaboration between Regulators

- Nuclear regulators make up a very small community and are far more connected than in any other arena

Challenges Unique to Nuclear Environment (cont.)

Robust QA/QC is Vital

- Components emplaced in nuclear units require much higher pedigree than those in fossil units



“Safety Culture”

- Companies involved in nuclear unit construction must not only foster safe working environments for employees, but also must create a culture at the worksite that prioritizes safety above scheduling and cost concerns

Specialization of Contractors & Subcontractors (C&S)

- Not all C&Ss have the programs, processes, procedures and people -- “The Four Ps” -- needed to successfully build nuclear operating units

Conclusion

Takeaway Comment:

- When constructing a major infrastructure addition such as a nuclear power plant, the selection of the “best fit” EPC contractor is not merely a function of who gives you the lowest price
- Instead, the key question a utility needs to ask itself is: Does this EPC contractor have the programs, processes, procedures, and people I can trust to successfully execute the project on time and within the agreed pricing framework?