Installation Aspects of ITER and JET

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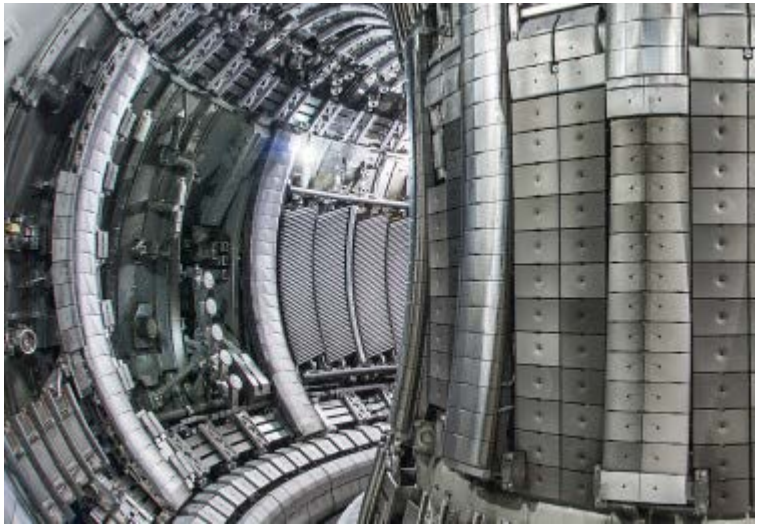
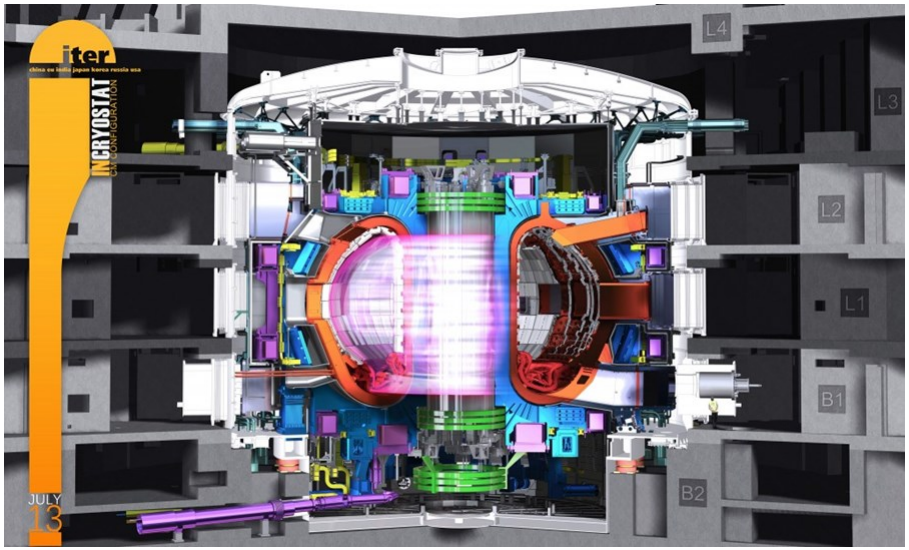
JET and ITER are large scale Fusion devices



In southern France, 35 nations are collaborating to build the world's largest tokamak, a magnetic fusion device that has been designed to prove the feasibility of fusion as a large-scale and carbon-free source of energy based on the same principle that powers our Sun and stars



JET is the largest tokamak in the world. In operation since 1983, JET was explicitly designed to study plasma. Today, its primary task is to prepare for the construction and operation of ITER, acting as a test bed for ITER technologies and plasma operating scenarios.

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Installation Aspects ITER and JET

- ITER Installation Organisation
- ITER Installation Management Processes
- Examples of Implementation from JET

Key Lessons Learnt from Recent Nuclear Construction Projects

- 1. Complete detailed design before starting construction
- 2. Understand regulatory, quality, safety, & large project requirements to instill a nuclear mentality at all levels
- 3. Provide adequate detailed planning, preparation, & integration for all project phases
- 4. Integrate nuclear/quality expectations & commitment into all organization levels & management processes
- 5. Define project execution roles & responsibilities
  - Recognize project phases, needs, & transitions
  - Owner/Licensee/Operator is the ultimate risk stakeholder
  - Pro-actively manage external stakeholders

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Key Lessons Learnt from Recent Nuclear Construction Projects

- 6. Develop appropriate contracting strategies that recognize the status of detailed design completion, provide win-win solutions for the licensee/contractors, & recognizes licensee risks must be managed….they cannot be shed
- 7. Implement effective design/construction configuration management & change control processes
- 8. Recognize that organization/management FOAK challenges rival or exceed technical/science FOAK issues
- 9. Keep It Simple & Less Is More….Beware of Bits & Bites
- 10. Adopt Integrated Project Team (IPT) organization approach with strong licensee leadership roll

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Correct Contract Structure Ensures Safety, Reliability, Cost Control and Delivery.

- ITER examined a number of strategies for the Installation Delivery
  - Design-Bid-Build (D-B-B)
  - Design-Negotiate-Build (D-N-B)
  - Design-Build (D-B)
  - Owner-Build (O-B)
  - Construction Management (CM) (IPD/CM Basis of AOP Construction Mgt Strategy)

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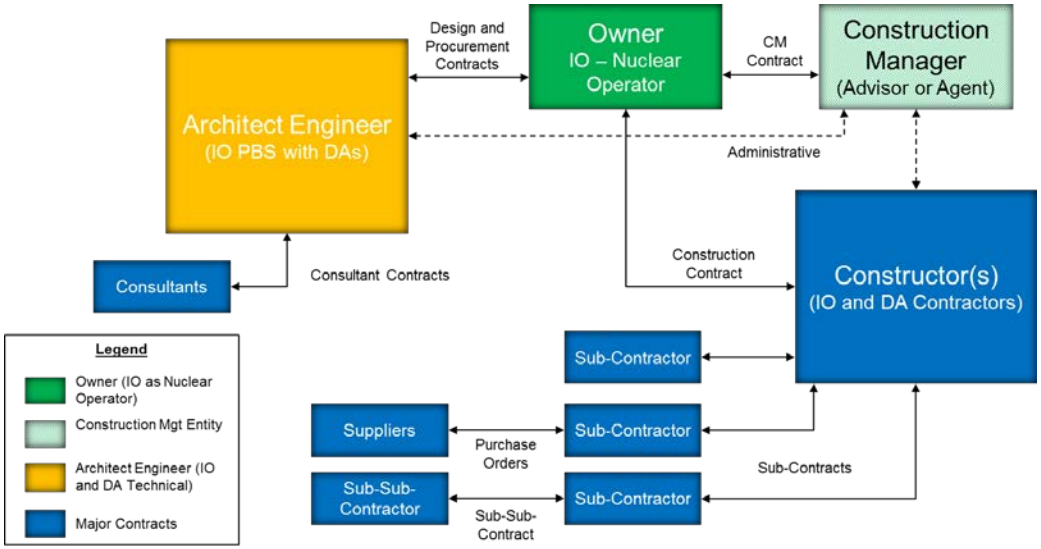
Integrated Project Delivery (IPD)/ CM

- Integrated Project Delivery (IPD) is the most common delivery method used for large, high-value complex projects such as ITER



- IPD/CM is the integration of two broad activities, 1) decide, design, and determine, and 2) supply, construct, and install

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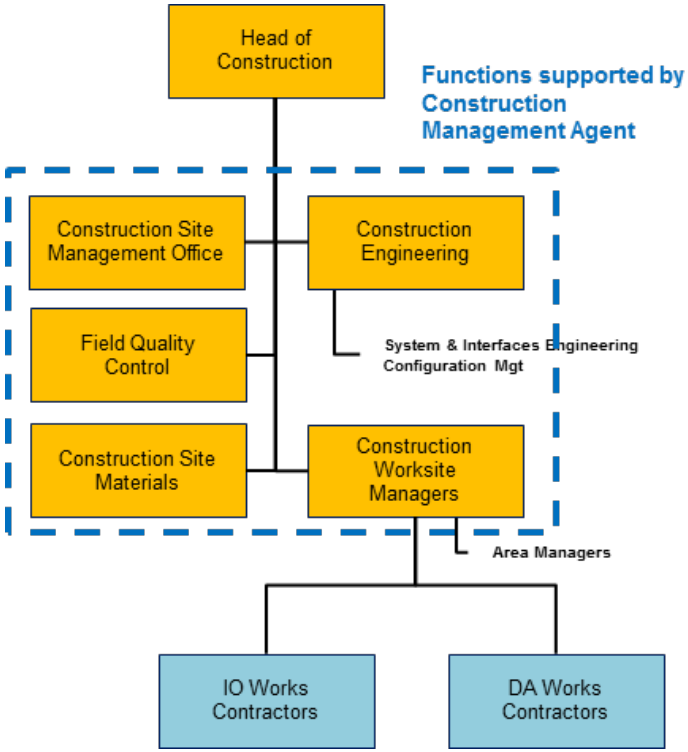
Perceived advantages of IPD / Construction Manager Contracts

- A better understanding of the design with a greater design option evaluation
- Improved visualization of the facility and installed plant before it becomes a project
- Detection and resolution of conflicts between components
- Increased coordination of installation documentation
- Greater prefabrication opportunities
- Optimized site utilization
- Efficiently scheduled delivery of product, materials, and equipment
- Reduction of installation waste
- Improved predictability of performance, cost, and time to construct
- Embedding and linking of vital design and installation information for use in facility management and operation

Use of Construction Manager as Agent support Process



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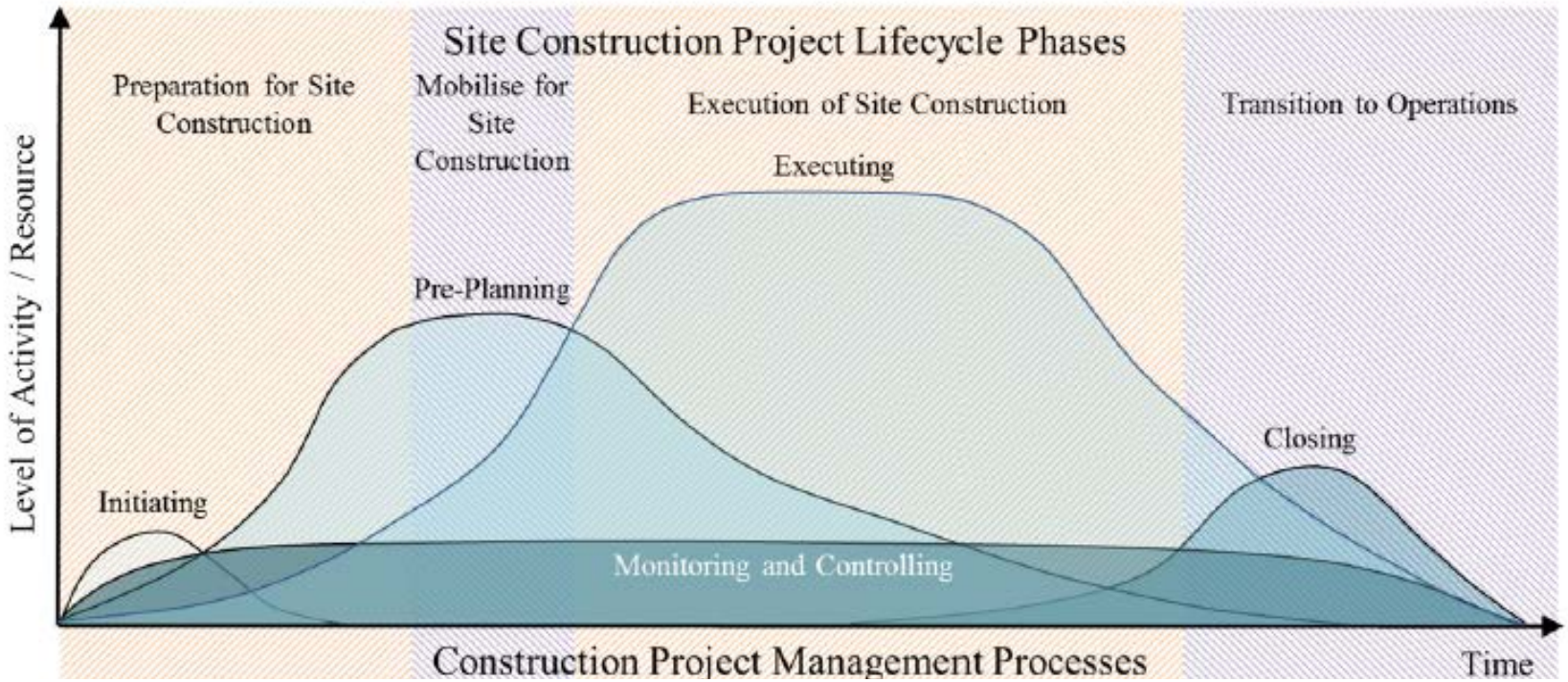
ITER Installation Management Processes is divided into four primary phases



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Preparation for Site Installation

- Initiating
- Project Planning
- Site Installation Specification
- Mobilisation and Logistics Plan
- Site Installation Procedures
- Installation Readiness Reviews

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Mobilisation for Site Installation

- Update plans and procedures
- Prepare and Issue the Initial Permits to Work
- Building or Area Handover for Site Installation
- Prepare the Worksite

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Execution of Site Installation and Construction activities

- Compliance with Nuclear Safety
- Hold Points
- Risk Assessments and Safety
- Training and Qualifications
- Day to Day Planning
- Check lists
- Installation Testing
- Waste Management / Housekeeping
- Machine Shop and Workshop Facilities and Services
- Supply of Tooling and Equipment

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Transition to Operations

- Systems Start-up, Testing and Turnover Plan
- Construction Worksite or Phase Close-out

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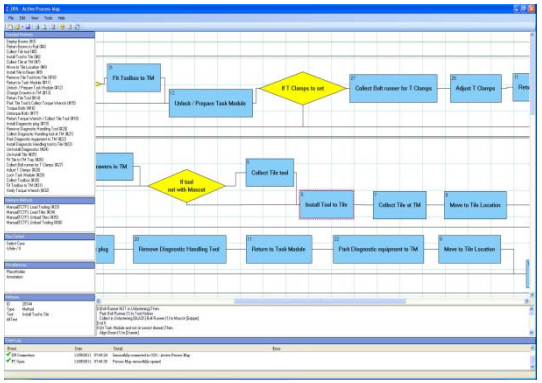
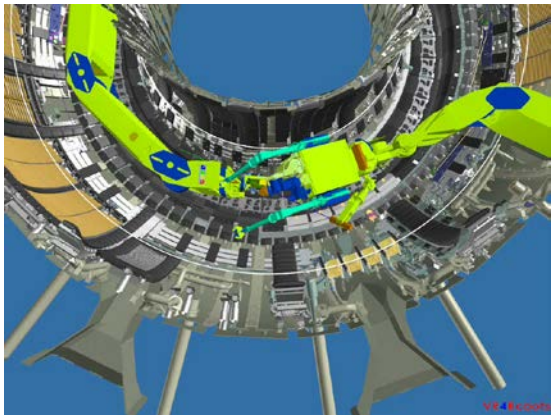
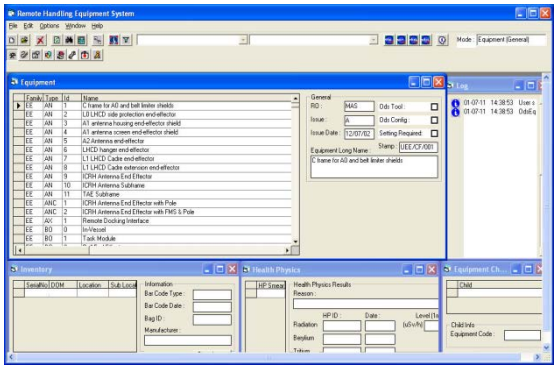
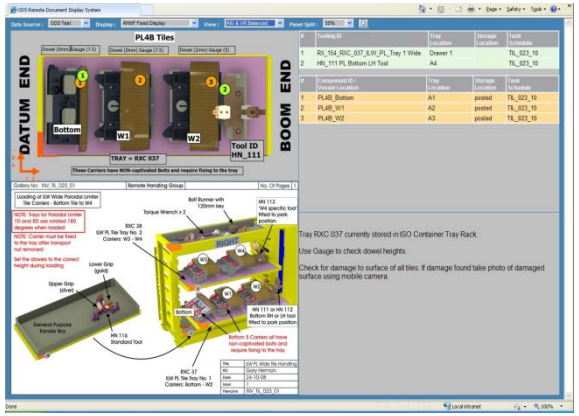
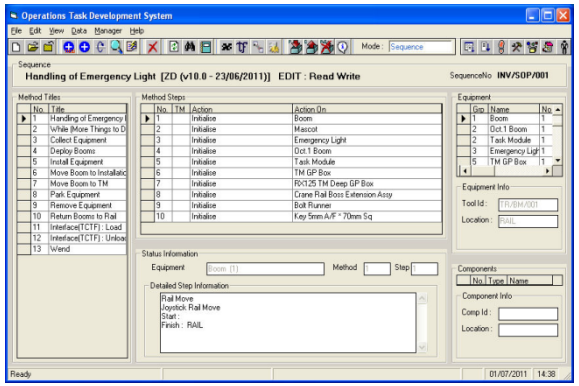
Example of Installation Implementation at JET

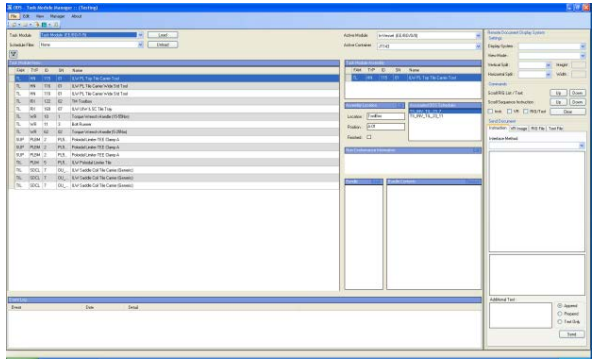












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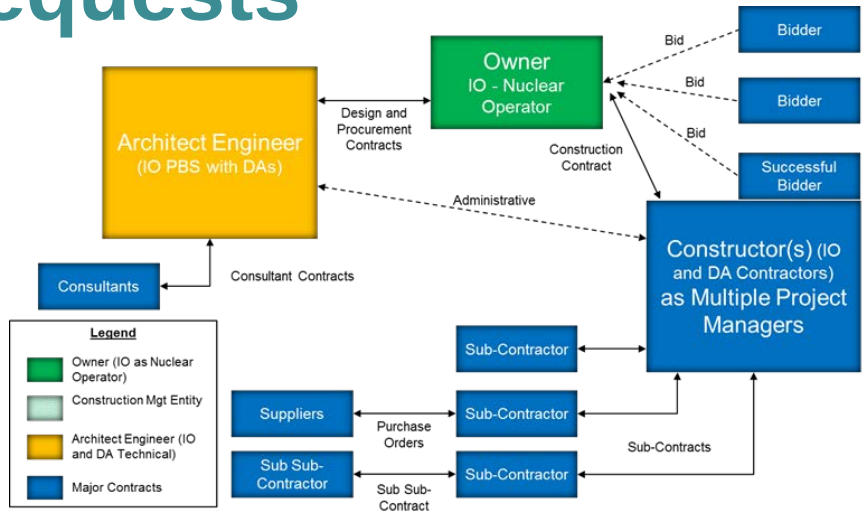
Design Bid Build Can lead to High Number of Change Requests

- Supports projects with staff without specialist construction experience
- All installation information required prior to bidding
- Used for ITER conventional facilities
- Not optimal for complex FOAK contracts



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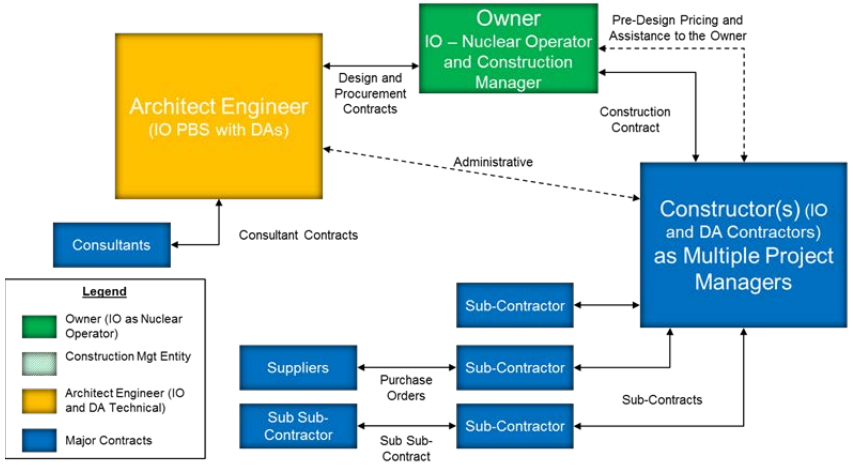
Design-Negotiate-Build delivery method

- The D-N-B delivery method is normally used in projects where it is necessary to construct in the shortest possible time at controlled cost but it is acceptable to construct at the detriment of quality



- D-N-B limits negotiation position of owner.
- Often disputes around changes orders.

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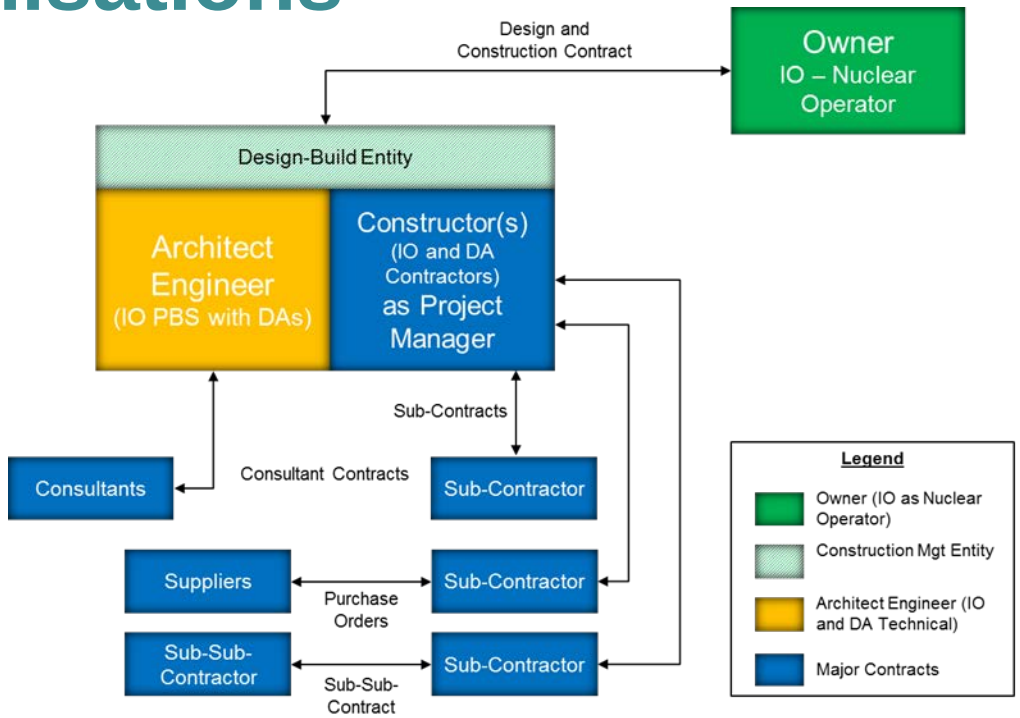
Design Build often used for specialist organisations

- This single-contract arrangement offers more control over project timing and costs
- Useful for specialists e.g. Educational offices, warehouses.



- This approach is frequently used in building construction but not complex technical projects.

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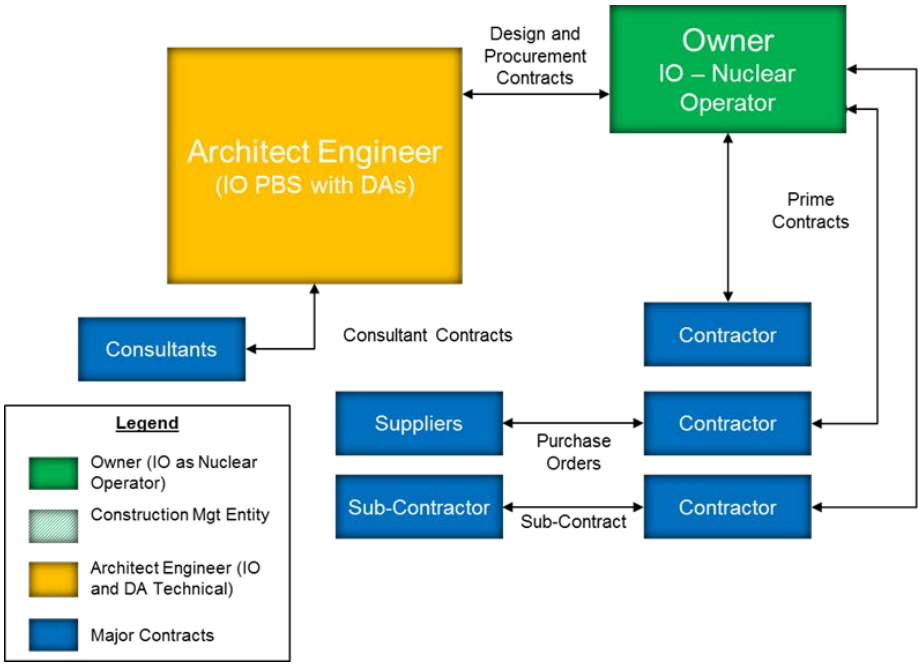
Owner Build in-house capability for duties that are normally contractor responsibility

- Method implemented on the SNS Project where six U.S. national laboratories collaborated on the installation of a linear accelerator for neutron scattering experiments



- Control & risk for transfers to the owner.
- Not used on ITER due to the distribution of works between the DA's.