

CAPABILITY UPGRADE & LIFE EXTENSION PROJECTS, SOME LESSONS LEARNED



Instead of exchanging older vessels for new ones, naval and offshore vessels are often modernised or converted for a new lease of life. With a proper approach, such projects can be a low cost and low risk solution. Years of experience in Life Extension and Conversion projects have taught us that such 'brownfield' projects encounter various generic difficulties. Common issues include risk allocation, planning, project preparation and management. With an emphasis on technical and engineering aspects, Nevesbu's Managing Director Kees van Roosmalen gives some advice on cost-effective execution of future projects.

Basic Principles for cost-effective project execution

Nevesbu's experience with Life Extension and Conversion projects has proven that for a cost-effective execution of such projects, the following principles must be applied:

- Thorough preparation in a phased and gated approach;
- Active management and involvement of sub-contractors and vendors;
- Teamwork between all parties;
- Realistic integrated planning;
- Early consideration of, and decisions on technical and strategic options.

While the above may not sound new, consider that 'What is not exposed as obvious is often ignored', a remark attributed to Rear Admiral J.R. Hill, R.N. (ret).

Avoid the 7 sorry mistakes described by Merrow in his book *Industrial Megaprojects*:

1. I want to keep it all!
2. I want it NOW!
3. Don't worry; we'll work out the details of the deal later.
4. Why do we have to spend so much up-front?
5. We need to shave 20 percent off that number!
6. The contractors should carry that risk; they're doing the project!
7. Fire those #@\$^! project managers who overrun our projects!

**Thorough preparation & gated approach**

Thorough preparation helps to define the project technically through Front End Engineering & Design (FEED). By doing so, it becomes clear what needs to be done. Reliable cost estimating and planning are possible when this clarity is achieved, and consequently an informed decision can be made regarding whether or not to continue the project.

The general approach, based on Systems Engineering principles and PRINCE2 Project Management, contains specific 'gates' at the end of each phase. These gates are: System Requirements Review (SRR), Preliminary Design Review (PDR), Basic Design Review (BDR), Critical Design Review (CDR), and Production Readiness Review (PRR). These gates need to be passed before moving on to the next phase. Gates can only be passed when the previous phase is fully completed and when the business case criteria are (still) met. A major principle in a gated approach is that phases are separated by formal 'gates' which are 'go/no-go' decision moments.

The objectives of the various phases are:

1. *Feasibility Study phase*: Ascertain Economic Viability, including definition of Business Case Criteria, Definition of Mission & Platform (Ship) Systems, Concept Design & Analysis, Definition of Requirements. This phase will end with a SRR.
2. *Preliminary Design phase*: definition of Project scope, including Develop Design Philosophies (e.g. Operability, Maintainability, Safety), Obtaining & Compilation of Platform & Mission System and Vendor Data, Definition & Integration of Major Mission Systems, Preliminary Arrangement & Design of Platform Systems. This phase will end with a PDR.
3. *Basic Design/FEED phase*: definition of the Project, including Platform General Arrangement & Structural Design, Design Definition of Major Mission Equipment and Systems, Platform System Integration of Major Mission Systems and Equipment; Platform System Design: P&IDs, Cable Routing, Instrumentation. This phase will end with a BDR.
4. *Detailed Design phase*: full definition of the Design, including Local Arrangement Design, Arrangement of Technical Spaces, Detailing of Structures, Piping, Pipe Supports, Cabling and Instrumentation. This phase will end with a CDR.
5. *Production Design phase*: Design Development for Production, including Shop Drawings, Isometrics, Loop Diagrams, Cable Termination, et cetera. This phase will end with a PRR.

Active management & involvement of major sub-contractors and vendors

Life Extension and Conversion projects mostly cover ships that need to perform special operational functions which require the use of special mission systems. For naval vessels these special mission systems would be weapon and/or sensor systems. Eventually, the ship must perform as an integrated mission effective operational unit, incorporating the naval architecture as well as naval mission requirements.

To properly incorporate the mission systems in the ship design, early communication is necessary between the ship designer and the supplier/designer of mission systems.

The ship designer is usually called the Platform System Integrator (PSI), while the mission system designer is called the Combat System Integrator (CSI). The CSI would be responsible for integration between all mission systems. It is clear that PSI and CSI must be designated early on in the project if the conditions to pass the earlier gates are to be properly met.

In both ship and mission systems, there will be systems and equipment that originate elsewhere. Such systems and equipment may be split in 'Commercial Off the Shelf' items (COTS), and Engineered items. COTS items are basically catalogue items in regular production by a vendor. Engineered items, on the other hand, are specially configured in response to project demand.

Proper integrated design of the ship requires early and properly detailed information of outside equipment and systems. To properly manage the project, system engineering principles must be applied to cater for the development in the quality and level of information from vendors. Early availability of reliable information for further design is an issue for engineered items in particular. In most cases, engineered items are developed in parallel with the main project with the consequence that information becomes more reliable over time.

To manage the interface with sub-contractors and vendors, the technical definition of their scope should typically cover the following:

- Performance Requirements (Specifications): What it should deliver, Technical/Operational Requirements, Control & Monitoring Philosophy and Safety Philosophy;
- Realisation Envelope: e.g. Allowable Size, Weight, CoG, Power/Utility Demand, Maintenance Requirements (Access, Work Space, Handling);
- Technical Interface Requirements: e.g. Supporting Requirements, Piping Interfaces, Electrical Power Supply and Control & Monitoring Interfaces;
- Special Operating Conditions (In and Out).

To support procurement, Nevesbu normally develops a set of General Technical Requirements (GTR) for the project. Definition of engineering items is typically at least partly interactive to make use of the suppliers' expertise as well as to manage costs by taking the suppliers' fabrication facilities into consideration.

Teamwork between All Parties

Project Management shall support pro-active involvement of major parties and stakeholders including Client, Contractor/ Shipyard, Combat System Integrator, Platform System Integrator, Procurement, major Sub-Contractors and Vendors.



Risk allocation

Although Nevesbu's experience concerns smaller projects, the risks appear much the same as for the megaprojects analysed by Merrow. According to Merrow, front loading (proper execution of the first three phases) is directly related to the risk of project time and budget overruns. Since the total cost of the first three phases is generally within 5% of the total value of the project, this is a small price to pay to mitigate the risk.

When a project is irrevocably contracted early, the risk of inadequate preparation is transferred to the contractor. However, contractors will need to put a price on the risk even though the owner cannot 'buy off' all risks: e.g. late delivery is never fully compensated by liquidated damages. Similarly Contractors cannot take risks that they cannot control: e.g. planning & efficiency consequences of late owner decisions, late information regarding owner furnished equipment (OFE), lacking logistic performances of OFE, and performance of OFE (including assigned Sub-Contractors/ Vendors). Contractors can, again, not "buy off" all risks of Sub-Contractors.

In addition, contractors and sub-contractors are generally non-capitalised, service firms with limited ability to carry large equity-type risks other than through project insurance. Risks should ideally be shared in proportion with the level of influence and the upward potential for any party. Remember that all parties are more or less *'In the Same Boat'*.

Realistic planning

Planning should consider the interdependencies between the various aspects in a project, such as engineering, procurement, licencing, obtaining approvals, fabrication and decision processes. EPC planning is often primarily focussed on the production of the hardware in a project. This is where the money is! However, poor preparation is where the money is lost and therefore a realistic planning should include proper preparation.

An often overlooked factor is the time consequence following from the relationship between engineering and procurement. Engineering is needed to define which items are to be procured. However, vendor information is also eventually needed for integration engineering. Consequently the project need for engineering must drive, but is simultaneously driven by procurement. The lead time for vendor information may drive procurement more than the lead time to 'required on site' or ROS-date.

Project planning must take interdependencies such as the above into account to be realistic. Disregarding critical interdependencies in the planning is driven by Merrow's Sorry Mistake number 2, 'I want it NOW', also known as 'Speed Kills'. According to Merrow this is the single factor most responsible for project failure. Note that there is no reason to plan deliberately slow. Losing continuity and momentum also pose project risks.

Fast Track & Cost Effective? Decision Making Process is Key

Technical/Strategic Options

Projects may be driven more by time than costs or vice versa. While these are valid drivers, the decision that one is governing shall be part of the project brief and not change in the course of the project. The same applies to technical strategies, e.g. proposed approach to production, outfitting, testing, et cetera. Re-iteration of considerations or going back on decisions made during Technical Reviews are sorry mistakes.

A Dutch saying is: 'Good preparation is half the work'. As execution of the first three phases (Feasibility Study, Preliminary Design and Basic Design) is normally within 5% of a project's cost, the saying can be amended for projects to read: 'Good preparation is half the work, but not nearly half the cost'.

'Hurry Slowly.' Apply a phased and gated approach (including Go/No-Go) and prepare and update a realistic integrated planning as the project is being defined (avoid 'wish' planning).

Organise for teamwork with all stakeholders, including: clearly defined project parties and their responsibilities, integration of procurement and engineering with due consideration for engineered vendor packages, and equitably allocated risks.

And always remember: 'In Theory Practice is as in Theory, In Practice it is Not'. However, when straying from the above, mind and mitigate the risks!

Food for thought