Megaproject Risks

Considerations for the Alaska LNG Project

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Pegasus's 2019 Report Overview

- Engaged by the State to provide advice concerning the risks associated with megaprojects, including specifically the proposed Alaska LNG project.
- Reviewed the Trans-Alaska Pipeline System (TAPS) and Strategic Reconfiguration project execution and issues encountered.
- Identified issues commonly realized on megaprojects.
- Discussed impact of cost overruns.
- Provided examples of contract tools to mitigate risks.

Megaprojects Defined

- Typically have costs in excess of $1 billion USD.
- Comparably high benefits and correspondingly high risk.
- Multi-year construction, often longer than a decade from feasibility planning through execution.
- Many stakeholders that can have substantial impacts on the project (environmentally, economically).
- Unique aspects/scopes (i.e. not a bigger version of a smaller project).
- Conventional project management processes and priorities often not sufficient.

Megaproject Challenges

- Inherent risks due to long planning/execution horizons and complex interfaces.
- Technology/components that are often not standard (including FOAK).
- Decision-making and planning involves multiple parties with conflicting interests.
- Unplanned events (black swans) are often not accounted for, but megaprojects have high exposure and high resulting impacts.
- Over optimism on costs, benefits, and risk treatment.

The “Iron Law” of Megaprojects

“Over budget, over time, under benefits, over and over again.”

– Bent Flyvbjerg

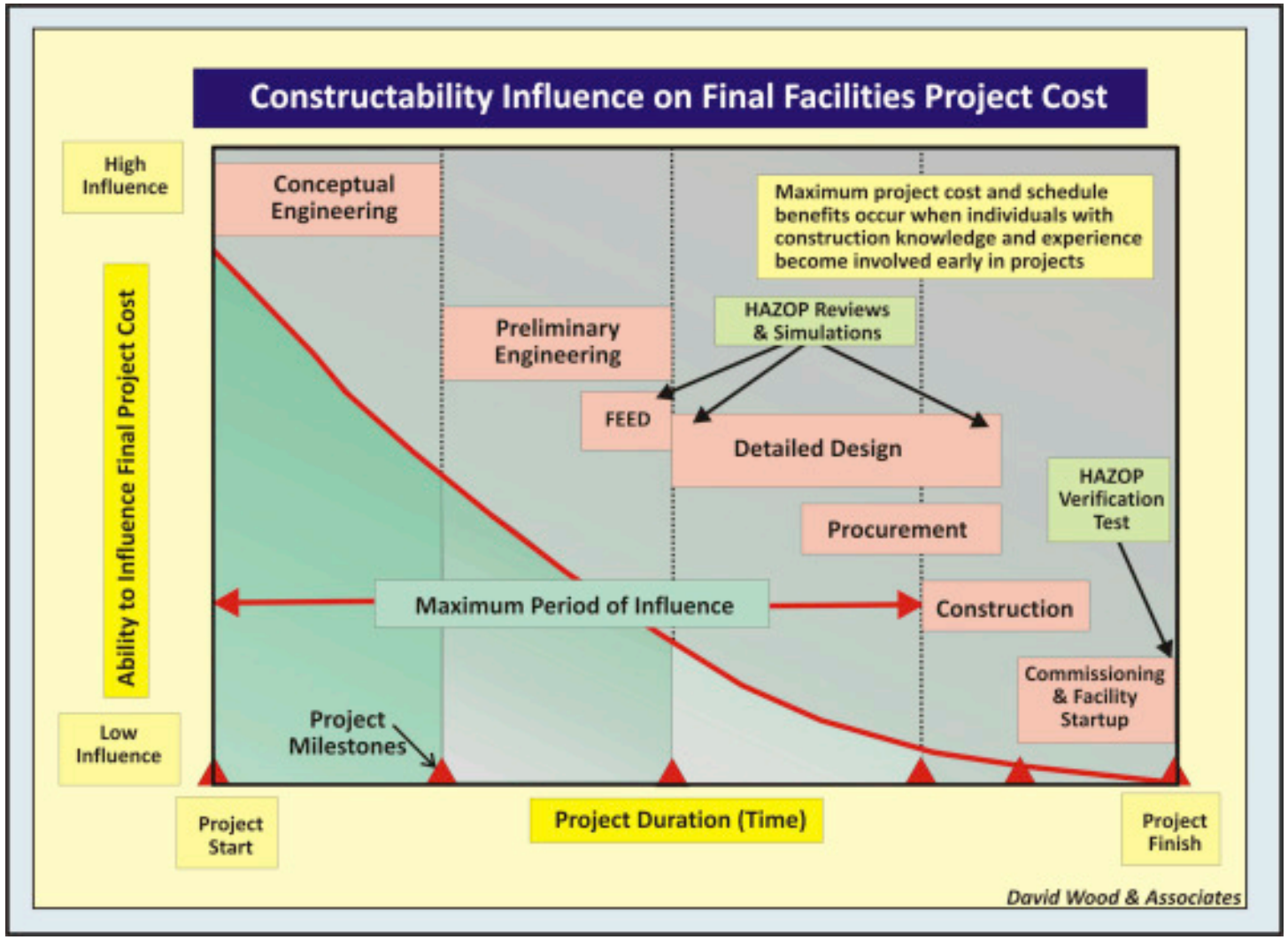
92% of megaprojects come in over budget, over schedule, or both!

LNG Project Risks

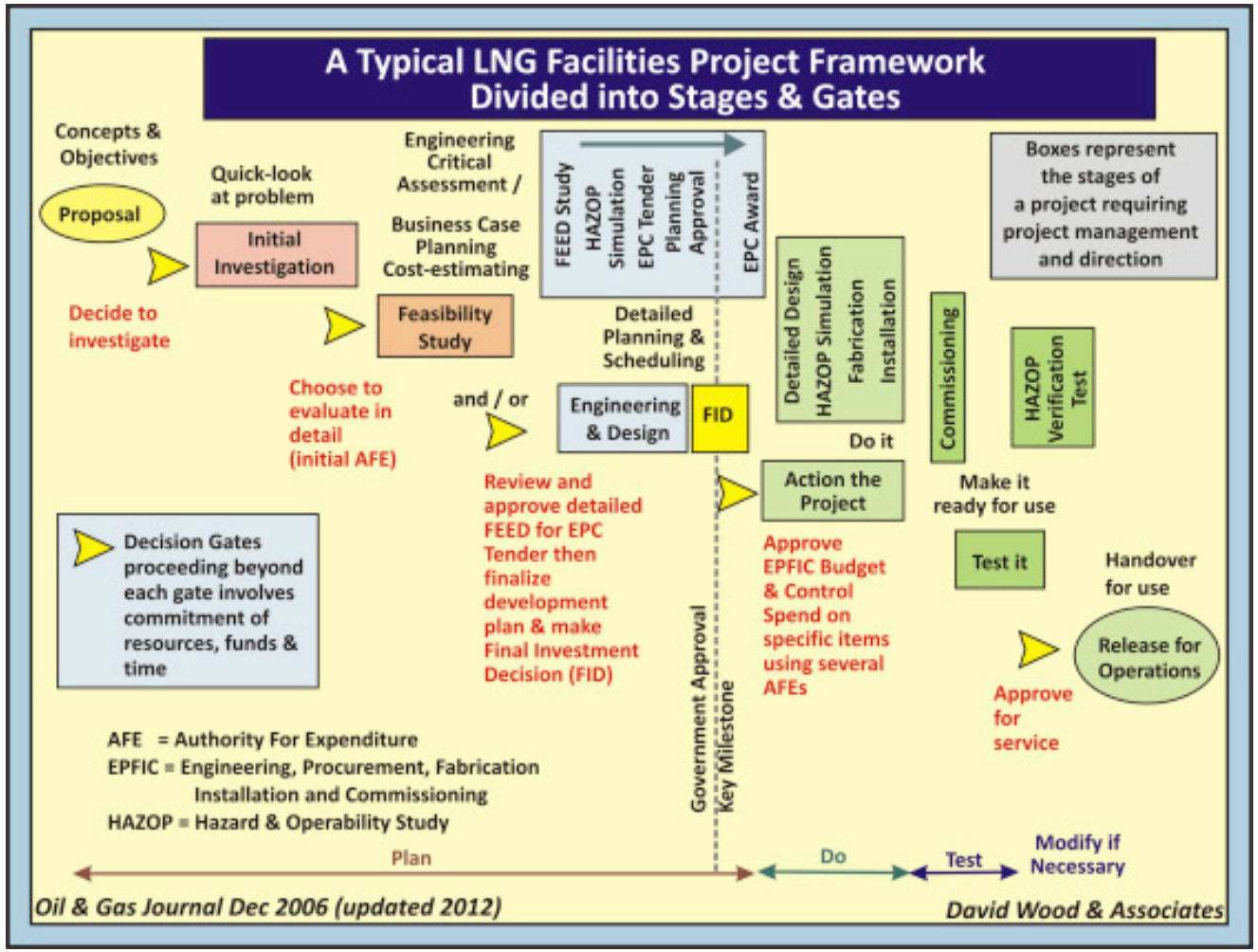
Examples

Risk Factor	Impact on Project Development
Project Economics	Long-term sales contracts that allow for a sufficient return typically underpin the financing of LNG projects. Developers generally need to secure long-term buyers for a large portion of the project's capacity before sanctioning a project; high project costs/changing markets can have a large impact on if/when a project is sanctioned; cost overruns post-FID impact project returns.
Regulatory Approvals	Regulatory process typically time consuming and costly, particularly for high-profile projects that attract opposition groups. May require additional requirements (including scope changes).
Partner Priorities	Alignment amongst project partners on strategies and objectives can be challenging; partners may face different constraints, have differing risk exposure.
Ability to Execute	Partners must have the technical, operational, financial, and logistical capabilities to execute the project. Technical hurdles may impact project feasibility. Craft labor must be available to support project needs. Limited number of contractors able to execute megaprojects.
Weather/Environment	Adverse/extreme weather impacts productivity and can lead to missed construction windows and schedule extensions.
Supply Chain/Logistics	Timely receipt of key material and equipment. Challenge of delivering to remote locations.

Impact of Risk Mitigation & Decision-Making



LNG Project Development Phases



Contracting Approaches

- Size and complexity of megaprojects typically requires multiple delivery methods and contracting approaches.
- Risk should generally be assigned to the party best able to manage/mitigate it.
- For a contractor to assume a risk, additional costs and/or contingencies are expected.
- Cost-plus and time and materials contracting approaches run the risk of the contractor low-balling the bid to win the award, leading to extensive change orders.
- Firm price/lump sum contracting approaches run the risk of the contractor adding excess contingency – and still has the risk of disputes if major issues are encountered.

Risk Allocation

Basic Allocation Principles

- Control: risk should be allocated to the party best in position to control and manage variable relevant to that risk.
- Clarity: allocation decisions should be clearly articulated and defined in relevant documents and the project contracts.
- Consistency: allocation decisions need to be expressed consistently across the project.
- Fairness: allocation should be conducted in a balanced, clear, and consistent manner.

Balance risk allocation to ensure alignment between the parties on project objectives.

Trans-Alaska Pipeline System

GAO Report Findings – Challenges and Cost Overruns

- Site-specific Challenges:
  - More groundwater than anticipated.
  - Underground construction required deeper/wider trenches than planned.
  - Wide variations in soil conditions.
  - Permafrost more difficult to move and drill than planned.
  - Less backfill material sites available, requiring additional hauling.
  - Tolerances for valve support structures far more critical than planned; temperature changes and settlement required realignment.
  - Productivity impacts in cold weather.
- Construction Cost Overruns:
  - Feasibility estimate contained no allowance for escalation (also experienced 4-year delay to start of construction).
  - Insufficient contingency (10%) compared to status of engineering.
  - Underestimated amount of elevated pipe.
  - Additional infrastructure required, but not in initial scope.
  - Underestimated support structure (camps, airstrips).
  - Underestimated scope for environmental requirements (vapor recovery, ballast water treatment system).

Trans-Alaska Pipeline System

GAO Report Findings – Lessons Learned

- Initial and subsequent cost estimates should be viewed with skepticism.
- As much site-specific data as is feasible should be obtained.
- Technical and geological uncertainties should be thoroughly investigated.
- Government approval should be contingent on detailed planning for management control, including cost controls.
- Future project expenditures should have an ongoing government audit to protect the public’s interest.

Strategic Reconfiguration Project (2004)

Prudence Review Findings

- Project engineer lacked Alaska experience, failed to effectively manage the project.
- Poorly defined scope at sanction, leading to poor cost/schedule estimates.
- Reduction of project contingency to an unrealistic level to improve project economics.
- No meaningful oversight by project owner.
- Failure to rely on internal project risk assessments.
- Assumed control of project at Supplement 1 decision point, despite insufficient resources to do so.

Open Questions on the Alaska LNG Project

- Status of program management plans.
- Status of the project’s risk management program.
- Status of conceptual or preliminary engineering (pre-FEED).
- Scope of the FEED Study efforts.
- Oversight of Glenfarne.

Recommendations

- Detailed review of the FEED Study (including updated cost estimate).
- Readiness reviews prior to FID and prior to execution.
- Perform a contract risk review for the EPC/EPCM contract.
- Independent project monitor/advisory committee during execution.