

INDEPENDENT PROJECT ANALYSIS, INC.



FPSOs

Getting the Project Right!

David Rosenberg



Introduction

- **Successfully executing an FPSO project on time and budget is a serious challenge—reality says FPSOs have a history of volatile performance**
- **Industry believes FPSO projects that are well defined in Front-End Loading (FEL) 3 stage are better positioned for project success**
- **This study will explicitly link FEL 3 practices with FPSO outcomes**

Poor FPSO Outcomes Are a Problem

But Good Outcomes Are Possible by Completing Definition

Outcomes	Median FPSO Performance	Well Executed FPSOs
Cost Deviation	33%	~0%
Schedule Deviation	14%	<5%
Production Attainment	67%	>90%
Incidence of Major Operability Problems*	69%	Low

***Major problem in first year:**

- Requiring extended shut-in of production
- Significant capital upgrade to repair
- Subsurface problem requiring modification



Objective

- **To:** Show the impact of complete definition (Define) deliverables on FPSO performance
- **By:** Demonstrating some key project practices in FEL 3 that are linked to FPSO project outcomes
- **So that:** you can smoothly and successfully execute your FPSO project



Outline

- ***IPA: Who We Are***
- **Database**
- **FPSO Project Performance**
- **Improving FPSO Performance**
- **Conclusions and Questions**



IPA's Mission

- **IPA**

- > *Founded in 1987*
- > *Head office in Ashburn, Virginia, US*
- > *Other offices: The Netherlands, UK, Australia, Singapore, China, and Brazil*

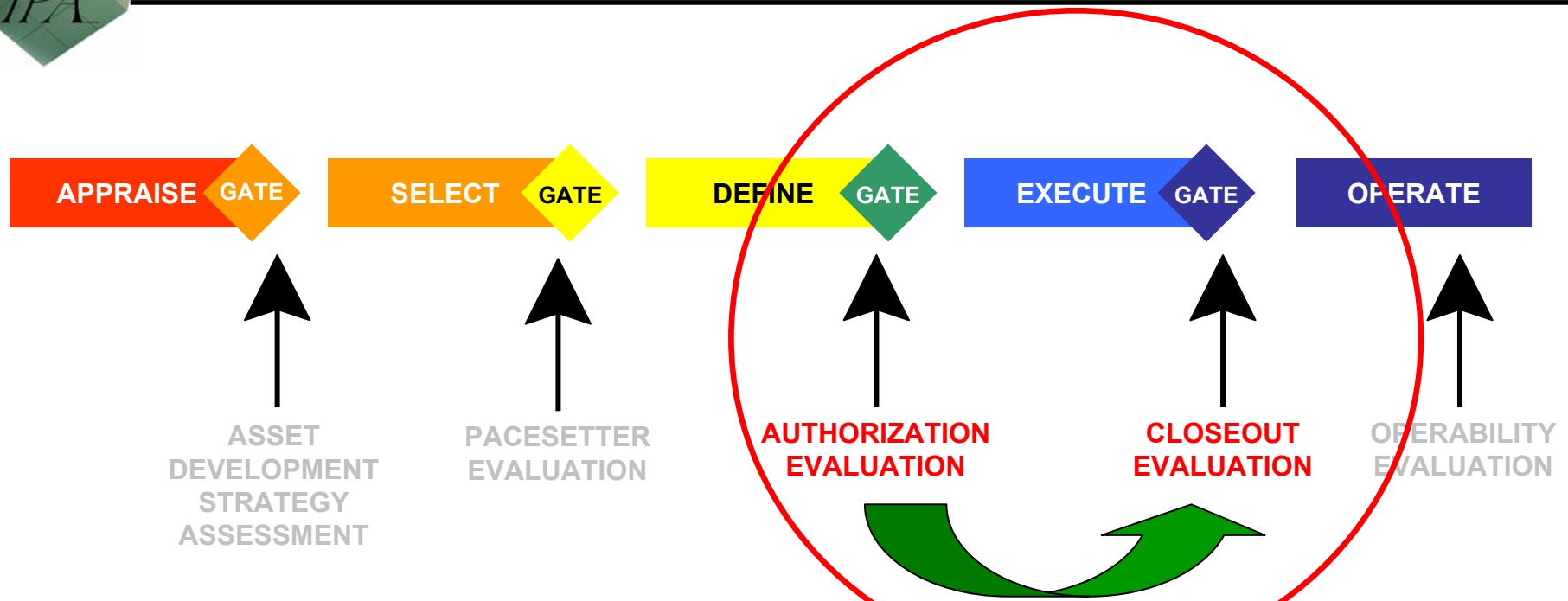
***IPA's mission is
to improve the competitiveness of its customers by
improving their use of capital in projects***

We achieve our mission:

- **Through quantitative benchmarking of capital asset development systems**
- **Through empirical research aimed at the root causes of success and failure in projects**



When Does IPA Get Involved in Projects?



- Pacesetter project evaluation to set targets, identify Best Practices, and quantify cost/schedule risks early
- **Authorization project evaluation when estimating data are available, support for Development Stage**
- **Closeout after startup, but prior to team being reassigned**
- Operability after first year of operation

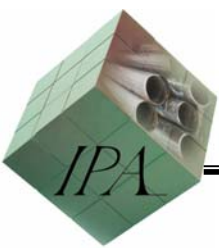


Outline

- **IPA: Who We Are**
- ***Database***
- **FPSO Project Performance**
- **Improving FPSO Performance**
- **Conclusions and Questions**

FPSO Database

Overall Project Data	66 projects (42 completed and 24 in execution—about 40 percent of world's FPSOs)
Median Authorization Date	2002
FPSO Cost (2009\$) (Owner Operated Only)	Average: \$1.15 billion
Reserve Estimate at Sanction	Average: 300 MMBOE



Definition of Terms (3)

- **Outcome Metrics**

- **Execution Schedule Competitiveness: Measure of project speed, comparing a project's planned or actual execution duration against the industry expected execution duration, as calculated by IPA's proprietary models**
- **Expressed as index in which:**
 - > **1.0 is industry average**
 - > **Numbers less than 1.0 are faster (more competitive) than Industry**
 - > **Numbers greater than 1.0 are slower (less competitive) than Industry**
- **Example:**
 - > **Actual Duration: 17 months**
 - > **Benchmark: 20 months**
 - > **Result: $17/20 = 0.85$ or 15 percent more competitive than Industry**



Outline

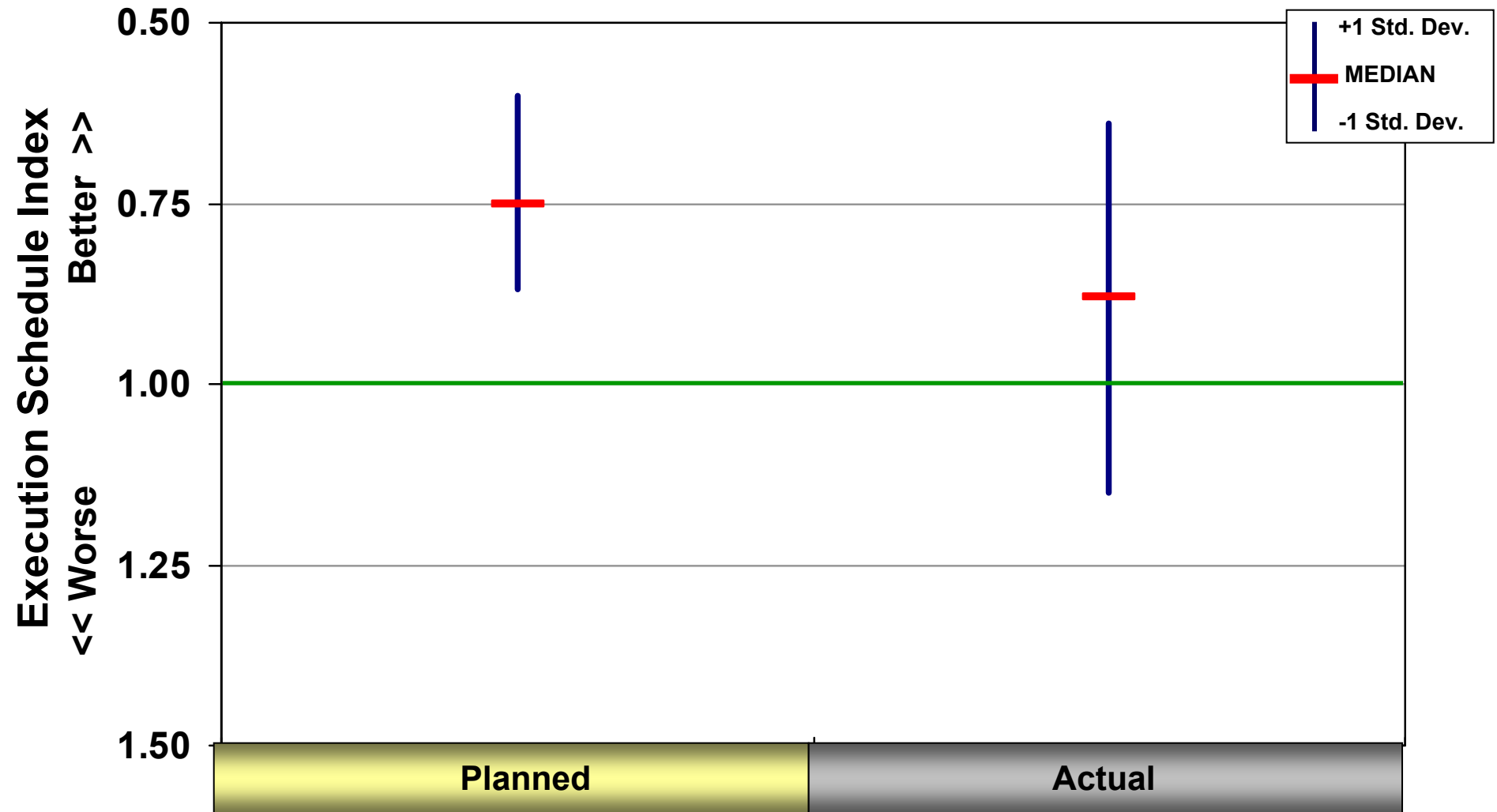
- **IPA: Who We Are**
- **Database**
- ***FPSO Project Performance***
 - ***FPSOs vs. Industry***
 - **Leading Indicators**
- **Improving FPSO Performance**
- **Conclusions and Questions**



Characterizing FPSO Performance

- **Good news is that FPSO projects are known for their fast execution schedules**
 - **FPSO projects routinely set and achieve faster schedules than comparable industry projects**
 - **Not surprisingly, leased FPSOs stand out as “the fastest of the fast”**
 - > **Leased FPSOs tend to be heavily standardized by contractors, allowing them to more quickly execute the FPSO**
- **Bad news is that FPSOs stand out in for their lack of predictability in other outcome measures**

FPSO Projects Set and Achieve Significantly Faster Schedules Than Other Industry Concepts



The difference in means and variance between FPSOs and Industry is statistically significant at the 0.05 level

Poor Outcomes Are a Problem

Results Are Worse Than All E&P Concepts

Outcomes	FPSO Median	Other Concepts Median
Cost Deviation	33%	5%
Schedule Deviation	14%	-3%
Production Attainment	67%	90%
Incidence of Major Operability Problems*	69%	40%

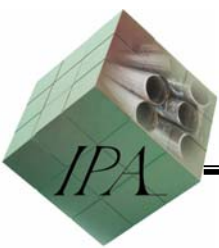
***Major problem in first year:**

- Requiring extended shut-in of production
- Significant capital upgrade to repair
- Subsurface problem requiring modification



FPSO Performance: A Summary

- **FPSO projects routinely set and achieve fast schedules**
- **However, fast execution schedules come with a price:**
 - **Extreme unpredictability in terms of cost growth**
 - **Routinely slipped first oil dates**



FPSO Performance: Leased FPSOs

- **Leased FPSO projects routinely deliver first oil 20 percent faster than other projects of similar complexity**
 - **However, as an industry, we expect these projects to be 35 percent faster!**
- **Slip these projects experience is more a reflection of unrealistic expectations, sometimes resulting from poor basic data**
- **Leased FPSOs also appear to struggle to deliver production expected at sanction, primarily related to basic data issues, especially concerning the reservoir**



Outline

- **IPA: Who We Are**
- **Database**
- ***FPSO Project Performance***
 - **FPSOs vs. Industry**
 - ***Leading Indicators***
- **Improving FPSO Performance**
- **Conclusions and Questions**



Cost Predictability is not a Characteristic of the FPSO Industry

- Using sample of 25 completed FPSOs with detailed cost accounting at sanction and completion, we find that even after controlling for inflation effects, costs are not under control
 - **Engineering overruns by 32 percent**
 - Project management (owner and contractor) overruns 48 percent
 - Hull fabrication/conversion overruns 19 percent
 - Topsides fabrication overruns 11 percent
 - Offshore HUC overruns 52 percent



Engineering

A Leading Indicator of Volatility

- **Digging deeper into FPSO performance shows that predictability around detailed engineering costs and schedule is good leading indicator of overall project performance**
- **Cost growth and schedule slip in detailed engineering campaign is early sign of disrupted project execution**
- ***In most cases, this is driven by incomplete project definition***

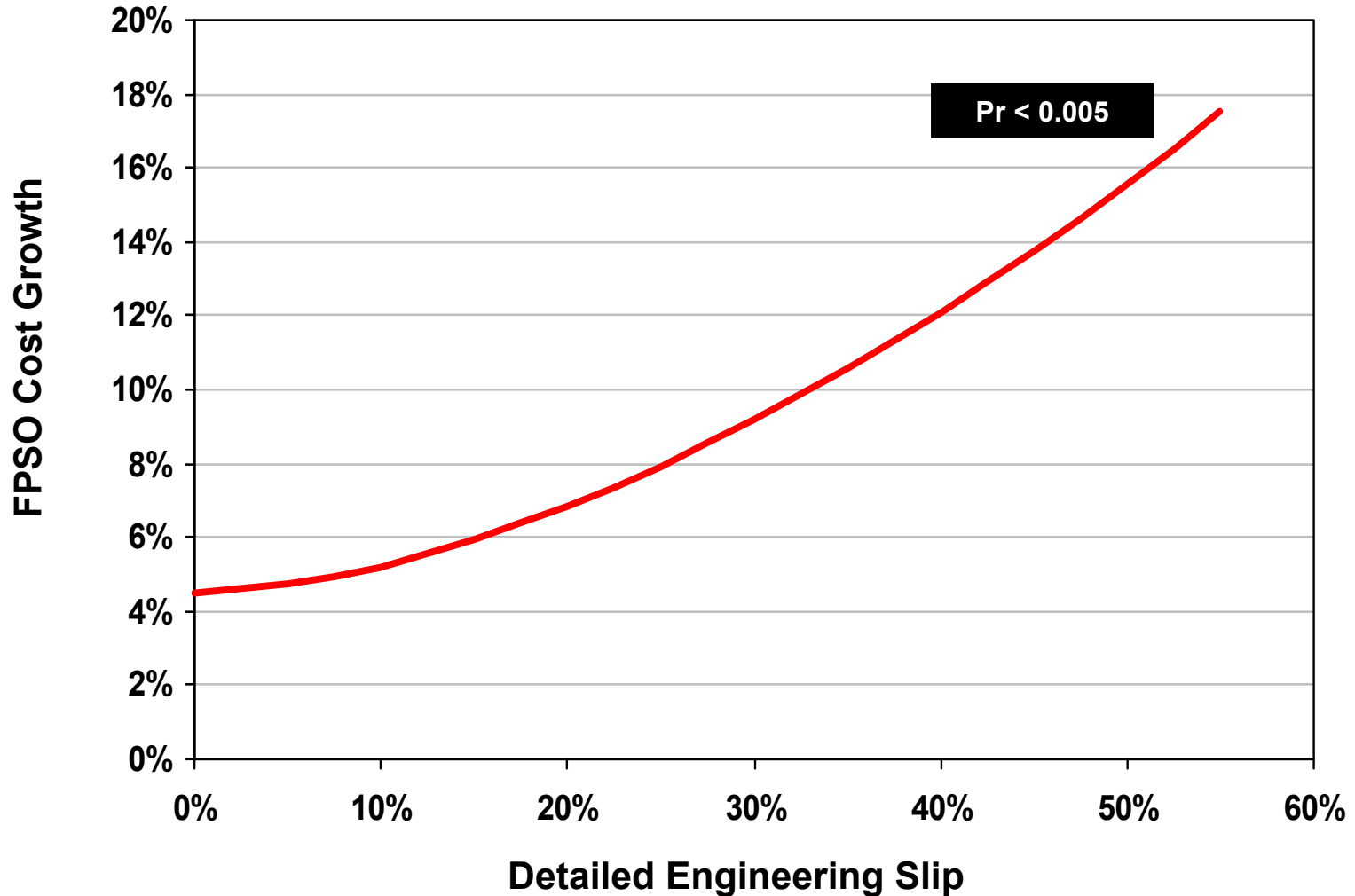


Reasons for Incomplete Definition

- **1. “Not enough time”**
 - **FPSOs tend to be high-profile developments, which have lots of senior management “attention”**
 - > **Schedule commitments are made independent of project realities**
 - **Result: To meet these commitments, definition stages are arbitrarily shortened, leaving insufficient time to complete definition deliverables**
- **2. “Its the (LS-EPC) contractors’ responsibility”**
 - **Owner teams often just provide a functional specification package to the bidder(s)**
 - **Result: Definition is not advanced beyond the functional specification**

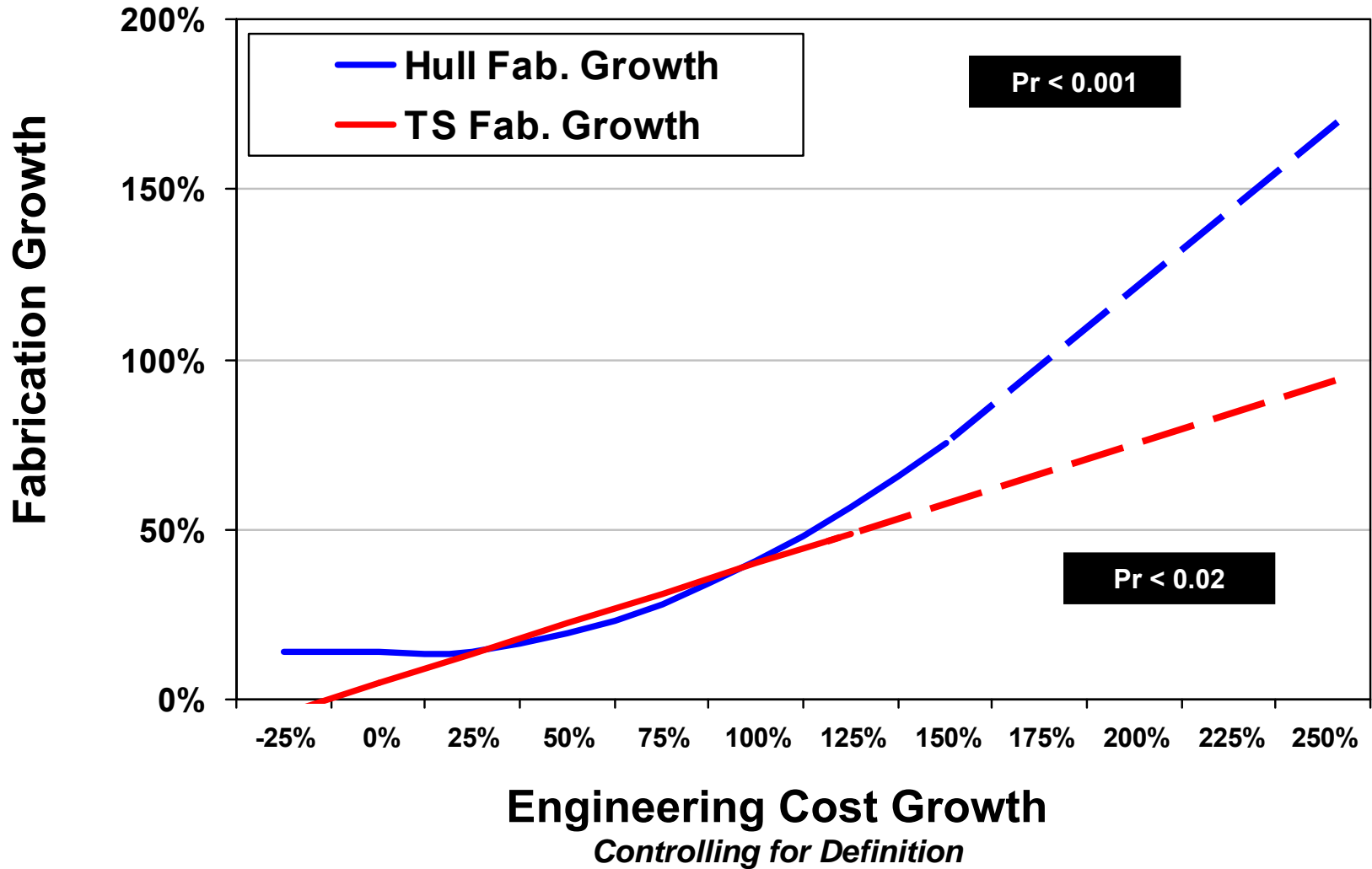
Slipping of Engineering Deliverables Adds to Project Costs

Late Engineering Deliverables Linked With Cost Growth



Cost Growth in Engineering Leads to Growth in Fabrication

50 Percent Growth in Engineering Leads to 20 Percent Hull/Topsides Fabrication Growth





Trade Off: Sail Away Slip and HUC Cost Growth

- As FPSO engineering and fabrication become disrupted, it becomes more difficult to meet the FPSO sail away date
- Once the sail away date is slipped by more than 25 percent, the project team is faced with two stark choices:
 - Carry onshore work into the offshore HUC campaign
 - > **HUC costs grow 300 percent, on average**
 - Miss the installation window
 - > **The FPSO comes on station over 1 year late**
- Results are not mutually exclusive



Engineering: The Root of Volatility

- **Unpredictability in the engineering phases disrupts the entire project, undermining cost and schedule targets, and is the herald of poor project performance**
- **Completeness of the work in Define/FEL 3/FEED sets the foundation for a smooth detailed engineering campaign and overall project success**
- **When this foundation is undermined, the whole project is at risk**



Outline

- **IPA: Who We Are**
- **Database**
- **FPSO Project Performance**
- ***Improving FPSO Performance***
- **Conclusions and Questions**



Improving FPSO Performance

Practices in Definition

- **IPA research shows that the work done in the Define Stage sets the project up for success in execution**
 - This is root cause of detailed engineering volatility
- **Two measures of completeness of project definition will be examined here:**
 - Engineering definition
 - Project execution practices
- **Some FPSO-specific practices in definition will also be investigated**



Engineering Definition

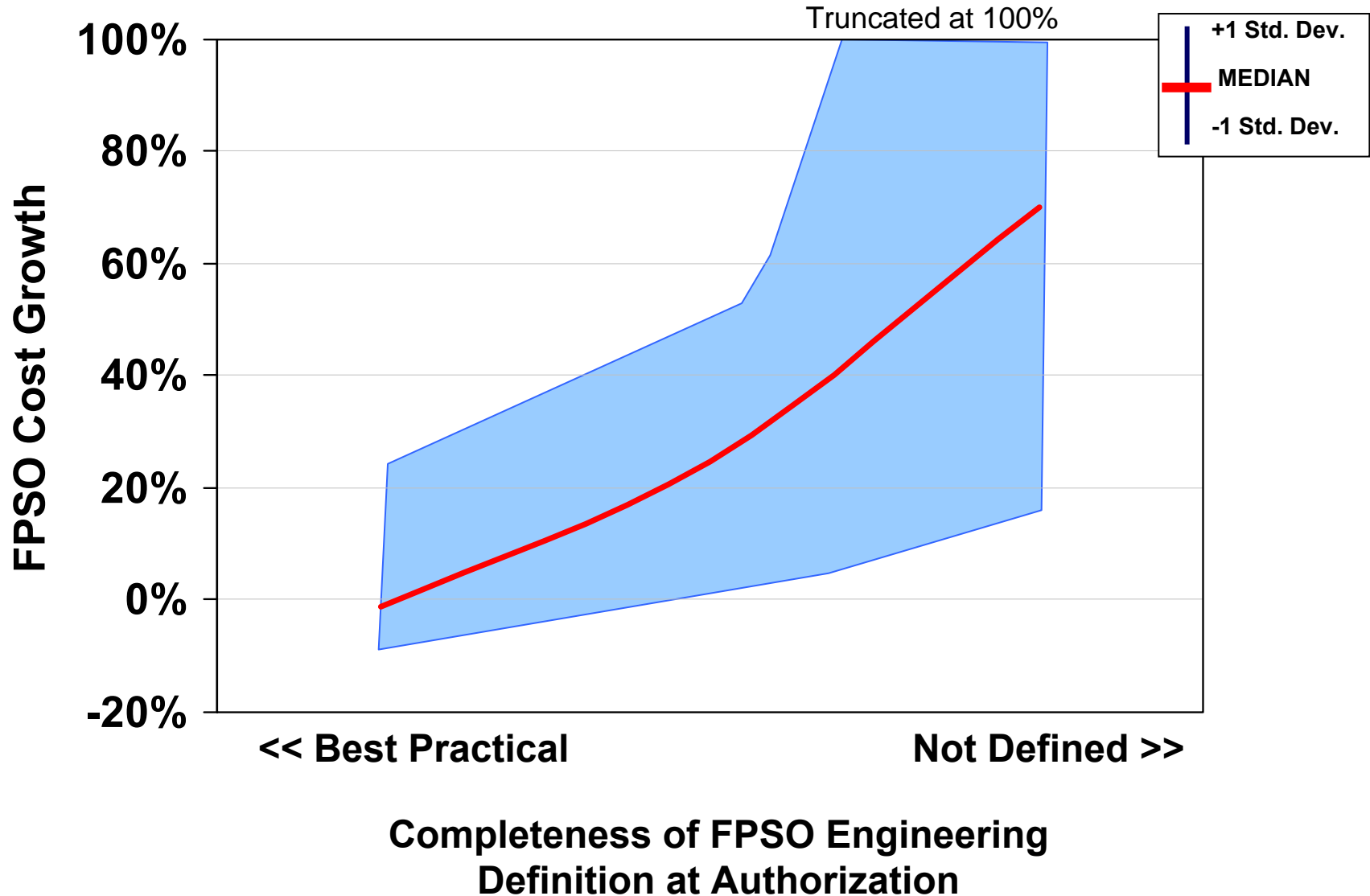
- **Addresses aspects related to the status of the process design (or conceptual design) and detailed design**
- **Considers the status of specific engineering design deliverables and participation by key stakeholders**
- **Reduces risks with proper definition because key engineering items are complete and provide sound basis for estimate**



Why Is it Important?

- **The design status at authorization can have a significant effect on project cost, schedule, and operability**
 - **Basis for equipment design and material quantity**
 - **Key element of an accurate cost estimate**
 - **Basis for alignment with production users regarding operations and maintenance**
- **Late changes to process design after the start of detailed design is costly and often hurts operational performance**

Skimp on Engineering Definition at Your Own Peril





What Is a PEP?

- **Project execution plan (PEP) is the result of defining the approach to be followed in executing a capital project**
- **The PEP answers some basic questions about the project**
 - **Who will participate, when will they participate, and what roles will they take?**
 - **How will the project be contracted, sequenced, managed, and controlled?**
 - **When will phase transitions and specific activities take place?**

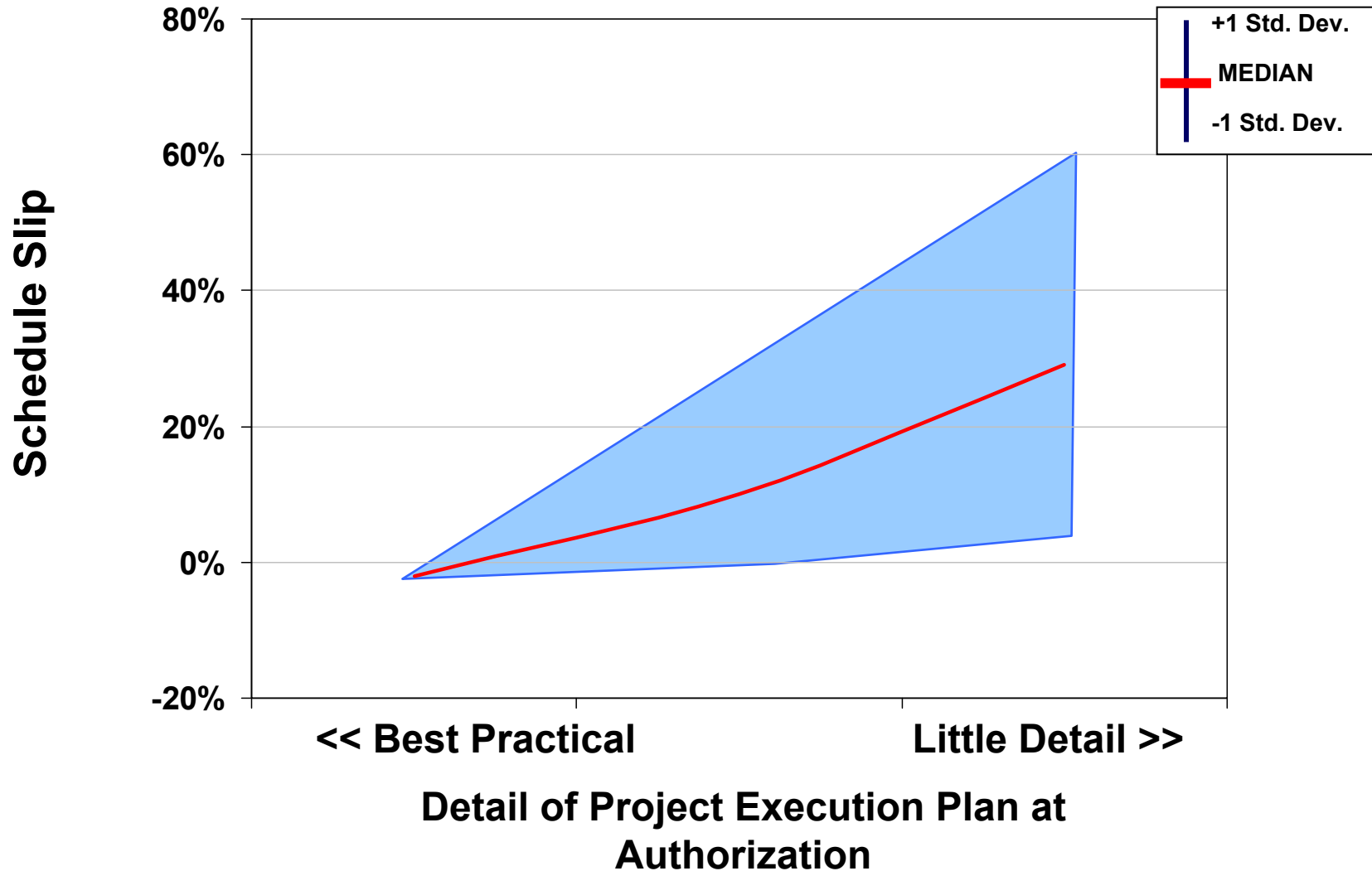


Why Is it Important?

- **The extent of planning work accomplished at authorization can have a significant effect on the ultimate project cost and schedule**
 - **Selecting the most efficient approach to execution in terms of sequencing and timing**
 - **Selecting the right staff and planning resource requirements**
 - **Selecting the contracting approach and procurement plan that best supports the staff and objectives**
 - **Identifying and mitigating project risks**
 - **Aligning cost estimate with execution approach**

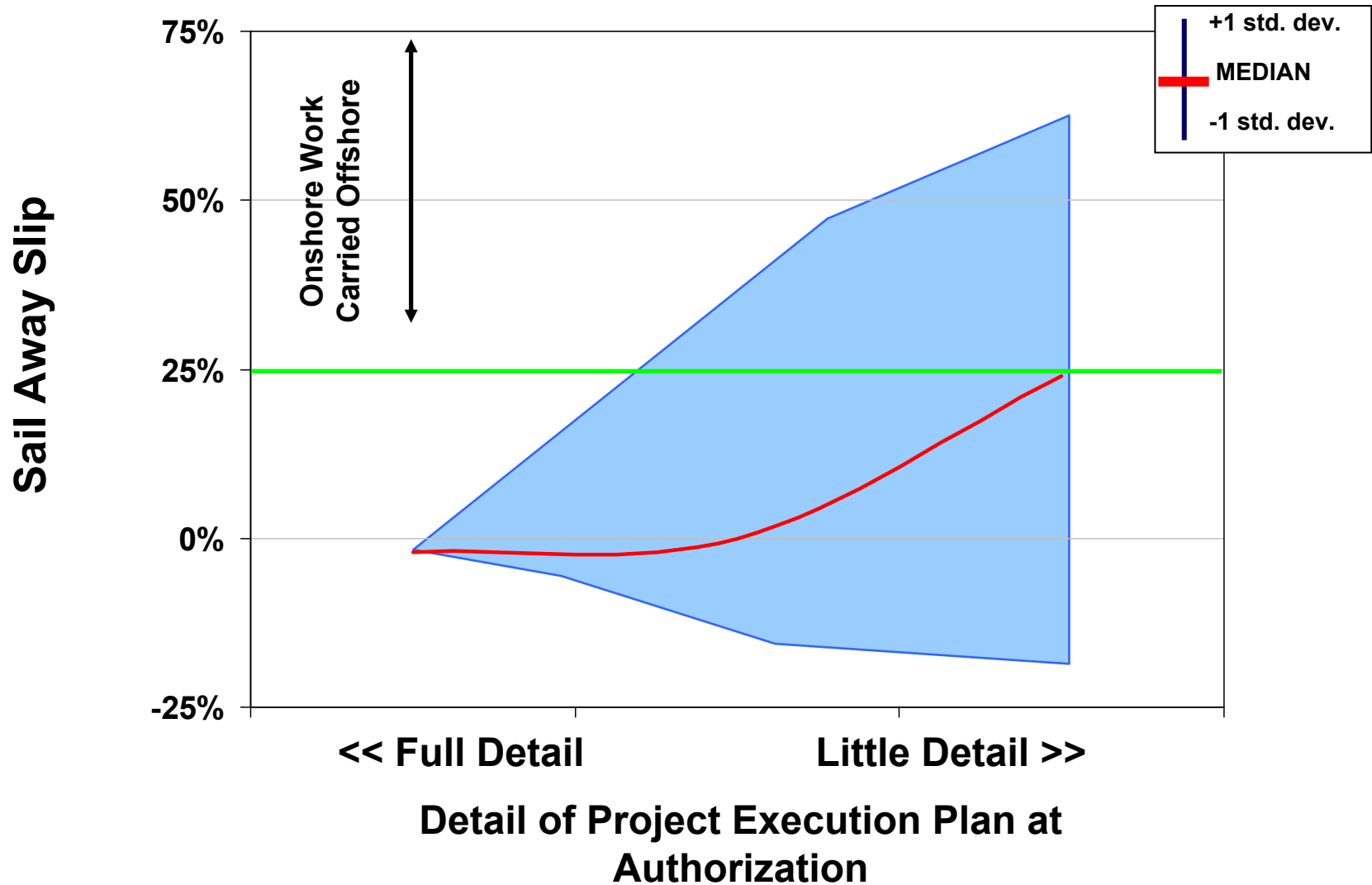
Greater Detail in the Schedule Gets Better Results

Those That Fully Develop Their Schedules Come in on Time



Greater Detail in the Schedule Gets Better Results

Those That Fully Develop Their Schedules Avoid Carrying Onshore Work Offshore



Tale of Two FPSOs

Two Similar FPSOs With Very Different Outcomes

FPSO #1

- Engineering Definition: Full Definition Completed
- PEP: Nearly Complete
- Planned Schedule: 0.90 (Slightly Aggressive)

FPSO #2

- Engineering: **Partially Defined, Key Deliverables Missing**
- PEP: **Incomplete, Missing Critical Details**
- Planned Schedule: 0.66 (Aggressive)

Tale of Two FPSOs

Two Similar FPSOs With Very Different Outcomes

FPSO #1

- Engineering: Engineering Definition Completed
- PEP: Nearly Complete
- Planned Schedule: 0.90 (Slightly Aggressive)
- Schedule Slip: 5%
- Actual Schedule: 0.95
- FPSO Costs Underrun: (-7%)
- Production Attainment: 105%

FPSO #2

- Engineering: **Partially Defined, Key Deliverables Missing**
- PEP: **Incomplete, Missing Critical Details**
- Planned Schedule: 0.66 (Aggressive)
- Schedule Slip: 32%
- Actual Schedule: 0.88
- FPSO Cost Growth: 61%
- Production Attainment: 63%



Additional Considerations for FPSOs During Definition

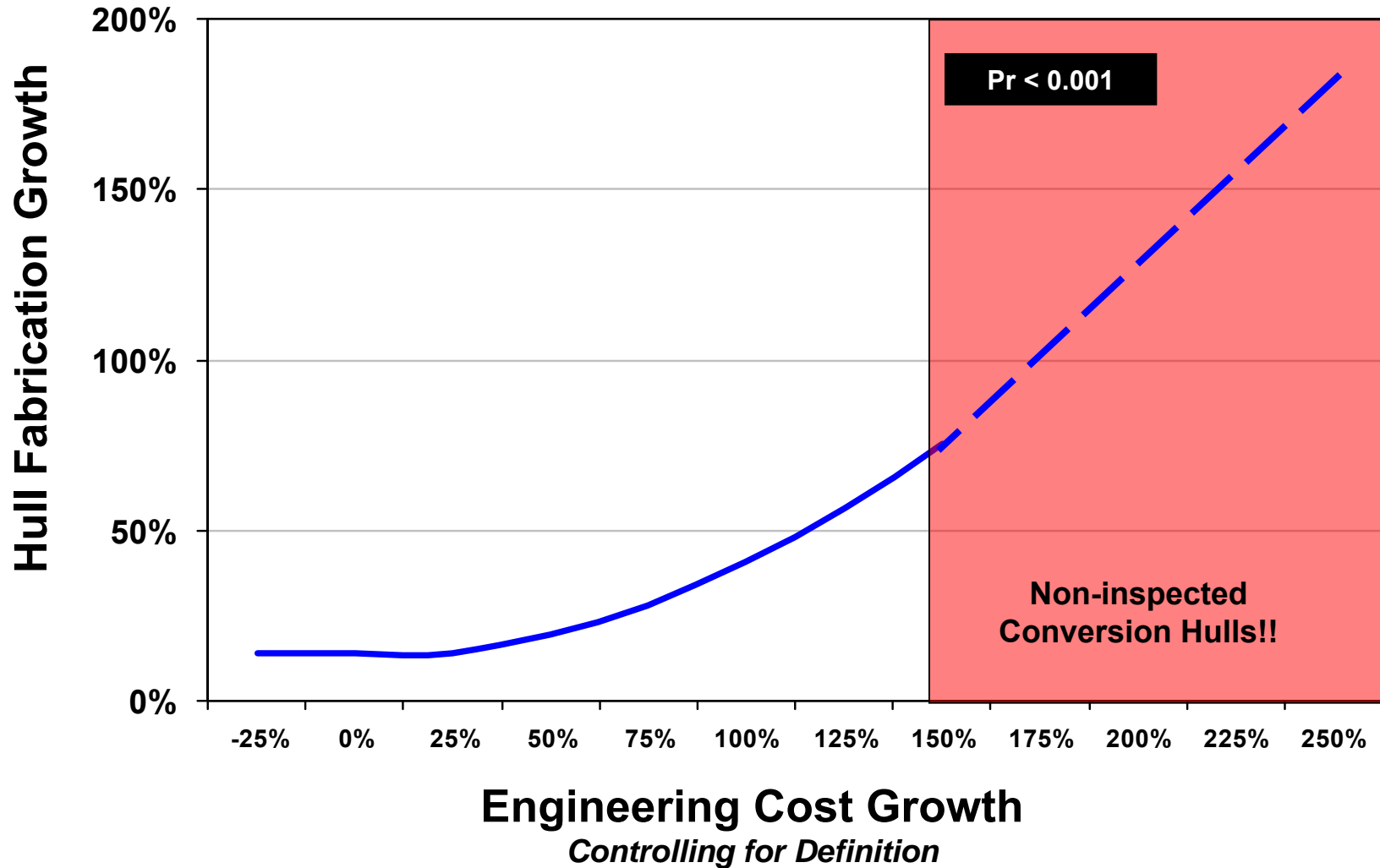
- **In addition to completing definition deliverables, IPA has seen the following activities and considerations influence FPSO outcomes:**
 - **Inspecting the hull to be converted prior to authorization**
 - **Aligning contractor capabilities with schedule expectations**



Inspect the Vessel Prior to Authorization

- **With conversion FPSOs, inspect the hull before preparing the cost estimate**
 - **Greatest source of cost growth and slip in conversion FPSOs is unexpected additional work in converting the hull**
- **After controlling for definition, 30 percent more cost growth for the FPSO**
 - **150 percent more cost growth in detailed engineering**
 - **112 percent more cost growth in hull conversion**
 - **60 percent slip in sail away date**

Failing to Inspect the Hull Drives Both Engineering and Hull Fabrication Cost





Do Not Set Your Contractors Up for Failure (1)

Attempting Difficult Work Quickly Often Leads to Disaster

- **When “stretching” contractor capabilities, aggressive schedules are not appropriate and are generally not achieved anyway**
- **Stretching means asking the FPSO contractor to do something new *relative to the contractor’s previous FPSO experience* in terms of:**
 - **Technology**
 - **Process**
 - **Size and capacity**
- **Schedules are considered aggressive when the planned execution duration is more than 15 percent faster than industry expectation**



Do Not Set Your Contractors Up for Failure (2)

Attempting a Difficult Thing Quickly Often Leads to Disaster

- **After controlling for FEL and schedule aggressiveness, these projects:**
 - **Slip their schedules by an additional 20 percent**
 - > **Sail away date slips by 43 percent**
 - **FPSO costs grow an additional 27 percent**

Tale of Two FPSOs

Two Similar FPSOs With Very Different Outcomes

FPSO #3

- Engineering: Engineering Definition Completed
- PEP: Fully Detailed PEP
- Planned Schedule: 1.11 (non-aggressive)
- **Stretched Contractor Capabilities**

FPSO #4

- Engineering: Engineering Definition Completed
- PEP: Nearly Completed PEP
- **Planned Schedule: 0.80 (Aggressive)**
- **Stretched Contractor Capabilities**
- **Did Not Inspect Hull During Definition**

Tale of Two FPSOs

Two Similar FPSOs With Very Different Outcomes

FPSO #3

- Engineering: Engineering Definition Completed
- PEP: Fully Detailed PEP
- Planned Schedule: 1.11 (Unaggressive)
- **Stretched Contractor Capabilities**
- Completed Early (-2% Slip)
- Actual Schedule: 1.08
- FPSO Costs Underrun (-2%)

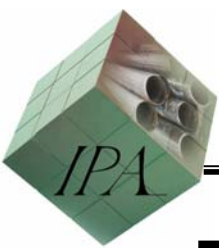
FPSO #4

- Engineering: Engineering Definition Completed
- PEP: Nearly Completed PEP
- **Planned Schedule: 0.80 (Aggressive)**
- **Stretched Contractor Capabilities**
- **Did Not Inspect The Hull During Definition**
- Slipped Schedule 50%
- Actual Schedule: 1.22
- FPSO Cost Grow by >100%



Outline

- **IPA: Who We Are**
- **Database**
- **FPSO Project Performance**
- **Improving FPSO Performance**
- ***Conclusions and Questions***



Conclusions

- **FPSO projects, while known for speed, do not have a history of cost and schedule predictability**
- **Performance in the FPSO detailed engineering campaign is an early indicator of overall project performance**
- **Lack of predictability can be brought under control by completing the deliverables during project definition**
 - **Strong engineering definition**
 - **Well-defined project execution planning**
- **Inspecting your conversion hull and honoring your contractors' limits can prevent FPSO cost growth and schedule slip**



Questions?

THANK YOU !!

For additional information, please contact David Rosenberg at +1-703-276-5481 or drosenberg@ipaglobal.com