REVISED FINAL

EXECUTIVE SUMMARY OF AN EARLY PACESETTER EVALUATION OF THE ALASKA STAND ALONE GAS PIPELINE PROJECT

Prepared for
Alaska Gasline Development Corporation

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Independent Project Analysis, Incorporated

44426 Atwater Drive
Ashburn, VA 20147

Telephone: +1 (703) 729-8300
Fax: +1 (703) 729-8301
www.IPAglobal.com

Prepared by Andrew Griffith & Carlton Karlik
Edited by Janice Handler
Reviewed by Randall Monk

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PREFACE

This document is an executive summary of a report issued by Independent Project Analysis, Inc. (IPA).[1] It summarizes IPA's analysis of the competitiveness of Alaska Gasline Development Corporation's Alaska Stand Alone Gas Pipeline Project (ASAP Project) using our Project Evaluation System (PES®).[2] The objectives of this analysis are as follows:

1. To provide feedback on the project's current status
2. To provide early benchmarks of project cost and schedule expectations
3. To present recommendations for risk reduction and performance improvement

The analysis systematically compares key parameters of the ASAP Project with the PES Process Plants Database, which consists of more than 12,000 projects conducted by more than 200 companies in the oil, chemicals, consumer products, and other capital-intensive industries during the past 25 years. The mechanism for comparison is a set of statistical models and database comparisons that are designed to evaluate the status of the project based on the following key areas:

- *Project Drivers*
- *Project Outcomes*

Please note that any scope changes to the project may alter or invalidate the analysis results discussed in this report.

Members of the project team supplied the information for this analysis in a meeting on November 3, 4, and 5, 2010, at Michael Baker's and the Alaska Gasline Development Corporation (AGDC) offices in Anchorage, Alaska. Project team members present at this meeting included Dave Haugen (Project Manager, AGDC), Michael Rocereta (Commercial Manager, AGDC), Dave Norton (Engineering Manager, AGDC), Bettina Chastain (Facilities Project Lead, Doyon Emerald), Mark Geiger (Lead Estimator, Prices Gregory), Bryan Thurlow (Facilities Estimating, Larkspur Associates), Cory Wilder (Pipeline Engineering Manager, Baker), Ron Baker (Project Engineer, Baker), Edgar Cowling (Technical Consultant, Baker), Shawn Snisarenko (Project Manager, Baker), Keith Meyer (Senior Engineering Advisor, Baker), and Kurtis Gibson (Deputy Director, Alaska Department of Natural Resources).

Andrew Griffith and Carlton Karlik represented IPA. Although members of the project team provided information, the interpretation and analysis are IPA's and do not necessarily reflect the views of those interviewed. For a more detailed discussion of IPA methodology, contact Andrew Griffith of IPA at +1 703 726-5375 or agriffith@ipaglobal.com.

[1] Andrew Griffith and Carlton Karlik, *An Early Pacesetter Evaluation of the Alaska Stand Alone Gas Pipeline Project*, IPA, AGD-0201-PAC, December 2010.
[2] PES is a registered trademark of IPA.

EXECUTIVE SUMMARY

IPA conducted a Front-End Loading (FEL) Workshop for AGDC's ASAP Project on November 3 and 4, 2010. The primary objective of this workshop was to assess the status of the project and to assist the project team in planning the project's definition phase. As part of that workshop, IPA also collected data on the project's project management and development practices and its cost and schedule targets. This report is an executive summary of IPA's early pacesetter evaluation that assesses the drivers and targeted outcomes of the ASAP Project.

KEY MESSAGE

The ASAP Project is now in the early stages of project definition and has a significant amount of work to complete before it will be ready to begin execution. The project faces a number of risks that must be proactively managed: the ASAP Project is a megaproject with the inherent difficulties of large, complex projects; the owner organization is a new venture with no existing project system; and the proposed schedule is short-cutting the project definition phase, which is a primary root cause of poor project performance. Our key recommendation is that the AGDC develop a comprehensive project development process specifically for the ASAP Project based on the stage-gated project delivery approach.

INDEPENDENT PROJECT ANALYSIS, INC.

IPA is an independent project management consulting and research company. Its corporate headquarters are located in the United States, with offices in the United Kingdom, The Netherlands, Brazil, Australia, Singapore, and China. It was founded in 1987 with the purpose of providing project research capability for the chemical process, petroleum, and minerals industries. The company is devoted exclusively to the analysis of capital projects as a field of empirical research.[3]

IPA's methodology provides a robust basis for capital project benchmarking and research. Its findings are based on actual industry data collected on a project-by-project basis. Using data collected directly from project teams, IPA builds carefully normalized project databases. Data collected on each project include cost history, schedule history, project scope and technologies, project team characteristics, and project management practices. Using these databases, IPA develops statistical models and builds comparison groups. These statistical tools make it possible to conduct quantitative analysis of individual projects, project system benchmarkings, and fundamental research.[4]

ASAP PROJECT OBJECTIVES AND SCOPE

The main project objective of the ASAP Project is to develop a pipeline transportation system to carry 500 million standard cubic feet per day (MMscfd) of natural gas and natural gas liquids (NGL) from Prudhoe Bay on the North Slope to a new gas terminal near Anchorage. The project scope includes a 737 mile long, 24 inch diameter gas pipeline (2,500 psig) from Prudhoe Bay to Wasilla, a 12 inch lateral pipeline that will supply gas to Fairbanks, a gas conditioning

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[3] For more information regarding IPA, please refer to the company's public website: http://www.ipaglobal.com.

[4] Griffith, Andrew F. (2006), "Improving Project System Performance Through Benchmarking," *2006 PMI Global Congress Proceedings*, Madrid, Spain, Project Management Institute, Newtown Square, PA, USA, May 2006.

plant that will treat the gas before entering the pipeline, and two NGL plants. One NGL plant is at the tie point of the Fairbanks lateral and the other is at the terminal point of the main pipeline. Finally, the scope also includes two compressor stations along the pipeline route.

At the time of the project interview in November 2010, the estimated total cost of the project was $7.8 billion (money of the day [MOD] with no forward escalation) and the targeted completion date was September 29, 2016.

MEGAPROJECTS

The ASAP Project falls into a class of projects often referred to as “megaprojects.” A project can be considered a megaproject if it meets one or more of three criteria. First, the project cost is greater than around $1.5 billion dollars (U.S.). The second is that the project can change its environment; that is, megaprojects can have major effects on the regulatory environment, local labor markets, political and social environment, and/or physical environment. And third, the project is a megaproject if it represents a major step-out of complexity or size for the owner company. Based on these criteria, the ASAP Project is clearly a megaproject.

Megaprojects bring with them a unique set of characteristics. They require huge physical and financial resources and stretch available resources to the limit. They are often built in hostile climates and in environments with inadequate basic infrastructure. They typically are high-profile within the company and in the politics of the region, with long schedules that result in more team member turnover than typical projects. They comprise several functional areas with separate project managers, schedules, and budgets, and include several major contractors, each with distinct contracting strategies. And finally, they have complicated communication matrices among functional areas, contractors, businesses, local and federal government agencies, etc. The ASAP Project clearly exhibits most of these features.

Unfortunately, megaprojects have a relatively high rate of failure. IPA studies have found that the challenges of megaprojects, combined with how Industry typically staffs and manages them, result in relatively poor performance when compared with other large capital projects.[5]

The ASAP Project faces significant risk because it is a complex megaproject that exhibits most of the characteristics listed above. In addition, the project’s owner organization is a new venture with no experience or established processes for developing and managing this class of capital project. Individuals within AGDC have some megaproject experience, but the organization itself has no established and tested procedures and practices for capital project development and execution.

PROJECT TECHNOLOGY

The project scope has technological innovation that introduces risk to the project. Each of the proposed technologies for the ASAP Project are commercially demonstrated and well understood. However, this will be the first gas pipeline to combine into one project this pressure (2,500 pounds per square inch gauge [psig]), length (737 miles), buried installation method in permafrost and intermittent permafrost conditions, and gas cooling to protect permafrost. IPA considers this a *new integration of existing technologies*.

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[5] E.W. Merrow, *Upstream Megaprojects Revisited*, IPA, UIBC 2010, November 2010.

Our research shows that combining innovative technologies with the complexities of a megaproject introduce compound risks that often surface in execution problems or even operational problems. In the case of the ASAP Project, one of the primary risks from its unique combination of technologies involves the permitting process. Permitting authorities may require some type of pilot program to demonstrate the feasibility of the design and installation concept, since it will be the first of its kind. At the time of the IPA workshop, the permitting requirements for validation of the concept were not known. Research has shown that problems with permitting frequently cause delays and costly changes to megaprojects.

PROJECT DRIVERS

Project drivers are practices that IPA research has shown have a statistically significant and positive effect on project performance. Through models developed using actual industry projects, IPA is able to benchmark project outcome performance for key performance indicators such as absolute cost and schedule, construction safety, cost growth, schedule slip, and operability. Based on these outcome performance measures, we then identify project practices that help to explain relative performance. Only practices that are statistically correlated with superior performance are identified as *Best Practices*.

Stage-Gated Project Definition Process

Research shows that following a stage-gated process for project development and delivery is strongly correlated with superior project results. The stage-gated approach involves breaking the life cycle of a capital project into defined phases with a clear set of deliverables for each phase. These deliverables must be completed before the project is approved to continue work on the next phase. The discipline of the stage-gated project system results in a repeatable process with periodic checks. The first major phase of a project delivery process is FEL or project definition.[6] IPA's generic model breaks the project definition process into three phases that ends with final project authorization and the start of production detailed engineering design: FEL 1 (Business Development), FEL 2 (Alternative Selection), and FEL 3 (Project Definition).

Based on data collected in the workshop and review of documents provided by the project team, we conclude that the ASAP Project is now in FEL 1 and will not complete this phase until July 2011, when AGDC submits the project plan to the Alaska legislature. We base this conclusion on the status of the business case, environmental and operational permit approval process, site investigations, engineering definition, and execution planning. When compared with industry *Best Practices*, the status of the ASAP Project is consistent with projects reaching the end of FEL 1.

[6] FEL is the process that considers a company's financial resources, facilities, people, and organizations in order to translate a company's marketing and technological opportunities into capital projects. The primary objective of FEL is to achieve an understanding of the project that is sufficiently detailed such that changes in the production engineering, construction, and startup phases will be minimized. FEL is the initial phase of a capital project and the results provide critical input into the final authorization decision. IPA research shows that the extent and quality of definition work completed during FEL prior to authorization is directly correlated with the ultimate project results. Better definition leading up to authorization drives superior project outcomes.

Front-End Loading Index

Given the status of the project (still in FEL 1), it is not expected to have fully applied Best Practices yet. The most important project driver is definition as measured by IPA's FEL Index. The FEL Index measures definition of a project as it progresses through the project definition phase and is broken down into three major categories: site factors, engineering definition, and project execution planning. This measure has an *Optimal* target for the end of FEL 2 and a *Best Practical* target for the end of FEL 3. Research shows that when projects reach the recommended levels of definition at each milestone, they typically have better cost, schedule, and operational performance than do projects that shortcut the gated process or authorize the start of execution without completing the appropriate definition. At the time of the FEL workshop, the ASAP Project's FEL Index was within the *Screening* range of project definition. This indicates that the project's definition is very preliminary and supports our conclusion that the project is in FEL 1.

Team Development

The project's level of team development is what would be expected given the current status of the project (FEL 1). The ASAP Project team is extremely lean with only about six full-time owner team members. The project team is supplemented by contractors for design, economic evaluations, estimating, and environmental permitting. As the project progresses into FEL 2, it needs to build a large integrated project team of people with a wide range of capabilities. Functional roles that are required include operations, maintenance, business, process design, project controls, construction management, procurement and contracting, quality assurance, health and safety, and permitting. In addition, comprehensive team development includes a clearly defined and specific set of project objectives, a formal risk analysis and mitigation process, and a roles and responsibilities document that includes all core project team members.

Value Improving Practices

The final project driver evaluated is the application of Value Improving Practices (VIP).[7] The ASAP Project is not yet in a position to implement a comprehensive VIPs program because the project is in FEL 1. However, one critical deliverable that should come out of FEL 1 is a clear VIPs strategy that (1) spells out which VIPs will be used in the ASAP Project, (2) schedules the appropriate time for each chosen VIP, and (3) estimates the resources required to properly apply each chosen VIP.

PROJECT OUTCOME TARGETS

IPA has developed industry benchmarks for key project outcomes. It is important to recognize the difference between a *benchmark* and an *estimate*. Benchmarks are data-driven metrics that tell what the industry average is for a specific metric, such as cost or schedule, controlling for basic project characteristics such as scope and location. An estimate, on the other hand, is a prediction of what a specific project will cost or how long it will take to execute. An estimate should reflect the practices and historical performance of the organization

[7] VIPs are out-of-the-ordinary practices used to improve cost, schedule, and/or operational performance of capital construction projects. Like FEL, these are important project drivers.

executing the project, taking into account unique aspects of the project scope or execution strategy.

Cost Targets

The ASAP Project's cost targets are conservative when compared with the industry benchmarks. The inside battery limits (ISBL) cost estimate for the gas plant is about 1.5 times higher than the benchmark for industry gas plants with similar functionality. There are two factors for which our cost analysis of the gas plant was not able to control. The first is the additional compression cost incurred by the ASAP Project gas plant. The specified outlet pressure is higher than is typical for gas plants in our model, and we recognize that the ISBL costs are affected by this higher pressure requirement. The project team was not able to estimate the cost for this additional compression. The second is the additional ISBL costs associated with building and operating a process plant on the North Slope. The extreme weather conditions drive higher capital costs such as enclosures and other process features like heat tracing. IPA's Cost Capacity Model is not able to adjust for these characteristics, which may explain some portion of the relatively high cost index.

The estimated cost effectiveness of the NGL plants' ISBL scopes is about 1.2 times higher than the industry benchmark, and the estimated cost of the entire pipeline is about 1.1 times higher than the industry benchmark after controlling for length, diameter, wall thickness, and route terrain as well as adjusting for local labor costs and productivity factors.

We note that the cost estimate was developed in May 2010 and is a high-level conceptual estimate. The purpose of this (FEL 1) cost estimate is to compare basic scenarios and to determine if the project shows enough economic promise to justify investing in the next project phase. This estimate should not be viewed as an accurate prediction of the final project cost, because the project faces significant risk of major scope changes, as it is still in the early stages of project definition.

IPA benchmarks are based on comparisons with industry projects that have similar functionality and scope, and we make adjustments for specific location differences in an attempt to create an "apples to apples" comparison. We adjust for local construction wage rates and labor productivity, and for unusual costs from executing a project in a particular location. However, the current ASAP Project cost estimate is a high level factored estimate and it is not possible to identify and adjust for all costs unique to construction on the North Slope (e.g. construction enclosures and restricted work hours). As a result, IPA could not reliably account for all location factors that increase the project's total costs relative to an industry average benchmark. Once a more detailed cost estimate and execution schedule is prepared for the project, IPA will be able to document and remove specific costs related to the extreme site conditions before making a comparison with industry average benchmarks.

Schedule Targets

As noted earlier in this summary, the ASAP Project is now in the first phase of project definition, FEL 1. Based on our experience and work with other major owners of capital projects that apply a stage-gated process, successful projects do not begin detailed design until late in FEL 3 once the conceptual design and basic engineering work are complete and a comprehensive project execution plan is in place. Therefore, our first observation regarding the ASAP published schedule is that the start of detailed design early in 2011 is very risky and is likely to result in wasted engineering costs; as project definition is developed, the detailed design would go through extensive and costly revisions and recycles. IPA data also show that starting detailed design too early in the FEL process does not save any time in the end because of the scope changes and errors that result.

The duration required by megaprojects of similar size to complete project definition (FEL 2 and FEL 3) is approximately 27 months (with a 50 percent range of 18 to 38 months). The duration for FEL is not only driven by technical definition and basic engineering, but also by issues other than technical design. Permitting requirements, right-of-way acquisition process, community relations issues, project size, and commercial issues all contribute to the definition duration.

Not captured in the industry benchmark is the requirement for an open season. Most megaprojects do not face this requirement and the expected FEL duration for the ASAP Project must include the estimated time for a successful open season. Based on feedback from the workshop, it is reasonable for the project to add as much as 6 months to the project definition schedule to account for an open season exercise, which would result in an industry average FEL duration of approximately 33 months.

The ASAP Project's schedule for the entire project is aggressive when compared with the industry average benchmark. When measured from July 2011 (start of FEL 2), the cycle time duration is 62 months, while the industry average cycle time for industry megaprojects is 75 months. The primary explanation for the aggressive schedule target is the extensive overlap of project definition and detailed engineering. However, IPA data clearly show that significant overlap in project definition and detailed engineering does not result in faster schedules. In fact, not completing project definition work prior to starting detailed engineering often results in significantly longer schedules as well as higher costs.

CONCLUSIONS AND RECOMMENDATIONS

Our primary conclusion from the analysis of the ASAP Project is that the project is now in FEL 1 and, based on comparison with similarly sized megaprojects, will require approximately another 2.5 to 3 years of project definition before the project will be able to develop an authorization-grade cost estimate and schedule. The estimate is subject to many changes and will depend on the specific requirements of both the permitting and open season processes.

Our analysis shows that the cost targets are conservative, while the overall schedule is aggressive. However, at this early stage of project definition, the targets are subject to change as the project scope and final execution strategy are further defined.

Based on our analysis, we offer one overall recommendation to help increase the likelihood of project success. At this early stage of project definition, the ASAP Project should invest in the development of a detailed and structured process for project definition designed specifically for the ASAP Project. This process should incorporate the Best Practices outlined in this executive summary and covered in the FEL Workshop. This recommendation involves many details on how the optimal project process should incorporate Best Practices for project development. We do not discuss these details in this executive summary; they are available from other IPA reports and presentations. However, some key elements that should be incorporated into the process are:

- Stage-gated project development process with clearly specified deliverables and authorization process for each gate, designed specifically for the ASAP Project. This process should also include the requirement to achieve *Optimal* definition at the end of FEL 2 and *Best Practical* definition at the end of FEL 3.

- Staffing plan for each phase of the project that includes robust representation from all key functional areas.
- Value Improving Practices (VIPs) plan that specifies which applicable VIPs will be used, along with a schedule and an estimate of resources required.
- Risk analysis and mitigation process and interface management plan.