EXECUTION STRATEGIES OF UNIQUE AND NEWLY INTRODUCED PROCESS UNITS

By Ali H. Al-Alaiwy, Rayed A. Al-Bassam

INTRODUCTION

Air Separation Units (ASU) are designed and installed for Saudi Aramco's grassroot Tanajib Gas Plant Mega Project to supply the facility's demand of Oxygen and Nitrogen by two identical units. The project is being executed through a Lump Sum Turn Key (LSTK) contacting strategy by a Saudi Aramco qualified Engineering, Procurement and Construction (EPC) contractor.

This major unit part of the project scope was identified as a challenge to the project execution by the project team since the selected air separation process is recently introduced to the Company with limited operational and design experience. Therefore, the project team has formulated several engineering solutions and procurement strategies to facilitate the execution of such major unit without jeopardizing the project's schedule, cost or quality.

The objective of this paper is to share the lessons learned for such scope execution and the best practices to address the associated challenges. The strategies shared in the paper can be applied in the execution of any major scope that have multiple interdependent components within, especially if it involves introduction of new process or technology.

PROBLEM STATEMENT – CHALLENGES

The main challenge of this major part of the scope is the lack of design specifications for the unit within the preliminary engineering documents. The preliminary engineering represented the unit as a whole with high level process information and performance specifications, but lacked details about the unit's components. Considering that the ASU is a newly introduced processing unit to the Company with limited previous experience to build on, uncertainty was introduced with scope definition, limitation of standard compliance, schedule constraints, interdependencies and interface challenges between the unit components. The project team has realized that executing this multi-million-dollar unit as whole would entail a significant risk to the project and hence mitigation plans and strategies are to be developed to prevent any impact on the project in terms of schedule, cost, quality and scope management.

MITIGATION PLANS

The project team has analyzed the situation and explored different engineering and procurement strategies to address the aforementioned risks and facilitate the execution of such major installation. The optimum

EXECUTION STRATEGIES **OF UNIQUE AND NEWLY** INTRODUCED PROCESS UNITS

By **Ali H. Al-Alaiwy, Rayed A. Al-Bassam**

strategy was to divide the engineering and procurement activities of the unit into five major components as follows;

- Air Compressors: Centrifugal compressors which are at the front end of ASU.
- Air Cooling System: Direct contact after coolers which utilize the plant cooling water system.
- Air Dryers: a set of Temperature Swing Adsorption (TSA) units and the associated auxiliaries.
- Cold Box: Cryogenic section of the ASU which includes heat exchangers, distillation columns, expander and process pumps.
- Storage and Vaporization: Sets of double walled storage vessels and bundles of atmospheric vaporizers.

Following extensive reviews of available licensors with proven designs and operating experience in such process, the project team decided that each of the unit components shall be designed and procured as an individual package with the condition to have the unit's design licensor provide all the engineering input to the EPC contractor who would manage the design and procurement of the other components in parallel. This approach has addressed the lack of established experience within the Company for air separation process by assigning the basic design of the unit to a specialized licensor. The team then short-listed licensors to be utilized during the EPC phase, and capitalized on their established knowledge to finalize the detailed design and procurement of the unit.

Furthermore, the project team carried out thorough stakeholder management throughout the execution of the ASU scope. The different Company organizations such as Project Procurement, Engineering Services and Gas Operations were appropriately involved in every step of the execution. This included the establishment of procurement strategy, identification of design and fabrication specifications and quality control requirements that were tailored for this unique cryogenic air separation process.

DESIGN AND PROCUREMENT DEVELOPMENT

As a result of the unit's scope division, the basic engineering was carried out for each of the components in parallel. The first purchase order was finalized for the Cold Box, as it was placed with the unit's design licensor considering the proprietary nature of the design and procurement of this component. This purchase order had an expedited process to review and verify the basic engineering for the remaining components. Based on that, material requisitions were subsequently finalized for all the remaining components and purchase orders were placed utilizing the Company's pre-established vendors lists for each type of commodity.

Each awarded vendor of the non-proprietary components, such as the Air Compressors, Air Cooling System, Air Dryers and Storage, was able to develop the detailed design and manufacturing plans with maximized compliance to the Company standards and project specifications, while adopting to the specific requirements of such a cryogenic

EXECUTION STRATEGIES **OF UNIQUE AND NEWLY** INTRODUCED PROCESS UNITS

By **Ali H. Al-Alaiwy, Rayed A. Al-Bassam**

service. Each of these components was developed as individual packages that had to meet certain process and performance parameters set forth by the unit's design licensor.

REALIZED BENEFITS

The division of scope has allowed the project to realize key benefits that improved the overall execution of the project's engineering and procurement phases. The first realized benefit was the ability of each awarded vendor to progress in each of the individual components, which include the engineering development, procurement progress and schedule compliance, due to their specific expertise within their assigned component.

As the non-proprietary components were awarded to the Company's pre-established list of qualified vendors for each component, the project immediately realized the benefit of maximized compliance to the Company's engineering standards in addition to the manufacturing and quality requirements. This has helped the project team to optimize time and effort for extensive engineering and quality reviews, and allowed the detailed engineering and fabrication to commence in-line with the project schedule.

Another realized benefit was the ability of the project's team to improve execution progress and scope control as a result of assigning each of the unit's components to dedicated and specialized vendors, with no progress distraction for unnecessary reviews or unclear scope definition. Furthermore, the team capitalized on the expertise of each component vendor in scope definition and control of their assigned component, which in turn helped in preventing scope creep for a unit with originally unclear scope definition.

CONCLUSION

The ASU scope division approach illustrated in this paper provided the project execution team with the ability to control the design, procurement and construction activities and therefore control of the overall project execution. Moreover, it has maximized the compliance to the Company standards and project's specifications, for a non-familiar process, while controlling scope.

It is recommended that preliminary engineering design to consider such division early in the project initiation phase, which would enable project teams and EPC Contractors to better estimate, plan and execute such projects. This is especially applicable for unique or newly introduced process units within mega projects.