

Panel Outbrief

**NSF Review of ATLAS High Luminosity
Upgrade Construction Progress**

August 18, 2021

1a - Review FDR panel recommendations and comment to NSF on whether they have been satisfactorily addressed

There were three major recommendations to the project at FDR: (i) clarify and document the requirements for LVPS radiation tolerance, (ii) establish verification and compliance matrices for QA/QC, and (iii) verify suppliers' capability to meet throughput assumptions. All of these recommendations were properly addressed by the project and are proposed to be closed.

1b - Have pre-construction technical activities that were separately funded by NSF through the ATLAS operations program been satisfactorily completed?

Yes

2a - Implementation of the Project Execution Plan, project controls and financial reporting, including sub-awardee oversight. Examine the current version of the Project Execution Plan, representative change control actions, and recent Earned Value Management Reports and advise NSF on their use as effective management tools.

ATLAS is effectively managing a well-developed project execution plan using a classic set of tools and systems which include a change control mechanism, established subaward and contract management systems, an invoice approval system and an earned value management system for the tracking, statusing and reporting of progress, cost incurred and variances.

2b - Financial tracking of COVID and non-COVID costs & cumulative COVID costs-to-date

ATLAS appears to be appropriately collecting and reporting the actual costs of internal work performed and is generally receiving current actual costs from its sub-awardees which are also included in its cost reports. An EVMS surveillance review being conducted this week by the Large Facilities Office will verify data integrity and reporting.

The appropriate inclusion of accruals is required in some cases and a necessary system for reconciling accruals with actuals is in place.

In addition, ATLAS uses a reasonable approach for estimating the amount of actual cost incurred due to the effects of COVID and segregates that amount in its EVMS reporting. BCPs are examined within the project and discussed with NSF staff to assure costs are properly recorded.

2c - Risk management process, including completeness of current projections of risk and potential mitigation costs and the adequacy of the contingency budget and schedule to mitigate future non-COVID risks. Advise NSF on the completeness of the risk register in identifying currently foreseen non-COVID related threats and opportunities with appropriate probabilities and estimated cost and schedule

Overall, the risk process and register is generally complete and well thought out but some minor improvements are suggested (see report). The risk register captures threats appropriately and the related potential cost and schedule non-COVID impacts.

2d - Adherence to the QA/QC processes presented at FDR. Advise NSF on whether it is being implemented as intended

The QA/QC documentation is captured in the DocDB archive and represents a satisfactory implementation of QA/QC concepts and practice. The documentation includes QA/QC narratives for each WBS deliverable item, as well as the corresponding Verification Matrices.

While the Verification Matrices properly frame the verification process, compliance estimates are not included

ATLAS experiment will review QA/QC before production starts.

3a - Examine and comment to NSF on COVID impact modelling and assessment by the project of forecast COVID-related cost and schedule impacts. Advise NSF on the realism of assumptions and the credibility of the models used, and the completeness (based on current understanding) of additional schedule and budget needs. Advise NSF on the timing for when additional NSF funds to offset pandemic impacts are likely to be needed within the project

ATLAS presented its approach for assessing a potential cost and schedule effects due to the current COVID delay, reduced future efficiency and COVID dependent risks.

In its model, ATLAS appropriately includes currently foreseeable risk and uncertainty assumptions related to COVID. Its modelling approach is reasonable and produces a credible range of potential cost and schedule adjustments for consideration.

At this time, the model does not assess the effects of a potential schedule delay by CERN. It appears that if such a delay does occur it appears that it will extend the installation schedule by not less than one year.

While increased vaccination rates are encouraging, all of the long term worldwide lasting effects of COVID and its variants are currently unknowable.

3b - Examine and comment to NSF on the realism of plans for the coming project year (10/1/21 – 9/30/22) based on current understanding of COVID pandemic impacts and mitigation strategies, and lessons learned from the first year of construction

The project has carefully gathered data on the impact of COVID and has thought carefully about what this effect will be in the coming year. However, as noted in presentations to the panel, the evolution of the COVID pandemic is fundamentally uncertain at this time. Based on the experience to date and on the project's detailed approach to this problem, the project plans for FY2022 are as well formulated and realistic as possible at this time.

3c - Examine the forecast risk-adjusted expenditure and obligation profile (including pandemic-related risks) for the coming fiscal year and advise NSF on the adequacy of its substantiation. Make recommendations for modification, if appropriate.

The project is finishing GFY21 with an estimated carryover (excluding NSF-held contingency) of about \$7.5M

Based on the project's expected spending in GFY22 (including the estimated GFY22 cost effect of COVID), it is currently forecasting a carryover of about \$3.3M by the end the next fiscal year. Coupled with the pool of unreleased contingency, these amounts appear adequate for ATLAS to confidently execute its plan through GFY22.

3d - Do the materials presented by the project provide adequate substantiation for re-baselining within the next 6-12 months? If not, what criteria must be satisfied as a precondition for conducting a re-baselining review that would confidently bound estimates for additional schedule and budget based on current understanding?

Some of the key underlying assumptions needed for a rebaseline appear to be fluid at this time and may evolve over the next 6 to 12 months. These include assumptions about the overall direction of COVID and its effects on the ATLAS supply base and associated lead times.

In addition, a delay in CERN's schedule may create an opportunity to replan activities affected by COVID in order to take advantage of additional float.

We recommend that these factors be weighted together with the time phased need for possible additional funding due to COVID in GFY22 and beyond before proceeding with a rebaseline exercise.

A minimum requirement for rebaselining is an updated CERN LHC schedule.

4a - Comment on the adequacy of progress and planning across all Level 3 Work Breakdown Structure (WBS) elements, considering COVID-19 uncertainties. Identify non-COVID-related impediments to technical progress and comment on the adequacy of plans and efforts exerted by ATLAS to mitigate their impacts.

The progress and planning of the subsystems are adequate.

4b - Comment on the level of engineering and scientific labor that is being applied to support Level 0 Trigger development, as evidenced by satisfactory technical progress in firmware development

Given the significance of the changes to the design of the trigger, it is recommended that NSF conduct a separate review of the trigger upgrade once the design changes are complete focusing on track triggering. This review should reevaluate the technical design of the project, its cost, and the revised schedule.