

HYTEC Monthly Progress Report – Submitted to SLAC

December, 2000

1. Monthly Management Review

Progress Report

Monthly progress report submitted January 5, 2001 for work performed by HYTEC during the month of December.

HYTEC Funding

Current funds for HYTEC work have been exhausted, as of December 31, 2000. The last invoice included December labor expenses and do not include outstanding purchase orders for a significant amount of materials. This will be resolved early January.

2. Schedule

The HYTEC schedule has been reviewed to determine the feasibility of accelerating the schedule to accommodate the Tracker PDR (June/July?) prior to the Instrument PDR (Aug). We will not be able to accelerate the schedule to accommodate the Tracker PDR. We will present, at the Tracker PDR, a snapshot in time and will present all additional work at the Instrument PDR, to demonstrate feasibility.

Currently, HYTEC is not meeting schedule requirements as presented in the Microsoft Project schedule provided to Tom. The carbon coating issues, material procurement for the first prototypes and fabrication of the first prototypes are behind schedule by about 1 month. However, we expect to recover this time by accelerating the back end of the schedule, because of up-front material procurement of long lead items, such as the carbon-carbon material. The net impact on schedule should be minimal.

3. Tracker Tower Level Modeling

Standard Tray Modeling to Determine CTE Effects of the Al Core

The CTE analysis of the GLAST sandwich structure continued. A method to calculate the CTE of a sandwich structure was derived and compared to old test data. The method was used to estimate the CTE of the GLAST trays. This analysis shows that the CTE of the aluminum core has some influence on the tray CTE, because of the thin face sheets. The tray CTE was calculated to be ~2 ppm/degC, which is closely matched to the silicon. This however can increase the thermally induced stress in the silicon, because the constraint on the converter materials is reduced. This CTE estimate will be verified by prototype testing of a single tray. Further tray/payload analysis is required to fully understand the

impact of the tray CTE combined with the payload modifications. A summary report is expected in January.

Bottom/Top Tray Modeling

FEA of the bottom tray has been completed. The analysis indicates that the core thickness must be about $\frac{3}{4}$ of the tray thickness to ensure adequate stiffness of the bottom and top trays, and avoid impact with adjacent trays during liftoff. These changes will be incorporated into the design.

Tracker/Instrument Modeling

A simplified model of the Tracker tower has been delivered to SLAC. This model is to be included in the Instrument model for system level analysis. The model represents the proper stiffness and mass of the Tracker tower. The proper bending stiffness of the trays is represented, however there are some questions about the shear stiffness. The shear stiffness of the tower, as it effects the grid, is under investigation and resolution is expected early in January. HYTEC is working closely with SLAC analysts to resolve such issues.

HYTEC will need input from this model to resolve Tracker tower design issues. Design requirements will be specified by the Tracker team and given to systems engineers for signoff. These design requirements are critical to ensure the design meets some criterion after prototype testing.

Tracker Tower-to-Grid Interface Modeling

The bottom tray to grid flexure mount concept has been included in the Tracker tower model. Fundamental frequency calculations were performed to estimate the impact on the tower response to the random vibration environment. The results indicated that the Tracker tower, under fixed base boundary conditions, would not effect the tower stiffness enough to warrant concern.

4. Tracker Documentation

Drawing Package

All Tracker mechanical structure drawings have been converted to metric dimensions. These drawings are using metric dimensions and standards as the primary dimension and english units are included as reference only.

A decision was made to use HYTEC drawing numbers on all HYTEC drawings and include the LAT drawing numbers on each drawing for reference only. This decision was made to maintain continuity between assemblies and component parts within the drawing package during fabrication and assembly.

Drawings are currently being officially released through HYTEC. We have not received the appropriate authorization within the SLAC system to properly release drawings through SLAC, however this is expected in early January.

The drawing package is available on the HYTEC/GLAST web site and will be updated as drawings are released.

5. Tracker Tray Closeout Development

Particulate Pollution Issues

Time constraint limited the amount of effort dedicated to addressing the coating issues. A preliminary test plan was put together and reviewed. It was believed that limitations in the testing approach would have produced questionable results. Therefore, a new plan is being put together. Testing is expected during January so that a decision on the coating can be made.

Carbon-Carbon Material Procurement

The first lot of the material order, expected in December, has been delayed. The material has apparently warped during one of the heat treat cycles. The severity of the problem is unknown at this time and the impact on material performance and delivery schedule will need to be assessed. Secondary heat treat operations are scheduled for early January to minimize the warping. The material is expected to be delivered mid- January.

The additional material for Pisa has been ordered. The order was placed by SLAC due to unavailable funds at HYTEC. The order is being processed with the second portion of the HYTEC material procurement and is expected late January.

Closeout Frame Development

The closeout frame design is continuing to progress. The closeout frame is being modified to accommodate changes to the MCM, and include features used for alignment during assembly. A simple corner joint concept has been prototyped to validate the feasibility of the concept to the design.

6. Face Sheet Material Selection

Face Sheet Material Purchase

The face sheet material has arrived at PCI and is ready for lay-up. The standard tray face sheet drawing has been sent to PCI. The order is expected to be completed and delivered around the end of January.

Of the total, ten 6-ply face sheets (8 will be machined to net shape) will be delivered to PISA for SuperGLAST tray fabrication. The remaining panels will be kept at HYTEC for tray prototype fabrication. This includes the face sheet materials for the SLAC prototype trays.

7. Tracker Tray Sidewall Design

Material Property Testing

Mechanical property results for both the YS-90A and P30 C-C samples have been received. The results for modulus indicate similar results for both materials with P30 C-C having a slightly lower modulus in most cases. Strength results indicate that the ultimate strength of the P30 C-C is roughly half the ultimate strength of the YS-90A.

Thermal conductivity results have been received. In-plane results are better than expected. Both the YS-90A and P30 C-C samples are showing in-plane

conductivity values that are as much as 30% higher than estimated. This is primarily due to the inclusion of the structural fabric ply's on the outsides of each panel. The thru-thickness conductivity of the P30 C-C is giving results that are almost an order of magnitude smaller than expected. We are suspect that the test method is not satisfactory, however the thru-thickness conductivity is low to begin with and should have little effect on the thermal performance of the panel, when attached to the towers. This is begin verified.

Pullout testing has begun and is expected to be completed early January. Preliminary results indicate that we will not have any difficulty meeting the load requirements. Shear-out tests are schedule for January.

8. Tracker Meetings and Tracker Technical Discussions

Weekly Tracker Meetings

HYTEC participated in all weekly tracker technical meetings with SLAC and UCSC, during the month of December.

Weekly Instrument Meetings

SLAC and HYTEC have scheduled weekly integration meetings to discuss Tracker to Grid integration issues. HYTEC has participated in each of the meetings as planned.

9. Tower Clearance & Alignment and Silicon-to-Tray Alignment

No progress to report.

10. Bottom Tray Attachment to Grid

A flexure concept for the Tracker tower-to-grid attachment has been developed. The design calls for a two-bladed flexure at the mid-span of each side of the tower to allow thermal growth in one direction, and a pivot-flexure in each corner to simulate a pinned connection and allow thermal growth in two directions. The flexures are made of titanium and use minimum space below the tower. Supporting calculations have been verified with FEA to validate the design concept. Additional concepts are under consideration to minimize cost and fabrication.

11. Tray Assembly

The assembly procedure is being modified to simplify the process. A single frame assembly jig is being investigated to allow repeatability of trays. The design details are expected to be completed in early January to allow fabrication of an assembly jig, to begin fabrication of tray prototypes.

Previous assembly concepts included post-bonding corner post bushings into each corner and located with an assembly jig. This concept required the use of extremely small bushings in the corners, and reduces the amount of parent carbon material in each corner to undesirable thicknesses. As a result, we are currently reconsidering post-machining the corner post holes, after fabrication of the trays. This issue is to be resolved during the month of January.