

## **HYTEC Monthly Progress Report – Submitted to SLAC**

**February, 2001**

### **1. Monthly Management Review**

#### *Progress Report*

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

#### *HYTEC Funding*

HYTEC funding issues were resolved during the month of January. Funding has been secured through FY'01 (September, 2001).

### **2. Tracker Tower Design**

#### *Tracker Tower Design Requirements*

Work has begun to define the TKR tower design requirements. These will be finalized in March.

#### *Tracker Tower Alignment*

There has been a great deal of discussion regarding the over-constraint of the sidewalls. HYTEC has spent a great deal of time performing a tolerance stack-up analysis to quantify the problems in addition to performing some tests to qualify the design concept. It is our opinion that the current tower assembly concept is viable and will satisfy the TKR tower requirements, without the use of expensive tooling. The schedule is very tight between now and PDR, therefore, we intend to proceed with this concept in order to build a prototype tower, which will validate the design concepts. We are also intending to develop alternate design concepts as a backup to reduce risk to the schedule.

### **3. Tracker Tower Level Modeling**

#### *Tracker/Instrument Modeling*

The TKR tower tray models have been finalized to update geometry and material property data. The tray sizes have been adjusted to be 368.5mm on a side, as per the current design. Material property data has been updated to reflect the results obtained from recent material testing. A summary report of the TKR tower analysis is being written and is expected to be completed in the month of March.

#### *Tracker Tower-to-Grid Interface Modeling*

We have received reaction force information from SLAC and will include this information in the TKR tower FE models. This is not a high priority at this time and will be reviewed in March.

#### **4. TKR CAD Modeling/Drawings**

##### *Solid Model*

The TKR tower solid model is being updated. CAD models of the MCM cables have been received from SLAC and are being incorporated into our model. This is to verify clearances and commonality with SLAC models.

A model of a single cell of the support grid is being included into the solid model. This will allow for interface issues to be addressed and coordinate attachment features with SLAC.

The solid models will be updated and completed during the month of March.

##### *Drawing Package*

It appears that we have worked out the bugs of the CyberDocs program at SLAC and have been able to gain access. We will need to work with Tom during March to finalize the drawing release process through the SLAC DCC.

#### **5. Tracker Tray Closeout Development**

##### *Particulate Pollution Issues*

Strength tests were completed during the month of February, which quantify the bond strength of two adherends coated with parylene. The results indicate a significant reduction to the bond strength. As a result, bond areas will be masked during coating operations to ensure maximum bond strength between the closeout walls and face sheets.

Additional testing is planned during March to verify the coating thickness. The vendor specifies a minimal thickness of several microns for particulate lockdown. Tests are planned to verify this and investigate wear on the coated surfaces.

##### *Carbon-Carbon Material Procurement*

The final shipment of C-C material has not arrived at HYTEC as of February. The material has been cut into its final dimensions and has been shipped out for a final densification and heat treating processes. The panels are expected to be delivered to HYTEC on March 23, 2001.

##### *Closeout Frame Development*

Two significant modifications to the closeout frame were made this month. Changes were made to the structural closeout wall to accommodate cable splices and support the cable during launch to avoid contact with the adjacent MCM walls. Changes were also made to the closeout wall insert configuration. The new concepts provide anti-rotational features to be used during insert assembly.

Closeout frame fabrication drawings are currently being updated to include the proper machining tolerances to meet the tower alignment requirements.

The closeout frame insert design is being investigated. We have been looking into the availability of off-the-shelf products, as well as finding a screw house that can fabricate custom inserts in short lead times. We are also investigating the material selection of the closeout wall inserts, Titanium vs Aluminum. Titanium

has greater strength, but at a higher cost. Our analysis is indicating that the pullout loads on the inserts will be fairly low. For this reason, we may be able to use 6061-T6 aluminum without helicoil inserts, as a cheaper alternative. We are planning some pullout testing of 6061-T6 aluminum female threaded inserts to quantify the thread strength. This is expected the first of March.

#### *Closeout Frame Prototyping and Testing*

The first closeout frame prototype has been submitted for fabrication. These closeout walls include only those features necessary to assemble a closeout frame, using the assembly tooling. The intent of this test is to begin assessing the assembly procedure and test the closeout frame as a stand-alone component. We intend on testing the frame to failure to assess the handling capabilities of the closeout frame as a bonded structure without face sheets. The prototype is expected mid-March and testing will begin immediately.

Closeout frame coupon testing has begun and will continue through March and into April. The first set of tests include corner joint tests to verify the bond strength of the corner joint concept. The second set of tests will be dedicated to insert qualification.

### **6. Face Sheet Material Selection**

#### *Face Sheet Material Purchase*

The face sheets have not been delivered. We were expecting them mid-February, however delays were inevitable because of a machine failure at PCI. The current delivery date is early March, however they are not needed until we begin tray prototype fabrication.

One modification was made to the face sheets. The cable run was modified, which changed the outer dimensions of the face sheet. This change has not affected the end product and will be included on the prototype trays.

### **7. Tracker Tray Sidewall Design**

#### *Material Property Testing*

All mechanical testing of the two sidewall materials is complete. The tests included modulus, strength, conductivity, pullout strength (with and without inserts), shear-out strength (with and without inserts), and surface roughness. The results are being consolidated and summarized in a report. A material selection will be made in early March in order to ensure that the sidewall procurement does not effect TKR tower prototype testing schedule.

## **8. Contact Resistance between Sidewall and Closeout**

The pressure between the sidewall and thermal boss was measured using a pressure sensitive tape. The tape has been sent to a vendor for analysis and is expected to be returned in March. We are hoping that this will give a good estimation of the contact resistance as well as show continuous contact along the thermal boss.

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

The TKR tower clearance tolerance stack-up analysis has been completed. A summary report of the results is being written, and will be completed mid-March. The analysis shows that the tray stack-up can meet the TKR tower alignment requirements if the machining tolerances are very tight. Tolerances on the order of 0.0005" are required and can be achieved with today's CNC machines and standard metals. However, the introduction of carbon fibers makes this more difficult. We have been contacting vendors to see if these machine tolerances can be held with our C-C materials. In some instances, we have sent small samples to the machine shops to get measurable results of tolerance. We expect to have these issues resolved during March. Alternate concepts are available to support the stack-up method of assembly.

## **10. Top Tray Design**

No significant progress to report. HYTEC is still waiting for feedback to see if the top tray design concept can accommodate cable termination, as proposed by UCSC.

## **11. Bottom Tray Attachment to Grid**

HYTEC has received reaction force results from SLAC. Location points are at the eight flexure mounting points. These results will be included in the TKR tower model at HYTEC to calculate stress levels. This analysis will be performed during March and April.

An alternate corner flexure design is being considered. The concept is a blade flexure acting at a 45 degree angle from either of the two mid-span flexures.

## **12. Tray Assembly Tooling**

HYTEC received quotes from four machine shops for the invar tooling concept. The quotes were very expensive with the lowest being \$7 K and the highest being \$13 K. To reduce costs, graphite tooling was considered. The fabrication costs for graphite tooling were an order-of-magnitude cheaper than the invar. Therefore, graphite tooling was purchased in the month of February. The delivery date for this tooling is March 9<sup>th</sup>. We will begin evaluating the assembly tooling and assembly procedure at that time.

### **13. 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 January.

#### *Weekly Instrument Meetings*

HYTEC has participated in all the weekly instrument integration meetings with SLAC to discuss Tracker to Grid integration issues.

#### *Engineering Meetings*

An engineering meeting with SLAC and INFN was held at HYTEC on February 1<sup>st</sup> & 2<sup>nd</sup>.