

TITLE: *Shearographic non-destructive evaluation of space shuttle thermal protection systems*

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Abstract:

Preliminary results of shearographic inspections of the **shuttle** external tank (ET) spray-on foam insulation (SOFI) and solid rocket booster (SRB) Marshall sprayable ablative (MSA-2) epoxy-cork thermal protection systems (TPS) are presented. Debonding SOFI or MSA-2 **damage** the orbiter 'belly' **tile** and exposes the ET/SRB to thermal loading. Previous work with the ET/SRB showed promising results with shearography. The first area investigated was the jack pad close-out, one of many areas on the ET where foam is applied at KSC. Voids 0.375 inch were detected in 1.75 inch thick foam using a pressure reduction of less than 0.4 psi. Of primary interest are areas of the ET that directly face the orbiter **tile** TPS. It is estimated that 90% of **tile** TPS **damage** on the orbiter 'belly' results from debonding SOFI during ascent. Test panels modeling these areas were manufactured with programmed debonds to determine the sensitivity of shearography as a function of debond size, SOFI thickness and vacuum. Results show repeatable detection of debonds with a diameter approximately half the SOFI thickness at less than 0.4 psi pressure reduction. Preliminary results are also presented on inspections of MSA-2 and the remote manipulator system (RMS) honeycomb material

Major Subject Terms:

NONDESTRUCTIVE TESTS ● SHEAROGRAPHY ● THERMAL PROTECTION ● EXTERNAL TANKS ● SPACE **SHUTTLE** BOOSTERS ● EPOXY RESINS ● CORK (MATERIALS) ● THERMAL INSULATION ● INSPECTION

Minor Subject Terms:

FOAMS ● DEBONDING (MATERIALS) ● TILES ● SPACE **SHUTTLE** ORBITERS ● VOIDS ● PRESSURE REDUCTION

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