SAND2008-3812C

Fabrication of Second Stage Conduit Cable - Stars Program

Sandia National Laboratories
Organic Materials, Dept. 2453-1

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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DEPARTMENT CAPABILITIES

- **Encapsulation:**
  - Potting Of Components
  - UV Conformal Coatings
- **Bonding:**
  - Various Types Of Dissimilar Surfaces, Surface Prep.
  - Primers
  - Ultrasonic Cleaners
  - Plasma Chambers
- **Composites:**
  - Graphite
  - Kevlar
  - Nickel
  - Fiberglass

MATERIALS

- Epoxies
- Polyurethanes
- Silicones
- Polysulfides
- UV Conformal Coatings

STRATEGIC TARGET SYSTEM (STARS)

What is “STARS” ?

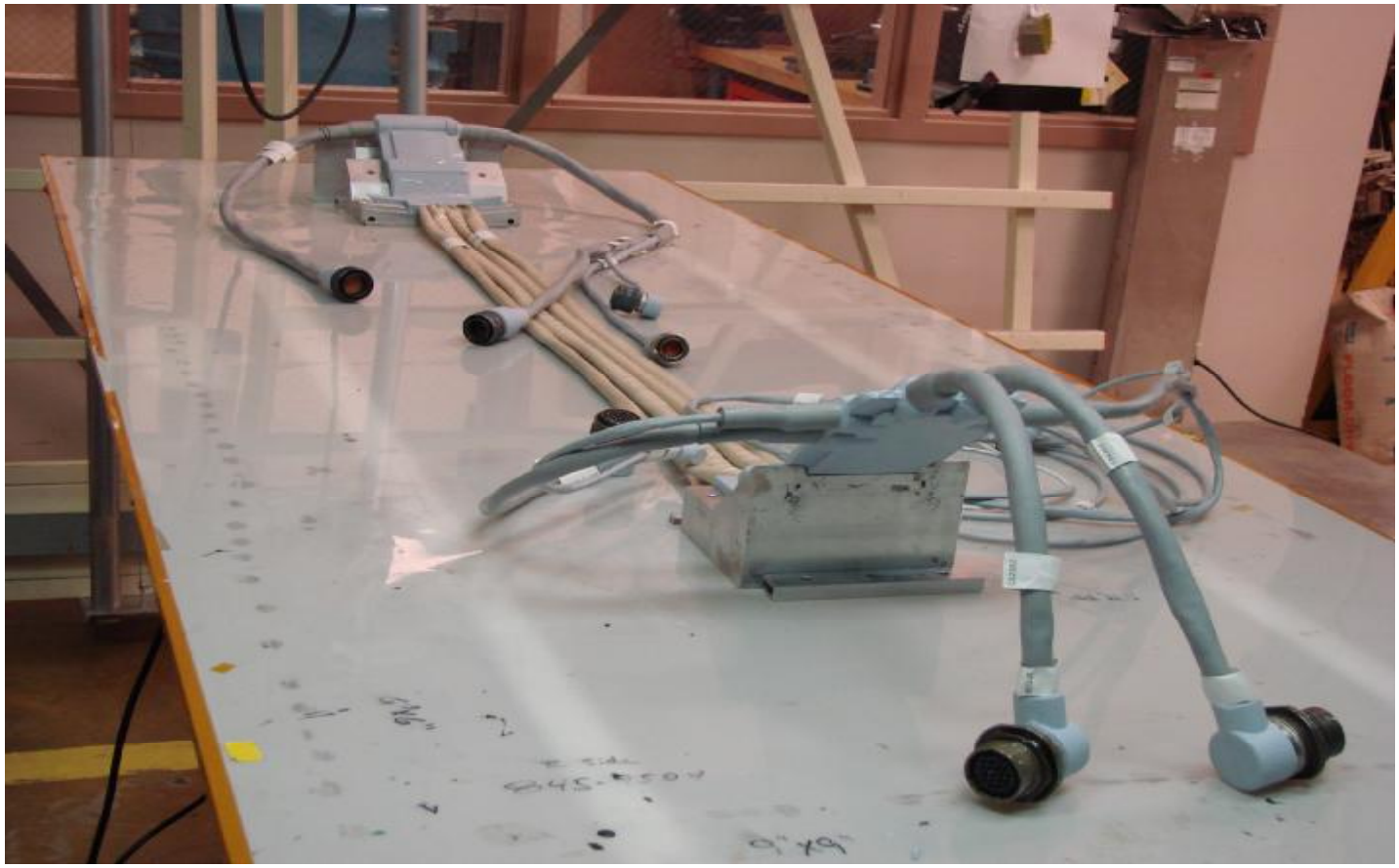
- Strategic Target System
- Part of the Missile Defense Program
- Launched out of Kodiak Alaska
- Re-entry Vehicle Target
- Derived from the Polaris A3P SS Motor
- Missile is Propelled by a Solid Propellant

WHAT IS THE PURPOSE OF THE CABLE?

- It is part of the Flight Termination.
- It sets off a “Linear Shape Charge” on to the Forward Dome.
  It does this on the 1st and 2nd stage of flight.
- It also operates other components on the flight and not just components of the 2nd stage of flight.
- It expels “Solid Propellant” from the dome for safety reasons.
- The rocket contains 28.8Klbs of Solid Rocket propellant.
- The equivalent of 10.5klbs of TNT.

STARS CABLE

Housing & Connectors

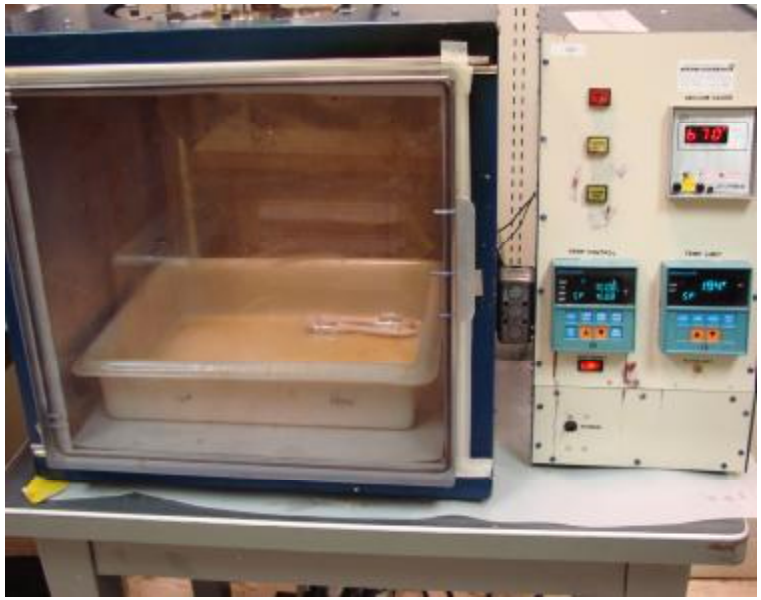


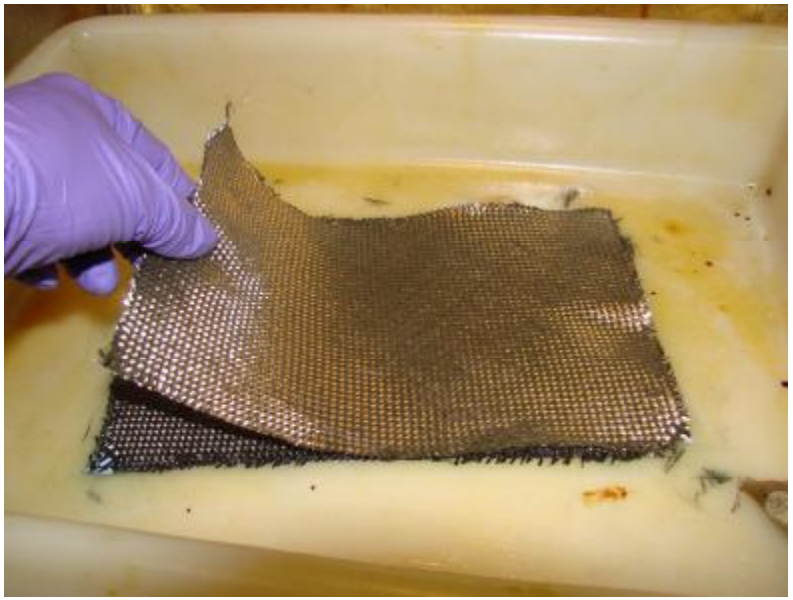
PREP WORK BEFORE LAY-UP Of HOUSINGS

- Cut out material from roll at 45º angle.
- Turn heat on Wabash press (160ºF).
- Clean aluminum molds, and RTV silicone pads with IPA.
- Mold Release all molds with Frekote 700 (3 coats). Spray a shot of MS122.
- Place all molds on Mylar and allow to heat for a minimum of 2 hours.
- Pre-heat Tactix resin system, Resin “742” and Thinner “123” at 160ºF, along with Ni/Gr cloths (heated 160ºF vacuum chamber for a minimum of 1 hour).

LAY-UP OF NI/GR HOUSING

- Place materials (epoxy: TACTIX 742 and 123) in 160ºF oven including pan and brushes.
- Add catalyst “H-41” to pre-heated cup of resin and thinner and pour into pre-heated pan in 160ºF oven.





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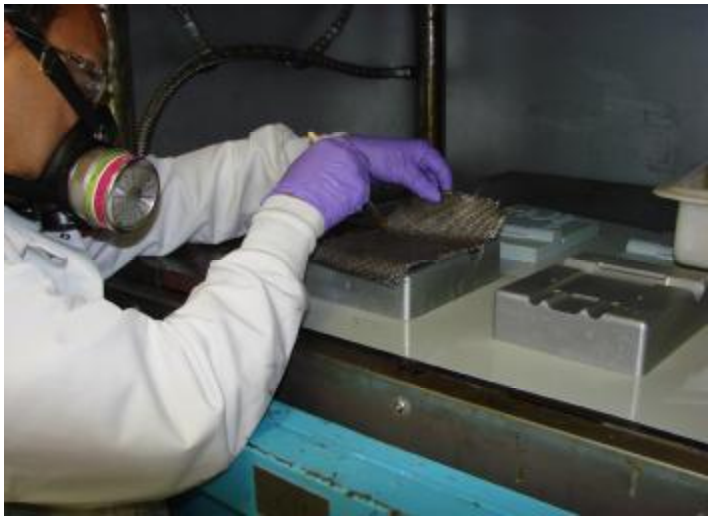
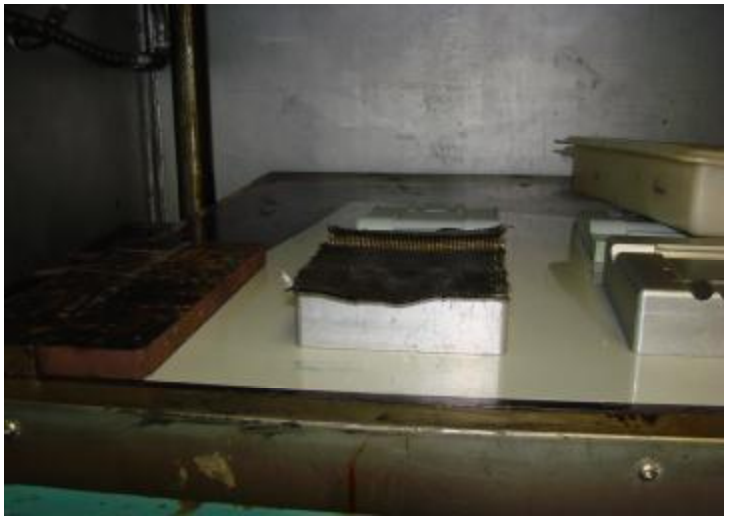
LAY-UP OF NI/GR HOUSING

- **Wet out 3 plies of Ni/ Gr cloth, one at a time while pulling a vacuum between plies.**
- **Take pan with wetted plies into press room & place onto heated molds (160ºF) on press.**
- **Apply load with press to molds starting at 1700lbs. For small molds and 3100lbs for larger molds.**
- **Document all parameters from press including time, temp., lbs., # on dial & inches.**





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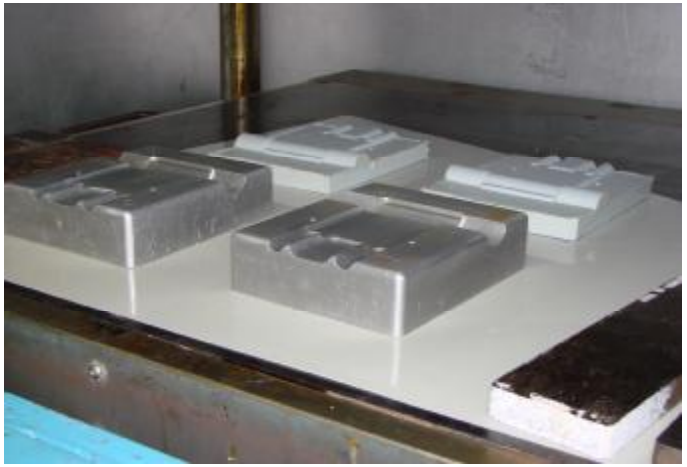
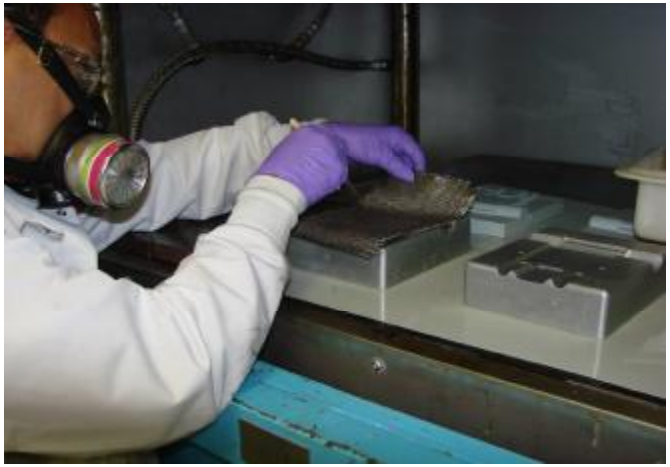
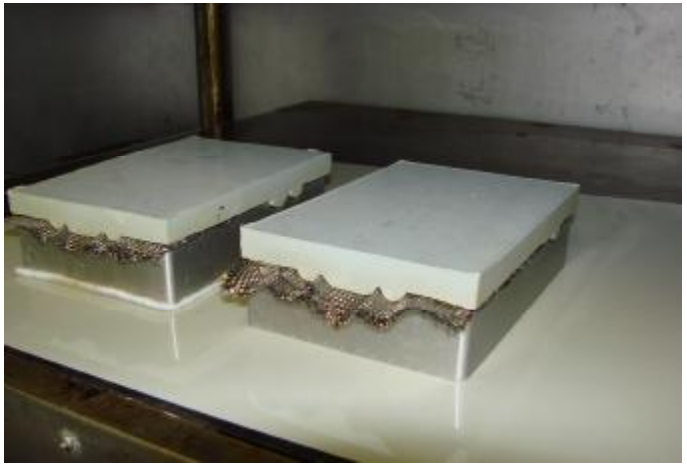
BUILD UP Ni/Gr HOUSINGS







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LAY-UP OF NI/GR HOUSING

- Next day turn off press, remove molds to down draft and disassemble housings from molds.
- Mark scribe lines on part and cut close to scribe lines on Band saw.

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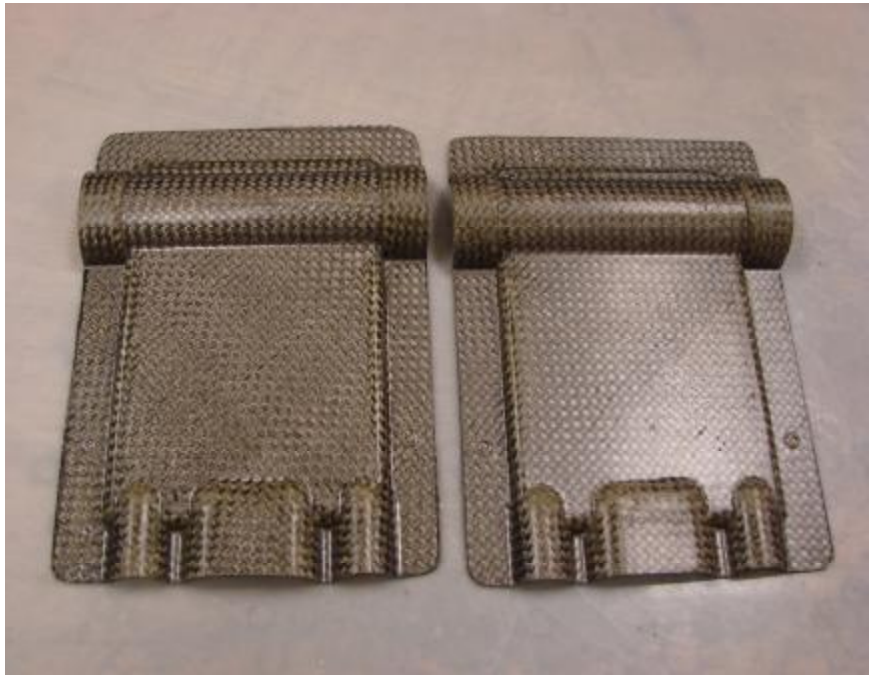
LAY-UP OF NI/GR HOUSING

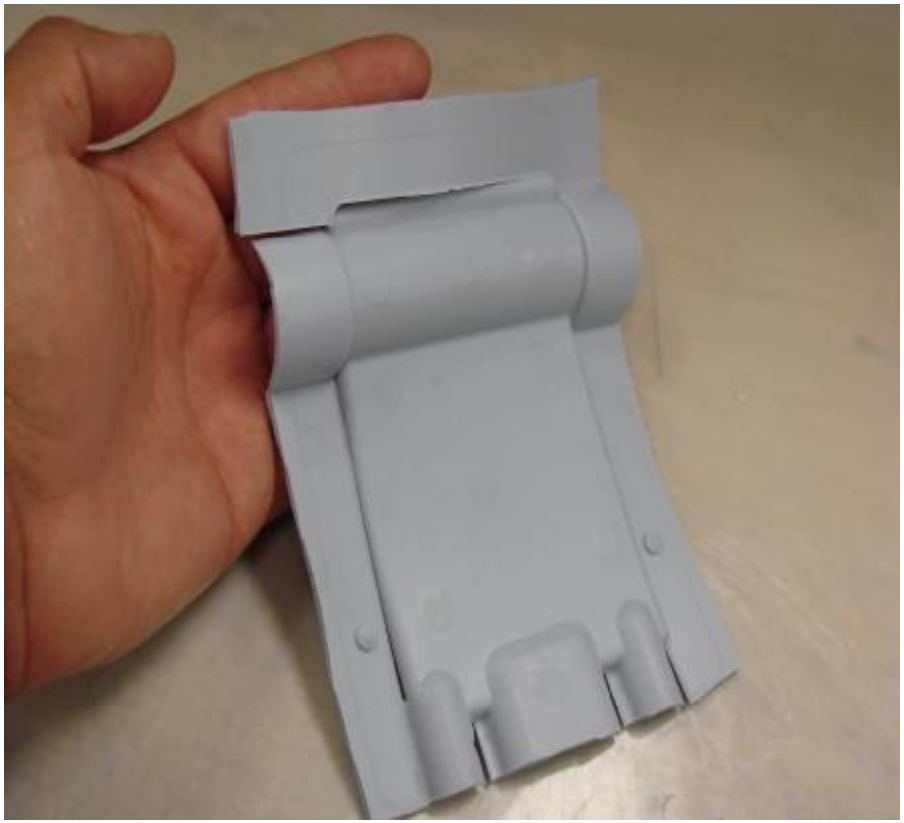
- Pneumatic Disc Grinder is used with 40 grit disc to grind down to scribe lines.
- File off rough edges around perimeter of housing.
- Sand inside flange of housing on granite table until flat.
- Sandblast outside of housing.

LAY-UP OF NI/GR HOUSING



MAKING OF RTV 630 COVERS

- Clean both aluminum and RTV pads with IPA.
- Mold Release aluminum molds with Frekote 700.
- Bond RTV 630 spacers .100” thick on aluminum mold.
- Assemble acrylic box to fit molds snug.
- Mix, evacuate and pour RTV 630 onto aluminum molds & place RTV pads on top with weight (~ 20lbs.) on top.
- Next day disassemble molds and trim to size.



BONDING OF HOUSINGS

- Make sure both Ni/Gr housing shells are flat against each other.
- Clean housings with IPA.
- Check each mold to ensure proper cable length.
- Perform dry fit to make sure cables lie in proper location in housings and mold.
- Disassemble from mold.
- Mix Silver Epoxy Tra-Duct “2902”.
- Apply epoxy to proper surfaces using acid brush.
- Clamp together with spring loaded clamps and allow to cure over night.

BONDING OF Ni/Gr HOUSINGS

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POTTING OF Ni/Gr HOUSINGS

- Mold Release molds with Frekote 700.
- Apply SS-4155 primer to areas of cable and bottom of housing to be potted.
- Place housings in mold using aligning pins.
- Seal mold along all seams, especially around cables coming out of bottom of mold using RTV 630. Allow RTV to cure over night before shooting material.
- Mix 700 grams of RTV 630, pull vacuum and pour into Semco Tube. Pull vacuum again on material in tube. Pre-cut tip to fit snug into spew hole.
- Maintain house air and regulator at 45 psi.

POTTING OF Ni/Gr HOUSINGS

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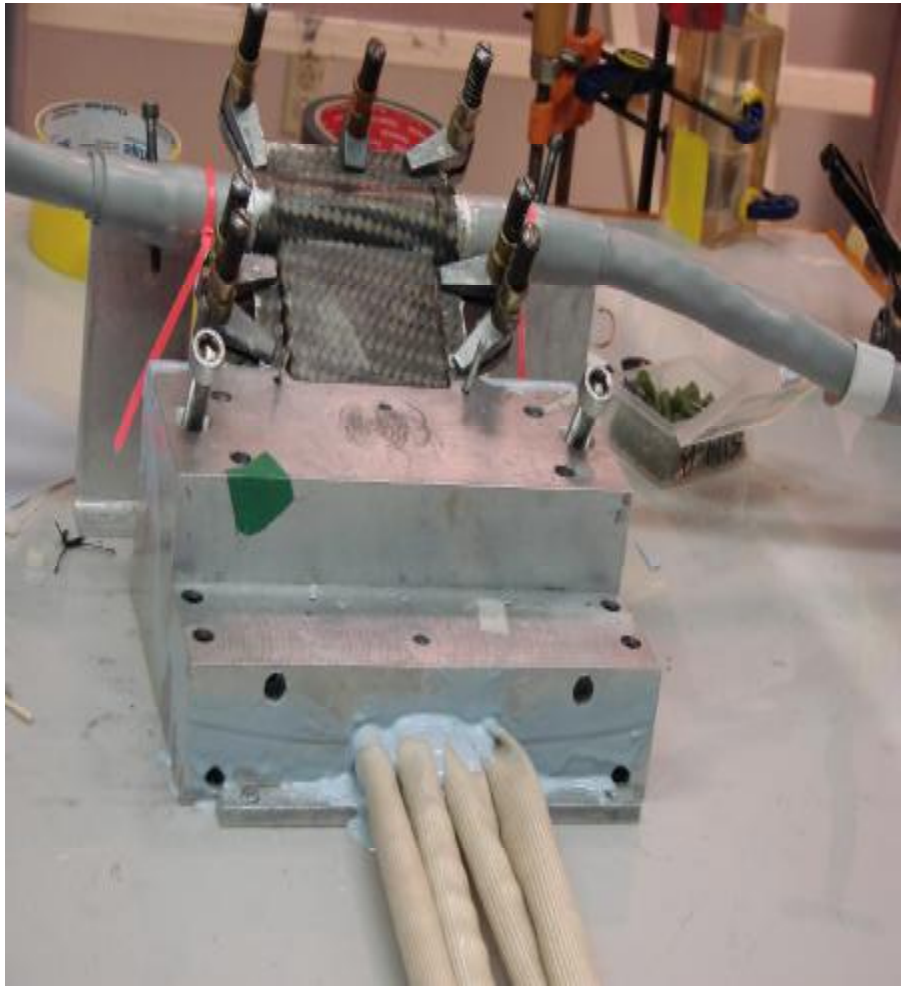
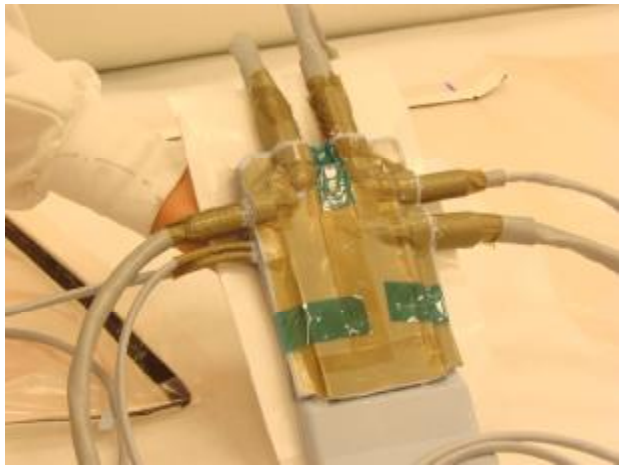
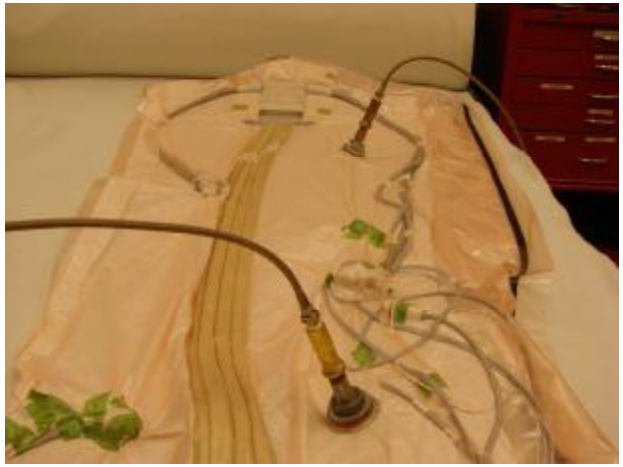
POTTING OF Ni/Gr HOUSINGS



- Next day take apart both molds and repair any voids if needed.
- Eliminate all flashing by cutting or sanding.
- Fill in any areas where cables show through.

BONDING OF RTV PADS

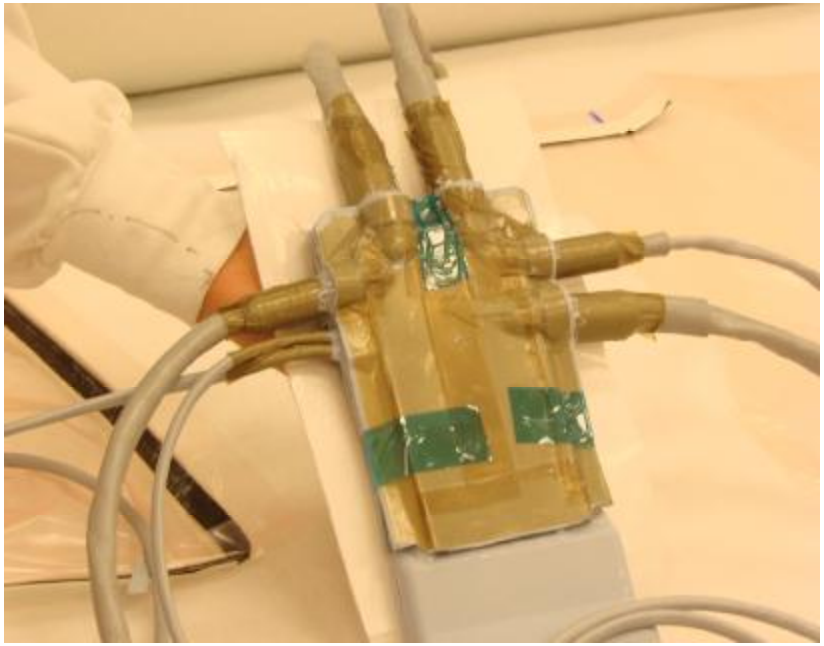


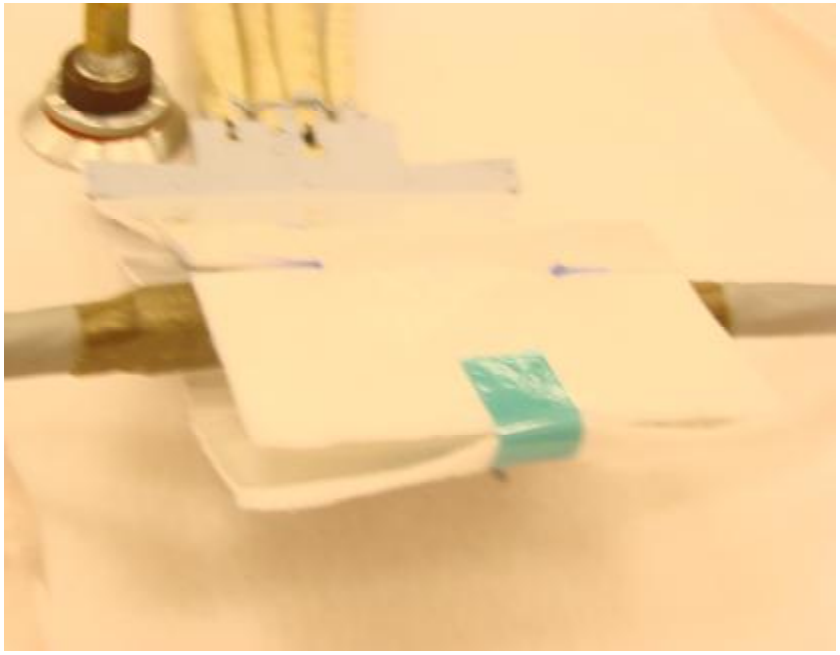


- Clean all surfaces with IPA.
- Abrade RTV pads.
- Prime (SS-4155) all areas to be bonded.
- Cut pads down to proper size to be bonded.
- Mask off tops of pads as well as cables.
- Wrap all connectors with air weave.
- Cut out bag 7’X6’ and apply vacuum tape to edges of bag.
- Mix RTV 630 and allow to cross-link for ~ 2 hours.

BONDING OF RTV PADS

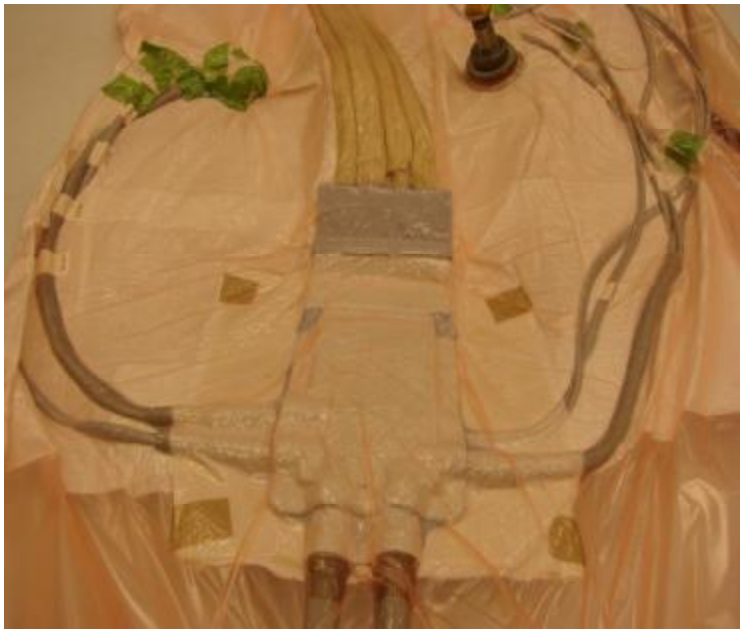
- After material cross-links for ~ 2 hours apply material to pad & Ni/Gr housings.
- Seal bag and check for bridging and run under vacuum at 17 inches of Mercury.





BONDING OF RTV PADS

- Remove from bag, disassemble and cut off all flashing.
- Touch up along sides of pads.



CLEANING OF CONNECTORS & BAKE OUT

- Ultrasonic base is filled with DI water and trays filled with Trichloroethylene.
- Keep shrink sleeving out of Trichloroethylene and run for 4 minutes.
- Run connectors in one more bath, this time IPA.

DRYING OF CONNECTORS

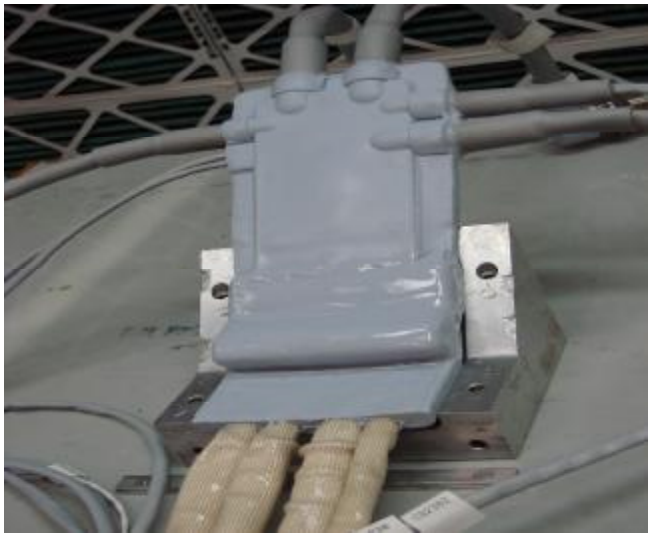
- **Run @ 100ºF for 2 hours under vacuum.**

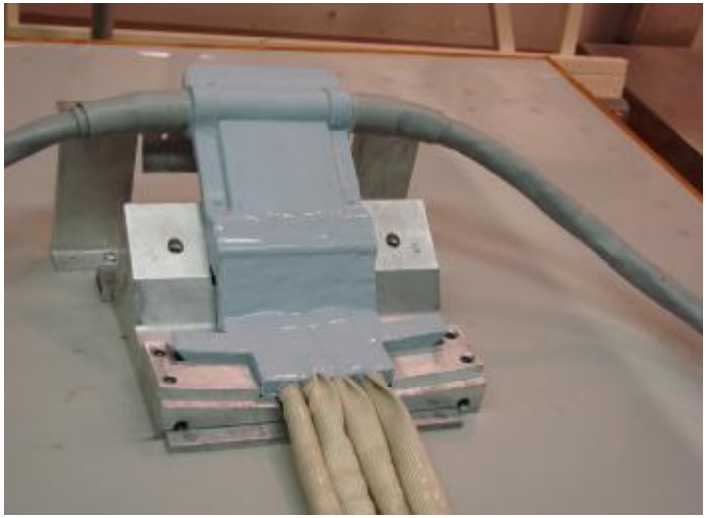
POTTING OF CONNECTORS

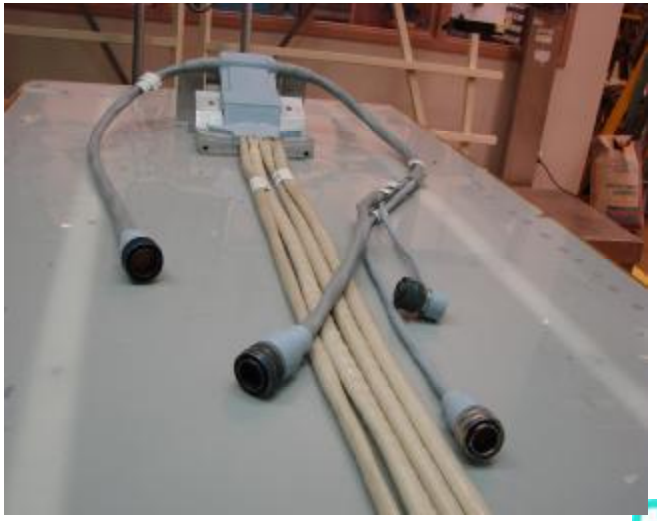
- Clean epoxy molds with IPA.
- Mold Release with Frekote 700 (3 coats).
- Assemble molds to proper connectors, using bar clamps and C-clamps.
- Mix RTV 630, evacuate and pour into EFD syringe with .060 inch tip.
- Using EFD set-up shoot RTV 630 into mold with regulator at 45 psi.
- Next day disassemble molds and trim off all flashing.

POTTING OF CONNECTORS

FINAL PRODUCT







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MISSILE LAUNCH FROM KODIAK ALASKA

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Acknowledgements

- **MISSILE FLIGHT SYSTEMS**

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- **ORGANIC MATERIALS**

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