Overview of Hydrazine Fuels Infrastructure

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LMP103S Technical Interchange Meeting

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**Hydrazine Requirements**

♦ Most “hydrazine” is, MIL-PRF-26536, HPH-grade
  - No aniline
  - Produced by Arch Chemical (Lonza) in Lake Charles, LA
  - Used by spacecraft for in-orbit propulsion
    ▪ Most are mono-propellant applications
    ▪ HPH/N2O4 bi-prop engines are becoming less rare
  - NASA uses HPH most often in its science spacecraft

♦ Other “hydrazine” is MPH grade
  - Up to 0.5 wt% aniline
  - Was primarily used by Shuttle for APUs and HPUs
  - No longer in production by Arch
  - Once DLA inventory is depleted, MPH will no longer be available
Equipment

♦ Various containers are used in hydrazine service
  ➢ All constructed of 304L SS
  ➢ All pressure load and offload
  ➢ Most containers are covered by various DOT SPs
  ➢ Non-bulk containers
    ▪ No pressure relief devices
    ▪ DOT4BW specification w/ SPs
    ▪ 5-, 30-, 55- and 120-gallon water capacity
  ➢ Bulk containers
    ▪ NASA 500-gallon GPTU
    ▪ Industry-owned DOT110A500W cylinders

♦ Similar or identical container designs are used with MMH and N2O4
GPTU fluid system access is supported with roll-around platform and stairs.

- **Gauge Valve**
- **Pressurization/Vent Valve**
- **Relief Valve W/ Isolation Valve**
- **Liquid Valve W/ Dip Tube To The Bottom Sump**
Containers - Cylinders

DOT110 cylinder

DOT4BW cylinder
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Personal Protect Equipment

- Hydrazine is toxic by both dermal and inhalation exposure
- “Class A” PPE is required
- NASA developed the SCAPE suit as an alternative to industrially available PPE
  - Fully encapsulated butyl-rubber-based suit
  - Supply breathing air via either back-pack or air-hose
- Emergency escape device
  - ELSA
  - 10-minute breathing air supply
  - Deployed in operational areas where a potential toxic vapor hazard exists
Built-up suit meets the technician's size. The 35-pound liquid air-pack is adjusted for comfort.

The zipper is then closed providing the full encapsulation of the technician.

The suited technician is ready for work. Air-pack has 2-hr capacity. Radio-com allows free mobility.
ELSA storage box usually located at evacuation route exit points

ELSA in use
Summary

♦ If NASA were to implement an alternative to hydrazine?
   - Would only reduce (or eliminate) SCAPE for hydrazine replacement
     - SCAPE is required for MMH and N2O4 operations
   - May or may not reduce scrubber requirements due to ammonia being present in the LMP103S fuel
   - LMP103S is a blend; volatile components may be lost during transfer operations due to venting

♦ Alternative fuels will probably not be a significant cost factor at KSC and CCAFS unless all MMH and N2O4 requirements shift to less-toxic alternative propellants
Acronyms

♦ APU – Auxiliary Power Unit
♦ DLA – Defense Logistics Agency
♦ DOT SP – Department of Transportation Special Permit
♦ ELSA – Emergency Life Support Apparatus
♦ GPTU – Generic Propellant Transfer Unit
♦ HPH – High Purity Hydrazine
♦ HPU – Hydraulic Power Unit
♦ MMH – MonoMethyl Hydrazine
♦ MPH – MonoPropellant Hydrazine
♦ N2O4 – Nitrogen Tetroxide; also NTO
♦ PPE – Personal Protective Equipment
♦ SCAPE – Self Contained Atmospheric Protective Ensemble
♦ SS – Stainless Steel