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Progress Report on PICA Sustainability in Support of New Frontiers Missions

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NASA is addressing PICA sustainability

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- NASA Ames is leading the effort funded by SMD-PSD.
- Evaluating a domestic rayon alternative (Lyocell) - a sustainable domestic source for next NF-4 missions and for long-term.
 - Contract in place with FMI to complete Lyocell derived PICA qualification tasks including:
 - Fabrication of PICA billets and near net shape cast forms
 - Completion of limited property testing and arc jet testing (arc jet testing completed by Sept 2017 prior to New Frontiers Phase A selection date of Nov 2017)
 - NASA will work with proposing organizations to help define relevant Lyocell derived PICA arc jet testing conditions in April-May 2017
- Proposers will have the final report detailing findings from this study by Jan of 2018 to make assessments.
- Anticipate Lyocell based PICA comparable to heritage PICA and it will be likely be a drop in replacement.

Qualification of an Alternative Based FiberForm[®] Precursor



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Role of Rayon/Lyocell in PICA Manufacturing



Rayon or Lyocell



Conversion to carbon



Near net shape preform



Single piece PICA heatshield (< 1.25m max diameter)



FiberForm[®] billet preform



Tiled PICA heat shield (> 1.25m max diameter)



Planned Testing for Lyocell PICA

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- 3 full Lyocell derived PICA blanks available to support testing (7" x 24" x 42")
- Same test methods and vendor that supported MSL / ADP used for Lyocell PICA characterization
- MSL lot acceptance testing consisted of thermal conductivity, density, TGA, TTT and IP tensile testing – all being performed for this activity – this effort is augmented and will include CTE and large coupon char yield evaluations
- Allows direct comparison to MSL PICA property database

Test	Target condition and # of coupons
Arc jet (high condition for failure mode evaluation)	1300 to 1600 W/cm ² – 4 coupons
Arc jet (thermal response – instrumented coupon)	Low condition TBD based on inputs from proposers – 4 coupons minimum
Thermal Conductivity	Min of 6 per PICA billet – can be augmented
TTT tensile	Min of 20 – can be augmented
IP tensile	Min of 20 – can be augmented
CTE – IP and TTT	Min of 6 per billet – can be augmented
TGA	Min of 6 per billet – can be augmented
Char yield on bulk coupons (larger than TGA)	Min of 6 per billet – can be augmented