



# PICA Status

## New Frontiers and Discovery Missions

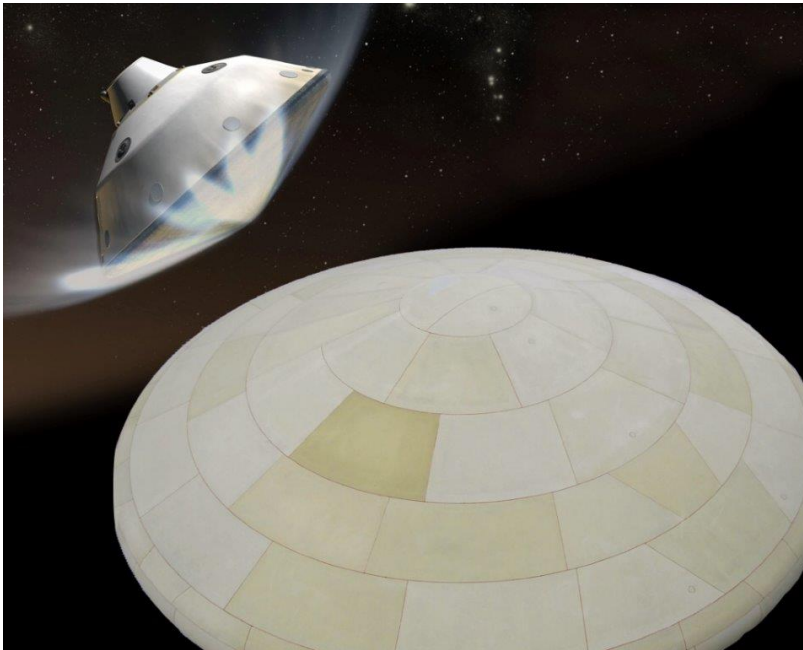
Ethiraj Venkatapathy, Mairead Stackpoole,  
NASA Ames Research Center  
and  
Steven M. Violette  
Fiber Materials Inc.

OPAG Meeting, August 11-12, 2016  
Flagstaff, AZ

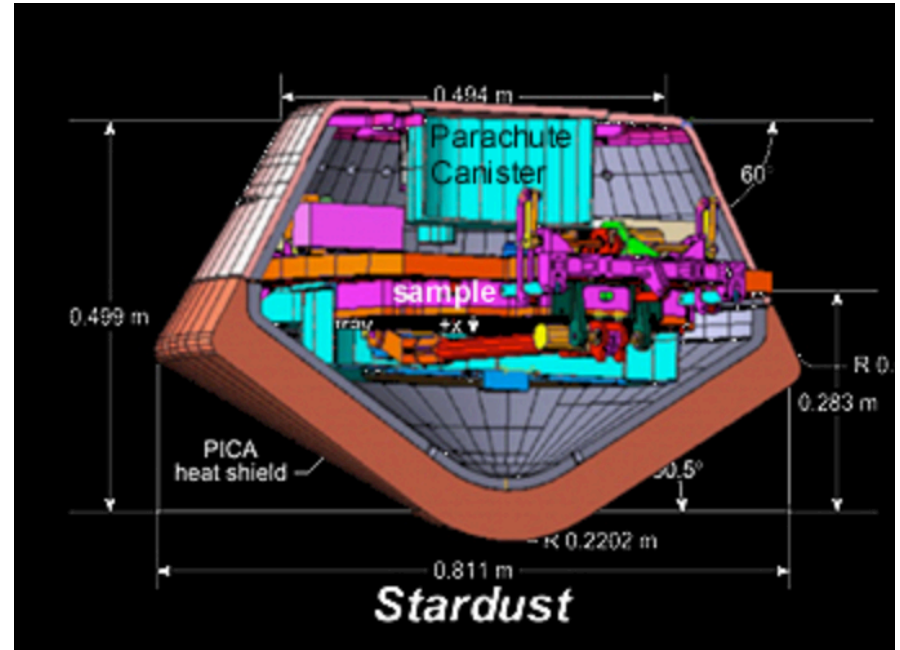


# Need for PICA

Multi-piece tiled heat-shield  
(MSL)



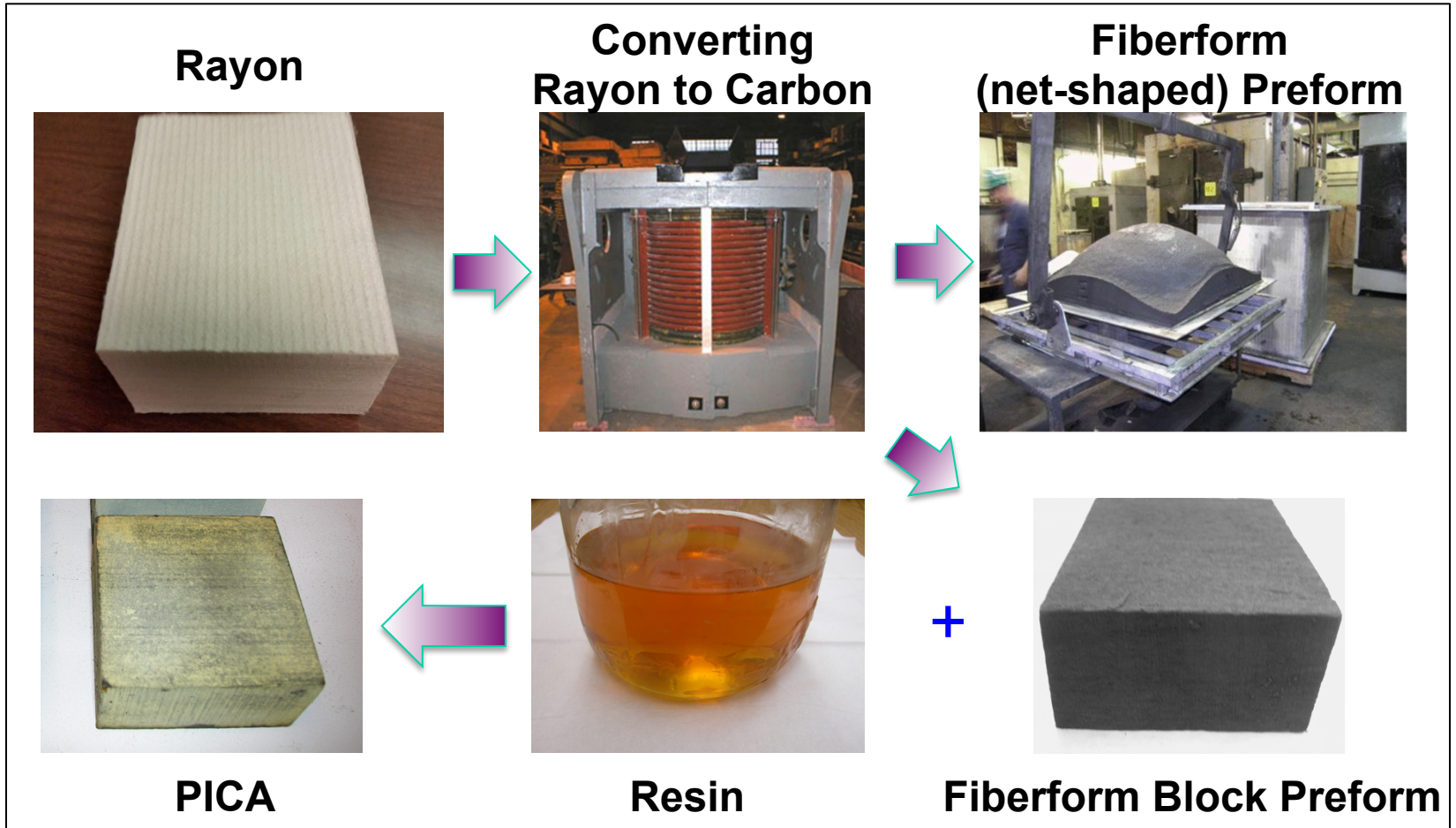
Single piece heat-shield  
(Stardust/OSIRIS-Rex)  
Net-shaped PICA



Upcoming NF-4 Mission proposals and future Discovery opportunities will need both single and multi-piece PICA TPS



# Role of Rayon in PICA Manufacturing



In the past two decades, rayon manufacturers had to be switched twice. MSL, OSIRIS-REx and Mars 2020 use Spanish Rayon. In manufacturing commercial fiberform, FMI is switching over to a South Korean rayon.



# PICA for NF-4 and future Discovery Missions

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- Need:
  - Secure the remaining heritage (Spanish) rayon.
  - Develop and implement plans for certifying an alternate rayon based PICA.
- NASA (SMD-PSD) funded ARC to procure and graphitize all of the available rayon through FMI. FMI will store the carbonized yarn for future mission use to be decided by SMD-PSD.
  - **There is sufficient quantity to allow a heat-shield for a single mission - OSIRIS-Rex mission class.**
- **The quantity of heritage PICA is most likely insufficient to support PICA needed for larger heat-shield or back-shell**
  - Ames working together with FMI has proposed options to SMD-PSD. Certify PICA from
    - S. Korean Rayon
    - Domestic Rayom (Lyocell)
  - Will take (12 – 18) to procure the rayon and convert into PICA billets. Material property testing and arc jet testing followed by thermal response model and material property data base needed to support NF-4 missions.
  - Proposal is under consideration for funding by SMD-PSD



# Single Piece PICA Heat-shield Going beyond ~1m size

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- Stardust and OSIRIS-Rex are ~1m class net shaped (single-piece) PICA heat-shield
  - Current single piece heat-shield all follow Stardust experience and current tooling and set-up can be expanded to support larger single piece heat-shield
- FMI has current capabilities to manufacture up to 55 inch (1.4 m) diameter single-piece heatshields.
- FMI can modify/add equipment for a 80 inch (2.0 m) diameter single-piece heatshields.
  - Need lead time to scale up and demonstrate fabrication (~6 months)
  - Characterization (mechanical, thermal, etc.) and arc jet testing, if needed, will need additional time.