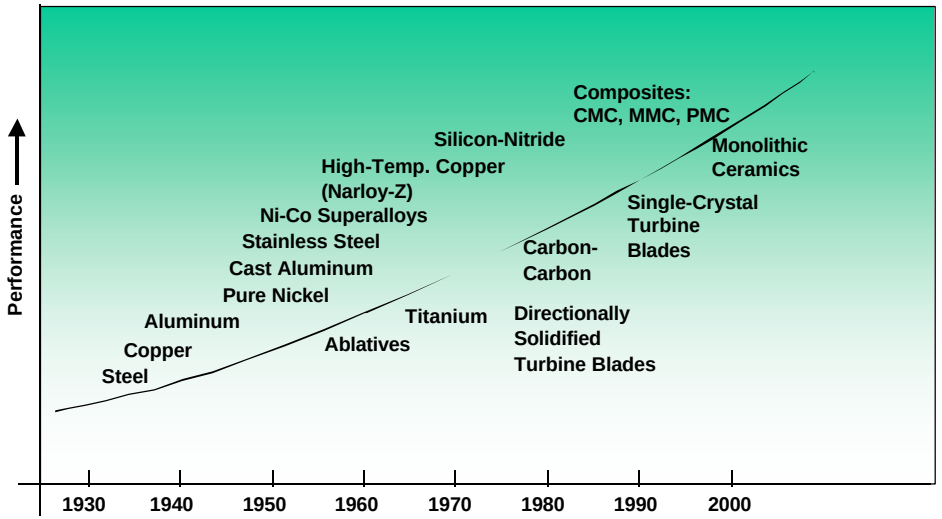
Light Weight Propulsion Subsystems

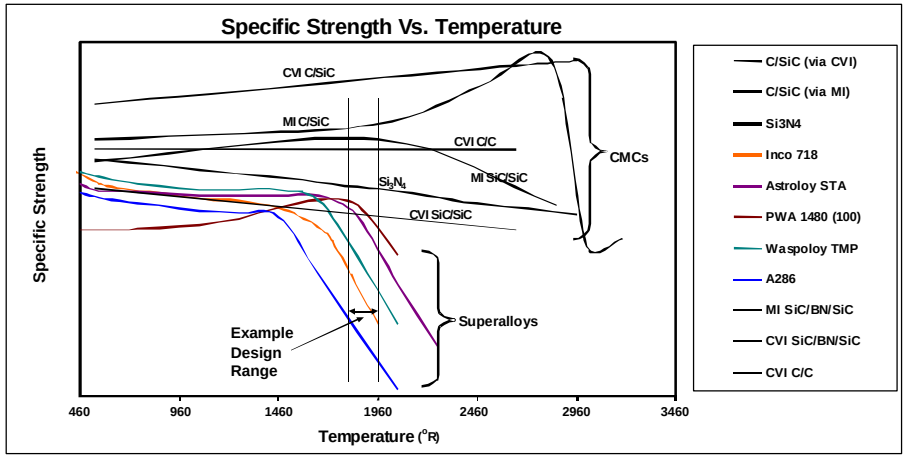
Space Propulsion Technology
Assessment Workshop

April 2001

Summary Description
Long Life, Light Weight Propulsion Materials and Structures

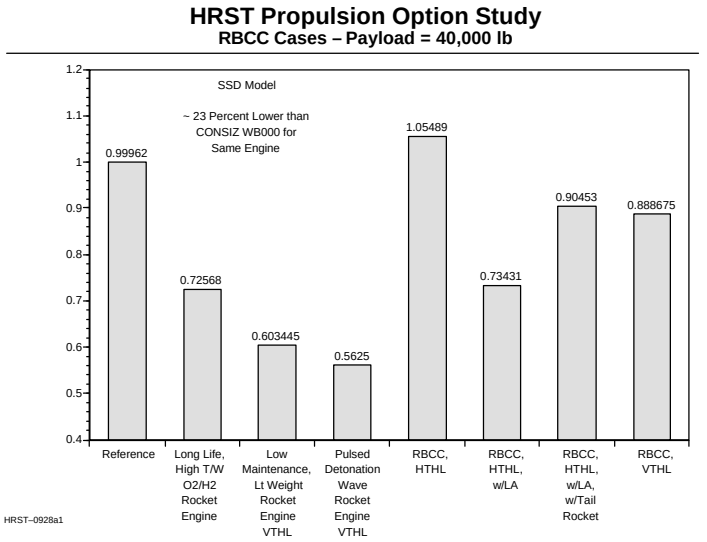
- The History of Engine Capability is the History of Materials Capability
- Significant Improvements in Engine Thrust/Weight, Operations, Life, Reliability, and Cost are Possible from New Materials
- Materials Being Investigated
  - Composites
    - Metal Matrix
    - Ceramic Matrix
    - Polymer Matrix
  - Ceramics
  - Nanophase metals
  - Inproved Superalloys

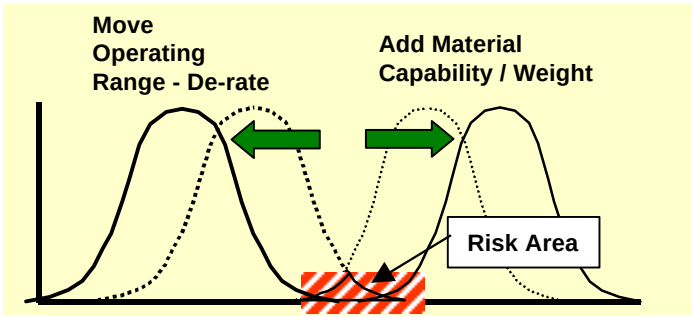




Potential Benefits
Long Life, Light Weight Propulsion Materials and Structures

- Significant Reductions in Weight
  - Vehicle Performance Improvements
- Use as System Trade to Move Material Capability to the Right and Either Keep Same Operating Point or Move to the Right but not as Much as Capability
  - Result is Significantly Increased Margin
    - Even with Weight Decrease
- For Some Materials
  - Coating Elimination
  - Building of Very Complex Single Parts
    - Result is Less Logistics, Less Operations, Less Maintenance
- Overall Significant Reductions in Design Variability
  - Longer Life





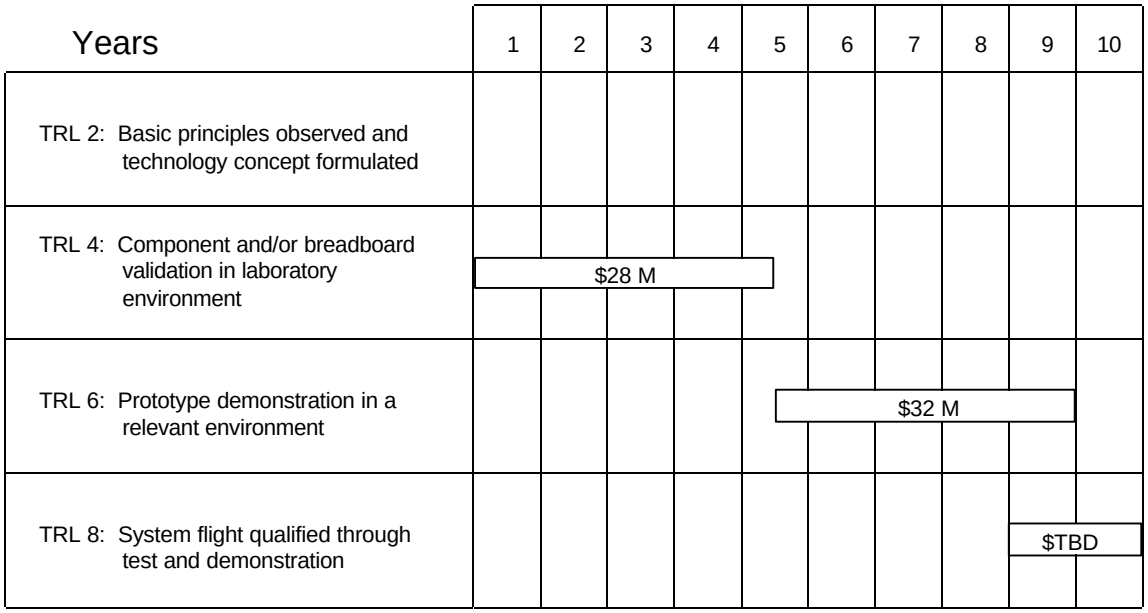
Potential Benefits
Long Life, Light Weight Propulsion Materials and Structures

	Engine T/W to be Off Steep Part of Vehicle Performance Weight Curve	Potential Engine T/W from use of New Materials	Potential Engine T/W "Points" Available to Trade Margins and Vehicle Performance
O2/H2 Rocket Engines	85 - 95	150 - 200	55 - 115
Pulsed Detonation Wave Rocket Engines	50 - 70	150 - 200	80 - 150
RBCCs	25 - 35	45 - 55	10 - 30

Current TRLs
Long Life, Light Weight Propulsion Materials and Structures

Nanophase Materials	TRL	4
Aluminum		
Nickel Superalloys	TRL	3
Matrix Composites		
Metal	TRL	3
Ceramic	TRL	4
Polymer	TRL	4
Ceramics		
Si3N4	TRL	4
Other		
Cu-8Cr-4Nb (combustor liner)	TRL	4

Cost to Mature Technology
Long Life, Light Weight Propulsion Materials and Structures



The cost is for each material brought to maturity