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THERMAL PROTECTION SYSTEMS FOR AEROBRAKES

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BACKGROUND IN TPS FOR ENTRY SYSTEMS

- 1962 - 1980
- o Ablative TPS
 - Apollo, Viking, Space Shuttle
 - Experimental Studies
 - developed ground test simulation techniques and methods
 - evaluation arc jet tests on new materials/joints
 - Analytical Studies
 - developed analytical models for ablator TPS
 - predicted performance in entry environments
 - Ablative Materials Development
 - o Shuttle Tile TPS
 - Ablator/tile compatibility studies
 - Shuttle TPS certification tests
- 1990 - present
- o Materials Division Aerobrake support team to LaRC SEIO

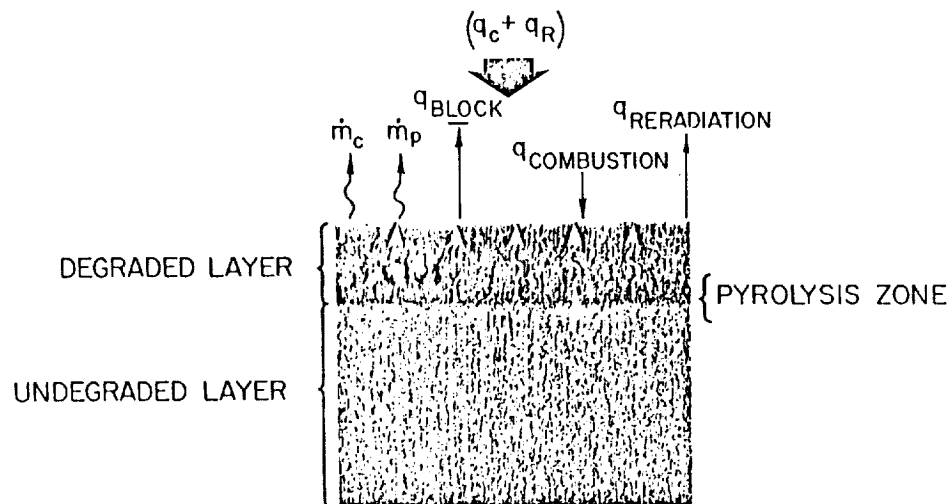
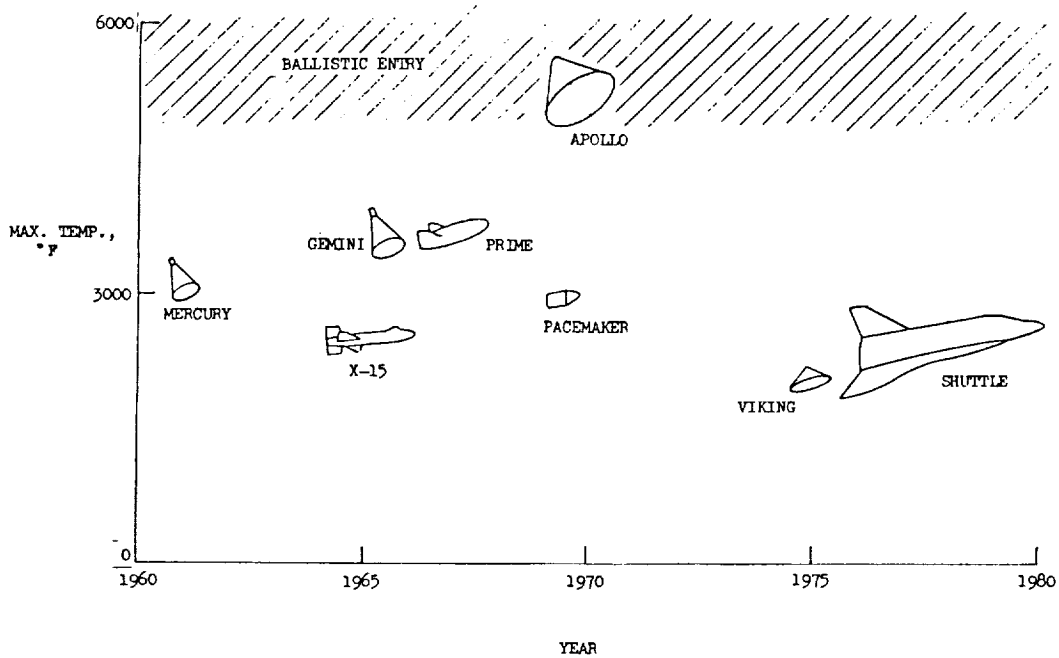


Figure 1.- Schematic diagram of charring ablator.

ABLATIVE HEAT SHIELD APPLICATIONS



QUESTIONS ADDRESSED IN SHUTTLE TECHNOLOGY PROGRAM

- o What ablation materials are suitable?
- o What defects are critical to the TPS performance?
- o Can fabrication costs be reduced?
- o How would an ablative TPS be refurbished?
- o What is the lowest weight, lowest cost, most efficient ablative TPS design?
- o Do ablative TPS have multi-use capability?

SUMMARY OF ADVANTAGES TO ABLATIVE TPS

- o Proven reliable TPS systems
- o Well characterized (thermally) with good, existing thermal analysis capability
- o Good candidate materials are available
- o Not sensitive to defects and more difficult to damage than RSI or C-C
- o Design program was completed which demonstrated simple (direct bond) application of large panels
- o Thermal excursions not catastrophic
- o No SIP required

AEROBRAKE TPS TECHNOLOGY NEEDS

- o Well defined service environment
- o Performance requirements
 - multi use
 - repair
 - panel size/assemble techniques
- o Established ground test methodology
- o Joint materials/design/evaluation
- o Established material systems compatibility

..... AND IN CONCLUSION

- o Several candidate TPS options exist
 - ablators
 - C-C
 - Ceramic tiles
- o Multi TPS on aerobrake deserve consideration
- o A number of technology needs exist

**10.3.6 Flexible Thermal Protection Materials for Entry Systems
by D.A. Kourtides, NASA ARC**