Thermal Protection Tradeoffs *for* Ballute versus Aeroshell Entry & Descent at Mars

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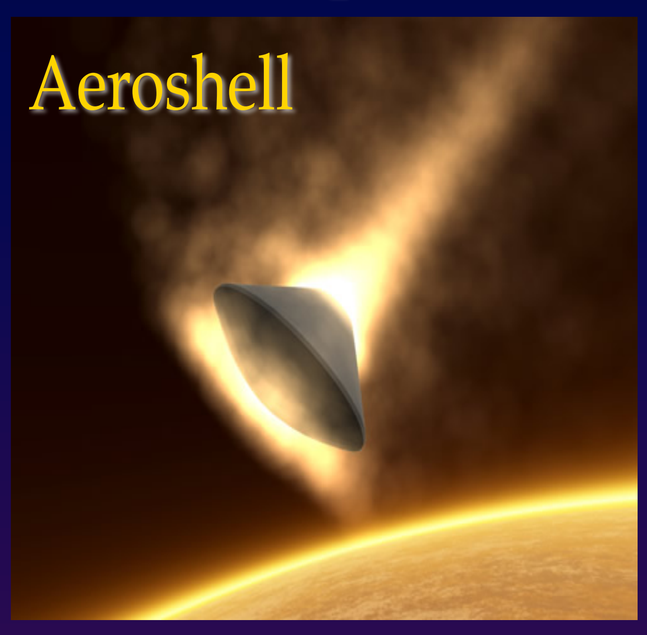
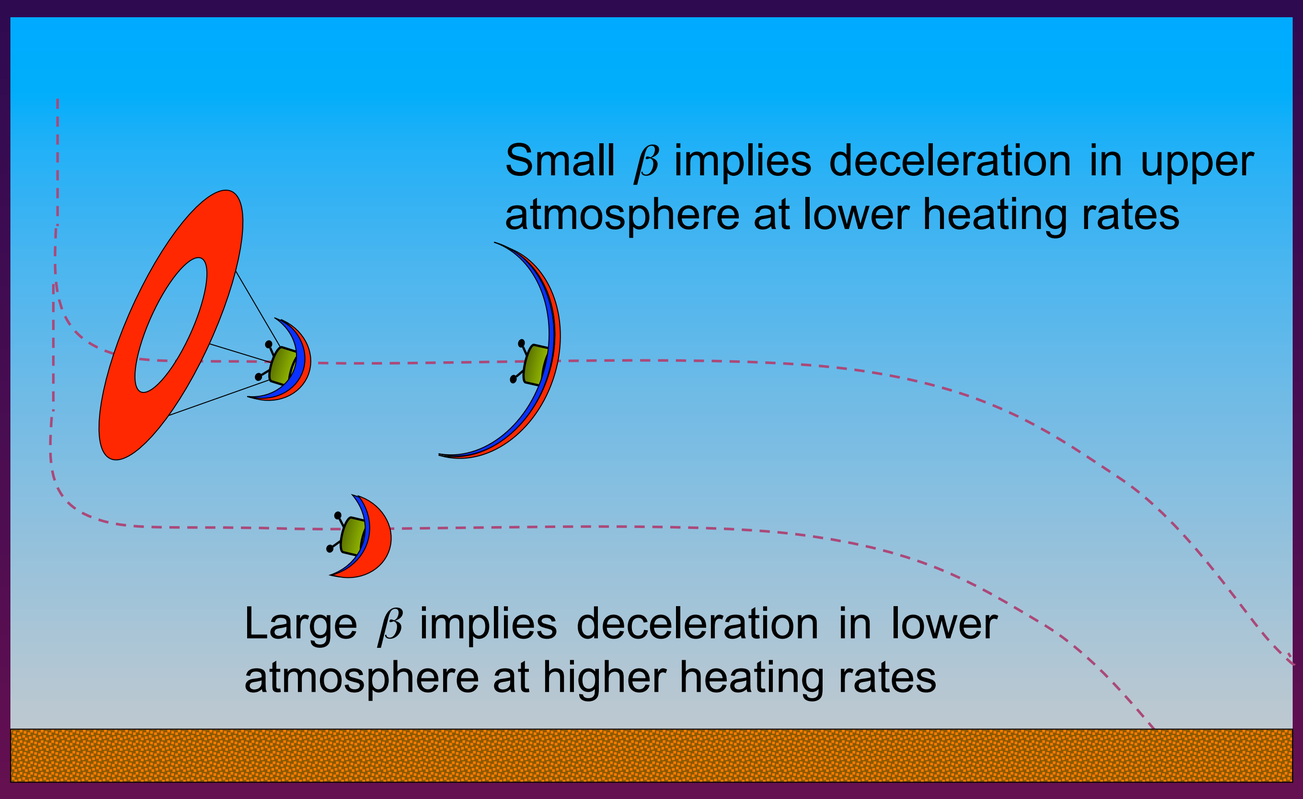
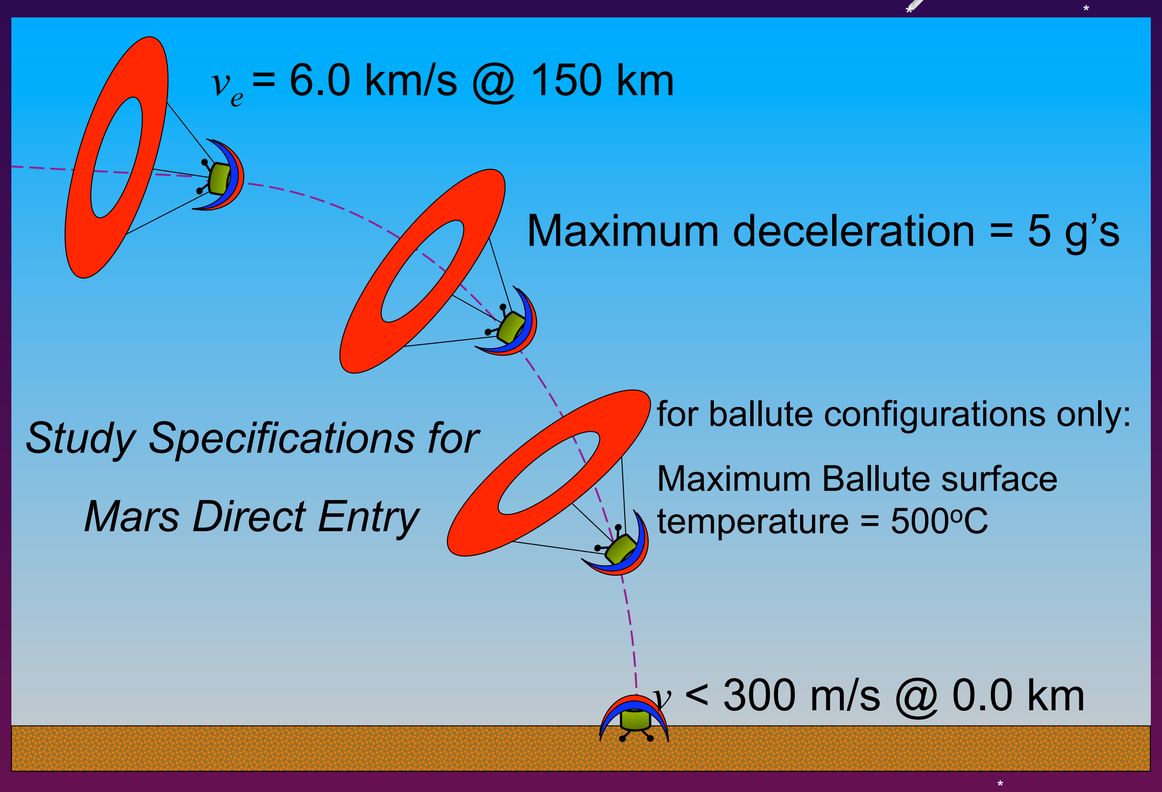
For high-mass Mars entry, which gives the lowest TPS mass?

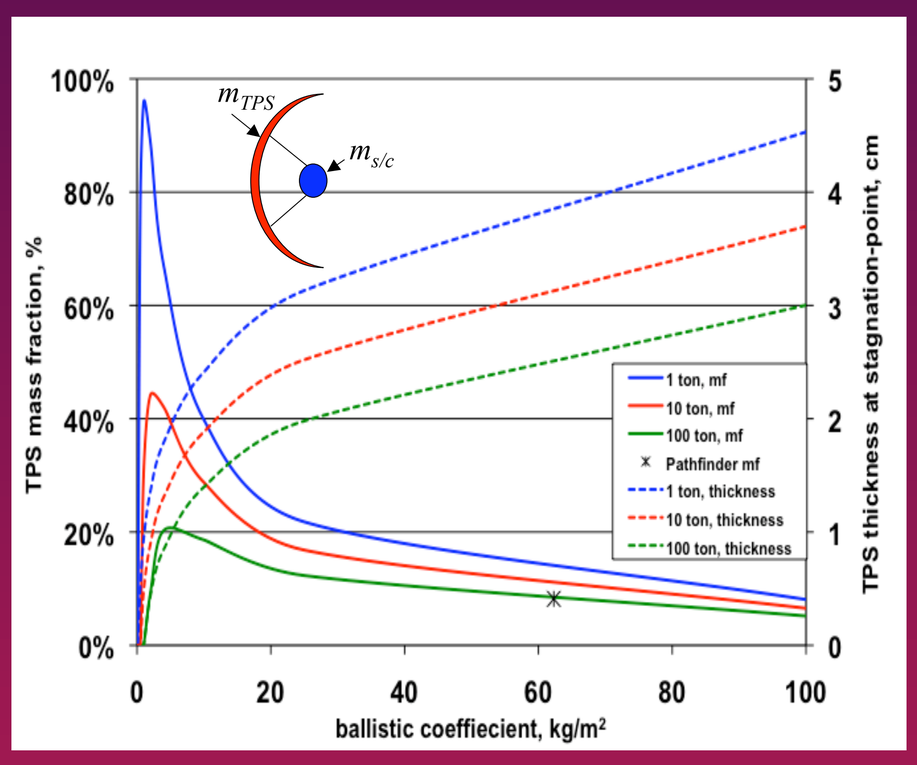
Capture can be achieved using...



OR





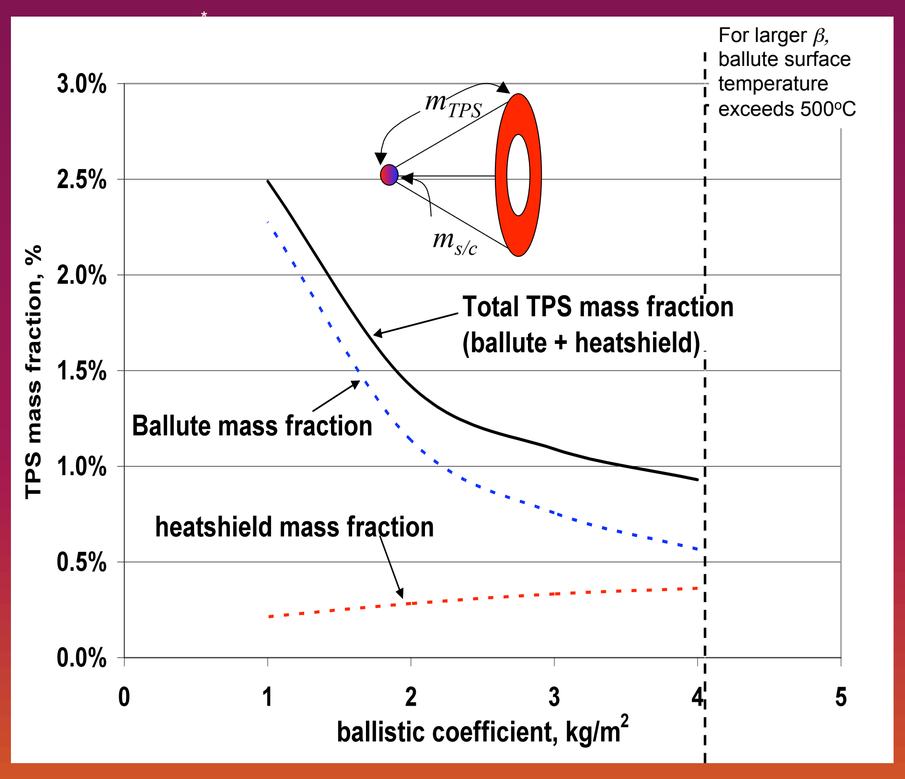


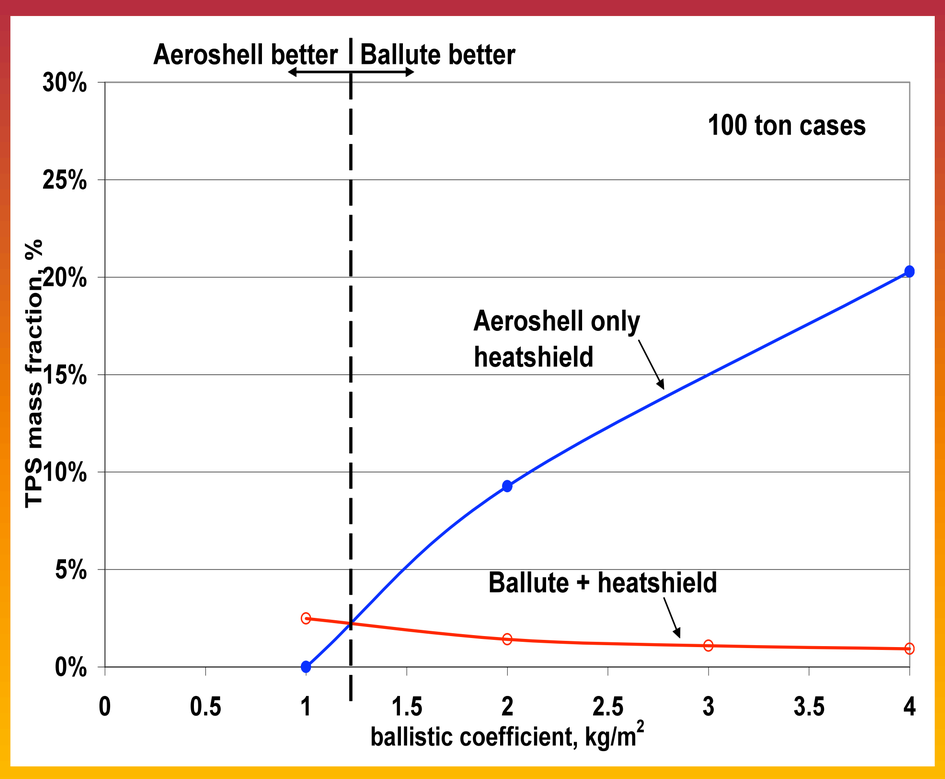
Aeroshells have two minima for TPS mass fractions:

- high ballistic coefficient (traditional approach)
- low ballistic coefficient (aeroshell emulates the ballute)

Ballute TPS results:

- mass fraction increases with decreasing ballistic coefficient
- smallest ballute occurs at material temperature constraint





Conclusion

Mass fractions for potential ballute + aeroshell are an order of magnitude lower than typical aeroshells for direct entry. Ballutes could provide an enabling technology for high-mass Mars entry.