

Expendable RS-25 Engine Affordability Study

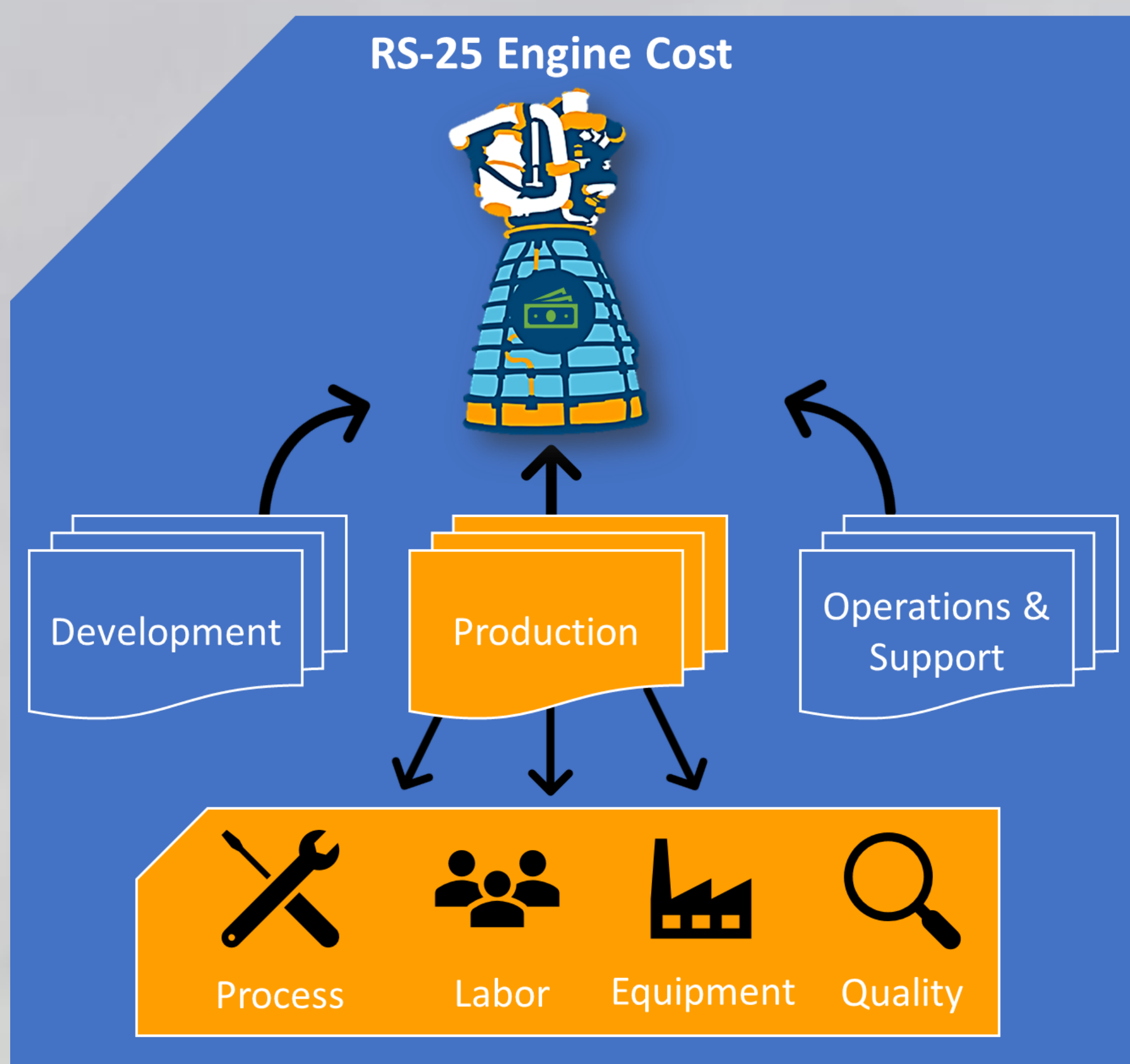
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Overview

The RS-25 engine powered the Space Shuttle into orbit for three decades and will now power the Space Launch System (SLS) for decades to come.

- First four launches of SLS will reuse RS-25 engines from the Shuttle Program
- RS-25 production will need to be restarted to meet future launch needs
- Opportunity to reduce unit cost of the RS-25 as it will now be expendable on SLS

Engine Cost Breakdown



Unit cost reductions can be realized via:

- **Manufacturing Processes**
 - In-house vs Industry sourcing
 - New technology infusion
- **Labor:** Automate more processes
- **Equipment:** Updated equipment to lower manufacturing and inspection time
- **Quality:** Fit Quality plan to mission need

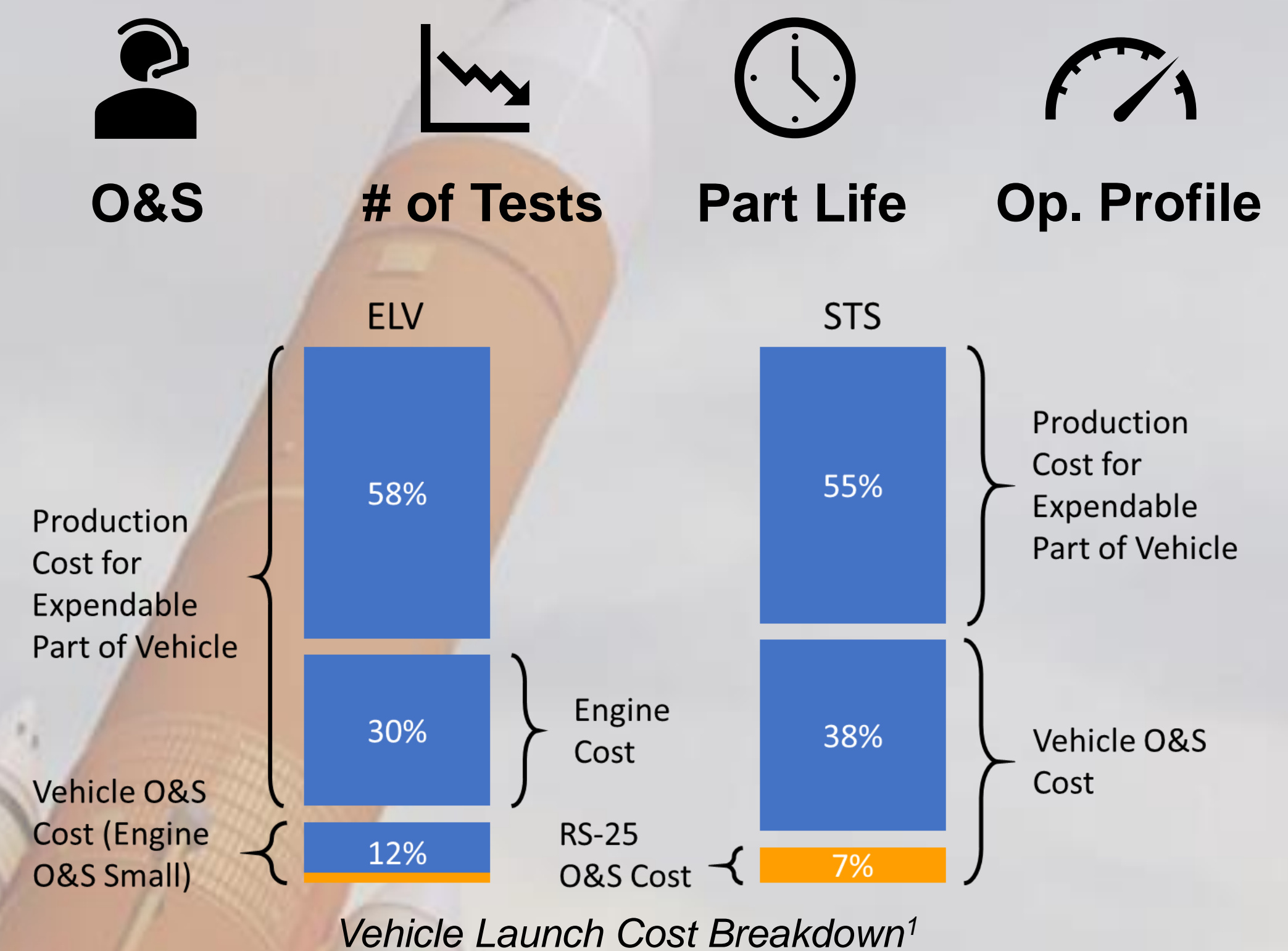
Acknowledgements

Thank you to my Advisers Dr. Dale Thomas and Dr. Paul Collopy for their support in this research.

Ref¹: "Life-Cycle-Cost Considerations for Launch Vehicle Liquid Propellant Rocket Engine" by Claus J. Meisl, Rockwell International

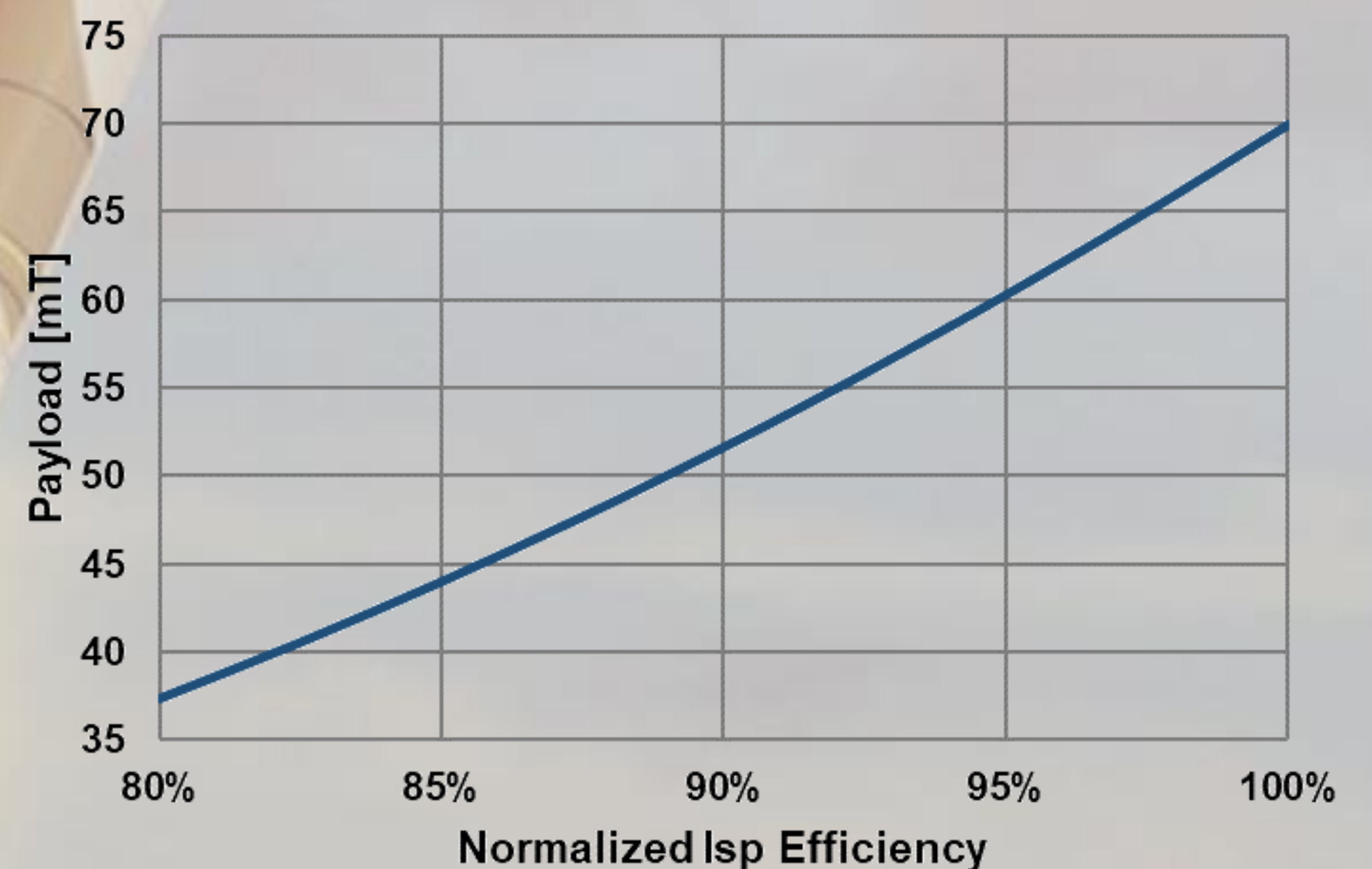
Reusable to Expendable

There are many factors to consider when operating a Reusable Liquid Rocket Engine (LRE) compared to an Expendable LRE.



Impact

RS-25 unit production cost cannot be viewed independently of SLS performance. Changes to the baseline engine can negatively or positively affect SLS payload to orbit. An integrated model in SysML and supporting tools will enable a more complete system view of the RS-25 and its interface and impact on SLS.



SLS Block I Payload to LEO versus RS-25 Normalized Vacuum Isp