ROCKET ENGINE
NUMERICAL SIMULATOR
OVERVIEW PRESENTATION

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ROCKET ENGINE
NUMERICAL SIMULATOR
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ROCKET ENGINE NUMERICAL SIMULATOR

RENS DEFINITION

• Rocket Engine Numerical Simulator (RENS) Performs Liquid Rocket Engine Propulsion System Analyses and Design
• RENS Gives Engineer a 3-D Transient Tool for Analyzing Engine Systems (Tanks - Feed System - Thrust Chamber)
• RENS Will Surpass/Encompass Capabilities of Current System Codes (ROCETS & Generic Power Balance)

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RENS DEFINITION

• RENS is Long Term and Large Scope
• RENS Features Include:
  - System Executive - Easy to Use
  - Data Management - Industry/University/Gov't Advisory Group
  - Graphical User Interface - Public Domain
  - Incorporation of Users' Technical Codes - Evolution of Capabilities
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OBJECTIVES

• Enable spontaneous and adaptive rocket definition, generation, performance evaluation, and failure analysis.

• Develop capability to simulate component and system level performance of rocket propulsion systems.

• Provide rapid and accurate assessment of rocket to increase design efficiency.

• Incorporate and integrate validated computational simulation codes/technologies.

JUSTIFICATION

• Following capabilities required by NASA to do our job: independent verification of proposed rocket performance, new rocket designs, assess impact of new rocket technologies.

• Standardized industry design/analysis tool (industry-university-government participation).

• Streamline, enhance, and alter research & analysis process to reduce time and cost.
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APPROACH

• The RENS program will be patterned after, and will leverage from, the Numerical Propulsion System Simulator (NPSS), currently under development at NASA LeRC for aircraft propulsion systems.

• RENS will incorporate component level descriptions to predict performance and reliability.

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POTENTIAL APPLICATIONS

• Chemical Propulsion Systems
• Nuclear Thermal Propulsion Systems
• Propulsion System Test Facilities
• Nuclear Electric Propulsion Systems
• Space Power Systems
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RENS PROTOTYPE - REDES

- REDES Used to Conduct Various Studies and Model Various Engines:
  - Nozzle Performance Parametrics (SSME, RL10)
  - Nozzle Design (NTR)
  - Rocket Engine Test Facility Capability Assessment (NASA LeRC Rocket Engine Test Facility Ejectors)

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REDES ANALYTICAL DOMAIN
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REDES

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CONCLUSIONS

• RENS Capabilities Required For Simulation Development.
• Simulation Capability Required By Gov’t, Industry, and University in Many Technical Disciplines.
• RENS Prototype Exists at LaRC.
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RENS USER SURVEY (part 1 of 2)

Q: How Would You Use RENS?
Q: What Would You Add To the Current RENS Description? What Would You Delete?
Q: What Do You Like About the Current RENS Description? What Do You Dislike?

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RENS USER SURVEY (part 2 of 2)

Q: Would You Be Interested In Developing Some Portion of RENS? What Portion?
Q: How Would You Justify Expending Resources In the Use of RENS to Your Management?
Q: May We Cite Your Responses In Our Advocacy Presentations to NASA Headquarters?