ROCKET ENGINE NUMERICAL SIMULATOR

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

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.
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.

POTENTIAL APPLICATIONS

• Chemical Propulsion Systems
• Nuclear Thermal Propulsion Systems
• Propulsion System Test Facilities
• Nuclear Electric Propulsion Systems
• Space Power Systems
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)
REDES

CONCLUSIONS

• RENS Capabilities Required For Simulation Development.
• Simulation Capability Required By Gov't, Industry, and University in Many Technical Disciplines.
• RENS Prototype Exists at LeRC.
• Grant Work in Critical Development Areas Initiated