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ROCKET ENGINE NUMERICAL SIMULATOR

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CONTENTS

- RENS Definition
- Objectives
- Justification
- Approach
- Potential Applications
- Potential Users
- RENS Work Flowchart
- RENS Prototype
- Conclusions

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.

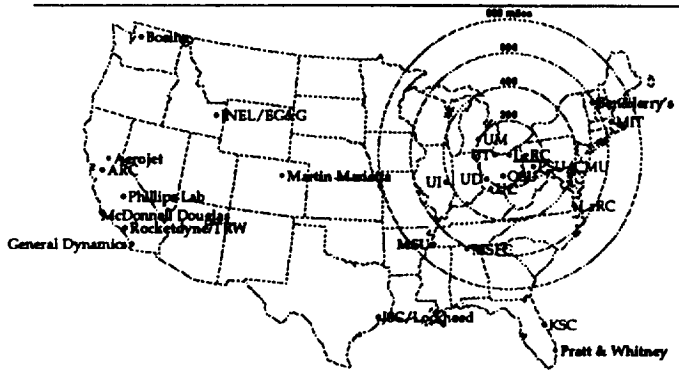
APPROACH

- 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.

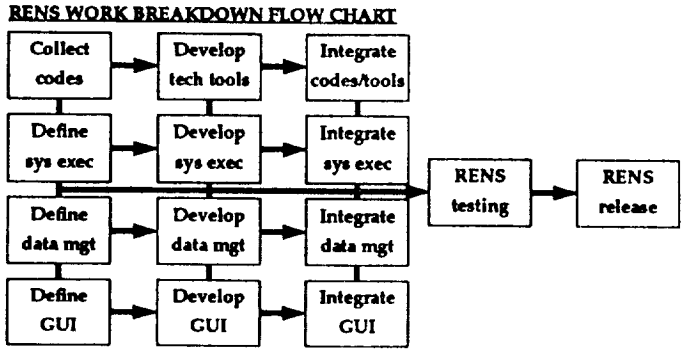
POTENTIAL APPLICATIONS

- Chemical Propulsion Systems
- Nuclear Thermal Propulsion Systems
- Propulsion System Test Facilities
- Nuclear Electric Propulsion Systems
- Space Power Systems

POTENTIAL USERS



RENS WORK STRUCTURE

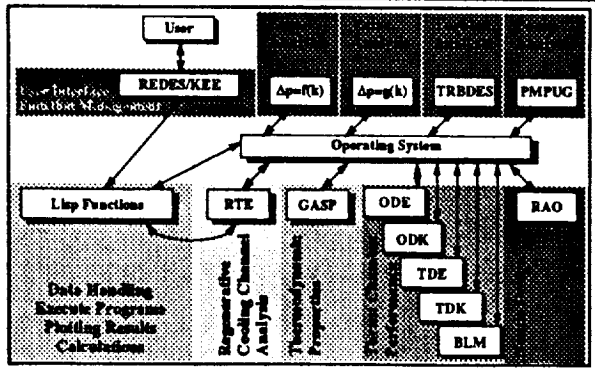


RENS PROTOTYPE - REDES

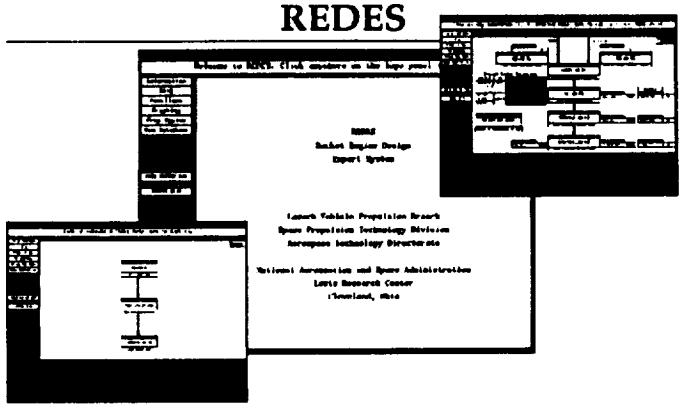
- Prototype Capability Initiated in 1989 with Rocket Engine Design Expert System (REDES).
- REDES Used to Conduct Various Studies and Model Various Engines:

- Nozzle Performance Parametrics (SSME, RL10)
- Nozzle Design (NTR)
- Rocket Engine Test Facility Capability Assessment (NASA LeRC Rocket Engine Test Facility Ejectors)

REDES ANALYTICAL DOMAIN



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