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NEP SYSTEMS MODELLING OVERVIEW

- An integrated systems analysis code is the next step for both SP-100 and SEI NEP systems analysis

- Preliminary in-house efforts at systems integration are underway

- Another alternative may be a general systems analysis code that can incorporate NPO system models

NUCLEAR PROPULSION OFFICE

NEP Systems Model

Nuclear Propulsion Technical Interchange Meeting
LeRC Plum Brook Station
October 22, 1992

Jeff George
Advanced Space Analysis Office

NASA Lewis Research Center
Advanced Space Analysis Office

New NEP Systems Analysis Code

- Modular
  - Driver Code
  - Variety of subsystem models

- Five subsystems modelled
  - Reactor/Shield
  - Power Conversion
  - Heat Rejection
  - PMAD
  - Thrusters

- Optimizes for:
  - Minimum mass
  - Minimum radiator area
  - Low mass/low area

- Parameters optimized:
  - Separation distance
  - Temperature ratio
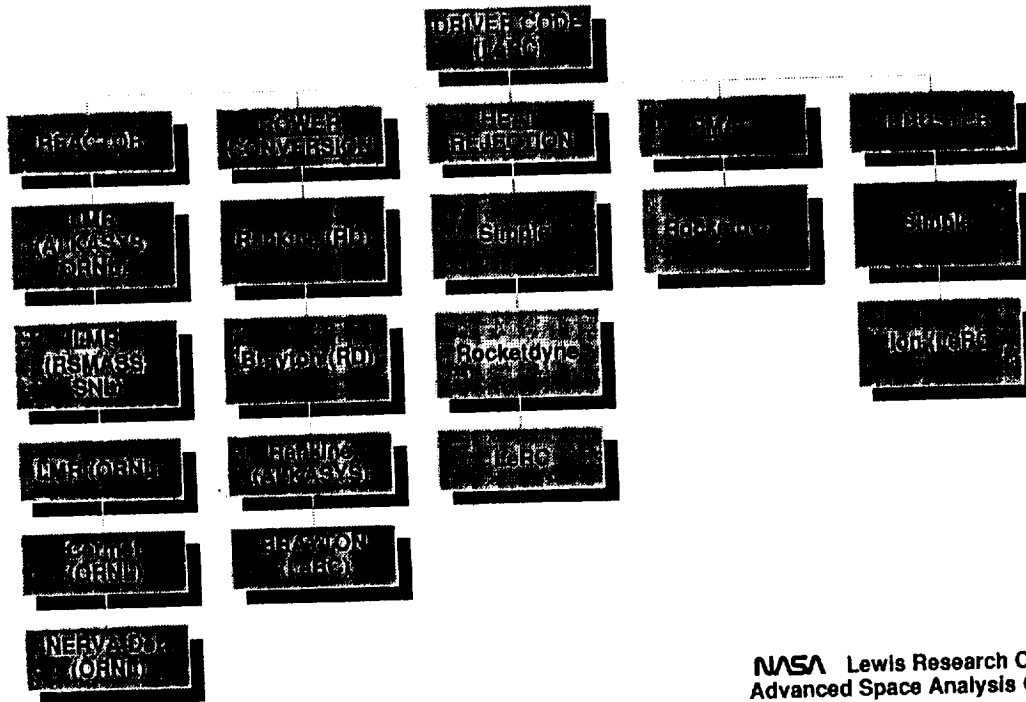 - (Pressure ratio)
  - (Transmission frequency)

New NEP Systems Analysis Code, Cont.

- Top level requirements

  - Power level

  - Full power lifetime

  - Payload dose constraint

  - Reactor temperature

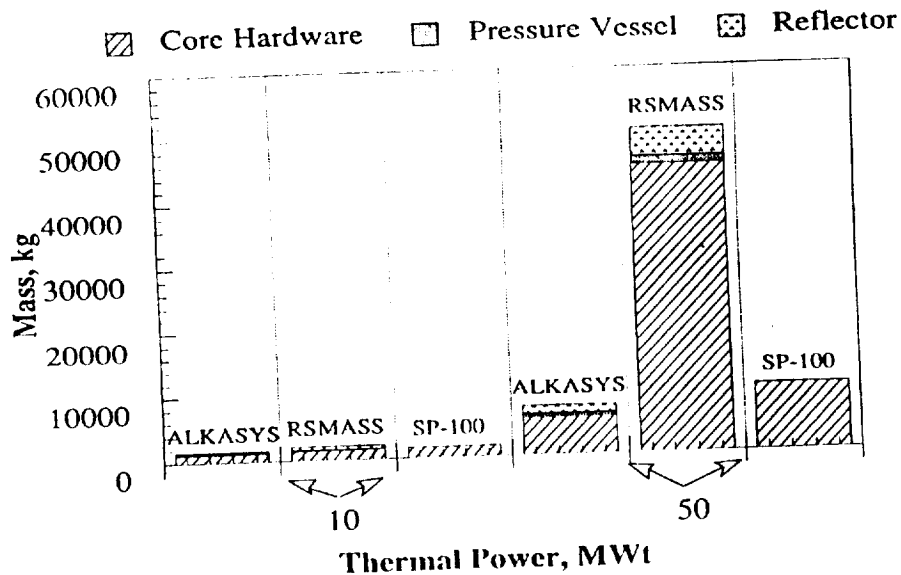 - Turbine inlet temperature

  - Materials

  - Subsystem types/models

Subsystem Models Library

Mass Distribution: ALKASYS v. RSMASS v. GE (SP-100)

☑ Core Hardware   ☐ Pressure Vessel   ⊡ Reflector

Mass, kg (y-axis): 0, 10000, 20000, 30000, 40000, 50000, 60000

RSMASS

ALKASYS

SP-100

ALKASYS   RSMASS   SP-100

10

50

Thermal Power, MWt

NEP: Systems Modeling

NP-TIM-92

Mass Distribution: ALKASYS v. RSMASS

10 Yr. Life, 1350 Reactor Out., Reactor Only

⊠ Core Hardware   ▣ Pressure Vessel   ⊡ Reflector

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System Mass for Different Materials

Temperature Penalty, Life=10 Yrs, Power = 10 MWt

Legend:
- —■— English ASTAR
- —□— ALK ASTAR
- —·— GE Nb-1%Zr
- —◇— ALK Nb-1%Zr
- —▲— PWC-11

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System Mass for Different Materials

Lifetime Penalty, Temp=1350 K, Power = 10 MWt
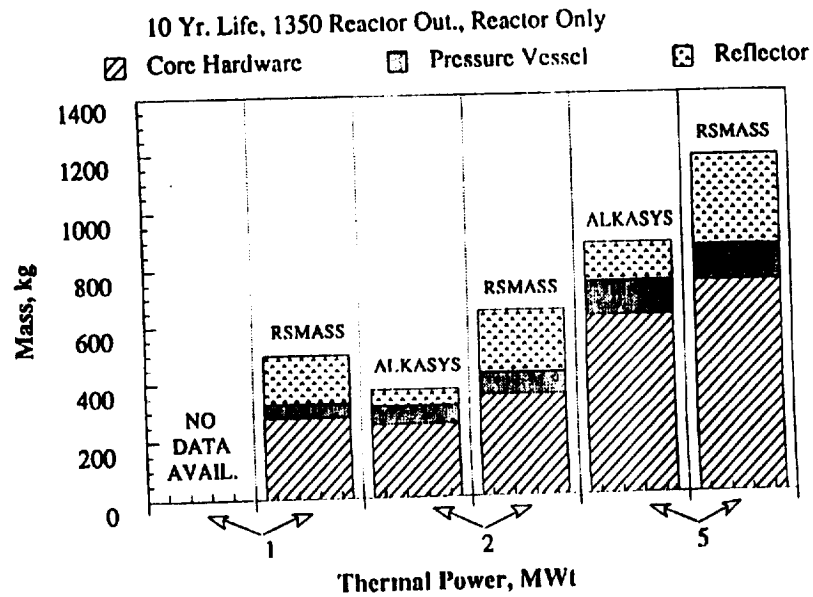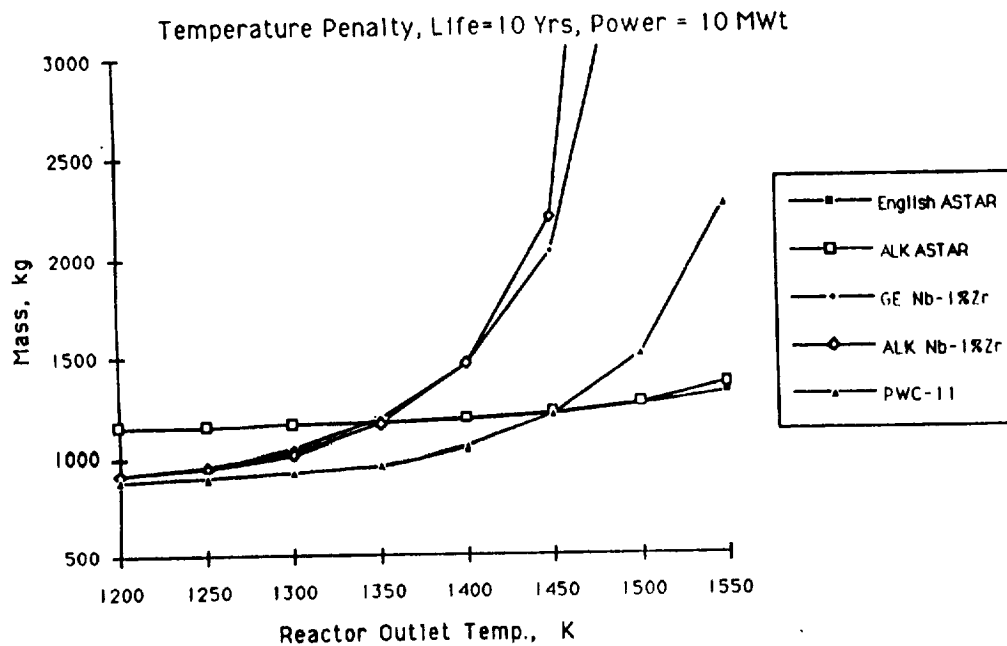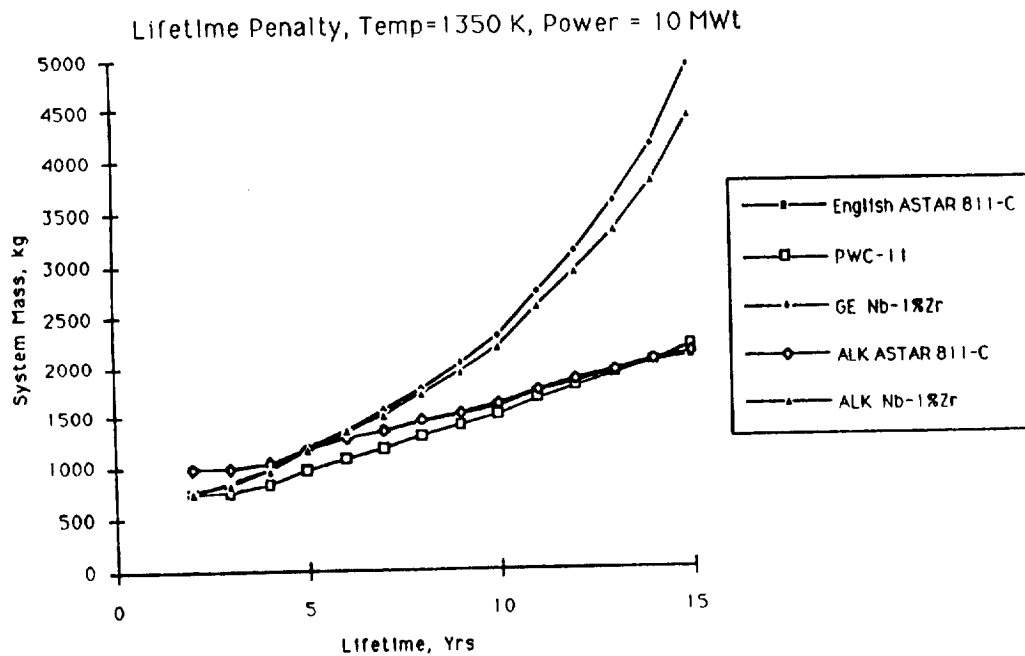
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Status

- **Two LMR reactor models comopared:**

  - **ALKASYS better above 2.5 MWt**

  - **RSMASS better below 2.5 MWt**

- **Modular systems driver code completed**

- **LMR/Rankine version undergoing verification & validation**

- **Various subroutine models collected, under development**