GT-MHR PLANT DESIGN OVERVIEW

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Arkal Shenoy
Director, Modular Helium Reactor
General Atomics

M-273(1)
8-27-01

GENERAL ATOMICS

Presentation Outline

- Design goals & requirements
- Design description
- International Program
- Commercial Program
- Design status and deployment schedule
- Conclusions

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MODULAR HTGR DEVELOPMENT FOCUSED ON GEN IV GOALS (for past 15+ years)

- Modular HTGR first conceptualized in early '80s to provide simple, enhanced SAFETY
- GT-MHR conceptualized in early '90s to provide enhanced ECONOMICS
- Gas reactor TRISO coated particle fuel form ideal for spent fuel WASTE
- Fissile fuel inventory, isotopic composition, and fuel form provides PROLIFERATION resistance

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MHR DESIGN APPROACH

- Utilize inherent characteristics
  - Helium coolant - inert, single phase
  - Refractory coated fuel - high temp capability, low release
  - Graphite moderator - high temp stability, long response times
- Utilize existing technology, successfully demonstrate components and experience
- Develop simple modular design
  - Small unit rating per module
  - Below-grade installation
- Develop passively safe design
  - Annular core, large negative temperature coefficient
  - Passive decay heat removal system
  - Minimized powered reactor safety systems

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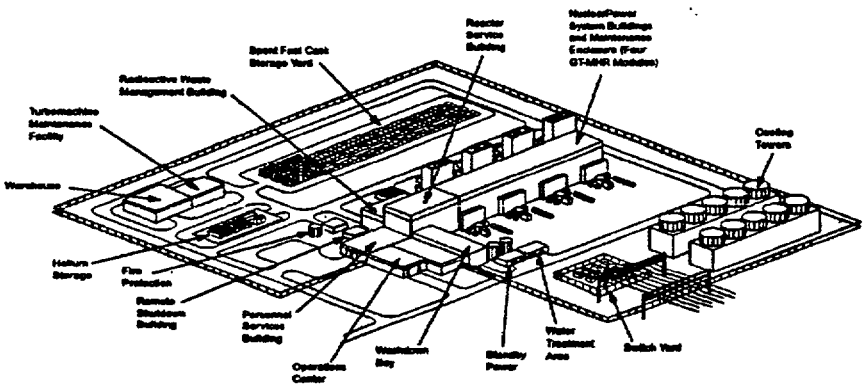
4 MODULES COMPRISE STANDARD PLANT



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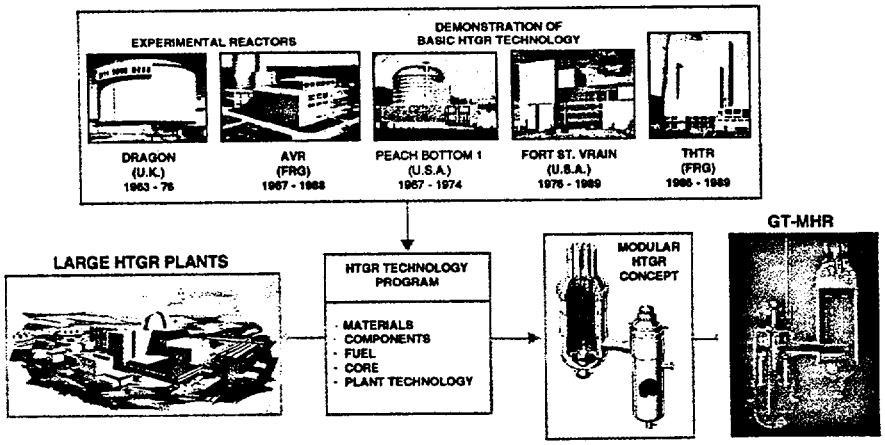
U.S. AND EUROPEAN TECHNOLOGY BASES FOR MODULAR HIGH TEMPERATURE REACTORS

BROAD FOUNDATION OF HELIUM REACTOR TECHNOLOGY



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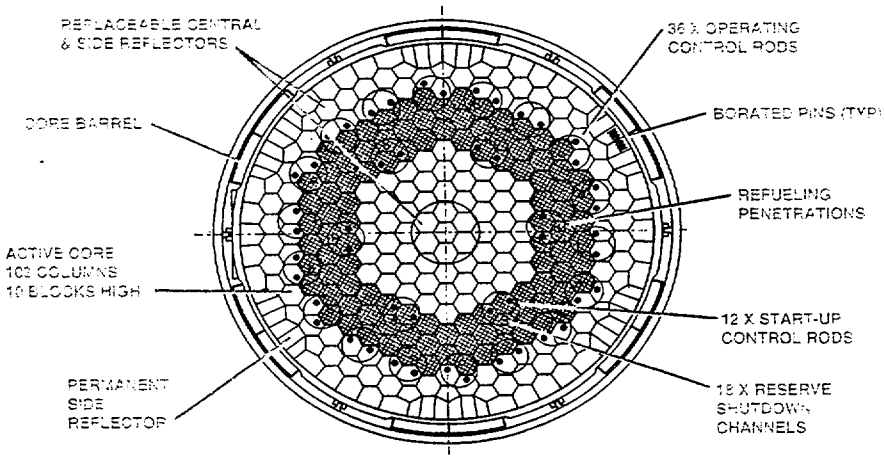
ANNULAR REACTOR CORE LIMITS FUEL TEMPERATURE DURING ACCIDENTS



...ANNULAR CORE USES EXISTING TECHNOLOGY

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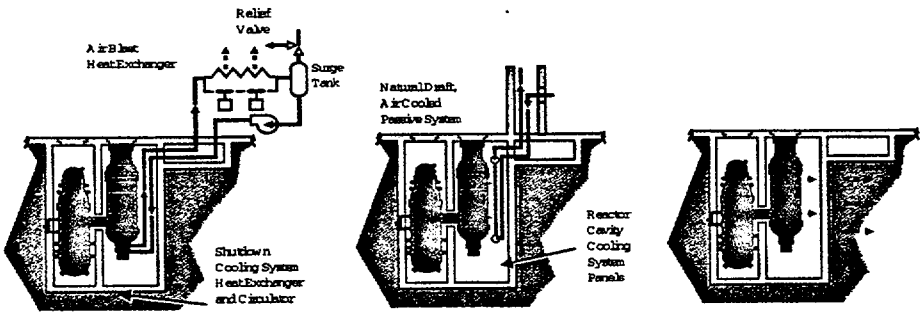
POSSIBLE HEAT REMOVAL PATHS WHEN NORMAL POWER CONVERSION SYSTEM IS UNAVAILABLE



A) Active Shutdown Cooling System

B) Passive Reactor Cavity Cooling System

C) Passive Radiation and Conduction of Afterheat to Silo Containment (Beyond Design Basis Event)

... DEFENSE-IN-DEPTH BUTTRESSED BY INHERENT CHARACTERISTICS

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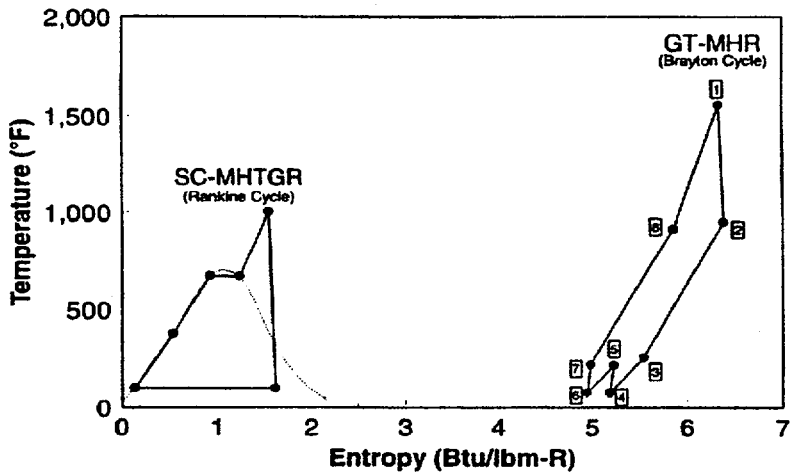
T-S DIAGRAM



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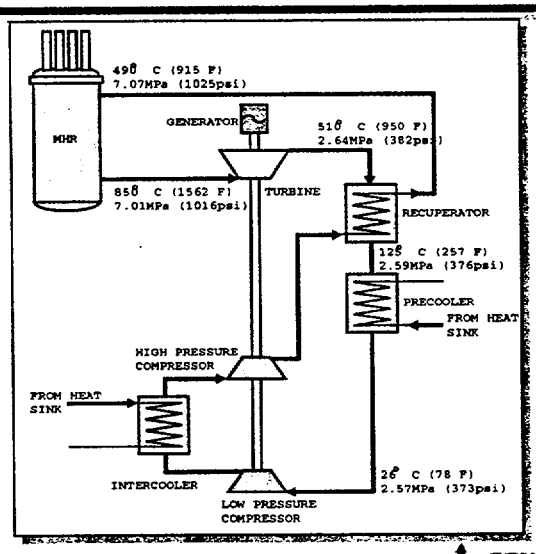
GENERAL ATOMICS

GT-MHR FLOW SCHEMATIC



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CONTROL BASED ON 3600 RPM SYNCHRONIZED GENERATOR

- Reactor controlled to maintain constant turbine inlet temperature during normal power operation
- Turbine bypass valve provides short term control
  - Rapid load following
  - Machinery protection
- Inventory (coolant pressure) control provides long term load control while maintaining high cycle efficiency
- Motorizing generator with frequency convertor provides startup and shutdown cooling capability

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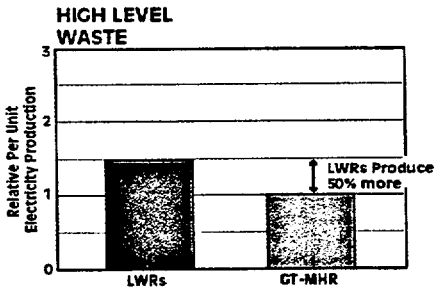
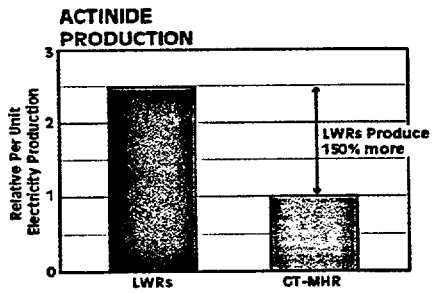
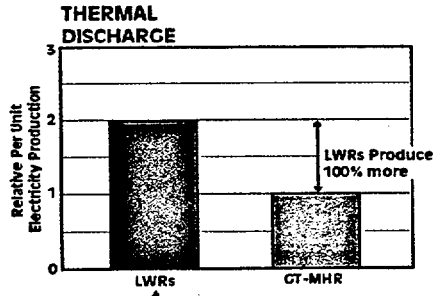
GT-MHR OFFERS MAJOR ENVIRONMENTAL BENEFITS







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LIMITED ENGINEERING WORK REQUIRED

COMMERCIAL PLANT ENGINEERING

- Define Commercial Plant Requirements
- Transfer International Program Technology
- Prepare Incremental Design Items
- Safety and Licensing
- Performance Assessments

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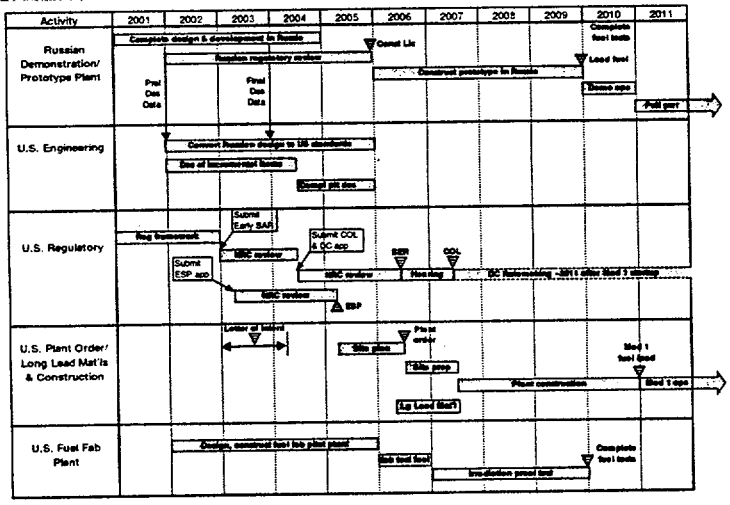
COMMERCIAL DEPLOYMENT CAN CLOSELY FOLLOW PROTOTYPE IN RUSSIA



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GT-MHR Being Designed for Prototype in Russia for Disposition of WPu

- April 1993: Minatom/GA MOU on joint GT-MHR development for commercial units
- June 1994: Russia proposes to build GT-MHR at Seversk to burn Russian WPu
- July 1994: GA and Minatom each pledge $1M for initial work
- Jan 1996: Framatome & Fuji Electric join GT-MHR program
- Dec 1997: Team completes Conceptual Design
- Sept 1998: GT-MHR becomes an option within the US/RF Pu Disposition Strategy
- Jan 2000: Work started on Preliminary Design

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GT-MHR NOW BEING DEVELOPED IN INTERNATIONAL PROGRAM

- In Russia under joint US/RF agreement for management of surplus weapons Plutonium
- Sponsored jointly by US (DOE) and RF (Minatom); supported by Japan and EU
- Conceptual design completed; preliminary design complete early 2002

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