

New File:  
High Temperature  
Gas Reactor



**United States  
Nuclear Regulatory Commission**

**Briefing for Commissioner Merrifield  
on  
DOE MHTGR  
and  
GT-MHR**

**T.L. King  
April 19, 2001**

H-3

## Background

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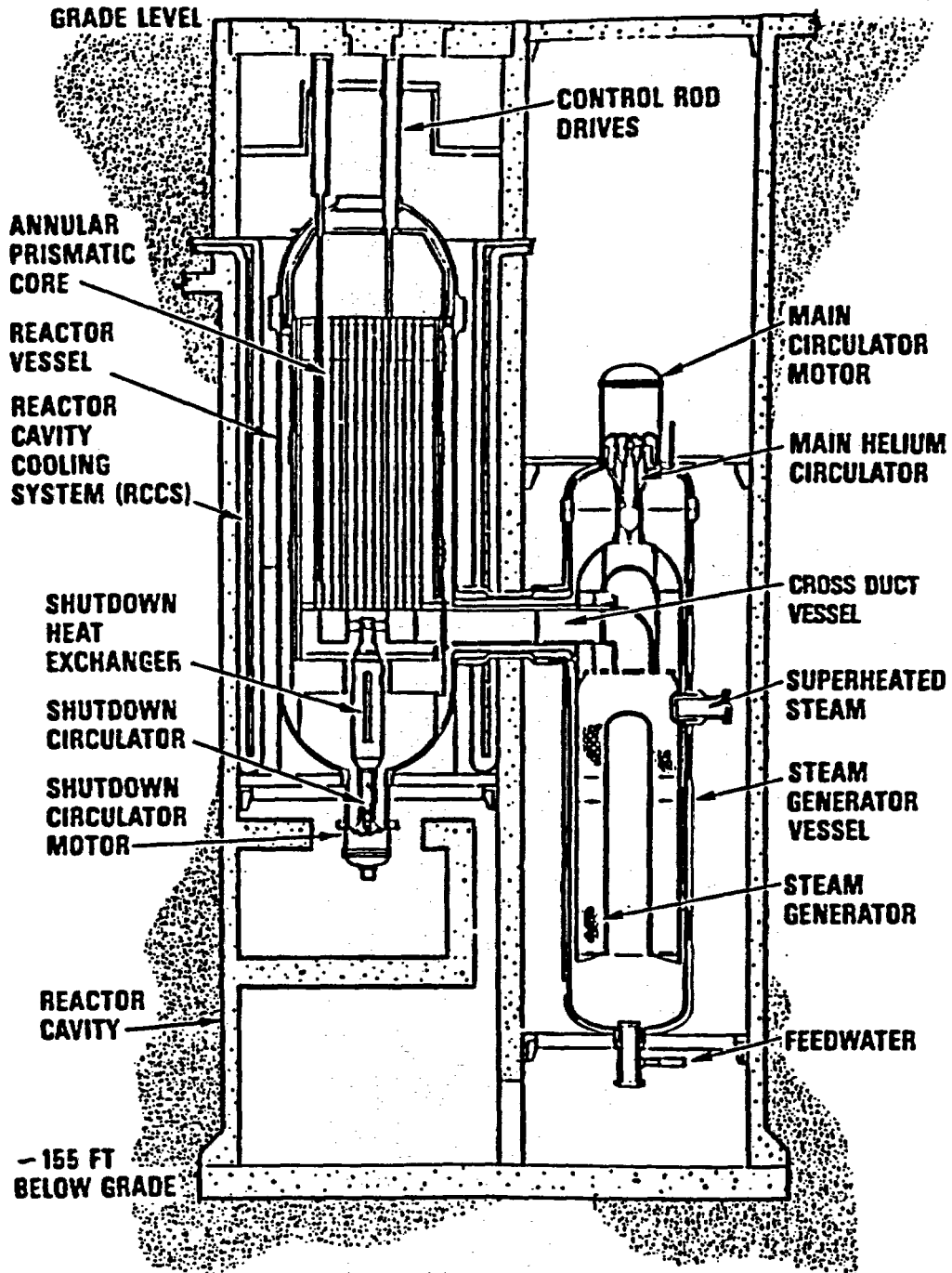
- Beginning in 1986, NRC conducted a preapplication review of a DOE sponsored modular HTGR design (MHTGR)
- The review objectives were to:
  - identify key safety, research and licensing issues
  - provide feedback to DOE on the potential licensability of the design
- Scope of review included:
  - conceptual design and safety analysis
  - preliminary PRA
  - regulations
- Draft preapplication SER (PSER) issued in March 1989 (NUREG-1338)
- DOE canceled the program in 1996. No final NUREG was issued.

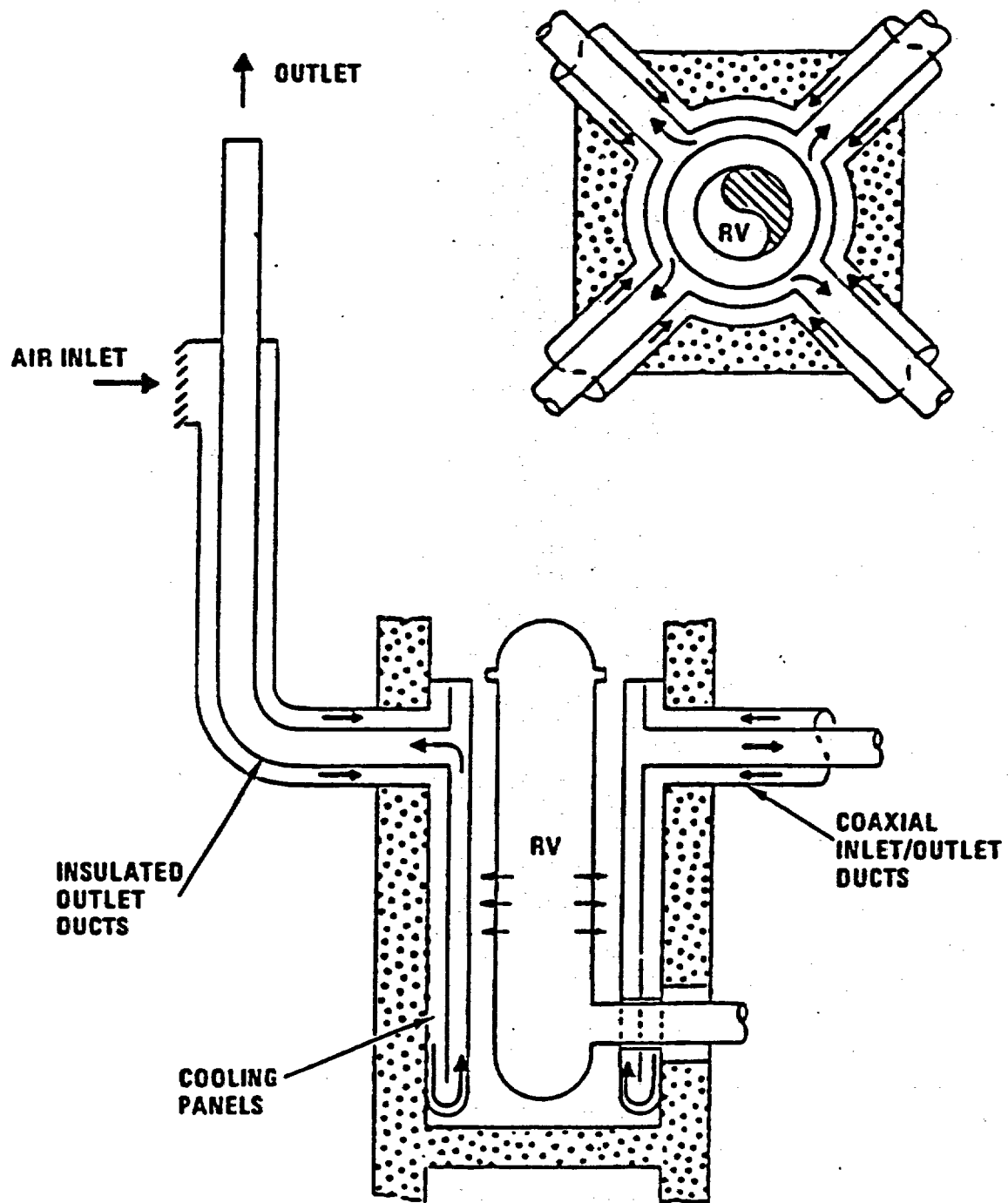
## MHTGR CONCEPT

- DESIGNERS - GA TECHNOLOGIES/S&W/BECHTEL/CE/GE.
- 350 MWT (137 MWE), MODULAR DESIGN, WITH REACTOR VESSEL AND STEAM GENERATOR LOCATED BELOW GRADE.
- STEEL REACTOR VESSEL.
- EXTERNAL STEAM GENERATOR.
- TRISO COATED FUEL PARTICLES SIMILAR TO FSV.
- ANNULAR COPE DESIGN WITH PRISMATIC FUEL BLOCKS SIMILAR TO FSV.
- ONE LOOP PER MODULE.
- ONE TURBINE-GENERATOR PER 2 MODULES.
- NO CONTAINMENT OR CONFINEMENT BUILDING.
- PASSIVE DECAY HEAT REMOVAL AND SHUTDOWN SYSTEMS
- NON-SAFETY GRADE BOP.
- 40 YEAR MODULE LIFETIME.

FIGURE 1.1

USA MODULAR HTGR -- 350 MW(t)





Passive air-cooling

## MHTGR Key Issues

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- **Source Term:**
  - proposed mechanistic source term for siting and containment evaluation
  - fuel quality was central issue
- **Containment:**
  - confinement proposed by DOE
- **EP:**
  - EPZ = site boundary proposed
- **Design Basis Accidents**
  - frequency criteria proposed
- **SECY-93-092 proposed criteria for their resolution**
  - SRM of July 30, 1993, provided guidance to the staff

## Current GA Design - GT-MHR

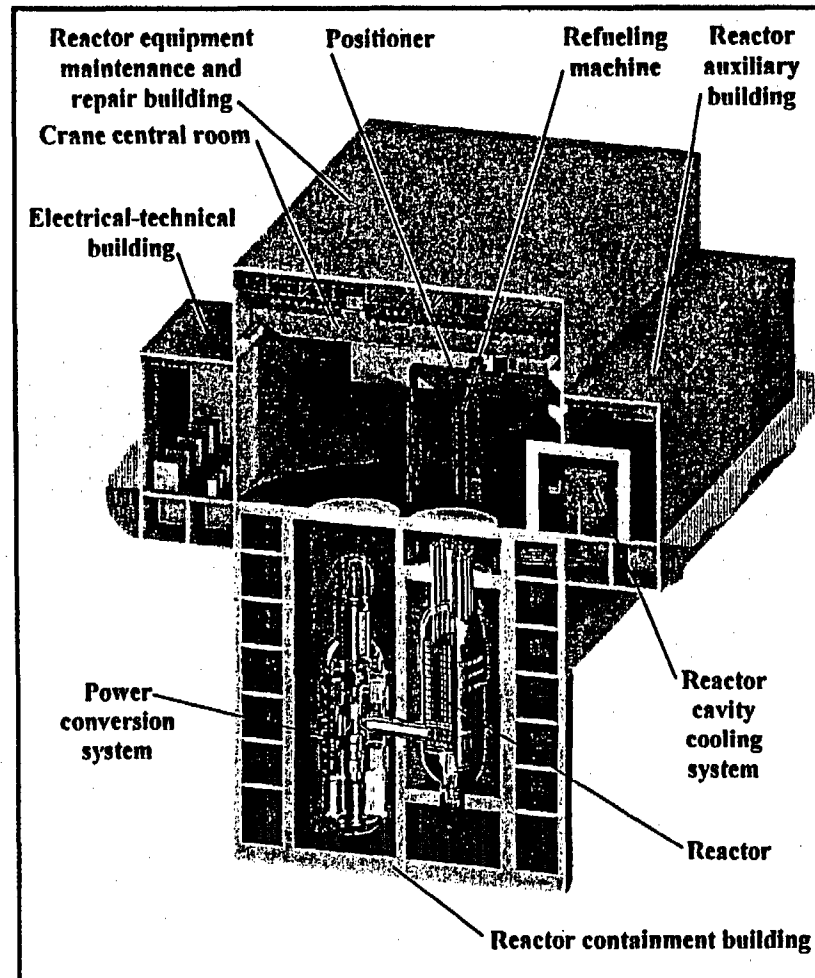
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- Evolution of the MHTGR design:
  - larger size - 600 Mwt
  - TRISO - UO<sub>2</sub> fuel
  - in-line Helium turbine
  - development funded by DOE for Pu disposition
- GA is pursuing a commercialization program
- Preapplication interactions with NRC requested

# INTERNATIONAL GT-MHR PROGRAM

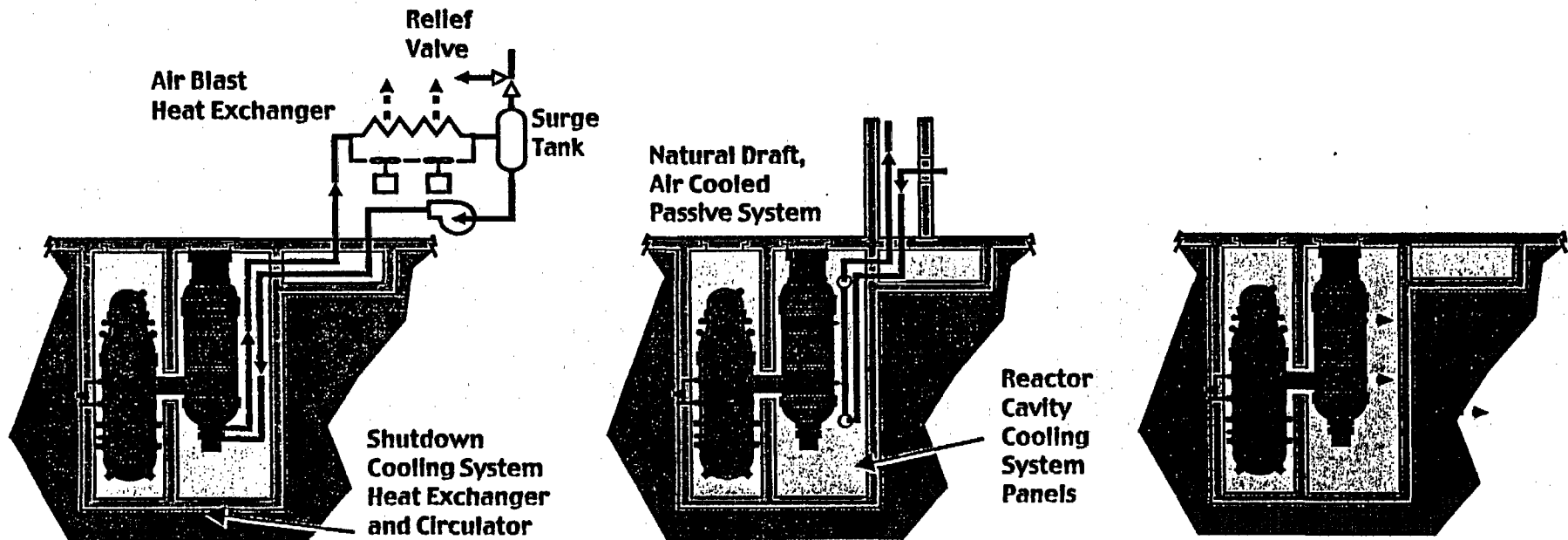
- Design, construct and operate a prototype GT-MHR module by 2009 at Tomsk, Russia
- Design, construct, and license a GT-MHR Pu fuel fabrication facility in Russia
- Operate first 4-module GT-MHR by 2015 with a 250 kg plutonium/year/module disposition rate

*....Fuel contains Pu only  
.....No fertile component*





# POSSIBLE DECAY HEAT REMOVAL PATHS WHEN NORMAL POWER CONVERSION SYSTEM IS UNAVAILABLE



A) Active Shutdown Cooling System

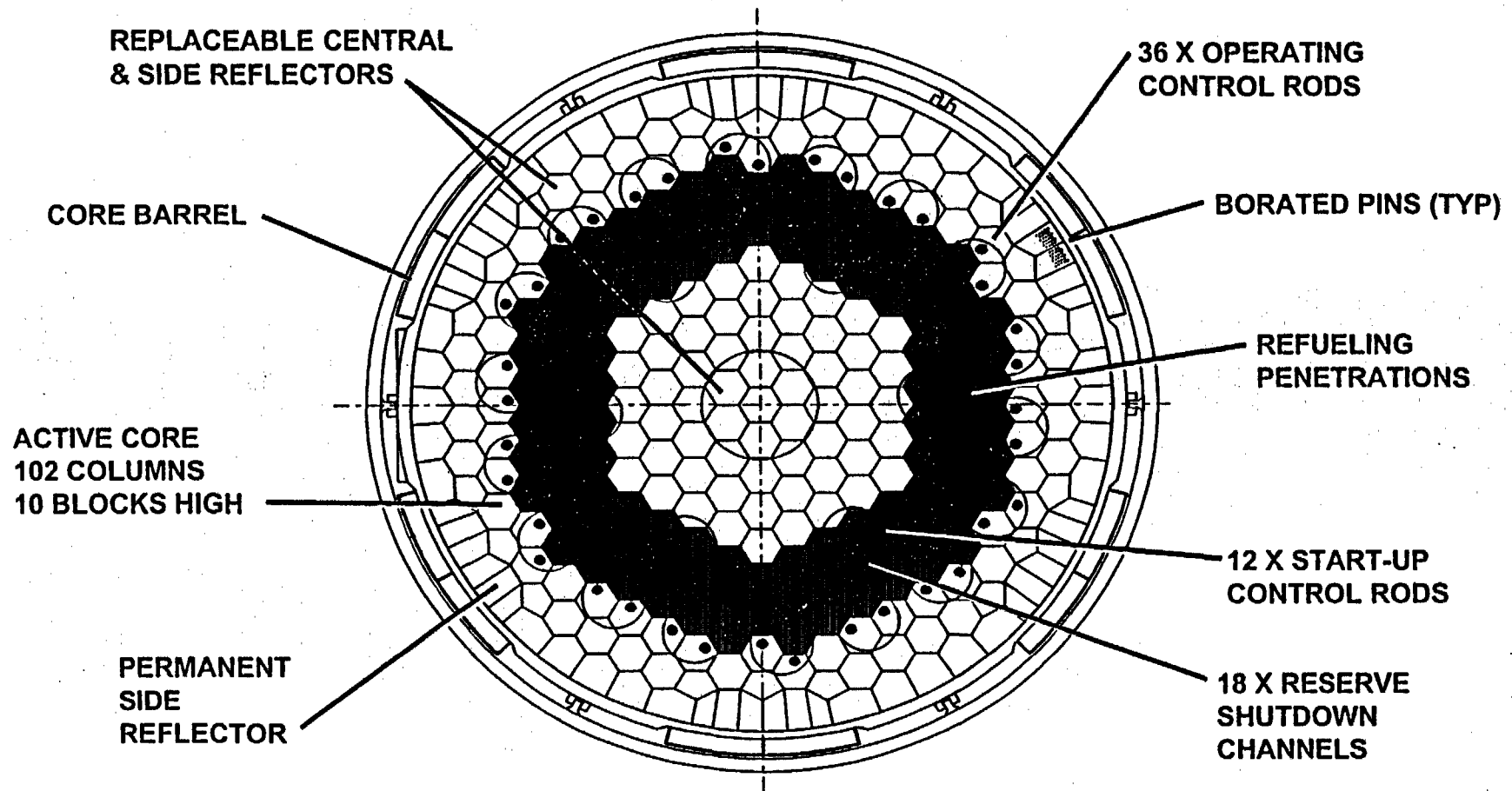
B) Passive Reactor Cavity Cooling System

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

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



# ANNULAR REACTOR CORE LIMITS FUEL TEMPERATURE DURING ACCIDENTS



... ANNULAR CORE USES EXISTING TECHNOLOGY



# COMMERCIAL PROGRAM FOLLOWS INTERNATIONAL PROGRAM

	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15
<b>INTERNATIONAL PROGRAM</b>														
Design and Devel				▼ Complete Design & Development										
Prototype Licensing				▼ Construction License										
Prototype constr										▼ Complete Proto Constr				
Prototype Startup										▼ Complete Proto Demo				
Full Power Operation										▼ Start Full Power Ops				
<b>GT-MHR COMMERCIAL PROGRAM</b>														
Prel Design			▼ Complete Plant Preliminary Design											
SAR			▼ Complete SAR											
SER				▼ Complete SER										
Final Design				▼ Complete Final Design										
Fuel														
- Automated FF Pt				▼ Complete Automated Fuel Fab Plant Pilot Plant										
- Qualified Fuel										▼ Complete Tests				
First Comm Pt														
- First Order			▼ Ltr of Intent		▼ Order for First Comm Plant									
- Constr				▼ Start Plant Construction										
- Operation Mod 1										▼ Startup of Module 1				
- Operation Mod 2										▼ Mod 2				
- Operation Mod 3										▼ Mod 3				
- Operation Mod 4												▼ Mod 4		