Five Top Challenges for MFE and IFE in the Next Decade

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- Over the past 30 years scientists and engineers have encountered dozens of physics and technology issues.
- Proposed solutions to these problems have been incorporated into designs.

  a) Near- term experiments (ETR, CIT, BPX, ITER, etc.)

  b) MFE power plants (UWMAK series, STARFIRE, ARIES series, etc.)

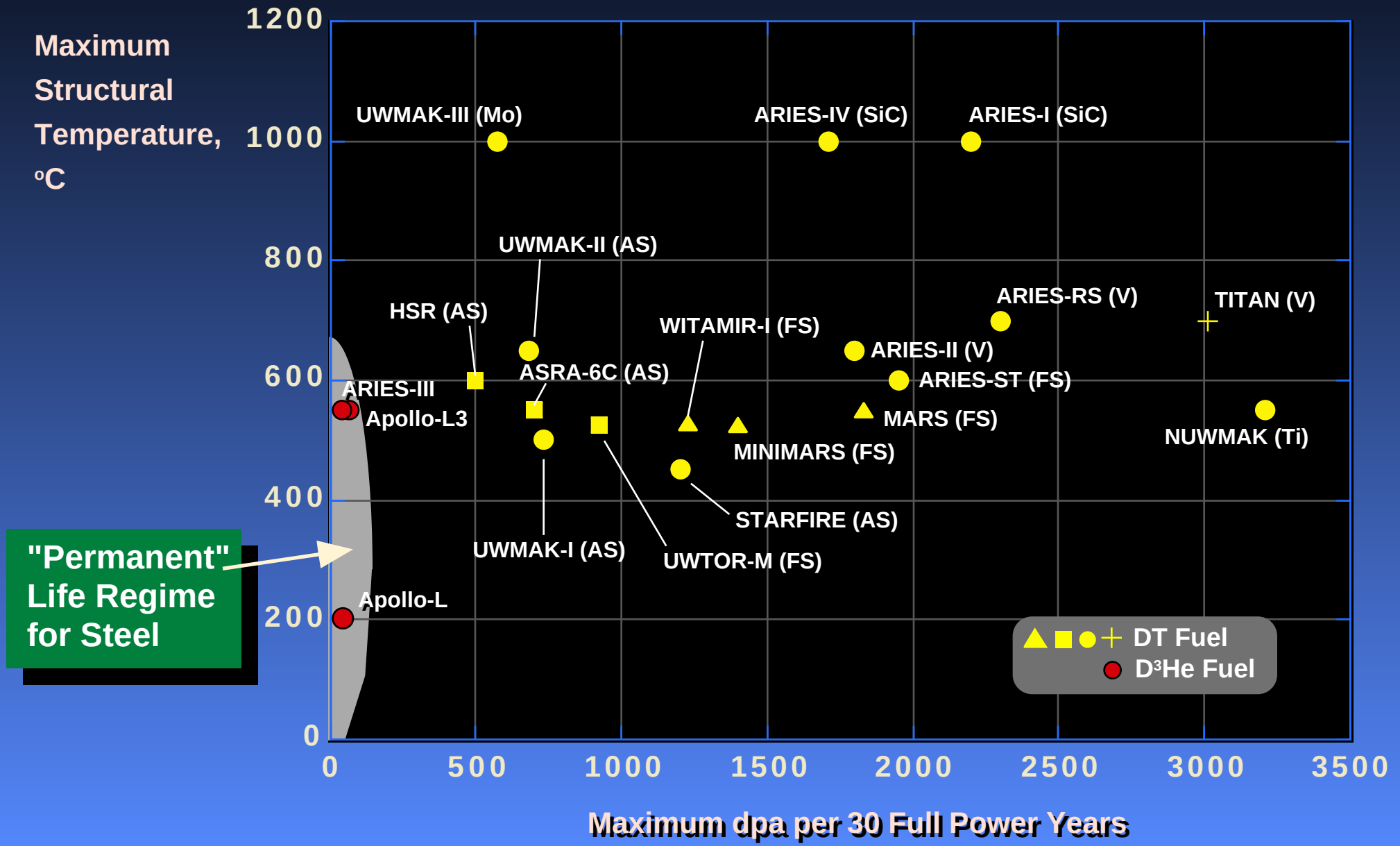
  c) IFE power plants (SOLASE, HYLIFE, HIBALL, LIBRA, SOMBRERO, Prometheus, etc.)

- What is the current view of the top 5 MFE and 5 IFE technology issues from a reactor design group?
  (aside from plasma physics, beam transport, and target physics issues)

Five Top Technology Challenges for MFE and IFE in the Next Decade

Magnetic Fusion	*Inertial Fusion*
• Neutron radiation damage	• First-wall protection from blast and neutrons
• Divertor design (Steady state and disruptions)	• Cavity clearing
• Insulator coatings for liquid metal coolants	• Final focusing protection
• Reduction of maintenance complexity	• Low-cost target fabrication, injection, and tracking
• Low-cost, high-field S/C magnets	• Driver efficiency and rep-rate

The Low Radiation Damage in D^{3}He Reactors Allows Permanent First Walls to be Designed



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Conclusions

- **Many of the key technology issues identified in the early 1970's still remain unsolved.**
- **Current (FY-99) Fusion Energy Sciences budget devotes less than 10% of its resources to the solution of these "show-stoppers".**
- **In spite of 3 decades of research, we still do not have a demonstrated solution for the neutron radiation damage problem in either MFE or IFE.**

Recommendations

- **The construction of a "real" volumetric 14 MeV neutron source should take the highest priority in the MFE technology program.**
- **A vigorous research program should be established to validate IFE chambers designed to protect the first walls and allow rapid rep rates.**