The ARIES Program

(Advanced Research Innovation and Evaluation Study)

http://aries.ucsd.edu/ARIES

ARIES Mission

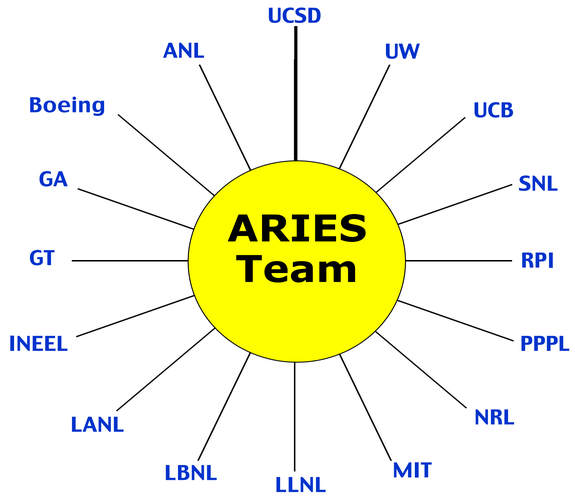
Perform advanced integrated design studies of long term fusion energy embodiments to identify key R&D directions and provide vision for the U.S. fusion program.

ARIES Goal

Demonstrate that fusion power can be a safe, clean, and economically attractive option.

The ARIES program is unique worldwide

in ability to provide fully integrated analysis of power plant options including plasma physics, fusion technology, economics, safety, etc.



The ARIES Team comprises key members

from major fusion centers: universities, national laboratories, and industry.

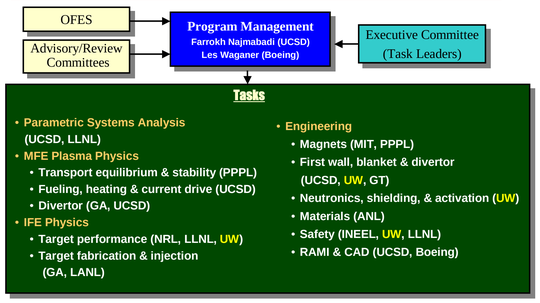
Expert groups and advocates

are brought in as needed to ensure flow of the latest information from the R&D program.

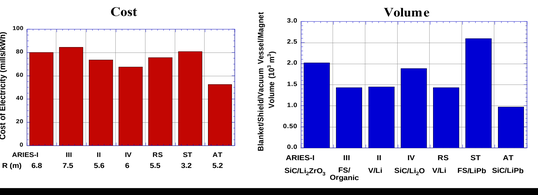
Workshops and "town meetings"

are held for direct discussion and dissemination of results.

ARIES Program is Organized as a Team



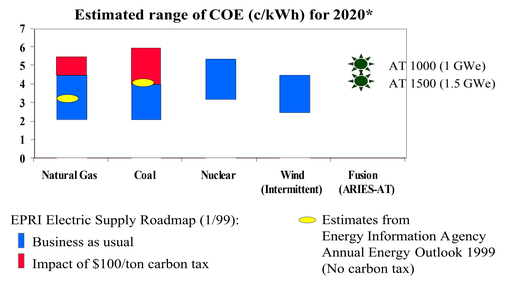
Magnetic Fusion Power Systems Have Improved Dramatically During the Last Decade, Due to Advances in Physics and Technology



The ARIES Team Has Examined Numerous Fusion Concepts as 1000 MWe Power Plants

- TITAN reversed-field pinch (1988)
- ARIES-I first-stability tokamak (1990)
- ARIES-III D-^{3}He-fueled tokamak (1991)
- ARIES-II and -IV second-stability tokamaks (1992)
- Pulsar pulsed-plasma tokamak (1993)
- SPPS stellarator (1994)
- Starlite study (1995) (goals & technical requirements for power plants & Demo)
- ARIES-RS reversed-shear tokamak (1996)
- ARIES-ST spherical torus (1999)
- Fusion neutron source study (2000)
- ARIES-AT advanced technology and advanced tokamak (2000)
- ARIES-IFE laser and HIB inertial fusion designs (2000-present)

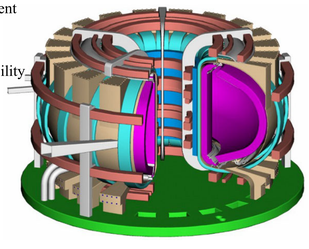
ARIES-AT is Competitive with Other Future Energy Sources



D-^{3}He Fueled ARIES-III: Easy Technology Shortens Time to Fusion Commercialization

Main Technological Features

- Simple FS design
- Low radiation damage => permanent components
- Low radioactivity => safer design
- Easy maintenance => high availability
- Direct energy conversion => high efficiency
- Lunar ^{3}He resources



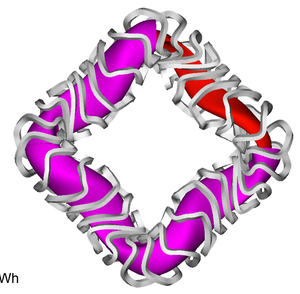
Key Parameters

major radius	7.5 m
aspect ratio	3
toroidal beta	24%
fusion power	2650 MW
COE	85 mills/kWh

Stellarator Power Plant Study Focused the U.S. Stellarator Activity on Compact Stellarators

- Modular MHH configuration represented a factor of two improvement on previous stellarator configuration with attractive features for power plants.
- Key Parameters

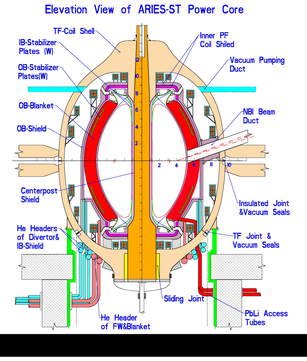
number of field periods	4
major radius	14 m
aspect ratio	12
beta	5%
fusion power	1730 MW
COE	75 mills/kWh



The ARIES-ST Study Identified Directions for Spherical Torus Research

- ARIES-ST provided guidance for NSTX physics research.
- Modest size machines can produce significant fusion power, leading to low-cost development pathway for fusion.
- Key Parameters

major radius	3.2 m
aspect ratio	1.6
toroidal beta	50%
fusion power	2980 MW
COE	80 mills/kWh



ARIES-AT: Combination of Advanced Tokamak Modes and Advanced Technologies

Main Features

- Competitive cost of electricity
- Steady-state operation
- Small waste volume
- High thermal efficiency (60%)
- High availability (85%)

Key Parameters

major radius	5.2 m
aspect ratio	4
toroidal beta	9.2%
fusion power	1720 MW
COE	55 mills/kWh