Distribution of Advanced Design Research

	FY02	FY03 (Current)
ARIES (IFE & MFE) System Studies	1,966	1,939
Socio-economic Studies	173	225
UCSD/UW/RPI		1,189
IFE Advocates		450
Stellarator Physics		300

⇒ ARIES activities will be divided roughly between IFE and MFE.

⇒ Slower start for Compact stellarator study.

ARIES-IFE Research Plans for FY03

Design Window for Thin Liquid Protection

- **Film Generation, Coverage and Stability (GIT)** .e., can a protective liquid film formed in the time between shots of 100-200 ms?
- **Chamber Clearing:** The liquid film that is evaporated forms an aerosol in the chamber and will recondense and/or transported in the chamber. The amount and size of the aerosol should be below certain limits so that target can be injected in the chamber and driver can be focused on the target. Specific issues are:
  - ✓ **2A) Characterization of aerosol source term (UCSD, UW),** i.e., better understanding and modeling of liquid film under photon and target threat including explosive boiling and other effects.
  - ✓ **2B) Transport of aerosol in the chamber (INEL, UCSD, UW),** i.e., nucleation, recondensation, and transport
- **Design window for successful injection and tracking of targets (GA, UCSD, ?),** i.e., acceptable range of aerosol size and density
- **Design window for successful propagation and focusing of heavy ion drivers (LBNL, et al)** i.e., acceptable range of aerosol size and density

Design Window for Thick Liquid Protection

- ➔ Feasibility issues for chambers with thick liquid walls are quite concept dependent. **Most of the work next year is aimed at HYLIFE design and/or small variation from HYLIFE**:
- ➢ Aerosol formation and transport in chamber (INEL, UCSD)
- ➢ Understand and assess droplet formation from the criss-crossing jets which could directly interfere with the driver (Georgia Tech)
- ➢ Configuration issues such as a) smaller oscillating jets together with stationary jets behind, b) relative importance of criss/crossing jets on attractiveness of the concept (ALL).
- ➢ Reproducibility of required jet behavior over multi-cycles.
- ➢ Structural material choice.

Heavy Ion Fusion Target Hohlraum Material and Design

- ➔ The selection of hohlraum materials for the Heavy Ion Fusion target is a significant feasibility issue as it must satisfy many multi-disciplinary requirements (All):
- ✓ Target physics/target gain
- ✓ Cost and complexity (even feasibility) of target fabrication
- ✓ Cost of equipment and operations to remove the materials from the chamber
- ✓ Chemistry and impurity control requirements for working fluid injection
- ✓ Compatibility of structural materials with hohlraum components (e.g., primary loop corrosion)
- ✓ Radioactive inventory of materials
- ✓ Decisions to recycle materials or discard them (waste volume, high-level waste generation)
- ✓ Heat transfer for layering the targets (if in-hohlraum layering is used)
- ✓ Acceleration limit for injecting the targets (strength of materials in needed density and geometry)

Heavy-ion driver Interface Studies

- **Beam Propagation in IFE Chambers (MRC, SNL, LBNL):**
  - ✓ The goal is to map out chamber size and operating pressure windows for the 3 propagation modes. Generally, the assisted pinch mode will operate in the 1-20 Torr regime, the self-pinch mode in the 5-100 mTorr regime, and the ballistic neutralized propagation operates below 5 mTorr.

- **Interface issues between chamber and the final focus magnet (LBNL, LLNL, UW, UCSD, …)** :
  - ✓ Goal is to understand trade-offs among and matching of propagation modes to the various chamber concepts and HIF indirect-drive target concepts (close-coupled and hybrid hohlraums).

ARIES-IFE Papers

Possible Special Issue of Fusion Science and Technology

Deadline for paper submission: Nov. 30, 2001

1. Dry Wall design Window (Raffray/Hayens)
2. Thin-liquid wall (Abdel-Khalik/Raffray)
3. Target fabrication, injection, and tracking (Petzoldt/Raffray)
4. Overview of beam transport, final focus magnet, and interface issues (Yu/Olson)
5. Overview paper + issues not covered (Najmabadi/Tillack)

* Lead authors in parentheses (develop outline, author list, etc.)

Distribution of Advanced Design Research

	FY02	FY03 (Current)
ARIES (IFE & MFE) System Studies	1,966	1,939
Socio-economic Studies	173	225
UCSD/UW/RPI		1,189
IFE Advocates		450
Stellarator Physics		300

⇒ ARIES activities will be divided roughly between IFE and MFE.

⇒ Slower start for Compact stellarator study.

ARIES-CS Research Plans for FY03

We would like to initiate a three-year study of compact stellarators as power plants

- Initiation of NCSX and QSX experiments in US; PE experiments in Japan (LHD) and Germany (W7X);
- Review committees have asked for assessment of compact stellarator option as a power plant; Similar interest has been expressed by national stellarator program.
- Such a study will advance physics and technology of compact stellarator concept and addresses concept attractiveness issues that are best addressed in the context of power plant studies.
- NCSX and QSX plasma/coil configurations are optimized for most flexibility for scientific investigations. Optimum plasma/coil configuration for a power plant may be different. Identification of such optimum configuration will help compact stellarator research program.

ARIES-Compact Stellarator Program is a Three-year Study

FY03: Development of Plasma/coil Configuration Optimization Tool

1. Develop physics requirements and modules (power balance, stability, α confinement, divertor, *etc.)*
2. Develop engineering requirements and constraints.
3. Explore attractive coil topologies.

FY04: Exploration of Configuration Design Space

1. Physics: β, aspect ratio, number of periods, rotational transform, sheer, *etc.*
2. Engineering: configurationally optimization, management of space between plasma and coils.
3. Choose one configuration for detailed design.

FY05: Detailed system design and optimization