

## 6. Management and Budget

Professor Michael Heath, CSAR Director, and the members of the Science Steering Committee continue to provide effective leadership and focus for the Center for Simulation of Advanced Rockets. The Center is administratively housed within the Computational Science and Engineering Program of the UIUC College of Engineering, reporting to the Dean of Engineering, William R. Schowalter.

The Computational Science and Engineering Program is inherently interdisciplinary, requiring expertise in advanced computing technology, as well as in one or more applied disciplines. The purpose of the CSE Option at the University of Illinois is a perfect complement to the academic goals of ASCI/ASAP—to foster interdisciplinary, computationally oriented research among all fields of science and engineering, and to prepare students to work effectively in such an environment.

Students electing the CSE Option become proficient in computing technology, including numerical computation and the practical use of advanced computer architectures, as well as in one or more applied disciplines. Such proficiency is gained, in part, through courses that are specially designed to reduce the usual barriers to interdisciplinary work. Thesis research by CSE students is expected to be computationally oriented and actively advised by faculty members from multiple departments. The CSE Program does not independently admit students or confer graduate degrees—students wishing to elect the CSE Option must first be admitted to one of the participating departments before enrolling in the CSE Program. Similarly, all faculty members affiliated with CSE have regular faculty appointments in one of the participating departments.

<b>Education Program</b>	<b>Research Program</b>	
<b>Computational Science &amp; Engineering Option</b>	<b>Center for Simulation of Advanced Rockets</b>	<b>Center for Process Simulation and Design</b>
12 departments	DOE funded	NSF & DARPA funded
120 faculty associates	\$20 million over 5 years	\$2.1 million over 3 years
60 graduate students	42 faculty	11 faculty
11 graduate fellows	40 graduate students	13 students & staff
	28 professional staff	

Fig. 6.1. CSAR is one of two research centers in UIUC Computational Science and Engineering Program. CSE education program is graduate student degree “option.”

### Program Management

The Director and Science Steering Committee members are responsible for nurturing the research program, administering the Center, and maintaining and expanding relationships with the DOE DP laboratories. This directorate provides the leadership necessary to ensure that the Center identifies the most important research areas, attracts the most qualified re-

searchers, and pursues and completes the work effectively over the long term. A small administrative staff works to properly execute Center activities (Fig. 6.2).

Each of the Research Groups has co-leaders who coordinate the technical program in that area. Nine technical teams have been formed (Fig. 6.3) that address specific issues within the research effort. Two representatives from each of the three DOE DP laboratories serve on a “Tri-lab Support Team” (TST). Each lab has an “applications” and a “computer science” member on the TST; their roles are to integrate Center research into the DOE DP lab programs and to review periodically the technical progress.

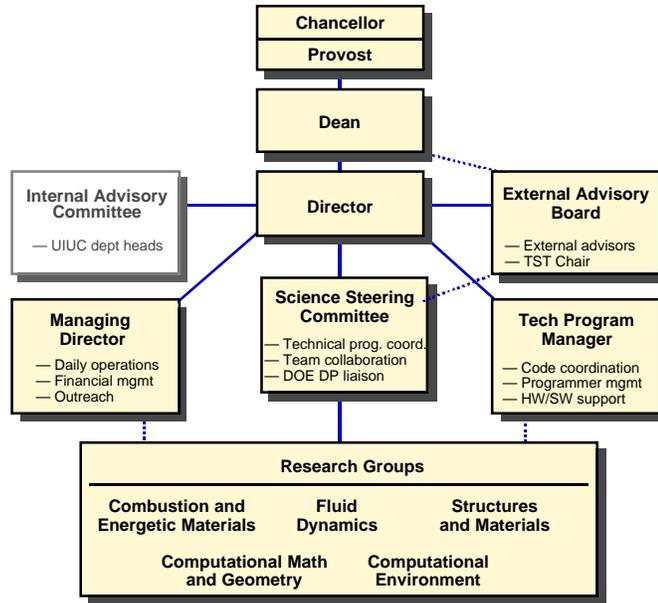


Fig. 6.2. CSAR management structure provides clear direction.

One new team was established in Y2. The Software Integration Framework (SWIFT) team was formed to craft a strategy for developing a general software architecture for component integration. The idea is to leverage our experience from the GEN1 integration effort, but abstract it and generalize it to make it more flexible and more broadly applicable, while still strongly supporting the specific needs of CSAR rocket simulations. A minor change was made among the CSAR teams; the Specification and Validation Team was renamed the Validation and Specification Team

(VAST) to better reflect its ongoing focus on validation.

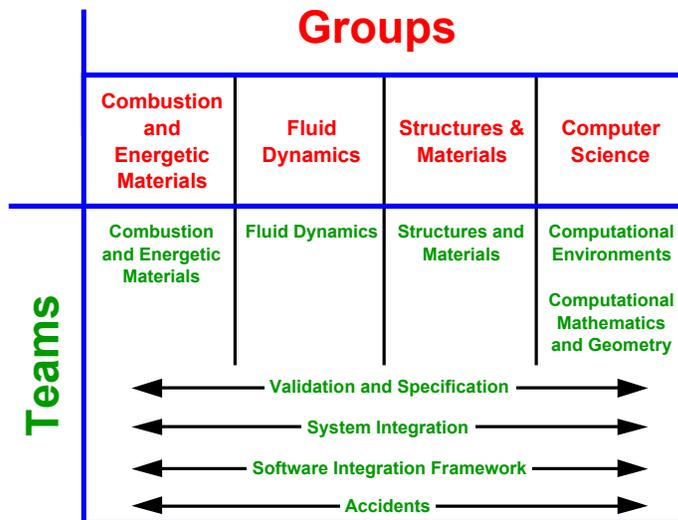


Fig. 6.3. Team efforts contribute to Research Groups. Software Integration Framework team is new in Y2—responds to suggestion of DOE Review Team.

The membership of the External Advisory Board (EAB) consists of individuals chosen from the DOE DP labs, industry, other governmental agencies, and other universities (Fig. 6.4). The External Advisory Board reviews research studies, makes research recommendations, and provides expertise for translating research findings into practice. An active communications link has been established with the EAB. The Board is expected to assess the progress of the

<b>Rocket Industry</b>	<b>Government Research Agencies</b>
Aeroflot	Air Force Research Laboratory
Alliant Techsystems	Army Research Office
Atlantic Research	Lawrence Berkeley National
Geisler Enterprises	NASA Headquarters
Lockheed-Martin Missiles & Space	NASA Marshall Space Center
Thiokol Propulsion	Naval Air Warfare Center, China
	Sandia National Laboratory
<b>Computer Industry</b>	<b>Universities</b>
Hewlett Packard Company	Caltech
Intel Corporation	Indiana University
IBM	University of Colorado
SGI	University of Tennessee Space
	Yale University

Fig. 6.4. Critical constituencies included on EAB.

Center in reports to the Dean of the College of Engineering.

## Staffing

### Administrative Staff

The Center for Simulation of Advanced Rockets has a very high quality professional staff that provides experienced management for the program. William Dick serves as Managing Director of the CSAR and Sheryl Hembrey is the Re-

source and Policy Analyst. Mr. Dick was formerly Assistant Dean of Engineering for External Affairs, focusing on the unique needs of the federally funded research centers in the College of Engineering. His role in the CSAR is to manage the day-to-day operations of the program, provide strategic direction, address facilities and equipment needs (including ASCI computing resources) and to assure that the Center is responsive to the DOE and ASCI. Robert Fiedler is the CSAR Technical Program Manager. Prior to joining CSAR, he was employed by Hewlett Packard as a consulting specialist in engineering application support and complex code parallelization. Dr. Fiedler convenes the System Integration Team and manages the code development process.

### Technical Staff

Seven research scientists, nine research programmers, and ten postdocs develop codes and advance the subscale simulations and physical models. In addition, forty graduate research assistants work with the faculty PIs. In Year 3, we expect to add two research programmers to the staff in the CS Group.

## CSAR Staff Employment

<u>Staff Classification</u>	<u>Y2</u>	<u>Projected (Y4)</u>
Senior investigators	42	42
Technical staff	28	30
Administrative staff	5	6
Graduate students	40	40
Undergraduate students	5	15
Total	120	133

## CSAR Technical Staff (by Group)

	<u>Senior Investigators</u>	<u>Graduate Students</u>	<u>Technical Staff</u>	<u>Changes in Y3</u>
Combust and Energ Mtrls	10	12	7	
Structures and Materials	12	8	7	
Fluid Dynamics	11	8	7	
Computer Science	9	12	4	(+2)
Integration			3	
Total	42	40	28	(+2)

### Research Group Structure

The system simulation effort is being carried out in a collaborative manner by a number of teams, each with specific responsibilities indicated below. To facilitate communication and cooperation among teams, there are appropriate overlaps in membership.

*Validation and Specification Team (VAST):* Responsible for specifying detailed blueprints of devices to be simulated, including physical dimensions and materials. This team is also responsible for identifying and measuring critical quantities for assessing quality of system simulation. This team has worked closely with NASA and Thiokol to collect detailed performance data for the Space Shuttle RSRM that will be used for validating CSAR simulations.

*System Integration Team (SITeam):* Responsible for overall system integration, including the mathematical model selection for the system components and the specification of compatible interfaces between component models. Includes both physical compatibility of component models and software and data interfaces between corresponding component codes.

*Software Integration Framework Team (SWIFT):* Responsible for crafting and executing a strategy for developing a general software architecture for component integration.

*Accidents Team:* Responsible for modeling and corresponding codes for assessing various failure modes, and effects of aging and damage on constituent materials. This team will begin work in Year 3.

*Combustion and Energetic Materials Team:* Responsible for combustion-injection modeling and corresponding codes for simulating burning of composite propellant. Also responsible for continuum-mechanical and molecular-level modeling and corresponding codes for simulating the thermo-mechanical behavior of energetic materials.

*Fluid Dynamics Team:* Responsible for fluid-mechanical modeling and corresponding codes for simulating the interior cavity flow and exhaust plume.

*Structures and Materials Team:* Responsible for solid-mechanical and thermal modeling and corresponding codes for simulating the case, nozzle, insulation, and propellant.

*Computational Environments Team:* Responsible for specifying compatible data structures and data formats for scientific data management, and also for parallel I/O and visualization. Also responsible for parallelization strategies, performance evaluation, and tuning of individual component codes as well as integrated system code.

*Computational Mathematics and Geometry:* Responsible for parallel numerical algorithms, such as sparse linear system solvers, as well as algorithms for mesh generation, partitioning, and adaptive refinement, needed for various component codes.

## Facilities and Space

The CSAR has been provided centralized office space for the program management and for the technical research staff. Four contiguous offices on the second floor of the Digital Computer Laboratory (DCL) presently house the management staff and four large offices on the third floor of DCL have been assigned for CSAR postdocs.

In addition to the space in DCL, the Center occupies approximately 5000 square feet of office and dry lab/computer space in a nearby building (Mechanical Engineering Laboratory). This space has been fully renovated by the University of Illinois for use by the Center and was occupied in September 1998. This space houses CSAR senior technical staff and visitors.

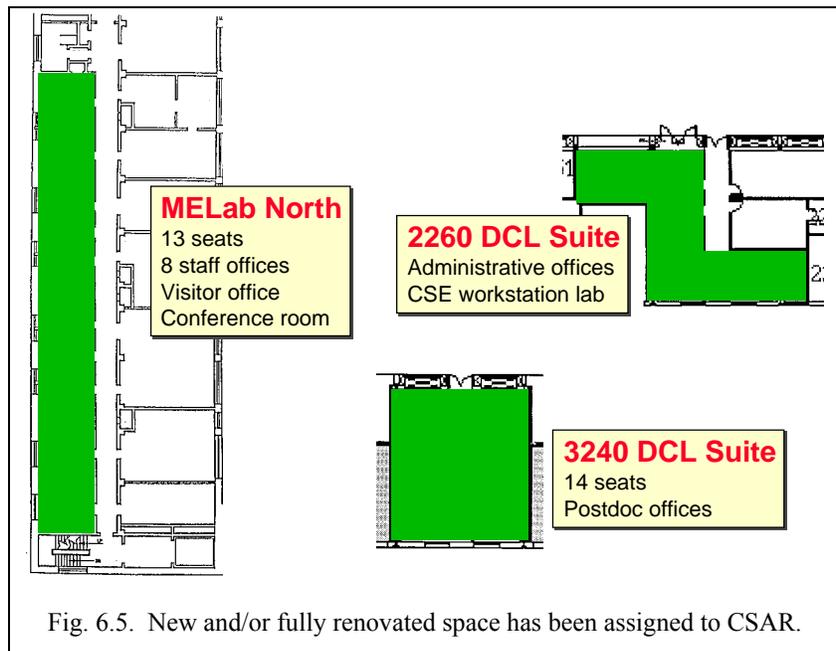


Fig. 6.5. New and/or fully renovated space has been assigned to CSAR.

## CSAR Seminar Series

Known as “Rocket Science 101”, the Center offers an internal seminar series designed to cross-educate the faculty, staff, and students. Further, the seminar series identifies key technology needs for research project development. The series also serves as a for-credit graduate seminar.

## Budget

The CSAR budget has been adequate to maintain an aggressive research program during the first contract year. In addition to funds provided by the DOE, the University of Illinois has provided needed support for both research expenditures and computer workstations, and facility renovation.

**CSAR Program Budget**  
(in Thousands)

<b>Expense Category</b>	<b>Y1 Expend</b>	<b>Y2 Expend</b>	<b>Y3 Budget</b>
Salaries			
Senior investigators	\$316	\$284	\$312
Clerical staff	36	17	30
Technical staff	358	960	1225
Graduate students	380	512	496
Undergrad students	16	6	20
Benefits	141	242	347
Equipment	340	60	100
Travel	135	109	100
Materials and supplies	68	128	83
Indirect costs	923	1430	1621
<b>Total</b>	<b>\$2,713</b>	<b>\$3,748</b>	<b>\$4,334</b>
<b>UIUC Match</b>	<b>\$190</b>	<b>\$525</b>	<b>\$257</b>

**Expenditures by Research Group**  
(in Thousands)

	<b>Y1</b>	<b>Y2</b>	<b>Y3</b>
CEM	\$544	\$902	\$954
SM	366	836	952
Fluids	517	820	894
CS	691	914	984
Admin*	594	276	550
<b>Total</b>	<b>\$2,713</b>	<b>\$3,748</b>	<b>\$4,334</b>

\* Includes all equipment purchases.