

SICSA OUTREACH

Sasakawa International Center for Space Architecture

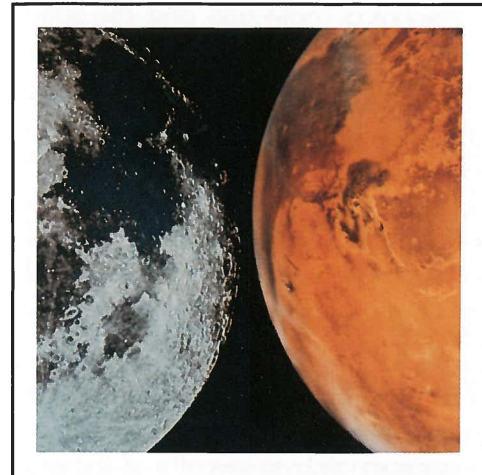
Planetary Missions and Settlements

The **National Commission on Space** appointed by President Reagan recommended that two bold new space initiatives, a permanent lunar outpost and human exploration of Mars, be realized early in the next century. These priorities were recently endorsed by U.S. astronaut Sally Ride, who headed a study team that assessed NASA's long-range goals. Both groups favor an evolutionary movement into space-- first making access to low-Earth orbit less costly and more routine, assembling the Space Station, establishing a permanent lunar base to extract oxygen and minerals, then pressing on to Mars.

Some space experts dispute the value of returning to the Moon, arguing that much needed reinvigoration of the U.S. exploration program can best be brought about through new challenges embodied in a manned Mars mission. Still others, including members of the **National Academy of Sciences Space Science Board**, believe that near-term missions beyond low-Earth orbit should be accomplished using unmanned automated spacecraft.

While views about priorities and means differ, diverse groups agree that the U.S. urgently needs a coherent and consistently sustainable long-range civil space strategy. This is necessary to rally public support; retain, expand and target technological resources; and provide reliable guidelines and incentives for cost-sharing cooperation with international partners.

Last year NASA adopted expansion of human presence into the Solar System as a major goal. SICSA is dedicated to Solar System exploration, development and habitation for purposes to benefit the world community.



Which is in the picture next?

In this issue of **SICSA Outreach**, two NASA experts discuss considerations for selecting the next major national/world-wide space effort beyond the Space Station... the Moon or Mars. Opinions offered are not intended by SICSA nor the authors as representations of official NASA policy nor as the formal positions of any NASA centers.

SICSA would like to receive reader thoughts about this important topic.

This issue also highlights current plans and recent developments within SICSA and the Experimental Architecture graduate program.

Moon First; Mars Later... Dr. Wendell W. Mendell

Human presence in the Solar System must ultimately include both the Moon and Mars. The planet which is selected as the first objective will determine the character and rate of space program progress for many generations to come.

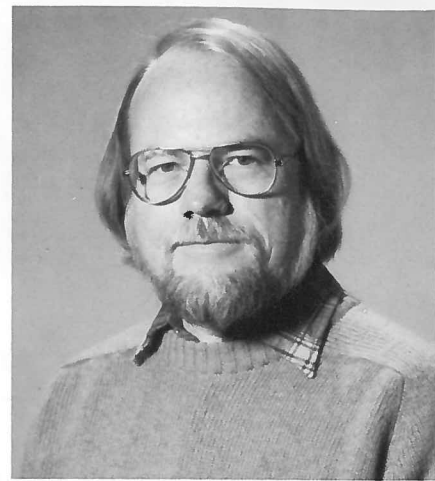
A permanent lunar base is essential to create a space transportation and industrial infrastructure to support ambitious manned exploration of other planets. A major technological priority is to develop closed, biologically-based life support systems to sustain a reasonable degree of operational autonomy for the settlement. Important payoffs will include the advancement of scientific and technical knowledge, and the acquisition of lunar resource materials to support other initiatives.

A manned lunar base can fulfill three distinct functions. The first involves scientific investigation of the Moon and its environment. Such research can provide new information about the early history of the Earth, offering a framework for interpreting observations about our Solar System. Potential utilization of lunar resources can also be evaluated.

A second lunar base function can be to exploit lunar resources for use in space. The commodity predicted to be of greatest demand in the Earth-Moon space over the next three decades is liquid oxygen. This fuel makes up approximately six-sevenths of the propellant mass utilized by cryogenic (hydrogen-oxygen) rockets, such as Centaur and various proposed orbital transfer vehicles. Abundant quantities of oxygen on the Moon are tied up in silicate and oxide materials which might be extracted by a number of different reduction processes.

A long-term and highly intriguing lunar base function is to conduct R&D leading to a self-supporting settlement. This can benefit society on our planet through the industrialization of near-Earth space.

The present lack of knowledge about effects of prolonged space travel on human physiology hampers near-term Mars mission planning. In addition, assembly of a massive Mars transfer vehicle in low-Earth orbit will present formidable scheduling and logistic challenges in view of limited two year launch windows. While a near-term manned Mars initiative offers dramatic, inspirational appeal, its legacy might be like Apollo... a glorious memory.



Dr. Wendell W. Mendell

Planetary Scientist, Solar System Exploration Division
NASA-Johnson Space Center, Houston, Tx.

Manned Lunar Base Benefits

Science and Technology

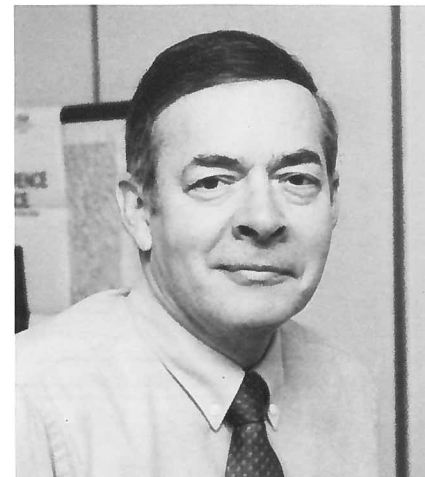
- *Planetological studies of the Solar System's origin and features.*
- *Surveys of lunar resources and extraction/processing methods.*
- *Physics/astrophysics research in a high vacuum environment.*
- *Medical/physiological research for planetary programs.*
- *Genetic engineering of microorganisms to extract soil volatiles.*
- *Plant growth/closed-loop ecological system experiments.*

Lunar Resource Exploitation

- *Collection/processing of oxygen for spacecraft propellant.*
- *Collection/processing of iron and ceramics for space structures.*
- *Collection/processing of titanium for OTV aerobrakes.*

Lunar Autarky

- *Self-sufficient settlement for lunar R&D/industrialization.*
- *Staging/operations base for planetary exploration missions.*



John M. Butler, Jr.

Chief, Orbital Systems Group, Advanced Systems
NASA-Marshall Space Flight Center, Huntsville, Al.

Manned Mars Program Benefits

Science and Technology

- *Planetological studies of the Solar System's origin and evolution.*
- *Studies of the Martian atmosphere, climate and topological evolution/features.*
- *Research, utilization, and export of resources on Mars and its moons.*
- *Searches for life forms on Mars.*
- *Research/verification of human and equipment performance on long missions.*
- *Incentive to develop new advanced systems for space and commerce.*

Inspiration and World Progress

- *Opportunity to explore a new world and expand human presence into the Solar System.*
- *Inspire and unify public, government and industry with a major new challenge.*
- *Promote international cooperation to increase trust and decrease world tension.*

Prepare for Both Options... John M. Butler, Jr.

At some time not too distant, we must decide on a plan of action for expansion of our human presence in space. The Moon and Mars each have their special appeal as our next venture. The Moon offers a nearby proving ground for development of systems and operations useful for living and working on a remote planetary body. It also offers the potential for scientific endeavors. Lunar planetology research which was truncated when we last departed the Moon can be continued. Some have suggested that the far side of the Moon can provide a stable and isolated astronomy base with electromagnetic quiescence and no obscuring atmosphere.

However, many others believe that Mars is more attractive as our next destination. To them, Mars has a greater lure of the unknown and potential for international cooperation between spacefaring nations than the Moon. Mars also represents a nearby (from a propulsion energy standpoint) opportunity to do more interesting science, offering both the goal and the gold we seek in human exploration of space.

Mars-next proponents believe that the planet is richer in resources than the Moon, offering water, propellants, some of the lighter elements, and even the possibility of eventually being "terraformed"

The best strategy at present is to vigorously pursue technologies common to both destinations. We should build as much flexibility into our space program as possible to support either choice, and to allow for future alterations of our plans after one direction is selected. This approach will permit adjustments to such unforeseen circumstances as international agreements or conflicts which impact opportunities and priorities.

To be marketable, a large new space venture must appeal to a great diversity of people: the American public and their government representatives; the scientific and engineering communities; and potential international partners. We must work to ensure that sufficient attractions are incorporated into our programs to seriously interest all of these groups.

Mission justifications listing scientific and technical objectives are not enough. Ultimate endorsements will be based on the reason most of us decide on any particular course of action... because we really want to do it.

Recent SICSA Developments

Introducing Our Staff



Larry Bell, Director
Professor of Architecture



Guillermo Trotti, Assoc. Director
Adjunct Assoc. Professor of Arch.



Li Hua, Senior Associate
Project Designer



Jeffrey Brown, Senior Associate
Project Coordinator



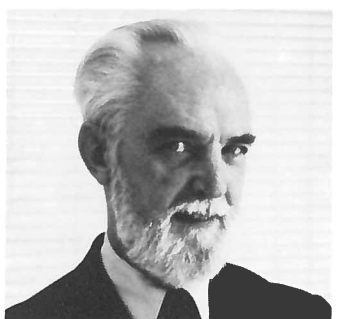
Deborah Neubek, Associate
Computer Systems Head



Dorian Olsen, Associate
Project Administrator



Col. Gerald Carr, Consultant
Skylab Astronaut- Commander



Dennis Fielder, Consultant
Former NASA Mission Planner



Wataru Tanaka, Consultant
International Space Writer



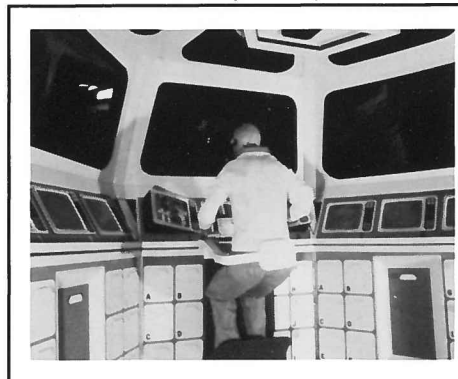
Laurie Weaver in NASA Mockup



NASA Space Station Cupola



Rodney Gentry



SICSA Space Station Cupola

Laurie Weaver: Outstanding NASA Co-op Student

Former SICSA/Experimental Architecture graduate student Laurie Weaver was selected from a field of 80 NASA-Johnson Space Center candidates as one of five Cooperative Education Program participants to receive an **Outstanding Co-op Student Special Achievement Award** during the January - May period. Laurie also received a NASA-JSC **Flag Award** for significant program accomplishments during May - August, 1987.

Laurie was recognized for important contributions in the design and development of Space Station elements. A full-scale mockup of her concept for a cupola work station and enclosure was constructed for testing in NASA's Weightless Environment Training Facility to evaluate anthropomorphic features. She also participated in the design of detailed crew quarters mockups.

Laurie has recently accepted a full-time position with the NASA-Johnson Space Center Man-Systems Division. She is Subsystem Manager for the **Crew Emergency Return Vehicle (CERV)** and cupola design. Laurie is also undertaking zero-gravity restraint system assessments.

Rodney Gentry: First Sasakawa Honor Scholar

Rodney Gentry has been selected as the first Experimental Architecture graduate student to be recognized as a **Sasakawa Honor Scholar** through a new annual SICSA-sponsored award program. He has received a \$1,000 cash prize and certificate of accomplishment as the student picked by faculty and staff for exceptional research and design performance during the past two semesters.

Rodney has begun his second and final year in the program. He entered Experimental Architecture with a Bachelor of Fine Arts degree in Industrial Design from the University of Illinois in Champaign-Urbana.

His principal University of Houston project involved requirements definition and concept development for **SpacePOST (Planetary Operations and Support Terminal)**, a second generation space station proposal. Rodney had key roles in developing the phased growth configuration, and produced a full-size cupola mockup with flight operations work station. The mockup is now on display at the Houston Museum of Natural Science in the SICSA **Blueprints for the Future** exhibit.

SICSA Receives NASA/USRA Grant

SICSA, through the University of Houston College of Architecture, has become the first non-engineering college organization to be funded to participate in the **NASA/USRA Universities Advanced Design Program**. The grant, which is expected to total approximately \$75,000 over a three year period, will support space-related research and design projects within the College's Experimental Architecture graduate study program. An initial award of \$22,484 has been issued for the August, 1987 - June, 1988 period.

Research and design activities will be coordinated with multiple advanced planning groups at the NASA-Johnson Space Center. Serving as NASA's lead project advisor is Dr. Michael B. Duke, Chief of the Johnson Space Center's Solar System Exploration Division.

The SICSA/Experimental Architecture studies will investigate comprehensive requirements and design options for planning a frontier phase lunar base, a manned Mars mission, and a lunar/planetary experiment demonstration facility in Antarctica.

SICSA Receives NASA-JSC Life Sciences Contract

SICSA, through the University of Houston College of Architecture, has received a \$15,000 contract with the NASA-Johnson Space Center's Space and Life Sciences Division to undertake an **Analysis of Medical, Life Sciences and Habitability System Requirements for Advanced Missions**. The one year study will identify and investigate requirements for medical accommodations and life science facilities to be incorporated into crew habitats for future lunar and Mars programs.

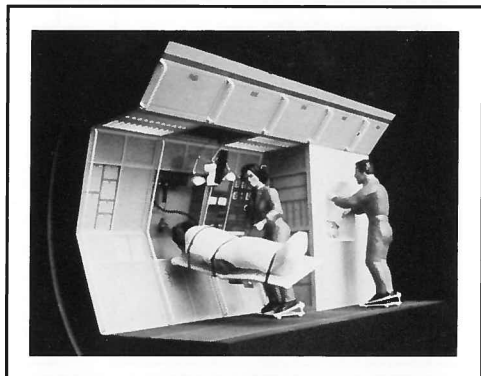
The study will expand upon related research and design activities previously undertaken by SICSA's predecessor organization, the Environmental Center. These projects have produced research and design proposals for Space Station health care systems and orbiting laboratories. Projects include equipment layouts and human factors planning for health maintenance and life science research facilities; and overall planning for simulated-gravity laboratories. A **Variable-Gravity Life Science Facility (VGLSF)** was proposed to investigate gravity levels and other requirements to sustain crew health on long-duration space, lunar and planetary missions.



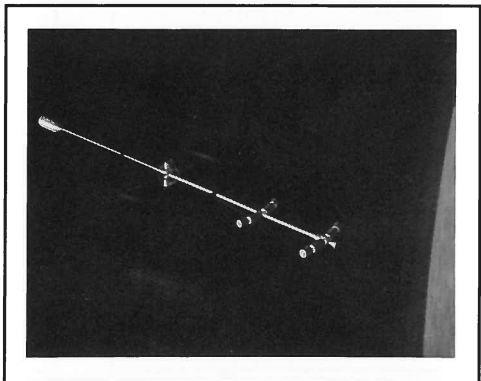
Project Leaders
Dennis Felder, Jeff Brown, Larry Bell, Sam Ximenes, Gui Trotti



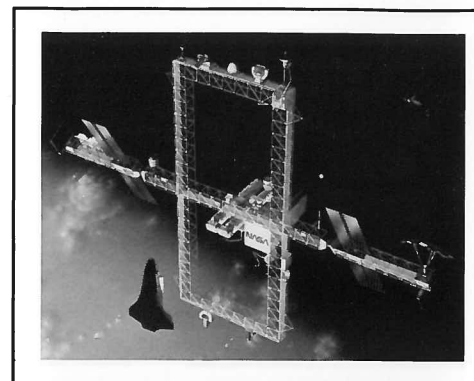
Graduate Students
Standing: F. Brave, M. Ahmadi, L. Toups, N. Moore, C. J. Baxmann, C. Higgins, S. Nolan, K. Kennedy, T. Polette.
Sitting: N. Bhattacharya, B. Ho, R. Gentry, D. Neubek, A. Bottelli, M. Siddiqui



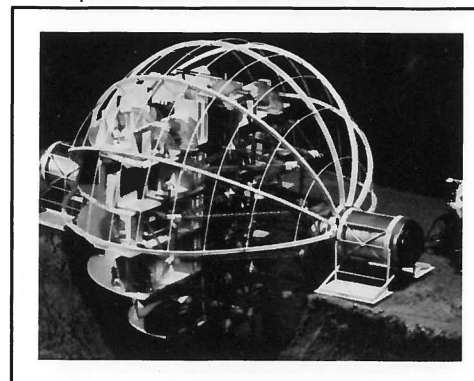
Health Maintenance Facility (HMF)



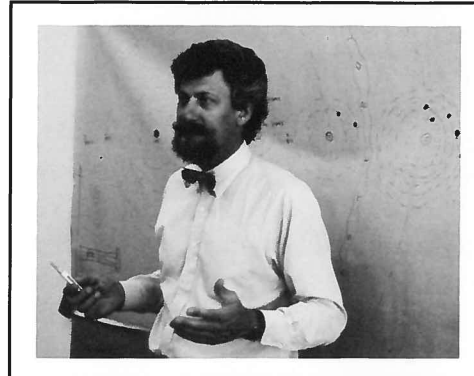
Variable-Gravity Life Science Facility (VGLSF)



Space Station - Denise Watt, Artist



Lunar Construction



Guillermo Trotti



Guillermo Trotti and Student, Simon Doms

SICSA to Cosponsor ISU Summer Course at MIT

SICSA and the **International Space University (ISU)** have entered into a cooperative relationship to jointly pursue programs of mutual interest. Through terms of this agreement, SICSA's Director, Larry Bell and Associate Director, Guillermo Trotti, along with Brand Griffin from the Boeing Aerospace Company, will co-direct a Space Architecture course to be offered as part of ISU's summer program on the Massachusetts Institute of Technology campus next year. The nine-week-long ISU event is expected to attract approximately 100 interdisciplinary graduate students from around the world. International space and technology experts will participate as lecturers and critics.

The SICSA-sponsored portion of the curriculum will address broad issues related to planning space stations, lunar bases, manned Mars missions and antarctic facilities. Topics will include design to optimize crew safety and performance in zero-gravity, evolutionary space station developments and concepts, lunar facility requirements and construction options, and antarctic analogs for planning advanced space missions.

SICSA Cosponsors National AIAS Design Charrette

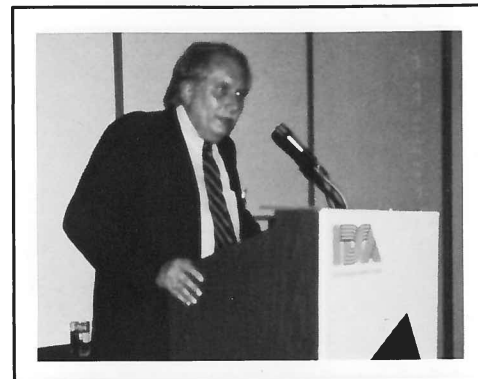
SICSA provided financial and technical support to the **American Institute of Architecture Students (AIAS)** as cosponsor of an **Environments in Space Design Charrette** at the National 1987 American Institute of Architects Convention in Orlando Florida on June 19 - 22. Sixty students participated in the charrette event which commenced with an evening lecture about lunar construction by SICSA's Associate Director, Guillermo Trotti. A six-hour design competition the next day was premised on a lunar base requirements program prepared by Jeffrey Brown of SICSA. The program emphasized use of construction approaches that minimize labor, maximize use of lunar resources and respond to reduced-gravity and other environmental conditions on the Moon.

Guillermo Trotti, notable architect Robert Venturi, and Rice University student Philip Arcidi picked three winning teams. Members were: Emilio Arango, Lourdes Bernard, Frank Davis, Jr., Carson Durham, Elmore Fewlie, James Galloway, Richard Griswold, Susan Harb, Robert Hudson, Byron Martin, Jeff Movens and Gina Panceria.

SICSA Representation at Recent Conferences

SICSA management and staff participated in recent national and international conferences that addressed important space-related topics:

- **1987 Industrial Designers Society of America (IDSA) Conference: Influences on Design**, Monterey, California, August 5 - 6. SICSA Director, Larry Bell keynoted a lecture session titled **Design for Space** that discussed Space Station habitability, safety and productivity considerations.
- **Pacific International Space Year Conference**, Kohala Coast, Island of Hawaii, August 19 - 21. Larry Bell along with Dr. Frank M. Salzman from NASA Headquarters and Dr. Sadao Sugiyama from Kwansei Gakuin University, Japan, coauthored a proposal to the International Council of Scientific Unions (ICSU) and the Committee on Space Research (COSPAR), to develop an **International Space Habitability Data Base**.
- **The Case for Mars III, Strategies for Exploration**, sponsored by the University of Colorado, Boulder, July 18 - 22. SICSA Associate Director, Guillermo Trotti participated in meetings and discussions that addressed goals, space policy issues, research and technology development requirements, and mission strategies for manned and unmanned explorations of Mars and its moons Phobos and Deimos.
- **The Human Experience in Antarctica: Applications to Life in Space**, cosponsored by the NASA Office of Space Science and Applications and the NSF Division of Polar Programs, Sunnyvale, California, August 17 - 19. Guillermo Trotti attended meetings which discussed past and current attempts to understand psychological and social aspects of Antarctica, space habitats and other isolated environments.
- **38th Congress of the International Astronautical Federation (IAF)**, sponsored by the British Interplanetary Society, in Brighton, England, October 10 - 17. SICSA presented a large model depicting a lunar base site development and facility concept, **Project LEAP**, prepared by the Experimental Architecture graduate program in cooperation with the NASA-Johnson Space Center Advanced Programs Office.



Larry Bell at IDSA Conference

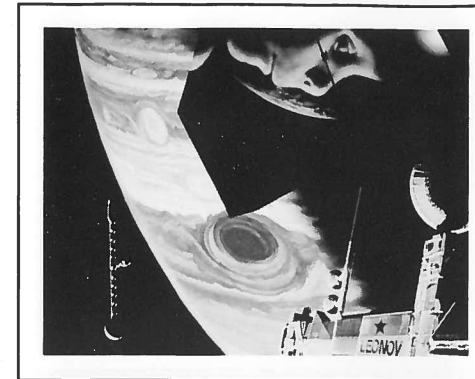


Innova Conference Center

Innova Sponsors SICSA Seminar

Approximately 150 designers and other professionals from organizations located throughout Texas attended a space design seminar presented by Larry Bell. The setting was at the impressive Innova Conference Center in Houston during the evening of September 18.

The meeting was offered as a part of **Innovations '87**, a week-long series of seminars, conferences and new product introductions sponsored by the Innova company. The SICSA program addressed space human factors requirements and crew system equipment concepts for Space Station, lunar base and manned Mars mission applications. Space lessons that apply to planning environments and systems on Earth were also discussed.



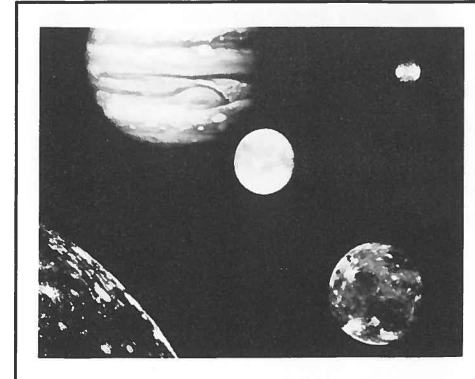
Syd Mead Poster for the Movie 2010



Skylab Commander Gerald Carr-NASA photo



Apollo Astronaut Harrison Schmitt-NASA photo



Future Destinations-NASA photo

SICSA and RDA to Cosponsor Space Lectures

SICSA and the **Rice Design Alliance (RDA)**, a nonprofit educational organization which is affiliated with the Rice University College of Architecture, are cosponsoring four public space lectures featuring prominent designers, engineers, scientists, astronauts and visionaries. Individuals providing planning and service support include Larry Bell and Guillermo Trotti, SICSA; Barbara Cochran, RDA; Frank Douglas, 3D/International; Elizabeth Glassman, Glassman and Lorenzo; Sandy Griffin; Mark Powers, Texas Air Corporation; Danny Samuels, Taft Architects; and Michael Schneider, Baylor College of Medicine. The lectures scheduled to be presented include the following topics and speakers:

- **October 28, Soaring Visions:** Internationally acclaimed designer-illustrator **Syd Mead** will present images of the future he has created for motion pictures such as *Bladerunner*, *Tron*, *2010* and a variety of events and publications. The lecture will be held at Rice University's Hamman Hall, 8:00 - 9:30 pm.
- **November 4, Living in Space:** Skylab astronaut/commander, **Gerald Carr**; NASA-Ames Research Center environmental psychologist, **Yvonne Clearwater**; NASA-Johnson Space Center man-systems planner, **Gary Kilmacher**; and SICSA Director, **Larry Bell** will discuss Space Station design issues. The presentations will be held at the University of Houston College of Architecture theater, 7:30 - 9:00 pm.
- **November 11, Man on the Moon:** Apollo 17 astronaut and former U.S. Senator, **Harrison Schmitt**; NASA-Johnson Space Center planetary scientist, **Wendell Mendell**; and SICSA Associate Director, **Guillermo Trotti** will talk about previous mission experiences and possible future settlements on the Moon. The presentations will be held at the University of Houston College of Architecture theater, 7:30 - 9:00 pm.
- **November 18, Mars and Beyond:** Former NASA astronaut, scientist and writer, **Brian O'Leary**, and **James Oberg**, author of planetary exploration books and expert on Soviet space developments, will discuss opportunities and challenges for the next century. The presentations will be held at the University of Houston College of Architecture theater, 7:30 - 9:00 pm.

SICSA Enjoys Spacious, Modern New Facilities

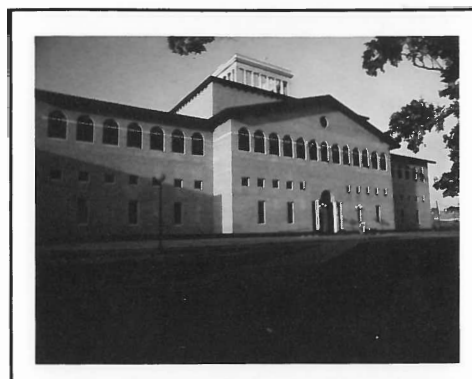
SICSA and its Experimental Architecture graduate study program enjoy outstanding facilities within a dramatic new College of Architecture building designed by Philip Johnson, one of the most prominent U.S. architects. Approximately 8,400 square feet of prime space (nearly an entire third floor wing) is designated for SICSA/Experimental Architecture use, including seven professional staff offices, research/design studios for 20 students, two seminar rooms, an administrative/publishing office, a conference room, a production room and a dedicated SICSA computer facility.

The College of Architecture also provides a variety of important facility resources which are available to SICSA/Experimental Architecture staff and students. These research and education resources include a large computer center, audio-visual center, library, lecture theater and model fabrication shop. In addition, SICSA has access to diverse UH campus resources which comprise the greatest concentration of academic, scientific, engineering and computing facilities in Southeast Texas.

New SICSA Computing Capabilities

SICSA makes extensive use of the computer as a research and design tool. Computer-aided design (CAD) resources available to SICSA through the College of Architecture include ten graphic work stations for a Prime 9955 super mini-computer using Medusa 2-D and 3-D software with capabilities for solids modeling, color shading, mass property analysis and finite element analysis. The College also provides thirty-two microcomputer graphic work stations with AutoCAD and MegaCADD software packages. Data base management, spreadsheet and word processing are also available.

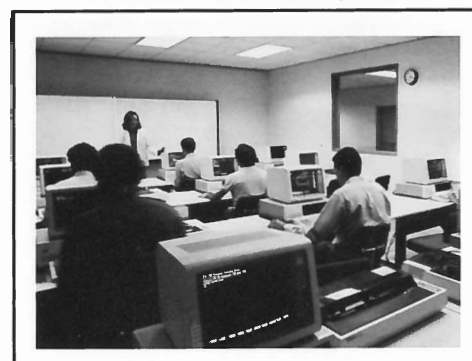
SICSA has upgraded the Prime 9955 system to provide an additional eight megabytes of RAM plus a 773 megabyte disk and controller. SICSA accesses the Prime 9955 CPU and software from its own computer facility room through two new graphic work stations, a Tektronix 4125 engineering work station, and a 32-bit Zenith 386 microcomputer. The 386 microcomputer can also act as a stand-alone graphic work station using Sigma Design's ARRIS software. New desktop publishing capabilities feature a powerful Macintosh II computer configured with a laser printer and scanner.



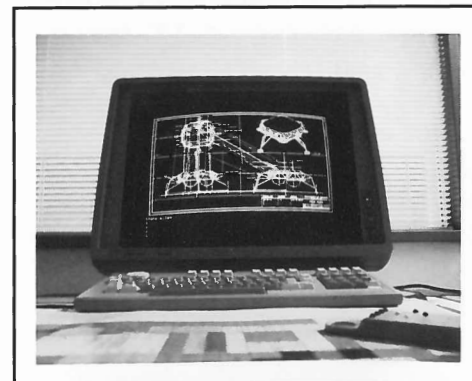
College of Architecture Building



Administrative/Publishing Office



College of Architecture Computer Center



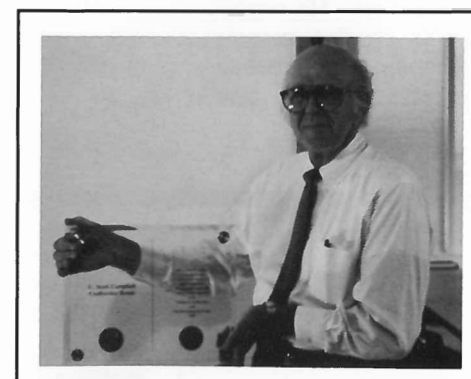
SICSA Tektronics Work Station



Sculptor Willy Wang and Sasakawa Plaque

The Artist:

Wei Li (Willy) Wang of Beijing, China graduated from the Peking Central Institute for Fine Arts in 1962. He has been commissioned to create busts of many heads of state, including esteemed mother of China, Mrs. Sun Yet Sen at her request, and Hafez al-Assad, President of Syria. Willy spent a year in the palace of the Dali Lama sculpting noted Tibetan figures for the History Museum.



Wm. Jenkins, Dean, Dedicates Campbell Rm.

New Health Environment Institute

SICSA has dedicated \$115,000 in current funds to support research development programs within the College of Architecture. This contribution has been used, in part, to create a new **T•H•E Institute (Texas Health Environment Institute)** which will sponsor graduate education courses and design projects to advance informed planning of health facilities for Earth and space applications.

SICSA Plaque Honors Ryoichi Sasakawa

An inscribed plaque honoring "Professor Ryoichi Sasakawa whose great vision and philanthropic contributions are advancing peaceful and beneficial uses of space" has been installed at the entrance to SICSA's administrative suite. Prominent Houston sculptor Willy Wang was commissioned to craft the life-size bronze likeness mounted upon a 20 by 30 inch granite tablet. A duplicate plaque has been fabricated for Mr. Sasakawa's office at the Japan Shipbuilding Industry Foundation (JSIF) in Tokyo, an organization he heads.

Mr. Sasakawa, an honorary Professor of Space Architecture at the University of Houston, has had great interest in the skies since childhood, becoming a pilot at age seventeen. A large **Space Science Exposition** in Tokyo, which he sponsored during 1978 - 79, expressed his commitment to fostering public awareness about space as a necessary frontier for exploration and development. The \$3,000,000 JSIF gift, which was instrumental in the creation of SICSA, reflects his vision and conviction.

C. Scott Campbell Conference Room Dedicated

Scotty Campbell was a quiet, humble man who worked for more than 30 years as a painter at the Exxon refinery in Baytown, Texas following service in the U.S. Navy during World War II. Living alone in a small apartment with spartan furnishings he pursued a frugal lifestyle. He invested most of his earnings in corporate stocks, intent upon donating the proceeds to worthwhile philanthropic purposes. Years of failing health prompted Scotty to want to leave something of value to others. He sought no recognition. The idea was a source of pleasure.

Scotty had witnessed growth of the University of Houston from a small junior college when he was a young boy, to a major institution of research and higher learning. He came to take special interest in the space architecture work that was being undertaken by SICSA's predecessor organization, the Environmental Center. Houston, and the importance of such activities to advance human progress. A substantial portion of his estate (approximately \$150,000) was assigned to support these programs. In appreciation, SICSA's main conference and meeting room was dedicated by William Jenkins, Dean of the College of Architecture, to honor Scotty's vision and generosity.

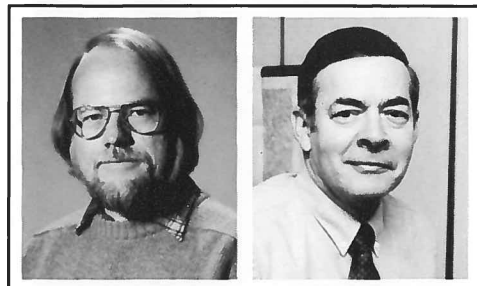
SICSA Background

SICSA is a nonprofit research, design and educational entity of the University of Houston College of Architecture. The organization's purpose is to undertake programs which promote international responses to space exploration and development opportunities and needs. Important goals are to advance peaceful and beneficial uses of space and space technology and to prepare professional designers for challenges posed by these developments. SICSA also explores ways to transfer space technology for Earth applications.

SICSA provides teaching, technical and financial support to the **Experimental Architecture** graduate program within the College of Architecture. The program emphasizes research and design studies directed to habitats where severe environmental conditions and/or critical limitations upon labor, materials and capital resources pose special problems. Graduate students pursue studies which lead to a Master of Architecture degree.

SICSA Outreach highlights key space developments and programs involving our organization, our nation, our planet and our Solar System. The publication is provided free of charge as a public service to readers throughout the world.

Inquires about SICSA and Experimental Architecture programs, or articles in this publication, should be sent to Professor Larry Bell, Director.



Dr. Wendell W. Mendell

John M. Butler, Jr.

Featured Contributors:

Dr. Wendell W. Mendell, planetary scientist at the NASA-Johnson Space Center's Solar System Exploration Division, coordinates planning for future lunar missions and bases. His work involves goal and strategy development and scientific studies for planetary exploration.

John M. Butler, Jr. is Chief of the Orbital Systems Group at the NASA-Marshall Space Flight Center's Advanced Systems Office. His organization undertakes diverse studies associated with spacecraft propulsion, orbital systems, habitats, planetary surfaces, and other topics.

SICSA

Sasakawa International
Center for Space Architecture

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