RESOLUTION NO. 98-97

A RESOLUTION OF THE RIDGECREST CITY COUNCIL APPROVING A REQUEST TO THE CALIFORNIA DEPARTMENT OF TRANSPORTATION TO EXTEND THE TIME FOR PERFORMANCE OF GRANT AGREEMENT NO. 95 A0006 FROM OCTOBER 31, 1998 TO JUNE 30, 1999

WHEREAS, the City of Ridgecrest entered into a Grant Agreement with the State of California Department of Transportation effective March 17, 1997. The termination date on the grant was October 31, 1998; and

WHEREAS, additional time is needed to complete the research and development work and the associated reports. The funding for the Grant expires on June 30, 1999.

WHEREAS, the task breakdown under the scope of work has evolved into greater detail with the progress of the research and development, requiring a change in the narrative to match the task breakdown.

NOW THEREFORE BE IT RESOLVED, that the Ridgecrest City Council authorizes the City Administrator to seek an extension of time from the State and execute a modification to the Grant Agreement extending the time through June 30, 1999.

APPROVED AND ADOPTED this 21st day of October, 1998, by the following vote:

Ayes: Mayor Lalor, Council Members Auld, Carter, and Morgan

Noes: None

Abstain: None

Absent: None

William R. Lalor, Mayor

ATTEST:

John I. Sterling
City Clerk

BENNETT OPTICAL RESEARCH INC.

201 N SANDERS STREET

RIDGECREST, CALIFORNIA 93555

October 20, 1998

MEMORANDUM

From: H. Bennett

To: Ken Kelley

Subj: Change in Statement of Work for SELENE Program

In our original proposal to the Department of Transportation on the SELENE program, dated December 1996, we proposed the following tentative fund distribution.

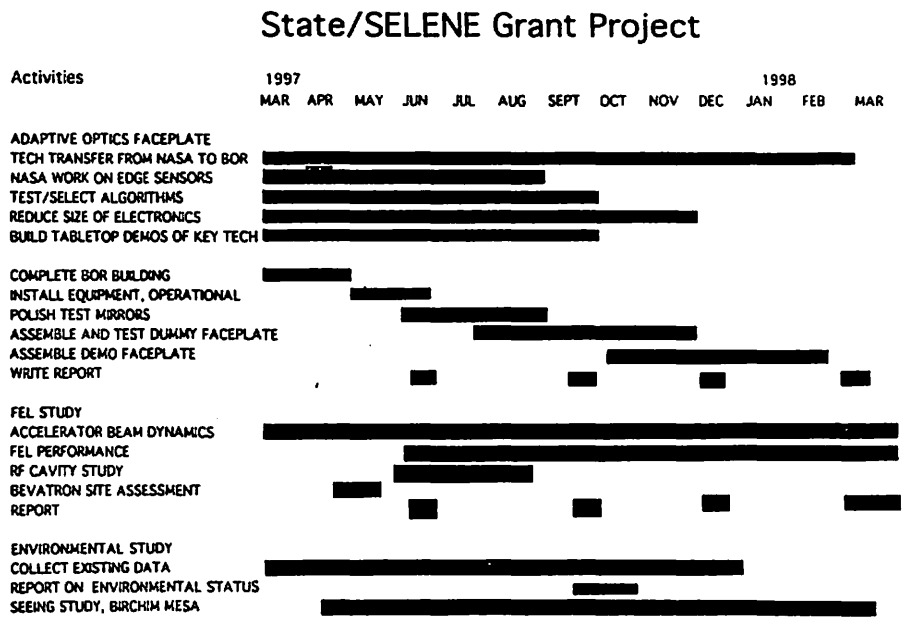
Project Task	Task Performer	In-kind & Contributed Funding	CDOT Grant
Free-electron laser evaluation	Lawrence Berkeley National Laboratory	$900 K	$225 K
Segmented mirror	NASA Marshall Space Flight Center	$1,200 K	$100 K
Local technology	Ridgecrest hi-tech companies & Space Applications Committee	$200 K	$75 K
Land use planning & Seeing study	Naval Air Weapons Station, China Lake	$500 K	$100 K
New environmental, laser/optics courses & consulting	Cerro Coso Community College	$200K	...
Financial management	City of Ridgecrest	$100 K	...
	TOTAL	**$3,100 K**	**$500 K**

The City of Ridgecrest will administer the grant funds.

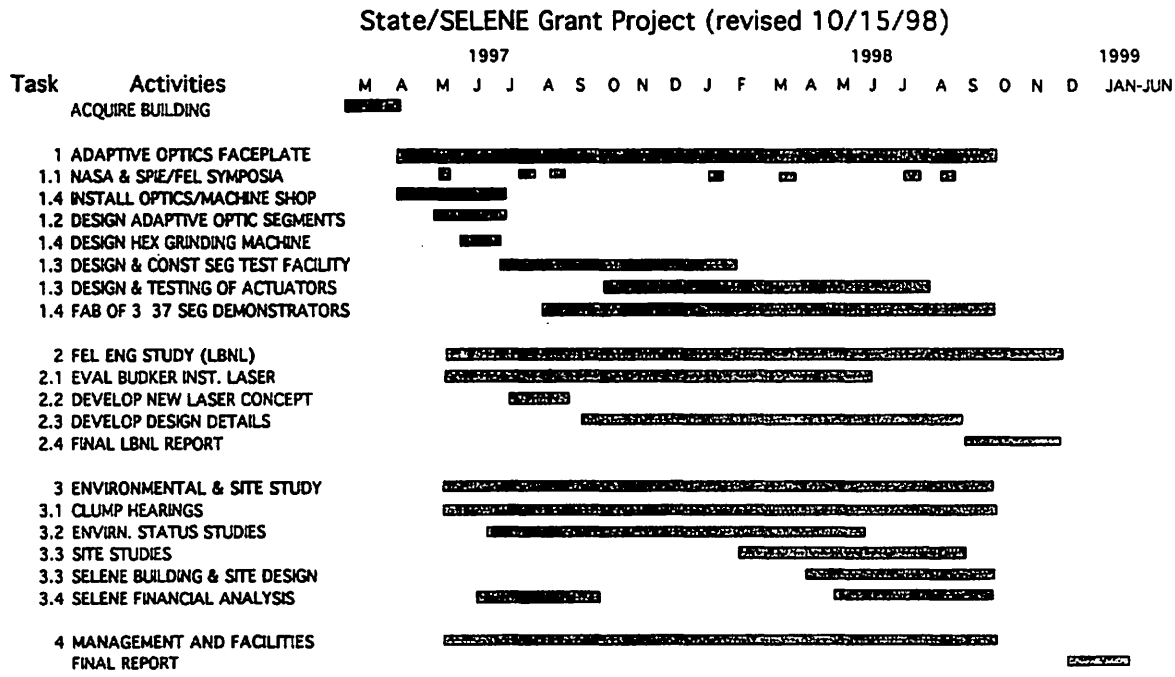
Shortly after the award was granted in March 1998 we had learned that the Naval Air Weapons Station supported SELENE but was not interested having this program involved financially with their land use survey. We therefore allocated the $100 K initially budgeted to that effort to an in-house environmental effort at Bennett Optical Research (BOR). Also NASA Marshall Space Flight Center was not moving in the direction we were heading in segmented mirror development and their key contractor, Blue Line Engineering, was having difficulty in getting their concept to work. We believed the concept we had developed was better than their concept and reallocated the $100 K initially budgeted for that effort to the in-house effort on segmented mirror development. The cost of the Lawrence Berkeley National Laboratory (LBNL) effort finally settled down at the beginning of June, 1997 at $239,139 (Saxer letter of 5/27/98 enclosing an agreement signed by Mayor Lalor) leaving us roughly $240K to be spent at LBNL and $260K in Ridgecrest.

Office (760)384-1177
fax (760)384-1801, InterNet bennett@ridgecrest.ca.us
Alternate (760)446-6471, fax (760)446-6473

The original proposal laid out the objectives of the SELENE study and included the timeline shown below. We have maintained these objectives throughout the program.



However we realized that they needed to be clarified and so in our first Status Report we broke them down into tasks, which are shown below. We also learned that the expected



TASKS
1.1 Collection of adaptive optic information & key technologies, 1.2 design of adaptive optic segments, 1.3 testing of seg. operation, 1.4 fab
2.1 Eval Budker Institute Laser, 2.2 new laser concept, 2.3 laser design details, 2.4 final LBNL report
3.1 Collect existing environ. data, 3.2 environmental status, 3.3 site study for SELENE, 3.4 management & financial analysis

follow-on funding for 1998 would not materialize and we had to extend the life to the funding in hand as far as possible. We therefore laid out a series of tasks (pp. 17 – 24 of Status Report #1) which have been worked on since that time. Progress on them, as reported in succeeding Status Reports, has been significant. The main tasks are:

Task 1 – Design, Fabrication And Demonstration of the Adaptive Optic Table-Top Demonstrator Faceplate.	$150K
Task 2 – Free Electron Laser Preliminary Engineering Study	$240K
Task 3 – Preliminary Environmental Study	$85K
Task 4 – Management and Facilities	$25K

Task 3 was initially budgeted at $100 K when it was thought that the FEL study would be $225 K, its initially quoted figure. Task 4 was added when it was realized that there were management tasks for BOR associated with Task 2 and infrastructure costs such as rent and utilities which could not be properly charged to the other tasks.

Since the grant program objectives have been refined and modified slightly since the initial proposal was made it is requested that the Council approve these modifications and request a change in scope be approved by the Department of Transportation.

Harold E. Bennett

Harold E. Bennett

President

LIST OF ATTACHMENTS

ATTACHMENT I	SCOPE OF WORK
ATTACHMENT II	PROJECT BUDGET
ATTACHMENT III	PROJECT SCHEDULE
ATTACHMENT IV	CITY COUNCIL RESOLUTION
ATTACHMENT V	CERTIFICATION OF FUNDS

SCOPE OF WORK (revised)

The purpose of the SELENE project is to beam electric power from the ground to telecommunications satellites in orbit around the earth. Electrical energy will be converted on the ground to laser energy and beamed to the satellite by an adaptive optic telescope that will correct the laser beam to compensate for the distortion of light by the earth's atmosphere.

The initial site proposed for the SELENE project is Bircham Mesa, elevation 5,600 feet, on the China Lake Naval Air Weapons Station near Ridgecrest, California. This site is on the eastern edge of the Navy's test ranges and is surrounded by restricted airspace. Other sites will be evaluated, however, as part of this project. Phase I of the SELENE project will conduct preliminary engineering and feasibility studies of SELENE functional infrastructure (i.e. the free electron laser (fel) and the demonstration segmented adaptive optic faceplate) and gather data needed for the environmental impact study for future construction and operational phases of the SELENE project. Matching funding support for Phase I of the SELENE project is the purpose of this grant.

Phase I will underwrite the initial steps required to produce SELENE functional infrastructure. Much of the funding to be matched comes from in-kind work provided by a partnership of dedicated scientific investigators, community volunteers, and government agencies. The synergistic efforts of this partnership have pulled together the diverse capabilities of the Naval Air Weapons Station, the Ridgecrest community, Cerro Coso Community College, Lawrence Berkeley National Laboratory, and the Budker Institute of Nuclear Physics in Russia.

PHASE I

SELENE Functional Infrastructure

1.0 Adaptive Optics Faceplate

A key element of the SELENE concept is the adaptive optic mirror in the telescope. The initial plan is to make the primary mirror the adaptive optic mirror. The mirror senses the distortion of light, which is caused by the atmosphere and corrects the outgoing laser beam to compensate for the distortion. The outgoing laser beam then arrives at the satellite as a focused, coherent light energy source. The Cassegranian telescope is described as "active" because the parabolic surface is made up of tiny hexagonal mirrors, each controlled by one or more actuators. By reading an incoming light source from space, the adaptive optic telescope will send the return laser beam with minimum distortion.

A capability will be generated in Ridgecrest, California to fabricate large segmented mirrors as an adaptive optics faceplate. Parts for the BOR optical and machine shop have been purchased and are currently stored in aircraft hangars or on trailers parked beside aircraft hangers. Parts of the machine shop are stored elsewhere in Ridgecrest. We are in the process of acquiring a manufacturing site in which to set up

this equipment. Part of the California Highway to Space grant funds will be used to set up this equipment and make it operational. In Phase I tasks under 1.0 will be:

1.1 Collect additional adaptive optic information and key technologies
1.2 Develop novel adaptive optic segment design
1.3 Set up initial optics/machine shop, fabricate segments and test segment operation
1.4 Set up a prototype optics/machine shop, fabricate, assemble and test several adaptive optic faceplates produced using the novel Bennett Optical design

2.0 Free-electron Laser (fel) Preliminary Engineering Study

The free-electron laser (fel) is the converter of electricity into laser power. High power fel's are at present largely a Russian technology. A system capable of producing 100 kW to 200 kW is presently being built at the Budker Institute in Novosibirsk, Russia. In operation an fel generates electrons, accelerates them through many large vacuum-tube-like devices called accelerator cavities to increase the energy of the electrons, in the Russian design returns them for a second, third and fourth trip through the accelerator cavities and after the electrons have a mass much larger than their rest mass and hence a large amount of energy sends them through an undulator of "wiggler" where they radiate part of their energy as light. The wiggler is in an optical cavity with a mode structure, which induces stimulated emission and thus lasing. This laser light is only used to sharpen the electron pulse, which then travels to a "radiator" which contains no optics. There lasing again occurs and the laser light leaves the system. The light beam carries only about 1% of the electron energy. Most of the energy is fed back into the cavities as the electron beam passes back through the cavities out of phase. When the spent electrons finally reach the energy dump they have so little energy left that they do not produce radioactive waste. The Russians have named this design a "microtron recuperator".

Personnel at Lawrence Berkeley National Laboratory (LBNL) in collaboration with scientists at the Budker Institute of Nuclear Physics (BINP) in Russia and oversight from personnel at BOR will have the following tasks:

2.1 Evaluate the BINP laser design
2.2 Investigate possible new laser concepts
2.3 Develop a detailed design of the laser for use for SELENE
2.4 Make a detailed proposal of how a high-power fel for SELENE could be fabricated and demonstrated at LBNL and transferred to the Ridgecrest and alternate sites.

It is expected that the results of this study will reduce the risks and lay the groundwork for a privately funded program to develop a high-power fel for use in SELENE.

3.0 Preliminary Environmental and Site Study

An environmental study is a necessary part of any large construction project and SELENE is no exception. By utilizing both the large amount of information gathered in the past by the Naval Air Warfare Center (China Lake) and the

ongoing Comprehensive Land Use Management Program (CLUMP) on the Center at present funded by the Navy we will hope to minimize the cost and reduce the time required to start of construction for SELENE. We will also request the Navy to cooperate by listing SELENE as one of the possible future uses of the land involved. Ultimately a professional organization is expected to be needed to complete the Environmental Impact Study (EIS) and the resulting Environmental Impact Report (EIR). The cost of this study can be materially reduced, however, by gathering and cataloguing the available data beforehand and making it available to the organization which will complete the study. Also the issues will be identified and a better estimate of the cost and of the study as well as its probably outcome will be developed. As part of the study alternate sites must be identified and their advantages and disadvantages catalogued. This risk reduction effort will make it easier to convince a private developer to undertake the SELENE project.

Another important risk reduction effort for private developers is to evaluate the financial advantages and risks of SELENE. This evaluation will be done as part of the Environmental and Site Study. Tasks for this study will be:

3.1 Collection of existing environmental data and interfacing with the Navy as it proceeds with CLUMP.
3.2 Status studies of environmental regulations affecting SELENE
3.3 Evaluation of alternate sites for SELENE and possible building and site design studies including projected costs
3.4 Financial analysis of returns on investment for SELENE

4.0 Management and facilities

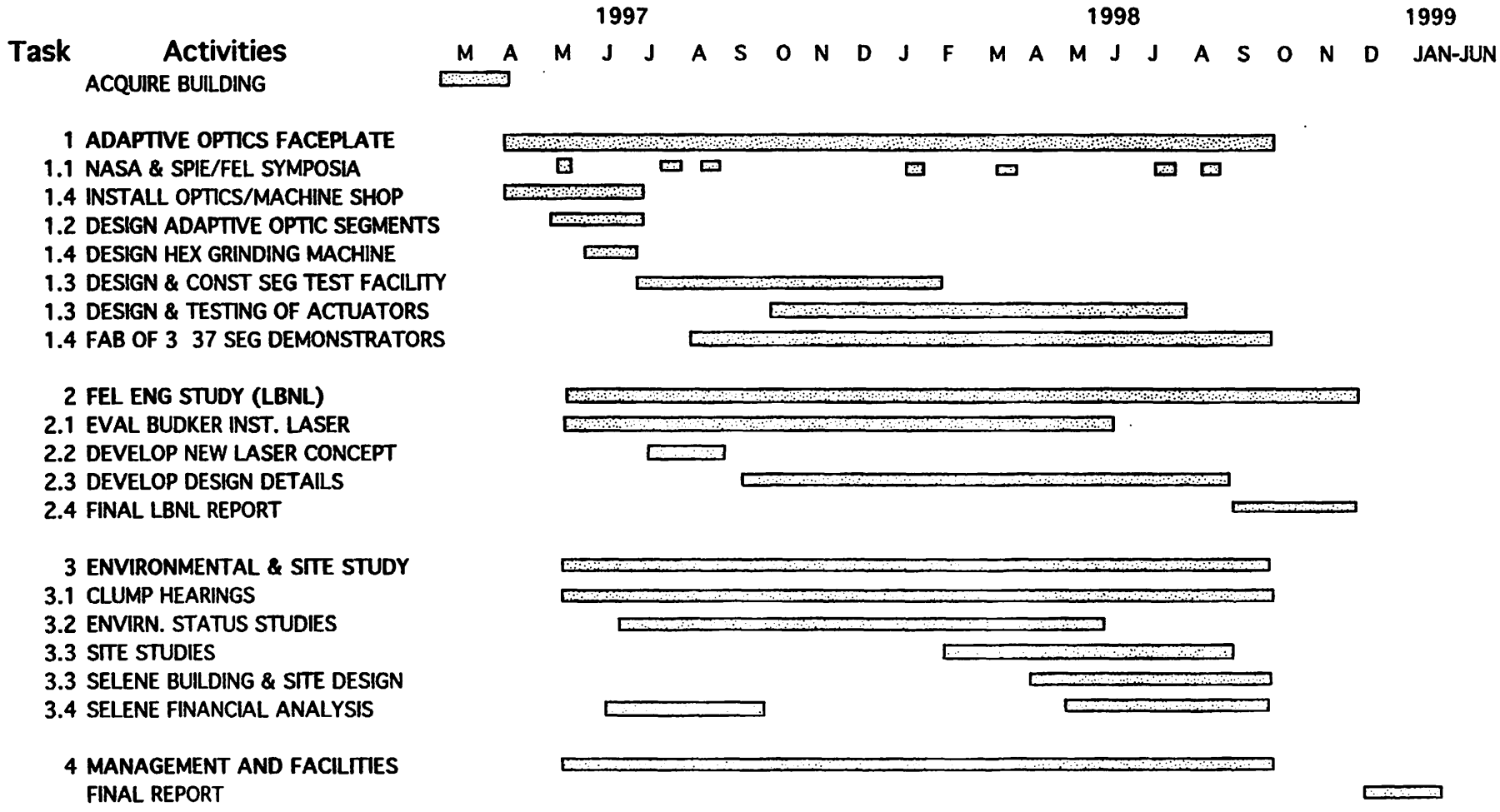
Some support is required for infrastructure and management costs to coordinate this effort. Regular communications and occasional trips must be made by BOR personnel to interface with the LBNL effort and to keep in contact with the Western Commercial Space Center, the Department of Transportation, and other State mandated commercial space interfaces. Also the cost of utilities, building rent, a receptionist, reports, graphics, displays, etc. are not covered by efforts 1 through 3. Therefore a fourth category was established to cover what we may call housekeeping tasks. These support functions allow efforts 1 through 3 to proceed at an optimal rate.

BUDGET

SELENE Project (Phase 1)						
Dollars in Thousands						
Project		Federal	State	Local	Private	Total
Table Top Demonstrator	Salaries & Benefits	260	70	10	180	520
	Consultants	700	30	0	0	730
	Travel	40	15	6	10	71
	Overhead	50	10	0	0	60
	Equipment	200	0	0	0	200
	Other Direct Costs	50	25	5	0	80
FEL Prelim Eng. Study	Salaries & Benefits	400	~~120~~ 135	10	140	670
	Consultants	50	20	0	0	70
	Travel	20	20	6	15	61
	Overhead	400	50	0	15	465
	Equipment	0	0	5	0	5
	Other Direct Costs	30	15	5	10	60
Prelim Envir. Study	Salaries & Benefits	100	50	210	10	370
	Consultants	400	~~20~~ 5	0	0	420
	Travel	0	0	0	0	0
	Overhead	0	10	0	0	10
	Equipment	0	0	0	0	0
	Other Direct Costs	0	20	0	0	20
Technical Oversight & Fin. Mgmt.	Salaries & Benefits	0	20	30	100	150
	Consultants	0	0	0	0	0
	Travel	0	5	0	10	15
	Overhead	0	0	0	10	10
	Equipment	0	0	0	0	0
	Other Direct Costs	0	0	0	0	0
	Total	2700	500	287	500	3987

75% of project funds will come from Federal, Local, or private sources identified above or other sources. A maximum of 25% of the project funds can be contributed by the State.

State/SELENE Grant Project



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MINUTES OF THE CITY COUNCIL

City of Ridgecrest, California

A regular meeting of the City Council of the City of Ridgecrest, California was held March 19, 1997 at 7:00 P.M.
e following named members were present: Mayor Lalor, Council Members Auld, Morgan, Carter & Parode.

4. CITY ADMINISTRATOR 1701

A. Request Approval for City Administrator to Sign Highway to Space Grant Agreement

* City Administrator has been working with State of California Department of Transportation Spaceport Office to enter into a grant Agreement for the California Highway to Space Program.
* Amount of the grant request will be $500,000 for the SELENE Project.
* City Administrator and City Attorney have reviewed the Agreement and staff is examining it.

Motion was made by Council Member Auld, seconded by Council Member Morgan to APPROVE REQUEST FOR CITY ADMINISTRATOR TO SIGN HIGHWAY TO SPACE GRANT AGREEMENT.

Council comment included:

* City accounting system is sufficient to meet the Grant's accounting needs.
* City Administrator Kelley responded to Council's questions regarding various sections of the document.
  * This is a long term project.
  * No actual money will be on the City's books.
  * Much of the work will be done at Lawrence Livermore Lab and at NASA Huntsville with some work done by Bennett Optical in Ridgecrest.
* Wants to ascertain if this will be a drain on city services.
  * Will be some cost to our Staff on this project.

Motion on the floor TO APPROVE REQUEST FOR CITY ADMINISTRATOR TO SIGN HIGHWAY TO SPACE GRANT AGREEMENT. Public comment was heard. Motion carried with a roll call vote of 4 ayes, 1 no. Mayor Lalor voted no.

State of California
County of Kern } ss.
City of Ridgecrest

As City Clerk and ex-officio Clerk of the City Council of the City of Ridgecrest, California, I hereby certify the foregoing to be a full, true and correct copy of the minute entry on record in this office.

IN WITNESS WHEREOF, I have hereunto set my hand and seal this 26th day of March 1997.

Pamela Bartlett
City Clerk and ex-officio Clerk of the City Council,
Ridgecrest, California

CERTIFICATION OF FUNDS

FUND SOURCE: 041R

SOURCE		CHARGE		EXP AUTH GEN LED | SUB ACCT	SPECIAL DESIGNATION SUBJOB NO. | R/W PARCEL NO.		OBJECT	AMOUNT	DR CR	FISCAL YEAR	ENCUMBRANCE DOCUMENT
DIST	UNIT	DIST	UNIT	WORK ORDER NO.	LOCATION	BRIDGE NO.					
95	002	95	002	9 2 6 003	3 0 0 0 1	7	1 3 2	$500,000		97	
I hearby certify upon my own personal knowledge that budgeted funds are available for the period and purpose of the expenditure stated above.							SIGNATURE OF ACCOUNTING OFFICER				DATE 4-1-97
ITEM 2660-001-0041		CHAPTER 162		STATUTES 1996		FISCAL YEAR 1996-97					

A New Space Business For California

A California small business, Bennett Optical Research Inc., in collaboration with California's Lawrence Berkeley National Laboratory, and with the support of the State of California through its space program, is developing a new industry, the laser power beaming industry. There is a critical shortage of power for satellites in space to perform such space-related services as e-mail, the world wide web, authorization of your credit card at the gas station, efficient routing of long distance trucking, high productivity farming, the morning weather report, the list goes on and on. Stringing copper electric power lines to the satellites won't work but using a virtually weightless laser beam to carry the power will. It can increase the output of the satellite solar panels we use now by a factor of eight or more. Near the little town of Ridgecrest, California on the eastern slope of the Sierra mountain range exists the best site for power beaming in the entire United States. Ridgecrest, home for the largest R&D facility in the Navy, is now both a high technology and a depressed area as a result of Department of Defense drawdowns. Power beaming will help bring back its economy and will provide California satellite manufacturers with the opportunity to develop another technological edge on out-of-state and foreign competitors. The results will benefit not only Californians but the entire United States and ultimately the entire world.

ACCOMPLISHMENTS

- OVER $55,000,000 SAVED BY USING AN ARRICEBO DESIGN MOUNT FOR ADAPTIVE OPTICS TELESCOPE
- NOVEL ADAPTIVE OPTIC FACEPLATE DESIGN BEING DEVELOPED IN RIDGECREST
- OPTICAL/MACHINE SHOP NOW OPERATIONAL FOR PROTOTYPE STUDIES
- MAJOR IMPROVEMENT IN FREE ELECTRON LASER DESIGN; MOST POWERFUL (200 KW) FEL EVER MADE NOW READY TO BUILD
- ALTERNATE SITE REDUCES CONSTRUCTION COST OF BUILDING FROM $720M TO $160M
- NEW $100,000 GRANT WON FROM STATE
- MAJOR PRIVATE INVESTORS ENCOURAGE TALKS TO FUND $320M FOR 2 SITES
- DISCOUNTED RETURN 32% /YEAR FOR SELENE, 39% /YEAR FOR SATELLITE COMPANY (10 YRS)