1982

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NASA

National Aeronautics and
Space Administration

Lewis Research Center
Cleveland, Ohio 44135

CONSTRUCTION OF FACILITIES
BUDGET REQUEST
FISCAL YEAR 1985

VOLUME 1

PRELIMINARY--NOVEMBER, 1982

FACILITIES ENGINEERING DIVISION

National Aeronautics and
Space Administration

Lewis Research Center
Cleveland, Ohio
44135

NASA

Reply to Attn of: 8600

October 19, 1982

Dr. Jack L. Kerrebrock
Associate Administrator for Office of
Aeronautics and Space Technology
National Aeronautics and Space
Administration
Washington, DC 20546

Dear Jack:

Transmitted herewith are five copies of the preliminary submission of the FY 1985 Major and Minor Projects for the Construction of Facilities Program. One copy is also being transmitted directly to Billie J. McGarvey.

There are included six projects that exceed the present budget limits established for minor projects. If these CoF limits are not raised, the projects will be rescoped to fit the current budget limits. These projects are identified on the 1514 Summary Sheet by asterisks.

Sincerely,

John M. Klineberg
Deputy Director

Enclosures

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FY 1985 SUMMARY PLAN

PRIORITY LIST

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program/Installation Office or Center)
SUMMARY FY 1985 PLAN
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST ($ Millions to nearest tenth) FY 85	FY ___	FY ___	FY ___	FY ___
1.	85-1DP	85LCAA Construction of Antenna Technology Laboratory	7.100				
2.	85-2DP	85LCBA Modifications for Flame Tube & Cyclic Combustor, Combustion Research Laboratories (35-9)	1.200				
3.	85-3DP	85LCCA Modification of Variable Frequency System, ERB - West Wing (23) and Refrigerated Air System, ERB (5)	4.800				
4.	85-4DP	85LCDA Modification of the Propulsion Systems Laboratory (PSL), Engine Test Building (125)	1.900				
5.	85-5DP	85LCEA Modification for Structural Dynamics Verification Facility, Zero Gravity Facility (110)	1.500				
6.	85-6DP	85LCFA Modification of Cooling Towers for Fire Protection - Various Buildings	1.800				
S.P.	85-1SP*	85LSAA Construction of Visitor Information Center	4.900				
7.	85-1RM	85LRAZ Modification of Various Buildings to Provide Smoke Detection Systems	0.310				
*Special Project		TOTAL ▶					

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NASA-HQ

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program/Installation Office or Center)
SUMMARY FY 1985 PLAN
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST ($ Millions to nearest tenth) FY 85	FY ____	FY ____	FY ____	FY ____
8.	85-1RE	85LMAZ Repair of Steam Condensate System, Buildings (125, 110, 64 and 49)	** 0.630				
9.	85-2RM	85LRBZ Modification for Life Safety/ Handicapped Requirements to D.E.B. (500)	** 0.650				
10.	85-3RM	85LRCZ Modification to Computer Power System at the Research Analysis Center, Building (142)	0.200				
11.	85-1MC	85LAAZ Construction of 480 V. AC Power System at Engine Research Building Complex (5 and 23)	** 0.370				
12.	85-4RM	85LRDZ Modification for Rocket Turbopump Testing, Rocket Engine Test Facility (202)	0.420				
13.	85-2RE	85LMBZ Repair Combustion Air Piping Insulation, Central Air Equipment Building (64) and Refrigeration Building (9)	0.400				
14.	85-3RE	85LMCZ Repair of Recertification of 125 PSIG Combustion Air System in ERB (5)	0.450				
**Projects Exceed Current Budget Limits		TOTAL ▶					

NASA FORM 1514 DEC 73

NASA-HQ

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES – FIVE-YEAR PLANNING

OR (Program/Installation Office or Center)
SUMMARY FY 1985 PLAN
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION		ESTIMATED COST ($ Millions to nearest tenth) FY 85	FY ____	FY ____	FY ____	FY ____
15.	85-5RM	85LREZ	Rehab & Mod for Employees Service Center, Utilities Building (15)	0.450				
16.	85-2MC	85LABZ	Construct Natural Gas Well LeRC Site	0.220				
17.	85-4RE	85LMDZ	Repair of Cathodic Protection System for LeRC Piping System	0.300				
18.	85-6RM	85LRFZ	Rehab & Mod of Interior - West Offices - Engineering and Supply Building (21)	** 0.630				
19.	85-5RE	85LMEZ	Repair Walcott Road Between Taylor Road and Brookpark Road	0.270				
20.	85-7RM	85LRGZ	Rehab & Mod of the ERB Room (Cafeteria), Engine Research Building (5)	0.300				
21.	85-3MC	85LACZ	Construction of Storm Sewer for West Area Road	** 0.270				
22.	85-6RE	85LMFZ	Repair Distribution Chilled Water Piping Between Refrigeration Building (9) to Engine Research Building (5)	0.460				
**Projects Exceed Current Budget Limits			TOTAL ▶					

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program Installation Office or Center)
SUMMARY FY 1985 PLAN
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST ($ Millions to nearest tenth) FY 85	FY ____	FY ____	FY ____	FY ____
23.	85-8RM	85LRHZ Rehabilitation of Emission Control System at the Steam Plant (12)	0.460				
24.	85-7RE	85LMGZ Repair Roofs, Buildings EPL (301) and SPRL (309)	0.320				
25.	85-9RM	85LRIZ Rehabilitation of 10x10 SWT Office Building (86), Interior and Exterior	** 0.630				
26.	85-4MC	85LADZ Construction of Emergency Freeze Protection System for Various Facility Equipment	0.200				
		APPROVAL: John M. Klineberg 10/19/82 John M. Klineberg Date Deputy Director					
**Projects Exceed Current Budget Limits		TOTAL ▶	31.140				

NASA FORM 1514 DEC 73

NASA-HQ

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program Installation Office or Center)
SPECIAL PROJECT FY '86, 87, 88
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST ($ Millions to nearest tenth) FY 83 PER	FY 84 DESIGN I	FY 85 DESIGN II	FY 86 PH. I	FY 87 PH. II	FY 88 PH. III
1.	Spec. Proj.	86LSAA Modification of Altitude Wind Tunnel for Icing and Propulsion	2.240	3.700	3.000	43.0	46.1	22.9
		TOTAL	2.240	3.700	3.000	-	-	112.0

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NASA-HQ

DISCRETE CoF PROGRAM

FY 1985

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program/Installation Office or Center)
FY 1985 DISCRETE PROGRAM
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST Budget Estimate	PER	Final Design	Studies Support Fin. Design	
1.	85-1DP	85LCAA Construction of Antenna Technology Laboratory	7,100,000	(55,000)	426,000	50,000	
2.	85-2DP	85LCBA Modifications for Flame Tube & Cyclic Combustor, Combustion Research Laboratories (35-9)	1,200,000	(53,000)	72,000	0	
3.	85-3DP	85LCCA Modification of Variable Frequency System, ERB - West Wing (23) and Refrigerated Air System, ERB (5)	4,800,000	63,400	288,000	155,000	
4.	85-4DP	85LCDA Modification of the Propulsion Systems Laboratory (PSL), Engine Test Building (125)	1,900,000	38,000	114,000	38,000	
5.	85-5DP	85LCEA Modification for Structural Dynamics Verification Facility, Zero Gravity Facility (110)	1,500,000	30,000	90,000	0	
6.	85-6DP	85LCFA Modification of Cooling Towers for Fire Protection - Various Buildings	1,800,000	(18,000)	108,000	36,000	
S.P.	85-1SP	85LSAA Construction of Visitor Information Center	4,900,000	98,000	294,000	0	
		( )Previously Funded					
		TOTAL ▶	23,200,000	(126,000) 229,400	1,392,000	279,000	

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NASA-HQ

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1985 ESTIMATES

PROJECT TITLE: Construction of Antenna Technology Laboratory

INSTALLATION: Lewis Research Center

FY 1985 CoF ESTIMATE: $7,100,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology and Office of Space, Science and Application

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	$569,000	---	$569,000
Capital investment	---	---	---
Total	$569,000	---	$569,000

SUMMARY PURPOSE AND SCOPE:

NASA's program is aimed at developing the high risk, advanced satellite communications technologies required to significantly increase the capacity of future satellite communications systems. The program includes both a broad technology development program focused on the critical technology elements and the definition of a suitable experimental flight system capable of verifying the readiness of the systems technology for operational system implementation. The goal of that program is:

To develop high risk advanced communications technology usable in multiple frequency bands to support a wide range of future communications systems required by NASA, other Government agencies, and United States industry.

The development of spacecraft communication antennas systems has been identified as an essential part of NASA's renewed space communications program.

The direction of future antenna technology will be toward antennas which are large, both physically and electrically; which will operate at frequencies to 60 GHz; and which are complex, implementing multiple beam and scanning beam concepts and monolithic semiconductor devices and techniques.

The acquisition of accurate antenna performance measurements is a critical part of the advanced antenna research program and represents a substantial antenna measurement technology challenge, considering the special characteristics of future spacecraft communications antennas.

Comparison of various antenna testing techniques and their relative advantages and disadvantages shows that the near-field approach is necessary to meet immediate and long term testing requirements.

Construction of an Antenna Technology Laboratory with a 60 foot (18.3m) scan, 60 GHz frequency, and 3000 D/λ capabilities are required to meet future program testing requirements.

A review of the large U.S. near-field planar facilities within industry, universities, and government has indicated that none exist (or are planned) with D/λ capabilities even closely rivaling the large horizontal scanner of the ATL; the ATL is a truly unique testing facility.

This project provides for the construction of an Antenna Technology Laboratory at Lewis Research Center. The facility will house computer and related research analysis equipment to provide for advanced research and development of space/ground antenna and related hardware. The Antenna Technology Laboratory will contain two environmentally controlled research areas, an assembly/disassembly area, control rooms and associated support/service areas. Each area will be properly configured and interrelated to provide an efficient research/development environment. The total facility will have an area of approximately 21,000 square feet (1951 square meters).

PROJECT JUSTIFICATION:

The demand for communication services is at a relatively high growth rate and this growth rate is expected to continue. The service demand through the year 2000 was investigated in market studies conducted by ITT and Western Union.

This assessment was revised by NASA in 1980. It shows demand (expressed as equivalent 36 MHz transponders) rising even faster than originally estimated in spite of projected improvements with time of the capability of transponders to handle more throughput. The capacity of a typical (36 MHz) transponder has grown from a few hundred half circuits in the early seventies to 1,000 or more today. Within the next decade, individual transponder capacities of up to 3,000 half circuits are expected to be in operation by using advanced modulation, coding and bandwidth compression techniques.

The estimated capacity limit of domestic satellites (DOMSATS) using C- and/or Ku-band frequencies was also increased from the earlier estimate of 430 transponders to about 1,200 transponders. This increase reflected projected improvements in frequency reuse at C- and Ku-bands. Even with these improvements, it may be seen that the C- and Ku-bands will be saturated in the early 1990's. In fact, given today's orbit spacing constraints (4° between C-band satellites and 3° between Ku-band satellites), the orbit space for existing plus planned C-band DOMSATS is already saturated. Closer spacing is currently under consideration by the FCC (down to 2° at C-band) and potentially offers additional orbit capacity but it is not expected that this would delay the onset of saturation by more than a few years.

Allocated frequencies bands for space communications services, established by international treaty. In order to provide additional space communications capacity, it will be necessary to develop the use of higher frequency bands of Ka band and above. Extension of current communications technology developed for C- and Ku-band fixed services to Ka-band (17.7 - 20.2 GHz downlink, 27.5 - 30.0 uplink) will provide the capacity. The development of Ka-band for fixed services, in itself, will be inadequate to meet service demand in the 1990 - 2000 time period. Therefore, the following technology options exists, in addition to those technologies necessary to implement Ka-band fixed service communications:

1. Development of multi-beam antenna technology for 20/30 GHz fixed services. This requires concomitant advances in sidelobe reduction and beam isolation.

2. Development of time division multiple access (TDMA) with on-board matrix switch routing to achieve greater capacity utilization through dynamic allocation based on demand.

3. Development of switched and/or scanned beam antennas.

4. Increases in the Bit/Hz utilization of allocated bandwidths form 1 Bit/Hz to 3 Bit/Hz. This will necessitate higher energy-per-bit/noise power density.

5. Improvements in orbital arc utilization. Reduction in satellite spacing from 4° to 2° between satellites.

6. Development of intersatellite relay technology from 54 GHz to 64 GHz. This technology can be used to enhance frequency reuse. Spatial discrimination between two satellites can be used where adjacent beam isolation is inadequate.

7. Development of technology for the 40/50 GHz frequency band.

Each of the above technology options contains, implicitly or explicitly, the need for antenna research and development. The directions of that antenna research and development is toward increasing aperture sizes; increasing frequencies of operation; and increasing complexity encompassing multibeam and scanning beam operation and adaptation of advances in solid state monolithic gallium arsenide and indium phosphide technology to arrays and array feeds. Within NASA's renewed space communications activities, antenna technology is an essential and significant part of all elements within the program.

The selected communications technology research and development can be grouped and presented in terms of three elements:

1. Near term programs

2. Advanced communication programs

3. A base R&T (research and technology) program

Program elements are related in content such that an orderly chronological development of enabling technology proceeds from the base R&T, to supporting research and development for advanced communications, to near-term projects.

The near-term program element includes ACTS-1 (Advanced Communications Technology Satellite-1) project. It is focused on the technology associated with high gain multibeam antenna systems, and interconnect technology for Ka band applications.

The advanced communications program element contains future projects beyond the ACTS-1 project, which contribute to the achievement of NASA's communications program goal. This program element addresses the development of other frequency bands, both lower and higher in frequency than Ka band, for advanced communications applications. It is a continuing element which currently includes SR&T for a Mobile Satellite project, ACTS-2. This project would develop space communication technology in the UHF frequency band for mobile switched telephone, rural fixed telephone and TV/audio distribution. In addition, the advanced communications program element includes large structures for communications and remote sensing, and space stations.

The base R&T program is a continuing program element in which research and advanced development is conducted to provide enabling technology required to support NASA's new emphasis in satellite communications systems. This element of the program currently includes research and advanced development of technology for enhancement of the ACTS-1 and 2, the mobile satellite application, intersatellite communications in frequency bands from 54 - 64 GHz, and potential communication applications at 40/50 GHz and higher.

The ACTS-1 project plans to develop multibeam and scanning beam space antennas for uplink reception at 30 GHz and downlink transmission at 20 GHz. There currently does not exist an antenna test facility to test large aperture (3.5m) antenna systems at these frequencies. The ability to test two-antenna flight and prototype hardware prior to 1987 launch will substantially reduce the risk associated with achieving the flight antenna related objectives. However, it is not critical to the flight program to conduct antenna systems tests. The flight program would proceed with higher risk.

Within the advanced program element it is planned to develop 15 to 30 meter deployable apertures operating at UHF. The ability to test flight and prototype hardware prior to launch will substantially reduce the risk associated with achieving flight programs objectives. There currently exist far-field ranges on which antenna tests could be conducted. However, the disadvantages of outdoor ranges for testing large, deployable, fragile antenna structures makes that use unacceptable.

The base R&T program is intended to provide enabling technology, through research and advanced development, for future satellite communications programs. Within this element of the communications program, antenna research and advanced development is directed toward the development of large aperture antenna systems ($\sim$4 meter diameter) and operating at frequencies extending from 1 GHz to 60 GHz. Advances in microwave solid state technology for monolithic circuits in GaAs and other III-V compounds will be incorporated with antenna technology to provide sophisticated antenna systems for multibeam and scanning beam transmission and reception. Large deployable antennas, with aperture diameters up to 150 M, are being investigated for communications and remote sensing applications. In addition, complex, multi-frequency antenna systems will be required for future space platform applications. To demonstrate concept feasibility for these advanced antenna concepts, it is necessary to be able to evaluate far-field patterns of complex, non-reciprocal antennas. This is necessary to provide an enabling antenna technology base for future communications program SR&T. Without this base, advanced program costs will be excessive due to high risks associated with these advanced antenna concepts, and development schedules will preclude project utilization. No facility currently exists in which many of these antenna concepts can be tested. The near-field approach is the only technically viable one for evaluating far-field performance for these advanced concepts.

Some advantages of near-field testing are: (1) Single site, close range testing in a controlled environment, (2) Problems associated with weather, interference, and atmosphere effects; ground reflections and logistic

problems encountered in far-field testing will be eliminated, (3) Antennas may be tested in any position to minimize distortion effects of gravity, (4) Antenna systems and spacecraft (or spacecraft mockups) may be tested to determine antenna/spacecraft interaction, (5) Extremely low R.F. power requirements, and (6) Scaled tests of large (to 30 meter diameter) antennas can be tested.

The proposed Antenna Technology Laboratory, near-field test range, will support commercial and related DOD programs including current ACTS-1 and 2 programs; development of UHF technology for mobile switched telephone, rural fixed telephone, and TV/audio distribution; intersatellite communication from 54-64 GHz, and communication applications at 40/50 GHz and higher, and large deployable antennas for communications and remote sensing.

IMPACT OF DELAY:

This project must be implemented now to support the development of near term and long range, efficient, high performance, space, and ground antennas. The impact of delaying the construction of this facility would delay the availability of desired antenna research required for basic communication industry and military satellite technology. Such delays would contribute to the future erosion of our nation's technological lead in the development and implementation of our satellite communication systems which would have a direct impact on our national communication network of the future.

PROJECT DESCRIPTION:

This project will provide a new Antenna Technology Laboratory (ATL) with a floor area of approximately 21,000 square feet (1951 sq. m). The laboratory will be located in the West Area (see Figure 2) at a site which will optimize its location in relation to existing facilities.

The ATL will consist of two environmentally controlled research areas, one approximately 85.0' x 85.0' x 80.0' (25.9m x 25.9m x 24.4m) high clear area and the other approximately 45' x 45' x 35' (13.7m x 13.7m x 10.7m). This facility will provide research capability for testing of both fixed and deployable antennas up to 15 meters (50 feet) in diameter. Special foundations in these areas will be provided for test equipment and antennas. Assembly, control/computer, office and support services areas will provide support for the test programs. Communications and fire detection and protection systems will be provided. Test and assembly areas will be provided with 5 and 10 ton overhead cranes to facilitate test build up and antenna handling. Site development will include installation of roads and parking areas and the extension of existing facilities.

The antenna test areas will be air conditioned to provide stratified temperature control with a $10^{o}F$ ($5.6^{o}C$) gradient and a maximum temperature of $90^{o}F$ ($32^{o}C$). Variation at any point on the gradient shall not exceed $\pm 1^{o}F$ ($\pm 5/9^{o}C$) and air velocity will not exceed 30 FPM (9.2 mPM). Humidity will be controlled. Airborn dust will be removed with 99.97% efficient filters. The assembly-disassembly area will be conditioned with a separate HVAC unit to prevent truck exhaust from circulating through the building. A manually operated CO_2 system will be installed in the horizontal and vertical test cells.

Equipment and antenna foundations will be isolated from the building foundation system to prevent vibration caused by mechanical equipment, and surface and air traffic from affecting the extremely sensitive scanner and probe components of the test equipment. Antenna foundations will be designated to accept special antenna support equipment that will position deployable antennas in their operating configurations.

PROJECT COST ESTIMATE:

The project cost estimate is based on the Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	- 0 -
Construction	---	---	---	---
Site development/utilities	---	---	---	424,000
Civil	LS	---	103,000	103,000
Mechanical	LS	---	44,000	44,000
Electrical	LS	---	277,000	277,000
Building	---	---	---	5,124,000
Architectural/Structural	LS	1	3,665,000	3,665,000
Mechanical	LS	1	473,000	473,000
Electrical	LS	1	986,000	986,000
Special Equipment	---	---	---	1,552,000
Cranes	LS	1	614,000	614,000
HVAC Test Cells	LS	1	411,000	411,000
CO_2 System	LS	1	527,000	527,000
Fallout Shelter (not feasible)	---	---	---	---
Total				7,100,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Building Floor Plan

OTHER EQUIPMENT SUMMARY:

Scanner equipment: $2,500,000 R&D funded.
ADP computer equipment: $2,200,000 R&D funded.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no currently foreseen future funding requirements to complete this project.

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR																							
	1981				1982				1983				1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
PER & STUDIES																								
DESIGN, CONSTRUCTION																								
ACTIVATION, CHECKOUT & OTHER																								

P.E.R. _._._._._ STUDY — — — DESIGN ---------- CONSTRUCTION/ACTIVATION ————

MODE OF ACCOMPLISHMENT:

This project will be carried out in the main in the conventional (design, advertise and build) procurement mode. NASA will contract with an A/E firm for the final design. For this, $426,000 is included in the design estimate. All supervision, inspection and engineering services required during construction will be accomplished by construction management contractor.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	IDENTIFICATION NO.
Nov. 1, 1982	85LCAA

INSTALLATION	PROGRAM OFFICE	FISCAL YEAR	PROPOSED BUDGET YEAR
Lewis Research Center	OAST/OSSA	1983	1985

PROJECT TITLE	EST. COST OF DESIGN	EST. CONSTR. COST
Construction of Antenna Technology Laboratory	$426,000	$7,100,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 81 b.		FY 82 c.		FY 83 d.		FY 84 e.		FY 85 f.		FY 86 g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1	Special Study	.038	.038														
2	Preliminary Engineering Report	.055	.055														
3	Design Study & Final Design									.050 .426	.050 .426						
4	Construction											7.100	3.800		3.300		
TOTAL ▶ OBL	7.669	.093								.476		7.100					
TOTAL ▶ OLY	7.669		.093								.476		3.800		3.300		

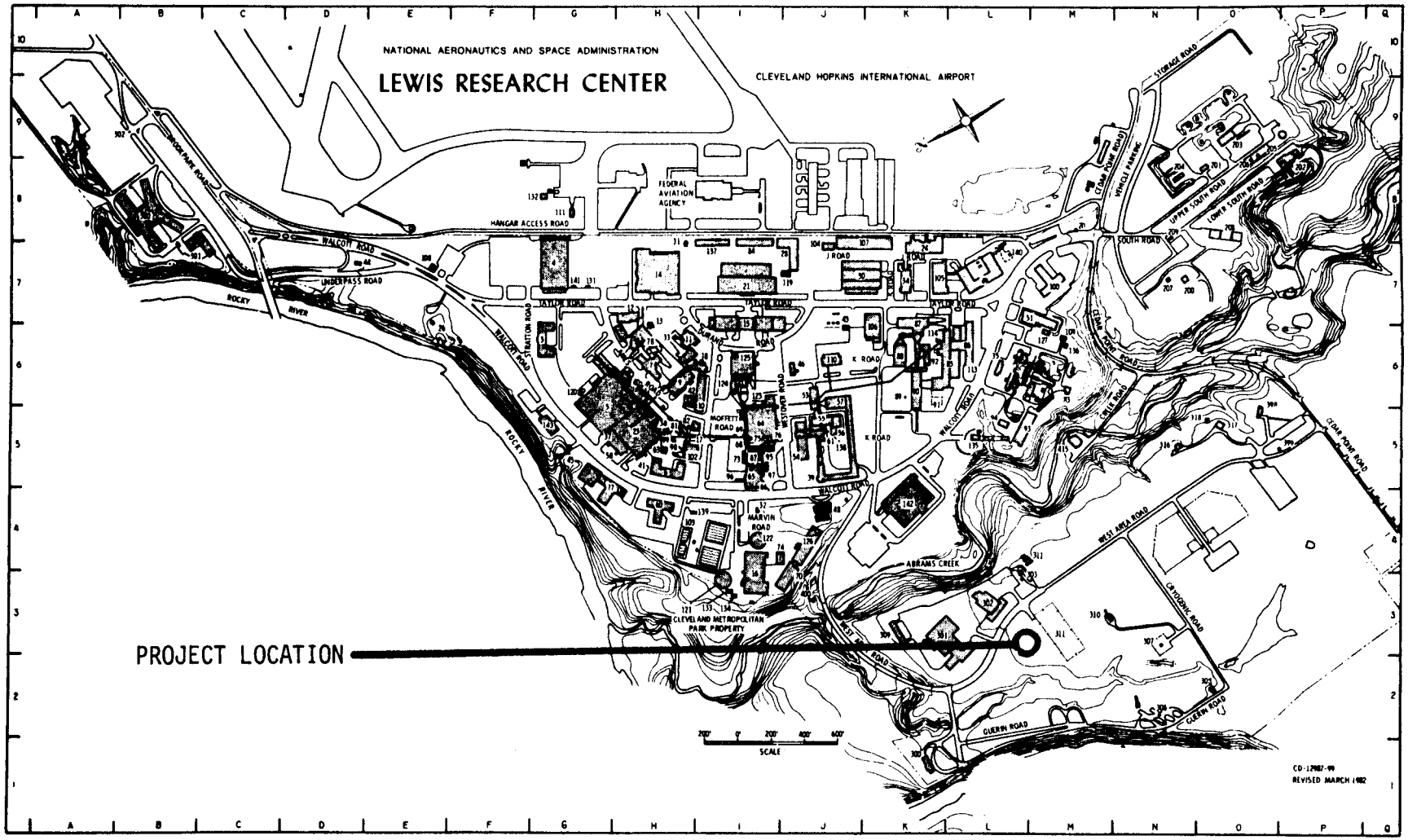
NASA FORM 1513 DEC 73

1DP

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCTION OF ANTENNA TECHNOLOGY LABORATORY



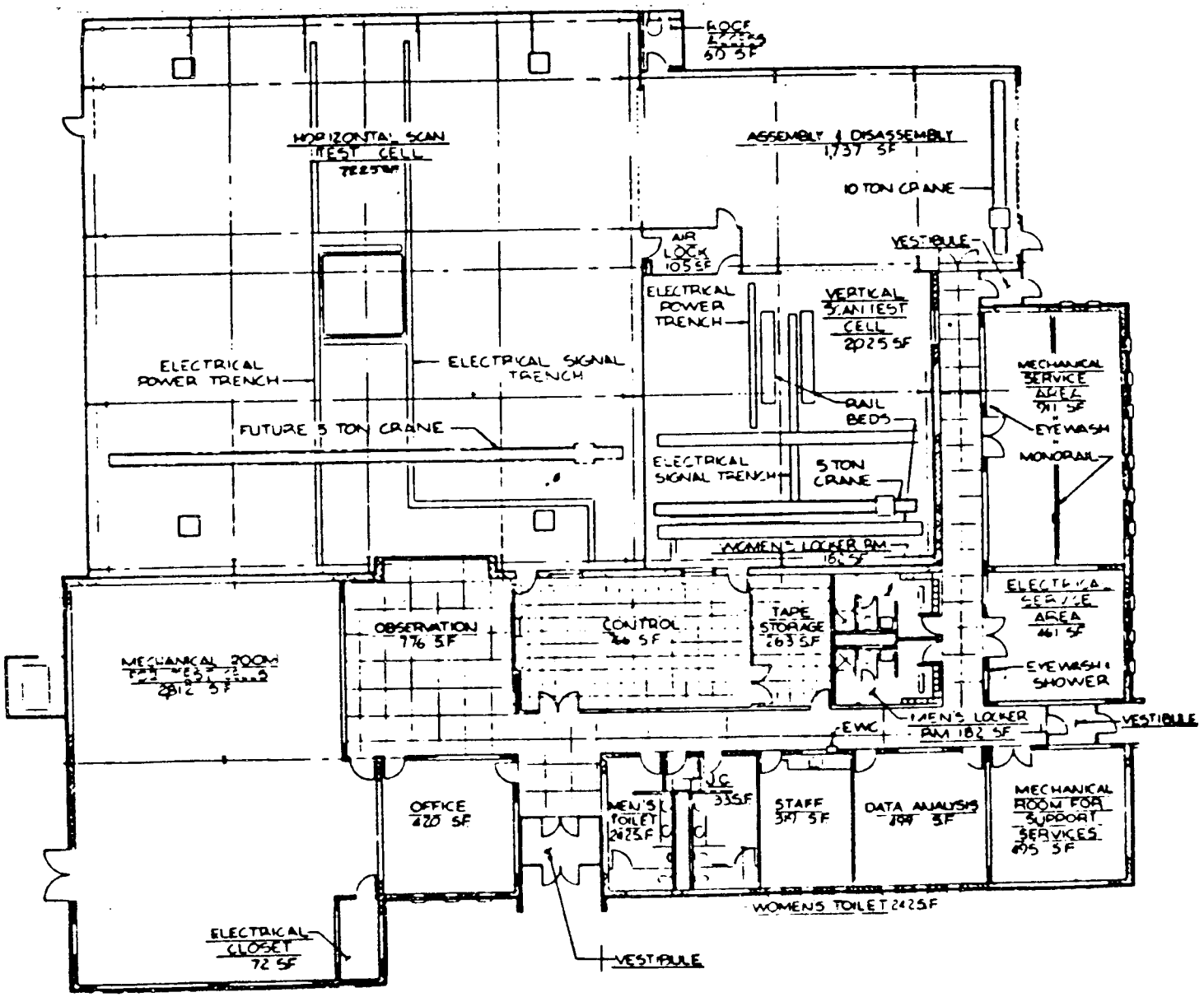
LOCATION PLAN

FIGURE 1

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCTION OF ANTENNA TECHNOLOGY LABORATORY



BUILDING FLOOR PLAN
FIGURE 2

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LCAA

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Construction of Antenna Technology Laboratory	LeRC/OAST/OSSA	Nov. 1, 1982	K

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$7,100,000

RELATED COST DATA *(Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)*

RELATED COSTS INVOLVED: ☒ YES (Identify) ☐ NONE

PER (Amount)	DESIGN (Amount)
$55,000*	$426,000

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED HSSS	$2,500,000	FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING ADP	$2,200,000	OTHER (Specify) HSSS Study ~~Study Siting~~	$50,000 $38,000*

CATEGORY	JUSTIFICATION	WORK
	Program Related	Construction

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will provide a new Antenna Technology Laboratory (ATL) with a floor area of approximately 21,000 square feet (1951 sq. m). A study has been performed to determine the optimum building location in the West Area in relation to future satellite antennas and existing facilities. Site development will include installation of roads and parking areas, and the extension of existing facilities. The ATL will consist of two environmentally controlled research areas, one approximately 85' x 85' x 80' (25.9m x 25.9m x 24.4m) high clear area and the other approximately 45' x 45' x 35' (13.7m x 13.7m x 10.7m). Provides research capability for testing of both fixed and deployable antennas to 15 meters (50 feet) in diameter. Special foundations in these areas will be provided for test equipment and antennas. Assembly, control/computer, office and support service areas will provide support for the test programs. Communications, and fire detection and protection systems, including CO_2 systems for the test areas, will be provided. Test and (continued)

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X ; c. Environmental impact See Text.

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

NASA's program is aimed at developing the high risk, advanced satellite communications technologies required to significantly increase the capacity of future satellite communications systems. The program includes both a broad technology development program focused on the critical technology elements and the definition of a suitable experimental flight system capable of verifying the readiness of the systems technology for operational system implementation. The goal of that program is: To develop high risk advanced communications technology useable in multiple frequency bands to support a wide range of future communications sytems required by NASA, other Government agencies and U.S. industry. (cont'd)

SCHEDULE DATES

DESIGN	PER	START	4-80
		COMPL	7-83
	FINAL	START	1-84
		COMPL	10-84
CONSTRUCTION		AWARD	1-85
		COMPL	7-86
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____.)

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85LCAA

Construction of Antenna Technology Laboratory

SCOPE/DESCRIPTION (continued)

assembly areas will be provided with overhead cranes to facilitate test build up and antenna handling.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

BASIS OF NEED (continued)

The development of spacecraft communication antennas systems has been identified as an essential part of NASA's renewed space communications program. The direction of future antenna technology will be toward antennas which are large, both physically and electrically; which will operate at frequencies to 60 GHz; and which are complex, implementing multiple beam and scanning beam concepts and monolithic semiconductor devices and techniques. The acquisition of accurate antenna performance measurements is a critical part of the advanced antenna research program and represents a substantial antenna measurement technology challenge, considering the special characteristics of future spacecraft communications antennas. Comparison of various antenna testing techniques and their relative advantages and disadvantages shows that the near field approach is necessary to meet immediate and long-term testing requirements. Construction of an Antenna Technology Laboratory with a 60' (18.3m) scan, 60 GHz frequency, and 3000 D/λ capabilities are required to meet future program testing requirements. A review of the large U.S. near-field planar facilities within industry, universities, and government has indicated that none exist (or are planned) with D/λ capabilities even closely rivaling the large horizontal scanner of the ATL; the ATL is a truly unique testing facility.

This facility will support research authorized by RTOP 541-02-12.

NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST/OSSA	DATE Nov. 1, 1982
PROJECT TITLE Construction of Antenna Technology Laboratory	SUBMISSION/REVISION K
	PROJECT CODE 85LCAA
BASIS OF COST ESTIMATE Preliminary Engineering Report (7-80), updated (7-82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$4,450,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	1,527,000	34%
3. SUBTOTAL *(1 + 2)*	$5,977,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	598,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*	525,000	8%
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$7,100,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/year to midpoint of construction (7-82 to 11-85) $(1.09)^{3.4} = 1.34$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
Facility & Antenna Siting 1. PRELIMINARY ENGINEERING REPORT			X X	A-E A-E	$ 38,000* 55,000*
2. SPECIAL STUDIES *(Specify)* Optimize HSSS & Determine Thermal Stability of HSSS (Horiz.Scan Sup.Sys)	X			A-E	50,000
3. FINAL DESIGN	X			A-E	426,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$569,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$55,000*	$426,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED Scanner	$2,500,000	8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING	$2,200,000	10. OTHER *(Specify)* Facility & Antenna Siting Studies - HSSS	$38,000* 50,000
	7. FUTURE FUNDING			

*Previously Funded

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST/OSSA	85LCAA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*	1. Civil	LS	1	64,600		64,600	103,000
	2. Mechanical	LS	1	27,600		27,600	44,000
	3. Electrical	LS	1	173,700		173,700	277,000
						265,900	424,000
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*							
	Building/Structure						
	1. Arch/Struct	LS	1	2,296,700		2,296,700	3,665,000
	2. Mechanical	LS	1	296,500		296,500	473,000
	3. Electrical	LS	1	618,000		618,000	986,000
						3,211,200	5,124,000
	Special Equipment						
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*	1. Cranes	LS	1	384,900		384,900	614,000
	2. HVAC Test Cells	LS	1	257,600		257,600	411,000
	3. CO_2 System	LS	1	330,400		330,400	527,000
5. SPECIAL FEATURES *(Summary)*						972,900	1,552,000
6. SOURCE OF COST DATA: Preliminary Engineering Report (7-82)			7.		TOTALS ▶	$4,450,000	$7,100,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1985 ESTIMATES

PROJECT TITLE: Modifications for Flame Tube and Cyclic Combustor, Combustion Research Laboratories (35-9)

INSTALLATION: Lewis Research Center

FY 1985 CoF ESTIMATE: $1,200,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	$125,000	---	$125,000
Capitol Investment Building (35)	---	$840,000	$840,000
Total	$125,000	$840,000	$965,000

SUMMARY PURPOSE AND SCOPE:

The Modifications of the Combustion Research Laboratory (Bldg. 35-9) for Flame Tube and Cyclic Combustor Testing (See Figures 1 and 2) at Lewis Research Center (LeRC) will provide the necessary capabilities for research and development of advanced turbine engine combustors for improvement of specific fuel consumption, reduced pollutant emissions and provide the capability of burning new fuels derived from shale oil and coal. Engines with these capabilities are required to reduce U.S. dependence upon imports of foreign oil. The logical design of combustors for these engines requires that reliable information be available to the combustor designers regarding those properties of potential fuels of interest. These include auto-ignition characteristics, flashback,

mixing and vaporization rates and completion of combustion. The flame tube will permit modeling of combustors and will provide the fastest and least costly method of obtaining these combustion properties in organized fashion. It provides capability to investigate the phenomena over the required range of parameters, including combustion air temperature, pressure and flow rate. The cyclic combustor provides a cost-effective method for the prediction of failure modes for new combustor designs for various types of gas turbine engines. It permits the rapid testing of partial combustor panels, which accurately simulate full-sized combustors as regards loading and thermal cycling to inexpensively determine these failure modes. The two test legs are sited together to make use of a common combustion air heater. Facility capabilities include combustion air supply at flow rates to 10 lbs/second (4.53 kg/sec); temperatures to 1200 degrees Fahrenheit (670 degrees C) and pressures to 150 psig (103 Newtons per square centimeter).

PROJECT JUSTIFICATION:

The reduction of U.S. dependence on foreign imported oil and good conservation practice require the development of gas turbine engines which exhibit reduced specific fuel consumption, lower levels of pollutant emissions, increased durability and the ability to burn new fuels derived from shale oil and coal. The development of these engines requires the development of advanced combustors, which will employ such refinements as multizone burning, lean premixed-prevaporized combustion and possibly catalytic combustion. Development of these combustors is a long-lead process, requiring good knowledge of the combustion characteristics of fuels over a broad spectrum of parameters. In many instances this data is lacking. The lead time for combustor development may also be reduced through a rapid test method which will indicate combustor failure modes and aid in their prediction. This facility will serve as a valuable tool in the entire combustor development process, and will do so in a very cost-effective manner.

Programs at Lewis which will directly benefit include the Alternative Fuels Program, the HOST (Hot Section Technology) Program, the ALEC (Advanced Low Emission Combustor) Program, and combustor development for general aviation, rotorcraft and ground power applications. Research program supported by RTOP 505-32-32.

There are no known facilities which provide the information to be derived from the Cyclic Combustor test leg. An attempt was made in industry to develop this capability, but failed because the induction heating method which was used did not accurately simulate actual combustor conditions. Since this facility will provide conditions for the tests which accurately duplicate actual combustor temperature distributions and loadings, much valuable data can be obtained. Since the cyclic combustor will employ small panels, many advantages accrue, namely: a) The small test panels are less expensive to fabricate than would be full-sized combustors, since they require fewer parts and much less fabrication. b) The smaller size permits lower fuel and air flows, saving energy and cost in testing. c) The lower flow rates also permit smaller, faster responding flow control elements, permitting realistic transient and cycling rates, thus further shortening test time. d) The

smaller sizes result in decreased thermal inertias, also reducing cycle times. and e) The test apparatus itself - heaters, housings, etc. are smaller and less expensive. The cyclic test leg will provide large cost benefits by providing a means for the prediction of failure modes in full-sized combustors, which are expensive to replace of themselves and require expensive and frequent engine tear-downs. It will be a useful tool for combustor development as long as this work is carried on at Lewis.

The flame tube will aid in the rapid development of combustors by furnishing specific, quantitative data on the parameters affecting combustor design for all fuels and will permit inexpensive combustor modeling. The cell which has been selected has available to it the required quantity of combustion air for all test legs, has a space adjacent to it available for the large air pre-heater which will be required, and is located in an area in which support personnel are familiar with this type of facility and can be shared with other test cells in the vicinity. Since the only other flame tube at Lewis is already fully utilized, this tube will be required to be used daily and nearly continuously in order to provide all of the data which is required. They will be operated manually remotely and will require the reassignment of one operations engineer nearly fulltime. One research scientist, also reassigned from other work, will be required to plan the experiments, reduce the data and write the reports which will be generated.

The present unavailability of any sort of cyclic combustor test leg has resulted in the expensive failure of complete combustors, and the inability to predict failures. The overload of the only existing flame tube has resulted in significant delays in combustor design and development. Without this facility, these costs and delays will continue.

IMPACT OF DELAY:

The impact of delaying the construction of this facility would be to continue to accrue the cost of the fuel burned in present day turbine engines at the present rate versus the savings which would be possible due to the advanced engine combustors, plus the additional cost of overhaul and rebuild of present day engines due to premature combustor failure versus the lengthened overhaul schedules which could result from ability to predict and prevent combustor failure, which is the object of building this facility.

PROJECT DESCRIPTION:

This facility will be located in existing Cell 24 of Building 35-9 at LeRC, which is currently not in use. The test cell measures 627 square feet (58 sq. m.) with an existing 418 square foot (39 sq. m.) control room. It will house mechanical and electrical equipment for the facility, including gas compressors, pumps, and electrical power distribution equipment.

The test legs will be located in the test cell. All are furnished with combustion air which can be heated to a maximum of 1200 degrees F (670 degrees C) by an air pre-heater located just outside the test cell. Each of the test legs is furnished with an inlet flow control valve, and is followed with a water spray quench and back pressure control valve. The test legs exhaust to atmosphere via a common exhaust muffler and stack.

Control of the flame tube is manual remote since rapid changes in test conditions are not required. The cyclic combustor requires automatic remote control of many variables in order to obtain rapid excursions in temperature and to permit unattended operation off-shift. The control systems are all within the state-of-the-art, but somewhat sophisticated since they must rapidly control a large number of parametric variables during each temperature cycle. These include, besides the temperature control of the specimen, temperature control of the air pre-heater, mass flow rate of the combustion air, fuel-air ratio controls, back pressure control, specimen differential pressure control, cooling air control, and control of cooling and quench water systems. In addition, such considerations as overshoot tendencies and ramp rates must be incorporated into the control system. Thus, the controls for the various flow streams account for a major amount of the cost of this facility. These features will be provided through research funding.

The Combustion Research Laboratory at Lewis was built up in stages and consists of various small and medium sized test cells which are served by various central services including the Central Air System. These cells have been used for a variety of research programs, and are especially well suited for combustion research activities.

PROJECT COST ESTIMATE:

The project cost estimate is based on a Preliminary Engineering Report, July 1982.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Building/Structural	---	---	---	306,000
Architectural/Structural	---	---	---	110,000
Mechanical	---	---	---	67,000
Electrical	---	---	---	129,000
Special Features	---	---	---	894,000
Air Heating Systems	---	---	---	312,000
Cooling Water Systems	---	---	---	93,000
Exhaust System	---	---	---	90,000
Compressed Air System	---	---	---	173,000
Instrumentation and Control	---	---	---	226,000
Fallout Shelter (not feasible)	---	---	---	---
Total				1,200,000

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR																							
	1980				1981/1982				1983				1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
PRELIMINARY ENGINEERING REPORT	_._._				_._._				_._.															
DESIGN, CONSTRUCTION													----------				————							
ACTIVATION, CHECKOUT & OTHER																							————	

P.E.R. _._._._._._ DESIGN ---------- CONSTRUCTION/ACTIVATION ————————

MODE OF ACCOMPLISHMENT:

This project will be carried out in the conventional (design, advertise and build) lump-sum procurement mode, using 3 or 4 work package contracts. Lewis will contract with an A/E firm for the development of the final design and special studies. All supervision, inspection and engineering services required during construction will be performed by a construction management contractor.

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Equipment Plan

OTHER EQUIPMENT SUMMARY: (R & D Funded)

Fuel System:	41,000
Flame Tube Test Leg:	313,000
Cyclic Combustor Test Leg:	268,000
Programmable Controller:	60,000
Research Data System:	350,000
TOTAL:	1,032,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	Nov. 1, 1982
IDENTIFICATION NO.	85LCBA
INSTALLATION	Lewis Research Center
PROGRAM OFFICE	OAST
FISCAL YEAR	1983
PROPOSED BUDGET YEAR	1985
PROJECT TITLE	Modifications for Flame Tube and Cyclic Combustor, Combustion Research Laboratories (35-9)
EST. COST OF DESIGN	$72,000
EST. CONSTR. COST	$1,200,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 84 b.		FY 85 c.		FY 86 d.		FY ___ e.		FY ___ f.		FY ___ g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1	Preliminary Engineering Report	.053	.053														
2	Final Design			.072	.072												
3	Construction					1.200	.840		.360								
TOTAL ▶	OBL 1.325	.053		.072		1.200											
	OLY 1.325		.053		.072		.840		.360								

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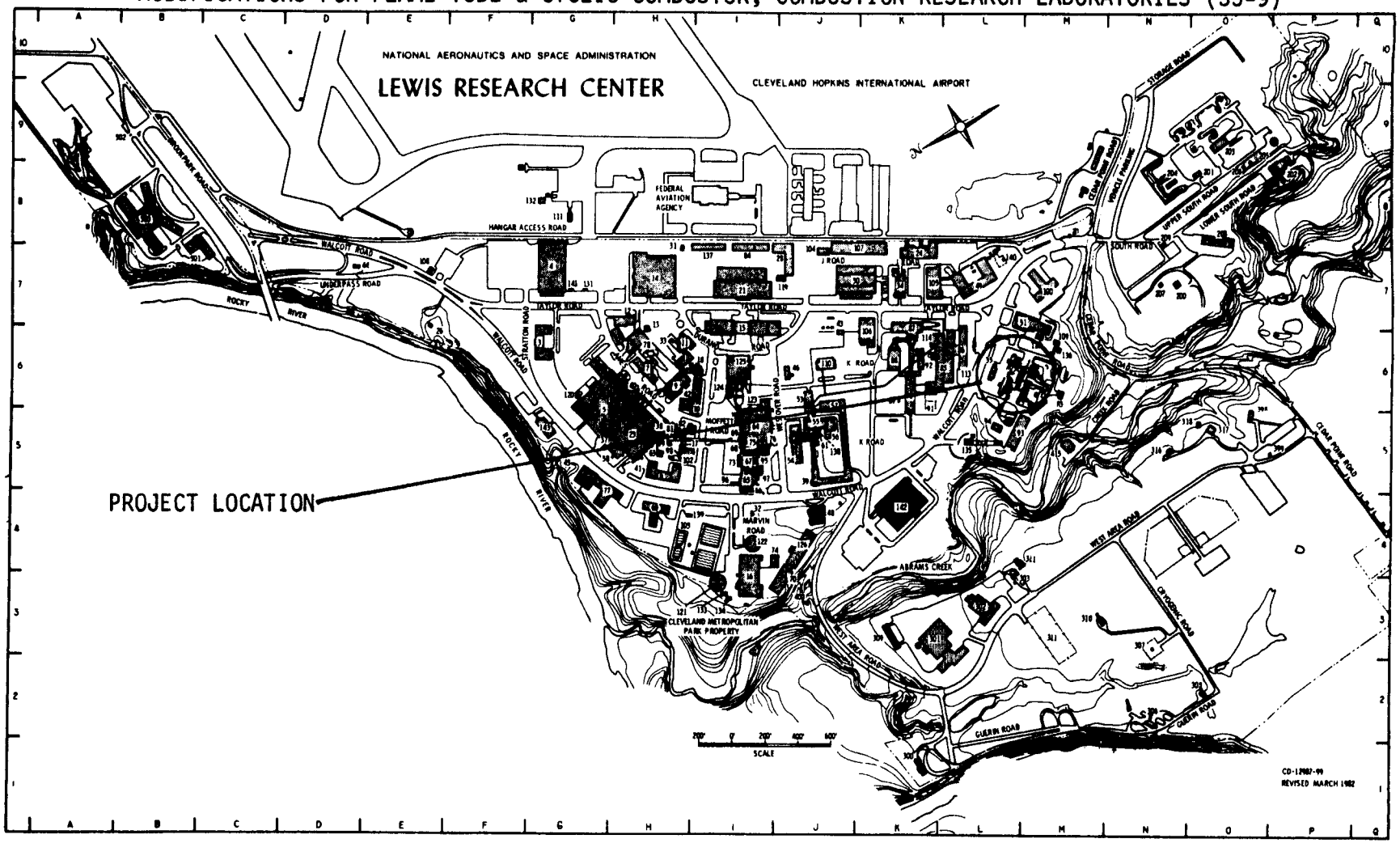
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATIONS FOR FLAME TUBE & CYCLIC COMBUSTOR, COMBUSTION RESEARCH LABORATORIES (35-9)



LOCATION PLAN

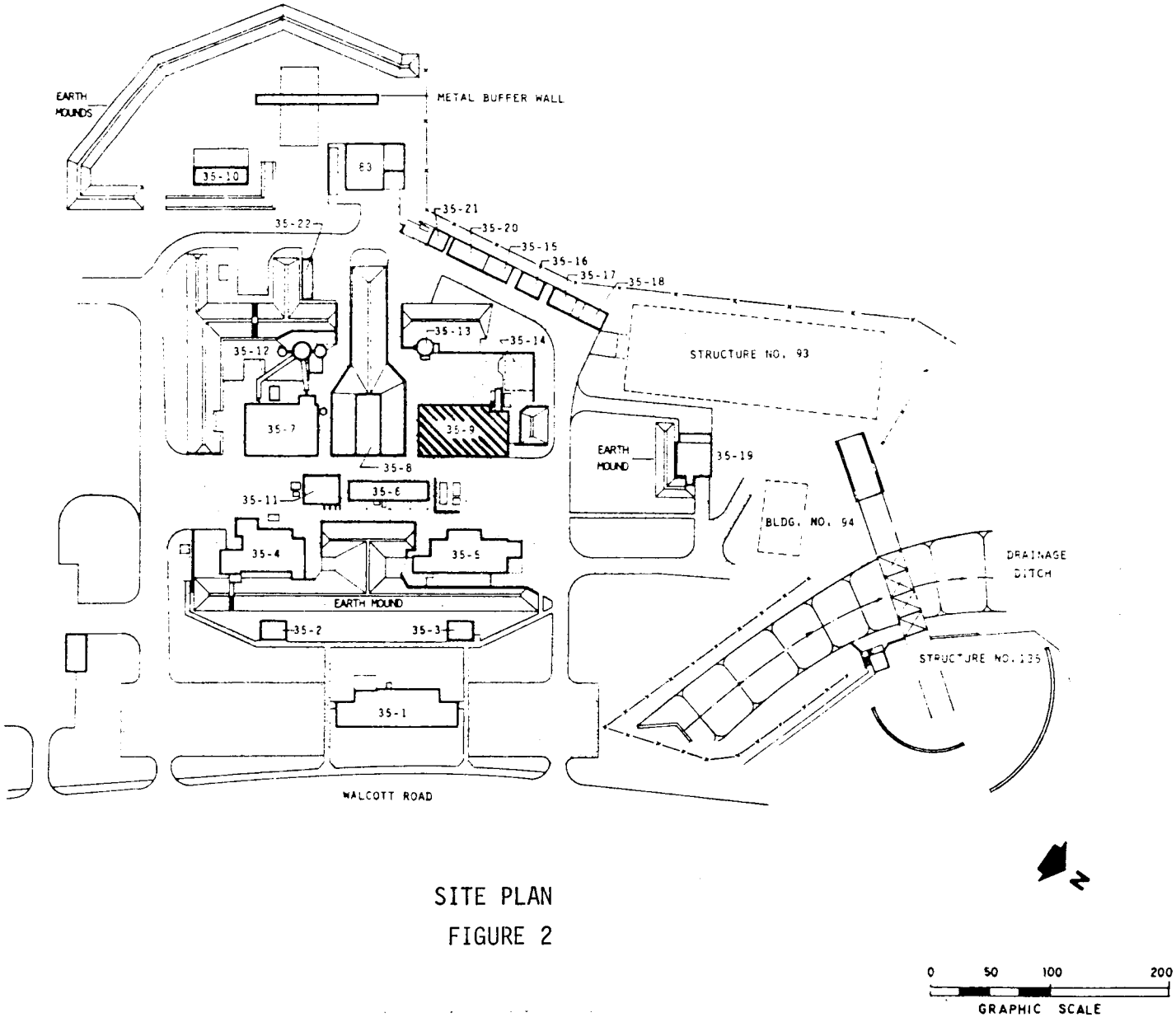
FIGURE 1

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATIONS FOR FLAME TUBE AND CYCLIC COMBUSTOR

COMBUSTION RESEARCH LABORATORIES (35-9)



SITE PLAN

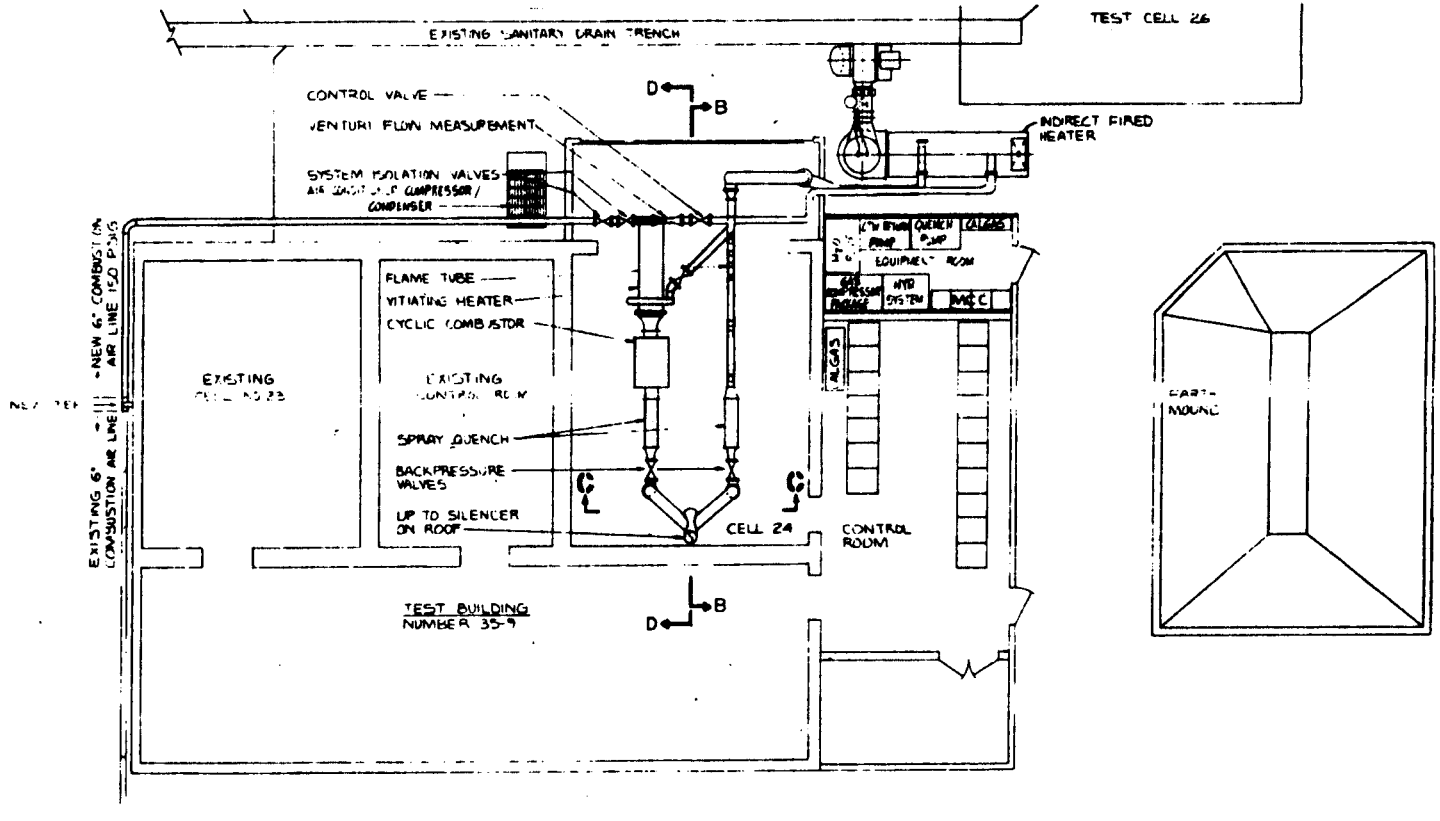
FIGURE 2

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATIONS FOR FLAME TUBE AND CYCLIC COMBUSTOR

COMBUSTION RESEARCH LABORATORIES (35-9)



EQUIPMENT PLAN
SCALE 1/4" = 1'-0"

EQUIPMENT PLAN
FIGURE 3

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National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LCBA

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modifications for Flame Tube & Cyclic Combustor, Combustion Research Laboratories (35-9)	LeRC/OAST	Nov. 1, 1982	F

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$1,200,000

CATEGORY	JUSTIFICATION	WORK
	Program Critical	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project

RELATED COST DATA (*Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable*)

RELATED COSTS INVOLVED	PER (*Amount*)	DESIGN (*Amount*)
☒ YES (*Identify*) ☐ NONE	$53,000*	$72,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED	$1,032,000	FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (*Specify*)	

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

The modifications of Cell 24, Bldg. 35 will provide the necessary services required for flame tube and cyclic combustor testing. The flame tube will be designed for performing research investigations into the fundamentals of combustion of both conventional and experimental jet fuels. The cyclic combustor leg will provide a capability for conducting cyclic life research on combustor components which operate under varying pressure and temperature conditions. The flame tube will require an air preheater, control valves, fuel systems, combustion air piping, supports, and safety systems. The cyclic combustor will include a vitiating air preheater, fuel systems, combustion air piping, supports, control valves, and safety systems. A common control room, located adjacent to the test cell, will serve for both the flame tube and the cyclic combustor. Operating conditions are as follows: (continued)

Impact on Existing Facility Capability: a. None _____ ; b. ~~Decrease~~ XXXXXX Increase X : c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

Future gas turbine engine combustion systems will be designed for improved performance, increased durability, and reduced pollutant emissions. These gains will be more difficult in future combustor systems due to increased combustor inlet air temperature and pressure as well as increased temperature-rise requirements. NASA LeRC is currently involved in basic and applied research aimed at providing the technology data base required for design of these systems. The proposed facility would provide LeRC with a much expanded capability for flame tube combustion research. It would also provide a currently unavailable capability to conduct cyclic life studies on combustor components, (cont'd)

SCHEDULE DATES				PROJECT APPROVAL			
DESIGN	PER	START	4-79	SUBMITTED BY	SIGNATURE AND TITLE John M. Klineberg, Deputy Director	DATE 10/19/82
		COMPL	7-83			
	FINAL	START	1-84	CONCURRENCE BY	SIGNATURE AND TITLE	DATE
		COMPL	12-84			
CONSTRUCTION		AWARD	1-85	BX CONCURRENCE	SIGNATURE AND TITLE	DATE
		COMPL	6-86	APPROVED BY	SIGNATURE AND TITLE	DATE
REQUIRED OPERATIONAL			12-86	PROJECT STIPULATIONS: (a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____ .)		

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Modifications for Flame Tube & Cyclic Combustor, Combustion Research Laboratories (35-9)

SCOPE/DESCRIPTION (continued)

	Flame Tube	Cyclic Combustor
Air Flow	4-10 lbs/sec (1.81 -4.53kg/sec.)	4-7 lbs/sec (1.81 -3.17 kg/sec.)
Pressure	44-150 psig (0.31 - 1.05 N/sq. M)	75-125 psig (0.53 -0.88 N/sq. M)
Temperature		
Heater Discharge	350°F - 1300°F (450°K - 977°K)	400°F - 1200°F (477°K - 922°K)

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

BASIS OF NEED (continued)

principally the film-cooled liner, and would also be useful in determining the coking tendency of main burner lines and the sooting tendency in the main burner.

In the flame tube test duct, experiments will be directed to examining the fundamental laws governing the combustion processes. Information gained from these tests and experiments will provide the basic understanding required to design advanced combustion systems. It is anticipated that with the requirement placed on combustion systems to operate at higher pressures and inlet temperatures while maintaining performance and emissions goals, the need for fundamental data will increase many fold.

The cyclic combustor would be used to evaluate the durability of various combustor components under cyclic conditions. Unless such tests can be performed in a controlled and well monitored environment, we may never be able to determine the input to the life prediction models with sufficient accuracy to better current predictions.

Research programs are supported by RTOP 505-32-32, Combustion and Fuels.

NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modificaton for Flame Tube & Cyclic Combustor, Combustion Research Laboratories (35-9)	SUBMISSION/REVISION F PROJECT CODE 85LCBA
BASIS OF COST ESTIMATE Preliminary Engineering Report (2-80), Revised (7-82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$ 758,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	258,000	34%
3. SUBTOTAL *(1 + 2)*	$1,016,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	102,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*	82,000	8%
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$1,200,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/year to midpoint of construction (7-82 to 11-85) $(1.09)^{3.33} = 1.34$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT			X	A-E	$ 53,000*
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	72,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$125,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$53,000*	$72,000

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED Fuel System, Flame Tube, Cyclic Combustor, Data System, Programmable Controller	$1,032,000	8. ACTIVATION	
			9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

*Previously Funded

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LCBA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Building/Structure						
	Arch/Struct	L.S.	1	69,600		69,600	110,000
	Mechanical	L.S.	1	42,000		42,000	67,000
	Electrical	L.S.	1	81,400		81,400	129,000
	Special Features						
	Air Heating System	L.S.	1	197,100		197,100	312,000
	Cooling Water System	L.S.	1	58,500		58,500	93,000
	Exhaust System	L.S.	1	57,100		57,100	90,000
	Compressed Air System	L.S.	1	109,600		109,600	173,000
	Instruments & Controls	L.S.	1	142,700		142,700	226,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA Preliminary Engineering Report, Updated (7/82)			7.		TOTALS ▶	$758,000	$1,200,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1985 ESTIMATES

PROJECT TITLE: Modification of Variable Frequency System, ERB - West Wing (23) and Refrigerated Air System, ERB (5)

INSTALLATION: Lewis Research Center

FY 1985 CoF ESTIMATE: $4,800,000

LOCATION OF PROJECT: Cleveland, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology (OAST)

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	506,400	---	506,400
Capitalized investment	---	16,833,000	16,833,000
Total	506,400	16,833,000	17,339,400

PART A - VARIABLE FREQUENCY SYSTEM

SUMMARY PURPOSE AND SCOPE:

Modification of the Variable Frequency System is required to improve stability and accuracy of the system output frequency, and provide greater reliability for the system. The technical objectives of current and long range research programs require the ability to maintain a given set speed for the experiment over a long period of time and a wide range of thru flow and back pressure to acquire valid performance data. Also, the

planned addition of four new drive motors in ERB West Wing test cells will further tax the system. This modification will provide for replacement of outdated electronic control equipment to improve performance of the system, as well as replacement of aging equipment and switchgear components to improve reliability of the system.

PROJECT JUSTIFICATION:

The current and future effort to improve the efficiency, operating range, distortion tolerance and reliability of fans and compressors that are part of advanced gas turbine propulsion systems require that experiments be carried out in the areas of steady state performance mapping and unsteady aerodynamics.

The technical objectives of current Fan and Compressor Research and the Long Range Plan for Turbomachinery Unsteady Aerodynamic Research, both being carried out under RTOP 505-32-2A, require performance of the Facilities Services in the ERB-Bldg. 23 complex which at the present time do not exist.

The need to modify and upgrade the existing Variable Frequency System is a requirement that is associated with both the Steady State Performance Mapping and the Unsteady Aerodynamics Programs. The Steady State Performance Mapping Programs are increasing the required time to maintain a given set speed by three fold compared to the conventional data acquisition techniques. This technique provides data, that was never before available, to validate the mathematical models of the complex flow in the blade passages of turbomachine components of advanced design.

This technique is presently being used in the W8 Single State Compressor facility and will be incorporated into the existing W-7 Multi-Stage Compressor facility and three new facilities presently under construction and design. They are the small high speed centrifugal facility in W8, the large low speed compressor facilities in W1 and the small gas turbine engine compressor facility in CE-18. The addition of four more drive motors in these new facilities further supports the need to upgrade the Variable Frequency System.

The Unsteady Aerodynamics Programs which consist of Stall Recovery, Aerodynamic Flutter and Forced Vibrations investigations also are placing speed control requirements on the Variable Frequency System. The Stall Recovery investigations impose the requirement that the combination of the controls and electrical-mechanical dynamics of the system maintain a set speed as the test rotor is traversed into and out of deep aerodynamic stall where the loads imposed on the drive system can change by 50% in two seconds. Presently this type of experimentation is planned for the W7 and W8 large scale facilities.

IMPACT OF DELAY:

A delay in the upgrading of the Variable Frequency System will directly impact and limit the experimental fundamental investigations on stall initiation and recovery that are proposed in the Unsteady Aerodynamics Stall Recovery Program.

The programmatic plan of initiating the establishment of an experimental data base on low speed axial stages in FY 1985 is dependent on initiating this C of F program in FY 1985.

The total Fan and Compressor Steady State Research Program will be impacted by a delay in implementing the upgrade in FY 1985. Programmatic costs to acquire the desired experimental data can rise if data has to be discarded and repeated because the system's speed regulation capability cannot match the requirements of the instrumentation techniques being used.

PROJECT DESCRIPTION:

Outdated electronic control equipment will be replaced to improve stability and accuracy of the system output frequency. Aging electrical equipment and switchgear components will be replaced to improve reliability of the system. Control panel instrumentation will be modified to interface with the new control system.

This project provides for replacement of the existing vacuum tube type control system with a present day technology solid-state control system. Nine motor driven field exciter sets and speed regulators for the 600 KW d.c. generators will be replaced with solid-state field power supplies and regulators. Three motor driven field exciter sets and voltage regulators for the 2,650 horsepower synchronous motors and 800 horsepower d.c. motors will be replaced with solid-state SCR field exciters. A programmable controller will be added which will provide master control for the regulators and control switching for parallel operation of the 1500 KVA frequency converters. Sensors for interfacing converter selection to the master control will also be added, and monitoring and control devices on existing test cell operator's panels will be replaced.

PROJECT COST ESTIMATE:

The project cost estimate is based on Preliminary Engineering Report, July, 1982.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Building/Structural	---	---	---	---
Equipment	---	---	---	1,630,000
Master Control and Paralleling Panel Modifications	EA	1	92,000	92,000
Convertor Control Panel Modifications	EA	9	128,000	1,152,000
Field Control Panel Modifications	EA	3	18,000	54,000
Installation	LS	---	332,000	332,000
Fallout Shelter (not applicable)	---	---	---	---
Total				1,630,000

FUTURE CoF FUNDING REQUIREMENTS TO COMPLETE THIS PROJECT:

The funding requested for FY 1985 will complete this project.

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Plan View, Variable Frequency System
Figure 4 - One-Line Diagram of System
Figure 5 - System Operation

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR																			
	1983				1984				1985				1986				19			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
P.E.R. & STUDY		—·—·—			—	—														
DESIGN & CONSTRUCTION					- - -	- - -	- - -		—	—	—	—								
ACTIVATION												—								

P.E.R. —·—·—·— STUDY — — — DESIGN -------- CONSTRUCTION/ACTIVATION ————

MODE OF ACCOMPLISHMENT:

A PER (Preliminary Engineering Report) will be prepared by LeRC in-house. NASA will contract with a single firm to provide for an initial controls study, final design, fabrication and installation. All supervision, inspection and engineering services required during construction will be accomplished by LeRC in-house.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	IDENTIFICATION NO.
Nov. 1, 1982	85LCCA

INSTALLATION	PROGRAM OFFICE	FISCAL YEAR	PROPOSED BUDGET YEAR
Lewis Research Center	OAST	1983	1985

PROJECT TITLE	EST. COST OF DESIGN	EST. CONSTR. COST
PART A Modification of Variable Frequency System, ERB West Wing (23)	$98,000	$1,630,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 84 b.		FY 85 c.		FY ____ d.		FY ____ e.		FY ____ f.		FY ____ g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1	Study and Field Investigation			.093	.093												
2	Final Design			.098	.098												
3	Fabrication and Installation					1.630	1.630										
TOTAL ▶	OBL 1.821			.191		1.630											
	OLY 1.821				.191		1.630										

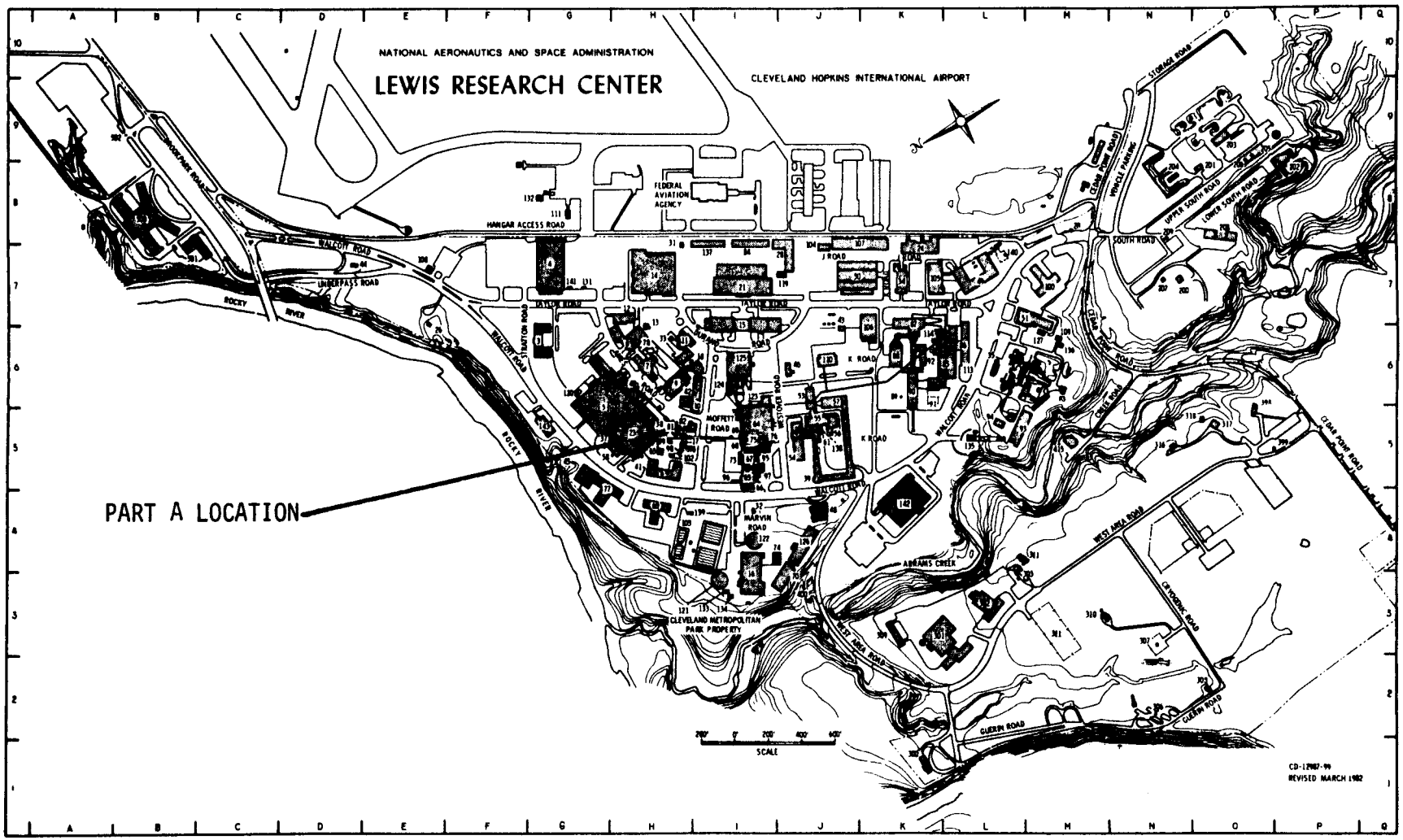
NASA FORM 1513 DEC 73

3DP

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF VARIABLE FREQUENCY SYSTEM, ERB - WEST WING (23)



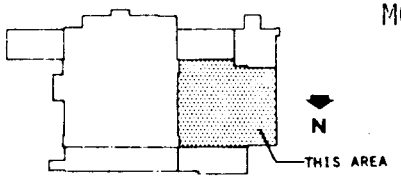
LOCATION PLAN

FIGURE 1

LEWIS RESEARCH CENTER

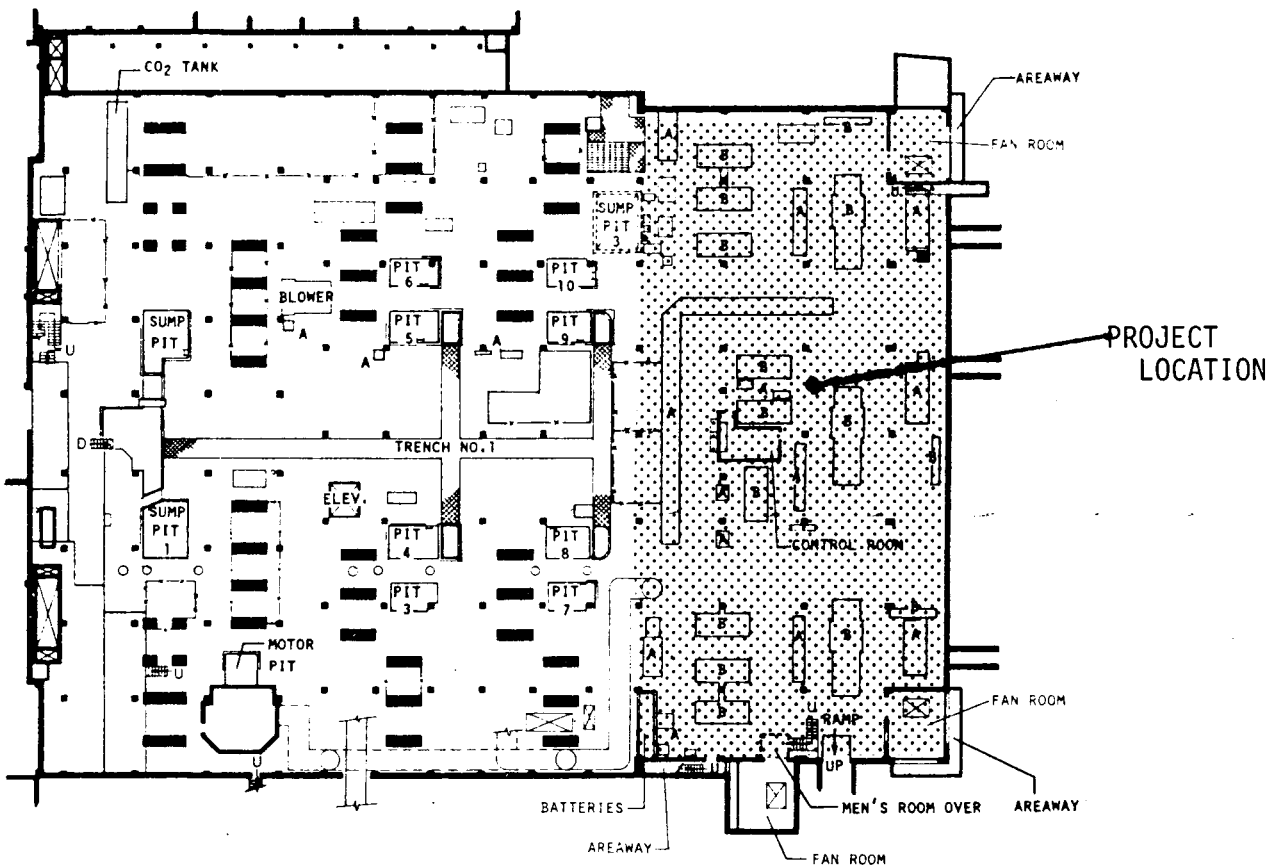
FY 1985 CoF ESTIMATES

MODIFICATION OF VARIABLE FREQUENCY SYSTEM, ERB WEST WING (23)



KEY PLAN

A = ELECTRICAL SWITCHGEAR
B = ROTARY ELECTRICAL EQUIPMENT

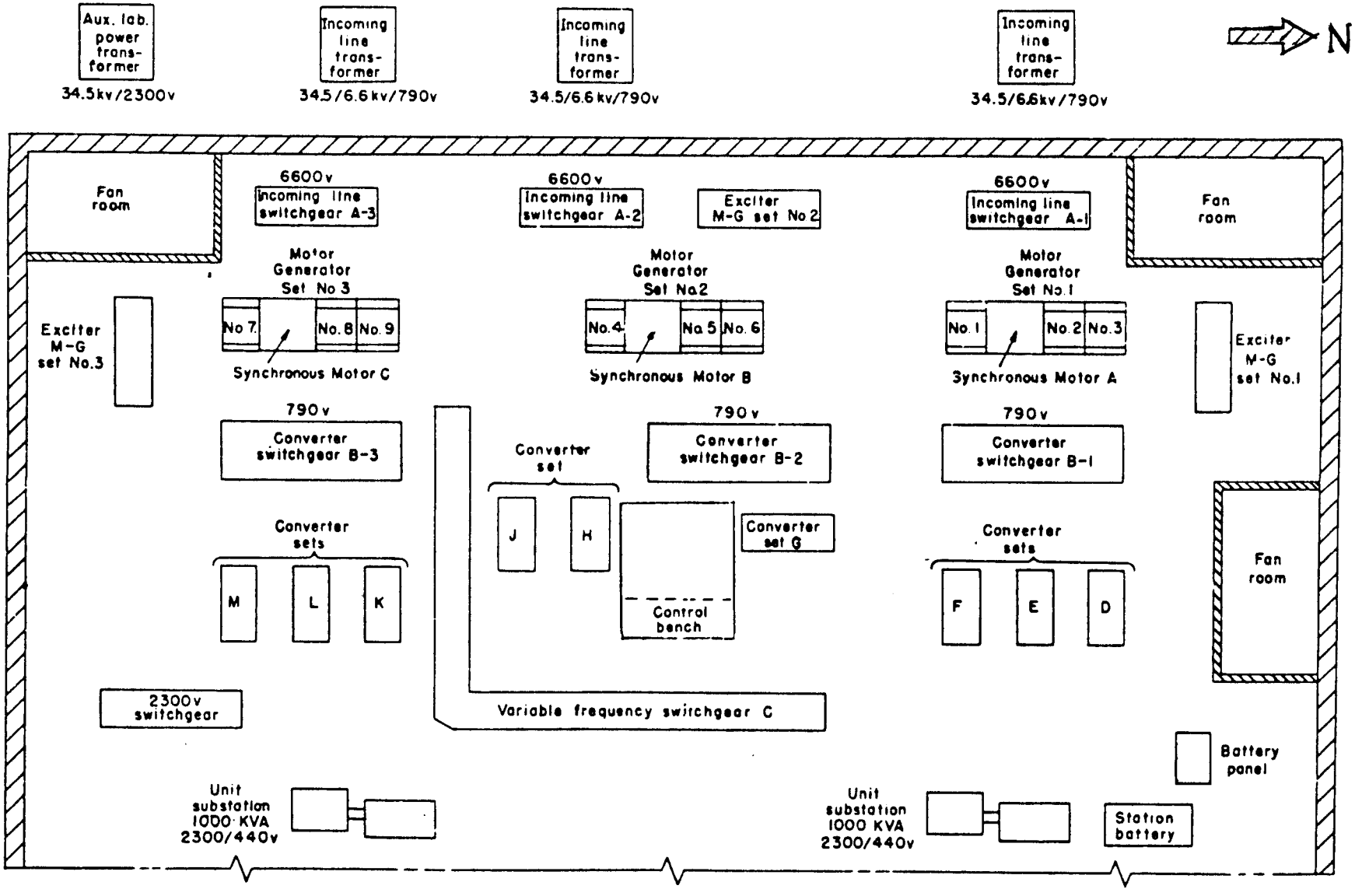


SITE PLAN
FIGURE 2

( ) AREA, SQ. FT.

25 0 25 50
SCALE 1/50"=1'-0"

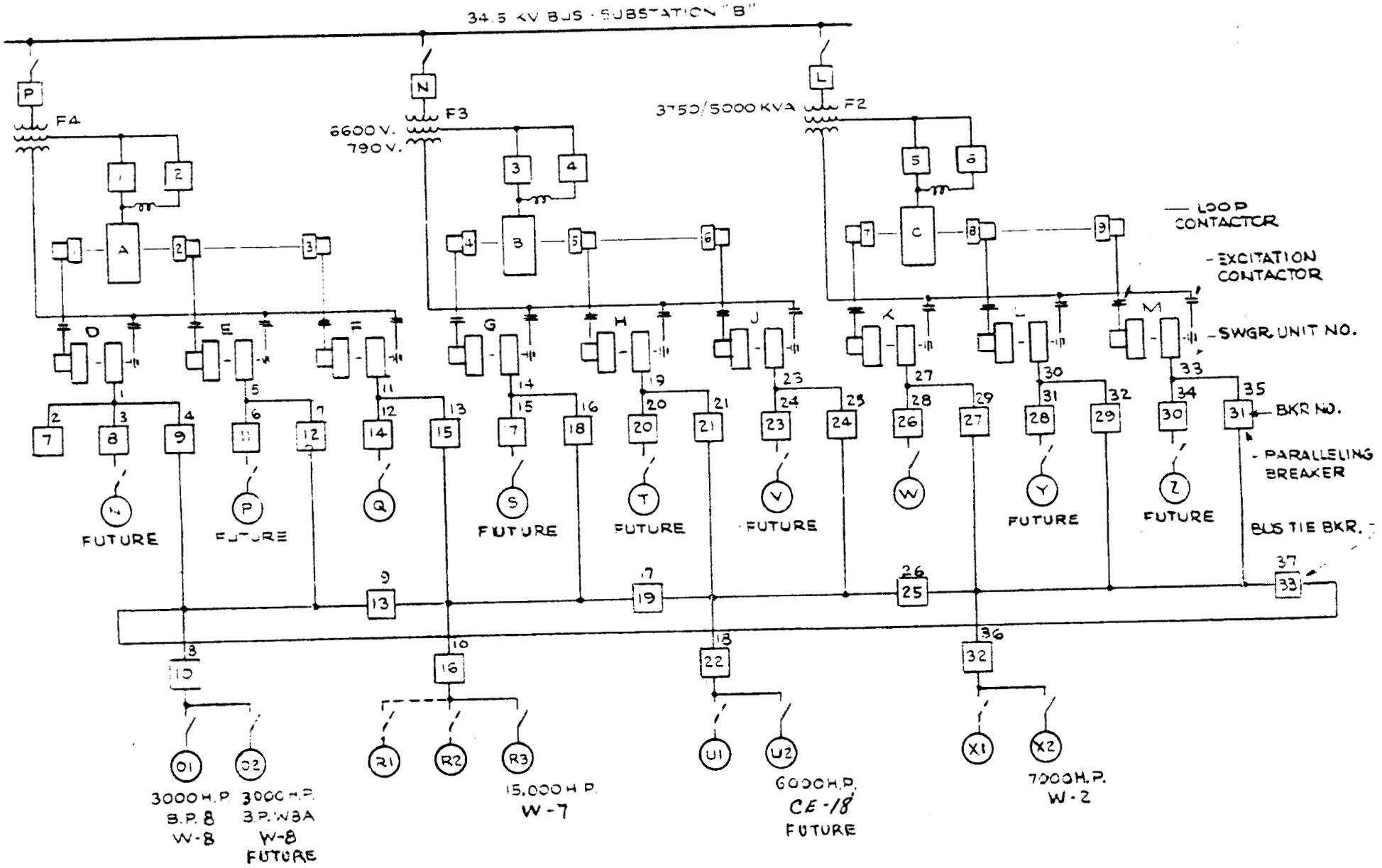
LEWIS RESEARCH CENTER
FY85 CoF ESTIMATES
MODIFICATION OF VARIABLE FREQUENCY SYSTEM, ERB WEST WING(23)



PLAN VIEW VARIABLE FREQUENCY SYSTEM - ERB WEST WING BASEMENT (23)

FIGURE 3

LEWIS RESEARCH CENTER
FY85 CoF ESTIMATES
MODIFICATION OF VARIABLE FREQUENCY SYSTEM, ERB WEST WING (23)



ONE-LINE DIAGRAM OF VARIABLE FREQUENCY SYSTEM

FIGURE 4

LEWIS RESEARCH CENTER

FY85 CoF ESTIMATES

MODIFICATION OF VARIABLE FREQUENCY SYSTEM, ERB WEST WING (23)

The Variable Frequency System consists of:

- o Three outdoor, oil-filled transformers (F_2, F_3 and F_4), each rated 3750/5000 KVA, 3 phase, 60 Hz, 33,000 - 6,600 - 790 volts.
- o Three motor-generator sets (A, B and C), each consisting of a 2,650 horsepower, 6,600 volt synchronous motor and three 600 Kw, 1,000 ampere, 600 volt d.c. generators.
- o Nine frequency converter sets (D through M), each consisting of an 800 horsepower, 600 volt d.c. motor coupled to a wound rotor induction machine. Each converter set is rated at 1500 KVA, 6,600 volts a.c., with 790 volts a.c. applied to the induction machine's slip rings.
- o All associated circuit breakers, contactors, auxiliary equipment and controls.

Operation of the Variable Frequency System is as follows:

- o Each converter has an output capability of 10 to 120 Hertz, with voltage proportional to frequency, to operate test cell drive motors at speeds of 300 to 3600 RPM.
- o A frequency converter is essentially a wound-rotor induction motor in which electrical power is fed into the rotor and taken from the stator.
- o The supply frequency is constant, therefore the output frequency of the converter is dependent upon the mechanical rotation of the rotor.
- o Each frequency converter is driven by a d.c. motor electrically connected to a d.c. generator.
- o Speed and direction of rotation of the converter set is controlled by varying the d.c. generator voltage and polarity.
- o D.C. voltage is controlled by motor driven rheostats (potentiometers), electronic tube type speed regulators and amplidyne generators driving the d.c. generator fields.
- o A regulated 250 volt d.c. source provides field excitation for the motors and some controls.

VARIABLE FREQUENCY SYSTEM OPERATION

FIGURE 5

PART B - REFRIGERATED AIR SYSTEM

SUMMARY PURPOSE AND SCOPE:

The objective of this project is the modification of refrigerated air capability to the ERB complex. This project is required so that the facilities services supplied by this complex are able to meet the requirements established by upcoming research programs that will be conducted in the experimental facilities in ERB and Building 23.

The scope of the modification of refrigerated air entails:

A. Perform an engineering study to establish specifications for turbo-expander-compressor unit and associated piping and controls.

B. Purchase and installation of:

1. A turboexpander with a freon compressor brake
2. A precooler
3. Related refrigeration equipment
4. Controls and instrumentation for system
5. Piping between ERB and Building 9

C. Addition to building to accommodate turboexpander.

D. Acoustic treatment of building housing turboexpander.

PROJECT JUSTIFICATION:

The current and future effort to improve the efficiency, operating range, distortion tolerance and reliability of fans and compressors that are part of advanced gas turbine propulsion systems require that experiments be carried out in the areas of steady state performance mapping and unsteady aerodynamics.

The technical objectives of current Fan and Compressor Research being carried out under RTOP 505-32-2A and the Long Range Plan for Turbomachinery Unsteady Aerodynamics Research require performance of the Facilities Services in the ERB-Building 23 complex which at the present time do not exist.

The need to reintroduce refrigerated air capability into the ERB-Building 23 complex is associated with the

requirements of the Steady State Performance Mapping and Unsteady Aerodynamics Programs. The primary requirement is for structural stress reduction in the rotating experimental hardware which is obtainable with the use of refrigerated air. The causative factors for the increased stress are different for each area of research. In the Steady State Performance Mapping, the problem arises from the combination of rotative speed and hardware configuration imposed by the aerodynamic design requirements for components of advanced performance.

In the Unsteady Aerodynamics research, the primary problems exist in the Stall Recovery investigations. In the conduct of these experiments, the rotating test hardware is intentionally operated in a region of severe aerodynamic stall which generates extremely high alternating stress levels in the blading due to rapidly changing aerodynamic loads being imposed on the blading.

In both of these cases, the extremely high stress levels being generated limits the acquisition of needed information.

Additional programmatic needs for refrigerated air in ERB may exist from proposed small aircraft engine simulated altitude-temperature performance studies and from fundamental combustor altitude relight studies.

IMPACT OF DELAY:

A delay in the reintroduction of refrigeration air into the ERB-Building 23 complex will directly impact and limit the experimental fundamental investigations on stall initiation and recovery that are proposed in the Unsteady Aerodynamics Stall Recovery Program.

PROJECT DESCRIPTION:

Refrigerated air capability will be reintroduced to the ERB complex with a flow capacity of 60 pounds per second (27 kg/sec) at 25 psia pressure (1.67 atmospheres), to a temperature of -70°F (-57°C). The air cooling will be accomplished using a turboexpander which drives a freon refrigeration system which in turn acts as a pre-cooler for the turboexpander. This equipment will be located in an addition to Building 9. The refrigerated air will be piped into existing cold air piping at the ERB complex.

This project will provide a refrigerated air system for Test Cells W-7, W-8, W-8-A and CW-2 in the Engine Research Building (5). The work includes: purchase and installation of a turbo-expander with freon compressor brake; purchase and installation of a pre-cooler; purchase and installation of related refrigeration equipment; installation of associated piping and controls; necessary building modification and acoustic treatment.

PROJECT COST ESTIMATE:

The project cost estimate is based on an in-house conceptual estimate of December, 1981.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Building Structural	LS	1	160,000	160,000
Equipment	---	---	---	3,010,000
Turboexpander-compressor	EA	1	715,000	715,000
Refrigeration Equipment	EA	1	715,000	715,000
Piping	LS	1	470,000	470,000
Controls	LS	1	240,000	240,000
Acoustic Treatment	LS	1	160,000	160,000
Installation	LS	1	710,000	710,000
Fallout Shelter (not feasible)	---	---	---	---
Total				3,170,000

FUTURE C of F FUNDING REQUIREMENTS TO COMPLETE THIS PROJECT:

The funding requested for FY 1985 will complete this project.

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Refrigeration System Diagram

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR																			
	1983				1984				1985				1986				19			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
P.E.R. & STUDIES																				
DESIGN & CONSTRUCTION																				
ACTIVATION																				

P.E.R. _._._._ STUDY — — — DESIGN -------- CONSTRUCTION/ACTIVATION ————

MODE OF ACCOMPLISHMENT:

A PER (Preliminary Engineering Report) will be prepared by an A/E firm. The PER will identify areas that will require special studies. NASA will contract with an A/E firm to perform these special studies, and do final design for fabrication and installation. Separate contracts will be awarded for the purchase of equipment and the installation of piping and equipment. All inspection and engineering services required during construction will be accomplished by Lewis Research Center in-house.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	Nov. 1, 1982
IDENTIFICATION NO.	85LCCA
INSTALLATION	Lewis Research Center
PROGRAM OFFICE	OAST
FISCAL YEAR	1983
PROPOSED BUDGET YEAR	1985
PROJECT TITLE	PART B Modification for Refrigerated Air System, ERB (5)
EST. COST OF DESIGN	$190,000
EST. CONSTR. COST	$3,170,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 83 b.		FY 84 c.		FY 85 d.		FY 86 e		FY ____ f.		FY ____ g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1	PER			.063	.063												
2	Special Studies					.065	.065										
3	Final Design					.190	.190										
4	Fabrication and Installation							3.170	2.980		.190						
TOTAL ▶ OBL	3.488			.063		.255		3.170									
TOTAL ▶ OLY	3.488				.063		.255		2.980		.190						

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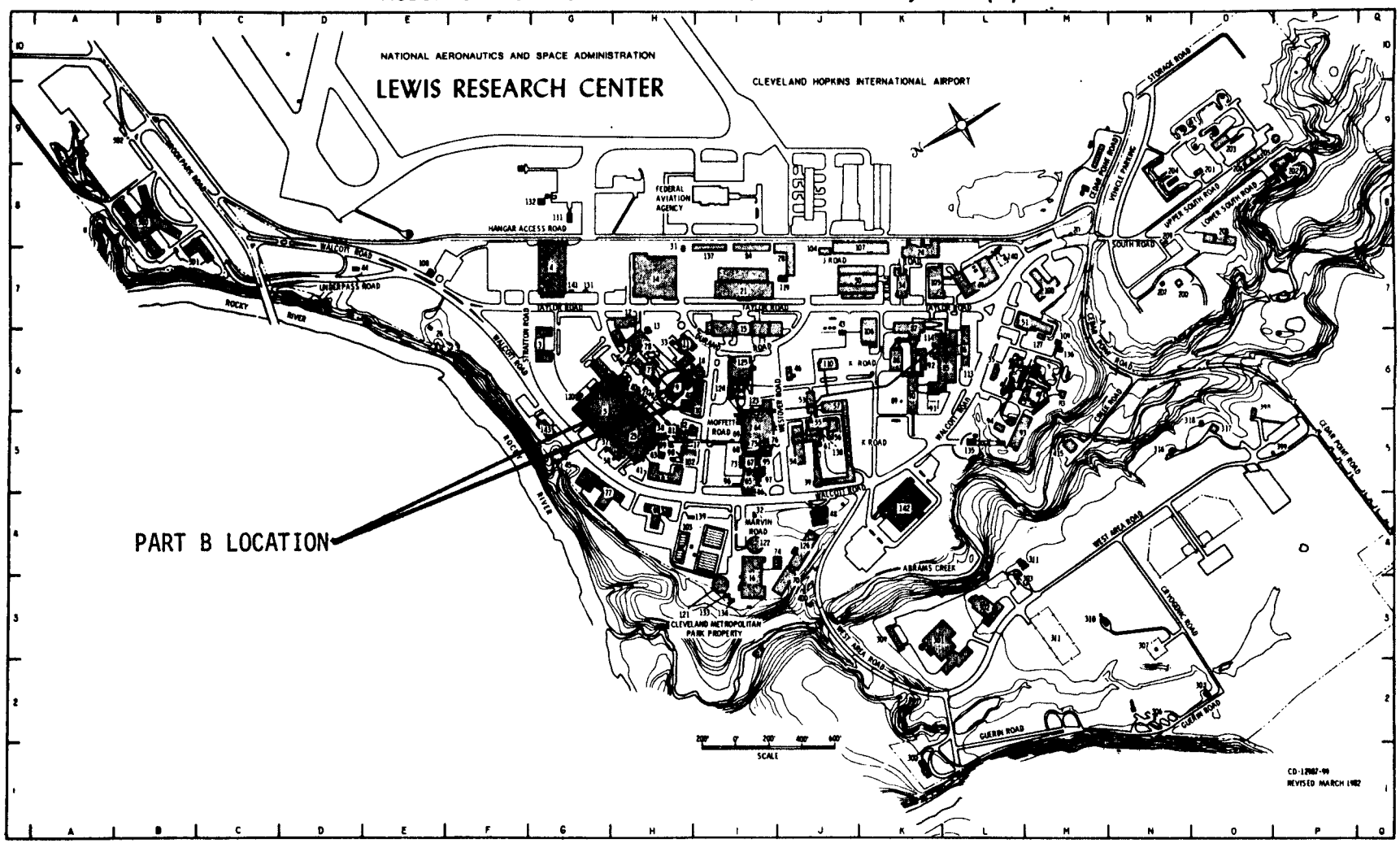
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION FOR REFRIGERATED AIR SYSTEM, ERB (5)



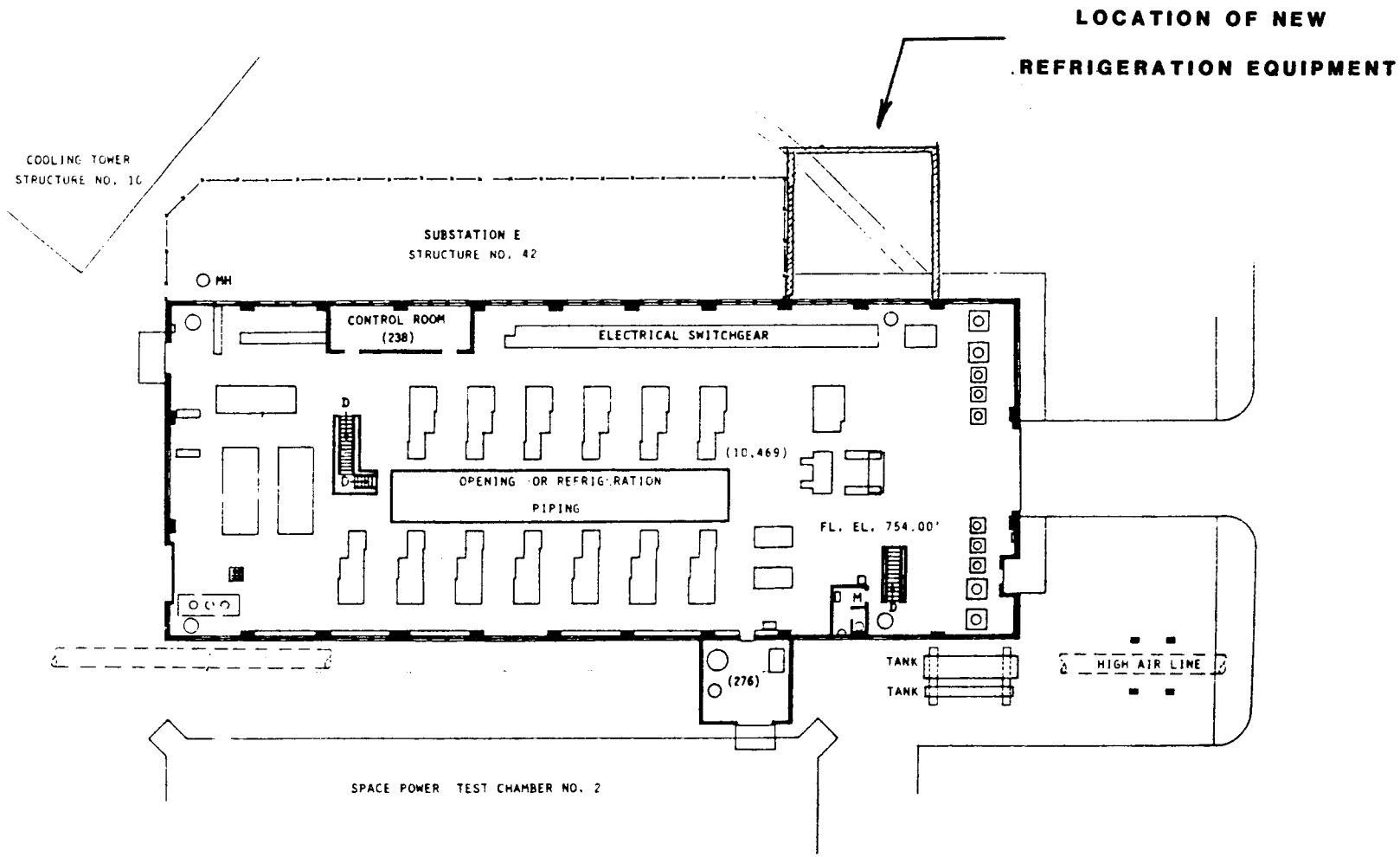
LOCATION PLAN

FIGURE 1

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION FOR REFRIGERATED AIR SYSTEM, ERB (5)



FIRST FLOOR PLAN
REF. DWG. NO. CD-10026

N

( ) AREA, SQ. FT.

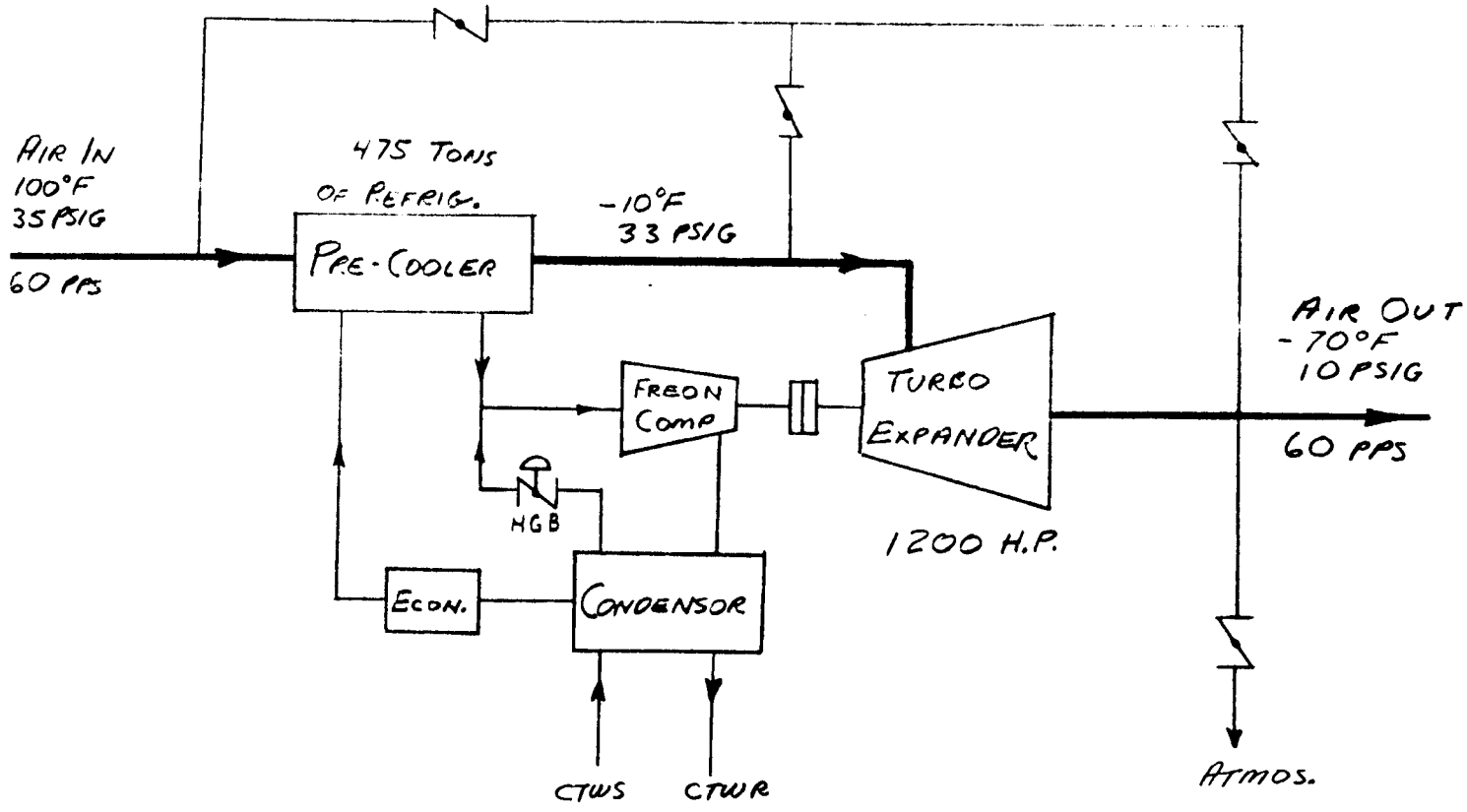
16 0 16 32
SCALE 1/32"=1'-0"

REFRIGERATION BUILDING

SITE PLAN

FIGURE 2

LEWIS RESEARCH CENTER
FY 1985 CoF ESTIMATES
MODIFICATION FOR REFRIGERATED AIR SYSTEM, ERB (5)



FREON COMPRESSOR LOADED TURBO-EXPANDER

REFRIGERATION SYSTEM DIAGRAM
FIGURE 3

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LCCA

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modification of Variable Frequency System, ERB - West Wing (23) and Refrigerated Air System, ERB (5)	LeRC/OAST	Nov. 1, 1982	C

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
Part A - Variable Frequency System	$1,630,000
Part B - Refrigerated Air System	3,170,000
TOTAL	$4,800,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$63,400	$288,000

OTHER RELATED EQUIPMENT

	ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED			FUTURE FUNDING	
			ACTIVATION	
TRANSFER TO EXCESS			Field Investigation	$ 30,000
EXISTING			OTHER (Specify) Criteria & System Modeling	125,000

CATEGORY: (A) JUSTIFICATION Program Related; (B) Instit. Crit.

WORK: Modification

FUND SOURCE: TYPE [ ] R&D [ ] R&PM [X] C OF F

IDENTIFICATION: FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

PART A

The Variable Frequency Project will provide for replacement of outdated electronic control equipment with modern devices. This modernization will improve stability and accuracy of the system output frequency by an order of magnitude to 01. Hz. Replacement of aging 35 year old electrical equipment and switchgear components will also be provided. Control panel instrumentation will be modified to interface with the new control system.

PART B

This project will provide a refrigerated air system for Test Cells W-7, W-8, W-8-A and CW-2 in the Engine Research Bldg. (5). The system will provide air to -70°F (-57°C) at flow rates to 60 lbs/sec (27 kg/sec) at 25 psia (1.7 atmos.). The work includes: purchase and installation of a turbo-expander with freon compressor brake; purchase and installation

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X; c. Environmental impact See text. (continued)

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

PART A

The Variable Frequency System provides variable frequency power to drive large variable speed motors for fan and compressor test rigs in the Engine Research Building - Building 23 complex. The technical objectives of current Fan and Compressor Research and long range Turbomachinery Unsteady Aerodynamic Research programs (RTOP-505-32-2A) require higher performance from the Variable Frequency System. Current Steady State Performance Mapping programs require the ability to maintain a given set speed of the research experiment over a long period of time and over a wide range of through flow and back pressure to acquire valid performance data. The Unsteady Aerodynamics Programs, consisting of (cont'd)

SCHEDULE DATES

DESIGN	PER	START	1-83
		COMPL	7-83
	FINAL	START	1-84
		COMPL	6-84
CON-STRUCTION		AWARD	1-85
		COMPL	6-86
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CON-CURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____.)

NASA FORM 1509 NOV 79 PREVIOUS EDITION MAY BE USED. GPO 863 884

3DP

85LCCA

Modification of Variable Frequency System, ERB - West Wing (23)
and Refrigerated Air System, ERB (5)

SCOPE/DESCRIPTION - continued

PART B
of a pre-cooler; purchase and installation of related refrigeration equipment; installation of associated piping and controls; necessary building modification and acoustic treatment.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

BASIS OF NEED - continued

PART A
Stall Recovery, Aerodynamic Flutter, and Forced Vibrations Investigations will also impose stringent speed control requirements on the Variable Frequency System. Modern instrumentation and data acquisition systems utilized in these programs will accelerate the evolution of turbomachine components of advanced design.

ERB test cells currently using the variable Frequency System are W-7 (Multi-Stage Compressor), W-8 (Single Stage Compressor) and W-2. The planned addition of four new drive motors in test cells W-1, W-8 and CE-18 will further tax the system. Replacement of equipment and switchgear components will provide greater reliability for the system.

PART B
The need to provide refrigerated air capability to the ERB Complex is associated with the requirements of the Steady State Performance Mapping and Unsteady Aerodynamics Programs. The objectives of current fan and compressor research being conducted under RTOP 505-04-22 and the long range plan for turbomachinery unsteady aerodynamic research requires performance of facilities services in the ERB Complex which do not presently exist. Current and future efforts to improve the efficiency, operating range, distortion tolerances and reliability of the fans and compressors in advanced gas turbine propulsion systems require that experiments be carried out in the areas of Steady State Performance Mapping and Unsteady Aerodynamics. Additional Programmatic needs for refrigerated air are anticipated for proposed small aircraft engine simulated altitude-temperature performance studies and fundamental combustor altitude studies.

NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE PART A Modification of Variable Frequency System, ERB - West Wing (23)	SUBMISSION/REVISION C PROJECT CODE 85LCCA
BASIS OF COST ESTIMATE Preliminary Engineering Report, July 1982	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$1,140,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	342,000	30%
3. SUBTOTAL *(1 + 2)*	$1,482,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	148,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$1,630,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/year to midpoint of construction (7/82 to 7/85) $(1.09)^3 = 1.30$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT			X	In-house	0
2. SPECIAL STUDIES *(Specify)* Field Investigation	X			A-E	$ 30,000
Control System Modeling	X			A-E	60,000
3. FINAL DESIGN	X			A-E	97,800
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$187,800

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	0	$97,800

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Control System Modeling	$60,000
	7. FUTURE FUNDING		Field Investigation	30,000

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LCCA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

PART A	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Master Control & Paralleling Pnl. Mods		1	64,000		64,000	92,000
	Converter Control Panel Mods		9	80,500		805,000	1,152,000
	Field Control Panel Mods		3	13,000		39,000	54,000
	Installation	LS	1	232,000		232,000	332,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA Preliminary Engineering Report, 7/82			7.		TOTALS ▶	$1,140,000	$1,630,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE PART B Modification for Refrigerated Air System, ERB (5)	SUBMISSION/REVISION C PROJECT CODE 85LCCA
BASIS OF COST ESTIMATE In-house Conceptual Estimate (6/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$2,070,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	621,000	30%
3. SUBTOTAL *(1 + 2)*	$2,691,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	269,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*	210,000	8%
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$3,170,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/year to midpoint of construction (6/82 to 6/85) $(1.09)^{3.0} = 1.30$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 63,400
2. SPECIAL STUDIES *(Specify)* Study of Design Criteria	X			A-E	65,000
3. FINAL DESIGN	X			A-E	190,200
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$318,600

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$63,400	$190,200

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Study of Design Criteria	$65,000
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LCCA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

PART B	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Equipment Installation	LS	1	470,000		470,000	710,000
	Piping & Insulation	LS	1	310,000		310,000	470,000
	Controls	LS	1	150,000		150,000	240,000
	Building Mod.	LS	1	100,000		100,000	160,000
	Acoustic Treatment	LS	1	100,000		100,000	160,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*	Turboexpander - Compressor	LS	1	470,000		470,000	715,000
	Precooler	LS	1	155,000		155,000	240,000
	Accessory Refrig. Equip.	LS	1	315,000		315,000	475,000
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA In-house Conceptual Estimate, (6/82)			7.		TOTALS ▶	$2,070,000	$3,170,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1985 ESTIMATES

PROJECT TITLE: Modification of the Propulsion Systems Laboratory (PSL) Engine Test Building (125)

INSTALLATION: Lewis Research Center

FY 1985 CoF ESTIMATE: $1,900,000

LOCATION OF PROJECT: Cleveland, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology (OAST)

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	190,000	---	190,000
Capitalized investment	---	5,326,000	5,326,000
Total	190,000	5,326,000	5,516,000

SUMMARY PURPOSE AND SCOPE:

This project will modify and upgrade the PSL #3 and #4 engine test cell facilities to 1) enable higher altitude test operation of turbofan engines using existing exhauster equipment, and 2) extend the low altitude test capability from the existing minimum altitude of 10,000 ft. down to sea level for most engines.

The modification will supply and install the following: in PSL #3 -- a variable-area, water cooled exhaust collector including associated positioning controls and piping, an engine-exhaust remote viewing system, replacement of two (2) existing by-pass valves for more positive prevention of back-flow of hot exhaust gases

(using the existing piping and controls); in PSL #3 and #4 -- four (4) new relief vent stations on each test cell hatch to prevent over-pressurization by cooling air during sea level tests (cells designed primarily for vacuum, below one atmosphere testing), a means of discharging vented air to outside of building, and a quick-opening manway in each hatch for fast access to cell without opening main hatch.

PROJECT JUSTIFICATION:

Present and future programmatic needs require that serious consideration be given to the support and improvement of the PSL Altitude Facility complex so that Lewis can continue to provide a strong technology base for future gas turbine engine system development.

A continuing joint full scale engine research technology effort with the Air Force, certain joint Navy Short Take-Off and Landing (STOL) support programs, and NASA programs such as: the Energy Efficient Engine and advanced turboprop engine tests will require use of the PSL altitude test facilities through the 1980's. In addition, the basic research and technology efforts of the Center utilizes this facility to conduct research programs in distortion, flutter, dynamics, 2-D nozzles, broad specifications fuel effects, economy of operation, durability, and use of full authority digital controls. This project will enhance the PSL facility capability to provide the required simulated environment for these programs.

This project will help support the programmatic needs of the following RTOP's:

- 505-40-62A Engine Dynamics and Distortion Research
- 505-43-22 Aerodynamic and Propulsion Integration
- Future Energy Efficient Engine Testing

The specific need for each part of the project is as follows:

1. The variable area exhaust collector will allow higher altitude operation than now possible in this test cell. It will also produce a decrease in the volume air-flow rate to be handled by the PSL exhausters with a resulting decrease in required electrical power, i.e., providing a more energy efficient and cost effective test facility.

   The variable area exhaust collector will act as an ejector to help "pump down" the test cell for testing. This "ejector" will operate in series with the PSL exhauster equipment. It will utilize the direct kinetic energy in the propulsion system exhaust jet to entrain the test cell cooling air and to increase the pressure at the ejector exit. By withdrawing the translating plug, the ejector action of the collector can be spoiled and the facility can then be operated at or near sea level. This feature then assists in

obtaining engine sea level test conditions. Two translating plugs and two matching conical spools are required so the facility can retain the capability of testing both low bypass and high bypass turbofan engines. A single plug and conical spool cannot satisfy the wide range of expected air flows and provide an optimum pumping capability. The variable area collector will replace the existing worn-out unit.

2. This modification will extend the test range capability from the present minimum of 10,000 feet (3048 meters) altitude down to sea level for most engines. Many engine projects require several sea level test points.

   Correlations of existing actual sea level data with sea level data obtained in the altitude test cell will lend added credibility to data obtained at altitude conditions. Engines are normally trimmed at sea level conditions so this modification will help improve trimming procedures.

Delay of this project would seriously affect both the low altitude and the very high altitude capabilities of this facility. An opportunity for decreasing electric power consumption would be delayed as well as a chance to improve operational safety in the test cell area.

No other operational facilities exist at Lewis or within NASA with comparable capabilities. PSL-1 and 2 (Building 65) at Lewis have been deactivated.

Outside of NASA, the Navy, Air Force, General Electric and Pratt and Whitney Aircraft have similar facilities each with different capabilities. These facilities are not readily available for NASA projects, as they maintain a heavy test shedule supporting their own activities. Also the cost of testing in these facilities is higher and would increase NASA R&D cost. Also, PSL instrumentation systems have been adapted for the specialized testing conducted by Lewis Research Center research organizations.

An operating cost reduction (electric power savings) will also be realized by installing the variable area collector. The actual cost savings will be a function of the specific operating conditions required for the various research programs. A 5% to 10% reduction in average exhauster power consumption is anticipated. The modifications provided by this project should not change other operating costs. There is no change in the required manpower.

PROJECT DESCRIPTION:

This project will modify and upgrade the PSL #3 and #4 engine test facility, Building 125. The project will cover two separate areas of work as follows:

1. Construction of a variable area exhaust collector section in test cell #3. The collector concept is shown in figure 2. Translation of a tapered plug within a conical spool can be used to maximize or spoil the ejector effect of an engine exhaust collection system (see Justification). This project supplies and installs one fixed support spool with a remotely controlled plug translating mechanism; one translating plug, and matching conical and forward spools sized for operation with low bypass turbofan engines; and a second plug and matching conical and forward spools for high bypass turbofan engines. The plugs and spools will be changed to accommodate the type of engine being tested. All plugs, spools and supporting structures are water cooled and to be designed for the environment existing in the exhaust gases of an afterburning engine.

   The existing periscope viewing system, located downstream of the collector, cannot be utilized because the variable area translating plug blocks the view of the test engine back end. A new viewing system is required and it will consist of a fiberoptic/remote color TV system with a view port located in the nose of the translating plug. A GN_2 purge/cooling system will be required for the viewing system.

   A remotely controlled hydraulic servocontrol system is required to properly position the translating plug for each new engine test condition. Collector instrumentation and signal connection to the PSL Data System will be provided by R&D sources.

   The existing worn-out test cell #3 exhaust collector and associated piping are to be removed and scrapped. Cooling tower water supply and return lines in the cell are to be adapted to service the new collector.

2. Modification of the engine test cells #3 and #4 to extend the test range capability to sea level for test operations of research engines. Supply and install four pressure relief vents on each test cell hatch (see figure 3). Each set of four relief vents will be capable of passing 150 lb/sec at a maximum 3/4 psi differential pressure. The relief vents will protect against test cell overpressurization during sea level testing (see Justification). Each relief vent will have a safety shield to minimize the hazard to personnel and equipment from flying debris during venting. Building ventilation to the outside will be increased as required to prevent building overpressurization during test cell venting.

   Supply and installation of valves in the PSL-3 test cell bypass line to replace existing valves. One 2-ft. valve and one 4-ft. valve are required. The valves are for 600°F service and shall contain internal ring seals which will prevent backflow of hot exhaust gases from the facility exhaust section to the inlet section (and the engine inlet) during sea level test operations. The valves are to be sized to fit into the existing bypass line without any modification to the piping. Existing hydraulic operators, position indicators and servocontrol systems are to be adapted and reused.

Supply and installation of a quick access manway (figure 3) in both PSL-3 and PSL-4 test cell hatches. The manways will be a minimum of 24 inches wide and contain quick opening latch mechanisms. The manways will provide rapid access to the research engine during testing so trim adjustments and minor repairs can be performed with a minimum of downtime.

The variable area exhaust collector concept has been utilized at the Navy engine test facility in Trenton, N.J. and by the Air Force at Arnold Engineering Development Center near Tullahoma, Tennessee. The concept proposed for PSL is very similar to that used by the Air Force. Arnold has published several reports on this collector concept, the latest describing actual test results obtained during a full scale test with an afterburning engine. The design of this collector is considered within the present state of the art.

All elements of the sea level test modifications are considered within the state of the art.

PROJECT COST ESTIMATE:

Criteria and conceptual design based on in-house and vendors cost figures.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Building/Structural	---	---	---	---
Special Equipment/Systems	---	---	---	---
Modification to PSL #3 Test Cell	---	---	---	1,266,000
Variable Area Exhauster	---	---	---	---
Demolition - Collector & Piping	LS	1	63,000	63,000
Spool, Plugs, & Support	LS	1	831,000	831,000
Plug Translating Mechanism	LS	1	277,000	277,000
Exhaust Viewing & Purge Systems	LS	1	95,000	95,000
Modification to PSL #3 & #4	---	---	---	634,000
Sea Level Test Capability	---	---	---	---
Pressure Relief System	LS	1	333,000	333,000
By-Pass Valve System (PSL #3 only)	LS	1	190,000	190,000
Access Manways	LS	1	111,000	111,000
Fallout Shelter (not feasible)	---	---	---	---
Total				1,900,000

FUTURE CoF ESTIMATED FUNDING REQUIREMENTS TO COMPLETE THIS PROJECT:

There are no currently foreseen future funding requirements to complete this project.

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Variable Area Exhaust Collector Concept (PSL #3)
Figure 3 - Modification for Sea Level Testing (PSL #3 & #4)

OTHER EQUIPMENT SUMMARY:

R&D Funded - $10,000 FY-1985 Instrumentation

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR															
	1983				1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
PER AND STUDIES	.—.—.				—	—										
DESIGN, CONSTRUCTION						- - -	- - -	-	—	—	—	—				
ACTIVATION, CHECKOUT & OTHER													—	—		

P.E.R. _._._._._ STUDIES — — — — DESIGN ---------- CONSTRUCTION/ACTIVATION ————

MODE OF ACCOMPLISHMENT:

This project will be carried out in the main in the conventional (design, advertise and build) procurement mode. NASA will contract with an A/E firm for final design. For this, $152,000 is included in the estimate for final design and $38,000 is included for site investigation to verify existing field conditions and update drawings. All supervision, inspection and engineering services required during construction will be accomplished by a construction management contractor.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	Nov. 1, 1982
IDENTIFICATION NO.	85LCDA
INSTALLATION	Lewis Research Center
PROGRAM OFFICE	OAST
FISCAL YEAR	1983
PROPOSED BUDGET YEAR	1985
PROJECT TITLE	Modification of the Propulsion Systems Laboratory (PSL), Engine Test Building (125)
EST. COST OF DESIGN	$114,000
EST. CONSTR. COST	$1,900,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 83 b.		FY 84 c.		FY 85 d.		FY 86 e.		FY 87 f.		FY ___ g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1	Preliminary Engineering Report			.038	.038												
2	Field Investigation & Final Design					.038 .114	.038 .114										
3	Construction							1.900	1.700		.200						
TOTAL ▶	OBL 2.090			.038		.152		1.900									
	OLY 2.090				.038		.152		1.700		.200						

NASA FORM 1513 DEC 73 (costs are in millions of dollars)

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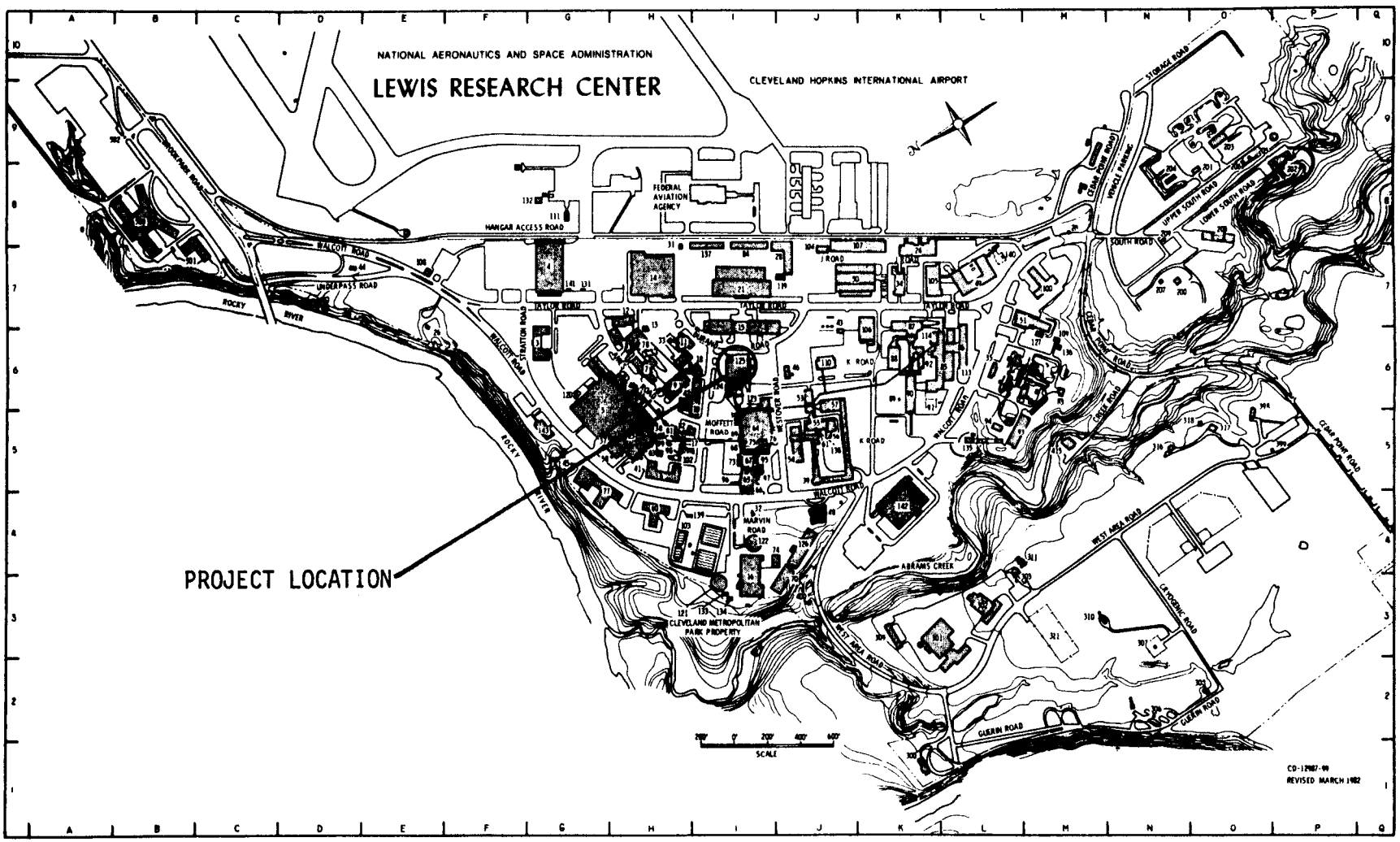
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF THE PROPULSION SYSTEMS LABORATORY (PSL), ENGINE TEST BUILDING (125)



LOCATION PLAN

FIGURE 1

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF THE PROPULSION SYSTEMS LABORATORY (PSL), ENGINE TEST BUILDING (125)

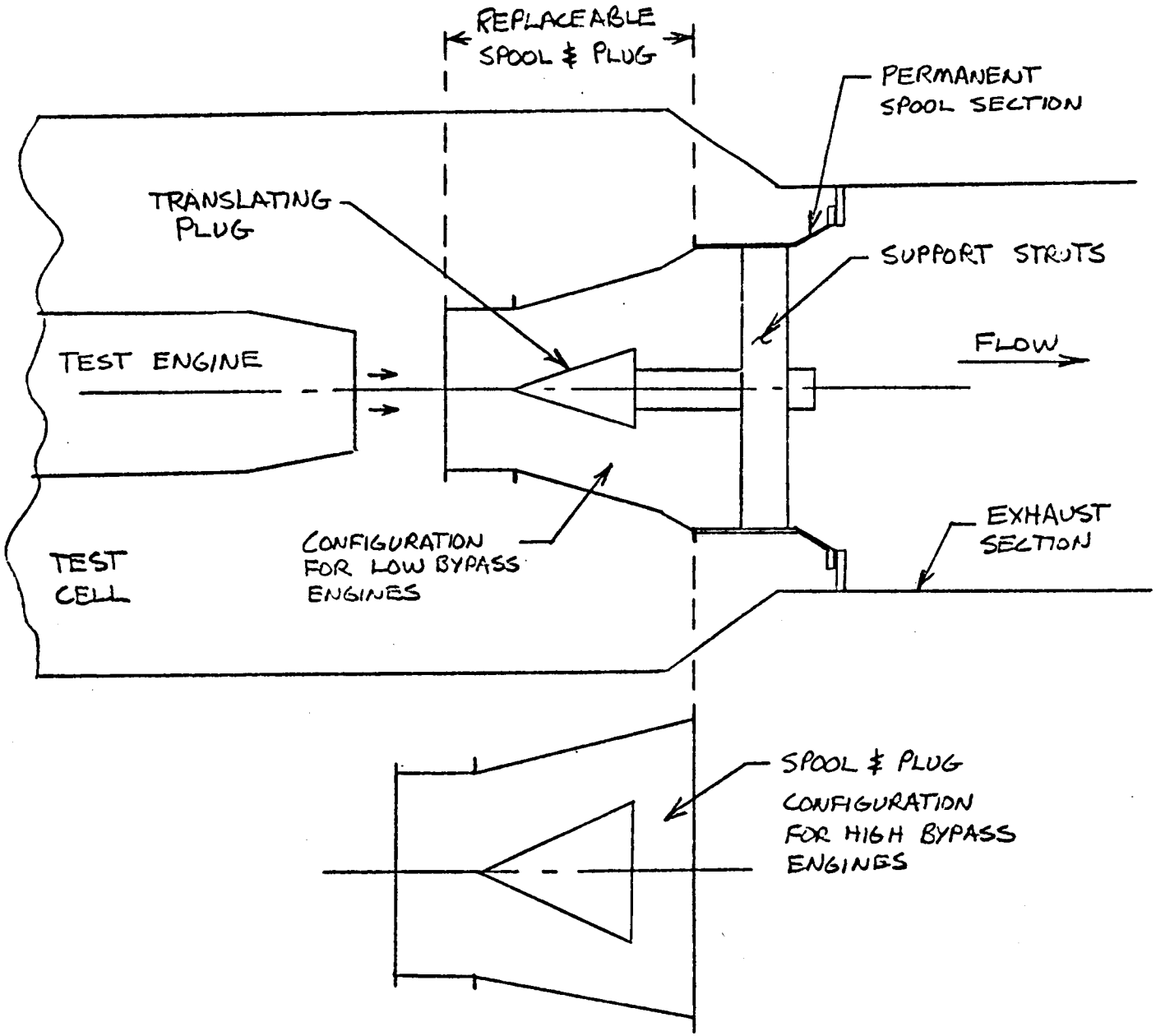


FIGURE 2 - VARIABLE AREA EXHAUST COLLECTOR CONCEPT (PSL 3 only)

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF THE PROPULSION SYSTEMS LABORATORY (PSL), ENGINE TEST BUILDING (125)

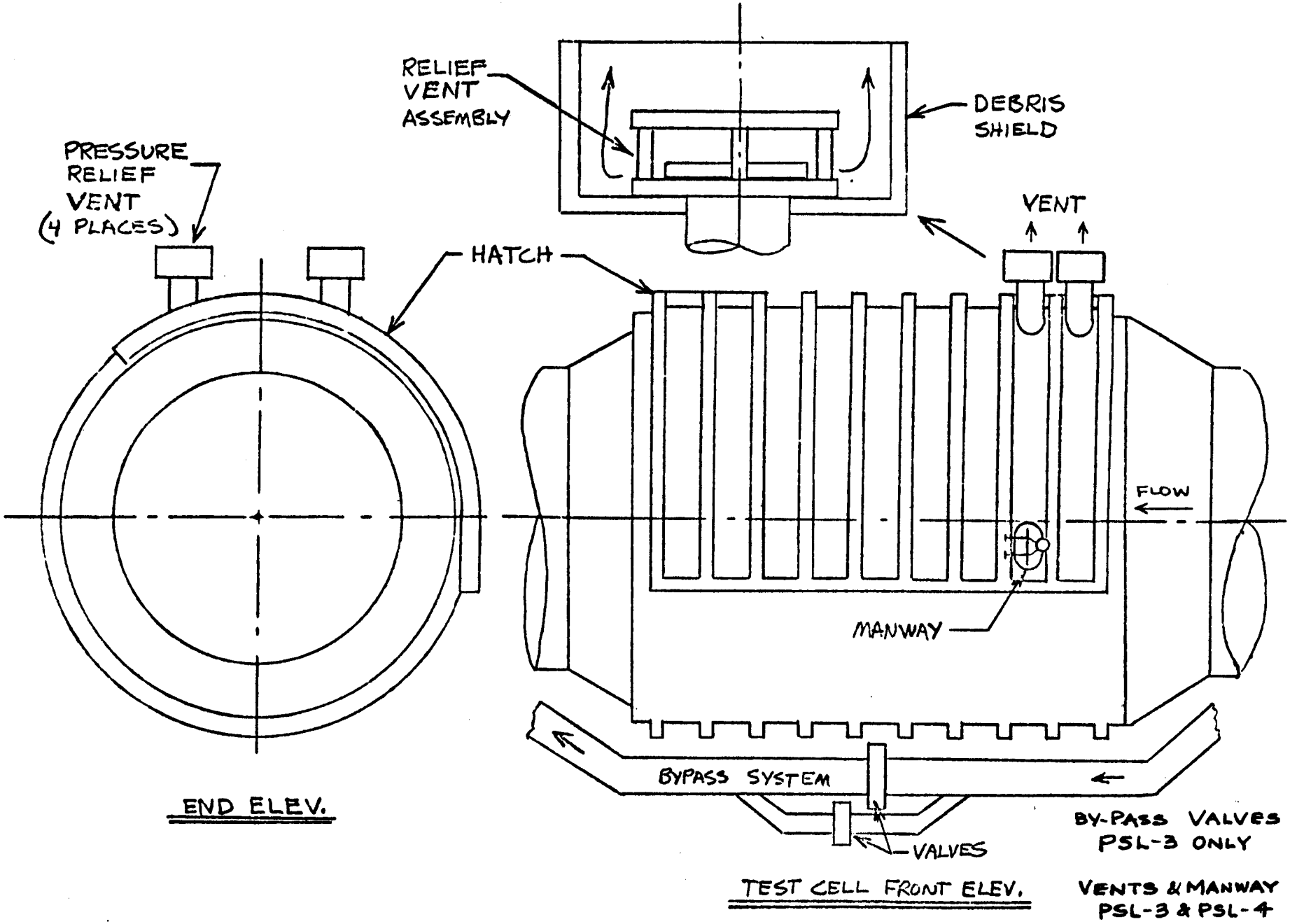


FIGURE 3 - PRESSURE RELIEF VENTS, MANWAY AND NEW BYPASS VALVES

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LCDA

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modification of the Propulsion Systems Laboratory (PSL), Engine Test Building (125)	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$1,900,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
[X] YES (Identify) [ ] NONE	$38,000	$114,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify) Field Investigation	$38,000

CATEGORY	JUSTIFICATION	WORK
	Program Related	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will replace an existing fixed area exhaust collector in the PSL #3 test-cell with a variable area collector which includes two (2) sets of a "movable tapered plug within a conical fixed spool", one (1) fixed support spool, a remotely controlled plug translating mechanism, a new engine exhaust nitrogen-cooled viewing system and cooling water piping modifications. The project will also supply and install in PSL #3 and #4: four (4) pressure relief vents in each test cell hatch including a means of discharging the vented air to the outside of Bldg. 125, a quick access 24-inch manway in each hatch, and replacement of a 2 ft. and a 4 ft. by-pass valve in existing piping.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None _____; b. ~~XXXXX~~/Increase X ; c. Environmental impact See text.

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

Present and future programmatic needs require that serious consideration be given to the support and improvement of the PSL Altitude Facility complex so that Lewis can continue to provide a strong technology base for future gas turbine engine system development. A continuing joint full-scale engine research technology effort with the Air Force, certain joint Navy Short Take-Off and Landing (STOL) support programs, and NASA programs such as the Energy Efficient Engine and advanced turboprop engine tests will require use of the PSL altitude test facilities through the 1980's. This project will enhance the PSL facility capability to provide the required simulated environment for these programs. (cont'd)

SCHEDULE DATES			
DESIGN	PER	START	2-83
		COMPL	6-83
	FINAL	START	2-84
		COMPL	10-84
CONSTRUCTION		AWARD	2-85
		COMPL	1-86
REQUIRED OPERATIONAL			6-86

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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NASA FORM 1509 NOV 79 PREVIOUS EDITION MAY BE USED.

GPO 863 884

85LCDA

Modification of the Propulsion Systems Laboratory (PSL),
Engine Test Building (125)

BASIS OF NEED - continued

The specific need for each part of the project is as follows:

1. The variable area exhaust collector will allow higher altitude operation than now possible in this test cell. It will also produce a decrease in the volume air-flow rate to be handled by the PSL exhausters with a resulting decrease in required electrical power, i.e., providing a more energy efficient and cost effective test facility.

2. This modification will extend the test range capability from the present minimum of 10,000 feet (3048 meters) altitude down to sea level for most engines. Many engine projects require several sea level test points. Correlations of existing actual sea level data with sea level data obtained in the altitude test cell will lend added credibility to data obtained at altitude conditions.

No other operational facilities exist at Lewis or within NASA with comparable capabilities. PSL-1 and 2 (Building 65) at Lewis has been deactivated.

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modification of the Propulsion Systems Laboratory (PSL), Engine Test Building (125)	SUBMISSION/REVISION A PROJECT CODE 85LCDA
BASIS OF COST ESTIMATE In-house and vendors cost estimates (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$1,200,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	400,000	30.4%
3. SUBTOTAL *(1 + 2)*	$1,600,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	165,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)* Constructon Management	135,000	8%
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$1,900,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost escalation @ 9%/year from 9/82 to midpoint of construction 10/85 $(1.09)^{3.08} = 1.304$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 38,000
2. SPECIAL STUDIES *(Specify)* Field Investigation	X			A-E	38,000
3. FINAL DESIGN	X			A-E	114,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$190,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$38,000	$114,000

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Field Investigation	$38,000
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LCDA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Variable Area Exhaust Collector						
Demolition - existing collector & assoc. cooling piping	LS	1	40,000		40,000	63,000
New - fixed support spool, two removable tapered plugs & matching forward spools, support structure	LS	1	525,000		525,000	831,000
New - plug translating mechanism, remote hydraulic servo-control syst.	LS	1	175,000		175,000	277,000
New - exhaust viewing system, with a remote TV system and a GN_2 purging system	LS	1	60,000		60,000	95,000
Sea Level Test Modification						
Pressure relief vent assemblies including safety shields; relief panels in building wall	LS	1	210,000		210,000	333,000
By-pass valves (2 ft, 4 ft) installed in existing lines; hook-up to existing controls	LS	1	120,000		120,000	190,000
Quick access manways in existing hatches (2)	LS	1	70,000		70,000	111,000
6. SOURCE OF COST DATA In-house & vendors cost estimates (9/82)		7.		TOTALS ▶	$1,200,000	$1,900,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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GPO 870 384

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1985 ESTIMATES

PROJECT TITLE: Modification for Structural Dynamics Verification Facility, Zero Gravity Facility (110)

INSTALLATION: Lewis Research Center

FY 1985 CoF ESTIMATE: $1,500,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	$120,000	---	$120,000
Capitalized investment	---	$3,884,000	$3,884,000
Total	$120,000	$3,884,000	$4,004,000

SUMMARY PURPOSE AND SCOPE:

Increased aircraft engine performance resulting in decreased fuel consumption is a primary goal of aeropropulsion research. Considerable resources are being expended to develop advanced structural dynamics analysis procedures and new design concepts leading to improved engine performance. Experimental testing is needed to substantiate the developed analytical procedures and to investigate the basic dynamic interaction of newly-designed engine components. This project provides for the construction of a facility for such testing, the Structural Dynamics Verification Facility (SDVF), at the Lewis Research Center. The SDVF will permit measuring the dynamic response of rotating engine components and full-size rotor/casing systems when excited by controlled vibratory forces.

Components and rotors will be spun in an evacuated chamber by an air-turbine drive system and dynamically excited by a multi-axis shaker system. Response will be measured by various instrumentation linked to an electronic data collection system.

The SDVF will be housed in the existing Zero Gravity Facility to advantageously utilize its existing services without jeopardizing the original research capabilities of that facility. The facility will contain a below-grade test chamber; a control room; a buildup area; and space to accommodate present spin rig equipment, bench tests, and an electronics laboratory. Required modifications to the Zero Gravity Facility consist primarily of enlargement of the building, construction of the test chamber, and extension of mechanical and electrical services.

PROJECT JUSTIFICATION:

To improve aircraft engine performance, considerable resources are being expended to develop advanced structural dynamics analysis procedures and new design concepts. This analytical effort is necessary because current design and analysis methods cannot adequately predict or quantify the dynamic interaction of lightweight flexible components. Experimental testing is required to substantiate the developed analytical procedures, to investigate the basic dynamic interaction of engine components, and to develop empirical design methods where adequate analytical models cannot be developed. The Structural Dynamics Verification Facility (SDVF) will provide this testing capability. The facility will possess the ability to excite and measure coupled dynamics between blades and shafting, to mechanically simulate various dynamic loadings which occur in operational engines, and to simultaneously excite and measure system responses. As such, the SDVF will permit fulfilling the goal of providing verified analytical prediction procedures of dynamic phenomena for incorporation into the analysis and design cycles of aircraft engines. Specifically, this facility will support the research efforts of the Loads, Dynamics and Aeroelasticity RTOP 505-33-5, the Forced Response Aeroelasticity of Turbine Engines Program, and the Structures and Mechanical Technologies Division Long Range Plan.

A survey of governmental and industrial installations has revealed that existing test facilities are primarily oriented toward component development and solution of current engine problems. Facilities for researching the dynamic interaction of engine systems do not exist except for full-engine test stands. These stands are costly to operate, limited in type and quality of measurements, and present a difficult environment in which to conduct generic research of engine structures. The SDVF will provide a unique experimental capability at Lewis Research Center and ensure the development of a cadre of personnel involved in quality research in high-speed, rotating, flexible structures.

IMPACT OF DELAY:

This project must be implemented now to support the experimental verification of advanced analytical techniques for predicting the dynamic response of aircraft engine components and systems. The impact of delaying the construction of the SDVF would be to impair the effectiveness of RTOP 505-33-5 and the Forced Response Aeroelasticity of Turbine Engines Program. This reduced effectiveness would lead to delays in the development of lighter, high-speed, more efficient engine systems.

PROJECT DESCRIPTION:

This project will provide a new Structural Dynamics Verification Facility (SDVF) with space for existing related test equipment and laboratories. The SDVF will be constructed at the south end of the Zero Gravity Facility. The Zero Gravity Facility is located in the central zone of Lewis Research Center and as such is served by most mechanical and electrical utilities or is in close proximity to sources of such utilities. The building is presently served by electrical power, service air, steam, domestic water, sanitary and industrial waste sewers, and a limited supply of cooling tower water. In addition, the facility is tied to the altitude exhaust system and contains a system of "Roots type" evacuators and a 20-ton bridge crane. The existence of the vacuum drawdown capability and the crane makes this facility an especially attractive site for the SDVF.

Construction of the SDVF will require extending the high-bay portion of the Zero Gravity building 75 feet to provide 3825 sq. ft. of additional grade-level floor area. The low-bay portion of the building will be extended 70 feet to provide 1400 sq. ft. of additional control room, laboratory, and equipment space. Runways of the existing crane will also be extended, making that crane available for use of the SDVF.

The SDVF test chamber will be constructed within the extended high-bay portion of the building. This test chamber will be a below-grade reinforced concrete pit with inside dimensions of approximately 15 ft. x 15 ft. x 15 ft. The pit will be capable of withstanding and maintaining a vacuum of 10 Torr. Adjacent to the test pit will be smaller below-grade chambers housing not more than nine vibration machines (shakers) and an air-turbine drive system. Foundations for the shakers and drive system will be integral parts of the chambers construction. Tops of all chambers will be sealed with removable covers designed to provide fragmentation shielding as well as vacuum integrity where necessary.

The 75-foot high-bay extension provides sufficient space for placement of two above-grade spin pots and their head storage rack in addition to the below-grade test chamber. Buildup of experimental test articles will be accomplished in a common section of the high-bay area shared with Zero Gravity experimenters.

The low-bay extension will be divided into a control room, a bench-test room, an electronics laboratory, and

a mechanical/electrical equipment room.

Cooling tower water for shaker cooling, pressurized air for driving the turbine, vacuum service piping, conditioned air, and electrical power will be extended to the test chamber. Usual utilities will be provided for the building extension.

Acquisition and installation of the shakers, drive system, controls, and data-collection/reduction system are not part of this CofF project.

PROJECT COST ESTIMATE:

This cost estimate is the result of in-house efforts only.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1,500,000
Site Development and Utilities	---	---	---	177,000
Power	LS	---	---	71,000
Utilities	LS	---	---	66,000
Paving and Walks	LS	---	---	40,000
Building	---	---	---	1,323,000
Building Modifications	LS	---	---	913,000
Test Chamber	LS	---	---	284,000
Extension of Utilities	LS	---	---	60,000
Power and Communications	LS	---	---	47,000
Crane Modifications	LS	---	---	19,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				1,500,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no currently foreseen future funding requirements to complete this project.

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Building Floor Plan

RELATED COSTS: (R&D Funded)

Equipment:	
Shakers and Controls	$ 960,000
Data Acquisition and Reduction	$ 712,000
Test Article	$ 518,000
Variable Dampening Bearings	$ 324,000
Drive System and Controls	$ 216,000
	$2,730,000
Studies:	
Developmental Model of Shakers Control System	$ 240,000
TOTAL	$2,970,000

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR																			
	1982				1983				1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
PRELIMINARY ENGINEERING REPORT																				
DESIGN, CONSTRUCTION																				
ACTIVATION, CHECKOUT & OTHER																				

P.E.R. _._._._._ DESIGN ---------- CONSTRUCTION/ACTIVATION ————————

MODE OF ACCOMPLISHMENT:

This project will be carried out in the conventional design, advertise and build procurement mode. NASA will contract with an A/E firm for the Preliminary Engineering Report and the final design. For this, $120,000 is included in the design estimate. All supervision, inspection and engineering services required during construction will be accomplished by a construction management contractor.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	IDENTIFICATION NO.
Nov. 1, 1982	85LCEA

INSTALLATION	PROGRAM OFFICE	FISCAL YEAR	PROPOSED BUDGET YEAR
Lewis Research Center	OAST	1983	1985

PROJECT TITLE	EST. COST OF DESIGN	EST. CONSTR. COST
Modification for Structural Dynamics Verification Facility, Zero Gravity Facility (110)	$90,000	$1,500,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 83 b.		FY 84 c.		FY 85 d.		FY 86 e.		FY ___ f.		FY ___ g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1	Preliminary Engineering Report			.030	.030												
2	Final Design					.090	.090										
3	Construction							1.500	.800		.700						
TOTAL ▶	OBL 1.620			.030		.090		1.500									
	OLY 1.620				.030		.090		.800		.700						

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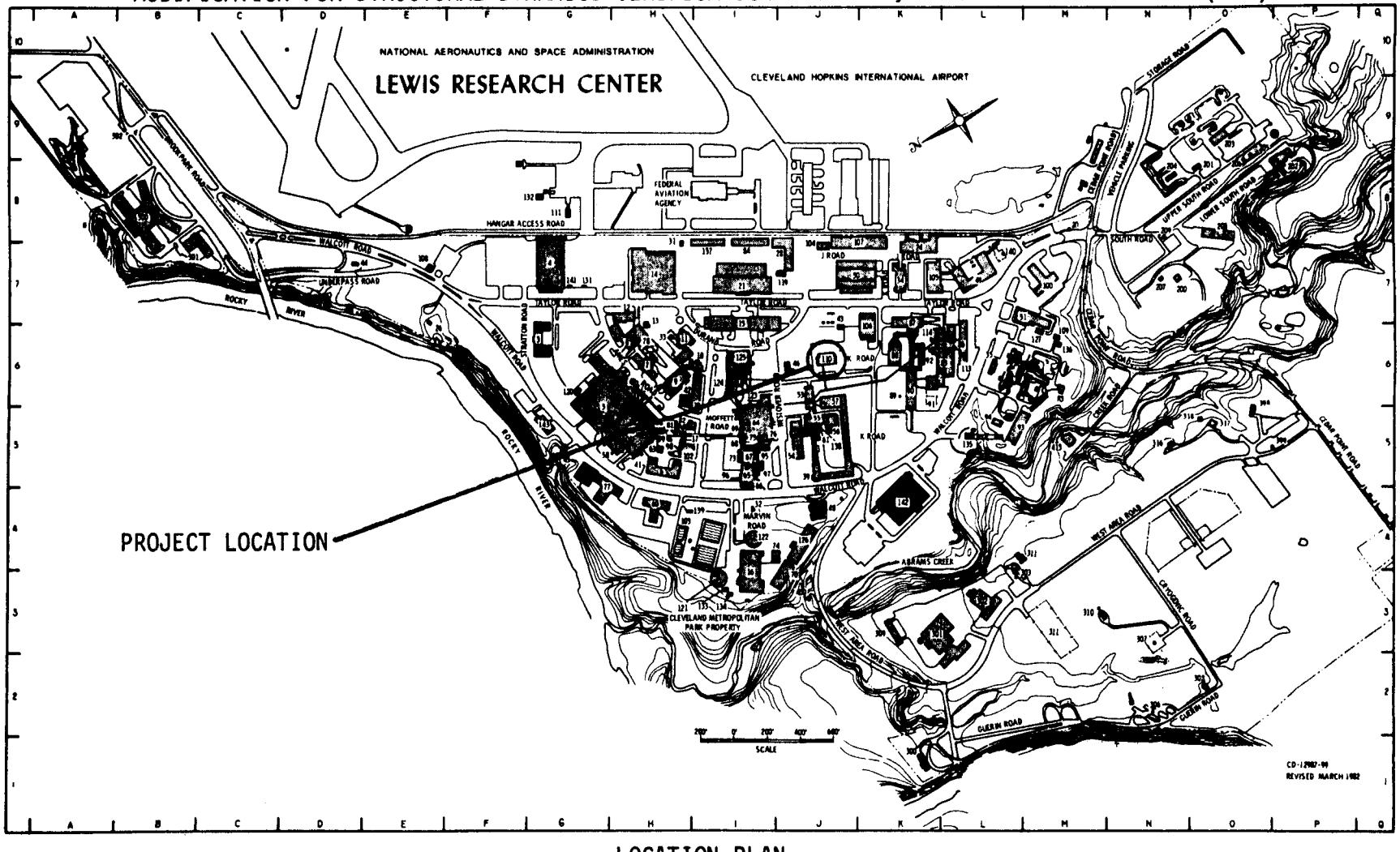
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION FOR STRUCTURAL DYNAMICS VERIFICATION FACILITY, ZERO GRAVITY FACILITY (110)



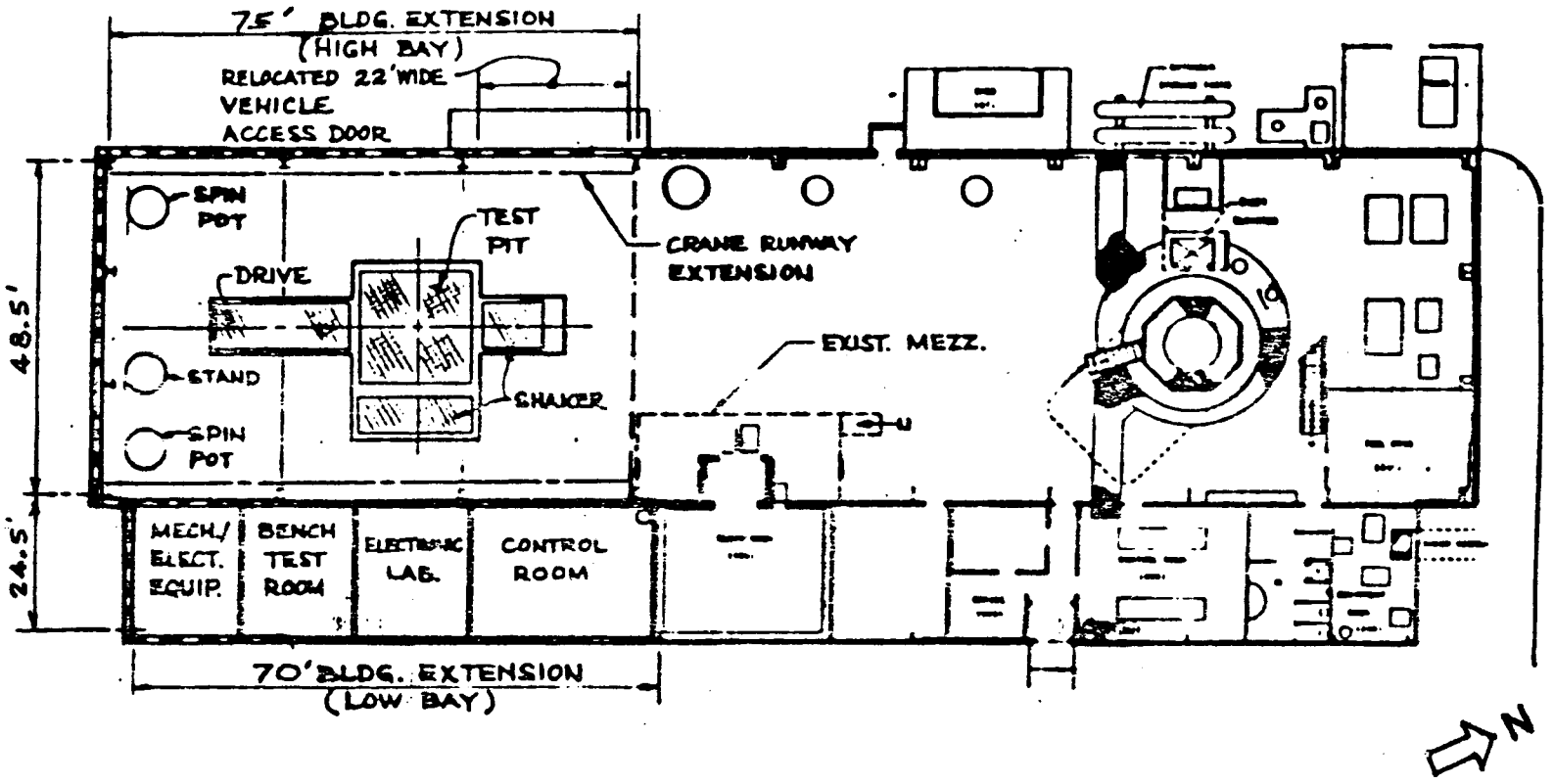
LOCATION PLAN

FIGURE 1

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION FOR STRUCTURAL DYNAMICS VERIFICATION FACILITY, ZERO GRAVITY FACILITY (110)



BUILDING FLOOR PLAN

FIGURE 2

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LCEA

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modification for Structural Dynamics Verification Facility, Zero Gravity Facility (110)	LeRC/OAST	Nov. 1, 1982	E

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$1,500,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$30,000	$90,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify) Shaker Controls	$ 240,000
			~~R&D Equip.~~	~~$2,730,000~~

CATEGORY	JUSTIFICATION	WORK
	Program Related	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will modify the existing Zero Gravity Facility (110) to provide a Structural Dynamics Verification Facility (SDVF). The work includes: extending the existing building to provide testing, buildup, laboratory, and control room space; constructing the SDVF test chamber within the extended portion of the building; and providing all utilities, including cooling tower water and compressed air, required for environmental control and facility operation. The SDVF test chamber will be a below-grade concrete structure capable of maintaining a vacuum and containing a test pit, shakers, and an air-turbine drive system. The top of the chamber will be sealed with removable covers designed to provide fragmentation shielding as well as vacuum integrity where necessary. The shakers, drive system, controls, and data collection/reduction system are not part of this CoF funding.

(continued)

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The facility will address research topics proposed for future work in the structural dynamics and rotor dynamics areas. These include: validation of transient analysis methods for blade loss dynamics, blade rub events, and blade/case interactions; validation of dynamics analysis for overhung fan stages including aspects of prop whirl, one-nodal diameter bladed-disk modes, and the general coupled blade/disk shaft problem; validation of modeling methods for treating rotating to static structure interfaces including methods for predicting dynamic bearing stiffnesses, force transmissions through dampers and bearing, and blade/case interaction dynamics; determinations of stiffness and damping (cont'd)

SCHEDULE DATES				PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
DESIGN	PER	START	1-83	SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
		COMPL	7-83	CONCURRENCE BY ▶		
	FINAL	START	1-84			
		COMPL	10-84	BX CONCURRENCE ▶		
CONSTRUCTION		AWARD	1-85	APPROVED BY ▶		
		COMPL	3-86			
REQUIRED OPERATIONAL			12-86			

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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Modification for Structural Dynamics Verification Facility,
Zero Gravity Facility (110)

SCOPE/DESCRIPTION - continued

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

BASIS OF NEED - continued

distributions on structural dynamic behavior including distributed structural damping on rotating members and discrete damper devices, correlation with critical speeds, and parametric studies of mount stiffness and damping effects; and preliminary evaluation of engine instrumentation including photo optical instrumentation, data communication from rotating members, laser balancing, and blade-mounted aerodynamic probes.

The research effort in this area is conducted under the Loads, Dynamics and Aeroelasticity RTOP 505-33-5 in which the acquisition of reliable experimental data for use in validation of analytical methods is specifically mentioned as an objective. The effectiveness of the Forced Response Aeroelasticity of Turbine Engines Program is also dependent upon the operation of this facility. In addition, the facility supports the Structures and Mechanical Technologies Division Long Range Plan (FY82 to FY91).

NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modification for Structural Dynamics Verification Facility, Zero Gravity Facility (110)	SUBMISSION/REVISION E PROJECT CODE 85LCEA
BASIS OF COST ESTIMATE In-house conceptual estimate dated August 1982	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$ 961,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	302,000	31.4%
3. SUBTOTAL *(1 + 2)*	$1,263,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	126,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*	111,000	8%
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$1,500,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/year to midpoint of construction (8/82 to 10/85) $(1.09)^{3.17} = 1.314$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 30,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	90,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$120,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$30,000	$90,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Model Study - Shaker Control Sys.	$ 240,000
	7. FUTURE FUNDING		R&D Equipment	$2,730,000

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LCEA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*	Power	LS		46,000		46,000	71,000
	Utilities	LS		42,000		42,000	66,000
	Paving and Walks	LS		25,000		25,000	40,000
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*							
	Building Modifications	LS		585,000		585,000	913,000
	Test Chamber	LS		182,000		182,000	284,000
	Extension of Utilities	LS		38,000		38,000	60,000
	Power and Communication	LS		31,000		31,000	47,000
	Crane Modifications	LS		12,000		12,000	19,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA In-house conceptual estimate dated August 1982			7.		TOTALS ▶	$961,000	$1,500,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1985 ESTIMATES

PROJECT TITLE: Modification of Cooling Towers for Fire Protection - Various Buildings

INSTALLATION: Lewis Research Center

FY 1985 CoF ESTIMATE: $1,800,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology, (OAST)

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	162,000	---	162,000
Capitalized investment	---	3,344,000	3,344,000
Total	162,000	3,344,000	3,506,000

SUMMARY PURPOSE AND SCOPE:

The Modification of Cooling Towers - Various Buildings is required to provide better fire protection by the addition of internal sprinklers for five (5) cooling water towers in various locations at Lewis Research Center (LeRC). These cooling towers are presently protected by fire fighting equipment and personnel capable of combating fires on the external portions of the towers only. No capability exists to combat fires internal to the towers which contain the most flammable material. The project provides for improved fire protection for Building 10 (tower #1), Building 70 (tower #3), Building 82 (tower #4), Building 93 (tower #5) and Building 126 (tower #6). Each tower will be protected with a multiple zone, dry pipe, pumped system, utilizing domestic

(potable) water system for water supply. The potable water system will be modified to provide sufficient flows at each tower location. The pumping stations will be provided with electrical power from a reliable source. This project is essential to LeRC research programs due to the vital part that cooling towers play in the research operations of the building they serve.

PROJECT JUSTIFICATION:

The services of cooling towers included in this project are vital to research and process needs of LeRC as follows: Towers #1 and #4 support research operations in Buildings 5, 11, 23, 37, 38, 81 and 102, process operation of refrigeration Building 9, and combustion air supply equipment in Building 5.

Towers #3 and #6 - research and equipment in Propulsion Systems Laboratory Complex - Buildings 64, 65, 66, 124 and 125, and research operations in Building 16.

Tower #5 - research and equipment in 10 x 10 ft. Supersonic Wind Tunnel (SWT) Complex - Buildings 86, 87, 90 and 113, research in Rocket Laboratory Group - Building 35, research and equipment in 8 x 6 ft. SWT - Building 39, research in Building 106, mechanical systems in Research Analysis Center (RAC) - Building 142 and is being extended to serve research operations in Buildings 24, 34, 49, 51, 100 and 105.

The cooling towers are of redwood construction and are located adjacent to other structures and buildings housing research test facilities. The locations and flammable materials of construction make the cooling towers susceptible to fire should it occur in adjacent structure. If a fire originates in a cooling tower, adjacent structures could also be affected. Should a fire of significant size occur in either Tower #3 or #6, it is felt that the tower in which the fire occurred would be lost, while the second tower could also be lost due to the very small separation between these two towers. A fire could also affect four fuel storage tanks (Building 48), which are located near tower #6.

A fire in these towers could be beyond the existing combined capabilities of the LeRC Fire Department and the mutual aid support provided by adjacent fire departments.

The proposed automatic sprinkler system was compared with alternate solution of upgrading the towers by replacing portions of the existing flammable wood fill at the bottom of the tower with 18 inches of cellular fill and replacing present drift eliminators with more efficient and fireproof eliminators.

Installation of the sprinkler system, including the modification of potable water system, was found to be more economical and less disruptive to the research activities at the Center. Rebuilding of the towers with fireproof

materials would involve long down time and disruption of research/operations activities in the areas serviced by the tower. The aggregate replacement cost of the towers, exclusive of basins and pumps, being protected is in excess of 11 million dollars at 1984 cost.

No outside "state-of-the-art" components are required for this fire protection system. All aspects of this project are covered by the Institutional Environmental Impact Statement approved August 25, 1971 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project.

PROJECT DESCRIPTION:

This project will provide fire protection for five (5) cooling water towers in various locations at LeRC (figure 1). Towers Nos. 1, 3, 4, 5 and 6 (Buildings 10, 70, 82, 93 and 126) will be provided fire protection by multiple zone, dry pipe, pumped sprinkler systems. Each pumping system will provide adequate pumping capacity to cover two (2) adjacent tower cells, with redundant pump back-up. Water will be supplied at the rate of 1/2 gpm per square foot of fan deck area from potable water system through a pump and control building to the tower distribution and sprinkler nozzle system (see figure 3). It will provide below deck sprinklers to suppress fire in the fill material and will also cover the area above the deck in the vicinity of the fan motors. The exterior of the towers will be protected through the use of hose lines from hydrants adjacent to the tower. Alarm system will be provided to alert Plant Protection Department, at the central station, of the sprinkler actuation.

The potable water system will be modified (figure 2) to provide sufficient flow at adequate pressure (20 psig or 1.41 kg/sq.cm) at each location. This requires replacing three (3) existing meters with new, low pressure loss meters, installation of the fourth meter, increasing the supply pipe size serving Tower 1, providing a new cross connection between systems in the central area and the southern portion of the loops.

To assure operational reliability each pumping station will be furnished with electrical power from suitable dependable source.

PROJECT COST ESTIMATE:

The project cost is based on a Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Distribution System	---	---	---	---
New Meters	LS	---	---	58,000
Domestic Water Mains	LS	---	---	369,000
Towers	---	---	---	---
Pump Houses and Valve Houses	LS	---	---	419,000
Fire Pumps	LS	---	---	274,000
Deluge Systems	SF	49,800	7.63	380,000
Fire Mains	LS	---	---	119,000
Standpipe Systems	LS	---	---	68,000
Exposure Protection	LS	---	---	88,000
Fire Alarm System	LS	---	---	25,000
Fallout Shelter (not feasible)	---	---	---	---
Total				1,800,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no future funding requirements necessary to complete this project.

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR																			
	PRIOR				1983				1984				1985				1986			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
P.E.R.																				
DESIGN, CONSTRUCTION																				
ACTIVATION, CHECKOUT & OTHER																				

P.E.R. _._._._ STUDY — — — DESIGN -------- CONSTRUCTION/ACTIVATION ————

MODE OF ACCOMPLISHMENT:

This project will be carried out in the conventional (design, advertise and build) lump-sum procurement mode using one (1) work package contract. Lewis will contract with an A/E firm for the development of the final design and special studies. All supervision, inspection and engineering services required during construction will be provided by the Government

IMPACT OF DELAY:

Delay of the project will increase the risk of loosing one of the towers to fire, and possible delay in some research programs.

LIST OF RELATED GRAPHICS:

Location Plan

Towers..... Figure 1
New Meters..... Figure 2

Technical Sketches

Cooling Tower Arrangement (TYP)..... Figure 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	Nov. 1, 1982
IDENTIFICATION NO.	85LCFA
INSTALLATION	Lewis Research Center
PROGRAM OFFICE	OAST
FISCAL YEAR	1983
PROPOSED BUDGET YEAR	1985
PROJECT TITLE	Modification of Cooling Towers for Fire Protection - Various Buildings
EST. COST OF DESIGN	$108,000
EST. CONSTR. COST	$1,800,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 80 b.		FY 81 c.		FY 82 d.		FY 83 e.		FY 84 f.		FY 85 g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1.	Preliminary Engineering Report			.018	.018												
2.	Safety Implementation Plan											.036	.036				
3.	Final Design											.108	.108				
4.	Construction													1.800	1.000		.800
TOTAL ▶	OBL 1.962			.018								.144		1.800			
	OLY 1.962				.018								.144		1.000		.800

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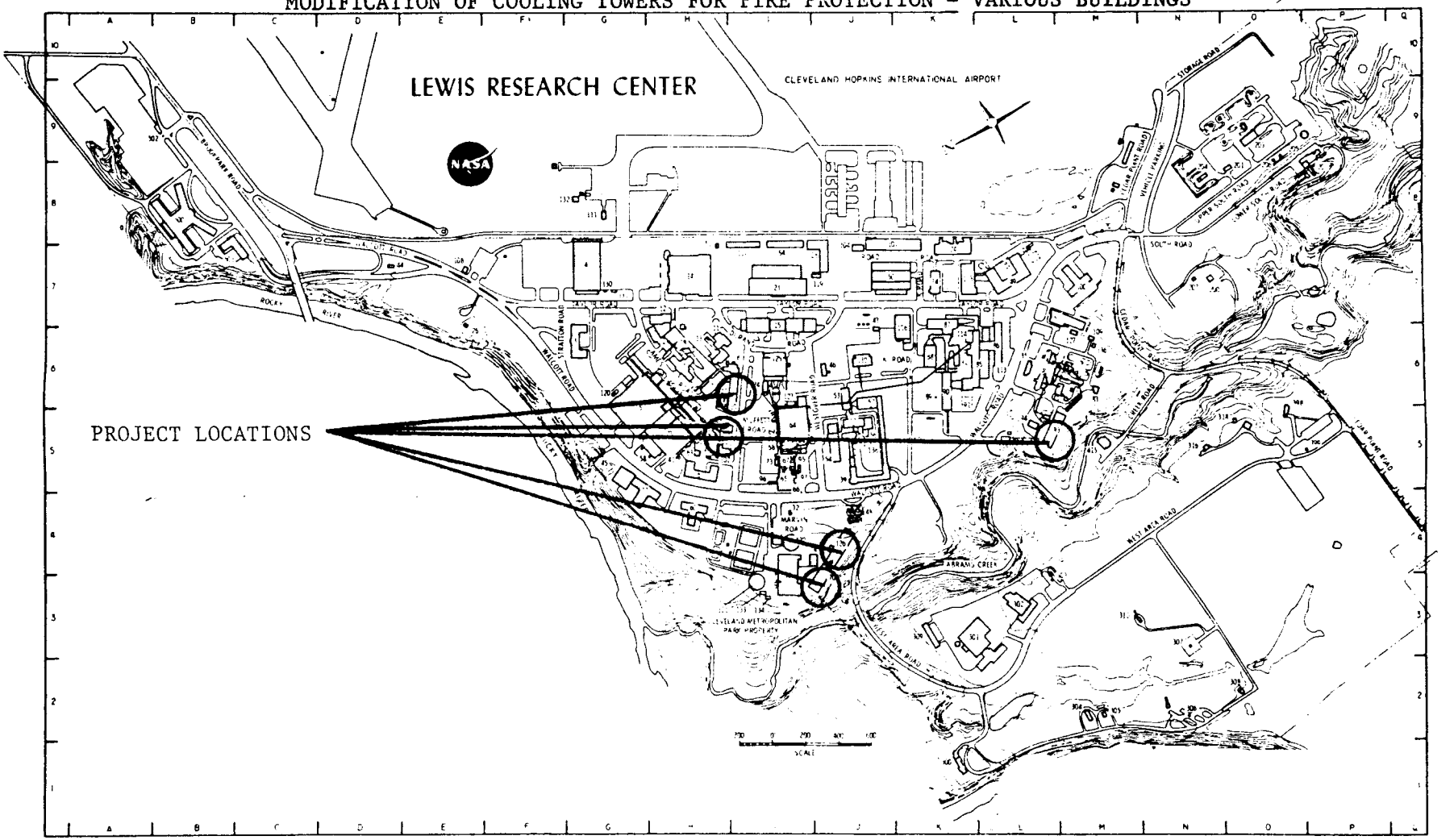
6DP

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF COOLING TOWERS FOR FIRE PROTECTION - VARIOUS BUILDINGS



LOCATION PLAN

FIGURE 1

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF COOLING TOWERS FOR FIRE PROTECTION - VARIOUS BUILDINGS

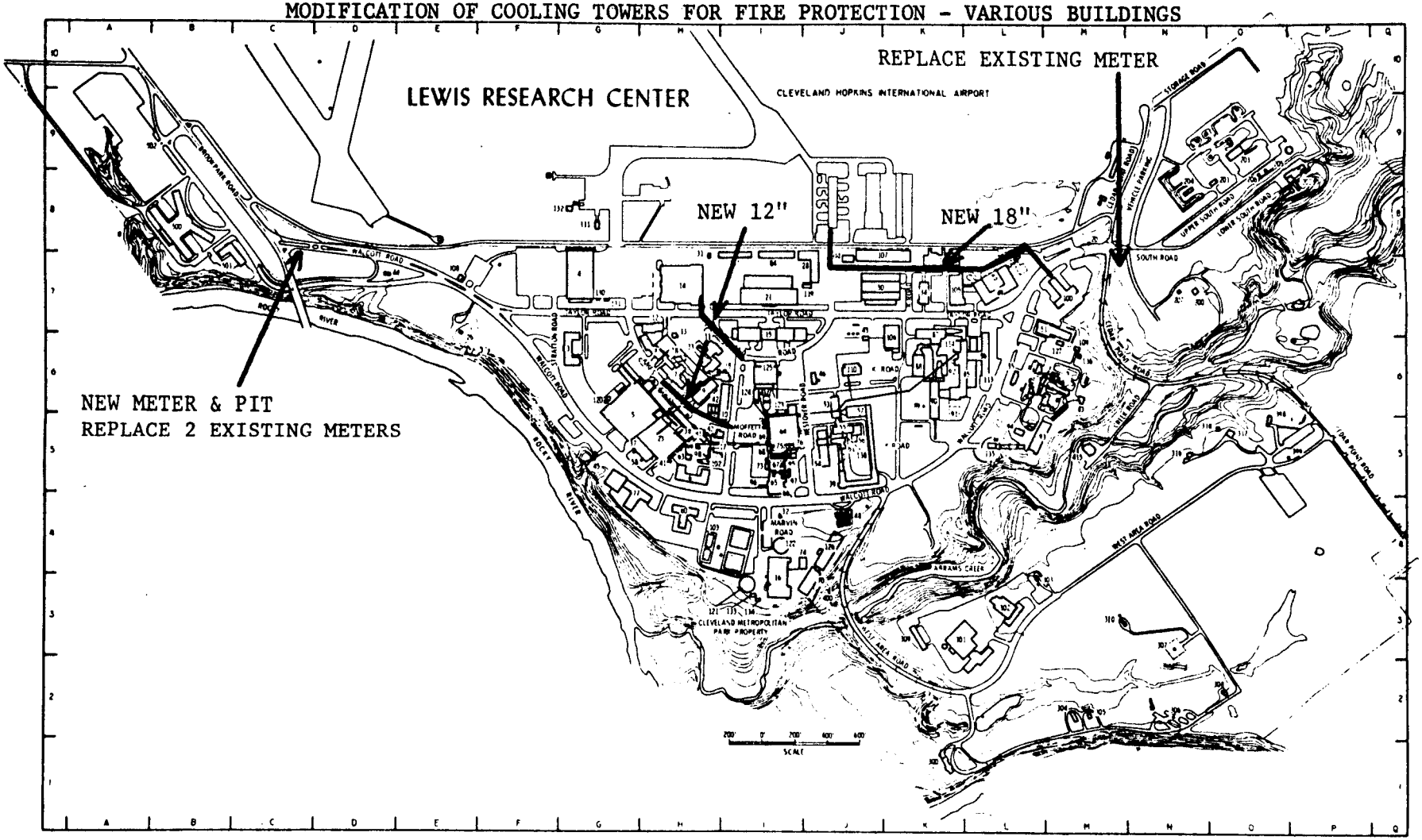
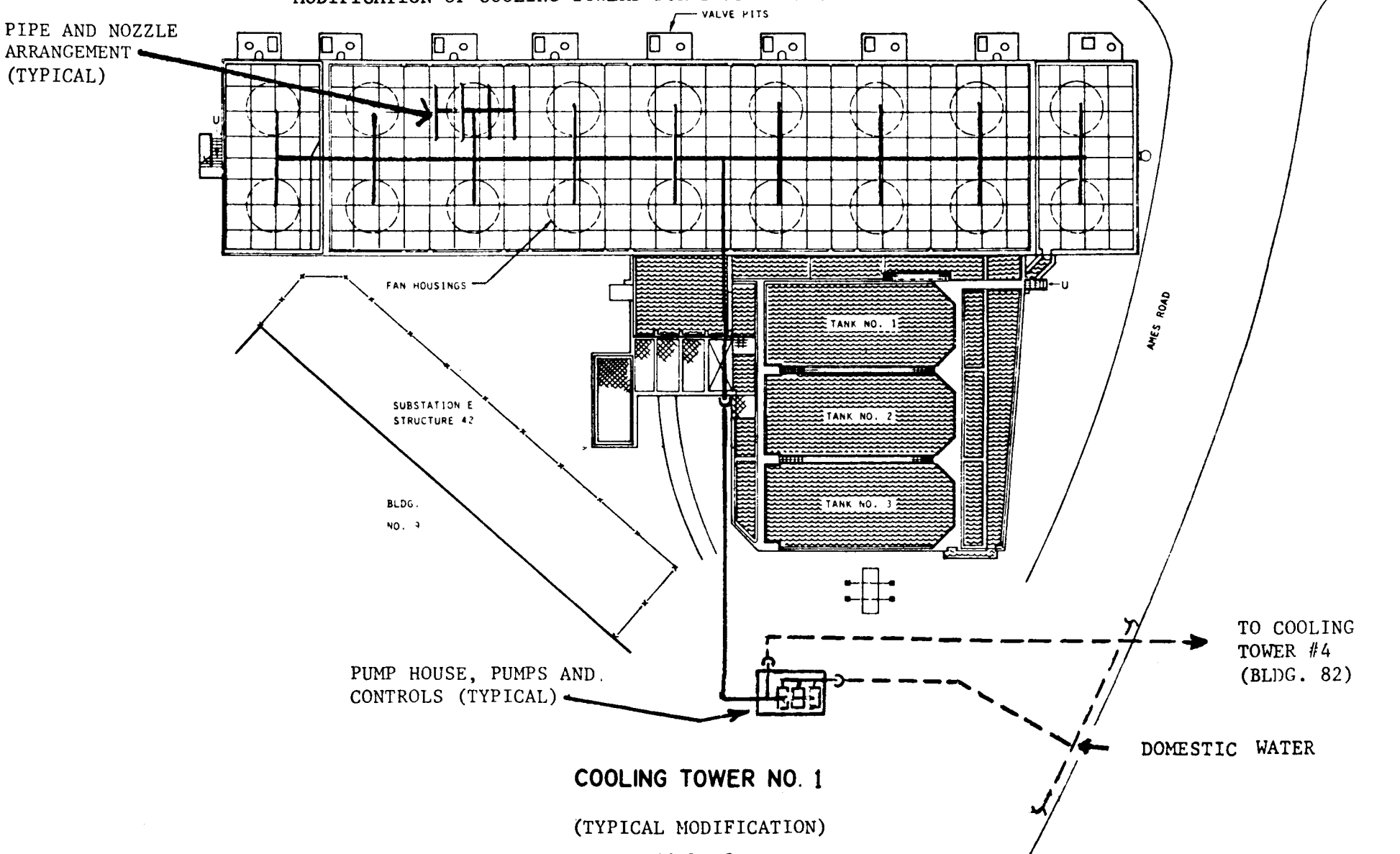


FIGURE 2

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF COOLING TOWERS FOR FIRE PROTECTION - VARIOUS BUILDINGS



COOLING TOWER NO. 1

(TYPICAL MODIFICATION)

FIGURE 3

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LCFA

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modification of Cooling Towers for Fire Protection - Various Buildings	LeRC/OAST	Nov. 1, 1982	E

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$1,800,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
X YES (Identify) ☐ NONE	$18,000*	$108,000

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify) Study	$36,000

CATEGORY	JUSTIFICATION	WORK
	Safety	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will provide fire protection for five cooling water towers around the Center, Towers 1, 3, 4, 5 and 6 (Buildings 10, 70, 82, 93 and 126) will be protected with multiple zone automatic deluge system. Each pumping system will provide adequate pumping capacity to cover two adjacent tower cells. In addition, the potable water systems will be modified to provide sufficient flow at adequate pressure at each location. This requires replacing three existing meters with new, low pressure loss meters, installing a new fourth meter, interconnections between the old fire and domestic distribution systems and providing new cross connections between the points of the distribution system. (Fig.2). All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The cooling towers are of redwood construction and are located amid other structures and buildings housing research test facilities. The location and flammable materials of construction make the towers susceptible to fire should it occur in adjacent buildings or could involve adjacent buildings should the tower catch fire. Services of these towers are vital to research and process needs as follows: Towers 1 and 4, research in Buildings 5, 11, 23, 37, 38, 81 and 102, process operation of refrigeration systems of Building 9, and combustion air supply equipment in Building 5; Towers 3 and 6, research and equipment in the Propulsion Systems Laboratory Complex (Buildings 64, 65, 66, 124 (cont'd)

SCHEDULE DATES

DESIGN	PER	START	2-80
		COMPL	6-83
	FINAL	START	1-84
		COMPL	9-84
CONSTRUCTION		AWARD	1-85
		COMPL	12-86
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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109

6DP

85LCFA

Modification of Cooling Towers for Fire Protection -
Various Buildings

BASIS OF NEED - continued

and 125) and research operations in Building 16; Tower 5, research and equipment in 10x10 Supersonic Wind Tunnel (SWT) Complex (Buildings 86, 87, 90 and 113), research in Rocket Laboratory Group (35), 8x6 SWT, (Building 39) and mechanical systems in Research Analysis Center (Building 142), and is being extended to serve research operations in Buildings 24, 34, 49, 51, 100 and 105.

The modification of the potable water systems is required to assure adequate flow and pressure at each tower location should a fire occur, with sufficient residual system pressure to allow research users time for an orderly shutdown. A study has been completed which determined that with the demand for fire protection water at any one tower, allowance for fire hose line water protection for adjacent buildings, and normal research and domestic uses the modifications described in the scope will provide the necessary 20 psig (1.41 kg/sq.cm.).

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modification of Cooling Towers for Fire Protection - Various Buildings	SUBMISSION/REVISION E PROJECT CODE 85LCFA
BASIS OF COST ESTIMATE Criteria & PER (12-80)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$ 984,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	560,000	57%
3. SUBTOTAL *(1 + 2)*	$1,544,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	154,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*	102,000	6%
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$1,800,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 12%/year from 12-80 to 12-81 and 9%/year from 1-82 to 1-86 to mid construction

$(1.12)^1 + (1.09)^{4.0} = 1.12 + 1.45 = 1.57$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT			X	A-E	$ 18,000*
2. SPECIAL STUDIES *(Specify)* Detailed Safety & Implementation Plan	X			A-E	36,000
3. FINAL DESIGN	X			A-E	108,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$162,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$18,000*	$108,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Detailed Safety and Implementation	$36,000
	7. FUTURE FUNDING			

*Previously Funded

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LCFA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
	New meters	LS				32,000	58,000
	Domestic water mains	LS				202,000	369,000
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Pump houses & valve houses	LS				229,000	419,000
	Fire pumps	LS				149,000	274,000
	Deluge systems	SF	49.800	4.17		208,000	380,000
	Fire mains	LS				65,000	119,000
	Standpipe systems	LS				37,000	68,000
	Exposure protection	LS				48,000	88,000
	Fire alarm system	LS				14,000	25,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA Criteria and PER (12-80)			7.		TOTALS ▶	984,000	1,800.000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1985 ESTIMATES

PROJECT TITLE: Construction of Visitor Information Center

INSTALLATION: Lewis Research Center

FY 1985 CoF ESTIMATE: $4,900,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics & Space Technology (OAST) and Office of External Relations (OER)

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	$392,000	---	$392,000
Capitalized investment	---	---	---
Total	$392,000	---	$392,000

SUMMARY PURPOSE AND SCOPE:

The Visitor Information Center (VIC) at Lewis Research Center was established in 1976, in compliance with the National Aeronautics and Space Act of 1958. This act "provides for the widest practicable and appropriate dissemination of information concerning the activities of the National Aeronautics and Space Administration, and the Lewis Research Center." The VIC functions primarily as an educational facility. The responsibility of this facility is to conduct public affairs and educational programs in the following six states: Minnesota, Wisconsin, Illinois, Indiana, Michigan, and Ohio. This project will provide a new 24,000 sq. ft. (2230 sq. m) facility. Information about NASA and its many contributions to the technological advancement of the nation

through scientific research will be on display in exhibition areas, and discussed in lecture and meeting rooms. Staff offices will be provided for management and maintenance of the facility along with provisions for repair, preparation, and storage of exhibitions and materials. The building construction will incorporate and showcase state-of-the-art energy conservation systems.

PROJECT JUSTIFICATION:

1. Educational Importance

A large audience is to be served by the Lewis VIC. In 1980, approximately 45 million people resided in the Lewis region. Of this total, approximately 10 million were school-age children. To instruct these young people, 499,458 full and part-time teachers were employed. In addition, there were 603 institutions of higher learning (4 year, 2 year public and private colleges and universities) to be served.

The current VIC cannot serve the vast six state audience. The VIC does not provide for (1) educational television and radio production capability; (2) site to train resource persons to give presentations in six state region; (3) construction site for traveling exhibits which can be displayed throughout region; (4) activity site for visitations by groups in six state area; and (5) expansion of Teacher Resource Room to support establishment of "satellite" Teacher Resource Rooms.

2. Space Limitations

The present Visitor Information Center (VIC) is operating at maximum capacity due to a limited amount of existing space. A single auditorium restricts the number and frequency of organized group tours. The size of the existing display area limits the quantity of displays being exhibited, and restricts display flexibility and creativity. Presently, there exists only a minimal amount of space designated for exterior displays. In addition, other areas such as the Teachers Resource Center, Control Room, and staff offices are all being utilized beyond their capacities. The existing VIC also lacks space to accommodate smaller groups and workshop sessions for both students and educators. Present service areas such as storage, reception, restrooms, and coat rooms are all incapable of meeting present needs, and cannot be expanded.

3. Safety Implications

The present Visitor Information Center (VIC) is located near the interior of the Center in an area where daily traffic is extremely heavy (see figure 1). The problems caused by the present location of the VIC are numerous: (1) Children comprise up to 85 percent of the daily VIC traffic, and are therefore constantly walking to and from buses and cars in the midst of a major traffic area. (2) Visitors to the existing VIC must park their

automobiles in either of two remote parking areas (see figure 2). Visitors are therefore allowed to traverse freely from their parking locations to the VIC building, and often drift into other areas on the Center. (3) The existing VIC exterior display area is across the street from the VIC building which again requires crossing Ames Road (see figure 3) to view exterior displays. The new VIC will totally eliminate problems related to both safety and security (see figure 4).

4. Altitude Wind Tunnel (AWT) Impact

The building which presently houses the VIC is a wood truss construction with masonry bearing walls. Expansion of the building is prohibited for fear of affecting its structural integrity. The AWT project will have a negative impact on the VIC operations by forcing the VIC to shutdown for some period of time during the construction of the AWT. In addition, the 60,000 h.p. drive motors required by the AWT will create both objectionable noise and vibration, and will be restrictive for evening programs.

IMPACT OF DELAY:

Delay of this project will cause the existing VIC to continue functioning as a less than adequate facility. Visitor attendance at the VIC has leveled off in the past 2 years, and will begin to decline if a new facility is not provided. If the AWT project proceeds as scheduled, the VIC project must precede it by one year to minimize the transition period required for relocating displays.

PROJECT DESCRIPTION:

This project will provide a 24,000 sq. ft. (2230 sq. m) building through which the objectives of the VIC as stated in the Space Act of 1958 will be accomplished. The basic components of the building will include: display areas for both interior and exterior exhibits and artifacts; auditoriums for briefings, presentations, demonstrations, and film viewing; classroom space for small groups and workshop sessions; Teacher Resource Center for providing curriculum enrichment materials for educators in the Lewis Research Center six state region; television/radio studio for educational television and radio production capability; and shop areas for repair and construction of exhibits and equipment. Staff offices, along with service and functional building requirements, shall also be included in this project as required. The site for this project is immediately adjacent to the Cleveland Hopkins Airport and north of the Flight Research Building, and in close proximity to four major interstate highways for maximum public access. Site improvements for this project include demolition of existing parking areas and construction of new parking areas. Surfaces for exterior displays shall be provided as required. Vehicular and pedestrian circulation patterns and access routes will be provided. The impact upon NASA security and safety will be minimal. A fire wall will be provided for physical separation between the existing Hangar Building (4) and the new VIC building.

The new VIC will consist of the following areas:

Exterior Display	12,000 sq. ft.
Interior Display	12,000 sq. ft.
Two Auditoriums (2,750 sq. ft. each)	5,500 sq. ft.
Classroom	1,000 sq. ft.
Manager's Office	300 sq. ft.
Volunteer Lounge	600 sq. ft.
Television Studio	400 sq. ft.
Staff Offices	700 sq. ft.
Electronics/Woodshops	900 sq. ft.
Teachers Resource Center	1,000 sq. ft.
Museum Store with Storage	500 sq. ft.
Control Room	300 sq. ft.

PROJECT COST ESTIMATE:

The project cost estimate is based on a conceptual design study estimate.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	---
Site Development/Utilities	LS	EA	227,000	330,000
Building	---	---	---	---
Architectural/Structural	LS	EA	1,453,000	2,200,000
Mechanical	LS	EA	1,033,000	1,600,000
Electrical	LS	EA	517,000	770,000
Special Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				4,900,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There exist no foreseen future funding requirements to complete this project.

LIST OF RELATED GRAPHICS:

Figure 1 - Project Location Plan
Figure 2 - Existing Parking Areas
Figure 3 - Existing VIC Site Plan
Figure 4 - New VIC Site Plan

SCHEDULE:

EVENTS/TIME PERIOD	CALENDAR YEAR																							
	1982				1983				1984				1985				1986				1987			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
P.E.R./STUDIES																								
DESIGN, CONSTRUCTION																								
ACTIVATION, CHECKOUT & OTHER																								

P.E.R. _._._._._._ DESIGN ---------- CONSTRUCTION ————————

MODE OF ACCOMPLISHMENT:

The project will be carried out in the conventional design, advertise, and build procurement mode. NASA will contract with an A/E for final design. For this, $392,000 is included in the design estimate. All supervision, inspection, and engineering services required during construction will be accomplished by construction management branch.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FACILITIES PROJECT FINANCIAL SCHEDULE

(See Instructions on Reverse)

DATE	IDENTIFICATION NO.
Nov. 1, 1982	85LSAA

INSTALLATION	PROGRAM OFFICE	FISCAL YEAR	PROPOSED BUDGET YEAR
Lewis Research Center	OAST/OER	1983	1985

PROJECT TITLE	EST. COST OF DESIGN	EST. CONSTR. COST
Construction of Visitor Information Center	$294,000	$4,900,000

LINE NO.	ACTIVITY	PRIOR YEARS a.		FY 83 b.		FY 84 c.		FY 85 d.		FY 86 e.		FY ____ f.		FY ____ g.		CARRY-OVER h.	
		OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY	OBL	OLY
1.	Preliminary Engineering Report			.098	.098												
2.	Final Design					.294	.294										
3.	Construction							4.900	2.45		2.45						
TOTAL ▶	OBL 5.292			.098		.294		4.900									
	OLY 5.292				.098		.294		2.45		2.45						

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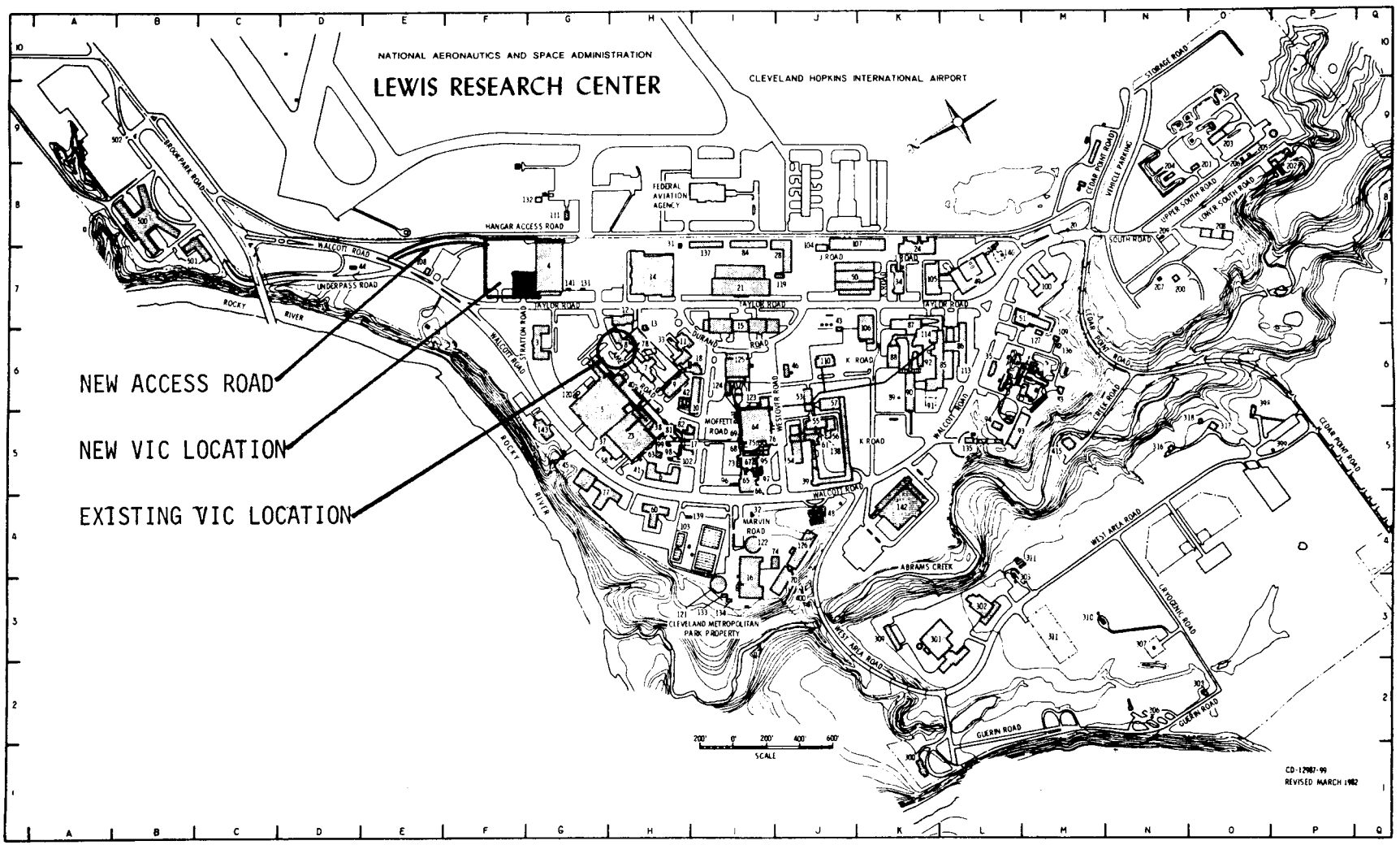
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCTION OF VISITOR INFORMATION CENTER



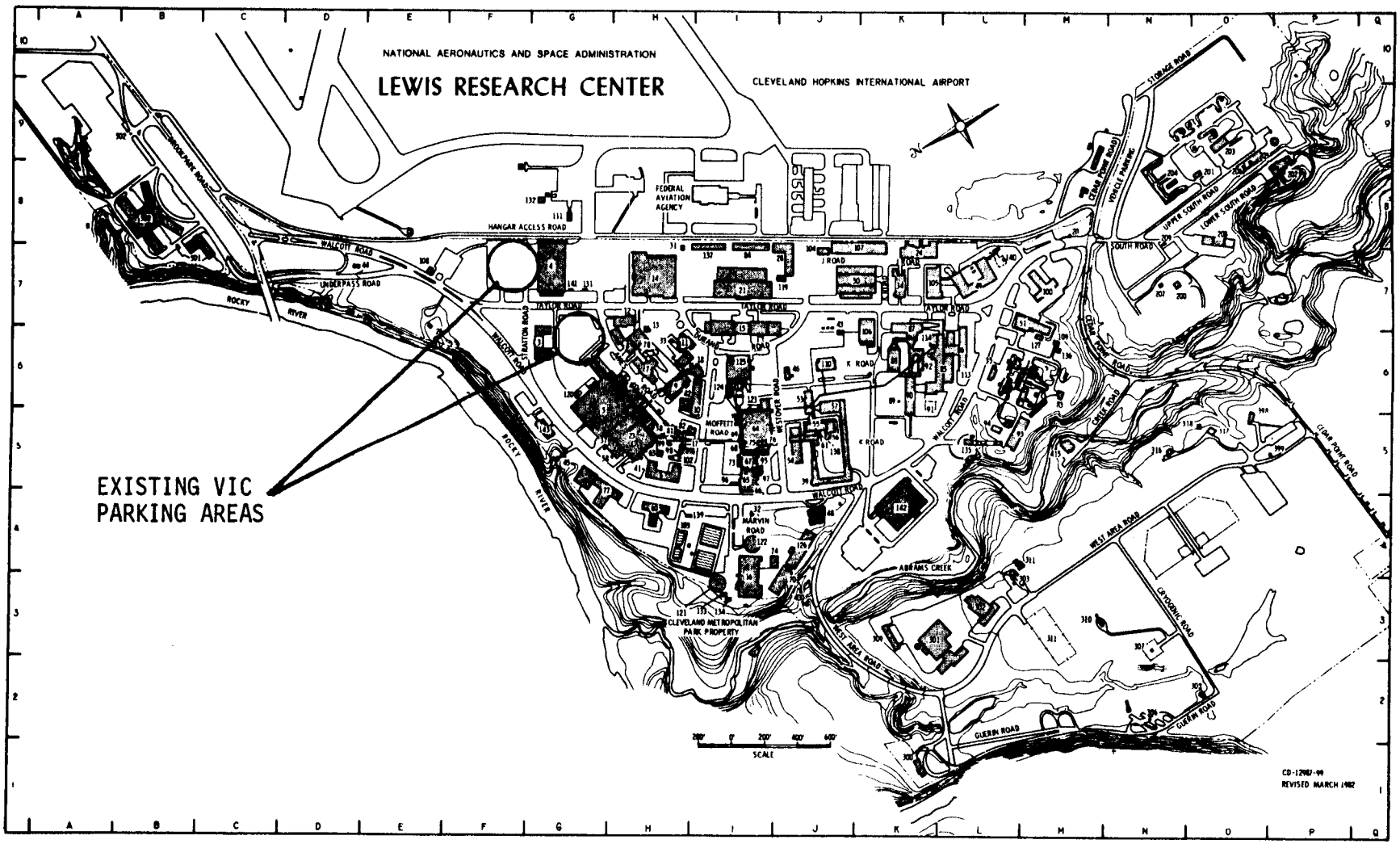
LOCATION PLAN

FIGURE 1

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

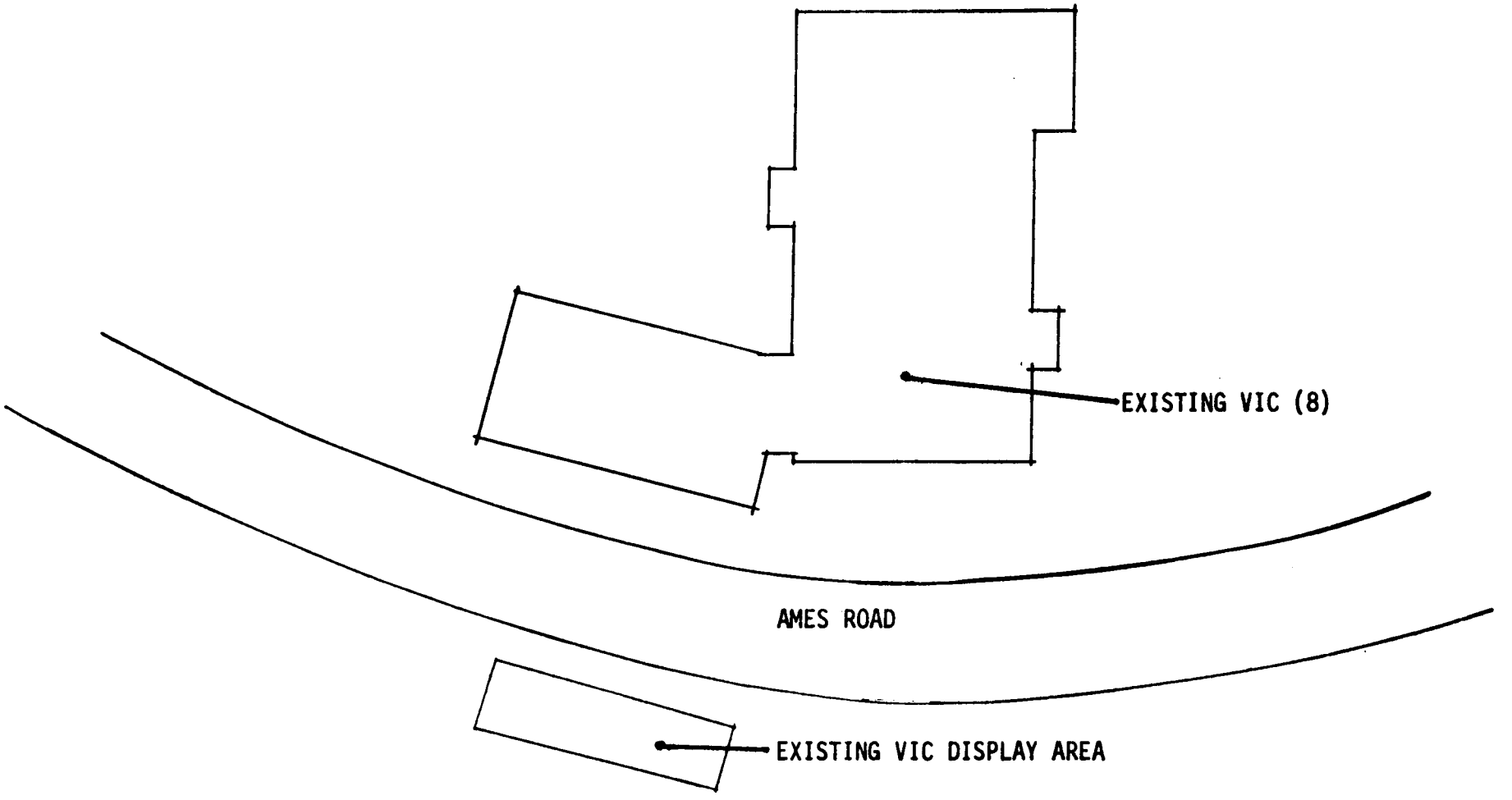
CONSTRUCTION OF VISITOR INFORMATION CENTER



EXISTING PARKING AREAS

FIGURE 2

LEWIS RESEARCH CENTER
FY 1985 CoF ESTIMATES
CONSTRUCTION OF VISITOR INFORMATION CENTER

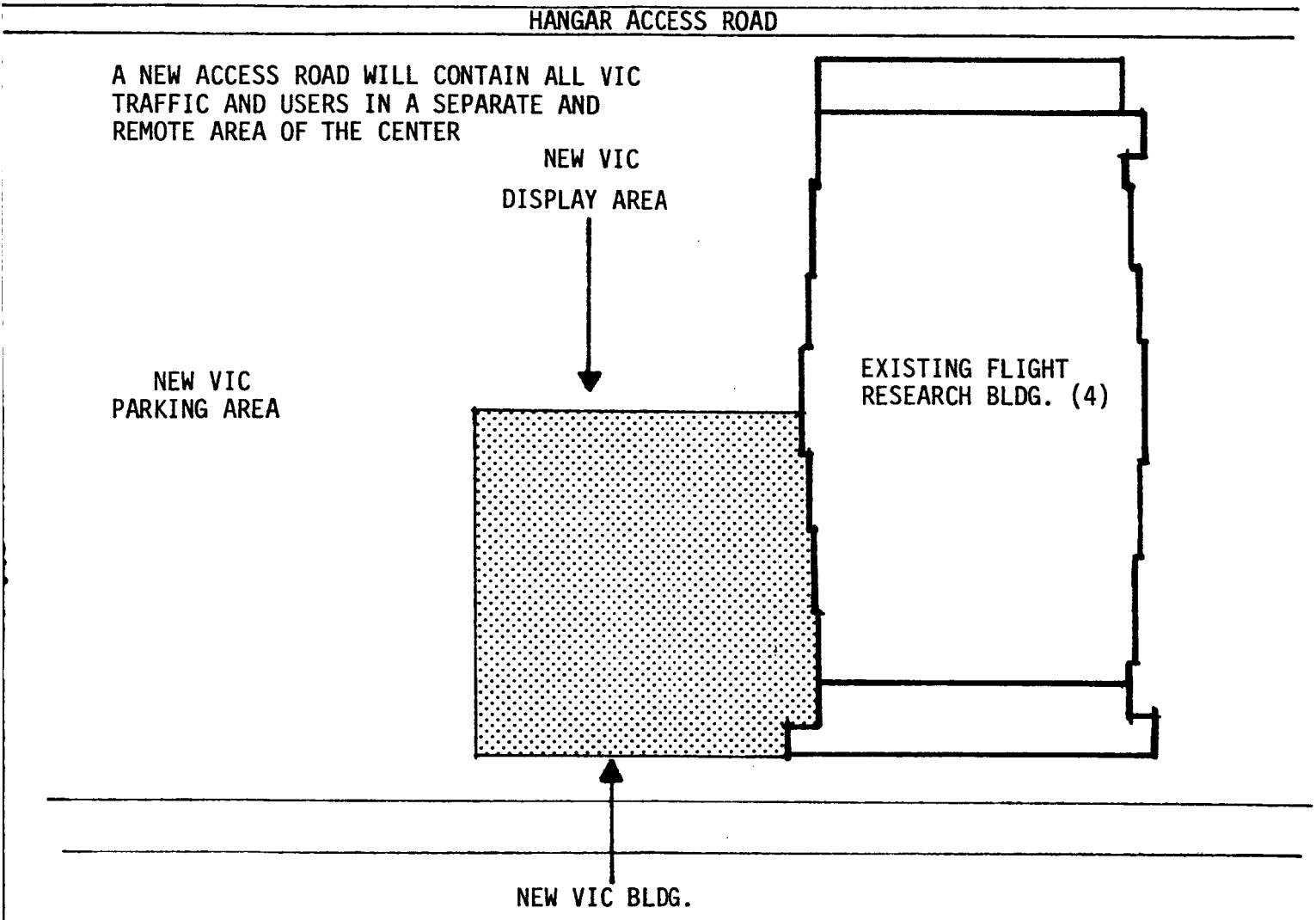


EXISTING VIC SITE PLAN
FIGURE 3

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCTION OF VISITOR INFORMATION CENTER



NEW VIC SITE PLAN

FIGURE 4

NASA National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LSAA

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Construction of Visitor Information Center	LeRC/OAST/OER	Nov. 1, 1982	C

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$4,900,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
[X] YES (Identify) [ ] NONE	$98,000	$294,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Critical	Construction

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will provide a 24,000 sq. ft. Visitor Information Center. Information about NASA and its many contributions to the technological advancement of the Nation through scientific research will be on display in exhibition areas and discussed in lecture and meeting rooms. The Center will arrange to accommodate visitors comfortably and efficiently. Provisions for handling, preparation and storage of exhibitions and materials are included. Site improvements for this project include demolition of existing parking areas and construction of new parking areas. Surfaces for exterior displays shall be provided as required. Vehicular and pedestrian circulation patterns and access routes will be provided. The impact upon NASA security and safety will be minimal. A fire wall will be provided for physical separation between the existing Hangar Building (4) and the new VIC Building. The VIC will be located adjacent to Cleveland Hopkins Airport and be in close proximity to four major interstate highways for maximum access by the public.

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X ; c. Environmental impact See text . (continued)

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

Providing quality educational programs is an essential function of the Visitor Information Center. Presently the Center receives 100,000 visitors per year and provides teacher resources for six states. Space limitations interfere with our ability to operate effectively. This project will satisfy the immediate and future need to inform the people of the Midwest of NASA's accomplishments and interests.

SCHEDULE DATES				
DESIGN	PER	START	1-83	
		COMPL	7-83	
	FINAL	START	1-84	
		COMPL	10-84	
CONSTRUCTION		AWARD	1-85	
		COMPL	12-86	
REQUIRED OPERATIONAL				

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX.(c)_____.)

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1SP

85LSAA

Construction of Visitor Information Center

SCOPE/DESCRIPTION - continued

The construction will incorporate and showcase state-of-the-art energy conservation systems.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST/OER	DATE Nov. 1, 1982
PROJECT TITLE Construction of Visitor Information Center	SUBMISSION/REVISION C PROJECT CODE 85LSAA
BASIS OF COST ESTIMATE In-house conceptual estimate (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$3,230,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	1,034,000	32%
3. SUBTOTAL *(1 + 2)*	$4,264,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	426,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*	210,000	5%
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$4,900,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/year to midpoint of construction (9/82 to 12/85) $(1.09)^{3.25} = 1.32$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS				
	NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/ AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 98,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	294,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$392,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE

2. PER *(Amount)* $98,000

3. DESIGN *(Amount)* $294,000

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST/OER	85LSAA	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
	Site Development	LS				227,000	330,000
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Architectural/Structural	LS				1,453,000	2,200,000
	Mechanical	LS				1,033,000	1,600,000
	Electrical	LS				517,000	770.000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: In-house conceptural estimate (9/82)		7.			TOTALS ▶	$3,230,000	$4,900,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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GPO 870 384
1SP

REHABILITATION AND MODIFICATION PROGRAM

FY 1984

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program, Installation Office or Center)
FY 1985 REHAB & MOD PROGRAM
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION		ESTIMATED COST Budget Estimate	PER	Final Design	Studies Support ~~Fin. Design~~	
1.	85-1RM	85LRAZ	Modification of Various Buildings to Provide Smoke Detection Systems	310,000	6,200	18,600	0	
2.	85-2RM	85LRBZ	Modification for Life Safety/ Handicapped Requirements to D.E.B. (500)	650,000	13,000	39,000	0	
3.	85-3RM	85LRCZ	Modification to Computer Power System at the Research Analysis Center, Building (142)	200,000	4,000	12,000	0	
4.	85-4RM	85LRDZ	Modification for Rocket Turbopump Testing, Rocket Engine Test Facility (202)	420,000	8,400	25,200	0	
5.	85-5RM	85LREZ	Rehab & Mod for Employees Service Center, Utilities Building (15)	450,000	9,000	27,000	0	
6.	85-6RM	85LRFZ	Rehab & Mod of Interior - West Offices - Engineering and Supply Building (21)	630,000	12,600	37,800	0	
7.	85-7RM	85LRGZ	Rehab & Mod of the ERB Room (Cafeteria), Engine Research Building (5)	300,000	6,000	18,000	0	
8.	85-8RM	85LRHZ	Rehabilitation of Emission Control System at the Steam Plant (12)	460,000	7,300	27,600	7,800	
			TOTAL ▶					

NASA FORM 1514 DEC 73

NASA-HQ

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program, Installation Office or Center)
FY 1985 REHAB & MOD PROGRAM
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST Budget Estimate	PER	Final Design	Studies Support ~~Fin. Design~~	
9.	85-9RM	85LRIZ Rehabilitation of 10x10 SWT Office Building (86), Interior and Exterior	630,000	13,000	38,000	0	
		TOTAL ▶	4,050,000	79,500	243,200	7,800	

NASA FORM 1514 DEC 73

NASA-HQ

BUILDING "SYSTEM" MODIFICATION PROJECT

Modification of Various Buildings
to Provide Smoke Detection Systems
Institutional

$310,000

This project provides for the installation of smoke detection systems in Materials and Structures Laboratories Buildings 49 and 140, in the 8x6 SWT Complex consisting of buildings 53, 54, 55, 56, 57, 61 and 138, and in the 10x10 SWT Complex consisting of Buildings 85, 86, 87, 90 and 113 for early warning fire detection.

Detector heads will be installed in all corridors as well as mechanical and electrical equipment rooms. Associated control and transmitter equipment, graphic display panels, alarm bells and standby emergency power supplies, together with the necessary conduit and wire will also be installed to provide complete smoke detection systems. Alarm signals will be sounded in the buildings and will also be connected to the existing Central Station Protective Signal System to alert the Lewis Fire Station.

The buildings do not have enclosed staircases as required by the Life Safety Code and are not normally occupied after normal working hours or on weekends. Thus, a fire could spread rapidly causing loss of life and extensive damage. The installation of smoke detection systems in these buildings will provide early warning of fires in the incipient stages thereby enhancing life safety and reducing fire and smoke damage.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LRAZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modification of Various Buildings to Provide Smoke Detection Systems	LeRC/OAST	Nov. 1, 1982	D

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$310,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$6,200	$18,600

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Safety	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

Smoke detection systems will be installed in Materials and Structures Laboratories Buildings 49 and 140, in the 8x6 SWT Complex consisting of Buildings 53, 54, 55, 56, 57, 61 and 138, and in the 10x10 SWT Complex consisting of Buildings 85, 86, 87, 88, 90 and 113 to provide early warning fire detection. Detector heads, associated control and transmitter panels, display panels and emergency power backup, together with necessary conduit and wire will be installed in the buildings. Alarm signals from the buildings will be connected to the existing Central Station Protective Signaling System to alert the Lewis Fire Station.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None _____ ; b. ~~Decrease~~/Increase X ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The buildings do not have enclosed staircases as required by the Life Safety Code and none of the buildings are occupied after normal working hours or on weekends. Thus a fire, either smoldering or active, could spread rapidly causing loss of life and extensive damage. The installation of a smoke detection system in these buildings will provide early warning of fires in the incipient stages thereby enhancing life safety and reducing fire and smoke damage.

SCHEDULE DATES

DESIGN	PER	START	1-83
		COMPL	6-83
	FINAL	START	1-84
		COMPL	9-84
CONSTRUCTION		AWARD	1-85
		COMPL	2-86
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213:(b)Send copy to NASA Hq, Code BX:(c)_____.)

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1RM

NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modification of Various Buildings to Provide Smoke Detection Systems	SUBMISSION/REVISION D PROJECT CODE 85LRAZ
BASIS OF COST ESTIMATE Recent A-E Cost Estimate (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$200,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	82,000	41%
3. SUBTOTAL *(1 + 2)*	$282,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	28,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$310,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost Escalation @ 9% per year from 9/82 to midpoint of construction 8/85 $(1.09)^3 = 1.41$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 6,200
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	18,600
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$24,800

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$6,200	$18,600

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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1RM

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRAZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

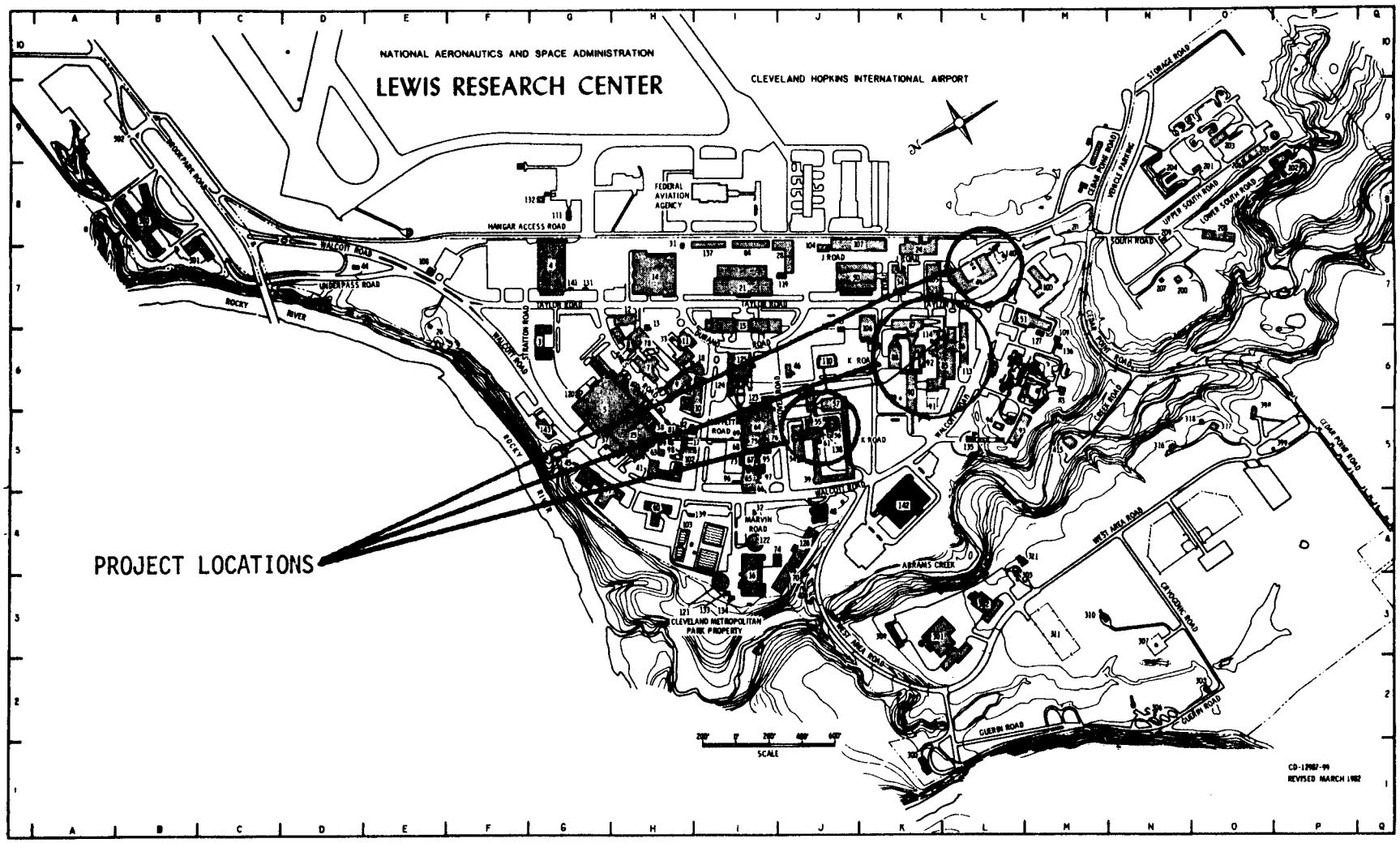
	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Smoke Detection Systems:						
	Materials & Structures Labs.	LS	1	43,900		43,900	68,000
	Buildings 49 and 140						
	8x6 SWT Complex Buildings 53, 54,	LS	1	46,400		46,400	72,000
	55, 56, 57, 61 and 138						
	10x10 SWT Complex Buildings 85, 86,	LS	1	109,700		109,700	170,000
	87, 88, 90 and 113						
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: Recent A-E Cost Estimates: (9/82)			7.		TOTALS ▶	$200,000	$310,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION OF VARIOUS BUILDINGS TO PROVIDE SMOKE DETECTION SYSTEMS



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" MODIFICATION PROJECT

Modifications for Life Safety/Handicapped Requirements to D.E.B. (500) Institutional

$650,000

This project consists of modifications to DEB No. 500 for life safety and handicapped requirements. The building is "K" shaped, 3 floors plus basement with 162,229 S.F. (15,071 S.M.) of floor space. Work consists of the following: Provide one hour fire rated stairwell enclosures; ceiling modifications; new emergency doors, exits, and lighting for 3 floors plus basement areas; and provide toilet room renovations to meet handicapped requirements (basement and first floor only).

NASA has established policies and long range goals to insure fire safety in buildings. This project will bring Building No. 500 into compliance with OSHA (29 C/FR Part 1910) and NFPA Life Safety Code on an equivalency basis. NASA has also established that all buildings accessible to the public shall be designed for the physically handicapped. Since parts of the DEB (Bldg. 500) are accessible to the public, handicapped provisions are included in this project and are in accordance with the Architectural Transportation Barrier Compliance Board - Minimum Guidelines and Recruitment for Accessible Design (36C FR Part 1190).

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LRBZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modifications for Life Safety/Handicapped Requirements to D.E.B. (500)	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$650,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$13,000	$39,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	OSHA Related	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project _____

SCOPE DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of modifications to DEB No. 500 for life safety and handicapped requirements. The building is "K" shaped, 3 floors plus basement with 162,229 S.F. (15,071 S.M.) of floor space. Work consists of the following: provide one hour fire rated stairwell enclosures; ceiling modifications; new emergency doors, exits, and lighting for 3 floors plus basement areas; and provide toilet room renovations to meet handicapped requirements (basement and first floor only).

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

NASA has established policies and long range goals to insure fire safety in buildings. This project will bring Building No. 500 into compliance with OSHA (29 C/FR Part 1910) and NFPA Life Safety Code on an equivalency basis. NASA has also established that all buildings accessible to the public shall be designed for the physically handicapped. Since parts of the DEB (Bldg. 500) are accessible to the public, handicapped provisions are included in this project and are in accordance with the Architectural Transportation Barrier Compliance Board - Minimum Guidelines and Recruitment for Accessible Design (36C FR Part 1190).

SCHEDULE DATES				
DESIGN	PER	START	1-83	
		COMPL	6-83	
	FINAL	START	1-84	
		COMPL	9-84	
CONSTRUCTION		AWARD	1-85	
		COMPL	12-85	
REQUIRED OPERATIONAL				

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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2RM

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modifications for Life Safety/Handicapped Requirements to D.E.B. (500)	SUBMISSION/REVISION A PROJECT CODE 85LRBZ
BASIS OF COST ESTIMATE AE conceptual study	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$460,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	130,000	29%
3. SUBTOTAL *(1 + 2)*	$590,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	60,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$650,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost escalation from 8/82 to 8/85 midpoint of construction @ 9%/yr $(1.09)^3 = 1.29$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$13,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	39,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$52,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$13,000	$39,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

2RM

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRBZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

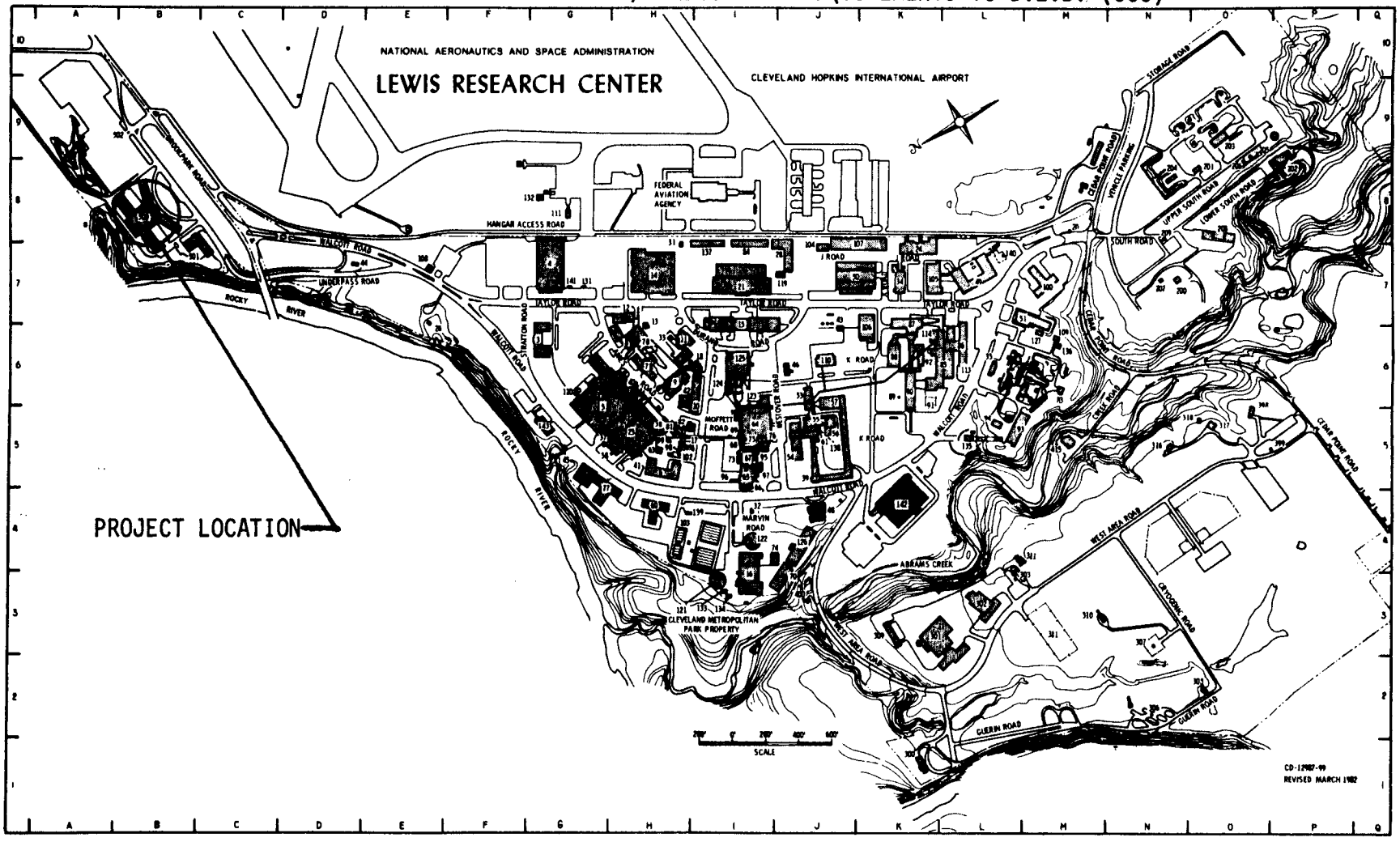
DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE (Summary)						
Architectural - Life Safety Requirements						
Enclose Center Stairwell	Ea	2	65,000		130,000	
New Exit at Basement	LS	1	30,000		30,000	
Enclose Basement Stair	LS	1	20,000		20,000	
Enclose Stairwells (Wings)	Ea	4	25,000		100,000	
New Exit at 1st Floor	LS	1	20,000		20,000	
						423,000
Architectural - Handicapped Requirements						
Handrail Extensions	Ea	6	2,000		12,000	
						17,000
Electrical - Life Safety Requirements						
Emergency Lighting	Ea	35	600		22,000	
Emergency Exit Signs	Ea	25	500		13,000	
						50,000
Electrical - Handicapped Requirements						
Telephones/Electric Water Coolers	LS	1	5,000		5,000	
						7,000
Mechanical - Handicapped Requirements						
Toilet Rooms - 2 Floors	Ea	4	27,000		108,000	
						153,000
6. SOURCE OF COST DATA R.S. Means Building Cost Data - 1982		7.		TOTALS ▶	$460,000	$650,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATIONS FOR LIFE SAFETY/HANDICAPPED REQUIREMENTS TO D.E.B. (500)



LOCATION PLAN

FIGURE 1

2RM

BUILDING "SYSTEM" MODIFICATION PROJECT

Modification to Computer Power System at the Research Analysis Center, Building (142) Institutional

$200,000

This project provides for the addition of a new 150 KVA UPS and modifications to existing electric supply systems for connections of the new UPS. It will include a new battery plant and static transfer switch with provisions to bypass the UPS in the event of malfunction and for performance of routine maintenance. The battery plant will be located in the basement area of the Electrical Distribution Room (EDR) Number 1 and the UPS with static switch will be located on the operating floor of EDR-1. The UPS will provide uninterruptible, regulated, disturbance free power to the existing on-line data acquisition systems. These data acquisition systems are presently powered by an existing 225 KVA, 60 Hertz UPS which was originally installed to provide power to the IBM 370/3033 large scale on-line digital computer. The additional load imposed by the data acquisition systems has loaded the UPS to 95 percent of its rated capacity, accounting for 40 percent of the total load. Planned future expansions for FY'83 and FY'84 in both the IBM 370/3033 Computer and in the data acquisition systems will exceed the full load capability of the existing UPS by approximately 45 percent. Providing a separate UPS for the data acquisition systems will off-load the existing UPS and will permit the necessary expansion requirements in both areas through FY'87.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LRCZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modification to Computer Power System at the Research Analysis Center, Building (142)	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$200,000

CATEGORY	JUSTIFICATION	WORK
	Instit. Critical	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$4,000	$12,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

SCOPE DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will provide an uninterruptible power system for the on-line data acquisition systems; including Escort II & III, Central Analog, Data Collector and Tradar. The uninterruptible power system consists of a battery charger/rectifier, a 5 minute battery plant, an inverter and an output bypass service. This system will use approximately 200 square feet of existing floor space in the RAC Building, Electrical Distribution Room (EDR) Number 1 Operating area and basement. The project includes minor building modifications for installation of the new UPS.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~ XXXXXX Increase X ; c. Environmental impact See text.

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The data acquisition systems are presently powered by the 60 Hertz Uninterruptible Power Supply (UPS) originally dedicated to the IBM 370/3033 large scale on-line digital computer. The present load on the UPS system is 95% of full capacity. The data acquisition systems represent 40% of this load. Planned future expansions for FY'83 and FY'84, in both the IBM 370/3033 computer and in the data acquisition systems, will exceed the full load capability of the existing UPS system by approximately 45%. Providing a separate UPS system for the data acquisition systems will off-load the existing UPS system and will permit the necessary expansion requirements in both areas through FY'87.

SCHEDULE DATES				
DESIGN	PER	START	1-83	
		COMPL	6-83	
	FINAL	START	1-84	
		COMPL	6-84	
CONSTRUCTION		AWARD	1-85	
		COMPL	10-85	
REQUIRED OPERATIONAL			12-85	

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq. Code BX; (c) _____.)

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NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modification to Computer Power System at the Research Analysis Center, Building (142)	SUBMISSION/REVISION A PROJECT CODE 85LRCZ
BASIS OF COST ESTIMATE In-house cost estimate 9/82	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$144,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	38,000	26%
3. SUBTOTAL *(1 + 2)*	$182,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	18,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$200,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost escalation @ 9% per year from 10/82 to 6/85; $(1.09)^{2.67} = 1.26$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 4,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	12,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$16,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$4,000	$12,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRCZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Uninterruptible Power Supply System	Pkg.	1	116,000		116,000	161,000
UPS Installation	Lot	1	26,000		26,000	36,000
Relocation of Existing Electrical Equipment in EDR-1	Lot	1	2,000		2,000	3,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*						
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA In-house cost estimate Based on Mfr's catalog data 9/82		7.		TOTALS ▶	$144,000	$200,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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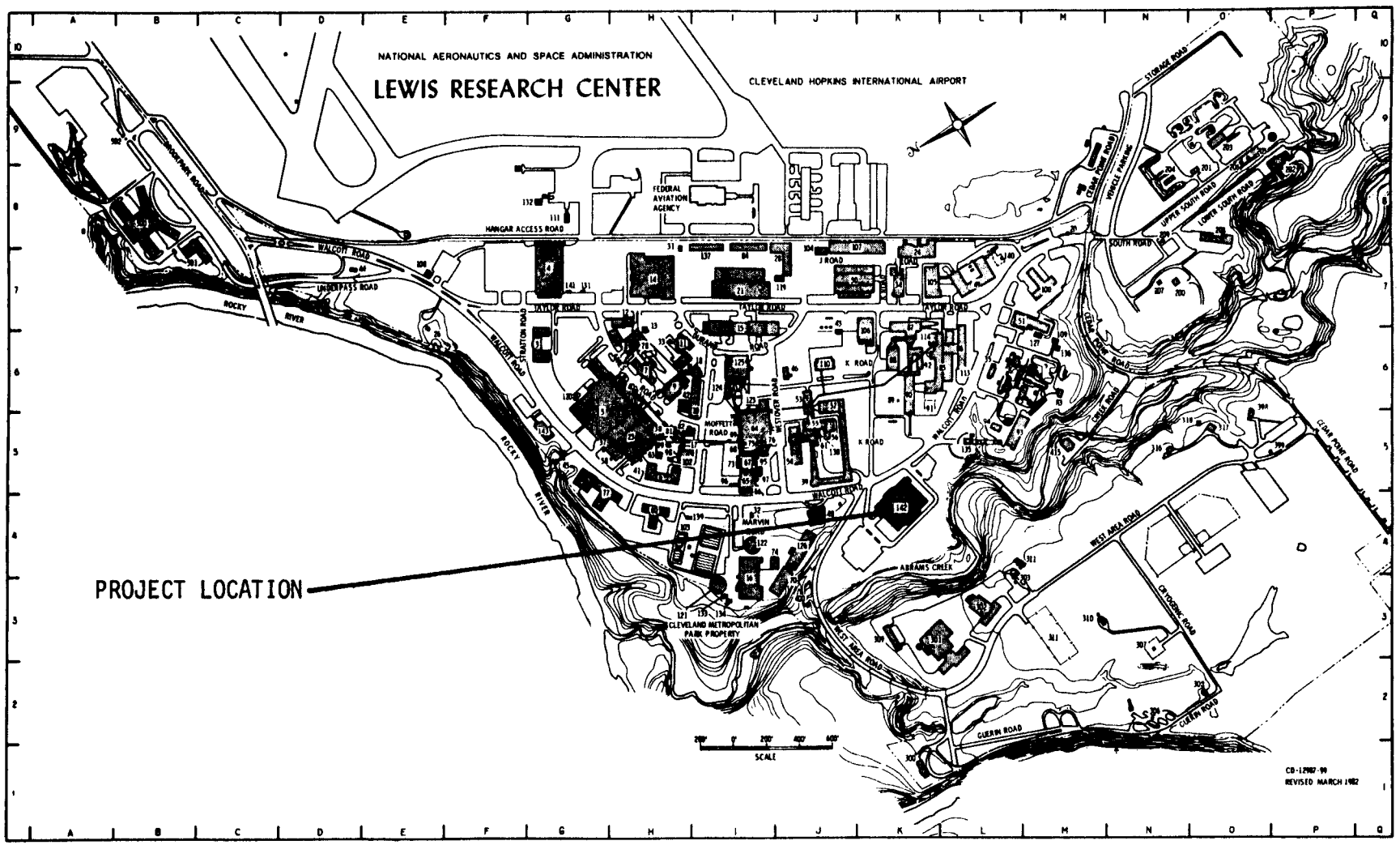
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION TO COMPUTER POWER SYSTEM AT THE RESEARCH ANALYSIS CENTER, BUILDING (142)



LOCATION PLAN

FIGURE 1

BUILDING REHABILITATION/MODIFICATION PROJECT

Modification for Rocket Turbopump Testing,
Rocket Engine Test Facility (202)
Programmatic

$420,000

This project consists of modifications to the RETF complex for Rocket Turbopump Testing. Cryogenic propellants will be supplied to the building in approximately 1000 feet (305 meters) of vacuum jacketed piping of sizes varying from 1 in. to 3 in. dia. (2.5 to 7.6 cm). Service utilities such as service air, domestic water, hydraulic oil, and CO_2 will be supplied to the building in approximately 600 feet (180 meters) of piping varying in size from 3/4 to 2 in. (1.9 to 5.1 cm). A new test building will be added that is suitable for a gaseous hydrogen environment. The 20' x 20' building will be fitted with roll-up doors on each side. The building will be provided with a remote operated TV camera, combustible gas detection system and explosion proof lighting. The project will also include cable and conduit system for instrumentation and for power to valves and components.

In FY 1981 three (3) contractors were selected by LeRC to identify, screen, and propose advanced technology concepts which would benefit future orbit-transfer-vehicle (OTV) rocket engines. These procurements are the first phase of the NASA-OAST program to provide OTV rocket engine technology readiness in the 1990-1995 time frame. Future phases of the program consist of experimental evaluation of proposed contractor specific and generic technologies. Turbomachinery is a critical area of these future engine systems and LeRC does not currently have a facility capable of testing cryogenic turbopumps. The limited testing capability that exists within the aerospace industry will be utilized for those technologies unique to the contractor's proposed specific engine systems. Thus the proposed turbopump research test stand at LeRC will be utilized in the evaluation of generic technologies, e.g., verification of pump and turbine performance models. The OTV engine technology is an approved OAST program and funded under RTOP 506-52-42; "Advanced Orbital Transfer Propulsion". Subcomponent technology programs were started in FY 1982. An engine configuration will be selected in FY 1985 to allow critical, full-scale component technology programs to be initiated. The proposed test stand will be utilized during this critical

component technology phase of the program. With an RTOP target of technology ready in FY 1990, it is imperative that funding be provided no later than FY 1985 to provide this facility to evaluate new turbopump systems and allow technology to proceed confidently into an OTV engine development program.

NASA National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LRDZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Modification for Rocket Turbopump Testing, Rocket Engine Test Facility (202)	LeRC/OAST	Nov. 1, 1982	B

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$420,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$8,400	$25,200

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Program Related	Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of modifications to the RETF complex for Rocket Turbopump Testing. Cryogenic propellants will be supplied to the building in approximately 1000 feet (305 meters) of vacuum jacketed piping of sizes varying from 1 in. to 3 in. dia. (2.5 to 7.6 cm). Service utilities such as service air, domestic water, hydraulic oil, and CO_2 will be supplied to the builidng in approximately 600 feet (180 meters) of piping varying in size from 3/4 to 2 in. (1.9 to 5.1 cm). A new test building will be added that is suitable for a gaseous hydrogen environment. The 20' x 20' building will be fitted with roll-up doors on each side. The building will be provided with a remote operated TV camera, combustible gas detection system and explosion proof lighting. The project will also include cable and conduit system for instrumentation and for power to valves and components.

(continued)

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X; c. Environmental impact See text.

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

In FY 1981 three (3) contractors were selected by LeRC to identify, screen, and propose advanced technology concepts which would benefit future orbit-transfer-vehicle (OTV) rocket engines. These procurements are the first phase of the NASA-OAST program to provide OTV rocket engine technology readiness in the 1990-1995 time frame. Future phases of the program consist of experimental evaluation of proposed contractor specific and generic technologies. Turbomachinery is a critical area of these future engine systems and LeRC does not currently have a facility capable of testing cryogenic turbopumps. The limited testing capability that exists within the aerospace industry will be utilized for those (cont'd)

SCHEDULE DATES				PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
DESIGN	PER	START	1-83	SUBMITTED BY ▶	John M. Klineberg, Deputy Director	10/19/82
		COMPL	6-83	CONCURRENCE BY ▶		
	FINAL	START	1-84			
		COMPL	10-84			
CONSTRUCTION		AWARD	1-85	BX CONCURRENCE ▶		
		COMPL	12-85	APPROVED BY ▶		
REQUIRED OPERATIONAL						

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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85LRDZ

Modification for Rocket Turbopump Testing,
Rocket Engine Test Facility (202)

SCOPE/DESCRIPTION (continued)

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

BASIS OF NEED (continued)

technologies unique to the contractor's proposed specific engine systems. Thus the proposed turbopump research test stand at LeRC will be utilized in the evaluation of generic technologies, e.g., verification of pump and turbine performance models. The OTV engine technology is an approved OAST program and funded under RTOP 506-52-42; "Advanced Orbital Transfer Propulsion". Subcomponent technology programs were started in FY 1982. An engine configuration will be selected in FY 1985 to allow critical, full-scale component technology programs to be initiated. The proposed test stand will be utilized during this critical component technology phase of the program. With an RTOP target of technology ready in FY 1990, it is imperative that funding be provided no later than FY 1985 to provide this facility to evaluate new turbopump systems and allow technology to proceed confidently into an OTV engine development program.

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Modification for Rocket Turbopump Testing, Rocket Engine Test Facility (202)	SUBMISSION/REVISION B PROJECT CODE 85LRDZ
BASIS OF COST ESTIMATE Concept in-house cost estimate (12/81)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$283,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	99,000	35%
3. SUBTOTAL *(1 + 2)*	$382,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	38,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$420,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

9%/year escalation from (12/81) to midpoint of construction (6/85) $(1.09)^{3.5} = 1.35$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 8,400
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	25,200
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$33,600

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$8,400	$25,200

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRDZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

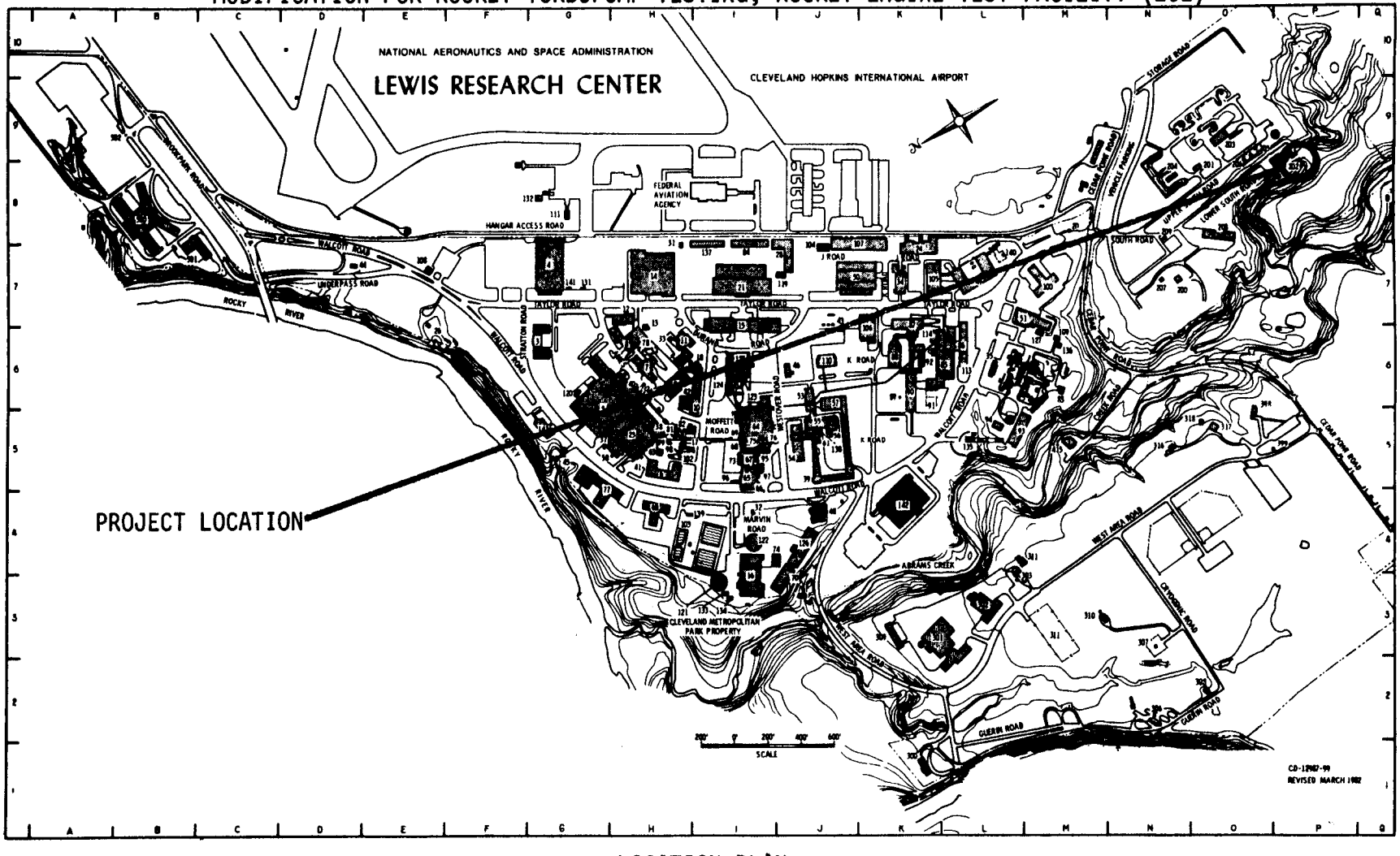
	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*	Utility Service Piping	LS	1	16,000		16,000	24,000
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Test Building	S.F.	400	52.50		21,000	31,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*	Cryogenic Supply Piping	LS	1	108,000		108,000	160,000
	Electrical & Instrumentation	LS	1	138,000		138,000	205,000
6. SOURCE OF COST DATA: In-house data (12/81)			7.		TOTALS ▶	$283,000	$420,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

MODIFICATION FOR ROCKET TURBOPUMP TESTING, ROCKET ENGINE TEST FACILITY (202)



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" REHABILITATION/MODIFICATION PROJECT

Rehabilitation and Modification for Employees
Service Center, Utilities Building (15)
Institutional

$450,000

This project consists of the modification of approximately 14000 sq. ft. (1300 sq. m) of the south wing of the Utilities Building (15). This includes installation of partitions and acoustical ceilings, replacement of floor covering and modification of HVAC, plumbing, lighting, power and communication systems.

Several employee services (Medical Service, Credit Union, Insurance Office, and Union Offices) require additional and/or improved space. Concentrating these services in Building 15 provides a central location and more suitable quarters for each. This area was recently vacated by the Carpenter Shop and the Wood Model Shop. It is a low bay, steel frame building with brick exterior. It is easily converted to this new use. Medical Services presently occupies space in Building 5, a congested, prime research facility. Relocation of the Medical Services will provide additional area for research needs and will provide a location which is more accessible for both personnel and for ambulance service. The Century Federal Credit Union presently occupies 860 sq. ft. (86 sq. m) in Building 106. Their increased business requires about twice this area, which cannot be provided in their present location. Relocation of the Insurance Office will make it more easily accessible to handicapped. Union Office will be relocated to this more central location, freeing their present location for other more suitable uses.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LREZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Rehabilitation and Modification for Employees Service Center, Utilities Building (15)	LeRC/OAST	Nov. 1, 1982	B

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$450,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$9,000	$27,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Rehabilitation & Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of the modification of approximately 14000 sq. ft. (1300 sq. m) of the south wing of the Utilities Building (15). This includes installation of partitions and acoustical ceilings, replacement of floor covering and modification of HVAC, plumbing, lighting, power and communication systems.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease Increase _____ : c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

Several employee services (Medical Service, Credit Union, Insurance Office, and Union Offices) require additional and/or improved space. Concentrating these services in Building 15 provides a central location and more suitable quarters for each. This area was recently vacated by the Carpenter Shop and the Wood Model Shop. It is a low bay, steel frame building with brick exterior. It is easily converted to this new use.
Medical Services presently occupies space in Building 5, a congested, prime research facility. Relocation of the Medical Services will provide additional area for research needs and will provide a location which is more accessible (cont'd)

SCHEDULE DATES				
DESIGN	PER	START	1-83	
		COMPL	6-83	
	FINAL	START	1-84	
		COMPL	10-84	
CONSTRUCTION		AWARD	1-85	
		COMPL	1-86	
REQUIRED OPERATIONAL				

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg, Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____.)

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85LREZ

Rehabilitation and Modification for Employees
Service Center, Utilities Building (15)

BASIS OF NEED - continued

for both personnel and for ambulance service.

The Century Federal Credit Union presently occupies 860 sq. ft. (80 sq. m) in Building 106. Their increased business requires about twice this area, which cannot be provided in their present location.

Relocation of the Insurance Office will make it more easily accessible to handicapped.

Union Office will be relocated to this more central location, freeing their present location for other more suitable uses.

This planning is coordinated with the Center's Master Facilities Plan.

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Rehabilitation and Modification for Employees Service Center, Utilities Building (15)	SUBMISSION/REVISION B PROJECT CODE 85LREZ
BASIS OF COST ESTIMATE Concept in-house estimate (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$322,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	87,000	27%
3. SUBTOTAL *(1 + 2)*	$409,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	41,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$450,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

9%/yr escalation from (9/82) to midpoint of construction (6/85) $(1.09)^{2.75} = 1.27$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 9,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	27,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$36,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$9,000	$27,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LREZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Architectural/Structural	LS	1	179,000		179,000	250,000
	Mechanical	LS	1	100,000		100,000	140,000
	Electrical	LS	1	43,000		43,000	60,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: Concept in-house estimate (9/82)			7.		TOTALS ▶	$322,000	$450,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

NASA FORM 1510 MAY 80 PREVIOUS EDITIONS ARE OBSOLETE.
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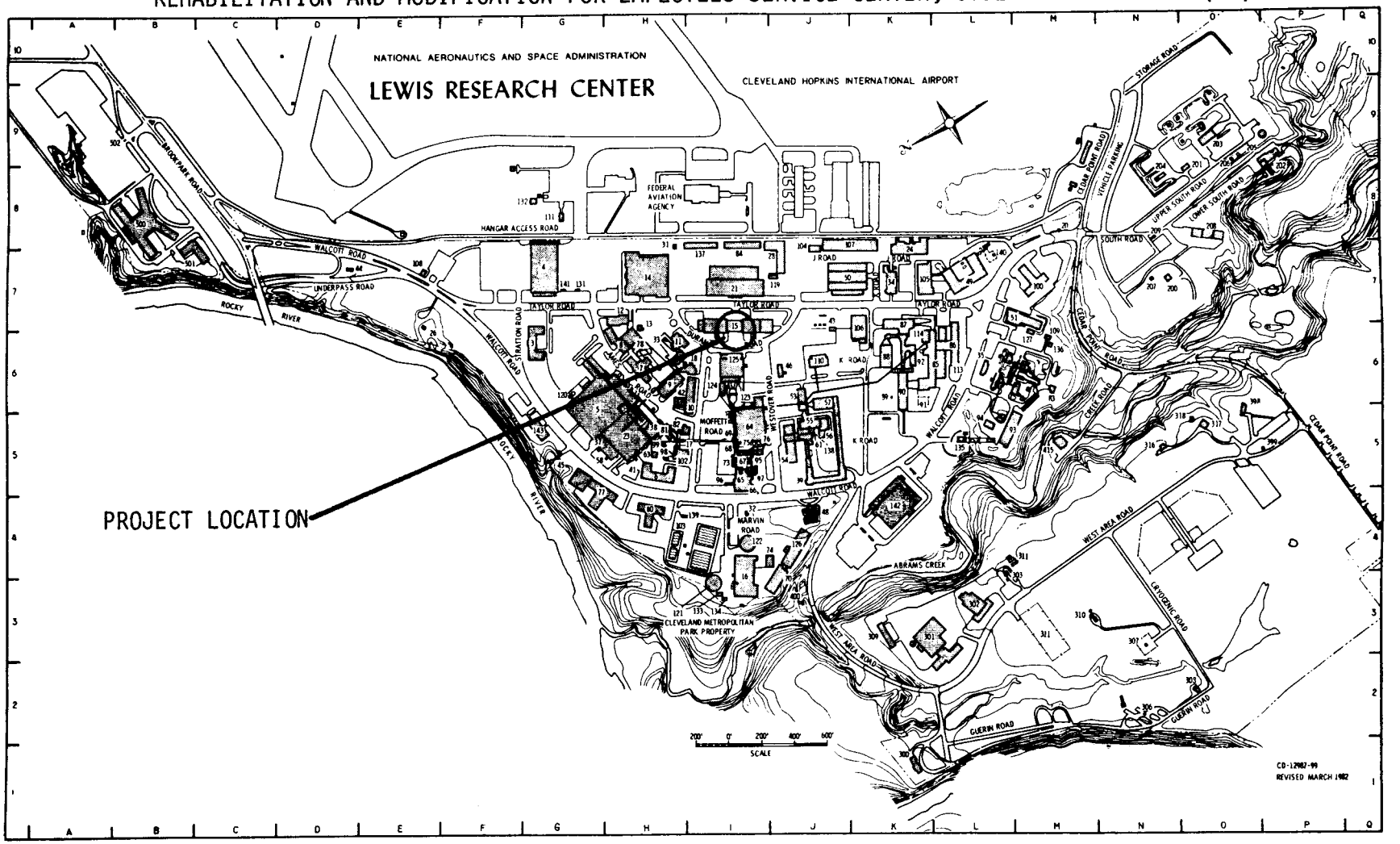
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REHABILITATION AND MODIFICATION FOR EMPLOYEES SERVICE CENTER, UTILITIES BUILDING (15)



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" REHABILITATION/MODIFICATION PROJECT

Rehabilitation and Modification of Interior - West Offices, Engineering and Supply Building (21) Institutional

$630,000

This project consists of the rehabilitation of Building 21 (West Offices) interior. The Engineering and Supply Building has office areas on the east and west sides of a warehouse area. This work is in the offices on the west side of the warehouse. It has a gross area of approximately 29,000 sq. ft. (2694 sq. m.). The work consists of new partitions, ceilings, flooring in 1/2 of first floor office area (8700 sq. ft. 808 sq. m.), also rehab of HVAC system on all of first floor with new piping and duct work. New fan-coil units will be installed on first and second floor. Other work includes: new lighting, communications, power panels, receptacles and smoke detection system, and toilet area modifications to meet handicapped requirements.

The office portion was constructed in 1944. Since then a second floor was constructed over the first floor. Interior rehabilitation is required to correct deteriorated conditions. The existing plumbing and mechanical systems have deteriorated and frequent maintenance is required, and the systems no longer adequately serve the present requirements.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LRFZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Rehabilitation and Modification of Interior - West Office, Engineering and Supply Building (21)	LeRC/OAST	Nov. 1, 1982	D

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$630,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$12,600	$37,800

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Rehabilitation

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of the rehabilitation of Building 21 (West Offices) interior. The Engineering and Supply Building has office areas on the east and west sides of a warehouse area. This work is in the offices on the west side of the warehouse. It has a gross area of approximately 29,000 sq. ft. (2694 sq. m.). The work consists of new partitions, ceilings, flooring in 1/2 of first floor office area (8700 sq. ft. - 808 sq. m.), also rehab of HVAC system on all of first floor with new piping and duct work. New fan-coil units will be installed on first and second floor. Other work includes: new lighting, communications, power panels, receptacles and smoke detection system, and toilet area modifications to meet handicapped requirements.

(continued)

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The office portion was constructed in 1944. Since then a second floor was constructed over the first floor. Interior rehabilitation is required to correct deteriorated conditions. The existing plumbing and mechanical systems have deteriorated and frequent maintenance is required, and the systems no longer adequately serve the present requirements.

SCHEDULE DATES

DESIGN	PER	START	1-83
		COMPL	6-83
	FINAL	START	1-84
		COMPL	10-84
CONSTRUCTION		AWARD	1-85
		COMPL	12-85
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____.)

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85LRFZ

Rehabilitation and Modification of Interior - West
Offices, Engineering and Supply Building (21)

SCOPE/DESCRIPTION - (continued)

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

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Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Rehabilitation and Modification of Interior - West Offices, Engineering and Supply Building (21)	SUBMISSION/REVISION D PROJECT CODE 85LRFZ
BASIS OF COST ESTIMATE Criteria & concepts only (9/80) updated (7/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$445,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	130,000	29.5%
3. SUBTOTAL *(1 + 2)*	$575,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	55,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$630,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

9%/yr escalation from (7/82) to midpoint of construction (7/85) $(1.09)^3 = 1.295$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$12,600
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	37,800
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$50,400

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$12,600	$37,800

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRFZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

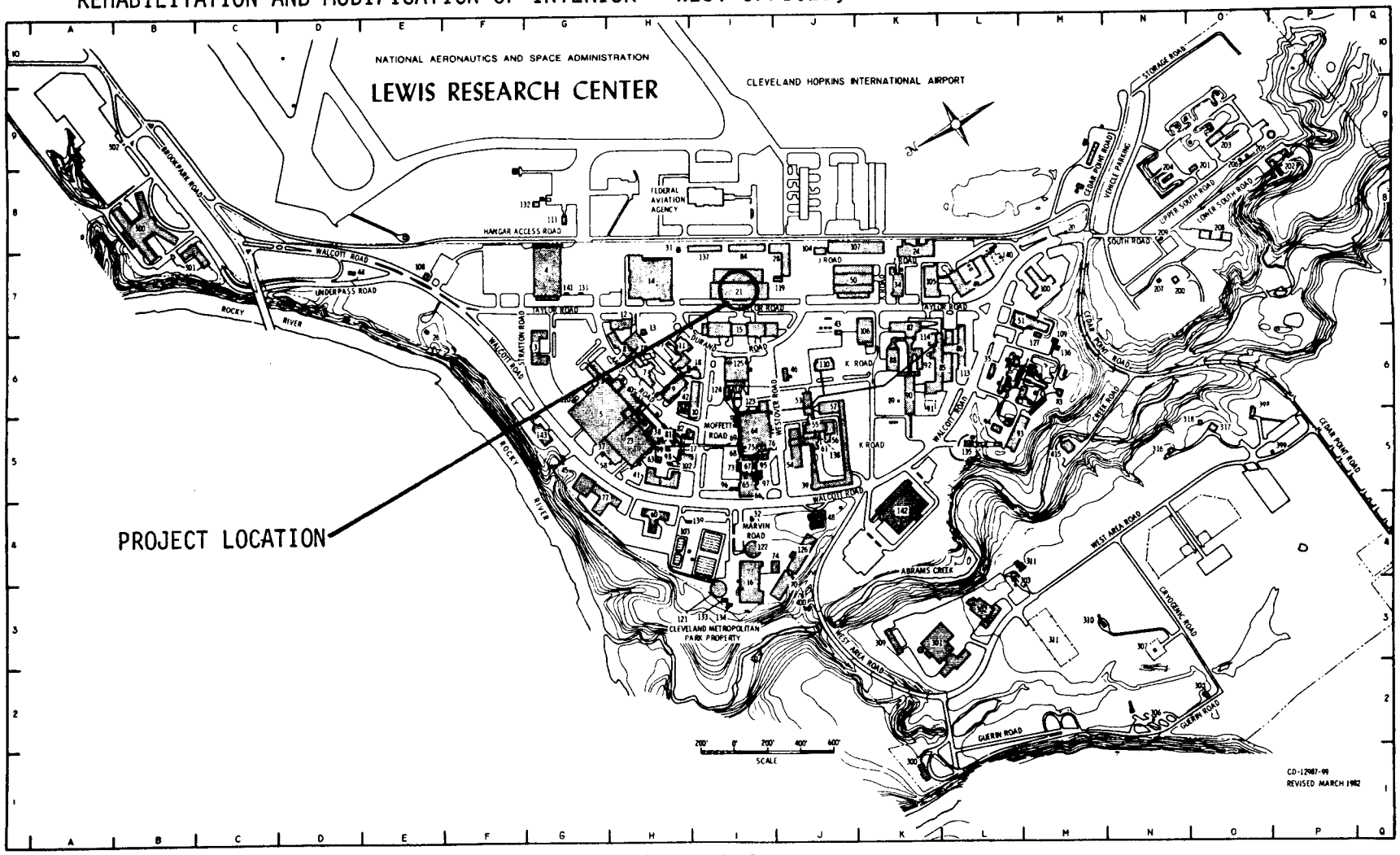
DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Architectural	LS				150,000	210,000
	Mechanical	LS				175,000	250,000
	Electrical	LS				120,000	170,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: AE (VAB) Study (7/82)			7.		TOTALS ▶	$445,000	$630,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REHABILITATION AND MODIFICATION OF INTERIOR - WEST OFFICES, ENGINEERING AND SUPPLY BUILDING (21)



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" REHABILITATION/MODIFICATION PROJECT

Rehabilitation and Modification of the ERB Room (Cafeteria), Engine Research Building (5) Institutional

$300,000

This project will modify the existing cafeteria (ERB Room) and will annex Rooms 100, 100A and 153 to increase the size of the cafeteria to approximately 2500 sq. ft. (232 sq. m.). This area will provide greater seating capacity, an effective and efficient traffic flow in the serving area and through the cashiers' stations. It will also provide for a greater storage capacity, food preparation area, refrigeration, storage and office space. The scope consists of demolition, removal of existing partitions, mechanical and plumbing systems, electrical/lighting and ceiling systems and the installation of new walls, ceilings, flooring, kitchen/cooking equipment, servery equipment, lighting/power, mechanical/plumbing systems and cabinetry.

The ERB Room serves a considerable number of LeRC personnel who do not use the main cafeteria (30% of gross) facilities but the seating is extremely limited. Traffic flow and servery area totally unsuitable for efficient use (time consuming). All of the cooking, refrigeration/freezing, food preparation equipment is obsolete and inadequate (some dangerously deteriorated). There is a severe shortage of kitchen equipment, which handicaps management in meal preparation and the number of meals that should be served. This facility is vital in reducing overload on the main cafeteria (during and after work hours). The existing facility is totally inadequate and inefficient for the service demands.

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Facility Project - Brief Project Document

CONTROL NO. 85LRGZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Rehabilitation and Modification of the ERB Room (Cafeteria), Engine Research Building (5)	LeRC/OAST	Nov. 1, 1982	B

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$300,000

RELATED COST DATA (*Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable*)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$6,000	$18,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Rehabilitation

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will modify the existing cafeteria (ERB Room) and will annex Rooms 100, 100A and 153 to increase the size of the cafeteria to approximately 2500 sq. ft. (232 sq. m.). This area will provide greater seating capacity, an effective and efficient traffic flow in the serving area and through the cashiers' stations. It will also provide for a greater storage capacity, food preparation area, refrigeration, storage and office space. The scope consists of demolition, removal of existing partitions, mechanical and plumbing systems, electrical/lighting and ceiling systems and the installation of new walls, ceilings, flooring, kitchen/cooking equipment, servery equipment, lighting/power, mechanical/plumbing systems and cabinetry.

(continued)

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X; c. Environmental impact ~~See text~~.

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The ERB Room serves a considerable number of LeRC personnel who do not use the main cafeteria (30% of gross) facilities but the seating is extremely limited. Traffic flow and servery area totally unsuitable for efficient use (time consuming). All of the cooking, refrigeration/freezing, food preparation equipment is obsolete and inadequate (some dangerously deteriorated). There is a severe shortage of kitchen equipment, which handicaps management in meal preparation and the number of meals that should be served. This facility is vital in reducing overload on the main cafeteria (during and after work hours). The existing facility is totally inadequate and inefficient for the service demand.

SCHEDULE DATES				PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
DESIGN	PER	START	1-83	SUBMITTED BY ▶	John M. Klineberg John M. Klineberg Deputy Director	10/19/82
		COMPL	6-83			
	FINAL	START	1-84	CONCURRENCE BY ▶		
		COMPL	8-84			
CONSTRUCTION		AWARD	1-85	BX CONCURRENCE ▶		
		COMPL	3-86	APPROVED BY ▶		
REQUIRED OPERATIONAL						

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213:(b)Send copy to NASA Hq. Code BX:(c)_____.)

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85LRGZ

Rehabilitation and Modification of the ERB Room
(Cafeteria), Engine Research Building (5)

SCOPE/DESCRIPTION - continued

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Rehabilitation and Modification of the ERB Room (Cafeteria), Engine Research Building (5)	SUBMISSION/REVISION B PROJECT CODE 85LRGZ
BASIS OF COST ESTIMATE Criteria & concepts (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$210,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	61,000	29%
3. SUBTOTAL *(1 + 2)*	$271,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	29,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$300,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost escalation from 9/82 to midpoint of construction 8/85 @ 9%/yr $(1.09)^2 = 1.29$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS				
	NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/ AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 6,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	18,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$24,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$6,000	$18,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRGZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Architectural/Structural/Demolition	LS	1	105,000		105,000	150,000
	Mechanical/Electrical	LS	1	48,000		48,000	68,000
	Kitchen-Seating/Equipment	LS	1	57,000		57,000	82,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: In-house cost estimate (9/82)			7.		TOTALS ▶	$210,000	$300,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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GPO 870 364

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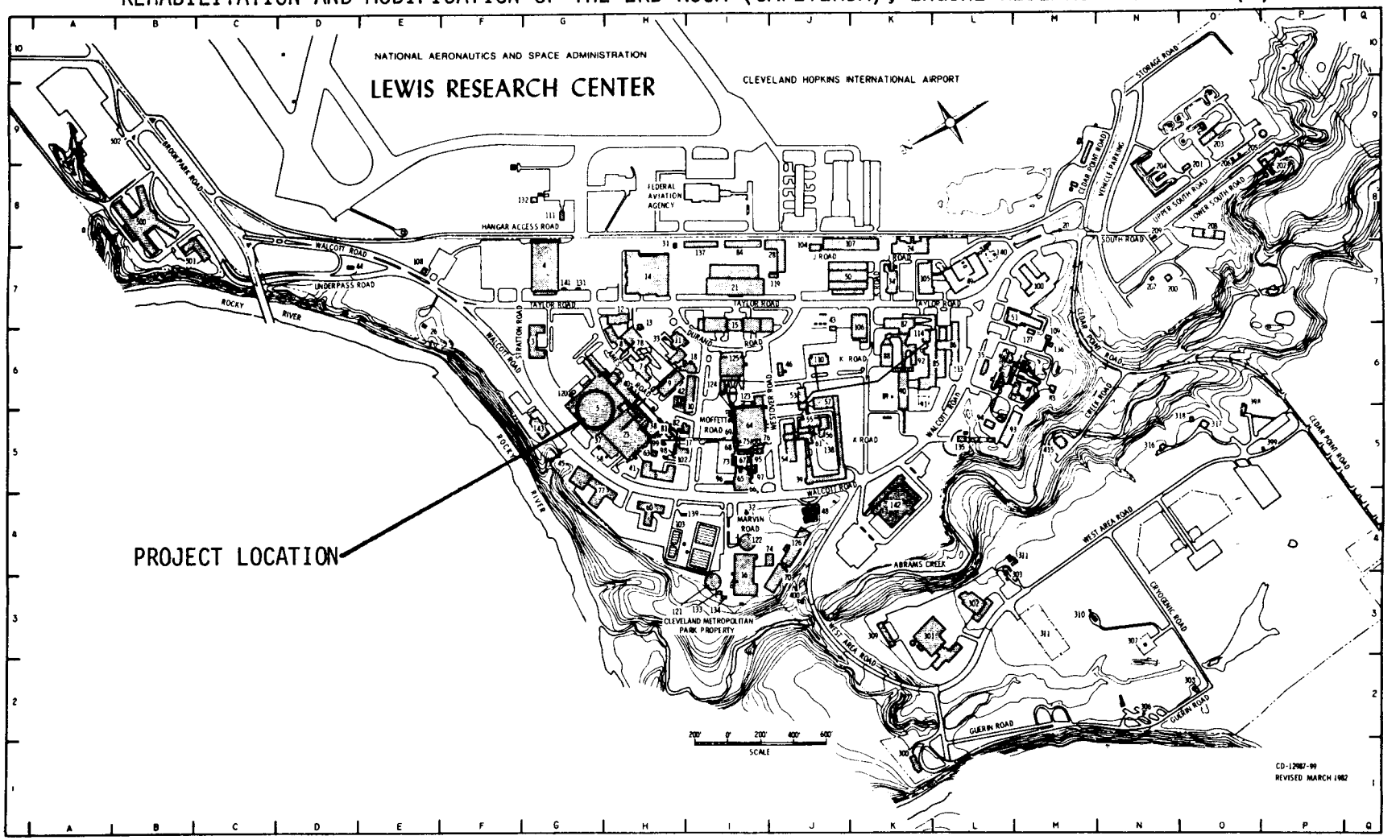
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REHABILITATION AND MODIFICATION OF THE ERB ROOM (CAFETERIA), ENGINE RESEARCH BUILDING (5)



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" REHABILITATION/MODIFICATION PROJECT

Rehabilitation of Emission Control System at the Steam Plant (12)
Institutional

$460,000

This project will rehabilitate and modify the emissions control system at the Steam Plant by installing additional particulate emissions abatement equipment, modifying the existing coal boiler stacks and breeching, and extending the fly ash transport system.

The particulate emissions will be reduced and will be in compliance with Ohio EPA emissions regulations. Coal usage for steam generation will increase, and oil and natural gas consumption will be minimized. The use of coal as primary fuel will be cost effective based on the projected cost of coal versus oil or natural gas for 1985 and beyond.

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Facility Project - Brief Project Document

CONTROL NO. 85LRHZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Rehabilitation of Emission Control System at the Steam Plant (12)	LeRC/OAST	Nov. 1, 1982	D

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$460,000

CATEGORY	JUSTIFICATION	WORK
	Cost Effective	Rehabilitation & Modification

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$7,300	$27,600

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify) Spec. Study	$7,800

SCOPE DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project provides for the rehabilitation and modification of the emission control system at the Steam Plant by the addition of equipment for the abatement of particulate emissions from the two coal boilers at the Steam Plant. The existing stacks and breeching will be modified or replaced, and the emissions abatement equipment will be installed. The existing fly ash transport system will be extended to service the new equipment.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The original installation of the coal boilers in 1948 included cyclone separators for fly ash control. This configuration, however, cannot be operated to achieve compliance with particulate emissions limits set forth in Ohio EPA regulations. This project will allow the Steam Plant coal boilers to operate below the emissions limits, thus, satisfying the EPA compliance order and allowing LeRC to use coal as its primary fuel for steam generation. This project will result in a significant increase in coal consumption and a decrease in oil and natural gas usage. The projected cost for coal versus oil or natural gas for 1985 and beyond, makes coal the more cost effective fuel to be used as the (cont'd)

SCHEDULE DATES				PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
DESIGN	PER	START	1-81	SUBMITTED BY ▶	John M. Klineberg John M. Klineberg Deputy Director	11/19/82
		COMPL	7-81	CONCURRENCE BY ▶		
	FINAL	START	1-84			
		COMPL	8-84	BX CONCURRENCE ▶		
CONSTRUCTION		AWARD	1-85			
		COMPL	12-85	APPROVED BY ▶		
REQUIRED OPERATIONAL						

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____)

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85LRHZ

Rehabilitation of Emission Control System at the Steam Plant (12)

BASIS OF NEED (continued)

primary source for steam generation.

NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Rehabilitation of Emission Control System at the Steam Plant (12)	SUBMISSION/REVISION D PROJECT CODE 85LRHZ
BASIS OF COST ESTIMATE Preliminary Engineering Report (7-81)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$295,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	123,000	42%
3. SUBTOTAL *(1 + 2)*	$418,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	42,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$460,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost escalation @ 9%/year to mid-construction (7-81 to 8-85) $(1.09)^{4.1} = 1.42$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT			X	AE	$ 7,300*
2. SPECIAL STUDIES *(Specify)* Field surveys and evaluate alternate equipment arrangements	X			AE	7,800
3. FINAL DESIGN	X			AE	27,600
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$42,700

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in Items 2 through 10)* ☐ b. NONE	$7,300*	$27,600

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Special Study: Field surveys and evaluate alternate equipment arrangements	$7,800
	7. FUTURE FUNDING			

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*Previously funded

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRHZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Arch./Structural	LS	1			61,200	95,000
	Mechanical						
	- Collector Fabrication	LS	1			129,000	201,000
	- Misc. Mechanical	LS	1			99,800	156,000
	Electrical	LS	1			5,000	8,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA Preliminary Engineering Report (7-81)			7.		TOTALS ▶	$295,000	$460,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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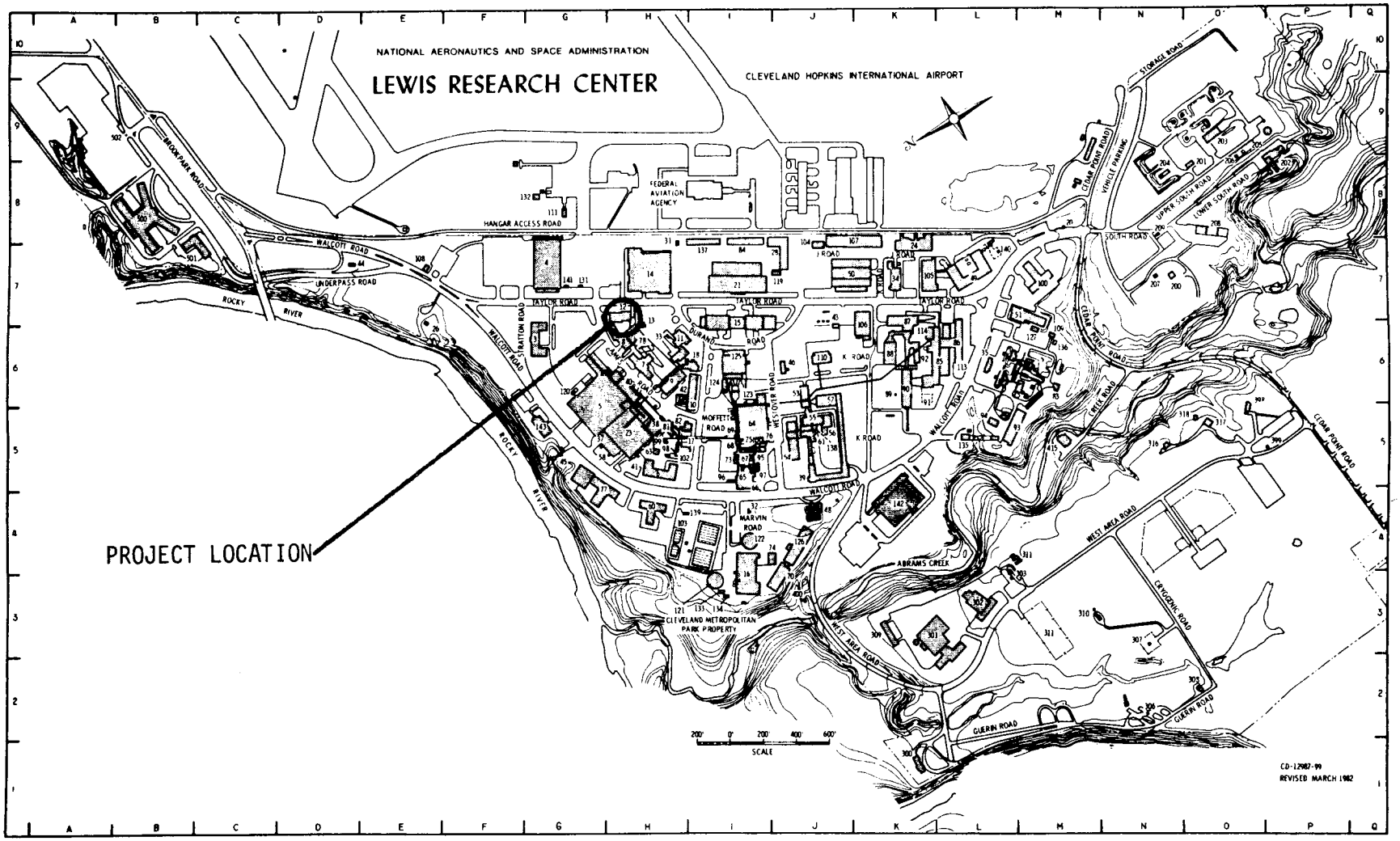
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REHABILITATION OF EMISSION CONTROL SYSTEM AT THE STEAM PLANT (12)



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" REHABILITATION PROJECT

Rehabilitation of 10x10 SWT Office Building (86)
Interior and Exterior
Institutional

$630,000

This work will include the following major items: Replace Annex and Tee Section windows with dual glazed window and insulated panel assemblies; complete interior painting; replace floor tile and base; replace ceilings in corridors; install acoustical ceilings in toilet rooms; provide new projection booth; upgrade ventilation systems; install temperature controls on fan coil units; and upgrade power and lighting.

The 10x10 SWT Office Building was built in 1955 and contains approximately 84,000 sq. ft. (7800 sq. m) of floor space. The interior of the building has received only minimum maintenance, and rehabilitation is required to correct deteriorated conditions that are beyond maintenance repair. The rehabilitation will upgrade the building and its systems to current standards of efficiency, security and safety; and will eliminate the frequent maintenance now being performed in the building.

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Facility Project - Brief Project Document

CONTROL NO. 85LRIZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Rehabilitation of 10x10 SWT Office Building (86) Interior and Exterior	LeRC/OAST	Nov. 1, 1982	G

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$630,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$13,000	$38,000

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Rehabilitation

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This work will include the following major items: Replace Annex and Tee Section windows with dual glazed window and insulated panel assemblies; complete interior painting; replace floor tile and base; replace ceilings in corridors; install acoustical ceilings in toilet rooms; provide new projection booth; upgrade ventilation systems; install temperature controls on fan coil units; and upgrade power and lighting.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The 10x10 SWT Office Building was built in 1955 and contains approximately 84,000 sq. ft. (7800 sq. m) of floor space. The interior of the building has received only minimum maintenance, and rehabilitation is required to correct deteriorated conditions that are beyond maintenance repair. The rehabilitation will upgrade the building and its systems to current standards of efficiency, security and safety; and will eliminate the frequent maintenance now being performed in the building.

SCHEDULE DATES

DESIGN	PER	START	1-83
		COMPL	6-83
	FINAL	START	1-84
		COMPL	6-84
CONSTRUCTION		AWARD	1-85
		COMPL	3-86
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Rehabilitation of 10x10 SWT Office Building (86) Interior and Exterior	SUBMISSION/REVISION G PROJECT CODE 85LRIZ
BASIS OF COST ESTIMATE Criteria & concepts only (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$444,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	129,000	29%
3. SUBTOTAL *(1 + 2)*	$573,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	57,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$630,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost escalation from 9/82 to midpoint of construction 8/85 @ 9%/year

$(1.09)^{2.92} = 1.29$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$13,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	38,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$51,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$13,000	$38,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LRIZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

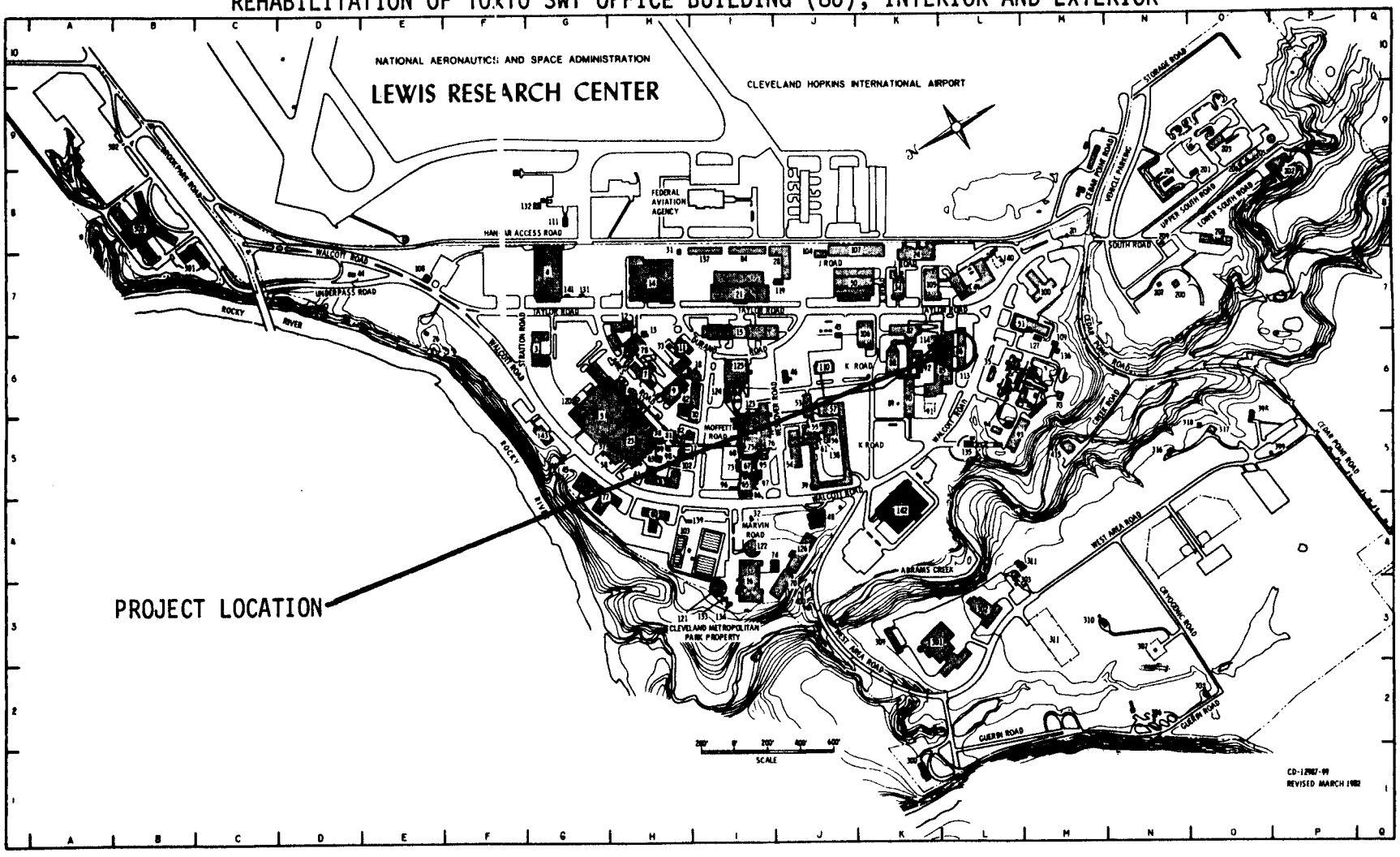
DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Architectural - Windows	L.S.	1	132,200		132,200	187,600
	Architectural - Interior	L.S.	1	113,100		113,100	160,500
	Mechanical	L.S.	1	105,200		105,200	149,300
	Electrical	L.S.	1	93,500		93,500	132,600
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: Criteria & concepts (9/82)			7.		TOTALS ▶	$444,000	$630,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REHABILITATION OF 10x10 SWT OFFICE BUILDING (86), INTERIOR AND EXTERIOR



LOCATION PLAN

FIGURE 1

REPAIR PROGRAM

FY 1985

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program, Installation Office or Center)
FY 1985 REPAIR PROGRAM
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST Budget Estimate	PER	Final Design	Studies Support Fin. Design
1.	85-1RE	85LMAZ Repair of Steam Condensate System, Buildings (125, 110, 64 and 49)	630,000	12,600	37,800	6,000
2.	85-2RE	85LMBZ Repair Combustion Air Piping Insulation, Central Air Equipment Building (64) and Refrigeration Building (9)	400,000	8,000	24,000	0
3.	85-3RE	85LMCZ Repair for Recertification of 125 PSIG Combustion Air System in ERB (5)	450,000	0	27,000	0
4.	85-4RE	85LMDZ Repair of Cathodic Protection System for LeRC Piping Systems	300,000	6,000	18,000	3,000
5.	85-5RE	85LMEZ Repair Walcott Road Between Taylor Road and Brookpark Road	270,000	5,000	16,200	0
6.	85-6RE	85LMFZ Repair Distribution Chilled Water Piping Between Refrigeration Building (9) to Engine Research Building (5)	460,000	9,200	27,600	0
7.	85-7RE	85LMGZ Repair Roofs, Buildings EPL (301) and SPRL (309)	320,000	3,200	19,200	0
		TOTAL ▶	2,830,000	44,000	169,800	9,000

NASA FORM 1514 DEC 73

NASA-HQ

UTILITY "SYSTEM" REPAIR PROJECT

Repair of Steam Condensate System,
Buildings (125, 110, 64 and 49)
Institutional

$630,000

This project consists of replacement of existing steam condensate piping in the basement, storage, test cell and office area heating systems in the following buildings: PSL Engine Test Building No. 152, Zero Gravity Facility No. 110, Central Air Equipment Building No. 64, and Materials and Structures Labs No. 49. This includes replacement of all traps, strainers, and valves at each heater location; insulation of exposed pipe and replacement of condensate return pumps.

The condensate pipe, valves and condensate pumps are the original building equipment. This material is 20 to 28 years of age. Components such as traps and strainers have been replaced as required for maintenance. These systems are in need of complete replacement due to corrosion and plugging which causes excessive maintenance of building heating system. System replacement is a cost effective way to reduce maintenance costs and reduce energy losses.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LMAZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Repair of Steam Condensate System, Buildings (125, 110, 64 and 49)	LeRC/OAST	Nov. 1, 1982	E

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$630,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$12,600	$37,800

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify) Site Investigation	$6,000

CATEGORY	JUSTIFICATION	WORK
	Cost Effective	Repair

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project _____

SCOPE DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of replacement of existing steam condensate piping in the basement, storage, test cell and office area heating systems in the following buildings: PSL Engine Test Building No. 152, Zero Gravity Facility No. 110, Central Air Equipment Building No. 64, and Materials and Structures Labs No. 49. This includes replacement of all traps, strainers, and valves at each heater location; insulation of exposed pipe and replacement of condensate return pumps.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The condensate pipe, valves and condensate pumps are the original building equipment. This material is 20 to 28 years of age. Components such as traps and strainers have been replaced as required for maintenance. These systems are in need of complete replacement due to corrosion and plugging which causes excessive maintenance of building heating system. System replacement is a cost effective way to reduce maintenance costs and reduce energy losses.

SCHEDULE DATES

DESIGN	PER	START	1-83
		COMPL	6-83
	FINAL	START	1-84
		COMPL	10-84
CONSTRUCTION		AWARD	1-85
		COMPL	12-85
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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1RE

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Repair of Steam Condensate System, Buildings (125, 110, 64 and 49)	SUBMISSION/REVISION E PROJECT CODE 85LMAZ
BASIS OF COST ESTIMATE In-house cost estimate (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$455,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	118,000	26%
3. SUBTOTAL *(1 + 2)*	$573,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	57,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$630,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/yr from (1/82) to midpoint construction (6/85) $(1.09)^{2.66} = 1.26$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$12,600
2. SPECIAL STUDIES *(Specify)* Site Investigation	X			A-E	6,000
3. FINAL DESIGN	X			A-E	37,800
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$56,400

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in Items 2 through 10)* ☐ b. NONE	$12,600	$37,800

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Site Investigation	$6,000
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

1RE

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LMAZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

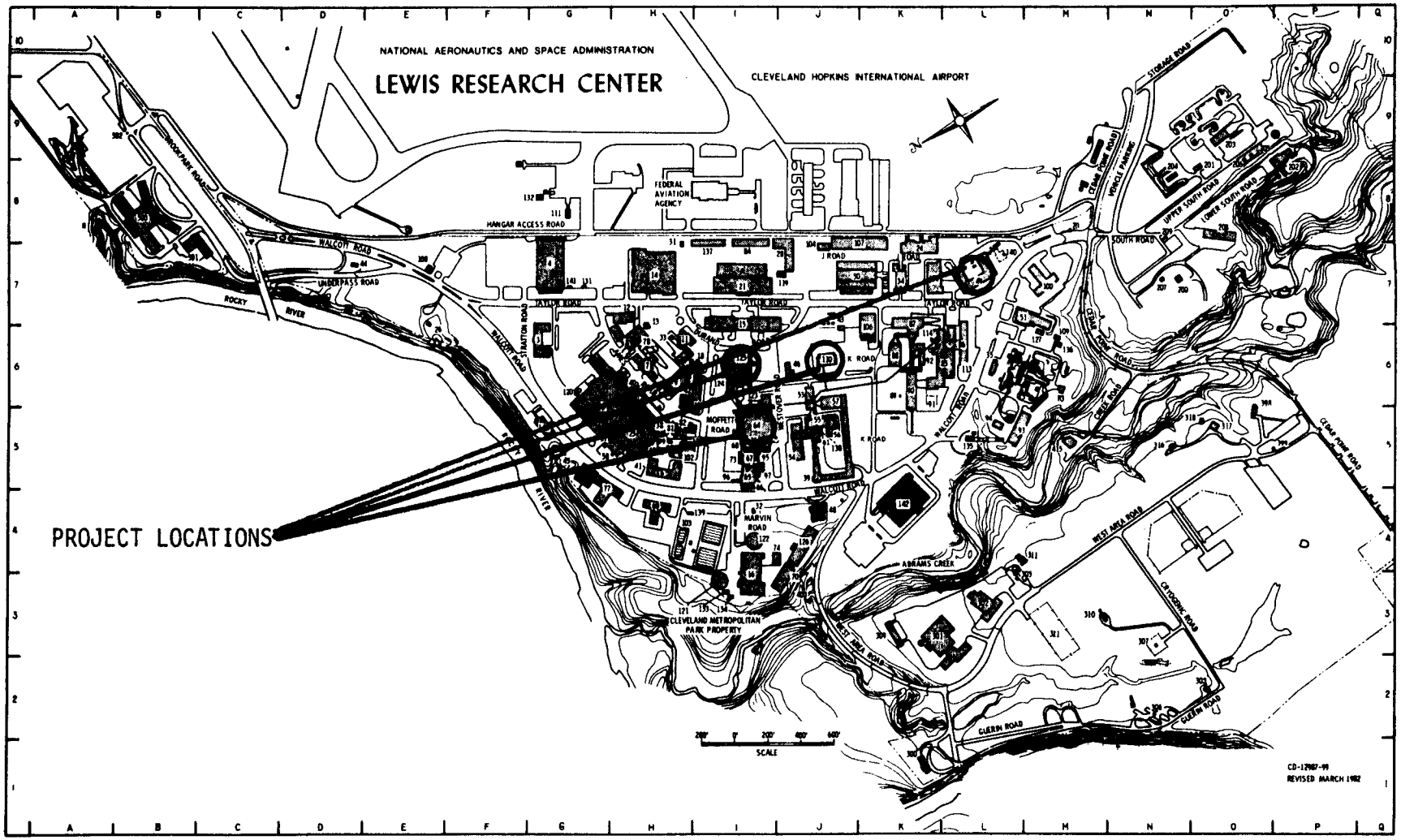
DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Building 125						
Piping & Insultaion	LF	900	50		45,000	
Traps & Pumps	EA	70	900		63,000	
					108,000	150,000
Building 110						
Piping & Insulation	LF	600	35		21,000	
Traps & Pumps	EA	16	900		15,000	
					36,000	50,000
Building 64						
Piping & Insulation	LF	1600	60		96,000	
Traps & Pumps	EA	62	800		49,000	
					145,000	200,000
Building 49						
Piping & Insulation	LF	1800	70		126,000	
Traps & Pumps	EA	100	400		40,000	
					166,000	230,000
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA In-House cost estimate (9/82)		7.		TOTALS ▶	$455,000	$630,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REPAIR OF STEAM CONDENSATE SYSTEM, BUILDINGS (125, 110, 64 AND 49)



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" REPAIR PROJECT

Repair Combustion Air Piping Insulation,
Central Air Equipment Building (64) and
Refrigeration Building (9)
Institutional

$400,000

This project consists of the repair of 1300 LF (396 M) of pipe insulation on various pipes - 36-inch (.91 m), 48-inch (1.2 m), 54-inch (1.4 m) and 6-inch (15 cm) in diameter of the combustion air system located near Central Air Equipment Building (64) and Refrigeration Building (9)

Existing insulation has deteriorated from exposure to weather, and has lost its insulating effectiveness. In some cases, it has become detached and is falling to the ground causing a safety hazard to personnel below. Replacement of this insulation will provide significant cost savings in the operations of the air temperature conditioning equipment and eliminate the safety hazard.

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Facility Project - Brief Project Document

CONTROL NO. 85LMBZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Repair Combustion Air Piping Insulation, Central Air Equipment Building (64) and Refrigeration Building (9)	LeRC/OAST	Nov. 1, 1982	D

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$400,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$8,000	$24,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Cost Effective	Repair

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of the repair of 1300 LF (396 M) of pipe insulation on various pipes - 36-inch (.91 m), 48-inch (1.2 m), 54-inch (1.4 m) and 6-inch (15 cm) in diameter of the combustion air system located near Central Air Equipment Building (64) and Refrigeration Building (9).

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

Existing insulation has deteriorated from exposure to weather, and has lost its insulating effectiveness. In some cases, it has become detached and is falling to the ground causing a safety hazard to personnel below. Replacement of this insulation will provide significant cost savings in the operations of the air temperature conditioning equipment and eliminate the safety hazard.

SCHEDULE DATES				
DESIGN	PER	START	1-83	
		COMPL	6-83	
	FINAL	START	1-84	
		COMPL	10-84	
CONSTRUCTION		AWARD	1-85	
		COMPL	12-85	
REQUIRED OPERATIONAL				

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶	SIGNATURE AND TITLE	
BX CONCURRENCE ▶	SIGNATURE AND TITLE	
APPROVED BY ▶	SIGNATURE AND TITLE	

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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2RE

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NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE: LeRC/OAST	DATE: Nov. 1, 1982
PROJECT TITLE: Repair Combustion Air Piping Insulation, Central Air Equipment Building (64) and Refrigeration Building (9)	SUBMISSION/REVISION: D
	PROJECT CODE: 85LMBZ
BASIS OF COST ESTIMATE: In-house cost estimate 1979 contract work (1/80) updated (8/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$277,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	83,000	30%
3. SUBTOTAL *(1 + 2)*	$360,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	40,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$400,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/yr from (8/82) to (6/85) midpoint of construction $(1.09)^{3.0} = 1.30$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 8,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	24,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$32,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$8,000	$24,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LMBZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

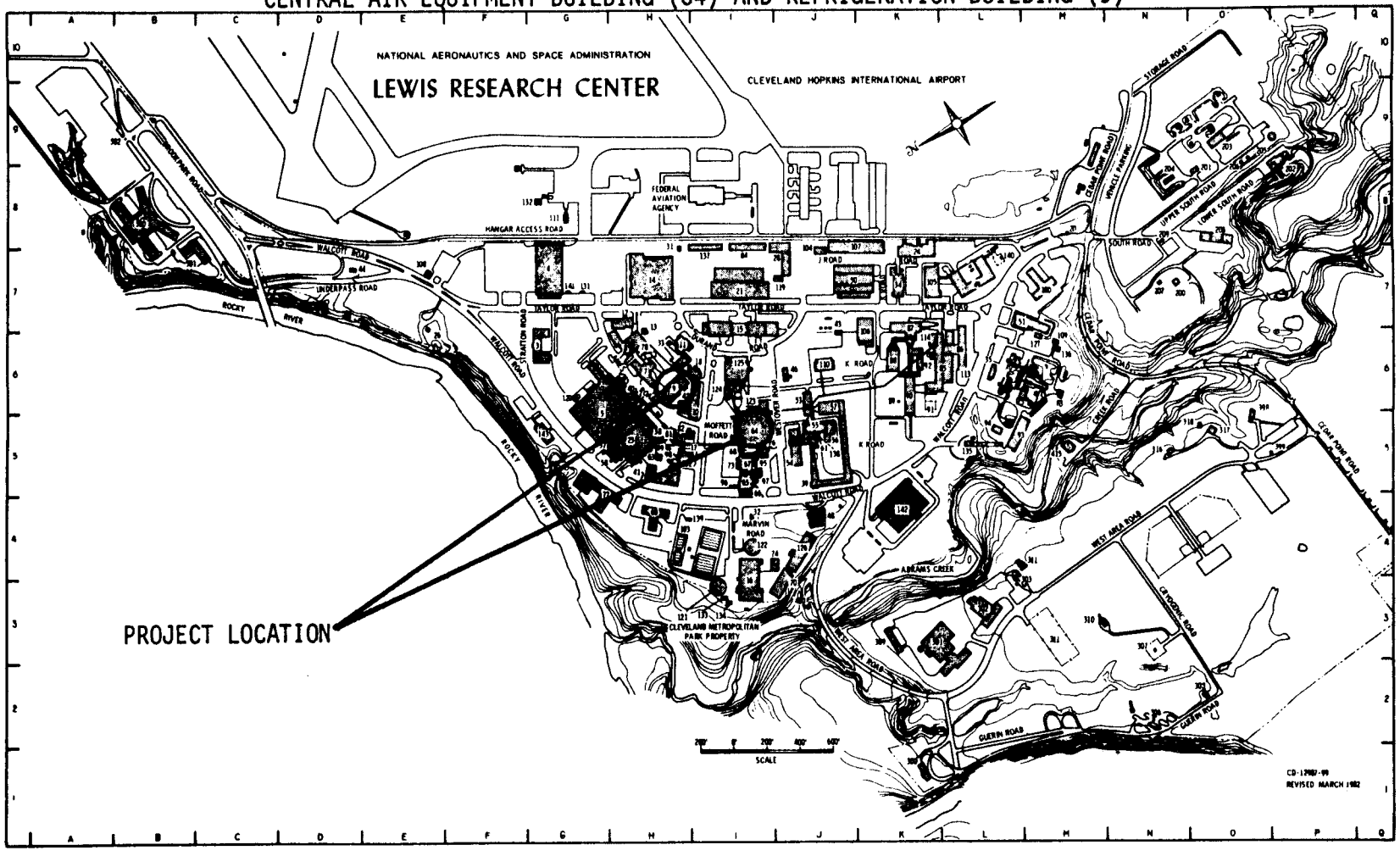
	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Replace insulation on 54" pipe	L.F.	450	306		138,000	200,000
	Replace insulation on 48" pipe	L.F.	200	405		81,000	117,000
	Replace insulation on 36" pipe	L.F.	50	160		8,000	11,000
	Patch insulation on 48" pipe	S.F.	1000	15		15,000	22,000
	Replace insulation on 6" pipe	L.F.	70	70		5,000	7,000
	Replace insulation on 5" pipe	L.F.	450	67		30,000	43,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA In-house estimate 1979 contract work (1/80) updated (8/82)			7.		TOTALS ▶	$277,000	$400,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REPAIR COMBUSTION AIR PIPING INSULATION,
CENTRAL AIR EQUIPMENT BUILDING (64) AND REFRIGERATION BUILDING (9)



LOCATION PLAN

FIGURE 1

UTILITY "SYSTEM" REPAIR PROJECT

Repair for Recertification of 125 PSIG Combustion Air System in ERB (5)
Institutional

$450,000

This project consists of the repair/replacement of deteriorated combustion air systems including piping, supports, expansion joints and other piping components that have been in service 20 to 30 years.

Normal wear/corrosion of piping and components in process systems have created conditions which require repairs/replacement to assure structural adequacy and continued safe operating conditions. The process systems are necessary to supply process fluids which are critical to the successful accomplishment of research tasks throughout the laboratory. The repair work also satisfies NMI 1710.3B (2/23/82) which establishes uniform NASA policy for the recertification of pressure vessels and pressurized systems.

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National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LMCZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Repair for Recertification of 125 PSIG Combustion Air System in ERB (5)	LeRC/OAST	Nov. 1, 1982	B

APPROVED FACILITY PROJECT COST ESTIMATE — ITEMS (List)	AMOUNT
TOTAL	$450,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
X YES (Identify) ☐ NONE	0	$27,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Repair

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM X C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of the repair/replacement of deteriorated combustion air systems including piping, supports, expansion joints and other piping components that have been in service 20 to 30 years.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease Increase _____ : c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

Normal wear/corrosion of piping and components in process sytems have created conditions which require repairs/replacement to assure structural adequacy and continued safe operating conditions. The process systems are necessary to supply process fluids which are critical to the successful accomplishment of research tasks throughout the laboratory. The repair work also satisfies NMI 1710.3B (2/23/82) which establishes uniform NASA policy for the recertification of pressure vessels and pressurized systems.

SCHEDULE DATES				
DESIGN	PER	START	1-83	
		COMPL	6-83	
	FINAL	START	1-84	
		COMPL	10-84	
CONSTRUCTION		AWARD	1-85	
		COMPL	12-85	
REQUIRED OPERATIONAL				

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg — John M. Klineberg, Deputy Director	10/19/82
CONCURRENCE BY ▶	SIGNATURE AND TITLE	DATE
BX CONCURRENCE ▶	SIGNATURE AND TITLE	DATE
APPROVED BY ▶	SIGNATURE AND TITLE	DATE

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____)

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3RE

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LMCZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

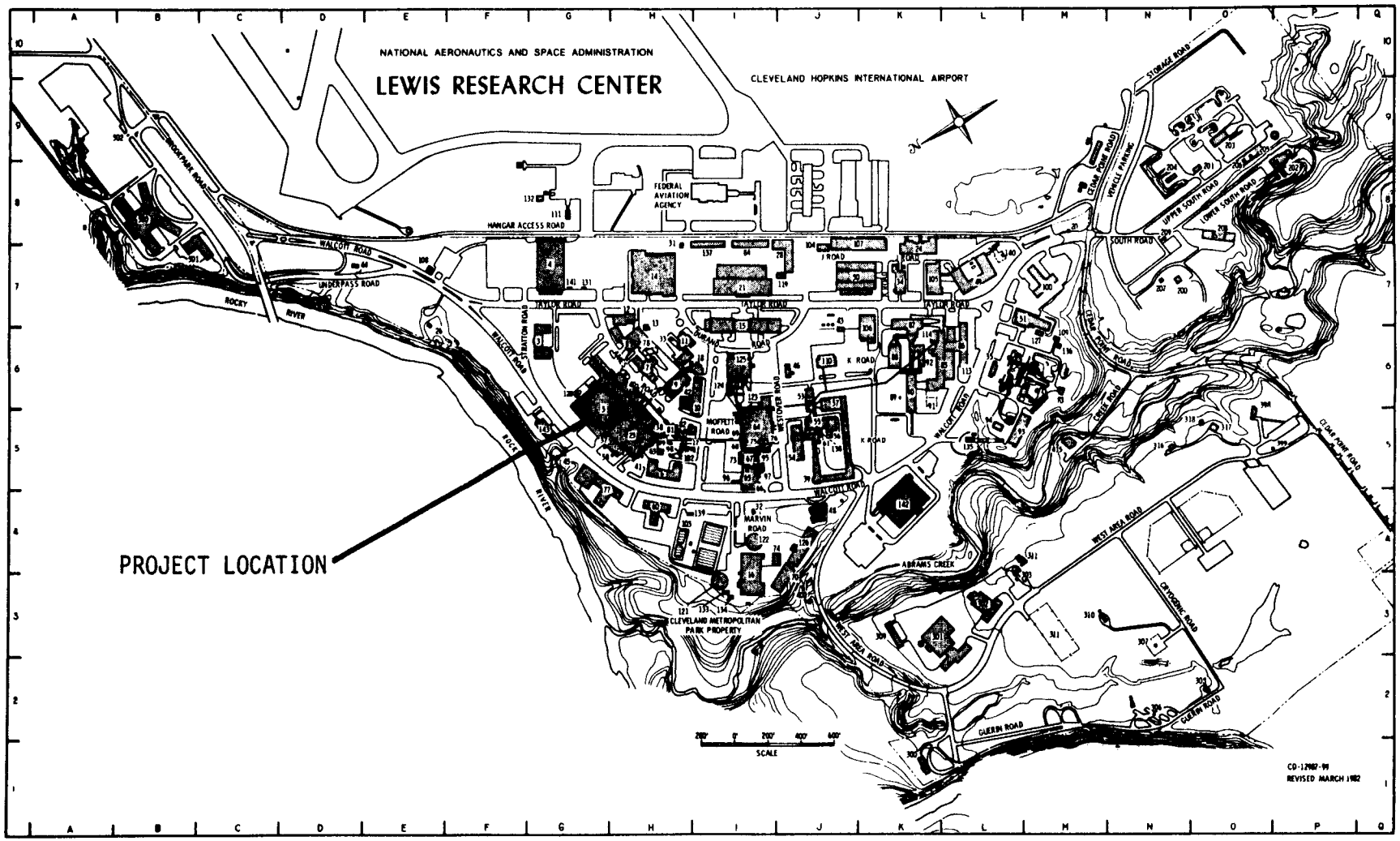
DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Misc. Piping & Component Repair/Replacement	Job		315,000		315,000	450,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: In-house cost estimate (8/82)			7.		TOTALS ▶	$315,000	$450,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REPAIR FOR RECERTIFICATION OF 125 PSIG COMBUSTION AIR SYSTEM IN ERB (5)



LOCATION PLAN

FIGURE 1

UTILITY "SYSTEM" REPAIR PROJECT

Repair of Cathodic Protection System
for LeRC Piping Systems
Institutional

$300,000

This project will provide for the repair of the cathodic protection system for the LeRC natural gas, cooling tower water, potable water, service air, and combustion air piping systems. The repair will consist of all labor and materials necessary to: 1) repair, replace, and install new test boxes, 2) provide for the installation of new anodes where required, 3) to provide all necessary excavation, backfilling, and sodding. Also included is documentation of all test box readings for the repaired cathodic protection system.

The existing cathodic protection system consists of sacrificial type magnesium anodes which are buried below ground level and bonded to the natural gas, cooling tower water, potable water, service air, and combustion air piping. The test boxes are used to obtain pipe-to-soil potential and current readings. The readings are directly related to the remaining life of existing anodes and to the degree of protection being afforded the piping system. From recent surveys of the test boxes, it has been determined that of the 160 original test boxes, 66 have either been destroyed or are unlocatable due to past construction of buildings, roadwork, and/or underground utility repair work or installation. Of the remaining 94 test boxes, 26 are in need of repair. Also there are approximately 40 areas from which test box readings indicate pipe-to-soil potential readings less than that required for a protected piping system.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LMDZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Repair of Cathodic Protection System for LeRC Piping Systems	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$300,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$6,000	$18,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER Study Field Investigation	$3,000

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Repair

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project will provide for the repair of the cathodic protection system for the LeRC natural gas, cooling tower water, potable water, service air, and combustion air piping systems. The repair will consist of all labor and materials necessary to: 1) repair, replace, and install new test boxes, 2) provide for the installation of new anodes where required, 3) to provide all necessary excavation, backfilling, and sodding. Also included is documentation of all test box readings for the repaired cathodic protection system.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ : c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The existing cathodic protection system consists of sacrificial type magnesium anodes which are buried below ground level and bonded to the natural gas, cooling tower water, potable water, service air, and combustion air piping. The test boxes are used to obtain pipe-to-soil potential and current readings. The readings are directly related to the remaining life of existing anodes and to the degree of protection being afforded the piping system. From recent surveys of the test boxes, it has been determined that of the 160 original test boxes, 66 have either been destroyed or are unlocatable due to past construction of buildings, roadwork, and/or underground utility repair work or (cont'd)

SCHEDULE DATES				PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
DESIGN	PER	START	1-83	SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
		COMPL	6-83	CONCURRENCE BY ▶		
	FINAL	START	1-84			
		COMPL	8-84	BX CONCURRENCE ▶		
CONSTRUCTION		AWARD	1-85	APPROVED BY ▶		
		COMPL	2-86			
REQUIRED OPERATIONAL						

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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GPO 863 884

85LMDZ

Repair of Cathodic Protection System
for LeRC Piping Systems

BASIS OF NEED (continued)

installation. Of the remaining 94 test boxes, 26 are in need of repair. Also there are approximately 40 areas from which test box readings indicate pipe-to-soil potential readings less than that required for a protected piping system.

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Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Repair of Cathodic Protection System for LeRC Piping Systems	SUBMISSION/REVISION A PROJECT CODE 85LMDZ
BASIS OF COST ESTIMATE In-house estimate 8/82	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$214,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	59,000	28%
3. SUBTOTAL *(1 + 2)*	$273,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	27,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$300,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9% per year to midpoint of construction (9/82 to 7/85) $(1.09)^{2.833} = 1.277$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 6,000
2. SPECIAL STUDIES *(Specify)* Field Investigation	X			A-E	3,000
3. FINAL DESIGN	X			A-E	18,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$27,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$6,000	$18,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)* Field Investigation Study	$3,000
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LMDZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

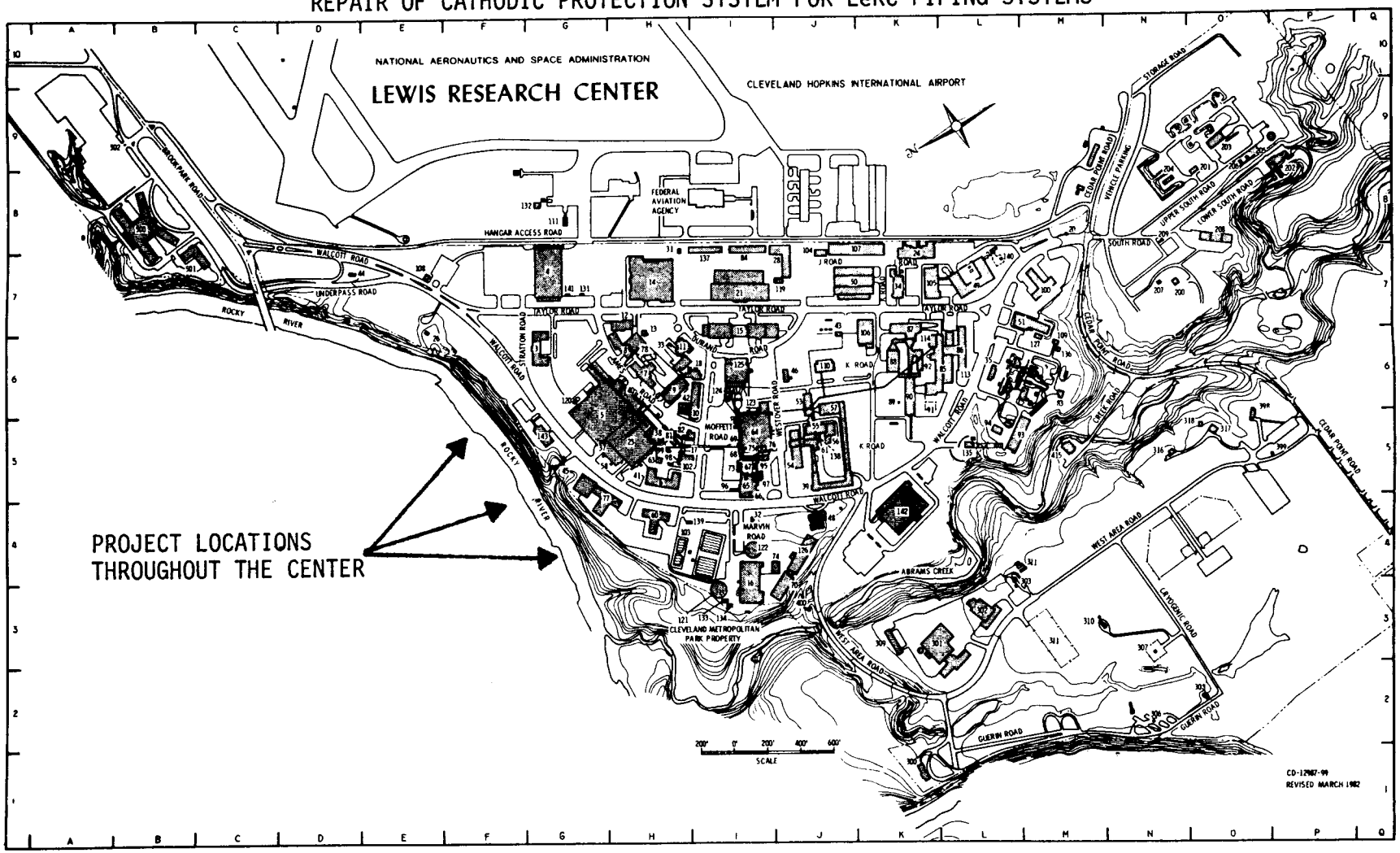
	DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Equipment	LS	1	$86,000		$ 86,000	$120,000
	Installation	LS	1	128,000		128,000	180,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA: In-house cost estimate 8/82			7.		TOTALS ▶	$214,000	$300,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REPAIR OF CATHODIC PROTECTION SYSTEM FOR LeRC PIPING SYSTEMS



LOCATION PLAN

FIGURE 1

ROAD REPAIR PROJECT

Repair Walcott Road Between Taylor Road
and Brookpark Road
Institutional

$270,000

This project provides for roadway repairs to approximately 1600 lineal feet (490 m) of Walcott Road between Brookpark Road and Taylor Road. This work will include removal and resurfacing of approximately 10,000 square yards (8400 sq. m) of asphalt pavement, removal and replacement of deteriorated concrete curbs and median pavement.

The roadway is the main entrance and exit to Lewis Research Center and varies in width from 60 feet (18 m) to 40 feet (12 m). Although this roadway receives regular maintenance, it requires a major repair to offset the deteriorating effects of heavy traffic and the normal weathering expected in this northern climate.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LMEZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Repair Walcott Road Between Taylor Road and Brookpark Road	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$270,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$5,400	$16,200

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Repair

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project provides for roadway repairs to approximately 1600 lineal feet (490 m) of Walcott Road between Brookpark Road and Taylor Road. This work will include removal and resurfacing of approximately 10,000 square yards (840 sq. m) of asphalt pavement, removal and replacement of deteriorated concrete curbs and median pavement.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

This roadway is the main entrance to Lewis Research Center and carries a very heavy traffic load. Although this roadway receives regular maintenance, it requires major repair to offset the deteriorating effects of the heavy traffic and the normal weathering expected in this northern climate.

SCHEDULE DATES

DESIGN	PER	START	2-83
		COMPL	6-83
	FINAL	START	2-84
		COMPL	8-84
CONSTRUCTION		AWARD	2-85
		COMPL	10-85
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶	SIGNATURE AND TITLE	DATE
BX CONCURRENCE ▶	SIGNATURE AND TITLE	DATE
APPROVED BY ▶	SIGNATURE AND TITLE	DATE

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213:(b)Send copy to NASA Hq, Code BX:(c)_____.)

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Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Repair Walcott Road Between Taylor Road and Brookpark Road	SUBMISSION/REVISION A
	PROJECT CODE 85LMEZ
BASIS OF COST ESTIMATE In-house (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$189,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	55,000	27%
3. SUBTOTAL *(1 + 2)*	$244,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	26,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$270,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/yr to midpoint of construction (9/82 to 6/85) $(1.09)^{2.75} = 1.27$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 5,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	16,200
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$21,200

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$5,000	$16,200

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LMEZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

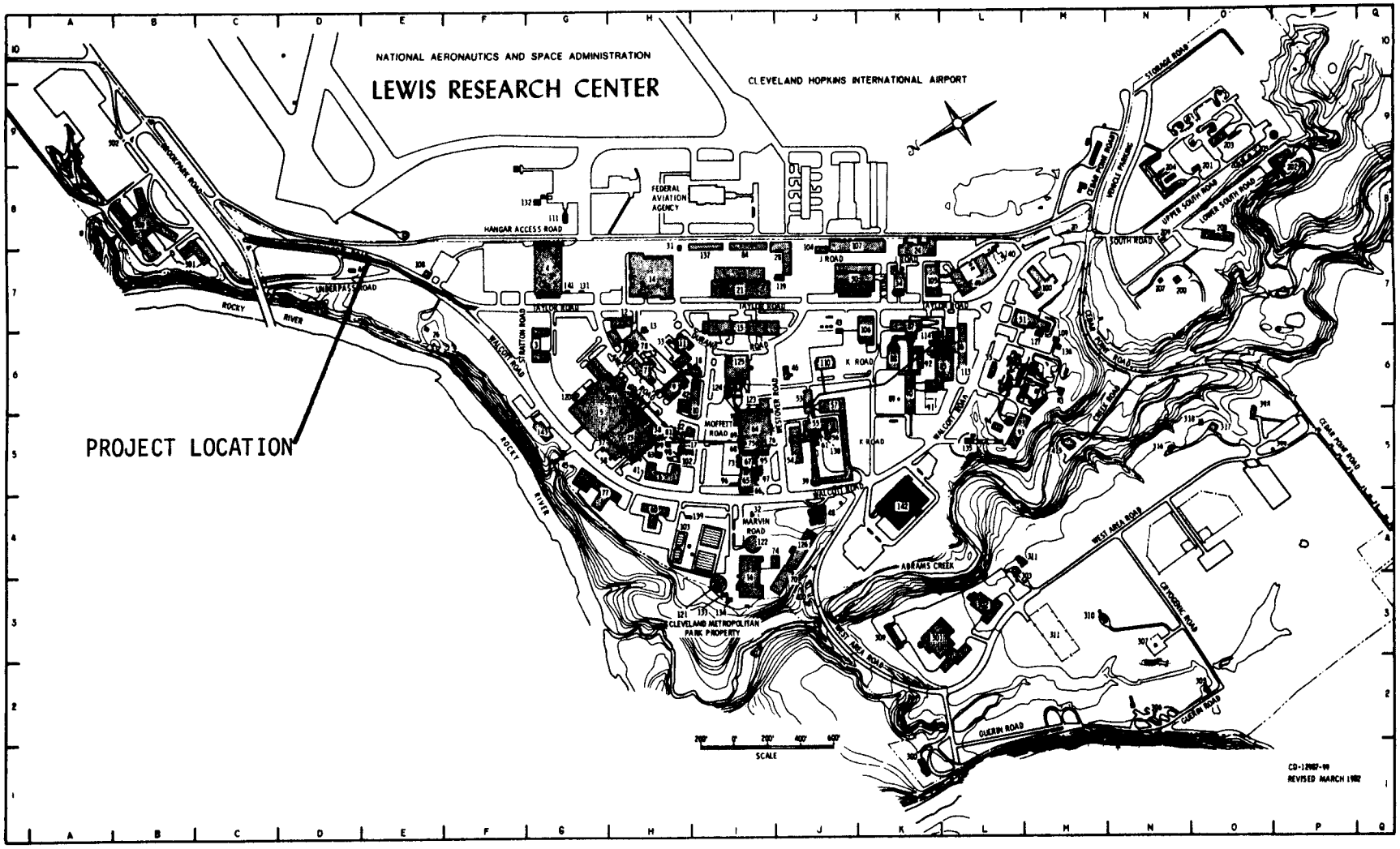
DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE					0	0
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Site Development & Utilities						
Demolition/Excavation					60,000	
Curbs					5,000	
Pavement					98,000	
Median					12,000	
Misc.					14,000	
					189,000	270,000
Building/Structure					0	0
Utilities Support					0	0
Facilities Project Equipment					0	0
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*						
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA In-house (9/82)		7.		TOTALS ▶	$189,000	$270,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REPAIR WALCOTT ROAD BETWEEN TAYLOR ROAD AND BROOKPARK ROAD



LOCATION PLAN

FIGURE 1

UTILITY "SYSTEM" REPAIR PROJECT

Repair Distribution Chilled Water Piping Between Refrigeration Building (9) to Engine Research Building (5) Institutional

$460,000

This project consists of the replacement of existing 1300 LF (398 M) of supply and return distribution piping from Refrigeration Building (9) to Engine Research Building (5). Pipe routing will parallel the existing overhead combustion air piping between buildings.

This system supplies chilled water to Buildings 3, 5, 6, 7, 23, 38, 60 and 77 for cooling control rooms, the Photo Lab, other laboratories and offices. The 40-year old piping has increased possibility of failure due to current usage of higher flow rate and pressure. Pipe failure would terminate cooling to the buildings for an extended length of time affecting many research rigs. The most cost effective method of correcting this problem is to reroute the piping to eliminate the maintenance of piping buried 15 feet (4.6 M) under Ames Road.

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Facility Project - Brief Project Document

CONTROL NO. 85LMFZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Repair Distribution Chilled Water Piping Between Refrigeration Building (9) to Engine Research Building (5)	LeRC/OAST	Nov. 1, 1982	D

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$460,000

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Repair

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$9,200	$27,600

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of the replacement of existing 1300 LF (398 M) of supply and return distribution piping from Refrigeration Building (9) to Engine Research Building (5). Pipe routing will parallel the existing overhead combustion air piping between buildings.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

This system supplies chilled water to Buildings 3, 5, 6, 7, 23, 38, 60 and 77 for cooling control rooms, the Photo Lab, other laboratories and offices. The 40-year old piping has increased possibility of failure due to current usage of higher flow rate and pressure. Pipe failure would terminate cooling to the buildings for an extended length of time affecting many research rigs. The most cost effective method of correcting this problem is to reroute the piping to eliminate the maintenance of piping buried 15 feet (4.6 M) under Ames Road.

SCHEDULE DATES				PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
DESIGN	PER	START	1-83	SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
		COMPL	6-83			
	FINAL	START	1-84	CONCURRENCE BY ▶		
		COMPL	9-84			
CONSTRUCTION		AWARD	1-85	BX CONCURRENCE ▶		
		COMPL	12-85	APPROVED BY ▶		
REQUIRED OPERATIONAL				PROJECT STIPULATIONS: (a) Notification of bid per NHB 7320.1, Par. 213; (b) Send copy to NASA Hq, Code BX; (c) _____)		

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NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Repair Distribution Chilled Water Piping Between Refrigeration Building (9) to Engine Research Building (5)	SUBMISSION/REVISION D PROJECT CODE 85LMFZ
BASIS OF COST ESTIMATE In-house estimate (8/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$322,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	97,000	30%
3. SUBTOTAL *(1 + 2)*	$419,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	41,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$460,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*
Cost escalation to midpoint of construction year @ 9%/year (8/82) to (8/85)
$(1.09)^{3.0} = 1.30$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 9,200
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	27,600
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$36,800

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE

2. PER *(Amount)* $9,200

3. DESIGN *(Amount)* $27,600

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LMFZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION		UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE							
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*							
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*	Pipe and Insulation						
	16", 12", 10" and 8" pipe	Ft.	1300	102		133,000	190,000
	Insulation	Ft.	1300	16		21,000	29,000
	Installation						
	Demolition	Ft.	115	87		10,000	15,000
	Excavation	Cy.	200	35		7,000	10,000
	Pipe Installation	Ft.	1300	97		126,000	179,000
	Electric Tracing	Ft.	1300	19		25,000	37,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*							
5. SPECIAL FEATURES *(Summary)*							
6. SOURCE OF COST DATA In-house estimate (1/80) updated (8/82)			7.		TOTALS ▶	$322,000	$460,000

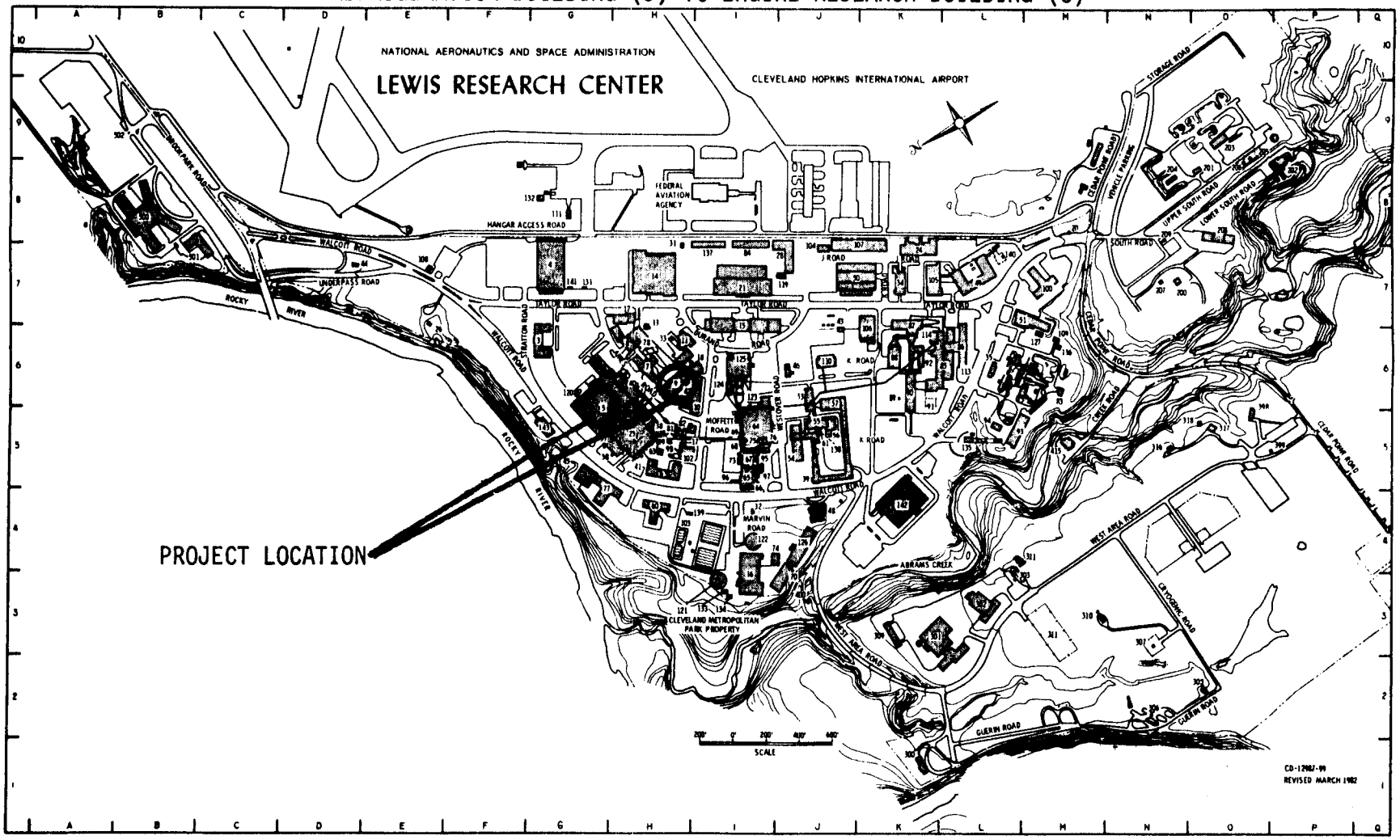
V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REPAIR DISTRIBUTION CHILLED WATER PIPING BETWEEN

REFRIGERATION BUILDING (9) TO ENGINE RESEARCH BUILDING (5)



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" REPAIR PROJECT

Repair Roofs, Buildings EPL (301) and SPRL (309)
Institutional

$320,000

This project consists of the repair of roofs on EPL (301) and SPRL (309). The work includes the removal of some portions of roofs to the roof deck. Other portions will be repaired extensively. Existing roof penetrations will be reconstructed to current penetration standards. Obsolete roof equipment out of service and no longer needed, will be removed. A Class A fire underwriters approved roofing system will be installed with the necessary roof insulation to meet current ASHRE standards wherever possible. Roof surfaces in pedestrian traffic areas will be protected with roof walkways.

These roofs, despite periodic routine maintenance and repair, have now deteriorated to a point where extensive repair and replacement is necessary. The roofs have exceeded the 20 year life expectancy, which is based on normal weathering and deterioration. Roof repairs are required to prevent damage to the building structure and equipment contained therein.

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Facility Project - Brief Project Document

CONTROL NO. 85LMGZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Repair Roofs, Buildings EPL (301) and SPRL (309)	LeRC/OAST	Nov. 1, 1982	E

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$320,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$3,200	$19,200

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify)	

CATEGORY: JUSTIFICATION: Instit. Routine; WORK: Repair

FUND SOURCE: TYPE: [ ] R&D [ ] R&PM [X] C OF F; IDENTIFICATION: FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of the repair of roofs on EPL (301) and SPRL (309). The work includes the removal of some portions of roofs to the roof deck. Other portions will be repaired extensively. Existing roof penetrations will be reconstructed to current penetration standards. Obsolete roof equipment out of service and no longer needed, will be removed. A Class A fire underwriters approved roofing system will be installed with the necessary roof insulation to meet current ASHRE standards wherever possible. Roof surfaces in pedestrian traffic areas will be protected with roof walkways.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. ~~Decrease~~/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

These roofs, despite periodic routine maintenance and repair, have now deteriorated to a point where extensive repair and replacement is necessary. The roofs have exceeded the 20 year life expectancy, which is based on normal weathering and deterioration. Roof repairs are required to prevent damage to the building structure and equipment contained therein.

SCHEDULE DATES

DESIGN	PER	START	1-83
		COMPL	6-83
	FINAL	START	1-84
		COMPL	10-84
CONSTRUCTION		AWARD	1-85
		COMPL	12-85
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213:(b)Send copy to NASA Hq, Code BX:(c)_____.)

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NASA
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Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Repair Roofs, Buildings EPL (301) and SPRL (309)	SUBMISSION/REVISION E
	PROJECT CODE 85LMGZ
BASIS OF COST ESTIMATE Criteria & concepts (9/80), updated (12/81)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$212,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	76,000	36%
3. SUBTOTAL *(1 + 2)*	$288,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	32,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$320,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

9%/yr escalation from (12/81) to midpoint of construction (7/85) $(1.09)^{3.58} = 1.36$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS				
	NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/ AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 3,200
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	19,200
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$26,200

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$3,200	$19,200

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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7RE

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LMGZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Building 301, Repair Roof	LS	1	170,000		170,000	257,000
Building 309, Repair Roof	LS	1	42,000		42,000	63,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*						
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA In-house estimate (9/80), updated (12/81)		7.		TOTALS ▶	$212,000	$320,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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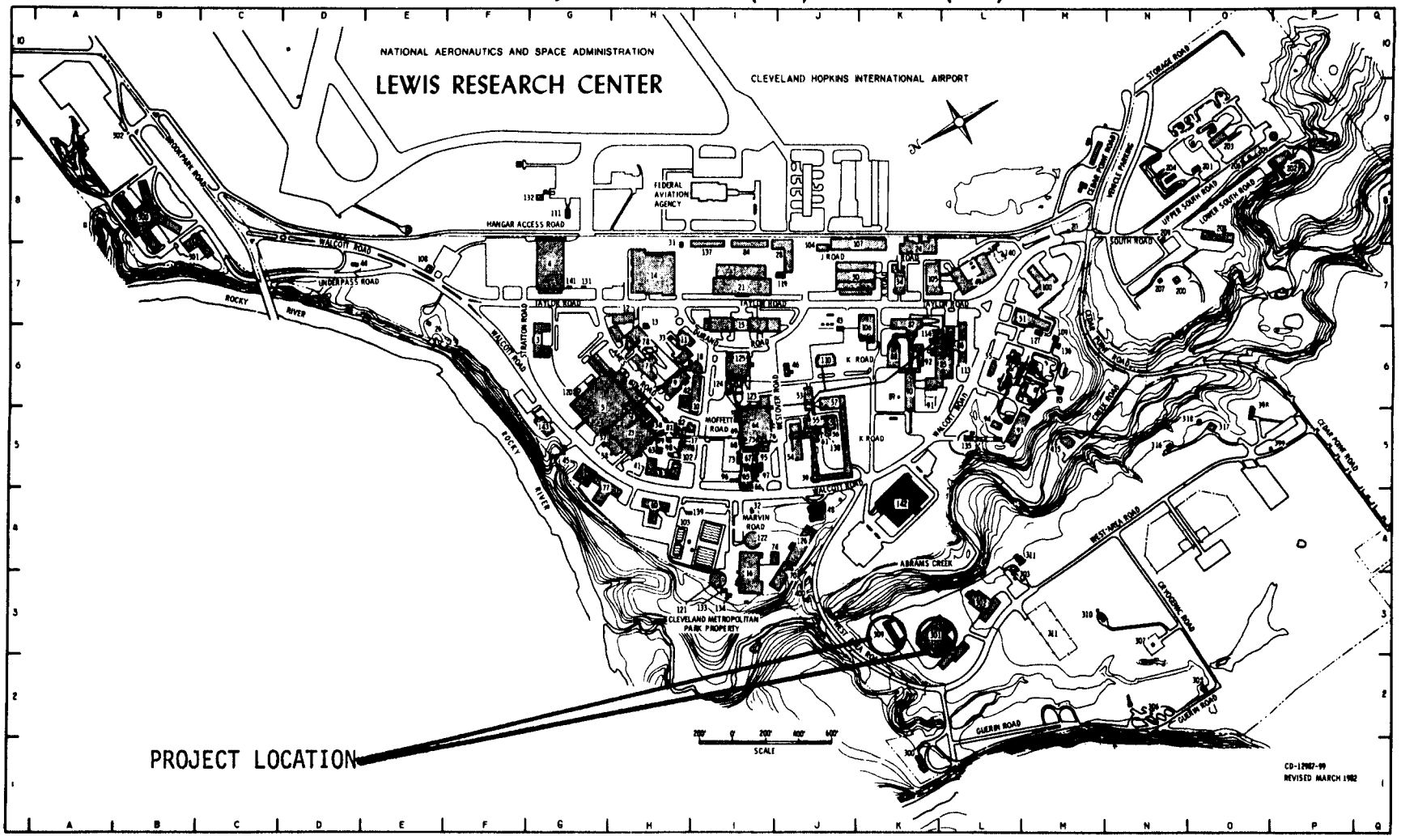
GPO 870 384
7RE

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

REPAIR ROOFS, BUILDING EPL (301) AND SPRL (309)



LOCATION PLAN

FIGURE 1

MINOR CONSTRUCTION PROGRAM

FY 1985

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES -- FIVE-YEAR PLANNING

FOR (Program, Installation Office or Center)
FY 1985 MINOR CONSTRUCTION PROGRAM
LEWIS RESEARCH CENTER

DATE
November 1, 1982

PRIORITY NO.	IDENTIFICATION NO.	TITLE OR DESCRIPTION	ESTIMATED COST ($ Millions to nearest tenth) Budget Estimate	PER	Final Design	Studies Support Fin. Design	
1.	85-1MC	85LAAZ Construction of 480 V. AC Power System at Engine Research Building Complex (5 and 23)	370,000	7,400	22,200	0	
2.	85-2MC	85LABZ Construct Natural Gas Well LeRC Site	220,000	0	0	0	
3.	85-3MC	85LACZ Construction of Storm Sewer for West Area Road	270,000	5,400	16,200	0	
4.	85-4MC	85LADZ Construction of Emergency Freeze Protection System for Various Facility Equipment	200,000	4,000	12,000	0	
		TOTAL ▶	1,060,000	16,800	50,400	0	

NASA FORM 1514 DEC 73

NASA-HQ

BUILDING "SYSTEM" MINOR CONSTRUCTION PROJECT

Construction of 480 V. AC Power System at
Engine Research Building Complex (5 and 23)
Institutional

$370,000

The proposed project will provide 480 volt power to the Engine Research Building Complex (Building 5 and 23). The 480 volt power system will consist of four 2400/480 volt load centers located in the ERB complex. Each unit will consist of a 5KV fused interrupter switch, 1000 KVA 2400/480 volt dry type transformer and a 480 volt distribution switchboard. Back-up power for each load center will be provided through secondary tie circuits. The high voltage supply will come from existing 2400 volt feeder circuit breakers from D3 and D6 switchgear. The load centers will be installed in the ERB basement. The load centers will serve as a 480 volt power source for future loads and some existing loads which can be transferred. No building modifications are required for this project.

The Engine Research Building complex electrical power system was originally designed to operate at 2400 volts or 120/208 volts. Most loads, in an industrial equipment environment like the ERB complex, are best served from a 480 VAC, 3 phase source. Serving such loads from a higher voltage (2400 VAC) results in higher equipment costs; utilizing a lower voltage source (208/120 VAC) also results in higher equipment costs and also increased operating costs due to inefficient operation. This project is intended to increase the 480 volt power source. Future power requirements can be met most efficiently and at least expense, considering both initial investment and long term operating cost, by utilizing a 480 volt power source.

NASA National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LAAZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Construction of 480 V. AC Power System at Engine Research Building Complex (5 and 23)	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$370,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$7,400	$22,200

OTHER RELATED EQUIPMENT

ITEM	AMOUNT	ITEM	AMOUNT
TO BE PURCHASED		FUTURE FUNDING	
		ACTIVATION	
TRANSFER TO EXCESS		OTHER REAL ESTATE	
EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Critical	Minor Construction

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

The proposed project will provide 480 volt power to the Engine Research Building Complex (Building 5 and 23). The 480 volt power system will consist of four 2400/480 volt load centers located in the ERB Complex. Each unit will consist of a 5 KV fused interrupter switch, 1000 KVA 2400/480 volt dry type transformer and 480 volt distribution switchboard. Back-up power for each load center will be provided through secondary tie circuits. The high voltage supply will come from existing 2400 volt feeder circuit breakers from D3 and D6 switchgear. The load centers will be installed in the ERB basement. The load centers will serve as a 480 volt power source for future loads and some existing loads which can be transferred. No building modifications are required for this project.

(continued)

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X : c. Environmental impact See text.

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The Engine Research Building Complex electrical power system was originally designed to operate at 2400 volts or 120/208 volts. Most loads, in an industrial equipment environment like the ERB Complex, are best served from a 480 VAC, 3 phase source. Serving such loads from a higher voltage (2400 VAC) results in higher equipment costs; utilizing a lower voltage source (208/120 VAC) also results in higher equipment costs and also increased operating costs due to inefficient operation. This project is intended to increase the 480 volt power source. Future power requirements can be met most efficiently and at least expense, considering both initial investment and long term operating cost, (cont'd

SCHEDULE DATES

DESIGN PER	START	1-83	
	COMPL	6-83	
DESIGN FINAL	START	1-84	
	COMPL	9-84	
CONSTRUCTION	AWARD	1-85	
	COMPL	11-85	
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213:(b)Send copy to NASA Hq, Code BX;(c)_____.)

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1MC

85LAAZ

Construction of 480 V. AC Power System at
Engine Research Building Complex (5 and 23)

SCOPE/DESCRIPTION (continued)

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

BASIS OF NEED (continued)

by utilizing a 480 volt power source.

NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Construction of 480 V. AC Power System at Engine Research Building Complex (5 and 23)	SUBMISSION/REVISION A PROJECT CODE 85LAAZ
BASIS OF COST ESTIMATE In-house construction estimate (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$264,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	71,000	27%
3. SUBTOTAL *(1 + 2)*	$335,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	35,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$370,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Cost escalation from 9-82 to 6-85 @ 9%/yr $(1.09)^{2.75} = 1.267$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 7,400
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	22,200
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$29,600

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$7,400	$22,200

	ITEM	AMOUNT	ITEM	AMOUNT
OTHER RELATED EQUIPMENT	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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PAGE 1 OF 2 PAGES

IMC

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LAAZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

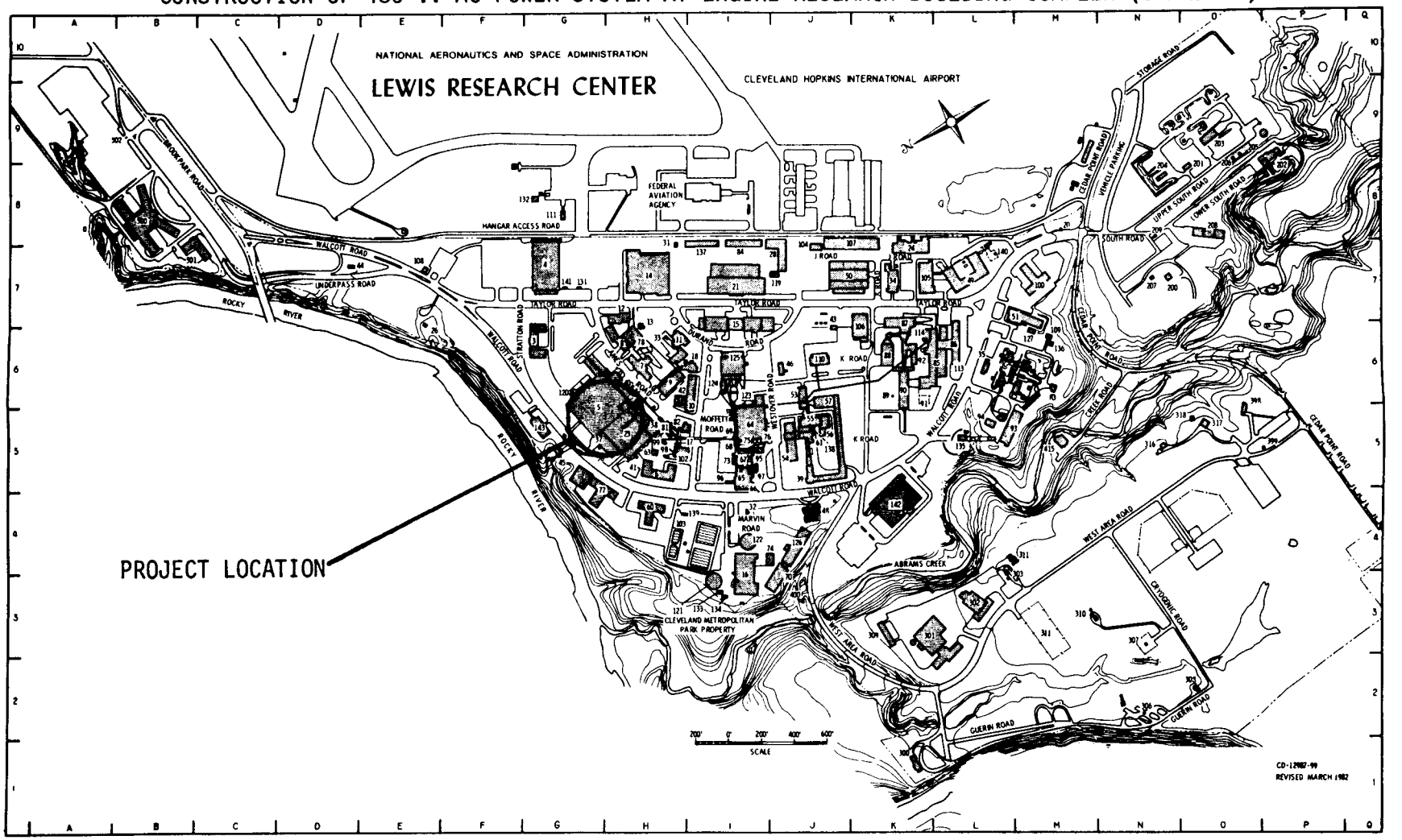
DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
1000 KVA Transformer	Ea	4	14,000		56,000	80,000
480 V Switchboard	Ea	4	17,000		68,000	100,000
Installation					140,000	190,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*						
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA: In-house construction estimate (9/82)		7.		TOTALS ▶	$264,000	$370,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCTION OF 480 V. AC POWER SYSTEM AT ENGINE RESEARCH BUILDING COMPLEX (5 AND 23)



LOCATION PLAN

FIGURE 1

UTILITY "SYSTEM" MINOR CONSTRUCTION PROJECT

Construct Natural Gas Well
LeRC Site
Institutional

$220,000

This project consists of drilling and developing one (1) natural gas well on LeRC property. The work will consist of site preparation, surveys, drilling to the Clinton Sandstone - approx. 2800 ft., geophysical logging, hydraulic fracturing, installation of necessary casings and ground equipment and tie into the existing natural gas line. Well drilling procedures will follow the guidelines of the Ohio Oil and Gas Laws: Ohio Revised Code Chapter 1509, Ohio Administrative Code Chapter 1501.

The cost of natural gas at LeRC is increasing at the rate of 25% per year. One average gas well will produce 50,000 cubic feet per day. This production on a yearly basis is approximately 4.5% of LeRC 1981 gas consumption and reflects a direct savings in LeRC natural gas costs.

NASA
National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LABZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Construct Natural Gas Well, LeRC Site	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$220,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED ☐ YES (Identify) ☒ NONE

PER (Amount)	DESIGN (Amount)
0	0

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Cost Effective	Minor Construction

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of drilling and developing one (1) natural gas well on LeRC property. The work will consist of site preparation, surveys, drilling to the Clinton Sandstone - approx. 2800 ft., geophysical logging, hydraulic fracturing, installation of necessary casings and ground equipment and tie into the existing natural gas line. Well drilling procedures will follow the guidelines of the Ohio Oil and Gas Laws: Ohio Revised Code Chapter 1509, Ohio Administrative Code Chapter 1501.

An environmental impact assessment statement will be written per NMI 8800.7D, Guidelines for Conducting Assessments and Preparing Environmental Statements required by the National Policy Act of 1969. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout Shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The cost of natural gas at LeRC is increasing at the rate of 25% per year. One average gas well will produce 50,000 cubic feet per day. This production on a yearly basis is approximately 4.5% of LeRC 1981 gas consumption and reflects a direct savings in LeRC natural gas costs.

SCHEDULE DATES				
DESIGN	PER	START		
		COMPL		
	FINAL	START	1-84	
		COMPL	6-84	
CONSTRUCTION		AWARD	1-85	
		COMPL	6-85	
REQUIRED OPERATIONAL				

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213:(b)Send copy to NASA Hq, Code BX:(c)_____.)

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2MC

NASA National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Construct Natural Gas Well, LeRC Site	SUBMISSION/REVISION A
	PROJECT CODE 85LABZ
BASIS OF COST ESTIMATE Recent contracts in adjacent areas (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$165,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	40,000	24%
3. SUBTOTAL *(1 + 2)*	$205,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	15,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$220,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9% per year 10-82 to 3-85 $(1.09)^{2.5} = 1.24$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS				
	NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/ AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT					
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN		X		In-house	0
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					0

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☐ a. YES *(Identify in items 2 through 10)* ☒ b. NONE	0	0

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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2MC

INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LABZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Construct Natural Gas Well						
Bonding and Surveys	LS	1	5,000		5,000	7,000
Drilling	LS	1	72,000		72,000	96,000
Well Development	LS	1	88,000		88,000	117,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*						
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA: Recent contracts in adjacent area (9/82)		7.		TOTALS ▶	$165,000	$220,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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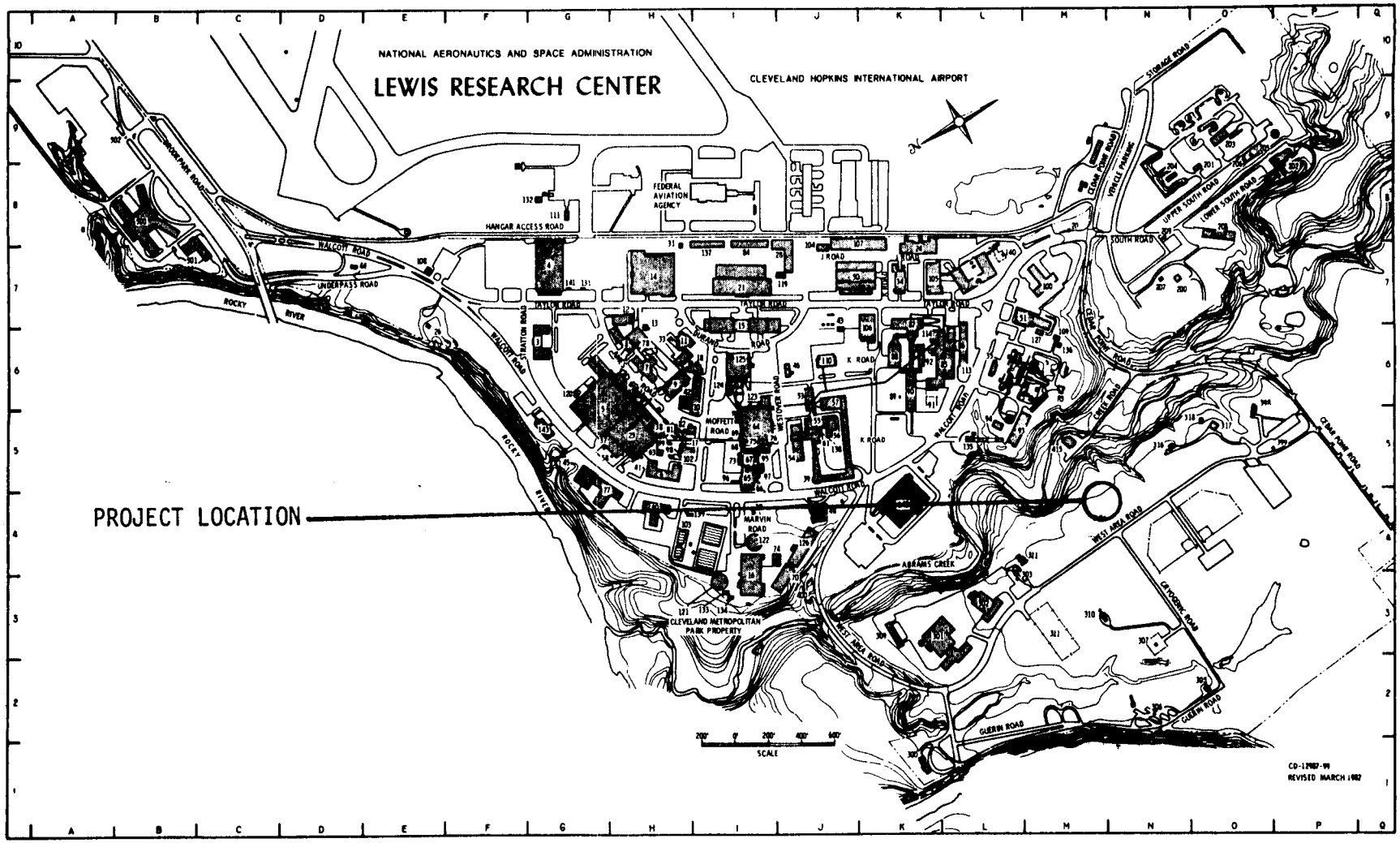
GPO 870 384
2MC

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCT NATURAL GAS WELL, LeRC SITE



LOCATION PLAN

FIGURE 1

UTILITIES "SYSTEM" MINOR CONSTRUCTION PROJECT

Construction of Storm Sewer
for West Area Road
Institutional

$270,000

This project provides for the construction of approximately 1900 lineal feet (579 m) of 36 inch (1 m) diameter concrete pipe storm sewer from an existing storm sewer located on the west side of West Area Road in the vicinity of the Photovoltaic Test Facility to the intersection of Cedar Point Road and West Area Road. Included is construction of ten storm sewer catch basins, related excavation, backfilling, and grading work.

This project will provide the main trunk of a major storm sewer system in the West Area to permit development of a large portion of the area. Construction of this storm sewer will eliminate the roadside ditch and maintenance caused by present conditions.

NASA National Aeronautics and Space Administration

Facility Project - Brief Project Document

CONTROL NO. 85LACZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Construction of Storm Sewer for West Area Road	LeRC/OAST	Nov. 1, 1982	A

APPROVED FACILITY PROJECT COST ESTIMATE	ITEMS (List)	AMOUNT
	TOTAL	$270,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED	PER (Amount)	DESIGN (Amount)
☒ YES (Identify) ☐ NONE	$5,000	$16,200

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Minor Construction

FUND SOURCE	TYPE	IDENTIFICATION
	☐ R&D ☐ R&PM ☒ C OF F	FY 1985 Project _____

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project provides for the construction of approximately 1900 lineal feet (579 m) of 36 inch (1 m) diameter concrete pipe storm sewer from an existing storm sewer located on the west side of West Area Road in the vicinity of the Photovoltaic Test Facility to the intersection of Cedar Point Road and West Area Road. Included is construction of ten storm sewer catch basins, related excavation, backfilling, and grading work.

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None X ; b. Decrease/Increase _____ ; c. Environmental impact See text .

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The present storm drainage system along West Area Road south of the Photovoltaic Test Facility, Building 311, consists of roadside ditches and culverts under intersecting roads. This project will eliminate the roadside ditch and maintenance caused by present conditions and will result in a more useable land area. The storm sewer is consistent with the long range development plan for the West Area.

SCHEDULE DATES				
DESIGN	PER	START	2-83	
		COMPL	7-83	
	FINAL	START	2-84	
		COMPL	9-84	
CONSTRUCTION		AWARD	3-85	
		COMPL	9-85	
REQUIRED OPERATIONAL				

PROJECT APPROVAL	SIGNATURE AND TITLE	DATE
SUBMITTED BY ▶	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY ▶		
BX CONCURRENCE ▶		
APPROVED BY ▶		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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NASA
National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Construction of Storm Sewer for West Area Road	SUBMISSION/REVISION A
	PROJECT CODE 85LACZ
BASIS OF COST ESTIMATE In-house estimate (9/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$189,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	55,000	27%
3. SUBTOTAL *(1 + 2)*	$244,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	26,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$270,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

Escalation @ 9%/yr to midpoint of construction (9/82 to 6/85) $(1.09)^{2.75} = 1.27$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS: NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 5,400
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	16,200
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST					$21,600

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in Items 2 through 10)* ☐ b. NONE	$5,400	$16,200

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LACZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

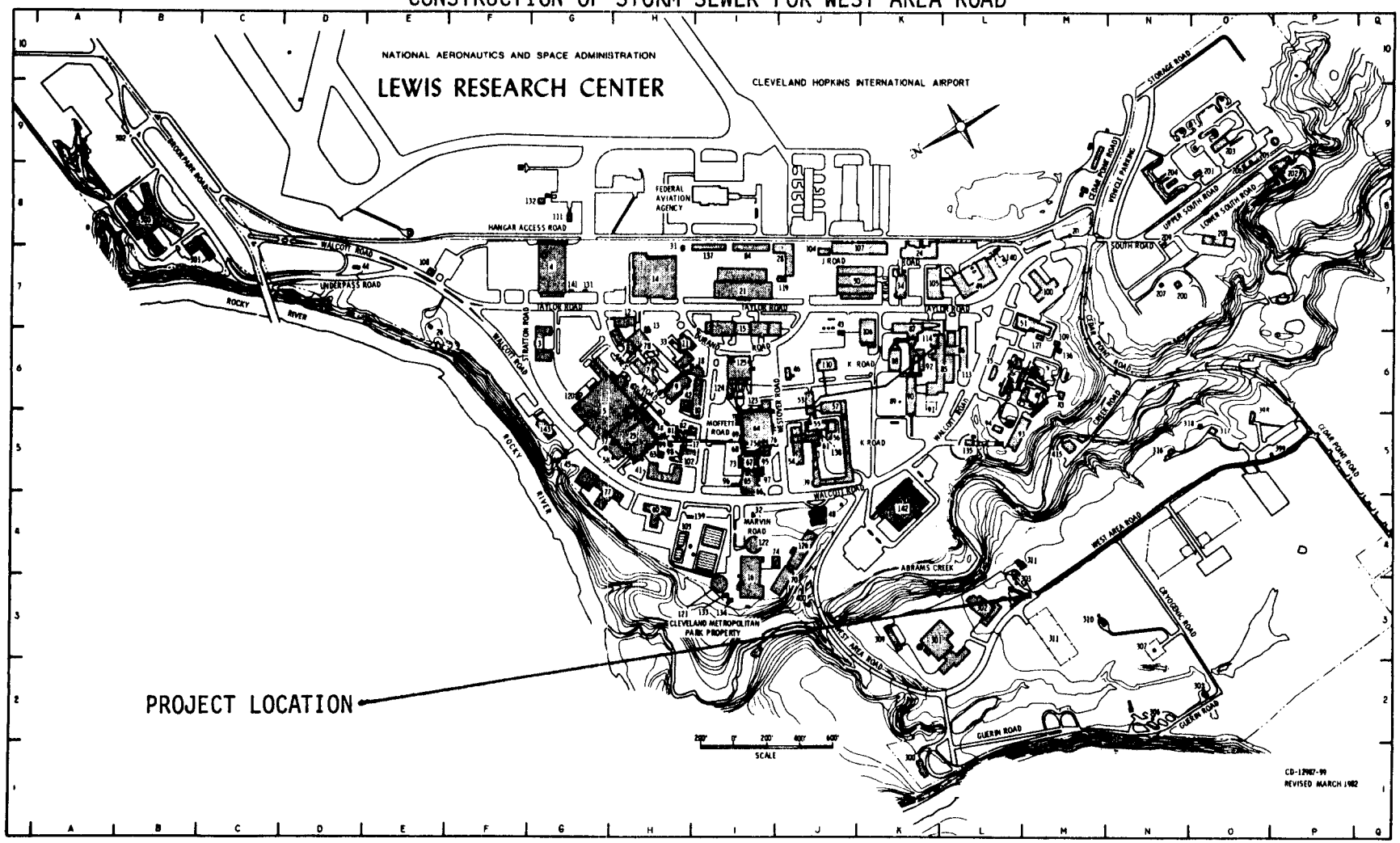
DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE					0	0
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Site Development & Utilities						
Storm Sewer 36"	Lin.Ft.	1900	84		159,000	228,000
Catch Basins	Ea.	10	1,300		13,000	18,000
Grading	LS		17,000		17,000	24,000
					189,000	270,000
Building/Structure					0	0
Utilities Support					0	0
Facilities Project Equipment					0	0
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*						
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA: In-house estimate (9/82)		7.		TOTALS ▶	$189,000	$270,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCTION OF STORM SEWER FOR WEST AREA ROAD



LOCATION PLAN

FIGURE 1

BUILDING "SYSTEM" MINOR CONSTRUCTION PROJECT

Construction of Emergency Freeze Protection System
for Various Facility Equipment
Institutional

$200,000

This project consists of the construction of a circulating water emergency freeze protection system. The work includes the installation of engine driven pumps and piping. A pumping station containing two pumps of nominal 4500 gpm (17 M^3/m) capacity will be housed in a small building adjacent to the existing Pump Building (74). Two complexes to be served are: Propulsion Systems Laboratory Complex (PSL) Buildings (64), (67), (68), (123), (124), and (125); and the 8x6 Supersonic Wind Tunnel Complex (8x6 SWT) Buildings (53) and (56).

The cooling water system is subjected to freezing temperatures. The cooling water serves systems containing expensive unique design heat-exchangers. These heat exchangers, because of configuration and/or location cannot be insulated or drained. When ambient temperatures are below freezing, and the system is not functioning at normal operating levels, minimal water circulation is maintained to prevent icing damage. Minimal water circulation is presently accomplished using one of the electrically driven circulating water pumps. This project will provide emergency freeze protection in the event of an electrical power failure or successive malfunction of the electrical driven water pumps.

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Facility Project - Brief Project Document

CONTROL NO. 85LADZ

PROJECT TITLE	INSTALLATION/PROGRAM OFFICE	DATE	REVISION NO.
Construction of Emergency Freeze Protection System for Various Facility Equipment	LeRC/OAST	Nov. 1, 1982	D

APPROVED FACILITY PROJECT COST ESTIMATE

ITEMS (List)	AMOUNT
TOTAL	$200,000

RELATED COST DATA (Not included in this Approved Facility Project Cost Estimate but required to make the facility initially operable)

RELATED COSTS INVOLVED: [X] YES (Identify) [ ] NONE

PER (Amount)	DESIGN (Amount)
$4,000	$12,000

OTHER RELATED EQUIPMENT

	ITEM	AMOUNT	ITEM	AMOUNT
	TO BE PURCHASED		FUTURE FUNDING	
			ACTIVATION	
	TRANSFER TO EXCESS		OTHER REAL ESTATE	
	EXISTING		OTHER (Specify)	

CATEGORY	JUSTIFICATION	WORK
	Instit. Routine	Minor Construction

FUND SOURCE	TYPE	IDENTIFICATION
	[ ] R&D [ ] R&PM [X] C OF F	FY 1985 Project

SCOPE/DESCRIPTION (Project write-up dated _____ and sketch dated _____ attached.)

This project consists of the construction of a circulating water emergency freeze protection system. The work includes the installation of engine driven pumps and piping. A pumping station containing two pumps of nominal 4500 gpm (17 M^3/m) capacity will be housed in a small building adjacent to the existing Pump Building (74). Two complexes to be served are: Propulsion Systems Laboratory Complex (PSL) Buildings (64), (67), (68), (123), (124) and (125); and the 8x6 Supersonic Wind Tunnel Complex (8x6 SWT) Buildings (53) and (56).

All aspects of this project are covered by the Institutional Environmental Impact Statement approved 8/25/71 for LeRC and the Environmental Resources Document dated April 1980. Randolph-Sheppard Act Amendments of 1974 are not applicable to this project. Fallout shelter required by Executive Order 11490 as amended is not applicable to this project.

Impact on Existing Facility Capability: a. None _____; b. ~~Decrease~~/Increase X : c. Environmental impact See text.

BASIS OF NEED ("Unforseen Programmatic" Project Analysis Sheet dated _____ attached, if applicable.)

The cooling water system is subjected to freezing temperatures. The cooling water serves systems containing expensive unique design heat-exchangers. These heat exchangers, because of configuration and/or location cannot be insulated or drained. When ambient temperatures are below freezing, and the system is not functioning at normal operating levels, minimal water circulation is maintained to prevent icing damage. Minimal water circulation is presently accomplished using one of the electrically driven circulating water pumps. This project will provide emergency freeze protection in the event of an electrical power failure or successive malfunction of the electrical driven water pumps.

SCHEDULE DATES

DESIGN	PER	START	1-83
		COMPL	6-83
	FINAL	START	1-84
		COMPL	10-84
CONSTRUCTION		AWARD	1-85
		COMPL	12-85
REQUIRED OPERATIONAL			

PROJECT APPROVAL

	SIGNATURE AND TITLE	DATE
SUBMITTED BY	John M. Klineberg Deputy Director	10/19/82
CONCURRENCE BY		
BX CONCURRENCE		
APPROVED BY		

PROJECT STIPULATIONS:
(a) Notification of bid per NHB 7320.1, Par. 213;(b)Send copy to NASA Hq, Code BX;(c)_____.)

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National Aeronautics and Space Administration

Facility Project Cost Estimate

INSTALLATION/PROGRAM OFFICE LeRC/OAST	DATE Nov. 1, 1982
PROJECT TITLE Construction of Emergency Freeze Protection System for Various Facility Equipment	SUBMISSION/REVISION D PROJECT CODE 85LADZ
BASIS OF COST ESTIMATE Conceptual design, in-house & Mfg. costs (1/81, updated 8/82)	PROJECT NO.

I. SUMMARY OF COST ESTIMATE

DESCRIPTION	AMOUNT a.	PERCENT b.
1. ENGINEERING ESTIMATE	$140,000	
2. COST ADJUSTMENT *(Enter percentage of item 1a to right in col. 2b)*	42,000	30%
3. SUBTOTAL *(1 + 2)*	$182,000	
4. CONTINGENCIES *(Enter percentage of item 3 to right in col. 4b)*	18,000	10%
5. SUPERVISION, INSPECTION AND ENGINEERING SERVICES *(Enter percentage of items 3a and 4a to right in col. 5b)*		
6. OTHER BURDEN COSTS		
7. TOTAL BUDGET ESTIMATE *(3 + 4 + 5 + 6)*	$200,000	

8. IDENTIFICATION OF COST ADJUSTMENT *(Item 2, above)* AND OTHER BURDEN COSTS *(Item 6, above)*

9%/yr excalation from (8/82) to midpoint of construction (6/85) $(1.09)^{3.0} = 1.30$

II. PLANNING AND DESIGN

DESCRIPTION	STATUS				
	NEEDED a.	IN-WORK b.	COMPLETE c.	IN-HOUSE/ AE d.	COST e.
1. PRELIMINARY ENGINEERING REPORT	X			A-E	$ 4,000
2. SPECIAL STUDIES *(Specify)*					
3. FINAL DESIGN	X			A-E	12,000
4. SUPERVISION AND ADMINISTRATION OF DESIGN SERVICES					
5. TOTAL PLANNING AND DESIGN COST ▶					$16,000

III. RELATED COST DATA *(Not included in this Approved Facility Cost Estimate but required to make the facility initially operable)*

1. RELATED COSTS INVOLVED	2. PER *(Amount)*	3. DESIGN *(Amount)*
☒ a. YES *(Identify in items 2 through 10)* ☐ b. NONE	$4,000	$12,000

OTHER RELATED EQUIPMENT	ITEM	AMOUNT	ITEM	AMOUNT
	4. TO BE PURCHASED		8. ACTIVATION	
	5. TRANSFER TO EXCESS		9. OTHER REAL ESTATE	
	6. EXISTING		10. OTHER *(Specify)*	
	7. FUTURE FUNDING			

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INSTALLATION/PROGRAM OFFICE	PROJECT CODE	DATE
LeRC/OAST	85LADZ	Nov. 1, 1982

IV. FACILITY PROJECT COST ESTIMATE

DESCRIPTION	UNIT OF MEASURE (1)	QUANTITY (2)	UNIT COST ENGNG (3)	UNIT COST BUDGET (4)	TOTAL COST ENGNG (5)	TOTAL COST BUDGET (6)
1. INTEREST IN REAL ESTATE						
2. SITE DEVELOPMENT & UTILITIES OUTSIDE 5 FOOT LINE *(Summary)*						
3. BUILDING/STRUCTURE WITHIN 5 FOOT LINE *(Summary)*						
Building Enclosure and Pump Base	LS		10,000		10,000	14,000
Engine-Driven Pumps	Ea	2	50,000		100,000	144,000
Pipe, Valves & Installation	LS				24,000	34,000
Electrical	LS		6,000		6,000	8,000
4. OTHER COLLATERAL EQUIPMENT NOT INCLUDED IN 3, ABOVE *(Summary)*						
5. SPECIAL FEATURES *(Summary)*						
6. SOURCE OF COST DATA Conceptual design, in-house & Mfg. costs (1/80) updated (8/82)		7.		TOTALS ▶	$140,000	$200,000

V. RELATED ITEMS/ACTIONS *(Explain as appropriate. Use extra sheets, as necessary, for this block and above)*

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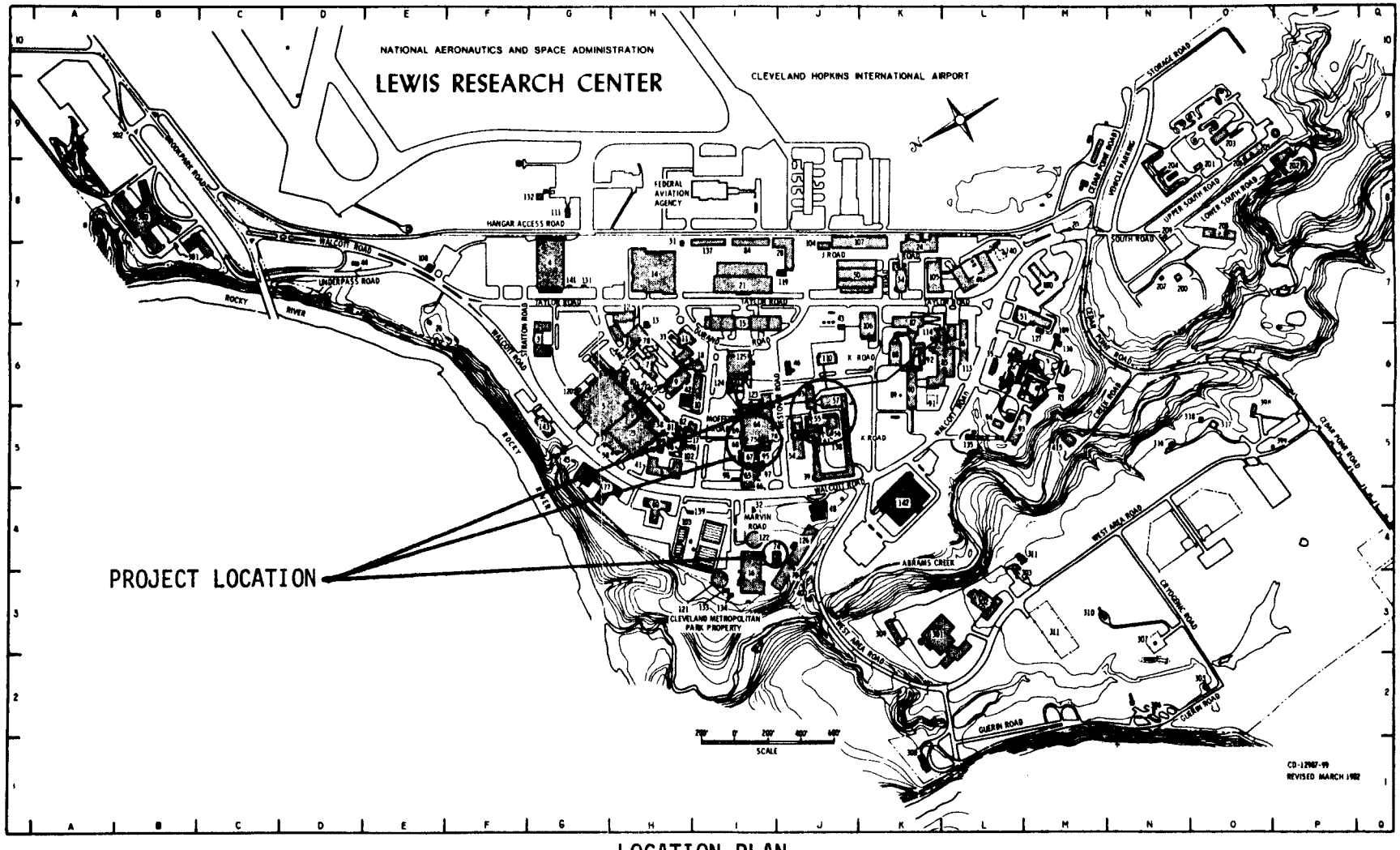
LEWIS RESEARCH CENTER

FY 1985 CoF ESTIMATES

CONSTRUCTION OF EMERGENCY FREEZE PROTECTION SYSTEM FOR VARIOUS FACILITY EQUIPMENT



LOCATION PLAN

FIGURE 1