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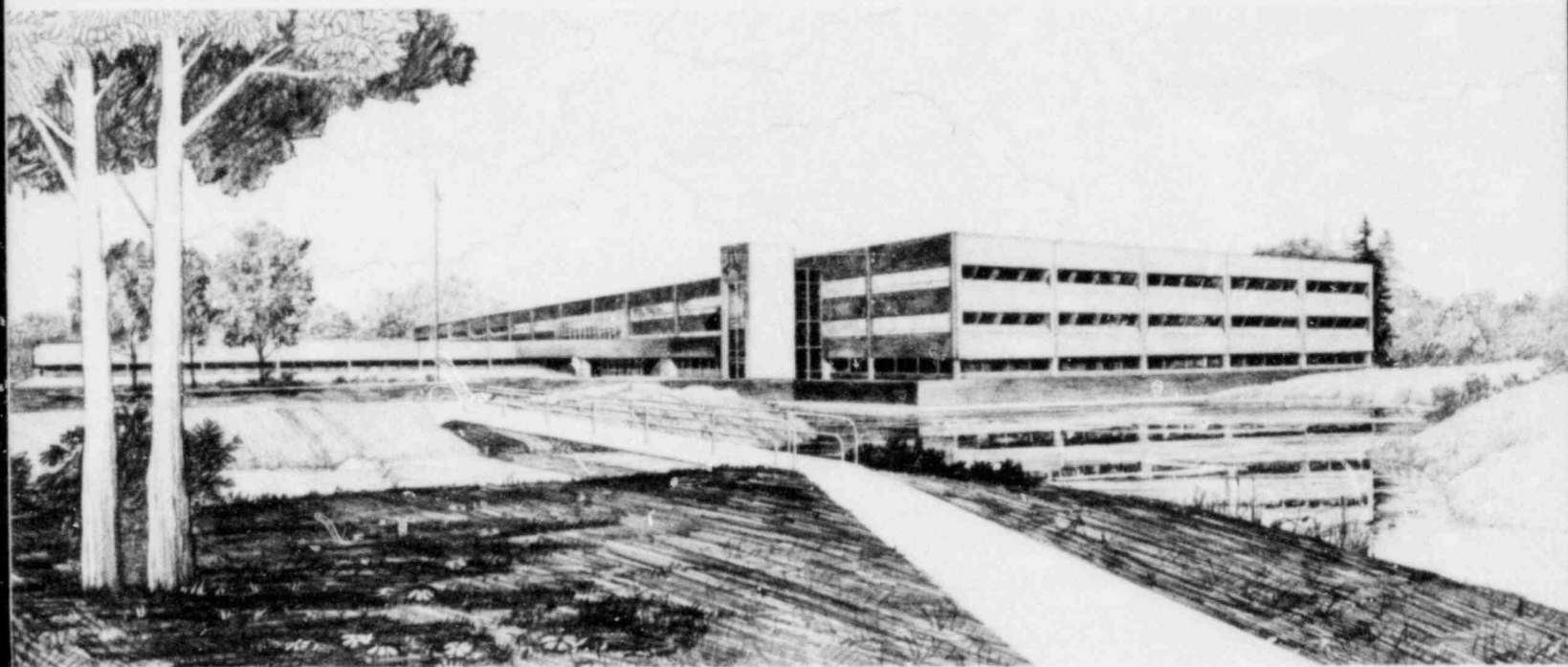
August 1982

JUNE 1982 LOFT PROGRESS REPORT  
TO FOREIGN PARTICIPANTS

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**U.S. Department of Energy**

Idaho Operations Office • Idaho National Engineering Laboratory



This is an informal report intended for use as a preliminary or working document

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## INTERIM REPORT

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This document was prepared primarily for preliminary or internal use. It has not received full review and approval. Since there may be substantive changes, this document should not be considered final.

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JUNE 1982 LOFT PROGRESS REPORT  
TO FOREIGN PARTICIPANTS

ACCOMPLISHMENTS

General Overview of LOFT Program

Experiment L2-5 was completed on the target date of June 16, 1982, in the Loss-of-Fluid Test (LOFT) facility. The principal work effort now in progress in the LOFT Experimental Program is the preparation for LOFT Experiment L6-8 (series) to be conducted during the target period of August 15 through September 1, 1982. Preparation is also in progress for LOFT Experiment L9-4 to be conducted on the target date of September 22, 1982.

Experiment L2-5 was the third experiment in the LOFT Power Ascension Experiment Series L2. Experiment L2-5 simulated a guillotine (offset shear) break in the inlet pipe of a commercial pressurized water reactor simultaneous with a loss of site power. In addition, an atypical primary coolant pump coastdown was imposed in an attempt to avoid the early bottom-up core-wide rewet which occurred in the earlier two Series L2 experiments, L2-2 and L2-3.

The early primary coolant pump trip and atypical coastdown were sufficient to avoid the early bottom-up rewet. A peak temperature of 1077 K (1479°F) was reached and data were collected on core reflood and quench on fuel rods which did not experience early return to nucleate boiling. These are the first such data collected in LOFT from conditions which are specified in 10 CFR 50 Appendix K for loss-of-coolant accident analysis. With the exception of early bottom-up rewet, the thermal and hydraulic responses during Experiment L2-5 were qualitatively similar to those that occurred during Experiment L2-3.

## LOFT Program Activities

### Work and Analyses for Experiment Preparation

Inservice inspection and waste gas processing system, isotope detection system, and surveillance testing were completed in preparation for Experiment L2-5.

Experiment Operating Procedure (EOP) L2-5, "Power Ascension Test Series L2," was successfully completed.

Experiment L2-5 requalification testing, including pump operations and cold rod drops, was performed.

Delivery of all required F2 fuel bundle pressure sensors was completed to Exxon Nuclear Company.

Exxon Nuclear Company completed the F2 fuel bundle design drawings, standard fuel rod depressurization or repressurization to 600 psi, fuel bundle skeleton assembly, and the initial instrumented fuel rods.

### Experiment Data Instrumentation Preparation

Battelle Pacific Northwest Laboratories completed attachment of 26 of 64 F2 fuel rod cladding thermocouples.

Presentations discussing the thermocouple problem analysis and the F2 fuel bundle cladding thermocouple life cycle testing were made to the Nuclear Regulatory Commission (NRC); Department of Energy, Idaho Office (DOE-ID); and the Light Water Reactor Fuel Research Division.

### Posttest Analyses and Documentation

The posttest analysis documents for Experiments L5-1/L8-2 and L9-1/L3-3 are in final review and editing.

The Experiment Data Report for LOFT Experiment L6-6 was published on schedule.

The Quick-Look Report for LOFT Experiment L2-5 (EGG-LOFT-5921) was completed.

#### Topical Reports, Studies, and Presentations

The following LOFT topical reports were completed and issued:

1. EGG-LOFT-5555, "Evaluation of Analytical Capability to Predict Blowdown Cladding Quench During a PWR Large Break Accident"
2. EGG-LOFT-5865, "A Comparison of Thermal Hydraulic Response of Three Large Break Test Facilities."

A paper, entitled "The LOFT Pulsed Neutron Activation System of Fluid Flow Measurement," was presented at the American Institute of Aeronautics and Astronautics/American Society of Mechanical Engineers Symposium in St. Louis, Missouri. A paper, entitled "Automated Data Qualification (ADQ)," was presented at the 1982 Symposium on Instrumentation and Control for Fossil Energy Processes in Houston, Texas.

The following papers were completed and submitted to the Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics to be held at Santa Barbara, California, on January 11-14, 1983:

1. "Primary Pump Power as a Measure of Fluid Density During Bubbly Two-Phase Flow"
2. "Natural Circulation Cooling Characteristics During PWR Accident Simulations"
3. "Effects of Cladding Surface Thermocouples and Electrical Heater Rod Design on Quench Behavior"

4. "Application of an Assessed Analytical Capability to Predict Rapid Cladding Quench During the Blowdown Phase of a Large Break Loss-of-Coolant Accident."

An abstract, entitled "Loss of Fluid Test Findings in Pressurized Water Reactor Loss-of-Coolant Accident Core Cooling," was accepted for presentation at the Thermal Engineering Joint Conference Session on Two-Phase Flow and Boiling Heat Transfer to be held at Honolulu, Hawaii.

Two LOFT personnel were members of the NRC-LOFT team which visited most of the European laboratories participating in the current LOFT program. Technical information was exchanged, and several presentations on LOFT results were given at each laboratory. Preparations are continuing for a similar information exchange with Japan, Taiwan, and South Korea, scheduled for late July 1982.

A presentation discussing the past LOFT Experimental Program was made to DOE-Washington personnel at the request of DOE-ID.

## FOREIGN-FUNDED TASK SUMMARIES

Foreign funded projects are summarized in this section.

### Summary of Tasks Funded by Japan (JAERI)

Numerous checkout tests for the postcritical heat flux (post-CHF) test section were conducted, and numerous data acquisition system, instrumentation, and hardware problems had to be resolved before acceptable data could be recorded. Orifice flow measurements were added to complement the turbine meter measurements. Enough checkout testing was accomplished to determine that the full range of test parameters cannot be tested with film boiling in the entire length of the test section. Therefore, some post-CHF data will be obtained with a quench front in the test section.

### Summary of Tasks Funded by Germany (FRG)

Results from the calculation for Experiment L3-7 were documented.

Work was performed for the F2 fuel rod pressure transducer temperature compensation. The algorithm derivation for all 31 Kaman pressure sensors was completed. All of the pressure sensors were delivered to Exxon Nuclear Company, and the end caps were welded to the transducers.

### Summary of Tasks Funded by France (CEA)

The Kaman pressure sensors and electronics were delivered to Westinghouse at the Hanford Engineering Development Laboratory for algorithm derivation. Plans for testing pressure transducers at Westinghouse and Exxon Nuclear Company were completed.



## IN-KIND FOREIGN TASK SUMMARIES

This section summarizes tasks performed at foreign laboratories for LOFT, per participating agreements.

### Summary of Tasks Performed by Austria (FZS)

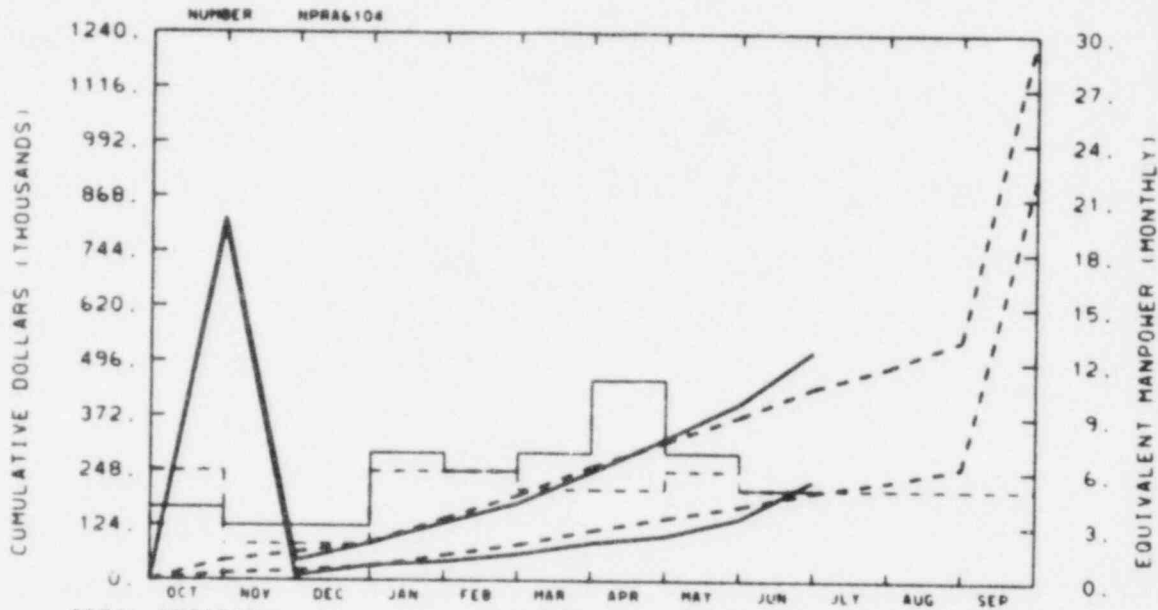
The FZS air-water loop is now operable. System checkout and scoping tests have been performed. The first test matrix will be performed to study horizontal stratified flows in a horizontal branch tee at steady flow conditions.

### Summary of Tasks Performed by Switzerland (EIR)

The Swiss NEPTUN reflood experiments are progressing. The original reflood experiments will be complete by early fall 1982.

FOREIGN-FUNDED COST GRAPHS

EG&G IDAHO INC.  
GERMAN FUNDS - 5G



TOTAL PROGRAM

BUDGET	45	64	86	141	193	258	314	373	438	485	547	1237
ACTUAL	818	45	86	131	175	247	322	403	521			

MATERIAL

BUDGET	15	23	32	58	81	114		170	203	226	258	918
ACTUAL	802	11	34	44	60	86	102	142	228			

MANPOWER

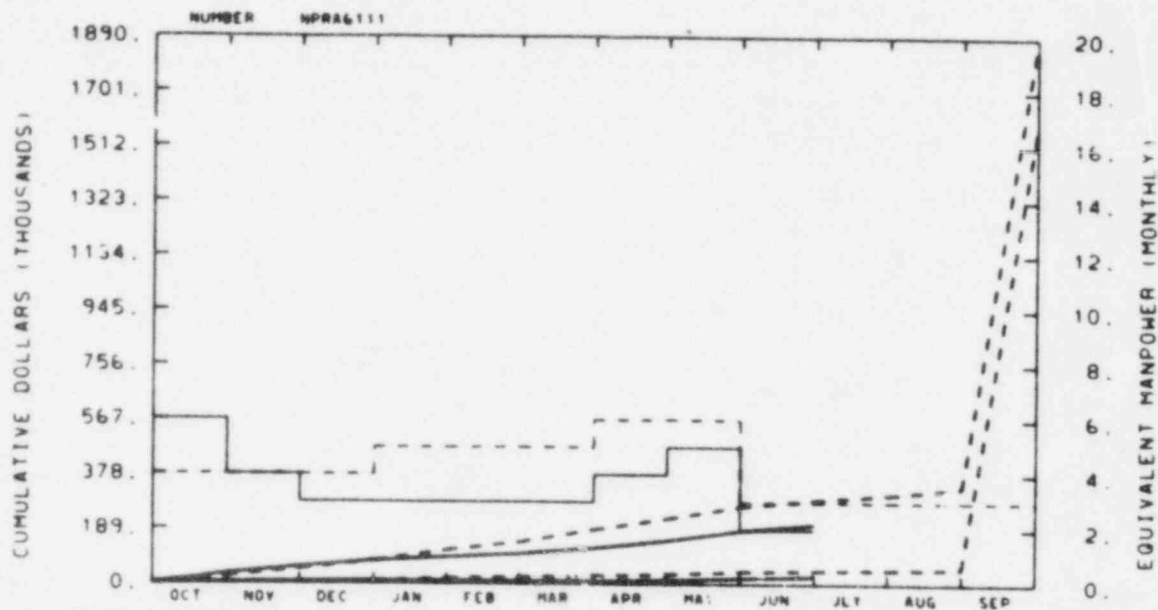
BUDGET	6	2	2	6	6	5	5	6	5	5	5	5
ACTUAL	4	3	3	7	6	7	11	7	5			

BUDGET

ACTUAL

The overrun is from early completion of work scope in the areas of labor and materials in the F2 fuel bundle instrument temperature compensation account. The budget and schedule will be modified to reflect the early accomplishment of this work scope.

EG&G IDAHO INC.  
 JAPANESE FUNDS - 5J



TOTAL PROGRAM

BUDGET	27	50	79	117	145	188	227	269	292	310	334	1892
ACTUAL	33	58	79	92	104	125	151	186	208			

MATERIAL

BUDGET	3	6	9	20	24	30	35	45	48	52	56	1584
ACTUAL	3	7	11	11	11	11	15	22	28			

MANPOWER

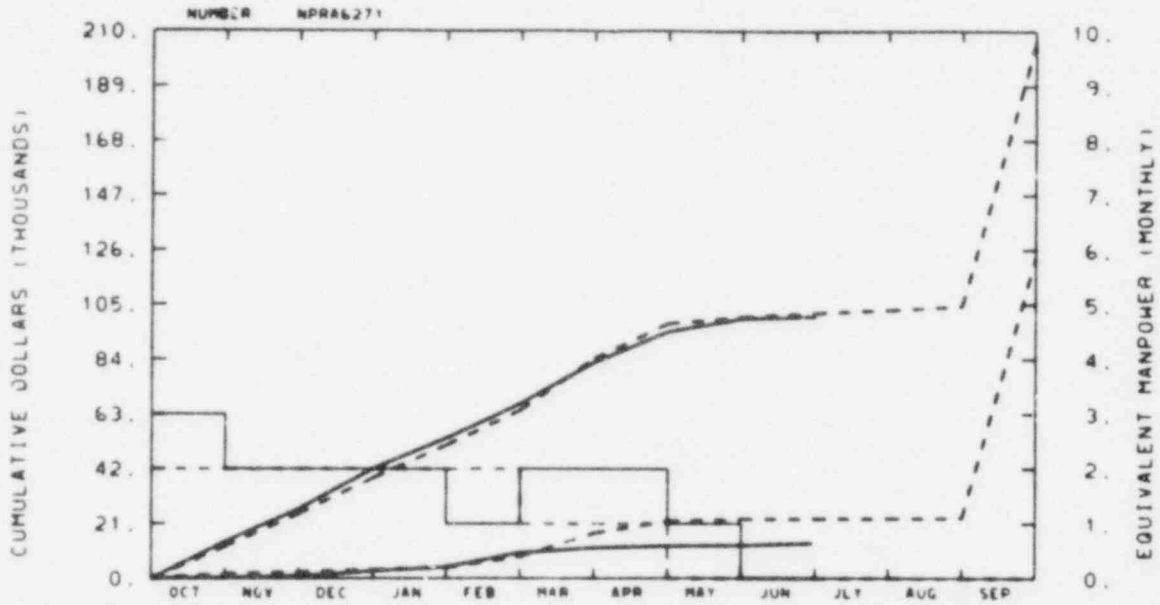
BUDGET	4	4	4	5	5	5	6	6	3	3	3	3
ACTUAL	6	4	3	3	3		4	5	2			

BUDGET

ACTUAL

The testing portion of the postcritical heat flux (post-CHF) task was delayed (which consequently delayed the analysis work that was budgeted) due to higher priority work at the LOFT Test Support Facility (LTSF). A management review of the post-CHF task has indicated budget and schedule adjustment requirements which will be submitted for Change Control Board (CCB) action.

EG&G IDAHO INC.  
 NETHERLANDS FUNDS - 5N



TOTAL PROGRAM

BUDGET	12	25	39	51	64	84	98	100	102	103	104	205
ACTUAL	14	27	42	54	67	83	95	99	100			

MATERIAL

BUDGET	2	3	3	4	8	17	22	23	23	23	23	123
ACTUAL	0	1	3	4	10	12	12	13	14			

MANPOWER

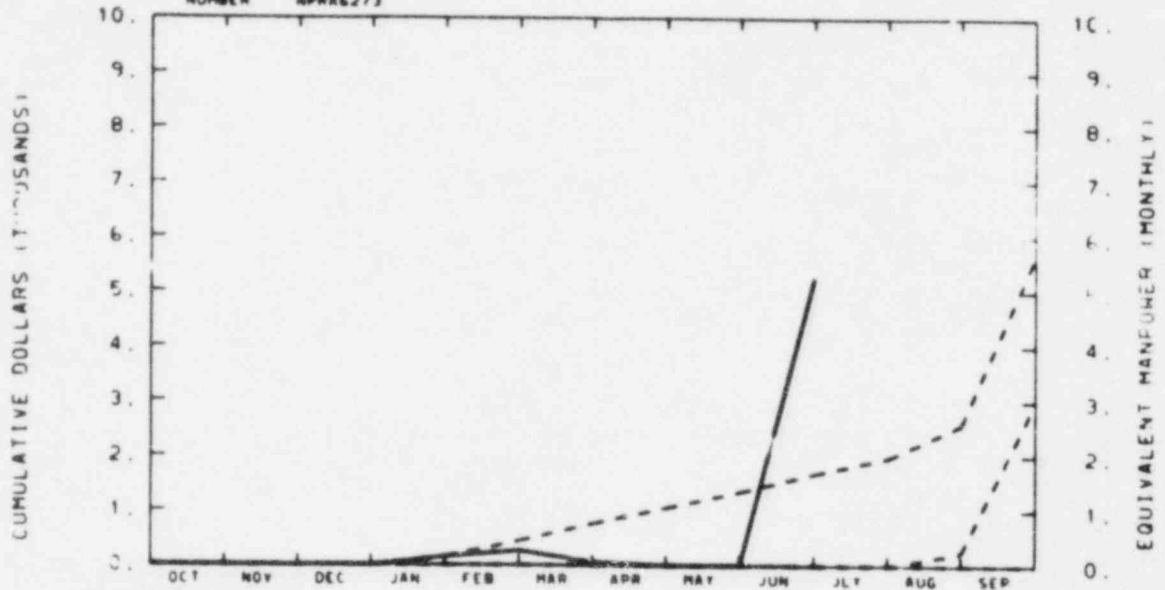
BUDGET	2	2	2	2	2	1	1	0	0	0	0	0
ACTUAL	3	2	2	2	1	2	2	1	0			

BUDGET  
 -----  
 ACTUAL  
 \_\_\_\_\_

No significant variance.

EG&G IDAHO INC.  
AUSTRIAN FUNDS - 5A

NUMBER NPRA6273



TOTAL PROGRAM

BUDGET	0	0	0	0	0	1	1	1	2	2	3	6
ACTUAL	0	0	0	0	0	0	0	0	5			

MATERIAL

BUDGET	0	0	0	0	0	0	0	0	0	0	0	3
ACTUAL	0	0	0	0	0	0	0	0	5			

MANPOWER

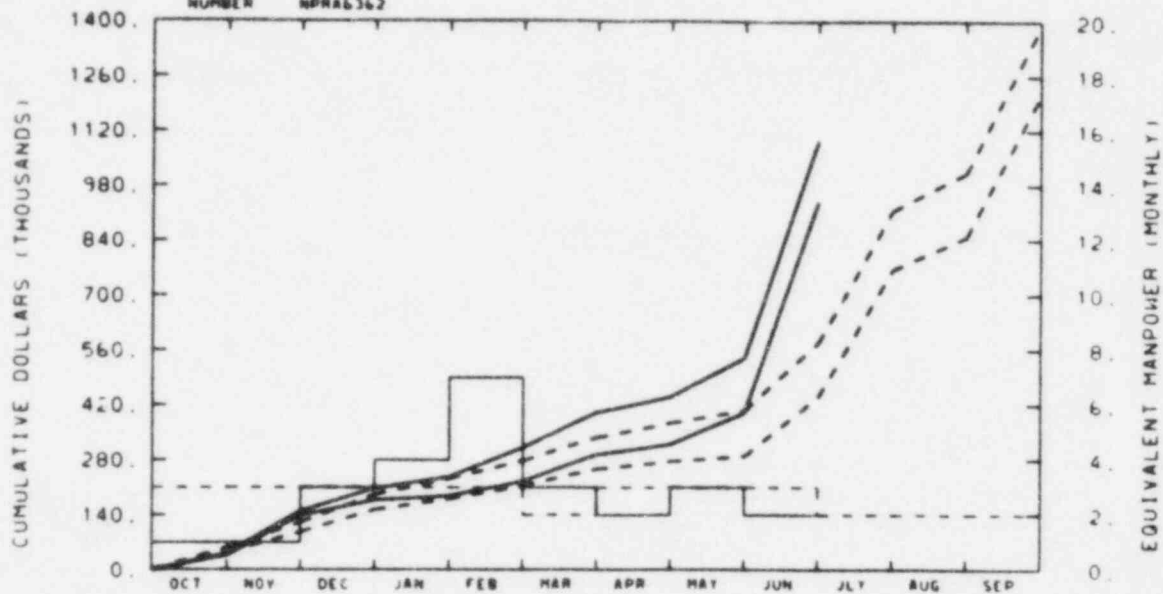
BUDGET	0	0	0	0	0	0	0	0	0	0	0	0
ACTUAL	0	0	0	0	0	0	0	0	0	0	0	0

BUDGET  
-----  
ACTUAL  
\_\_\_\_\_

This account was used in June for Nuclear Regulatory Commission (NRC) travel to Europe, including Austria, in support of the NRC-LOFT team annual information exchange. No overrun is anticipated, as these funds were being held for this trip.

EG&G IDAHO INC.  
FRENCH FUNDS - 5F

NUMBER NPR61362



TOTAL PROGRAM		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
BUDGET		17	121	192	233	278	338	375	406	578	916	1012	1391
ACTUAL		42	150	208	237	312	401	441	540	1095			

MATERIAL		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
BUDGET		16	97	153	181	214	258	276	289	440	766	847	1213
ACTUAL		37	138	178	188	226	294	321	400	938			

MANPOWER		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
BUDGET		3	3	3	7	3	2	3	3	3	2	2	2
ACTUAL		1	1	3	4	7	3	2	3	2			

BUDGET  
-----  
ACTUAL  
\_\_\_\_\_

The variance is due primarily to (a) early payments or accruals of the F2 fuel bundle instrumentation subcontract to Kaman Services (K6364), (b) delayed payments or accruals of the F2 fuel bundle design and assembly subcontract to Exxon Nuclear Company (K106), and (c) the Kaman subcontract contains components that are both operating (French funds) and LOFT capital equipment funds. The Kaman estimates were spread through June and July, while the payments and/or accruals were costed in June. The contract must be costed before the cost transfer can be prepared (scheduled for July business). The Exxon contracts have fluctuated slightly on a monthly basis, but are tracking with annual estimates and no problems are anticipated.

TABLE 1. PLANNED LOFT EXPERIMENT SEQUENCE

Test ID	Commitment Date	Description
CV leak test	07/09/81 <sup>a</sup>	Required test of containment leak integrity.
L6-7/L9-2	07/31/81 <sup>a</sup>	Simulated turbine trip multiple failure continuation of L6-7.
L5-1	10/26/81 <sup>a</sup>	Intermediate size break (accumulator line).
L8-2	11/16/81 <sup>a</sup>	Core uncover at high decay heat level.
Replace A2 with F1	11/19/81 through 01/29/82 <sup>a</sup>	F1 center fuel pressurized to 350 psig.
L9-3	04/07/82 <sup>a</sup>	Anticipated transient without scram (ATWS) loss of feedwater.
L6-6	04/21/82 <sup>a</sup>	Boron dilution from cold shutdown.
L2-5	06/16/82 <sup>a</sup>	200% cold leg break at 50 MW to produce the worst probable core thermal-hydraulic conditions, without fuel damage.
L6-8	10/21/82	Three anticipated transients.
L9-4	11/18/82	ATWS.
Replace F1 with F2	02/23/83	F2 fuel bundle pressurized.
L2-6	03/24/83	200% cold leg break double-ended at 50 MW.
Initiate cold shutdown	09/29/83	In standby--cold without core.
<hr/>		
a. Completed.		



TABLE 2. FOREIGN-FUNDED ACCOUNTING AT END OF JUNE 1982  
(thousands of dollars)

<u>Participant</u>	<u>Total Funds Provided</u>	<u>Funds Spent (Completed Tasks)</u>	<u>Reserve</u>	<u>Spending Authorized (Current Tasks)</u>
JAERI	7000	4725.0	1511.3	763.7 <sup>a</sup>
FRG	6260	4610.3	629.3	1020.4 <sup>a</sup>
CEA	2000	47.5	347.4	1605.1 <sup>a</sup>
ECN	640	372.0	98.7	169.3 <sup>a</sup>
FZS	<u>147</u>	<u>141.3</u>	<u>0</u>	<u>5.7</u>
Total	16047	9895.8	2586.7	3564.2 <sup>a</sup>

a. Includes FY-1983 funds identified for the baseline (Q82-2-0), but spending of those funds has not yet been authorized.

TABLE 3. FOREIGN-FUNDED TASK SUMMARY AT END OF JUNE 1982  
(thousands of dollars)

<u>Task Description</u>	<u>Spending Authorized</u>	<u>Spending to Date</u>	<u>Budget to Date</u>	<u>Scheduled Completion</u>
<u>JAERI Tasks</u>				
5J12211 JAERI Management (FY-1982)	61.4	39.4	35.6	September 1982
5J12211 JAERI MANAGEMENT (FY-1983) <sup>a</sup>	25.4	0	0	September 1983
5J12212 JAERI Delegate Support (FY-1982)	15.6	2.8	6.0	September 1982
5J12212 JAERI Delegate Support (FY-1983) <sup>a</sup>	16.0	0	0	September 1983
5J12223 International Program Evaluation (FY-1982)	64.0	25.3	34.2	September 1982
5J12223 International Program Evaluation (FY-1983) <sup>a</sup>	99.2	0	0	September 1983
5J12231 Post-CHF Phase II	151.0	63.6	151.0	August 1982
5J12232 Post-CHF Phase I	235.1	237.1	235.1	November 1982
5J12233 Density for Post-CHF	44.6	41.0	30.9	August 1982
5J13321 Display Evaluation	<u>51.4</u>	<u>51.4</u>	<u>51.4</u>	Completed
Total	763.7	460.6	544.2	
<u>FRG Tasks</u>				
5G12E11 Experimental Analysis	255.4	255.4	255.4	Completed
5G12211 FRG Management (FY-1982)	40.5	27.7	30.5	September 1982
5G12211 FRG Management (FY-1983) <sup>a</sup>	25.4	0	0	September 1983
5G12212 FRG Delegate Support (FY-1982)	14.5	14.3	9.1	September 1982
5G12212 FRG Delegate Support (FY-1983) <sup>a</sup>	15.9	0	0	September 1983
5G12223 International Program Evaluation	70.0	69.8	70	Completed
5G12512 Facility Response Study	104.0	101.7	104.0	Completed
5G12513 LOFT Scaling	52.0	41.5	52.0	September 1982
5G13311 Temperature Compensation	<u>442.7</u>	<u>381.6</u>	<u>288.0</u>	September 1982
Total	1020.4	892.0	809.0	

TABLE 3. (continued)

<u>Task Description</u>	<u>Spending Authorized</u>	<u>Spending to Date</u>	<u>Budget to Date</u>	<u>Scheduled Completion</u>
<u>CEA Tasks</u>				
5F12211 CEA Management (FY-1982)	40.9	24.2	25.4	September 1982
5F12211 CEA Management (FY-1983) <sup>a</sup>	24.0	0	0	September 1983
5F12212 CEA Delegate Support (FY-1982)	14.1	9.1	7.6	September 1982
5F12212 CEA Delegate Support (FY-1983) <sup>a</sup>	15.9	0	0	September 1983
5F13N12 F2 Fuel Bundle	369.4	359.9	369.4	Completed
5F13311 Temperature Compensation	649.5	753.3 <sup>b</sup>	206.2	September 1982
5F14N21 Fuel Instrumentation	<u>491.3</u>	<u>469.5</u>	<u>491.3</u>	Completed
Total	1605.1	1616.0	1099.9	
<u>ECN Tasks</u>				
5N12211 ECN Management (FY-1982)	14.0	7.7	8.9	September 1982
5N12211 ECN Management (FY-1983) <sup>a</sup>	14.7	0	0	September 1983
5N12226 Startup and Operational Test	78.1	77.6	78.1	Completed
5N12227 Nuclear/Electric Rod	<u>62.5</u>	<u>62.8</u>	<u>62.5</u>	Completed
Total	169.3	148.1	145.5	
<u>F25 Tasks</u>				
5A12211 F25 Management	<u>5.7</u>	<u>5.3</u>	<u>1.7</u>	September 1982
Total	5.7	5.3	1.7	

a. FY-1983 funding has been identified for the baseline (082-2-0), but spending is not yet authorized.

b. A cost transfer will be made from foreign to operating funding to remove incorrect charges against this account.