

HOST Liner Cyclic Facilities

Facility Description

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Three liner cyclic test apparatus are presently planned. The first is a simple 5 x 8 inch rectangular box incorporating four 6KVA quartz lamps for cyclic heating of the test specimen. This apparatus will include a silicon window viewport for IR camera temperature measurement. The quartz lamp box will be used to verify simple liner configurations and to evaluate strain and temperature measuring techniques. This evaluation is scheduled to begin in June 1983.

The second facility (shown schematically in Figure 1), is a twenty inch diameter annular O.D. liner simulator which is a joint NASA Lewis - United Technology Research Center program. One hundred and twelve 6 KVA quartz lamps will be cycled. Power levels will be adjusted to simulate typical liner heat loadings. Air will be supplied to provide typical liner film and backside cooling. Two or three liner designs will be evaluated to compare with the modeling results. The indicated modeling effort will be conducted independently by UTRC and NASA Lewis.

This apparatus in addition to 672 KVA of 480 Volt power, requires 7.5 lb/sec of 1000^oF air at 30 psia, 3.5 lb/sec of ambient temperature air at 5 psig, 1.5 lb/sec of ambient temperature air at 1 psig and 64 GPM of cooling water. This apparatus is scheduled to go under testing in April 1984.

The third facility; the low pressure liner cyclic can rig (shown schematically in figure 2); is being designed to fit the same test leg as the annular quartz lamp rig. It will utilize a JT8D size can combustor operating on Jet-A or possibly propylene fuel. (Propylene being a gaseous fuel of similar percent hydrogen as Jet-A, would significantly reduce fuel injector problems associated with cyclic operation while retaining similar flame radiation characteristics.) The test section of this rig would operate at about 2 1/2 atmospheres absolute pressure. A vitiated preheater will be used to supply 2.4 - 4.8 lbs/sec of 800 - 1000^oF air to the test section. A torch ignitor will be used to minimize ignition problems associated with the cyclic operation. Testing of this apparatus is scheduled for November 1984.

Special Test Instrumentation

Liner cold side temperatures will be measured using an IR-TV camera system. This will permit several hundred temperature measurements to be made in a relatively small area. Liner hot side temperatures will be measured with thin film thermocouples. New technology high temperature strain gauges will be used to obtain local strain measurements.

Preliminary Small Scale Tests

December 1981 saw the initial testing of a three lamp quartz lamp apparatus pictured in figure 3. Limited success was obtained with this rig. A test plate temperature of 2000°F was achieved. Lamp life, however, appeared to be limited for the standard commercial quartz lamps then available. Redesigned lamps will be used in the two new quartz lamp facilities which should overcome the problems of the earlier lamps.

A preheater test is scheduled for December 1982 to design vitiated and non-vitiated preheaters required for the quartz lamp annular rig and the cyclic can rigs.

HOST LINER CYCLIC FACILITIES

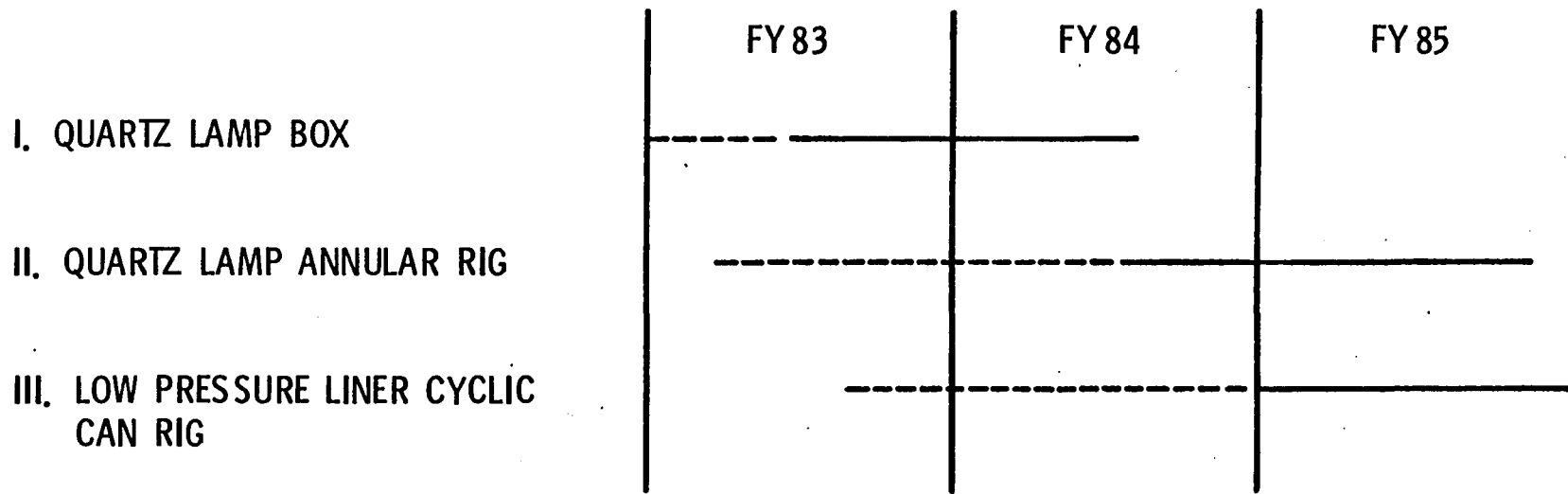
I. QUARTZ LAMP BOX

II. QUARTZ LAMP ANNULAR RIG

III. LOW PRESSURE LINER CYCLIC CAN RIG

HOST CYCLIC LINER PROGRAM

SCHEDULE



----- DESIGN, PROCUREMENT, INSTILLATION
———— TEST

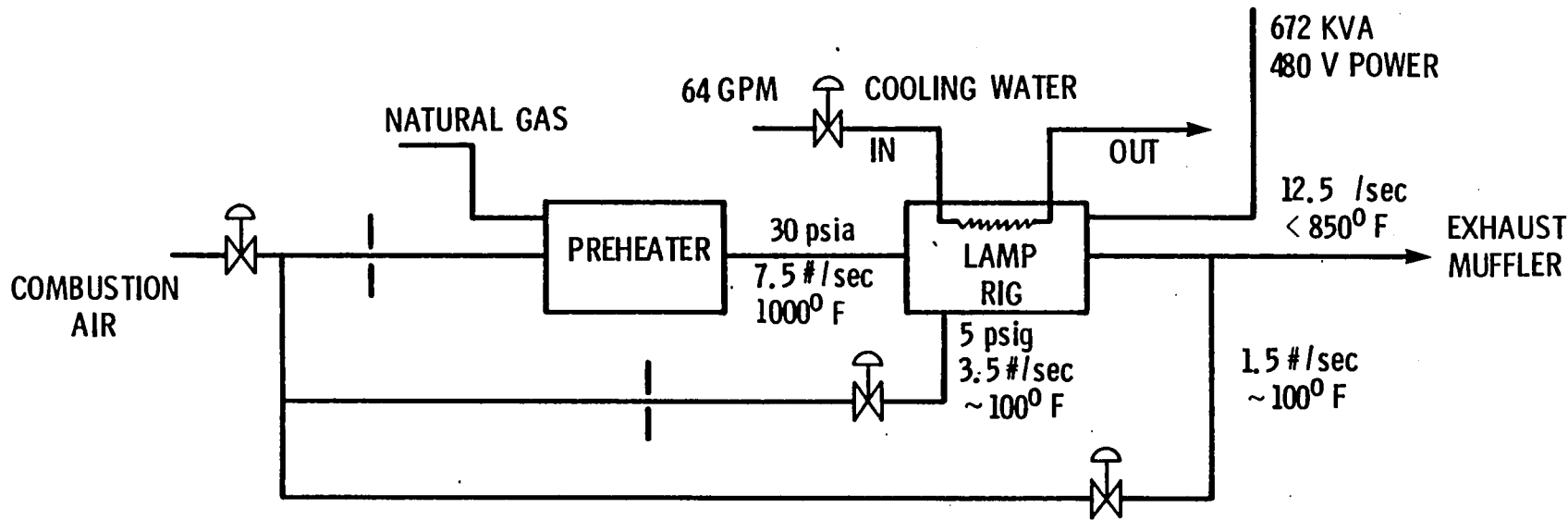
FIRST QUARTZ LAMP BOX RIG



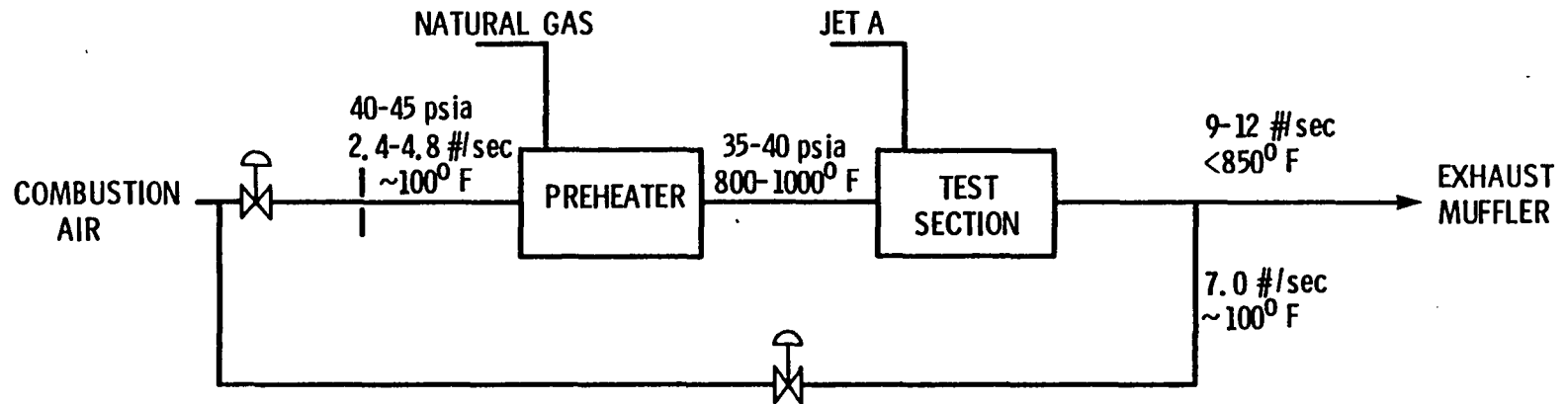
FIRST QUARTZ LAMP BOX RIG

- **OBTAINED 2000° F TEST PLATE TEMPERATURE**
- **LIMITED LAMP LIFE**

HOST QUARTZ LAMP ANNULAR RIG SCHEMATIC-ECRL-1



HOST LOW PRESSURE LINER CYCLIC CAN RIG SCHEMATIC-ECRL-1



SPECIAL INSTRUMENTATION

I. IR - TV MONITORING OF LINER TEMPERATURES

II. THIN-FILM THERMOCOUPLES

III. LASER STRAIN GAUGE

IV. HIGH TEMPERATURE STRAIN GAUGES

FACILITY PREHEATER TEST

OBJECTIVE:

1. DETERMINE IF A NATURAL GAS FIRED VITIATED PREHEATER IS CLEAN ENOUGH FOR USE WITH THE ANNULAR LAMP RIG.
2. EVALUATE PERFORMANCE OF LOW PRESSURE LINER CYCLIC CAN RIG VITIATED PREHEATER.

THE FUTURE OF HOST

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REPORTING

- 0 ANNUAL CONTRACTOR WORKSHOP
- 0 ANNUAL REPORTS
- 0 FINAL REPORTS

RESOURCES

0 FY81: \$2.4M

0 FY82: \$4.0M

0 FY83: \$5.6M

0 FY84-89: \$7.5-\$12M/YEAR (?????)

FUTURE DIRECTIONS

- 0 CONTINUING HOT SECTION DURABILITY RESEARCH
- 0 SELECTED INTERDISCIPLINARY GRANTS
- 0 STRONG NASA LEWIS IN-HOUSE RESEARCH EFFORTS
- 0 COMPATIBILITY WITH DOD
- 0 ANALYSIS METHODS IS THE CORNERSTONE

NEXT YEAR

ANNUAL CONTRACTOR WORKSHOP II

- 0 OCTOBER 25, 26, 27, 1983
- 0 RESULTS, RESULTS, RESULTS
- 0 FORMAL PAPERS/PROCEEDINGS (FEDD)
- 0 WORKSHOP SIDE SESSIONS ???