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NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY
Annapolis, Maryland 21402

TRANSIENT RESPONSE OF A 25,000 HORSEPOWER
MARINE GAS-TURBINE ENGINE

By
C. J. Rubis

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ELECTRICAL LABORATORY
RESEARCH AND DEVELOPMENT REPORT

August 1969



Report 3064

Transient Response of a 25,000 Horsepower
Marine Gas-Turbine Engine

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Naval Ship Research and Development Center
Washington, D.C. 20007

TRANSIENT RESPONSE OF A 25,000 HORSEPOWER
MARINE GAS-TURBINE ENGINE

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ELECLAB 54/69

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ABSTRACT

This report presents the results of transient tests on a 25,000 horsepower marine gas-turbine engine. The Pratt & Whitney FT4A-2 was used for the tests because of its availability at the engine-test installation at the Philadelphia Division, Naval Ship Engineering Center.

Engine loading was accomplished by a water brake with power levels ranging from zero to 23,000 horsepower.

Throttle commands consisted of step changes and triangular throttle pulses at several power levels for the engine with an operational speed governor and with the governor disabled.

Several load torque variations at various power levels with a constant throttle setting were also performed.

The eight parameters recorded as a function of time during the transient tests are: throttle lever position, fuel flow rate, low-pressure compressor speed, high-pressure compressor speed, engine (free turbine) speed, gas generator discharge total temperature, gas generator discharge total pressure, and load torque.

From these data the following additional data were computed in 0.1 second time intervals: engine pressure ratio, engine acceleration, engine torque, and engine power.

ADMINISTRATIVE INFORMATION

This work was started in March 1968 under the Independent Exploratory Development task "Gas Turbine Propulsion Plant Control," Task Area Z-F013 01 01, Task 11275, Assignment 62-139. The work was concluded with this report under the Independent Exploratory Development task "Gas Turbine Transient Response," with the same task area and Assignment 621-101.

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DISTRIBUTION LIST

DEFINITIONS AND TERMINOLOGY

- W_f - Engine fuel flow rate (lb per hr)
- N_1 - Low-pressure compressor speed (rpm)
- N_2 - High-pressure compressor speed (rpm)
- N_3 - Engine free turbine speed (rpm)
- Q_E - Engine free turbine torque (lb-ft)
- P_{ENG} - Engine horsepower (ft-lb per sec)
- L - Throttle lever position (%)
- P_{t7} - Gas generator total discharge pressure (psig)
- P_{t7} - Gas generator total discharge pressure (psia)
- P_{t2} - Gas generator total inlet pressure (psia)
- t_{t7} - Gas generator total discharge temperature ($^{\circ}$ F)
- EPR - Engine pressure ratio (dimensionless)
- SFC - Engine specific fuel consumption (lb per hp-hr)
- P_b - Burner pressure (psi)
- Q_L - Load torque (lb-ft)
- k_g - Reduction gear ratio (dimensionless)
- I - Polar moment of inertia of drive train, including free turbine and load (lb-ft-sec²)

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

TRANSIENT RESPONSE OF A 25,000 HORSEPOWER
MARINE GAS-TURBINE ENGINE

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INTRODUCTION

Fundamental analytical investigation, system design, and simulation is required to provide the engineering basis for higher performance automated propulsion plants. Computer simulation of an entire propulsion system and a maneuvering ship can provide performance analysis and design information for complex ship control problems.

Studies of ship propulsion system dynamics require information on the transient response characteristics of the propulsion engines. These dynamics studies are underway in the Navy, Coast Guard, and Merchant Marine for a variety of ship types including destroyers, gunboats, surface-effect craft, icebreakers, cutters, and cargo ships.

The Pratt & Whitney Aircraft FT4A-2 marine gas-turbine engine is the largest aircraft-type gas turbine of American manufacture in production today. This engine has received Navy supported development funding and has been tested extensively by the Navy.

The FT4A-2 gas turbine consists of a twin-spool axial flow, compressor-type engine used as a gas generator (J75) aerodynamically coupled to a free turbine. This engine is rated at 25,000 to 30,000 bhp* at a free turbine (N_3) speed of 3,600 rpm for Navy boost applications and a rating of 21,500 bhp at 3,600 rpm for base applications.

*Abbreviations used in this text are from the GPO Style Manual, 1967, unless otherwise noted.

In testing the transient response of a gas-turbine engine, the investigator is faced with a highly nonlinear device. Thus, from a previous report,¹ "A gas turbine is a highly nonlinear system, and so its response is not predictable by linear methods of analysis. Consequently, there is no 'transfer function,' as such, for a gas turbine."

To obtain data on the transient response of the FT4A-2 engine for use in ship dynamics studies, this engine was tested under various transient conditions in the engine-test installation at NAVSECPHILADIV.

BACKGROUND

Ship propulsion dynamics studies have been in progress for several years at this activity, following a number of systems and automation programs for destroyer escort vessels begun with the SEA HAWK Project in 1963.

An independent exploratory development task was begun in July 1967 to analyze the dynamic performance of a combined gas turbine base and gas turbine boost propulsion plant for a single-screw destroyer escort. Two FT4A-2 gas-turbine engines driving a reversing reduction gear were used.

The results of this study were published in the report,¹ "Gas Turbine Ship Propulsion Dynamics" in January 1969. During the course of this study, the transient tests on the FT4A-2 engine were conducted in March 1968 at NAVSECPHILADIV on the T453 endurance engine-test installation by a team of personnel from NAVSECPHILADIV and this activity.

A brief history of the testing/improvement of the FT4A engine is given below.²

¹Superscripts refer to similarly numbered entries in Appendix B.

"The FT4A engine test program at NAVSEC-PHILADIV is part of the Navy's overall development program for this marine gas turbine engine. Starting with the first engine to be converted from an aircraft JT4A to the marine FT4A in 1963, the program has accumulated 6200 hours of operation at increasing power ratings from 17,000 HP to the present rating of 25,000 HP with 100°F inlet air. Over this period of time sixteen design changes have been made to the engine as a result of the lessons learned from testing under simulated shipboard operating conditions. The salt water introduced into the inlet air and fuel systems and the engine operating profiles are all based on the conditions the engine will see on shipboard. The FT4A program to date has resulted in a 25,000 HP marine gas turbine engine with demonstrated 'hi-shock' capability which is capable of burning Navy diesel fuel (MIL-F-16884). At the present time the program is directed toward evaluating this engine's capability with heavier distillate fuels."

SCOPE

This report presents the results of transient tests on the Pratt & Whitney Aircraft FT4A-2 engine.

Engine loading was accomplished by a water brake with power levels ranging from zero to 23,000 horsepower.

Throttle commands consists of step changes and triangular throttle pulses at several power levels for the engine with an operational speed governor and with the governor disabled.

Several load torque variations at various power levels with a constant throttle setting were also performed.

The eight parameters recorded as a function of time during the transient tests are: throttle lever position, fuel flow rate, low-pressure compressor speed, high-pressure compressor speed, engine (free turbine) speed, gas generator discharge total temperature, gas generator discharge total pressure, and load torque.

From these data the following additional data were computed in 0.1 second time intervals on an IBM System 360 computer (Appendix A): engine pressure ratio, engine acceleration, engine torque, and engine power.

ENGINE DESCRIPTION

A complete description and technical data on the FT4A-2 engine are available in the FT4 Gas Turbine Engine Installation Handbook³ published by Pratt & Whitney Aircraft. The FT4A-2 is a version of the FT4 engine designed for marine service which involves primarily the use of materials capable of resisting corrosion in a marine environment. The engine horsepower, P_{ENG} , as a function of the engine speed, N_3 , and the engine specific fuel consumption (SFC) is taken from the manufacturer's curves³ shown in Figure 1. The conditions specified in Figure 1 are for a standard barometric pressure at sea level of 29.92 in. Hg or 14.7 psia, with no inlet or exhaust duct pressure losses, and at an engine inlet temperature of 80° F.

As previously indicated, this engine is rated at 25,000 to 30,000 bhp at a free turbine (N_3) speed of 3,600 rpm for Navy boost applications and a rating of 21,500 bhp at 3,600 rpm for base applications.

The control system used on the engine under test is the JFC 25-28 hydromechanical fuel control system.

The mass polar moments of inertia of the rotating parts of the FT4 marine engines as published³ are:

	<u>LB-FT²</u>
Low-pressure compressor - turbine unit	586
High-pressure compressor - turbine unit	489
Free turbine rotor	5009 .

A pictorial diagram of the engine indicating the control and sensing elements appears as Figure 2.

ENGINE AND WATER BRAKE TEST INSTALLATION DESCRIPTION

The gas turbine operates in an acoustic enclosure and is controlled from an engine operating console several feet from the gas turbine. The engine operating console contains the engine-start/shut-down controls, engine throttle, and various engine displays. In addition, the water brakes are controlled and monitored from this same location. The photograph, Figure 3, shows the test installation. Miscellaneous other engine and water brake instrumentation are located in close proximity to the operating console.

Engine loading is provided by two large water brakes run in tandem and coupled to the gas turbine through a 5.053 to 1 planetary reduction gear. The tandem water brake installation is the Model 2x14u2u110 manufactured by Zöllner and Company, Kiel-Gaarden, Zur Fähre 1. Power capacity for the tandem water brake installation is 35,000 hp with a maximum water brake speed of 1,000 rpm. Figure 4 shows the gas turbine and water brake layout, and Figure 5 gives the horsepower/speed curves for the tandem water brake.

Four motor-driven valves operated from the engine control console are used to adjust the rates of water inlet and outlet to the water brakes. These valves are used to adjust the water level in the water brake cavities. The power absorption at a given speed is determined by that level.

The rate of valve opening and closing affects how fast the loading can be changed at a fixed water brake speed. Measured valve-response time is approximately 30 seconds from zero valve opening to full open and vice versa.

Polar moments of inertia for the water brake test installation including the reduction gear, couplings, and both water brakes are as follows:

	<u>Cavities Filled with Water lb-ft²</u>	<u>Cavities Empty lb-ft²</u>
At Water Brake Speed	51,240	49,810
At Gas Turbine Speed	2,000	1,950

These moments of inertia were calculated from data supplied by the manufacturer.

The weight of water required to fill each water brake cavity is 2975 pounds or about 357 gallons.

MEASURED AND COMPUTED PARAMETERS

MEASUREMENTS

Eight parameters were measured as a function of time during all the transient testing. They are:

- Throttle lever position - L
- Fuel flow rate - W_f
- Low-pressure compressor speed - N_1
- High-pressure compressor speed - N_2
- Engine (free turbine) speed - N_3
- Gas generator discharge total temperature - t_{t7}
- Gas generator discharge total pressure - p_{t7}
- Load torque - Q_L

Other important engine parameters such as gas flow rates and total temperatures and pressures at various engine locations were either too difficult or impractical to instrument properly and could not be measured in the course of the testing. For example, only p_{t7} and p_{t2} could be instrumented to read total pressures. All others were instrumented to obtain static pressures.

In conducting transient tests, it is important to design the sensors and recording instrumentation with a response time faster than the response of the variables to be measured.

The only change from the normal sensors required for the transient tests was the thermocouple that measured gas generator discharge temperature, t_{t7} . A low mass, specially built thermocouple was used whose response time was shorter than the temperature change rates under measurement.

All the parameters were recorded on an oscillographic recorder as a function of time with light-sensitive recording paper having major time divisions of 0.1 second and moving rapidly enough to

resolve all recorded data to better than 0.1 second in time. The data were then converted to digital form by the Gerber Digital Data Reduction System.

Load torque on each water brake was measured by the force absorbed on a load cell connected to the brake housing through a brake arm. The lever arm lengths of 3.5013 feet were used to calculate the total load torque exerted by both water brakes. Engine torque was not measured directly but was calculated from the load torque measurements and the torque equation of the system discussed later.

COMPUTATIONS

Torque measurements were taken only on the load, since the gas-turbine shaft was not instrumented for torque.

Computations were made to find the engine torque, Q_E , from the measured load torque, Q_L , with the system torque equation below:

$$\frac{2\pi I}{60} \frac{dN_3}{dt} = Q_E - \frac{Q_f}{k_g} - \frac{Q_L}{k_g}$$

where:

I = total drive train polar moment of inertia referred to the engine speed (lb-ft-sec²)

$$= I_{ENGINE} + I_{LOAD} = \frac{5009 + 2000}{32.2} = 217 \text{ lb-ft-sec}^2$$

$\frac{dN_3}{dt}$ = engine acceleration (rpm per sec)

Q_E = engine torque (lb-ft)

Q_f = friction torque (lb-ft)

Q_L = load torque (lb-ft)

k_g = reduction gear ratio (5.053).

The frictional torque loss, Q_f , for the reduction gear, bearings, and water brake system is assumed constant with speed and torque. Measurements indicate a loss of about 1.6%. Thus, $Q_f = 0.016 Q_L$, and the torque equation becomes

$$2\pi I \frac{dN_3}{dt} = Q_E - \frac{1.016 Q_L}{k_g} .$$

Solving for Q_E

$$Q_E = \frac{1.016 Q_L}{k_g} + \frac{2\pi I}{.60} \frac{dN_3}{dt} \quad (\text{lb-ft})$$

$$Q_E = \frac{1.016 Q_L}{5.053} + 22.794 \frac{dN_3}{dt} \quad (\text{lb-ft}) .$$

Transient engine torque and power were computed from experimental data (Q_L and N_3) containing typical experimental data spread resulting largely because of the data reduction from analog strip chart form to digital data. To produce meaningful results, digital computer smoothing (averaging) of the Q_L and N_3 data was required, especially when computing the engine acceleration dN_3/dt , N_3 DOT which is needed to compute the transient engine torque (Q_E) and power (P_{ENG}). Of several smoothing techniques tried, the most successful was a routine of arithmetic averaging over a total of five time increments (two time increments of 0.1 second each side of the point being averaged). For example, the average value of \dot{N}_3 at i is

$$\text{AVG } \dot{N}_3 i = \frac{1}{5} \sum_{k=-2}^{k=+2} \dot{N}_3 (i + k)$$

Load torque, Q_L , and engine speed, N_3 , were similarly smoothed in computing Q_E and P_{ENG} . In the printout of data (Appendix A) and in the various graphs, only \dot{N}_3 , Q_E , and P_{ENG} are smoothed data; all other data are as originally recorded.

Additionally, analysis of the results showed that the smoothing was not destroying the transient content of the data.

The engine power, P_{ENG} , was computed from the equation

$$P_{ENG} = \frac{Q_E N_3}{5252} .$$

Engine pressure ration, EPR, was computed as follows:

$$EPR = \frac{P_{t7}}{P_{t2}} = \frac{P_{t7} + 14.7}{14.7}$$

where p_{t7} is the measured gas generator total discharge pressure (gage). A standard atmospheric pressure of 14.7 psia was assumed for P_{t2} .

CONDITIONS OF TEST

The fuel flow rate was measured in gallons per second and then corrected for changes in fuel weight per gallon due to temperature as follows:

$$W_f = \text{Fuel flow (gal per sec)} \times K_1 \quad (\text{lb per hr}) .$$

For a measured fuel temperature of 54° F with a specific gravity of 0.8265, $K_1 = 418.989$.

Ducting losses vary with the power level; nominal values of the losses at this installation are:

- 4 inches of water, total inlet pressure loss
- 6 inches of water, static pressure loss at exhaust.

No corrections were made for ambient air temperature or pressure differences from standard conditions nor were corrections made for ducting pressure losses.

The tests were conducted during the month of March 1968 at NAVSECPHILADIV (at sea level) with an average outside temperature of 45° F.

Diesel fuel was used (MIL-F-16884) with an approximate heating value of 18,500 Btu per pound.

The accuracy of the data in this report is probably no better than 5% due mainly to the limited resolution of the analog recordings and the analog-to-digital data reduction subsequently employed.

TRANSIENT TESTING

ENGINE ACCELERATION (THROTTLE STEP INCREASES)

A series of acceleration runs were made by step changes in the engine throttle. The fuel flow rate increase being the maximum rate permitted by the fuel control.

Step throttle changes were introduced from engine idle to several power levels ranging from 4,000 to 20,000 horsepower. Step throttle changes between other various intermediate power levels were also made between 4,000 and 23,000 horsepower.

The water brake loading calibration was established at various power levels as follows:

A combination of throttle lever position and water brake inlet/outlet valve openings was used to establish a particular steady state power level, and the engine throttle setting was noted.

With the water brake controls kept fixed, the throttle lever was moved to an idling or intermediate power level position.

After steady state was reached at the idle or intermediate position, a step throttle change of a magnitude corresponding to the previously calibrated throttle position was introduced.

Since the water brake loading varies with speed (the cavity water level being kept constant), the load on the gas turbine increased with speed until the predetermined loading value was reached during the acceleration tests. Both closed- and open-loop engine acceleration tests were run. In the closed-loop tests, the JFC 25-28 hydromechanical fuel control was connected to the speed governor sensing free turbine (N_3) speed. For open-loop

tests, linkage between the speed governor and the fuel control was removed.

THROTTLE PULSE TESTS

To determine system dynamics, pulse testing is commonly used.^{4, 5, 6}

The requirements for the type of pulse are⁴

"... any forcing pulse must contain all of the frequencies at which frequency response measurement is desired. More specifically, the pulse must contain sufficient energy to produce a measurable response in process output that is readily discernible from system noise. At the same time, the pulse amplitude and its derivatives must not be so great as to drive the elements into saturation or other nonlinear regions. And if the system is nonlinear, it is also important that the frequency components of the pulse maintain essentially constant amplitude throughout the frequency band of interest."

The forcing pulse during the transient tests was a throttle pulse of short time duration, manually generated after some practice, with a number of trial runs. Attempts were made to generate triangular throttle pulses because of their relatively wide frequency spectrum.

Both closed- and open-loop throttle pulse tests were performed about several power levels with throttle pulse magnitude increases of from ~~6%~~ to 44%.

Pulse widths of approximately 1.5 to 4.0 seconds were used.

LOAD CHANGE TESTS

Load torque changes were produced by changing the water brake load by means of the water inlet and outlet valves.

Both open- and closed-loop conditions were tested for power levels of 5,000, 10,000, and 20,000 horsepower.

During all the load change tests, the throttle setting was kept constant. No change occurred in the fuel flow rate, W_f , under open-loop conditions as the load was varied, and in the closed-loop mode the governor introduced a fuel flow rate change with varying load.

RESULTS

Figures 6 through 17 show the results of the engine acceleration tests due to step throttle increases. In these figures, only the following curves are shown:

- L - Engine throttle lever position, %
- W_f - Engine fuel flow rate, lb per hr
- N_3 - Engine free turbine speed, rpm
- Q_E - Engine free turbine torque, lb-ft
- P_{ENG} - Engine horsepower.

A multiplying scale factor of 1000 applies to all the curves except for L.

Complete numerical data on the other parameters for each test appear in Appendix A.

Figures 18 through 24 shows the results of the throttle pulse tests. As with the step throttle increases, the same five variables are plotted with the same scale factors and additional numerical data on these tests are given in Appendix A.

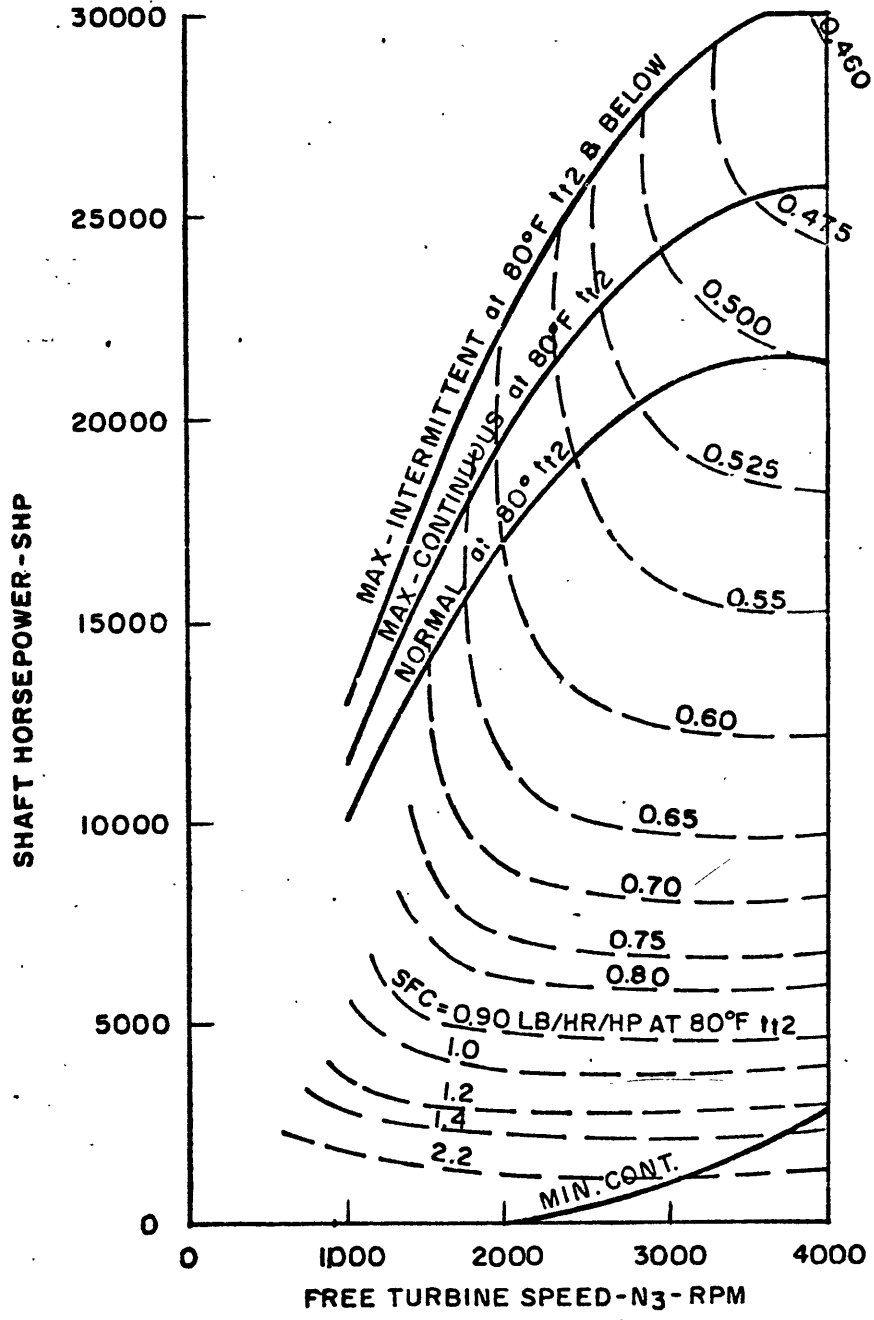
No attempt was made in this report to analyze the results of these tests.

Methods of frequency analysis of pulse tests data by means of Fourier Transforms and Bode plots are given in references 4, 5, 6, and 7.

The results of load change tests are shown in Figure 25 through 29 with the same scale factors as in the other tests and additional data in Appendix A.

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY
 ESTIMATED SHAFT HORSEPOWER & SPECIFIC FUEL CONSUMPTION
 SEA LEVEL (29.92 IN. Hg ABS. OR 14.7 PSIA)
 NO INLET OR EXHAUST DUCT PRESSURE LOSSES

NOTE - BASED ON LIQUID FUEL LHV = 18500 BTU/LB



Courtesy of Pratt & Whitney Aircraft

Figure 1

FT4A-2 Gas Turbine Engine

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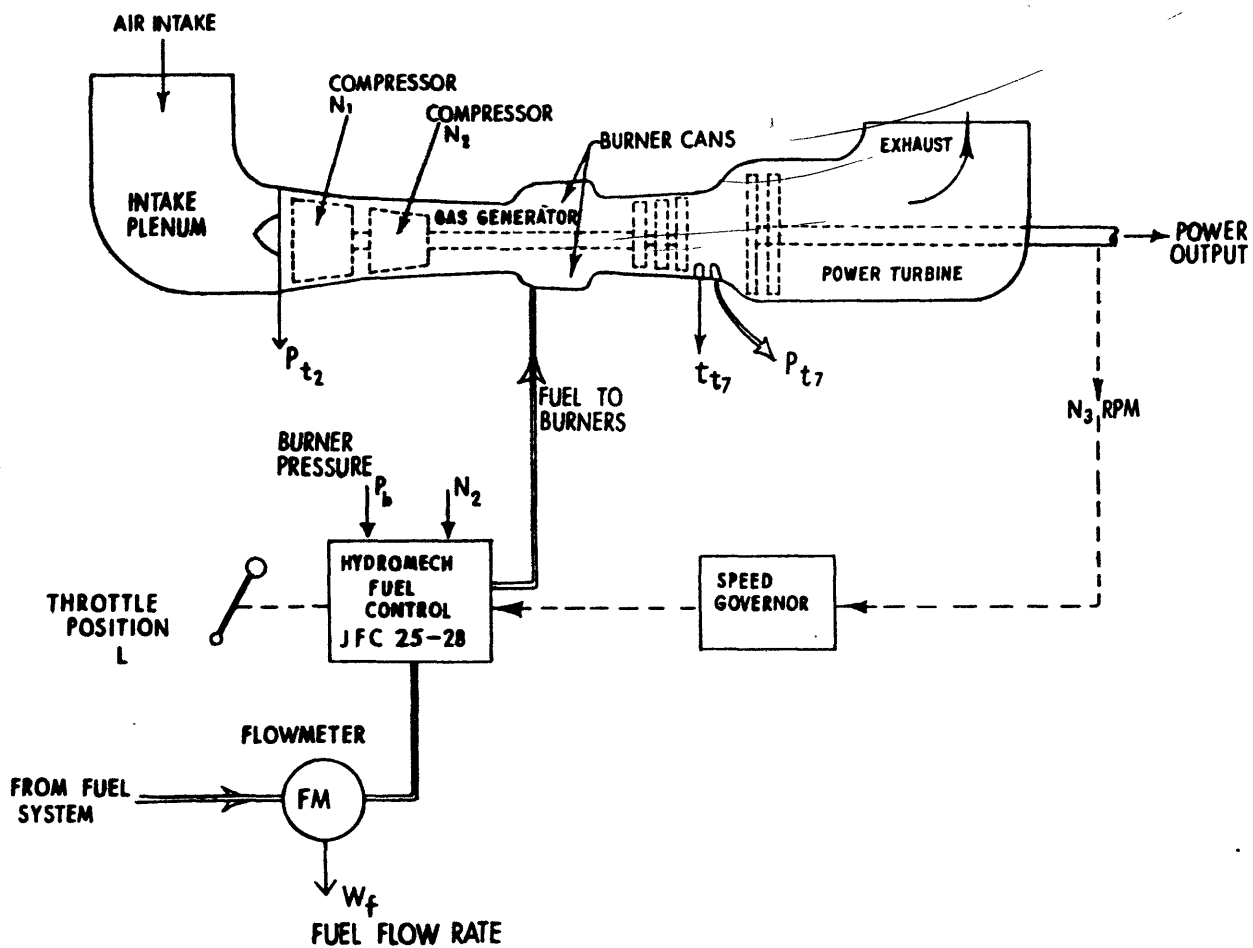


Figure 2

Gas-Turbine Control and Sensing Elements

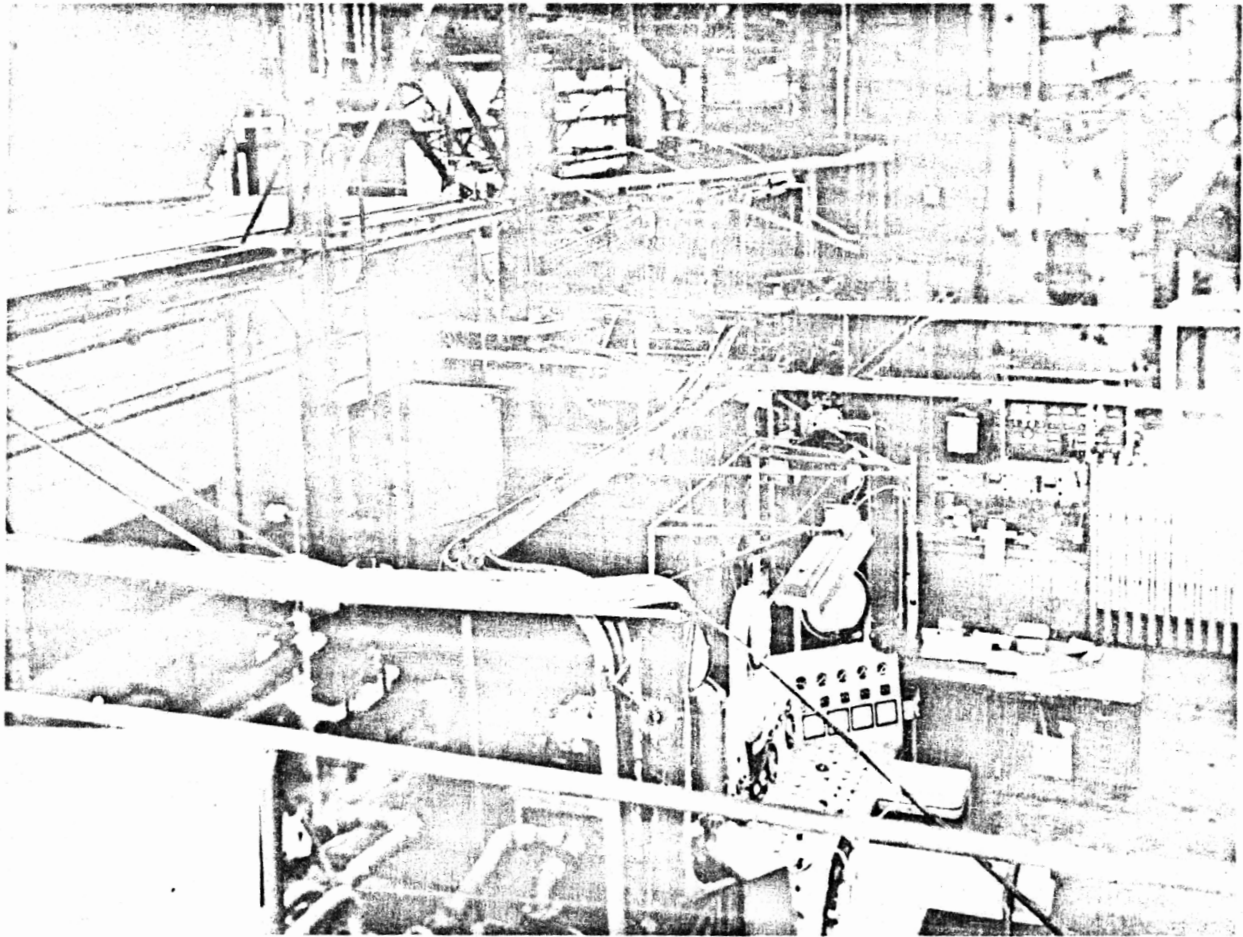


Figure 3

Gas Turbine Test Installation at NAVSECPHILADIV

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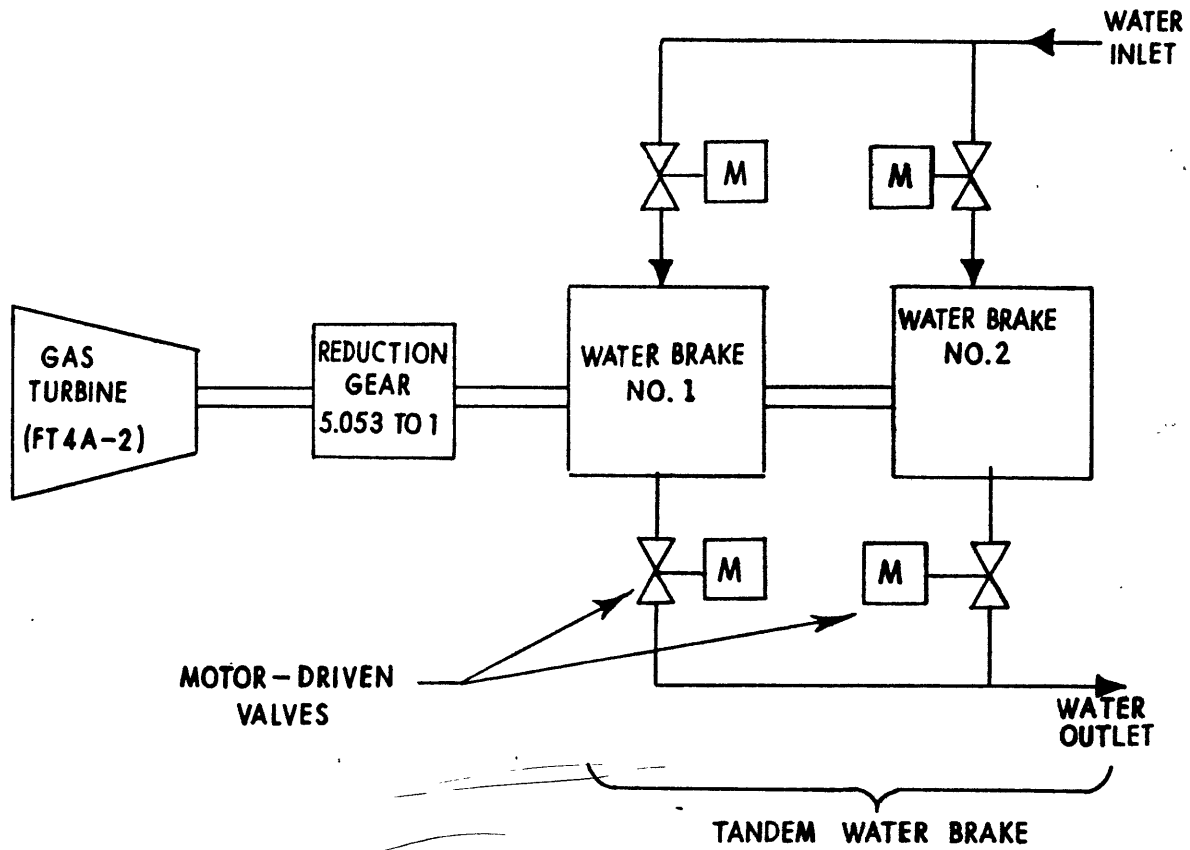


Figure 4

Gas Turbine and Water Brake Test Installation

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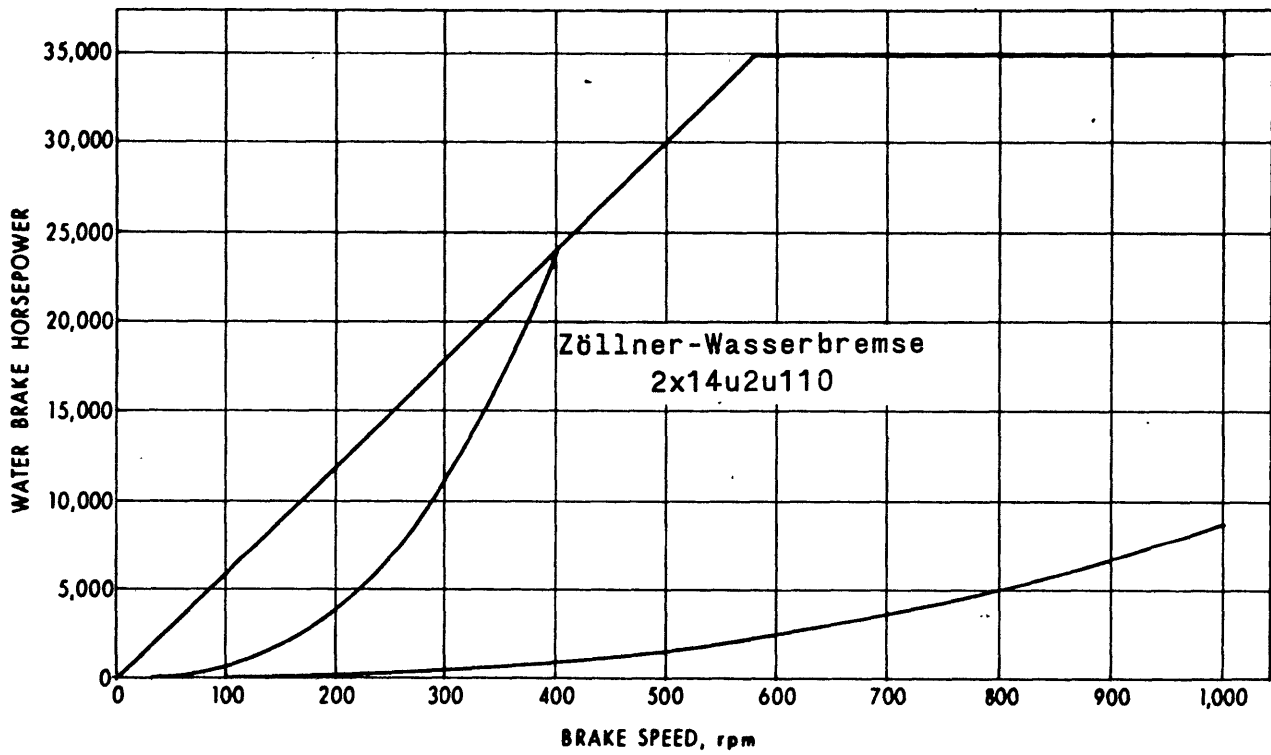


Figure 5
Tandem Water Brake Horsepower Versus Speed

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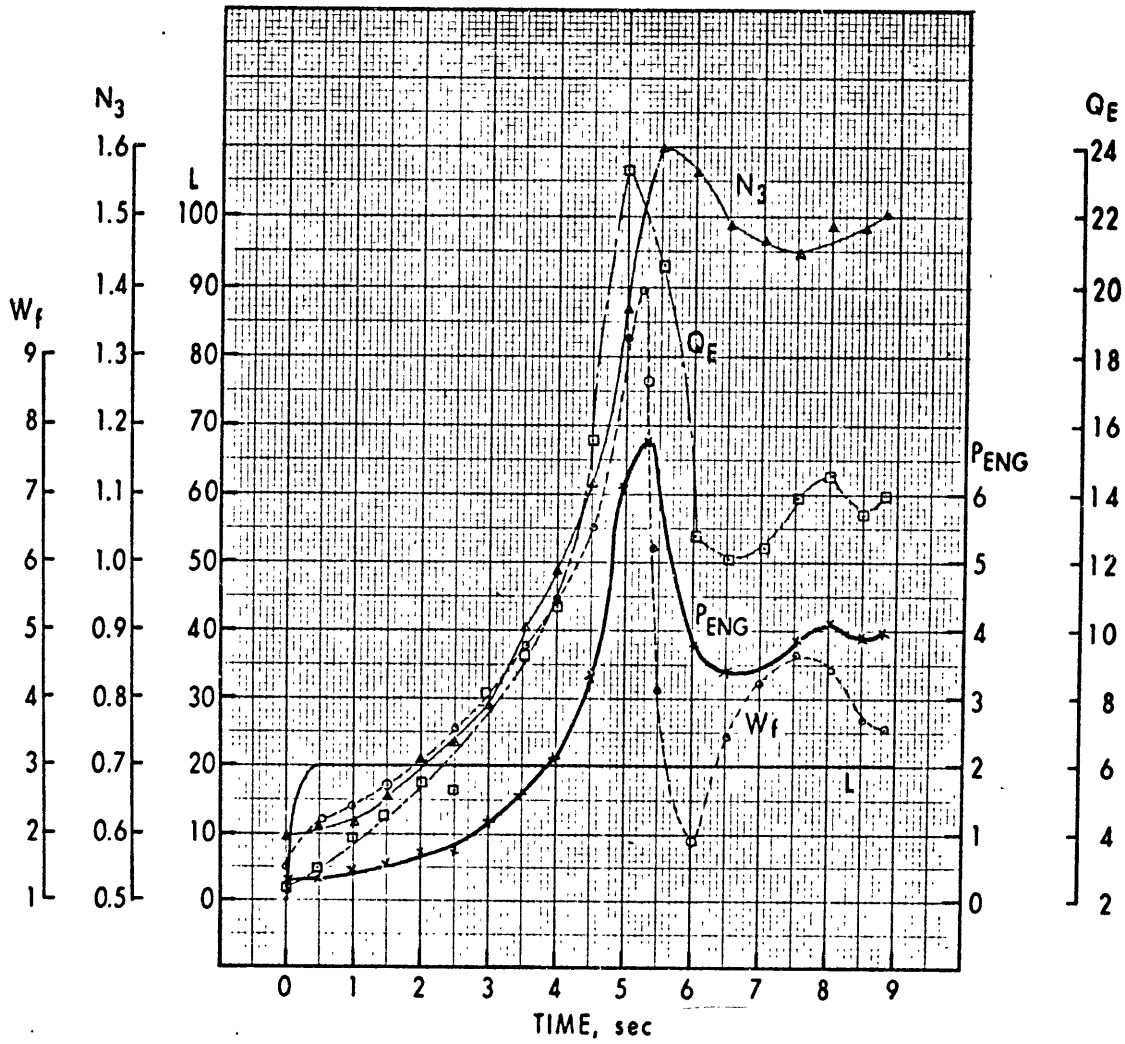


Figure 6

Throttle Step Increase (Closed Loop)
 Idle to 4000 Horsepower - Test TS-1

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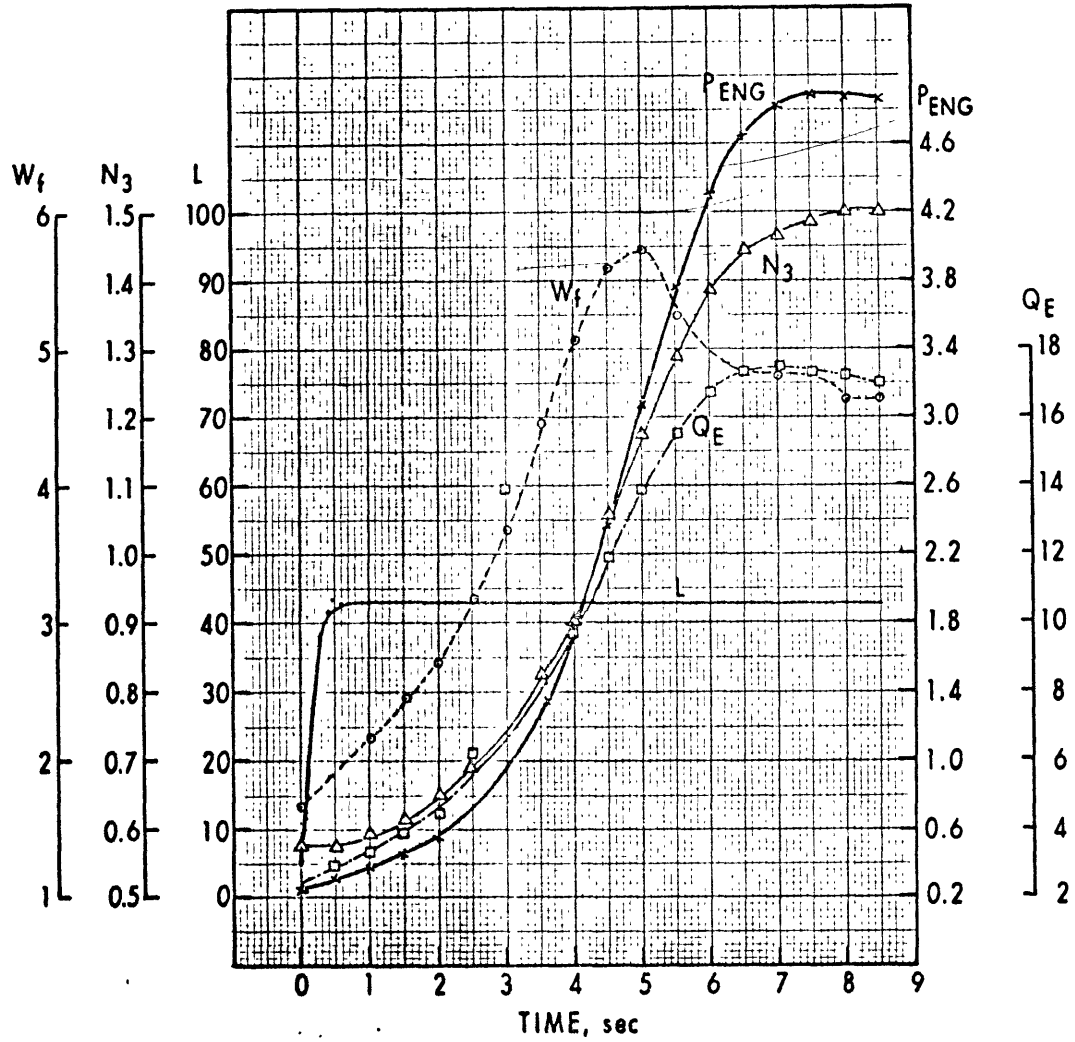


Figure 7

Throttle Step Increase (Open Loop)
 Idle to 5000 Horsepower - Test TS-2

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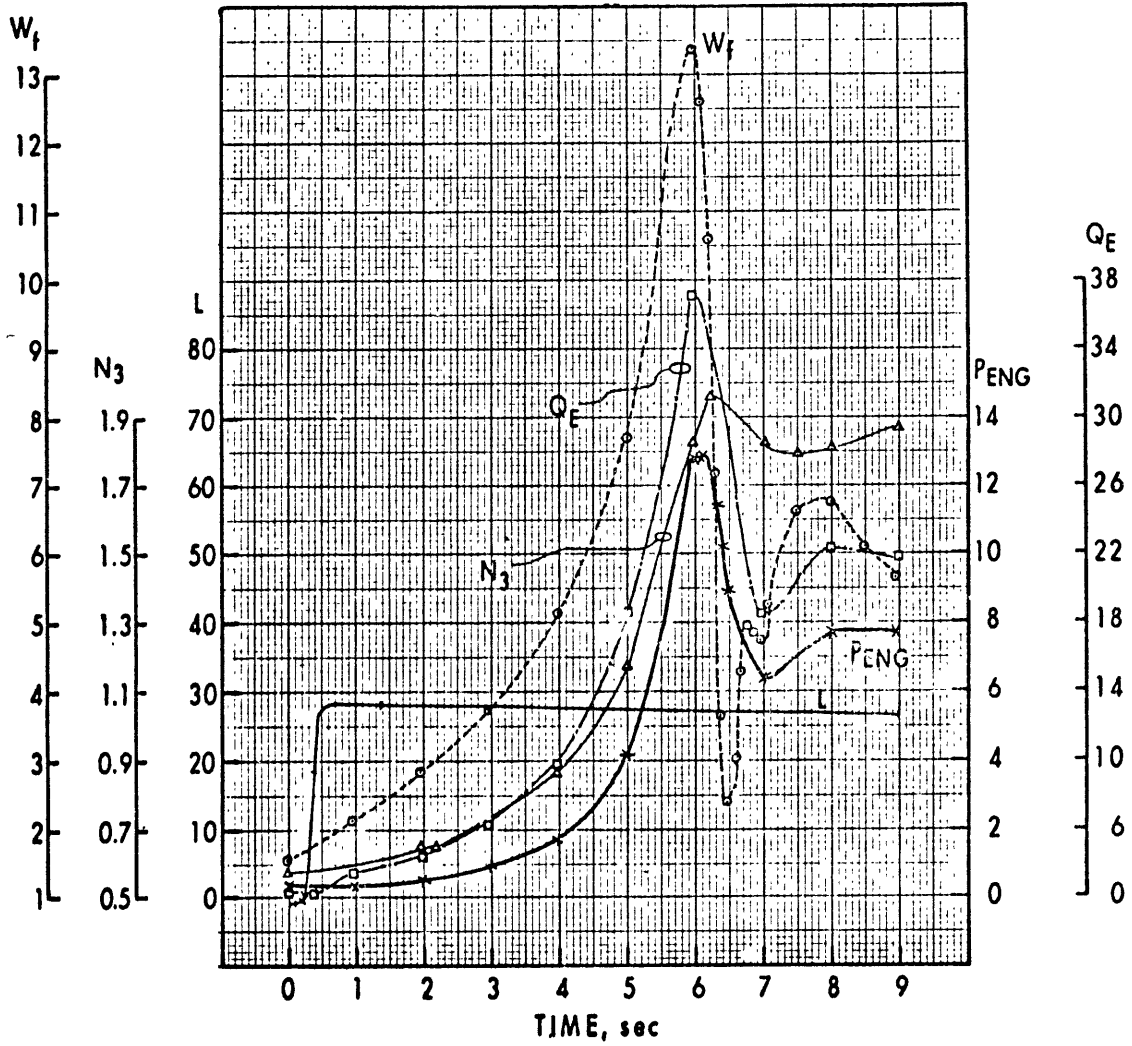


Figure 8

Throttle Step Increase (Closed Loop)
 Idle to 8000 Horsepower - Test TS-3

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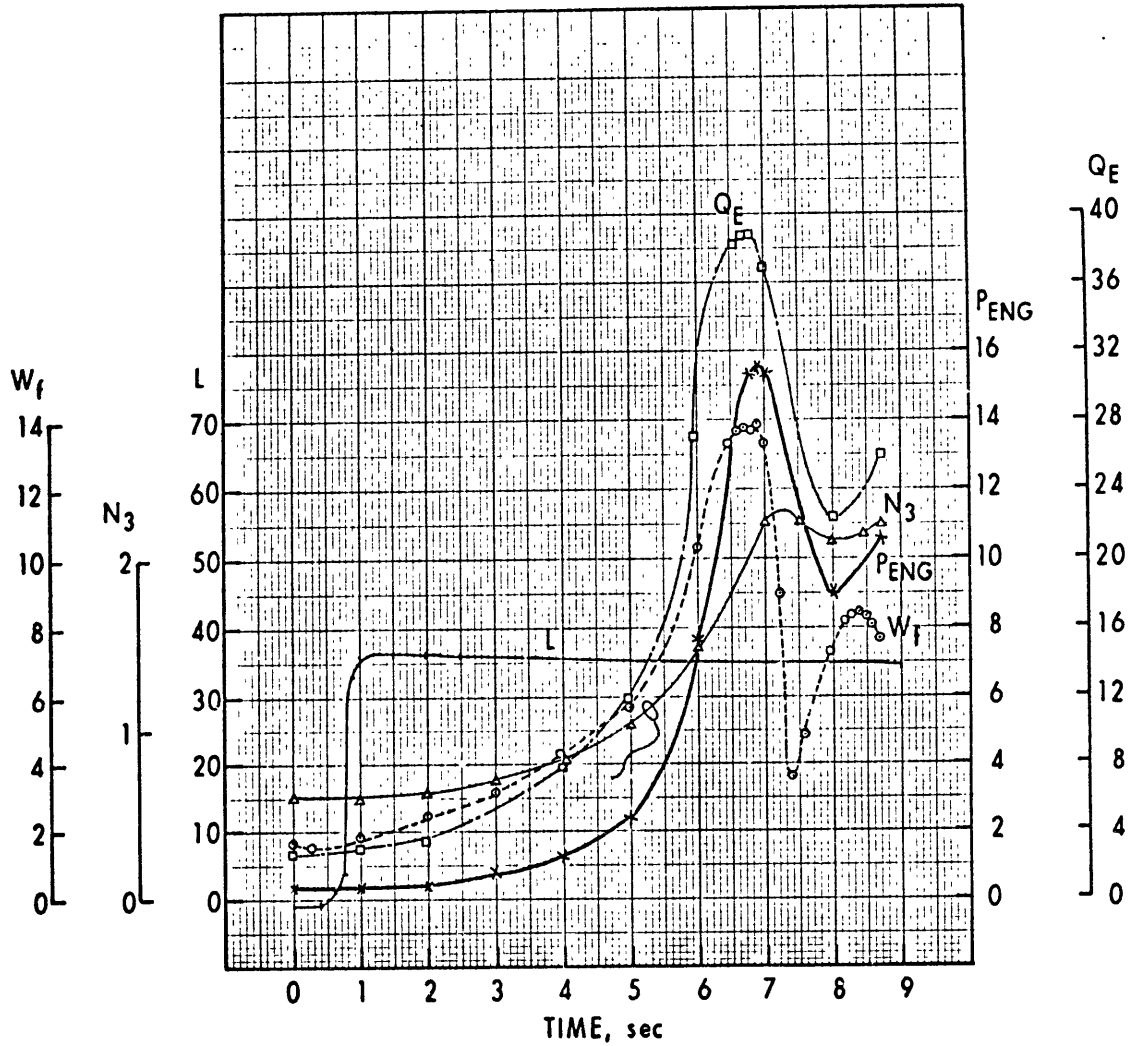


Figure 9

Throttle Step Increase (Closed Loop)
 Idle to 10,000 Horsepower - Test TS-4

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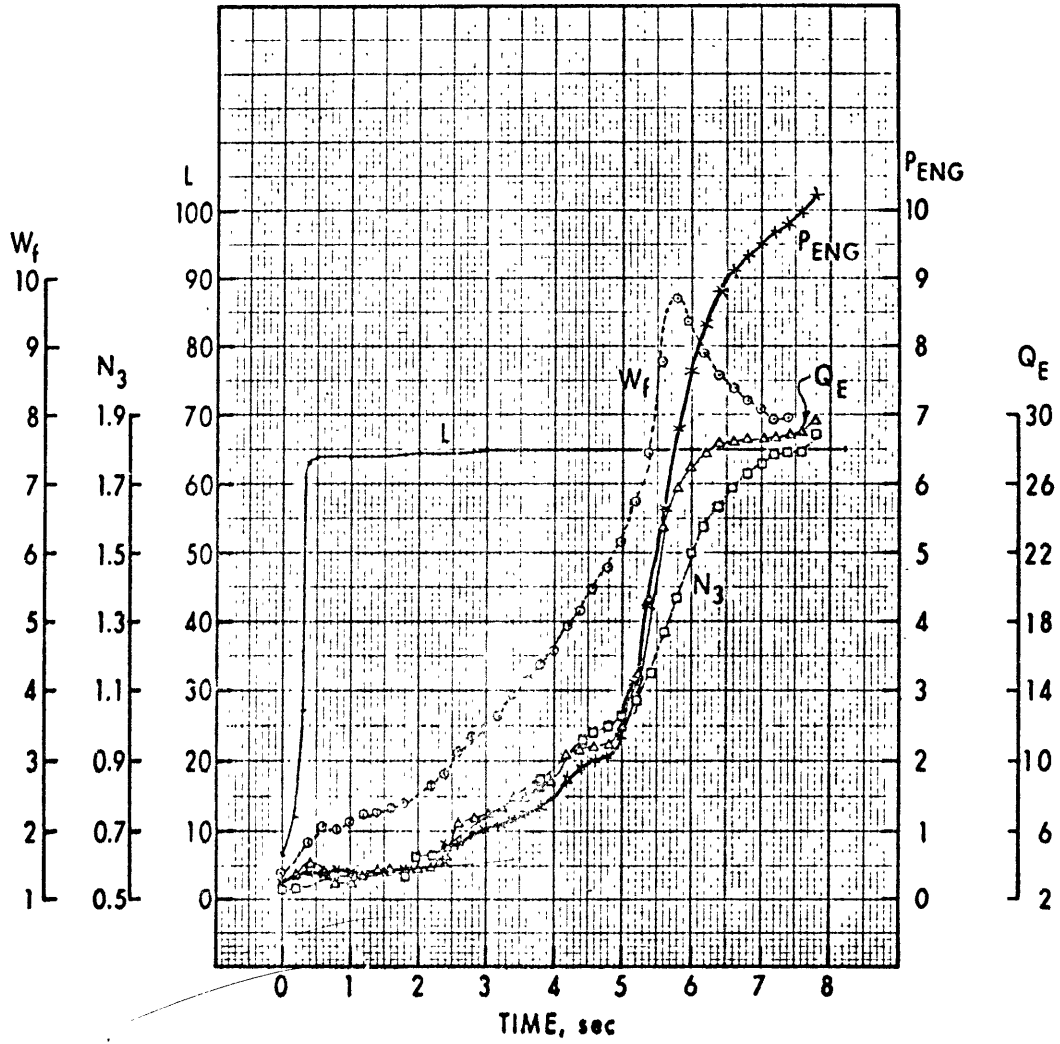


Figure 10

Throttle Step Increase (Open Loop)
 Idle to 10,000 Horsepower - Test TS-5

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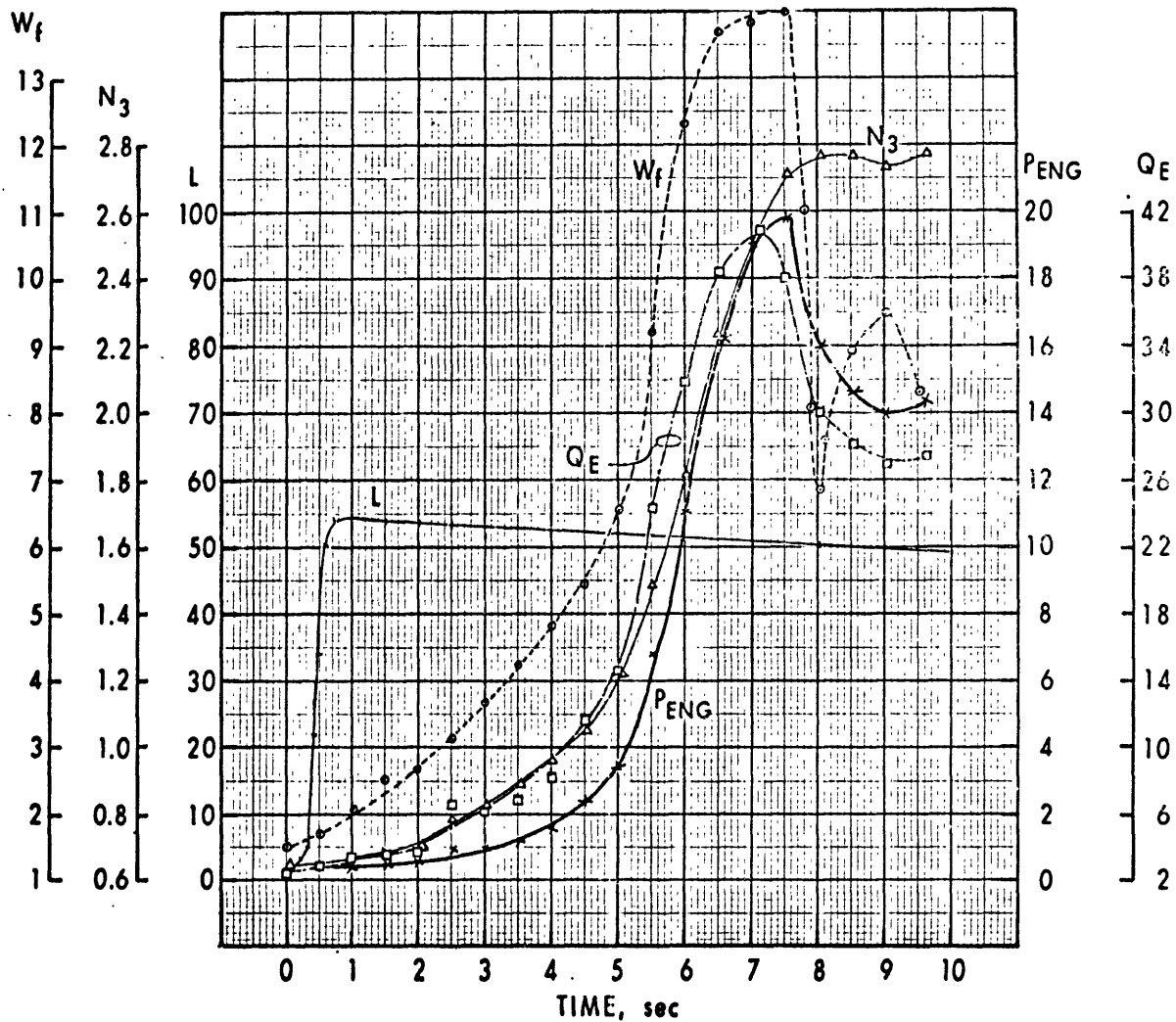


Figure 11

Throttle Step Increase (Closed Loop)
 Idle to 14,000 Horsepower - Test TS-6

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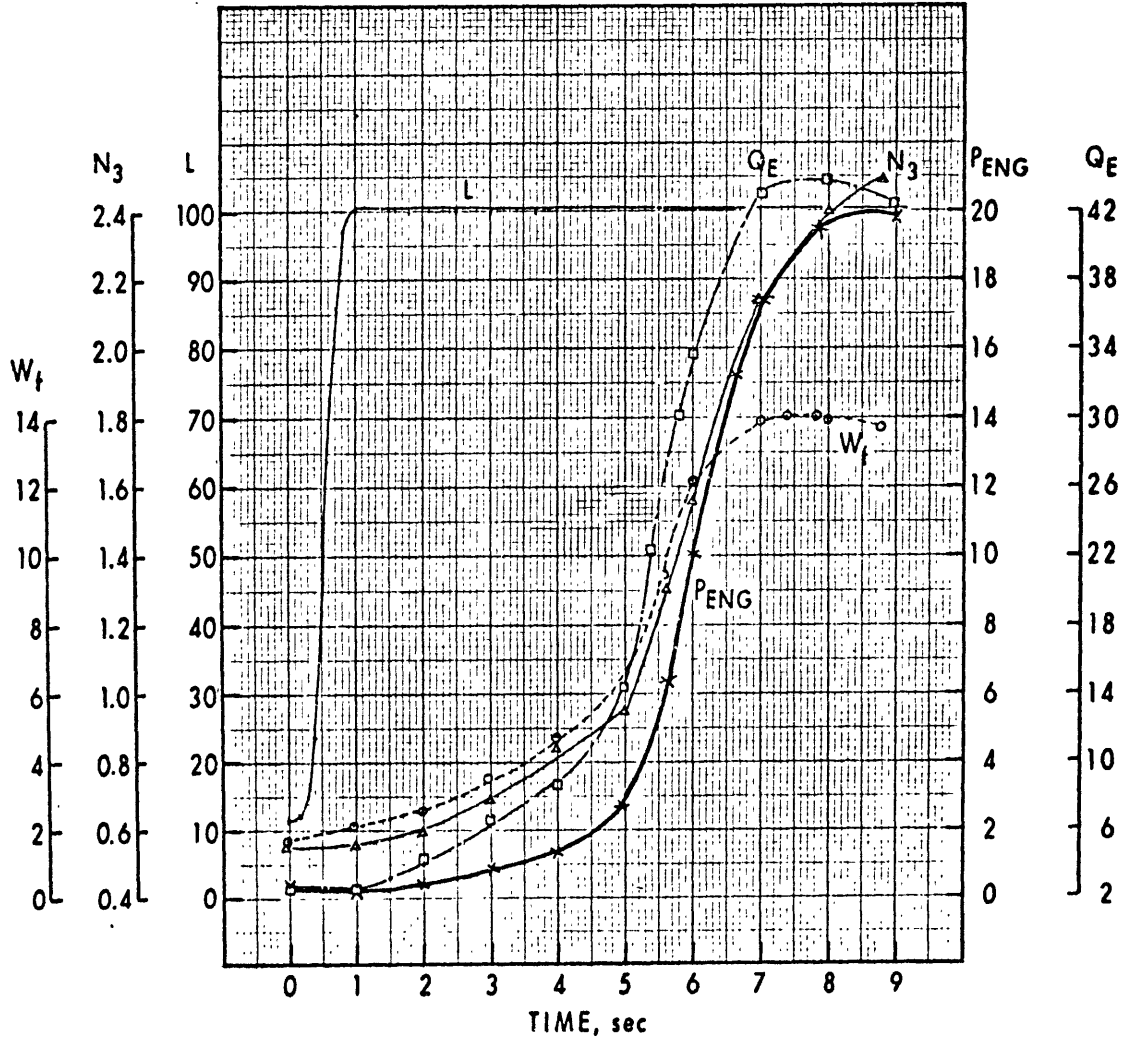


Figure 12

Throttle Step Increase (Open Loop)
 Idle to 20,000 Horsepower - Test TS-7

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

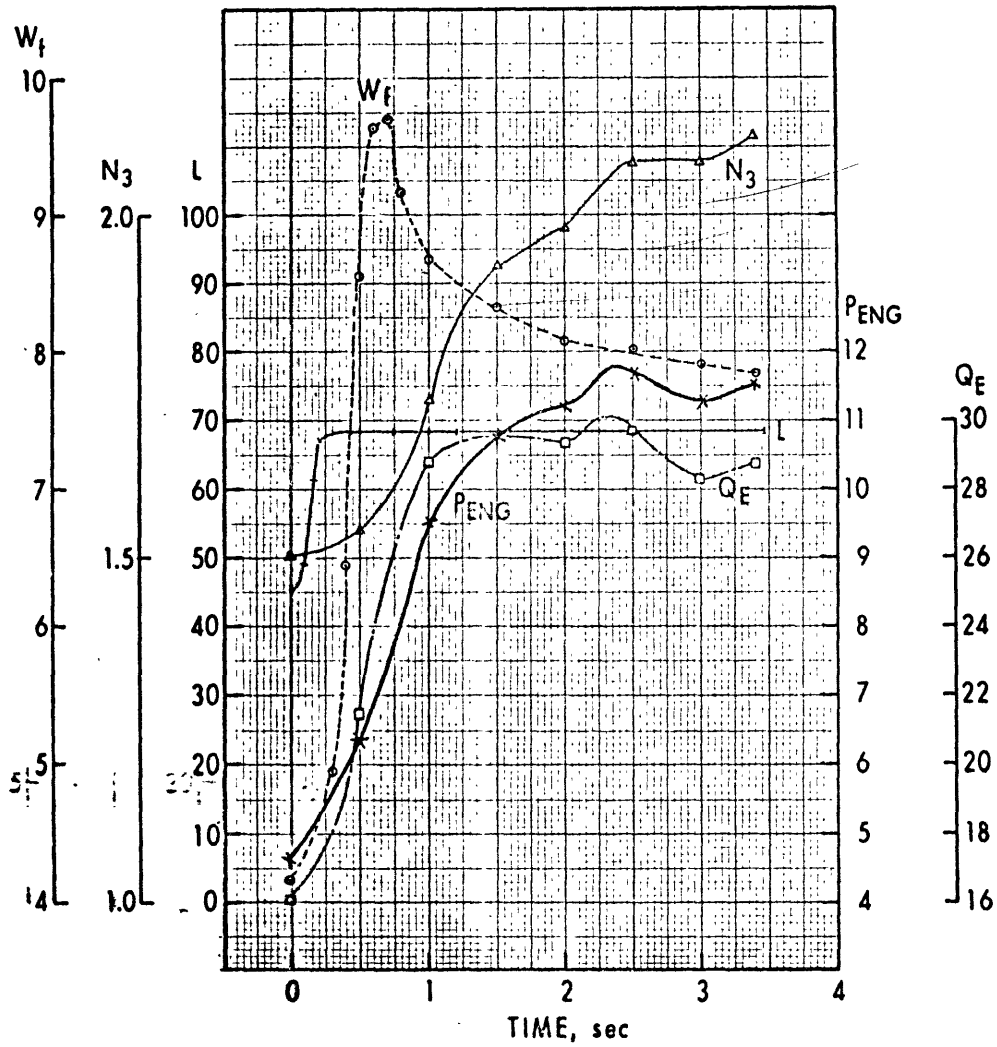


Figure 13

Throttle Step Increase (Open Loop)
4,000 to 11,000 Horsepower - Test TS-8

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

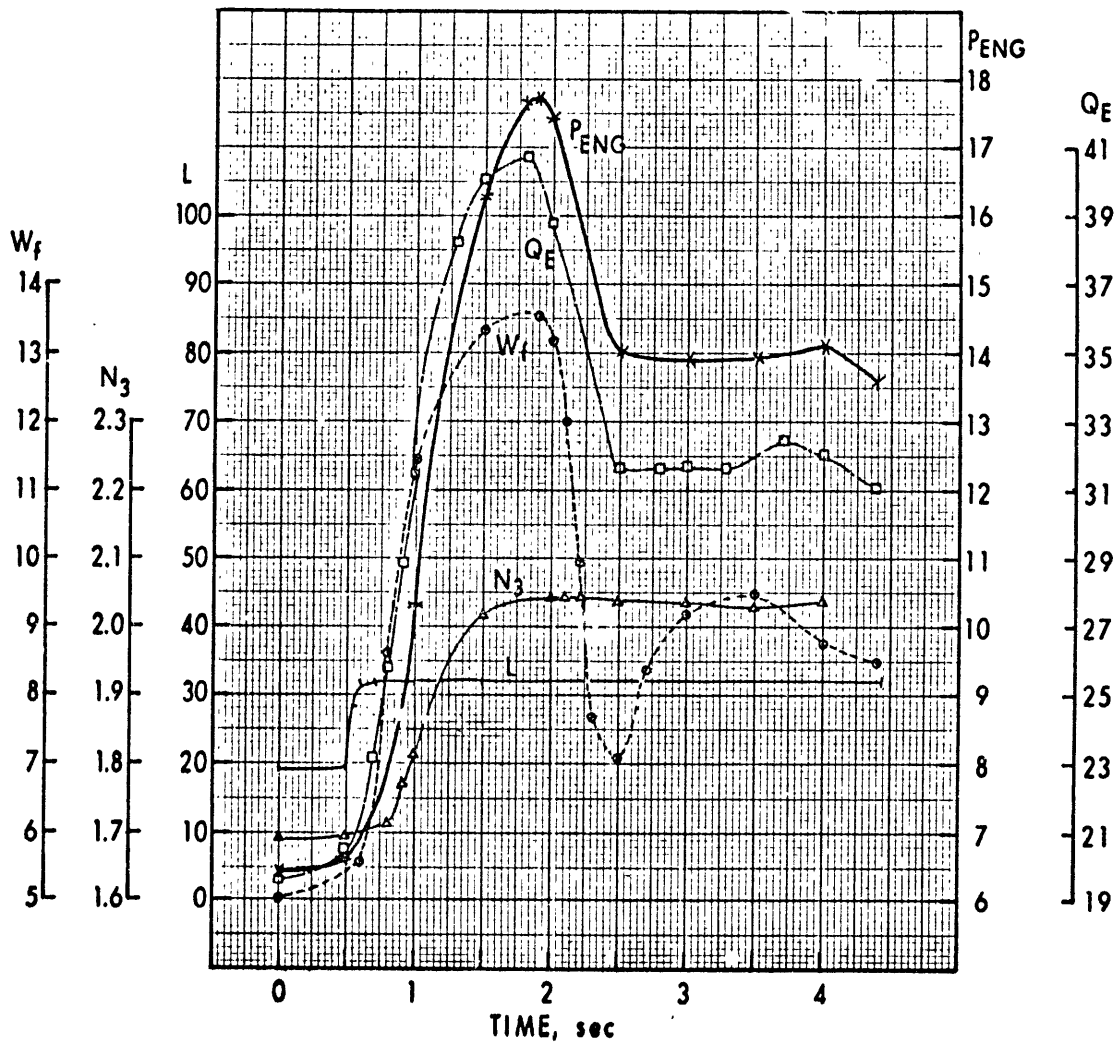


Figure 14

Throttle Step Increase (Closed Loop)
6,000 to 14,000 Horsepower - Test TS-9

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

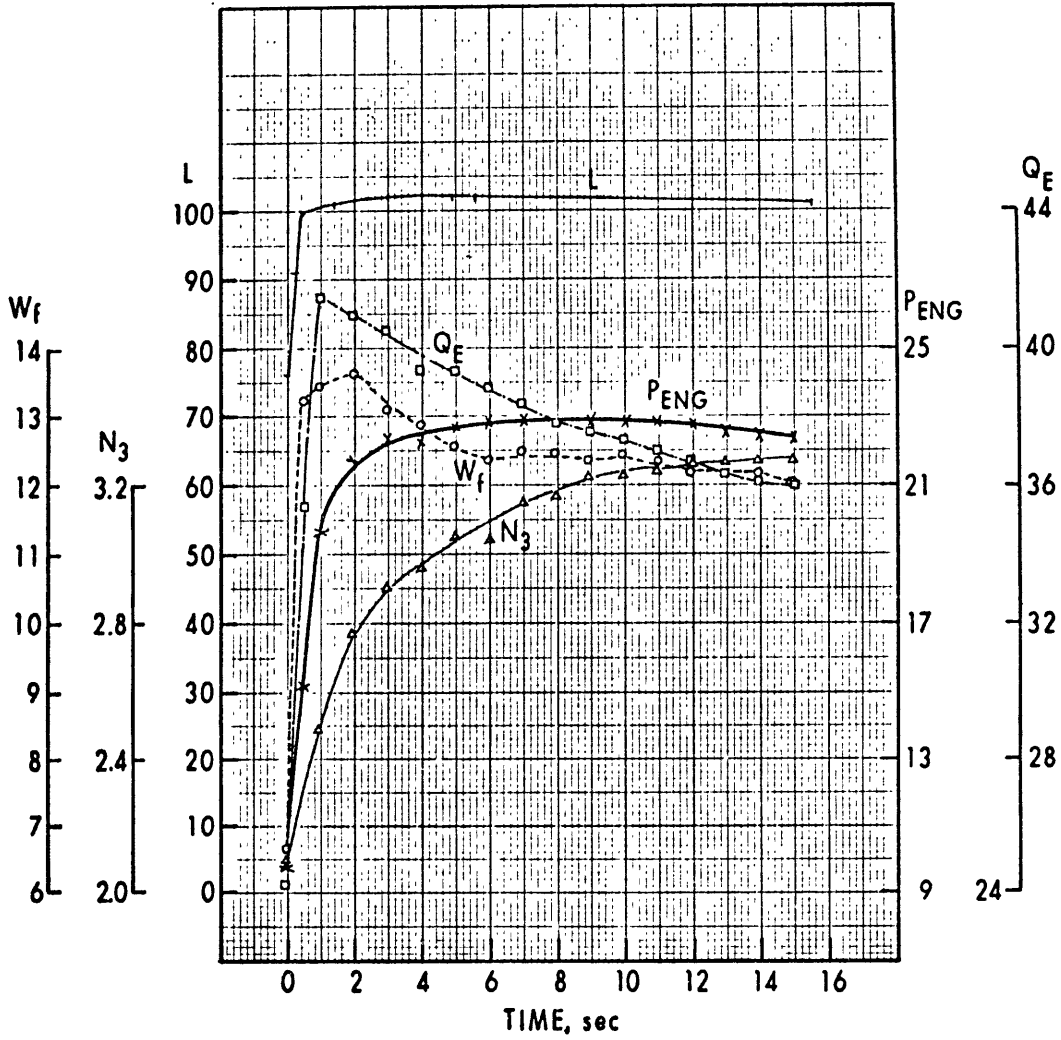


Figure 15

Throttle Step Increase (Open Loop)
 10,000 to 22,000 Horsepower - Test TS-10

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

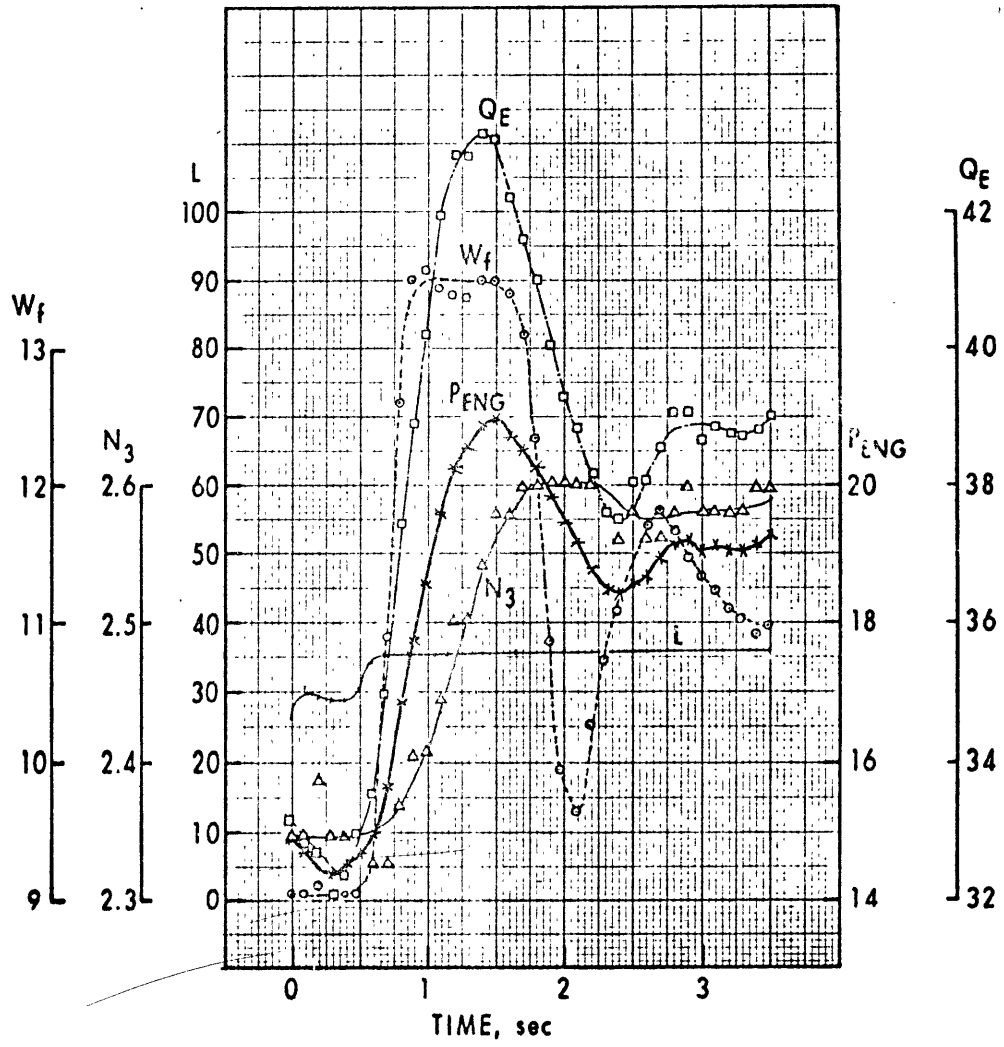


Figure 16

Throttle Step Increase (Closed Loop)
 15,000 to 19,000 Horsepower - Test TS-11

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

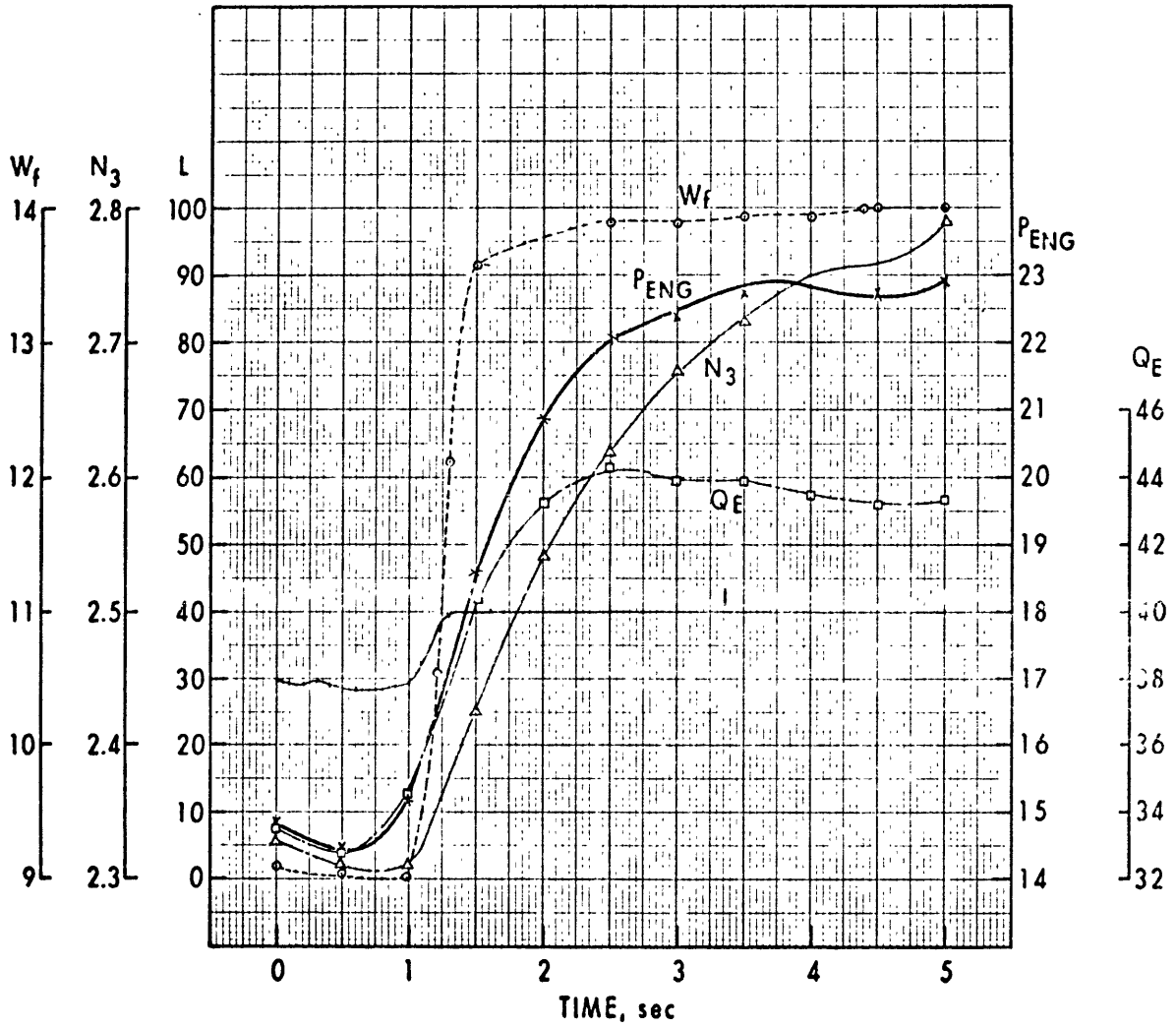


Figure 17

Throttle Step Increase (Closed Loop)
15,000 to 23,000 Horsepower - Test TS-12

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

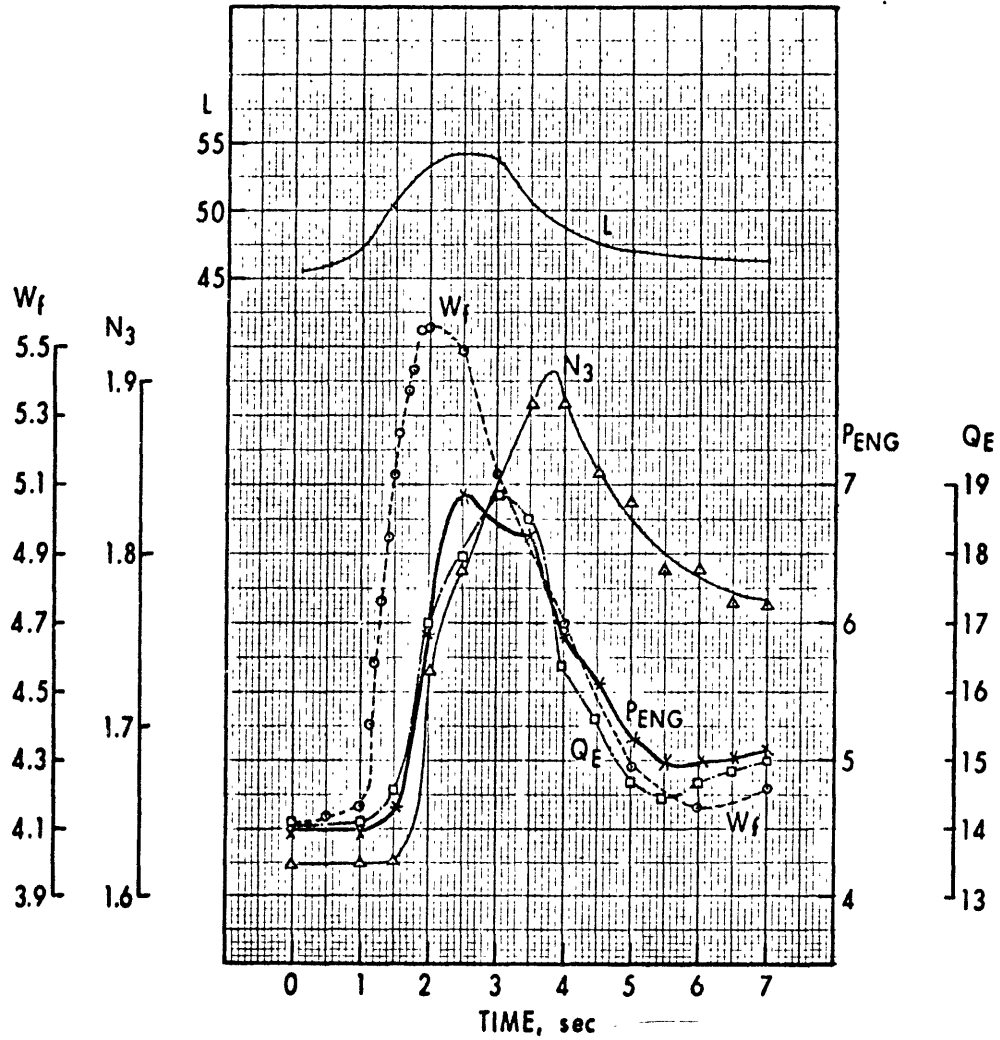


Figure 18

Throttle Pulse (19%) at 4000 Horsepower (Open Loop)
Test TP-1

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

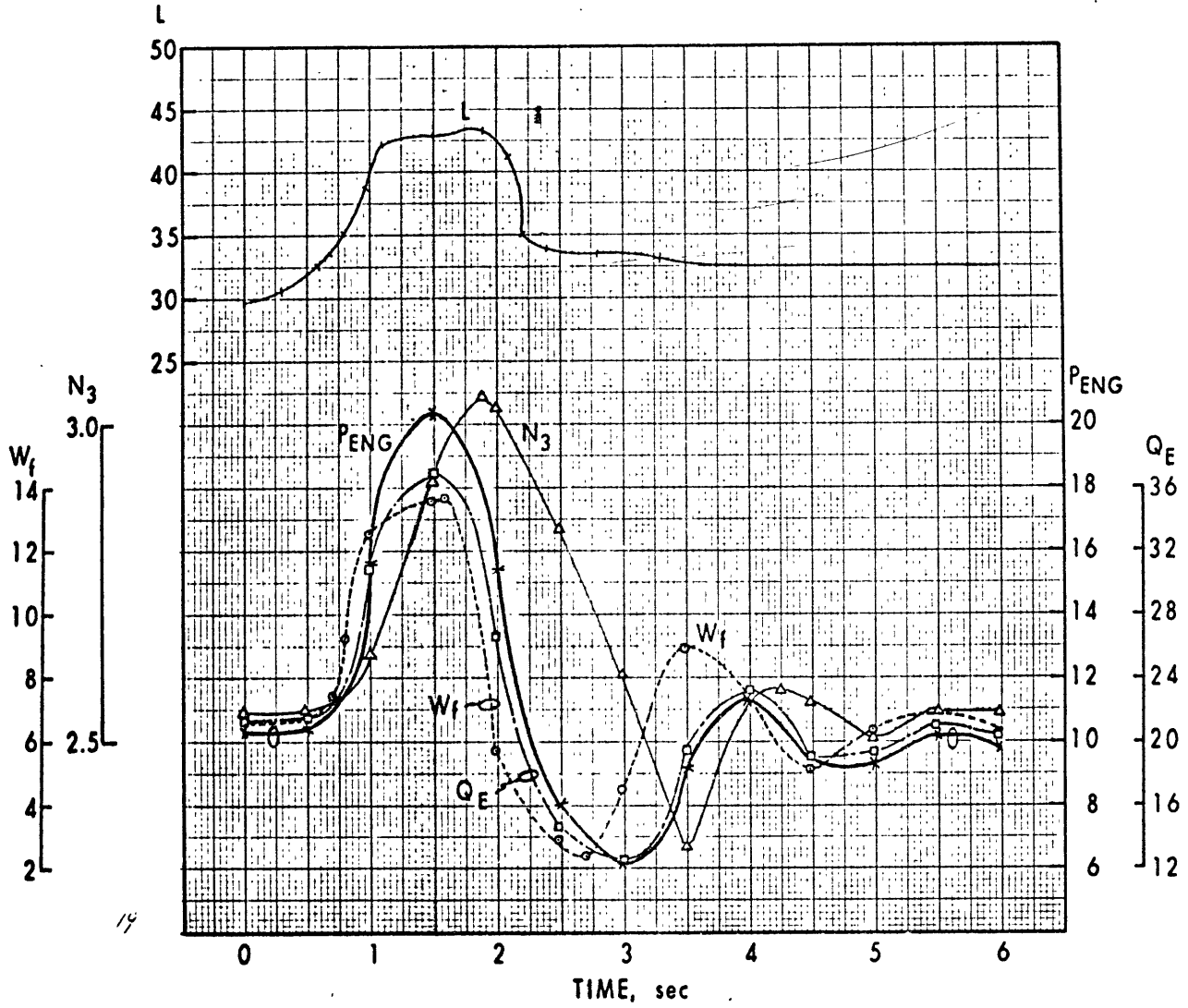


Figure 19

Throttle Pulse (37%) at 10,000 Horsepower (Closed Loop)
Test TP-2

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

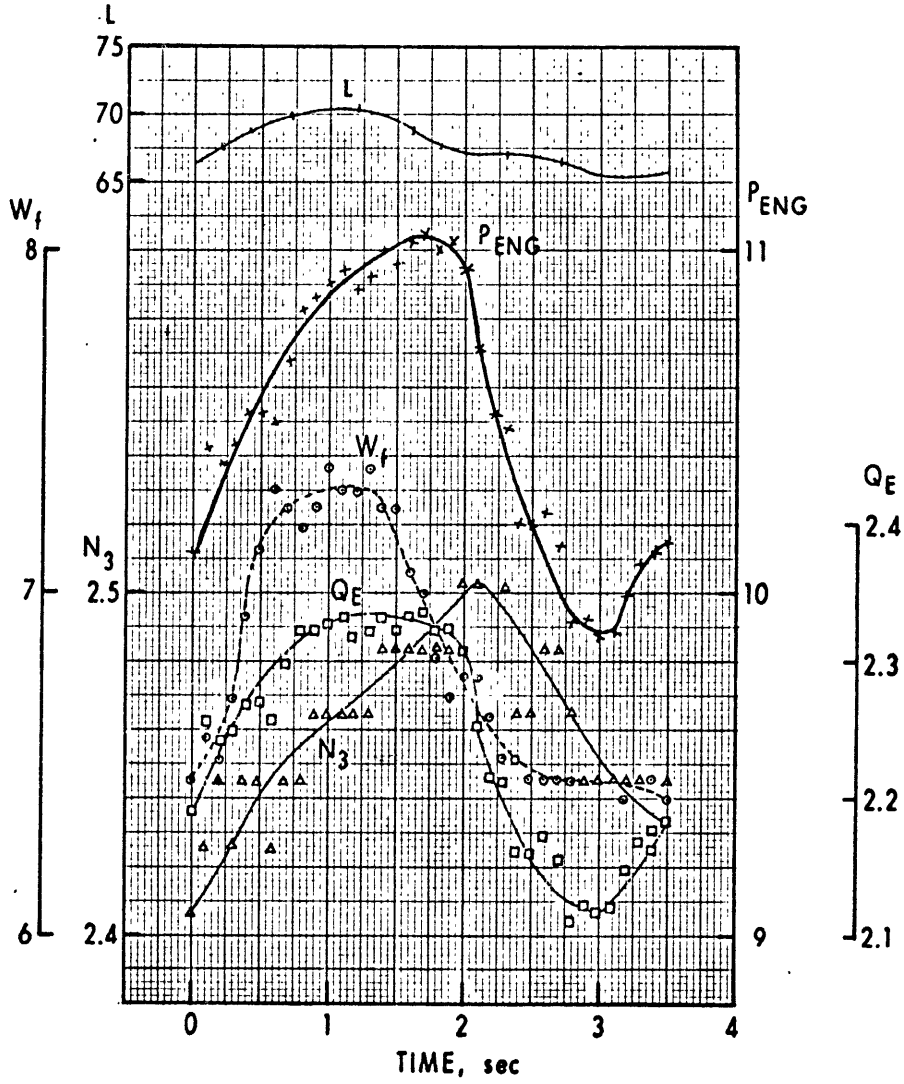


Figure 20

Throttle Pulse (6%) at 10,000 Horsepower (Open Loop)
Test TP-3

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

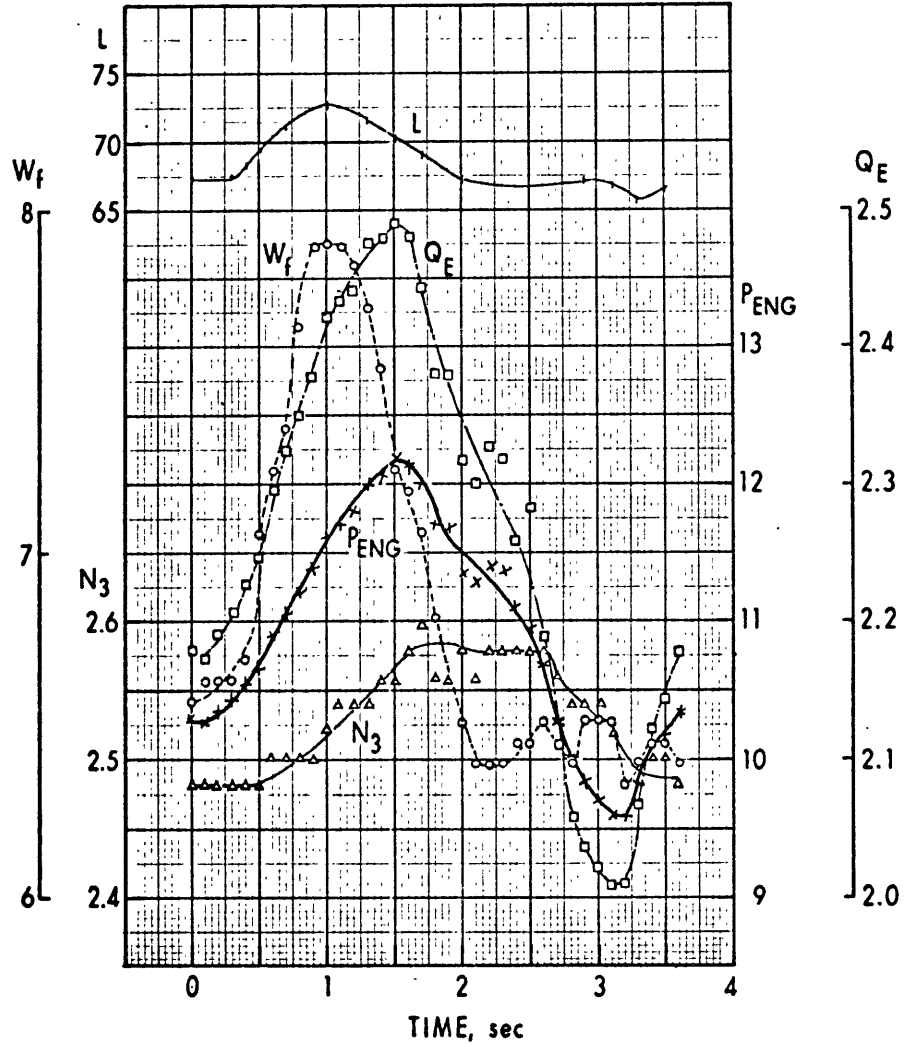


Figure 21
 Throttle Pulse (9%) at 10,000 Horsepower (Open Loop)
 Test TP-4

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

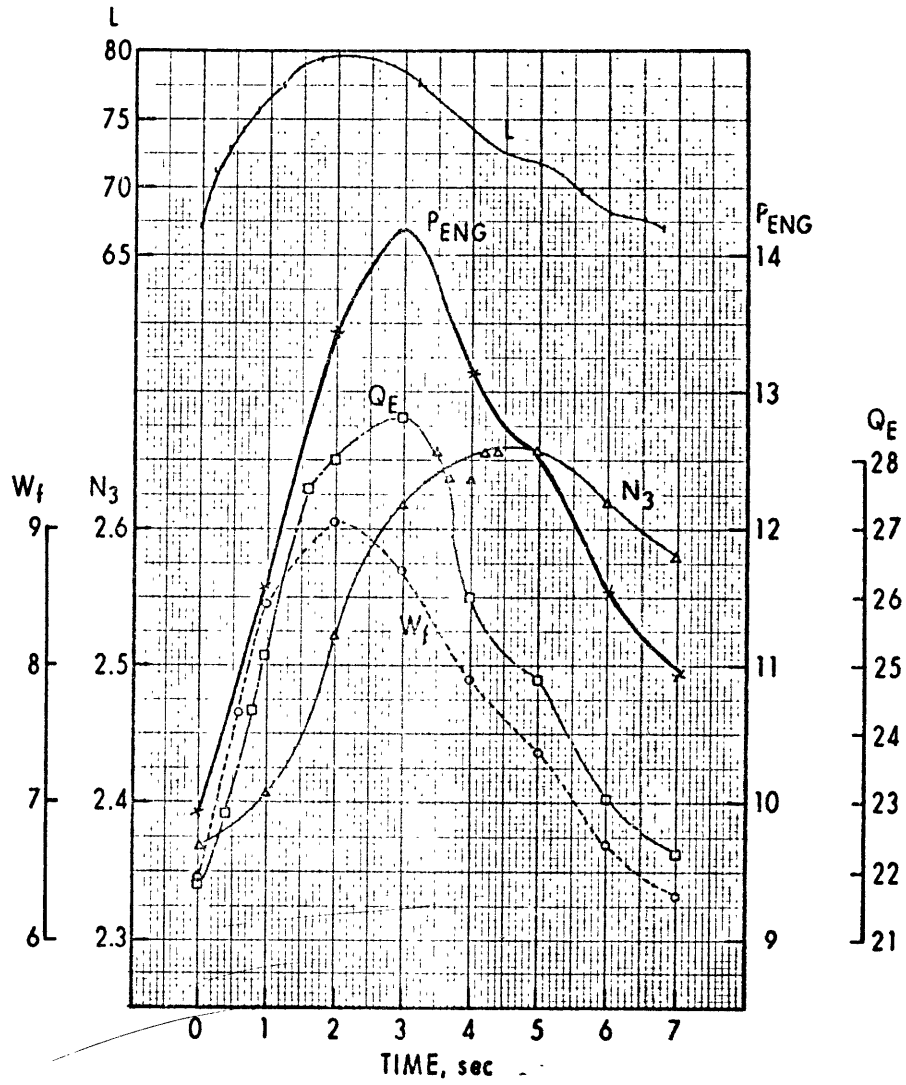


Figure 22
 Throttle Pulse (19%) at 10,000 Horsepower (Open Loop)
 Test TP-5

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

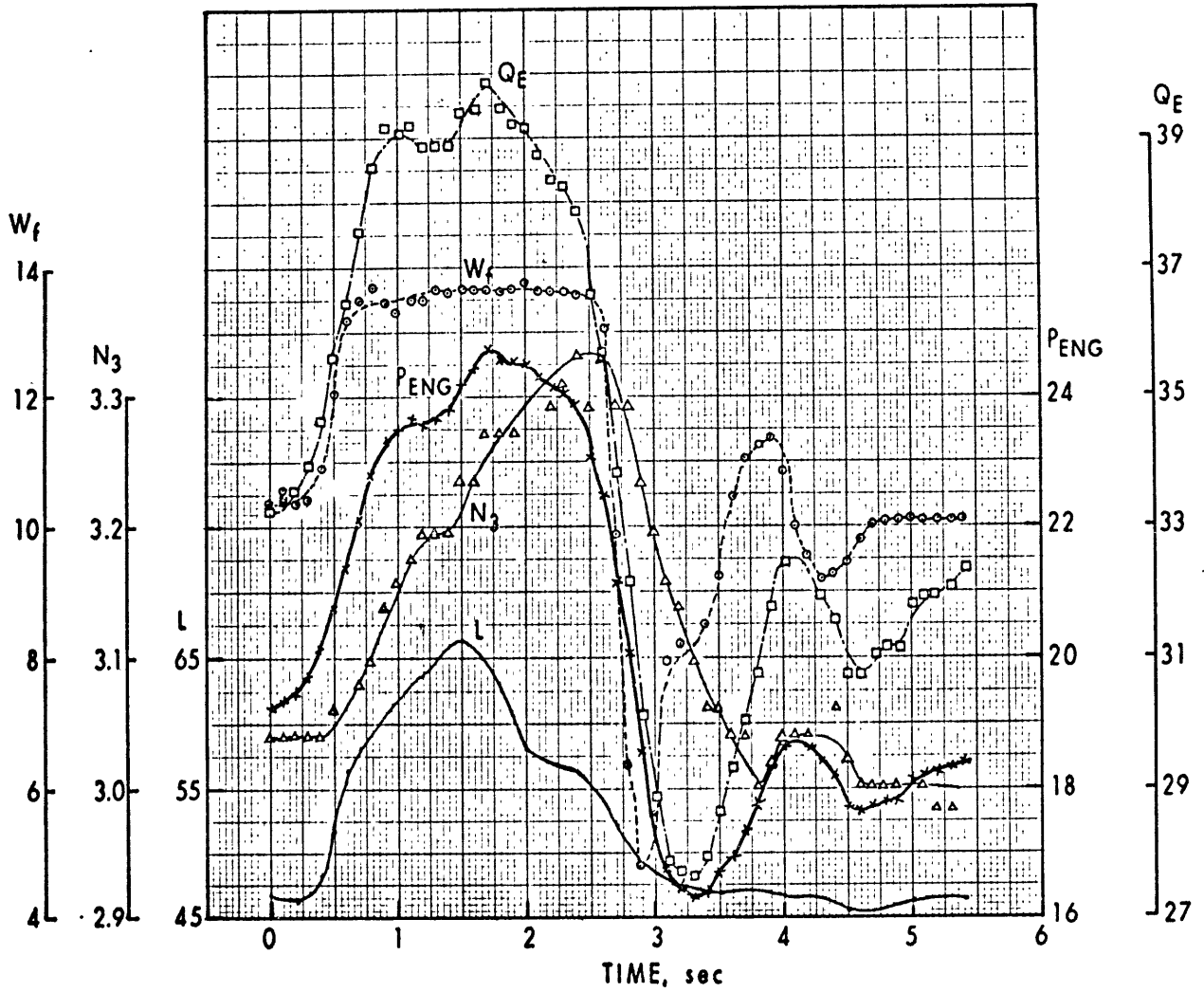


Figure 23

Throttle Pulse (44%) at 20,000 Horsepower (Closed Loop)
Test TP-6

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

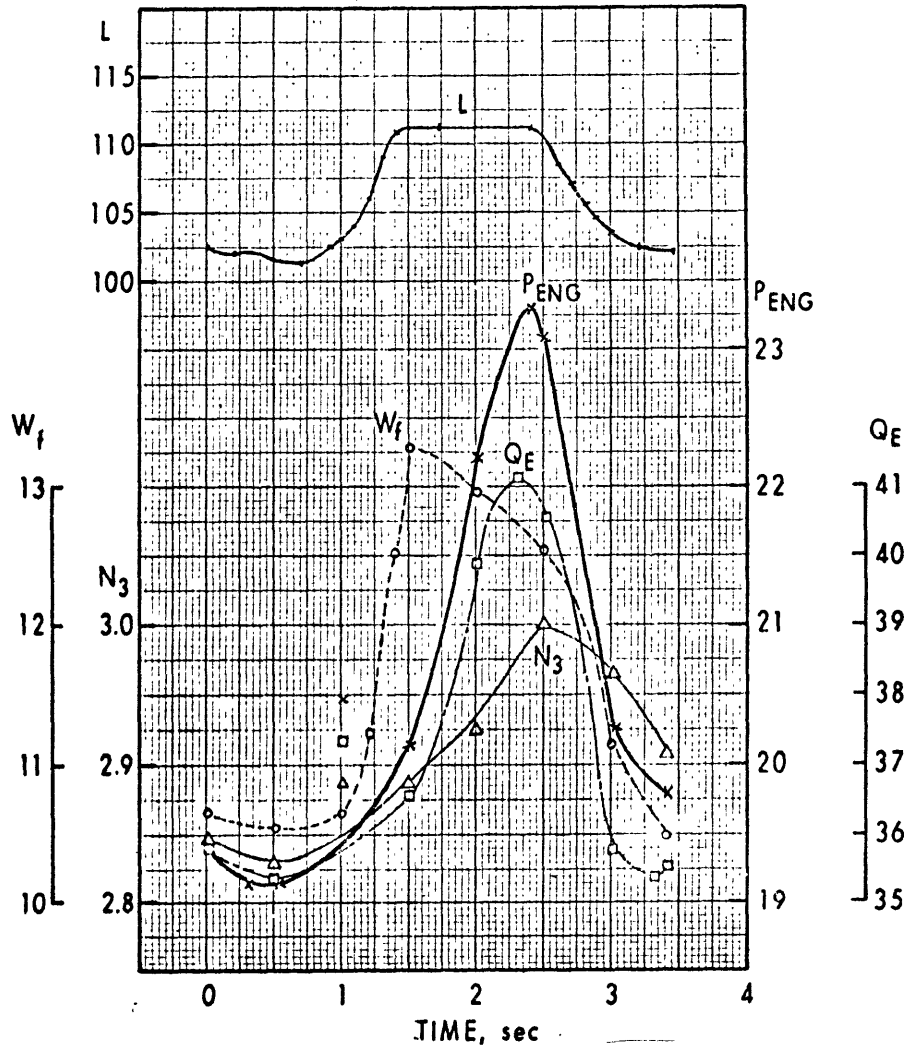


Figure 24

Throttle Pulse (9%) at 20,000 Horsepower (Open Loop)
Test TP-7

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

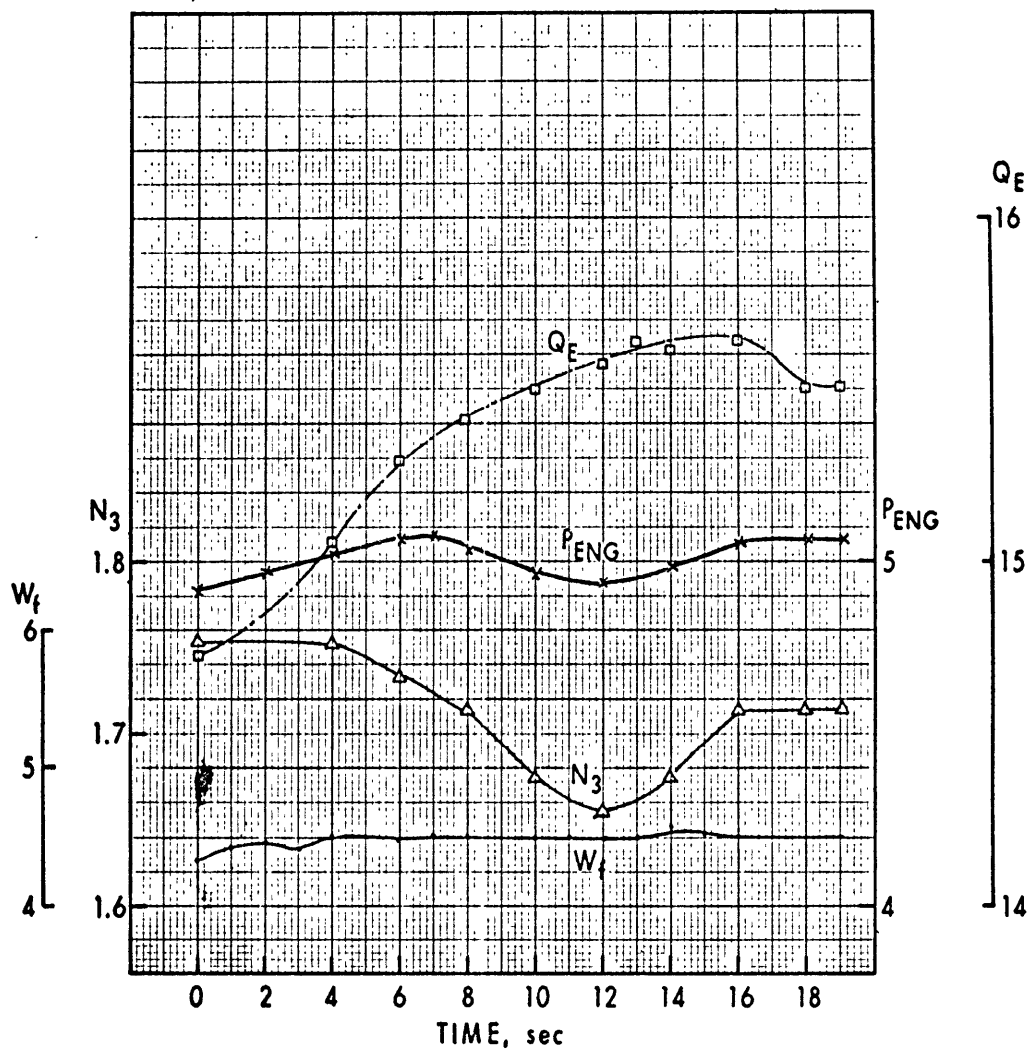


Figure 25

Load Torque Change (Open Loop), Constant Throttle
at 5000 Horsepower - Test LC-1

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

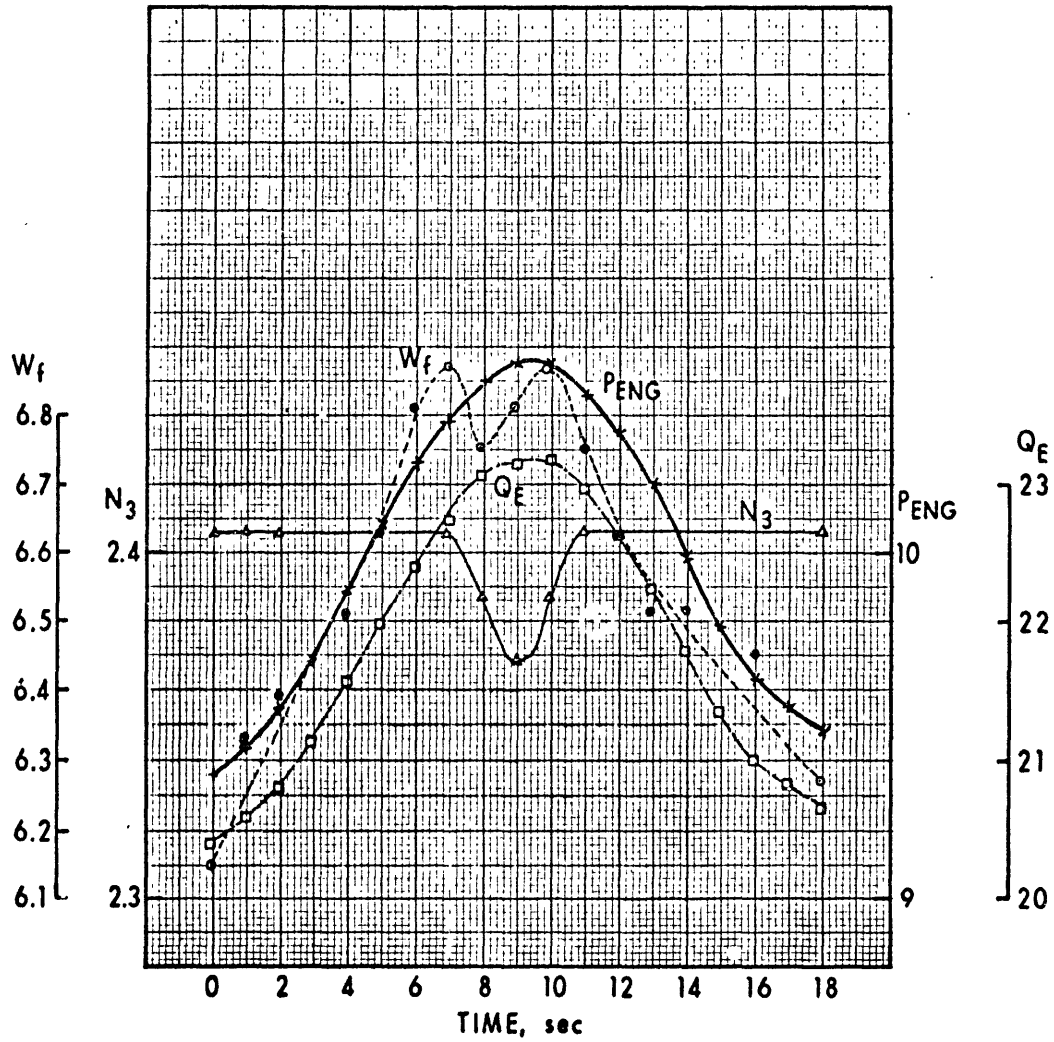


Figure 26

Load Torque Change (Closed Loop), Constant Throttle
at 10,000 Horsepower - Test LC-2

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

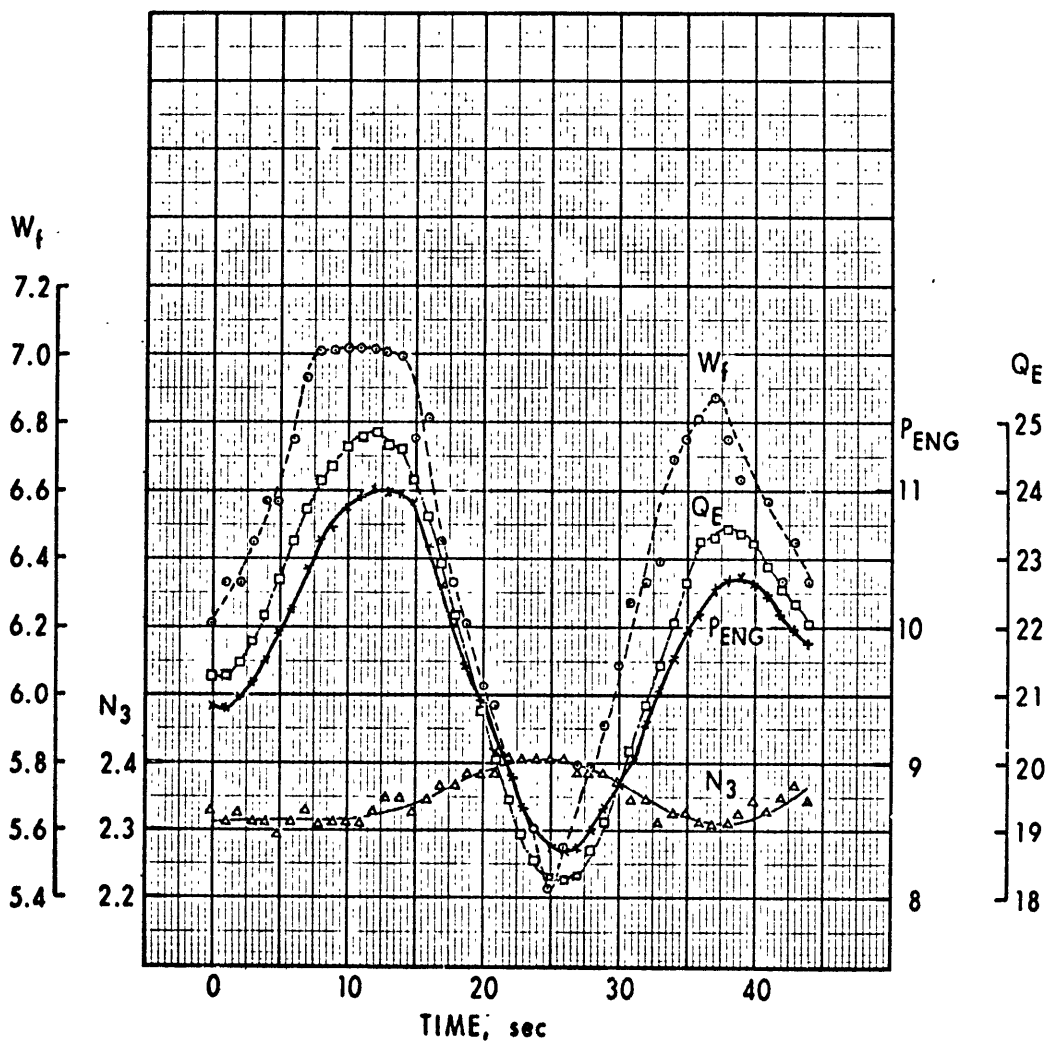


Figure 27

Load Torque Variation (Closed Loop), Constant Throttle at 10,000 Horsepower - Test LC-3

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

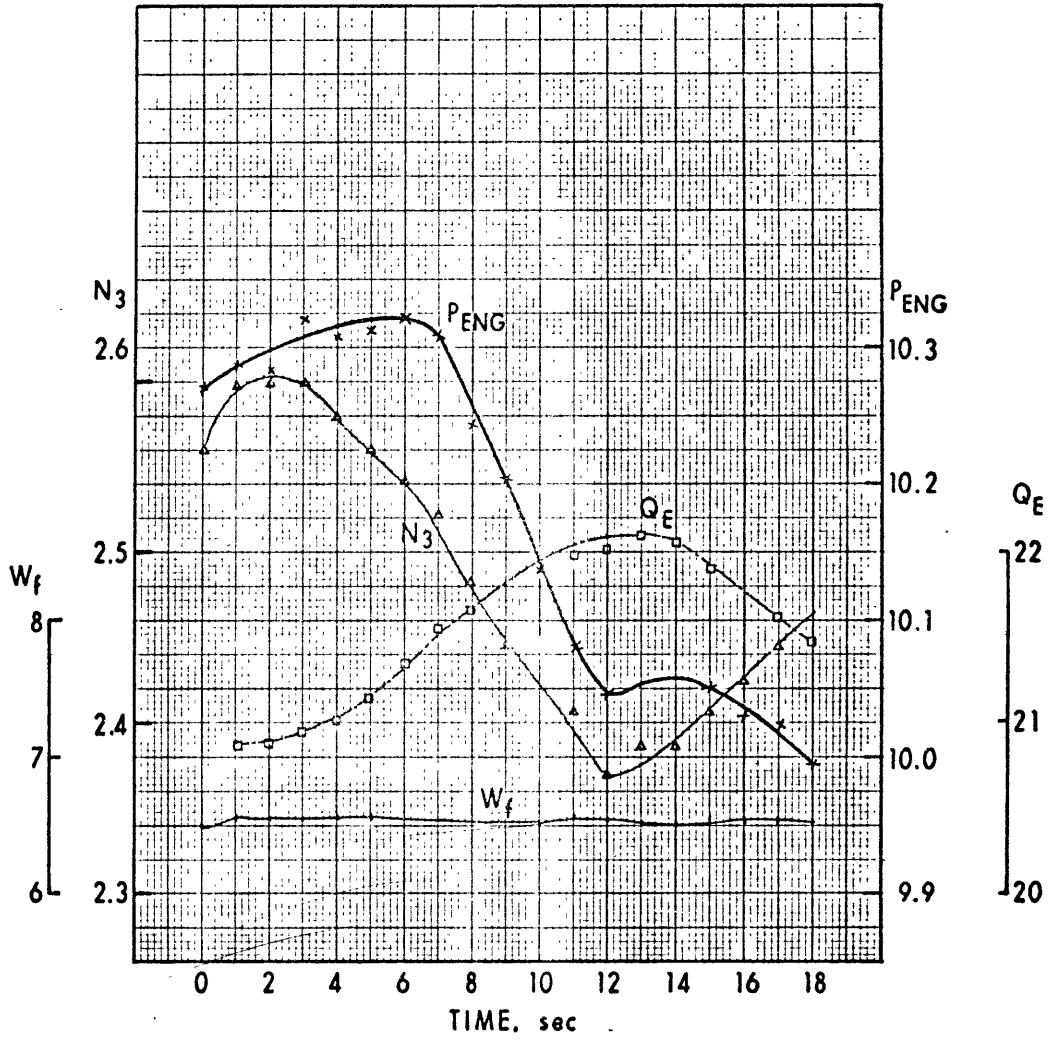


Figure 28

Load Torque Change (Open Loop), Constant Throttle
at 10,000 Horsepower - Test LC-4

NAVAL SHIP RESEARCH AND DEVELOPMENT LABORATORY

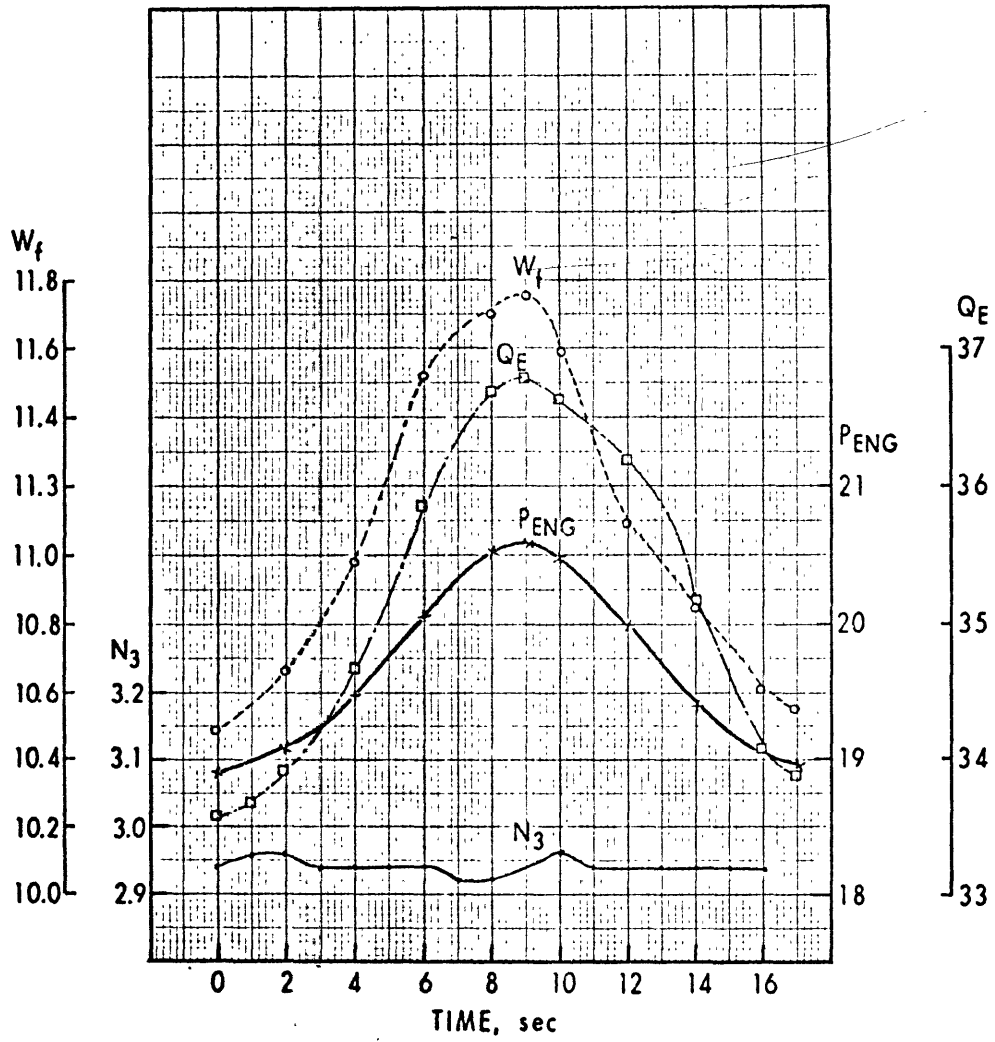


Figure 29

Load Torque Change (Closed Loop), Constant Throttle
at 20,000 Horsepower - Test LC-5

Appendix A
Transient Gas Turbine Test

TEST TS-1, THROTTLE STEP INCREASE (CLOSED LOOP), IDLE TC 4,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	0.0	1507.	2320.	5274.	597.	433.	0.95	1.06	11777.	C.	2361.	268.
0.1	13.3	1628.	2320.	5274.	597.	436.	0.95	1.06	12267.	15.	2797.	320.
0.2	18.0	1807.	2320.	5351.	597.	447.	0.95	1.06	11188.	15.	2707.	310.
0.3	19.5	2050.	2349.	5351.	616.	491.	0.95	1.06	11678.	23.	2875.	331.
0.4	19.5	2231.	2349.	5351.	597.	532.	0.95	1.06	11678.	13.	2683.	309.
0.5	20.0	2231.	2378.	5390.	616.	567.	1.14	1.08	11678.	23.	2965.	343.
0.6	20.0	2171.	2407.	5428.	597.	585.	1.14	1.08	12857.	15.	2857.	331.
0.7	20.0	2231.	2436.	5467.	616.	603.	1.14	1.08	12757.	31.	3251.	379.
0.8	19.5	2291.	2465.	5505.	616.	608.	1.14	1.08	13347.	36.	3474.	405.
0.9	19.5	2291.	2523.	5582.	616.	617.	0.95	1.06	12757.	46.	3670.	433.
1.0	20.0	2412.	2552.	5621.	616.	622.	1.14	1.08	12857.	54.	3885.	465.
1.1	20.0	2412.	2610.	5659.	635.	622.	1.33	1.09	13347.	65.	4283.	515.
1.2	20.0	2472.	2610.	5698.	655.	624.	1.33	1.09	13837.	65.	4350.	529.
1.3	20.0	2533.	2639.	5736.	635.	626.	1.33	1.09	14427.	62.	4257.	524.
1.4	20.5	2593.	2697.	5775.	655.	629.	1.33	1.09	14427.	65.	4516.	563.
1.5	20.5	2713.	2755.	5813.	655.	629.	1.52	1.10	14917.	69.	4603.	577.
1.6	20.0	2713.	2813.	5890.	674.	631.	1.71	1.12	15407.	77.	4841.	614.
1.7	20.5	2774.	2842.	5929.	674.	633.	1.71	1.12	15997.	77.	4904.	629.
1.8	20.5	2834.	2871.	5967.	674.	633.	1.90	1.13	15997.	92.	5295.	691.
1.9	20.5	2894.	2929.	6006.	693.	638.	1.90	1.13	15997.	100.	5542.	731.
2.0	20.5	3015.	2958.	6044.	712.	643.	1.90	1.13	15997.	100.	5585.	749.
2.1	20.0	3075.	3016.	6121.	712.	645.	2.09	1.14	17076.	85.	5277.	720.
2.2	20.5	3196.	3074.	6160.	732.	654.	2.09	1.14	17076.	85.	5384.	742.
2.3	20.5	3377.	3074.	6198.	732.	663.	2.09	1.14	17076.	77.	5315.	736.
2.4	20.5	3497.	3132.	6237.	732.	666.	2.28	1.16	18646.	69.	5203.	728.
2.5	20.5	3558.	3190.	6314.	732.	666.	2.28	1.16	18646.	69.	5266.	745.
2.6	20.5	3618.	3248.	6352.	751.	663.	2.47	1.17	18646.	85.	5704.	815.
2.7	20.5	3739.	3277.	6391.	770.	652.	2.66	1.18	18646.	100.	6118.	833.
2.8	20.5	3859.	3364.	6468.	770.	643.	2.66	1.18	19236.	116.	6579.	965.
2.9	20.5	3919.	3422.	6506.	770.	638.	2.66	1.18	20216.	139.	7256.	1085.
3.0	20.5	4040.	3511.	6545.	789.	633.	2.85	1.19	21395.	169.	8151.	1243.
3.1	20.5	4161.	3538.	6545.	828.	629.	2.85	1.19	22375.	193.	8847.	1381.
3.2	21.0	4281.	3567.	6660.	847.	624.	3.04	1.21	23455.	200.	9197.	1476.
3.3	20.5	4462.	3625.	6699.	866.	613.	3.23	1.22	23455.	208.	9542.	1574.
3.4	20.5	4522.	3654.	6699.	886.	603.	3.23	1.22	24535.	200.	9497.	1601.
3.5	20.5	4764.	3741.	6776.	905.	597.	3.23	1.22	25615.	185.	9319.	1605.
3.6	20.5	4884.	3799.	6814.	924.	590.	3.42	1.23	25615.	169.	9185.	1609.
3.7	20.5	5005.	3799.	6853.	943.	583.	3.61	1.25	27774.	169.	9398.	1674.
3.8	20.0	5125.	3828.	6853.	943.	576.	3.80	1.26	28854.	169.	9611.	1740.
3.9	20.5	5306.	3915.	6930.	963.	569.	3.80	1.26	29834.	185.	10243.	1892.
4.0	20.0	5487.	3944.	6930.	982.	560.	3.80	1.26	30914.	200.	10831.	2040.
4.1	20.0	5729.	4002.	6968.	1020.	555.	4.18	1.28	32583.	223.	11614.	2239.
4.2	19.5	5909.	4060.	7007.	1039.	560.	4.37	1.30	33663.	231.	12069.	2380.
4.3	20.0	6090.	4147.	7045.	1059.	564.	4.56	1.31	35233.	254.	12920.	2614.
4.4	19.5	6271.	4234.	7084.	1078.	590.	5.13	1.35	36802.	293.	14160.	2927.
4.5	19.5	6512.	4321.	7161.	1116.	649.	5.51	1.37	38962.	335.	15600.	3316.
4.6	20.0	6934.	4408.	7238.	1136.	684.	6.08	1.41	41611.	385.	17083.	3769.
4.7	20.0	7417.	4582.	7315.	1193.	714.	6.65	1.45	43281.	454.	19180.	4401.
4.8	20.0	8080.	4727.	7392.	1270.	748.	7.41	1.50	45930.	508.	20993.	5017.
4.9	20.0	8743.	4901.	7507.	1309.	776.	7.98	1.54	49660.	531.	22143.	5535.
5.0	20.0	9286.	5075.	7584.	1367.	797.	8.74	1.59	53489.	547.	23267.	6072.

TEST TS-1 (CONTINUED)

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3DOT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
5.1	20.0	976.9	5162.	7661.	1424.	806.	9.31	1.63	57118.	539.	24035.	6520.
5.2	19.5	994.9	5249.	7777.	1482.	813.	9.88	1.67	62517.	493.	23977.	6749.
5.3	19.5	862.3	5278.	7777.	1540.	741.	10.07	1.69	69485.	424.	23384.	6788.
5.4	19.5	6211.	5220.	7777.	1578.	656.	9.50	1.65	74294.	331.	22229.	6599.
5.5	19.5	4100.	5162.	7700.	1598.	567.	8.93	1.61	78024.	223.	20545.	6190.
5.6	19.5	2352.	5017.	7661.	1598.	505.	8.36	1.57	80773.	116.	18581.	5626.
5.7	19.5	2110.	4872.	7584.	1598.	452.	7.98	1.54	81753.	23.	16775.	5079.
5.8	19.5	2171.	4727.	7507.	1578.	417.	7.22	1.49	81753.	-62.	14908.	4491.
5.9	19.5	1997.	4582.	7430.	1578.	373.	6.65	1.45	81753.	-108.	13787.	4124.
6.0	19.5	1869.	4437.	7353.	1559.	355.	6.08	1.41	79593.	-146.	12673.	3744.
6.1	19.5	1869.	4350.	7315.	1540.	351.	5.70	1.39	79103.	-162.	12022.	3516.
6.2	19.5	2231.	4263.	7276.	1501.	353.	5.51	1.37	75864.	-162.	11659.	3367.
6.3	20.0	2894.	4234.	7199.	1501.	378.	5.51	1.37	74294.	-139.	11822.	3380.
6.4	19.5	3377.	4205.	7199.	1482.	422.	5.32	1.36	72725.	-123.	11806.	3349.
6.5	20.0	3437.	4205.	7199.	1482.	443.	5.51	1.37	70565.	-100.	12013.	3390.
6.6	20.0	3437.	4234.	7161.	1482.	472.	5.51	1.37	69975.	-77.	12240.	3436.
6.7	20.0	3497.	4234.	7199.	1463.	491.	5.32	1.36	67916.	-69.	12179.	3401.
6.8	20.0	3678.	4234.	7199.	1463.	509.	5.32	1.36	66836.	-62.	12161.	3388.
6.9	20.0	3919.	4292.	7199.	1444.	516.	5.32	1.36	66836.	-54.	12167.	3371.
7.0	20.0	4221.	4292.	7238.	1463.	525.	5.51	1.37	65756.	-38.	12411.	3430.
7.1	19.5	4342.	4292.	7238.	1444.	528.	5.51	1.37	65756.	-38.	12348.	3403.
7.2	20.0	4402.	4321.	7276.	1444.	532.	5.70	1.39	65266.	-15.	12788.	3525.
7.3	20.0	4462.	4350.	7276.	1444.	539.	5.70	1.39	65266.	0.	13095.	3600.
7.4	20.0	4583.	4379.	7276.	1444.	539.	5.70	1.39	64676.	23.	13602.	3749.
7.5	20.0	4643.	4408.	7315.	1444.	541.	5.89	1.40	64676.	38.	13929.	3850.
7.6	19.5	4643.	4437.	7315.	1463.	541.	6.08	1.41	65266.	62.	14456.	4016.
7.7	20.0	4643.	4437.	7353.	1463.	541.	6.08	1.41	64676.	69.	14695.	4104.
7.8	20.0	4643.	4466.	7315.	1482.	537.	6.08	1.41	65266.	69.	14762.	4144.
7.9	19.5	4522.	4495.	7353.	1482.	532.	6.27	1.43	66246.	62.	14606.	4122.
8.0	20.0	4402.	4495.	7315.	1482.	528.	6.27	1.43	66346.	54.	14517.	4108.
8.1	20.0	4221.	4524.	7353.	1501.	521.	6.27	1.43	65756.	38.	14229.	4037.
8.2	20.0	4161.	4495.	7353.	1482.	516.	6.27	1.43	66836.	23.	13926.	3961.
8.3	19.5	3919.	4495.	7353.	1501.	514.	6.27	1.43	66836.	23.	13989.	3979.
8.4	19.5	3859.	4495.	7353.	1501.	511.	6.27	1.43	67426.	15.	13900.	3954.
8.5	20.0	3678.	4495.	7315.	1482.	507.	6.27	1.43	67916.	6.	13724.	3914.
8.6	19.5	3678.	4466.	7353.	1501.	507.	6.08	1.41	67916.	15.	13987.	3989.
8.7	20.0	3618.	4466.	7353.	1501.	502.	6.08	1.41	67916.	19.	14095.	4017.
8.8	19.5	3558.	4437.	7353.	1501.	500.	5.89	1.40	67916.	13.	13948.	3988.

TEST TS-2, THROTTLE STEP INCREASE (OPEN LOOP), IDLE TO 5,000 H.P.												
T	L	WF	N1	N2	N3	TT7	PT7	EPI	QL	N3DOT	QE	PENG
(SEC)	(%)	(LP/HR)	(RPM)	(RPM)	(RPM)	(DFGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
0.0	5.1	1683.	2274.	5159.	577.	440.	1.14	1.08	11777.	0.	2401.	261.
0.1	12.3	1807.	2274.	5159.	558.	440.	0.95	1.06	11777.	6.	2564.	280.
0.2	28.2	1867.	2204.	5123.	577.	456.	1.33	1.09	12267.	13.	2700.	295.
0.3	38.0	2113.	2233.	5159.	577.	502.	1.14	1.08	12267.	21.	2895.	316.
0.4	42.1	2231.	2262.	5236.	577.	539.	1.14	1.08	11777.	17.	2866.	315.
0.5	43.1	2231.	2262.	5274.	577.	562.	1.14	1.08	12267.	23.	3021.	334.
0.6	42.6	2231.	2320.	5274.	577.	576.	1.33	1.09	12857.	31.	3196.	354.
0.7	42.6	2231.	2320.	5313.	597.	583.	1.14	1.08	12857.	31.	3240.	361.
0.8	43.1	2231.	2349.	5313.	577.	592.	1.33	1.09	12267.	23.	3108.	349.
0.9	42.6	2171.	2349.	5351.	597.	599.	1.33	1.09	12857.	38.	3459.	390.
1.0	42.6	2171.	2436.	5390.	597.	603.	1.33	1.09	13347.	38.	3482.	393.
1.1	43.1	2231.	2436.	5424.	597.	606.	1.52	1.10	12857.	38.	3526.	403.
1.2	43.1	2171.	2465.	5467.	597.	608.	1.52	1.10	13447.	46.	3721.	428.
1.3	43.1	2291.	2474.	5505.	616.	613.	1.52	1.10	13347.	54.	3897.	451.
1.4	43.1	2352.	2552.	5582.	616.	613.	1.52	1.10	13347.	46.	3765.	442.
1.5	43.1	2472.	2581.	5582.	616.	615.	1.71	1.12	13347.	54.	3979.	470.
1.6	42.6	2533.	2610.	5582.	635.	613.	1.52	1.10	13937.	62.	4179.	496.
1.7	43.1	2533.	2639.	5659.	616.	613.	1.52	1.10	14427.	54.	4047.	486.
1.8	43.1	2593.	2668.	5698.	635.	613.	1.52	1.10	13937.	62.	4266.	519.
1.9	42.6	2653.	2726.	5736.	655.	615.	1.71	1.12	14427.	69.	4504.	551.
2.0	43.1	2713.	2784.	5813.	655.	615.	1.90	1.13	14427.	69.	4548.	563.
2.1	43.1	2774.	2784.	5852.	655.	620.	1.90	1.13	15507.	69.	4611.	578.
2.2	43.1	2894.	2842.	5890.	655.	622.	1.90	1.13	15507.	85.	5049.	640.
2.3	43.1	3015.	2871.	5929.	674.	626.	2.09	1.14	15507.	100.	5486.	704.
2.4	42.6	3075.	2929.	5967.	693.	631.	1.90	1.13	16586.	116.	5881.	767.
2.5	43.1	3196.	2958.	6006.	693.	636.	2.09	1.14	16586.	131.	6295.	840.
2.6	42.6	3316.	2987.	6044.	712.	643.	2.09	1.14	16586.	139.	6577.	897.
2.7	43.1	3437.	3074.	6121.	732.	652.	2.28	1.16	17076.	162.	7167.	998.
2.8	43.1	3497.	3161.	6163.	751.	654.	2.28	1.16	18156.	200.	8131.	1150.
2.9	43.1	3558.	3248.	6237.	770.	643.	2.47	1.17	18156.	293.	10514.	1534.
3.0	42.6	3678.	3277.	6275.	751.	636.	2.47	1.17	18746.	424.	13971.	2130.
3.5	42.6	4462.	3480.	6545.	828.	606.	3.23	1.22	23455.	123.	7836.	1287.
4.0	43.1	5065.	3770.	6699.	905.	578.	3.61	1.25	28854.	155.	9717.	1745.
4.5	43.1	5609.	4002.	6853.	1059.	539.	4.56	1.31	35822.	188.	11927.	2387.
5.0	43.1	5729.	4350.	7084.	1174.	620.	5.89	1.40	44851.	196.	13891.	3075.
5.5	43.1	5246.	4582.	7276.	1290.	587.	6.65	1.45	57118.	188.	15582.	3769.
6.0	43.1	4945.	4640.	7353.	1386.	546.	7.22	1.49	67916.	162.	16702.	4297.
6.5	43.1	4824.	4640.	7353.	1444.	534.	7.41	1.50	75274.	126.	17335.	4664.
7.0	43.6	4824.	4640.	7392.	1463.	530.	7.22	1.49	78514.	87.	17442.	4833.
7.5	43.1	4824.	4669.	7353.	1482.	532.	7.22	1.49	80673.	57.	17373.	4890.
8.0	43.1	4643.	4640.	7392.	1501.	530.	7.22	1.49	82243.	41.	17231.	4879.
8.5	43.1	4643.	4640.	7392.	1501.	532.	7.03	1.48	82733.	27.	17069.	4859.

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TEST TS-3, THROTTLE STEP INCREASE (CLOSED LCCPI), IDLE TC 8000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	-1.0	1568.	2291.	5313.	577.	429.	0.76	1.05	11777.	0.	2408.	265.
0.1	-1.0	1568.	2291.	5313.	577.	429.	0.76	1.05	12367.	0.	2368.	260.
0.2	-1.0	1628.	2291.	5274.	577.	429.	0.76	1.05	11777.	0.	2344.	258.
0.3	0.0	1749.	2291.	5313.	577.	429.	0.95	1.06	11188.	0.	2344.	258.
0.4	19.0	1869.	2320.	5313.	577.	431.	0.76	1.05	11188.	0.	2321.	255.
0.5	28.7	1930.	2320.	5313.	577.	440.	0.95	1.06	11777.	0.	2344.	258.
0.6	28.7	1990.	2349.	5351.	577.	495.	0.95	1.06	11777.	0.	2368.	260.
0.7	27.2	2050.	2378.	5390.	577.	532.	1.14	1.08	12367.	0.	2591.	285.
0.8	28.2	2171.	2436.	5428.	577.	567.	1.14	1.08	11777.	15.	2810.	309.
0.9	27.7	2171.	2436.	5428.	577.	583.	1.14	1.08	12367.	31.	3204.	355.
1.0	27.7	2171.	2465.	5505.	577.	594.	1.14	1.08	12857.	46.	3575.	398.
1.1	27.7	2291.	2523.	5544.	597.	606.	1.14	1.08	12857.	62.	3989.	450.
1.2	28.2	2352.	2552.	5582.	597.	613.	1.14	1.08	12857.	62.	4009.	458.
1.3	28.2	2412.	2581.	5621.	616.	617.	1.33	1.09	13347.	65.	4204.	487.
1.4	28.2	2472.	2610.	5698.	616.	622.	1.33	1.09	12857.	62.	4068.	474.
1.5	28.2	2533.	2610.	5698.	616.	622.	1.52	1.10	13347.	54.	3956.	467.
1.6	28.2	2533.	2668.	5698.	616.	624.	1.33	1.09	13837.	54.	3999.	475.
1.7	28.2	2593.	2726.	5813.	635.	626.	1.52	1.10	14427.	62.	4238.	506.
1.8	28.2	2653.	2755.	5813.	635.	626.	1.52	1.10	14427.	54.	4106.	497.
1.9	28.7	2713.	2784.	5852.	635.	624.	1.52	1.10	14427.	62.	4329.	530.
2.0	28.2	2834.	2842.	5929.	655.	629.	1.52	1.10	14427.	65.	4548.	560.
2.1	28.2	2894.	2871.	5967.	655.	631.	1.52	1.10	15017.	65.	4615.	575.
2.2	28.2	2894.	2929.	5967.	655.	633.	1.71	1.12	15507.	65.	4678.	590.
2.3	28.2	3015.	2987.	6083.	674.	638.	1.90	1.13	16096.	85.	5116.	653.
2.4	28.7	3075.	3016.	6083.	674.	643.	1.90	1.13	15997.	85.	5175.	668.
2.5	28.2	3196.	3045.	6160.	693.	647.	1.90	1.13	16586.	92.	5441.	714.
2.6	28.2	3256.	3103.	6198.	693.	652.	2.09	1.14	16586.	92.	5504.	730.
2.7	28.2	3437.	3161.	6237.	712.	659.	2.09	1.14	17666.	100.	5794.	782.
2.8	28.2	3497.	3219.	6275.	712.	659.	2.28	1.16	17666.	100.	5901.	805.
2.9	28.2	3678.	3277.	6314.	732.	649.	2.47	1.17	18846.	108.	6226.	863.
3.0	28.7	3739.	3306.	6198.	732.	638.	2.47	1.17	19236.	108.	6357.	895.
3.1	28.7	3919.	3364.	6275.	751.	629.	2.85	1.19	20316.	123.	6858.	980.
3.2	28.2	3980.	3393.	6506.	770.	622.	2.85	1.19	20905.	123.	6960.	1010.
3.3	28.2	4161.	3451.	6545.	770.	622.	3.04	1.21	21395.	131.	7290.	1079.
3.4	28.2	4281.	3509.	6583.	789.	620.	3.04	1.21	21395.	146.	7814.	1174.
3.5	28.7	4402.	3596.	6622.	809.	613.	3.23	1.22	23065.	154.	8183.	1254.
3.6	28.2	4402.	3654.	6660.	809.	603.	3.23	1.22	24635.	146.	8225.	1290.
3.7	28.7	4583.	3683.	6699.	847.	597.	3.42	1.23	25714.	162.	8836.	1412.
3.8	28.7	4703.	3741.	6776.	866.	594.	3.61	1.25	26794.	162.	9073.	1470.
3.9	28.2	4945.	3770.	6814.	866.	587.	3.80	1.26	27874.	162.	9310.	1542.
4.0	28.7	5125.	3828.	6891.	866.	580.	3.99	1.27	28954.	177.	9898.	1669.
4.1	28.7	5246.	3886.	6968.	905.	571.	3.99	1.27	30523.	216.	11056.	1905.
4.2	28.7	5367.	3973.	6968.	924.	564.	4.37	1.30	31603.	231.	11687.	2065.
4.3	28.7	5487.	4031.	6968.	963.	555.	4.56	1.31	33763.	254.	12513.	2284.
4.4	28.7	5668.	4060.	7007.	982.	551.	4.75	1.32	34842.	270.	13168.	2471.
4.5	28.2	5849.	4118.	7007.	1020.	551.	4.94	1.34	36412.	285.	13843.	2669.
4.6	28.2	6030.	4176.	7084.	1039.	567.	5.13	1.35	38082.	285.	14167.	2804.
4.7	28.2	6271.	4234.	7084.	1059.	601.	5.32	1.36	39651.	300.	14885.	3033.
4.8	28.2	6693.	4350.	7238.	1097.	656.	5.89	1.40	41811.	331.	15938.	3342.
4.9	28.7	7236.	4437.	7276.	1136.	693.	6.27	1.43	43970.	362.	17071.	3692.
5.0	28.2	7718.	4611.	7315.	1174.	725.	6.65	1.45	45150.	400.	18556.	4162.

TEST TS-3 (CONTINUED)												
T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3CNT	QE	PENG
(SEC)	(°)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEG)	(LB/SQIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
5.1	28.7	3261.	4756.	7430.	1213.	755.	7.22	1.49	48779.	447.	20256.	4707.
5.2	28.2	3585.	4901.	7546.	1270.	778.	8.17	1.56	54768.	493.	22126.	5353.
5.3	29.7	9407.	5046.	7584.	1309.	794.	8.93	1.61	57907.	535.	24186.	6099.
5.4	27.7	10070.	5191.	7700.	1336.	815.	9.69	1.66	64286.	601.	26731.	7035.
5.5	27.2	10513.	5336.	7777.	1444.	824.	10.45	1.71	70175.	647.	28940.	7977.
5.6	27.2	11336.	5441.	7892.	1501.	847.	11.59	1.79	77143.	693.	31366.	9082.
5.7	27.2	12000.	5626.	7963.	1538.	866.	12.73	1.87	83522.	747.	33992.	10316.
5.8	26.7	12663.	5771.	8085.	1675.	884.	13.68	1.93	92060.	762.	35784.	11384.
5.9	26.7	13326.	5916.	8123.	1752.	900.	14.63	2.00	99029.	732.	36625.	12244.
6.0	26.2	13387.	5974.	8200.	1829.	905.	15.20	2.03	105997.	678.	36971.	12873.
6.1	26.7	12603.	6032.	8239.	1925.	870.	15.39	2.05	115615.	577.	36110.	12971.
6.2	27.2	10613.	5974.	8200.	1963.	790.	14.63	2.00	122584.	408.	33476.	12319.
6.3	26.7	7175.	5800.	8200.	1963.	682.	13.68	1.93	127393.	235.	30586.	11412.
6.4	26.2	3674.	5597.	8046.	1983.	571.	12.35	1.84	129552.	77.	27417.	10230.
6.5	26.7	2412.	5394.	7969.	1953.	502.	11.59	1.79	130142.	-77.	24037.	8916.
6.6	26.7	3015.	5162.	7892.	1925.	461.	10.64	1.72	128473.	-193.	21191.	7767.
6.7	26.2	4281.	5104.	7815.	1906.	445.	10.07	1.69	125823.	-235.	19688.	7101.
6.8	26.2	4945.	4988.	7738.	1848.	447.	9.50	1.65	122094.	-262.	18558.	6584.
6.9	25.6	4824.	4930.	7661.	1823.	447.	9.12	1.62	118365.	-246.	18266.	6400.
7.0	26.7	4764.	4901.	7661.	1809.	489.	8.93	1.61	115125.	-208.	18457.	6386.
7.1	25.6	5246.	4901.	7661.	1809.	511.	8.74	1.59	112476.	-154.	19018.	6525.
7.2	25.6	5909.	4901.	7661.	1790.	541.	8.74	1.59	108747.	-116.	19292.	6576.
7.3	26.2	6271.	4930.	7661.	1771.	551.	8.74	1.59	105507.	-65.	19828.	6744.
7.4	26.2	6512.	4959.	7661.	1771.	601.	8.93	1.61	103348.	-31.	20252.	6873.
7.5	25.6	6633.	5017.	7700.	1790.	615.	9.12	1.62	102268.	8.	20825.	7068.
7.6	26.2	6814.	5046.	7700.	1790.	636.	9.50	1.65	101188.	23.	21003.	7144.
7.7	26.2	6995.	5017.	7738.	1790.	645.	9.69	1.66	101188.	38.	21287.	7272.
7.8	26.2	6934.	5104.	7777.	1790.	647.	10.07	1.69	101188.	54.	21634.	7406.
7.9	26.2	6874.	5133.	7777.	1809.	649.	10.26	1.70	101678.	65.	22048.	7564.
8.0	26.2	6754.	5162.	7815.	1809.	649.	10.26	1.70	102168.	77.	22310.	7687.
8.1	26.2	6633.	5191.	7815.	1809.	645.	10.45	1.71	102758.	85.	22636.	7849.
8.2	26.2	6512.	5162.	7815.	1829.	636.	10.26	1.70	103348.	92.	22922.	7998.
8.3	26.2	6392.	5162.	7815.	1848.	624.	10.45	1.71	104918.	85.	22857.	8009.
8.4	26.2	6211.	5191.	7815.	1857.	613.	10.26	1.70	104428.	69.	22596.	7951.
8.5	26.2	6090.	5191.	7777.	1848.	603.	10.26	1.70	104918.	46.	22137.	7806.
8.6	26.2	5970.	5162.	7815.	1848.	599.	10.07	1.69	105017.	38.	21942.	7753.
8.7	26.7	5909.	5133.	7815.	1848.	594.	9.88	1.67	105017.	25.	21703.	7668.
8.8	26.2	5849.	5133.	7738.	1867.	590.	9.88	1.67	104428.	31.	21688.	7679.
8.9	26.7	5729.	5104.	7738.	1867.	593.	9.69	1.66	103938.	25.	21611.	7664.
9.0	26.2	5664.	5104.	7738.	1867.	583.	9.69	1.66	103448.	39.	21776.	7742.

TEST TS-4, THROTTLE STEP INCREASE (CLOSED LOOP), IDLE TC 10,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SQIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	-1.0	1568.	2291.	5313.	597.	429.	0.95	1.06	13347.	C.	2605.	296.
0.1	-1.0	1568.	2291.	5313.	597.	426.	1.14	1.08	12757.	-29.	1912.	215.
0.2	-1.0	1568.	2320.	5313.	597.	426.	1.14	1.08	12757.	-23.	2023.	227.
0.3	-1.0	1507.	2320.	5313.	577.	431.	1.14	1.08	12267.	-31.	1780.	198.
0.4	-1.0	1507.	2291.	5313.	577.	431.	0.95	1.06	12267.	-21.	1956.	218.
0.5	-0.5	1568.	2291.	5313.	577.	429.	0.95	1.06	11678.	-15.	2068.	229.
0.6	1.5	1568.	2291.	5313.	597.	431.	1.14	1.08	11678.	0.	2419.	268.
0.7	1.5	1628.	2291.	5313.	577.	431.	0.95	1.06	12267.	0.	2395.	265.
0.8	3.6	1628.	2291.	5351.	577.	431.	0.95	1.06	12267.	8.	2595.	289.
0.9	33.3	1688.	2291.	5313.	577.	431.	1.14	1.08	11678.	15.	2794.	311.
1.0	35.9	1809.	2320.	5313.	597.	456.	1.14	1.08	12267.	23.	2950.	329.
1.1	35.5	1990.	2349.	5390.	597.	505.	1.14	1.08	12267.	23.	2930.	329.
1.2	35.9	2231.	2378.	5390.	577.	539.	1.33	1.09	11777.	31.	3110.	351.
1.3	35.9	2291.	2407.	5467.	597.	569.	1.33	1.09	11777.	46.	3484.	396.
1.4	35.5	2291.	2436.	5467.	597.	583.	1.33	1.09	11777.	46.	3504.	401.
1.5	35.9	2291.	2465.	5505.	616.	599.	1.33	1.09	12857.	46.	3543.	410.
1.6	35.9	2291.	2494.	5544.	616.	606.	1.52	1.10	12757.	38.	3431.	400.
1.7	36.4	2352.	2523.	5544.	616.	613.	1.52	1.10	12757.	31.	3319.	389.
1.8	36.9	2352.	2552.	5621.	616.	615.	1.52	1.10	13347.	23.	3163.	371.
1.9	36.4	2412.	2610.	5659.	616.	617.	1.52	1.10	13347.	23.	3187.	374.
2.0	36.4	2412.	2610.	5659.	616.	620.	1.52	1.10	13347.	31.	3405.	402.
2.1	36.4	2472.	2639.	5736.	616.	622.	1.71	1.12	13347.	46.	3776.	448.
2.2	36.5	2472.	2697.	5775.	635.	624.	1.71	1.12	13837.	62.	4171.	501.
2.3	36.4	2533.	2726.	5813.	635.	624.	1.71	1.12	13837.	62.	4214.	513.
2.4	36.4	2533.	2755.	5852.	655.	624.	1.71	1.12	14427.	65.	4453.	548.
2.5	36.4	2653.	2813.	5890.	655.	626.	1.71	1.12	14427.	62.	4344.	538.
2.6	36.4	2774.	2842.	5967.	655.	626.	2.09	1.14	14917.	62.	4411.	553.
2.7	36.4	2834.	2871.	5967.	655.	629.	1.90	1.13	15507.	65.	4611.	581.
2.8	36.9	2955.	2900.	6044.	674.	631.	1.90	1.13	15507.	92.	5181.	661.
2.9	36.4	3075.	3016.	6121.	674.	638.	2.09	1.14	15017.	108.	5595.	726.
3.0	36.4	3136.	3016.	6121.	693.	643.	2.09	1.14	15507.	131.	6193.	822.
3.1	35.5	3256.	3045.	6198.	712.	652.	2.28	1.16	16586.	146.	6607.	896.
3.2	35.9	3316.	3103.	6237.	732.	663.	2.09	1.14	17176.	154.	6908.	957.
3.3	35.9	3437.	3161.	6275.	751.	654.	2.28	1.16	17076.	146.	6879.	973.
3.4	35.9	3618.	3219.	6352.	751.	647.	2.28	1.16	18156.	135.	6830.	986.
3.5	35.9	3799.	3277.	6391.	770.	636.	2.66	1.18	19136.	139.	6976.	1023.
3.6	35.5	3980.	3335.	6429.	789.	631.	2.66	1.18	19726.	131.	6950.	1034.
3.7	35.5	4040.	3422.	6468.	789.	626.	2.85	1.19	20806.	123.	6905.	1048.
3.8	35.4	4161.	3480.	6506.	809.	620.	2.85	1.19	20806.	135.	7390.	1138.
3.9	35.9	4281.	3538.	6545.	828.	615.	3.04	1.21	21395.	146.	7720.	1205.
4.0	35.4	4342.	3596.	6622.	828.	606.	3.04	1.21	22475.	139.	7658.	1230.
4.1	35.5	4462.	3625.	6660.	847.	601.	3.04	1.21	23555.	154.	8270.	1346.
4.2	36.4	4342.	3683.	6737.	886.	592.	3.42	1.23	24635.	165.	8834.	1457.
4.3	34.9	4643.	3741.	6776.	886.	587.	3.61	1.25	26304.	162.	8872.	1496.
4.4	35.9	4824.	3770.	6814.	886.	580.	3.61	1.25	26694.	169.	9260.	1595.
4.5	35.9	4945.	3799.	6776.	924.	569.	3.61	1.25	27774.	193.	9976.	1748.
4.6	35.5	5065.	3857.	6853.	943.	562.	3.80	1.26	28854.	193.	10142.	1814.
4.7	35.4	5246.	3915.	6891.	963.	555.	3.80	1.26	29344.	193.	10335.	1894.
4.8	35.9	5427.	3973.	6891.	982.	548.	3.99	1.27	30424.	208.	10900.	2037.
4.9	35.4	5548.	4031.	6930.	1001.	544.	3.99	1.27	31503.	216.	11288.	2151.
5.0	35.9	5728.	4089.	6968.	1020.	544.	4.18	1.28	33073.	231.	11900.	2320.

TEST TS-4 (CONTINUED)

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
5.1	35.4	5909.	4147.	7007.	1039.	548.	4.56	1.31	34153.	254.	12706.	2534.
5.2	35.9	6090.	4205.	7045.	1078.	564.	4.94	1.34	35822.	285.	13708.	2814.
5.3	35.9	6392.	4292.	7084.	1097.	613.	5.32	1.36	37392.	316.	14714.	3107.
5.4	35.9	6754.	4408.	7161.	1155.	663.	5.89	1.40	38962.	362.	16158.	3518.
5.5	35.4	7176.	4524.	7238.	1174.	702.	6.27	1.43	40631.	400.	17462.	3930.
5.6	35.4	7718.	4669.	7315.	1213.	728.	7.03	1.48	43871.	462.	19403.	4537.
5.7	35.4	8321.	4785.	7430.	1270.	753.	7.79	1.53	46420.	516.	21255.	5173.
5.8	35.4	8985.	4930.	7546.	1328.	781.	8.55	1.58	50739.	570.	23277.	5938.
5.9	35.4	9527.	5104.	7661.	1405.	799.	9.31	1.63	54469.	616.	25163.	6714.
6.0	35.4	10311.	5278.	7777.	1482.	813.	10.26	1.70	60357.	655.	26964.	7531.
6.1	34.9	10975.	5394.	7815.	1521.	829.	11.02	1.75	64577.	678.	28607.	8367.
6.2	35.4	11578.	5510.	7931.	1598.	845.	11.78	1.80	69386.	724.	30951.	9461.
6.3	35.4	12241.	5684.	8008.	1675.	875.	12.73	1.87	78514.	755.	32987.	10543.
6.4	35.4	12844.	5829.	8085.	1752.	896.	14.06	1.96	86562.	778.	34982.	11745.
6.5	35.9	13326.	5916.	8162.	1848.	905.	14.82	2.01	93530.	793.	36908.	12959.
6.6	35.4	13688.	6003.	8239.	1944.	905.	15.39	2.05	101089.	793.	38439.	14089.
6.7	35.4	13809.	6061.	8277.	2002.	902.	15.96	2.09	108547.	739.	38675.	14742.
6.8	35.4	13743.	6177.	8277.	2079.	896.	16.53	2.12	116595.	678.	38755.	15313.
6.9	35.4	13869.	6206.	8354.	2137.	898.	17.10	2.16	122974.	593.	38201.	15514.
7.0	35.4	13326.	6235.	8354.	2214.	886.	17.10	2.16	130433.	477.	36820.	15304.
7.1	35.9	12000.	6206.	8354.	2233.	831.	16.34	2.11	135341.	331.	34480.	14584.
7.2	35.9	9045.	6032.	8316.	2252.	725.	15.20	2.03	139660.	193.	32039.	13669.
7.3	35.9	5306.	5771.	8162.	2271.	626.	14.44	1.98	141330.	46.	29056.	12396.
7.4	35.4	3618.	5597.	8085.	2233.	546.	13.30	1.90	140840.	-92.	25920.	11001.
7.5	35.4	3859.	5423.	8008.	2214.	511.	12.35	1.84	139170.	-177.	23705.	9959.
7.6	34.9	4945.	5162.	7931.	2175.	493.	11.59	1.79	135931.	-223.	22159.	9178.
7.7	34.9	5608.	5104.	7777.	2137.	495.	11.02	1.75	132692.	-231.	21336.	8743.
7.8	34.9	5970.	5104.	7777.	2117.	518.	10.83	1.74	128963.	-200.	21328.	8646.
7.9	34.4	6271.	5075.	7815.	2117.	557.	10.64	1.72	124743.	-146.	21893.	8811.
8.0	34.4	7176.	5075.	7815.	2098.	603.	10.64	1.72	121504.	-100.	22346.	8960.
8.1	34.4	7839.	5133.	7815.	2098.	643.	10.83	1.74	119444.	-38.	23233.	9299.
8.2	34.4	8261.	5278.	7892.	2098.	675.	11.02	1.75	117775.	15.	24095.	9644.
8.3	34.4	8442.	5336.	7931.	2098.	693.	11.40	1.78	116105.	62.	24931.	10015.
8.4	34.4	8442.	5334.	7963.	2117.	705.	11.59	1.79	115615.	85.	25411.	10264.
8.5	34.4	8321.	5423.	8008.	2137.	717.	12.16	1.83	116105.	108.	25763.	10482.
8.6	34.9	8140.	5452.	8008.	2156.	707.	12.16	1.83	116105.	116.	25929.	10596.
8.7	34.4	7658.	5452.	8008.	2175.	693.	12.16	1.83	115615.	116.	25945.	10651.

TEST TS-5, THROTTLE STEP INCREASE (OPEN LOOP), IDLE TO 10,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	7.2	1387.	2175.	5159.	539.	447.	0.95	1.06	12367.	C.	2447.	251.
0.1	7.2	1447.	2204.	5159.	539.	445.	0.95	1.06	11777.	29.	3115.	320.
0.2	12.3	1507.	2204.	5159.	539.	449.	0.95	1.06	12367.	38.	3360.	347.
0.3	27.7	1688.	2204.	5159.	539.	447.	0.95	1.06	12367.	54.	3735.	392.
0.4	63.6	1869.	2204.	5159.	558.	484.	0.76	1.05	12857.	69.	4153.	441.
0.5	64.6	2110.	2262.	5274.	577.	523.	1.14	1.08	12957.	62.	4021.	433.
0.6	63.6	2110.	2262.	5274.	577.	555.	0.95	1.06	13447.	46.	3670.	401.
0.7	64.1	2110.	2262.	5274.	577.	576.	1.14	1.08	13447.	38.	3475.	380.
0.8	64.1	2050.	2291.	5274.	577.	585.	1.14	1.08	12367.	23.	3143.	343.
0.9	64.6	2110.	2349.	5313.	558.	597.	1.14	1.08	12367.	e.	2792.	307.
1.0	63.6	2171.	2378.	5351.	577.	603.	1.14	1.08	13447.	23.	3124.	343.
1.1	64.1	2291.	2407.	5428.	597.	610.	1.14	1.08	13447.	31.	3323.	365.
1.2	64.6	2291.	2436.	5428.	577.	615.	1.33	1.09	12957.	31.	3366.	375.
1.3	64.1	2291.	2436.	5467.	577.	620.	1.14	1.08	12957.	46.	3741.	420.
1.4	64.1	2291.	2494.	5505.	597.	620.	1.52	1.10	13447.	54.	3917.	442.
1.5	64.1	2352.	2465.	5544.	597.	620.	1.52	1.10	14037.	46.	3785.	433.
1.6	64.1	2352.	2523.	5621.	616.	622.	1.33	1.09	13447.	54.	4043.	465.
1.7	64.6	2412.	2581.	5621.	616.	624.	1.52	1.10	14037.	46.	3911.	453.
1.8	64.1	2412.	2610.	5659.	597.	624.	1.52	1.10	15017.	38.	3712.	435.
1.9	64.1	2472.	2610.	5698.	616.	624.	1.52	1.10	14527.	46.	3954.	464.
2.0	64.6	2593.	2668.	5736.	635.	624.	1.52	1.10	13447.	38.	3818.	451.
2.1	63.6	2593.	2668.	5813.	616.	622.	1.52	1.10	15116.	23.	3447.	412.
2.2	63.6	2653.	2726.	5813.	635.	626.	1.71	1.12	15017.	46.	4013.	480.
2.3	63.6	2774.	2813.	5852.	635.	631.	1.90	1.13	14527.	62.	4475.	535.
2.4	63.6	2834.	2842.	5852.	616.	633.	1.71	1.12	15507.	69.	4737.	576.
2.5	63.6	2955.	2900.	5929.	635.	633.	1.71	1.12	16196.	108.	5769.	715.
2.6	64.1	3136.	3016.	5929.	674.	643.	2.09	1.14	17276.	131.	6469.	816.
2.7	63.6	3196.	3074.	6006.	693.	647.	2.28	1.16	18846.	139.	6779.	880.
2.8	64.6	3316.	3132.	6121.	693.	656.	2.47	1.17	18846.	146.	7124.	940.
2.9	64.6	3437.	3161.	6121.	712.	659.	2.66	1.18	18846.	146.	7231.	975.
3.0	65.2	3497.	3219.	6198.	693.	654.	2.66	1.18	20415.	139.	7205.	993.
3.1	64.6	3497.	3248.	6237.	751.	649.	2.66	1.18	19925.	154.	7686.	1076.
3.2	64.6	3618.	3335.	6352.	770.	636.	2.66	1.18	22575.	139.	7505.	1073.
3.3	64.6	3799.	3393.	6429.	751.	626.	2.85	1.19	22085.	131.	7483.	1097.
3.4	64.6	3980.	3451.	6468.	789.	622.	3.04	1.21	23065.	146.	8028.	1189.
3.5	64.6	4040.	3480.	6506.	789.	620.	3.23	1.22	24244.	146.	8154.	1225.
3.6	63.6	4161.	3509.	6583.	789.	610.	3.42	1.23	24734.	131.	7953.	1224.
3.7	64.1	4402.	3538.	6660.	828.	608.	3.42	1.23	25714.	139.	8239.	1293.
3.8	63.6	4402.	3567.	6699.	847.	601.	3.61	1.25	25814.	146.	8608.	1369.
3.9	63.6	4522.	3596.	6660.	866.	597.	3.80	1.26	25814.	139.	8602.	1387.
4.0	64.6	4583.	3625.	6699.	847.	592.	3.61	1.25	29053.	146.	8908.	1463.
4.1	64.6	4764.	3654.	6737.	847.	587.	3.99	1.27	28954.	162.	9409.	1573.
4.2	63.6	4945.	3770.	6814.	905.	585.	3.80	1.26	28954.	193.	10320.	1763.
4.3	64.6	5065.	3828.	6853.	924.	578.	3.80	1.26	29543.	193.	10446.	1823.
4.4	63.6	5186.	3886.	6853.	963.	569.	3.80	1.26	31013.	193.	10663.	1915.
4.5	64.1	5367.	3915.	6853.	943.	562.	3.99	1.27	32193.	177.	10549.	1926.
4.6	63.6	5487.	3973.	6891.	982.	551.	3.99	1.27	34352.	177.	10806.	2004.
4.7	63.6	5668.	4031.	6930.	982.	546.	4.18	1.28	34842.	146.	10301.	1933.
4.8	63.6	5789.	4060.	6930.	1001.	548.	4.18	1.28	35922.	154.	10690.	2045.
4.9	63.1	5970.	4089.	6968.	1020.	564.	4.56	1.31	35922.	162.	11035.	2136.
5.0	63.1	6151.	4176.	7045.	1039.	574.	4.94	1.34	37492.	193.	12037.	2374.

TEST TS-5 (CONTINUED)

T (SEC)	L (°)	WF (LB/HP)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DFGF)	PT7 (LB/SQIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
5.1	63.1	6392.	4205.	7045.	1039.	608.	5.32	1.36	38572.	223.	13015.	2615.
5.2	63.1	6754.	4263.	7084.	1078.	647.	5.51	1.37	42301.	293.	15049.	3100.
5.3	63.6	6995.	4350.	7161.	1097.	686.	5.89	1.40	42891.	354.	16934.	3600.
5.4	63.1	7477.	4495.	7238.	1155.	728.	6.65	1.45	47110.	424.	19181.	4246.
5.5	63.1	8321.	4727.	7392.	1213.	762.	7.22	1.49	49469.	485.	21319.	4923.
5.6	63.6	8804.	4814.	7430.	1270.	781.	8.17	1.56	55158.	531.	23359.	5634.
5.7	63.1	9346.	4959.	7507.	1328.	794.	8.74	1.59	60557.	535.	24588.	6200.
5.8	64.1	9708.	5162.	7623.	1367.	799.	9.50	1.65	67426.	535.	25764.	6780.
5.9	63.6	9648.	5249.	7623.	1444.	799.	9.88	1.67	73314.	524.	26597.	7253.
6.0	63.6	9346.	5278.	7700.	1501.	764.	10.64	1.72	78713.	485.	26900.	7592.
6.1	63.6	9045.	5336.	7777.	1521.	748.	11.02	1.75	84602.	447.	27273.	7937.
6.2	63.6	8924.	5394.	7777.	1578.	730.	11.40	1.78	89901.	416.	27823.	8301.
6.3	63.6	8743.	5394.	7777.	1598.	707.	11.40	1.78	98539.	362.	27912.	8532.
6.4	63.6	8623.	5394.	7777.	1636.	693.	11.78	1.80	104428.	323.	28286.	8833.
6.5	63.6	8442.	5394.	7777.	1694.	686.	11.97	1.81	111496.	285.	28577.	9050.
6.6	63.1	8382.	5423.	7777.	1694.	679.	11.97	1.81	115715.	231.	28343.	9121.
6.7	63.1	8261.	5423.	7815.	1674.	675.	11.97	1.81	118954.	185.	28134.	9157.
6.8	63.1	8201.	5394.	7777.	1732.	666.	12.16	1.83	123273.	177.	28606.	9374.
6.9	63.1	8140.	5394.	7777.	1732.	661.	12.16	1.83	125433.	135.	28293.	9333.
7.0	63.6	8080.	5365.	7777.	1752.	656.	12.16	1.83	127592.	123.	28443.	9487.
7.1	63.1	7960.	5394.	7777.	1752.	659.	12.35	1.84	129752.	108.	28444.	9529.
7.2	63.1	7899.	5394.	7777.	1790.	656.	12.35	1.84	131421.	100.	28596.	9643.
7.3	63.6	7960.	5394.	7777.	1771.	659.	12.16	1.83	132011.	65.	28158.	9516.
7.4	63.6	7960.	5394.	7815.	1790.	659.	11.97	1.81	133581.	85.	28730.	9751.
7.5	63.1	7839.	5394.	7815.	1771.	656.	11.97	1.81	134171.	67.	28490.	9690.
7.6	63.6	7779.	5394.	7777.	1790.	659.	12.16	1.83	135250.	82.	28976.	9941.
7.7	63.6	7839.	5365.	7777.	1809.	656.	12.16	1.83	135250.	83.	29066.	9988.
7.8	63.1	7839.	5365.	7777.	1848.	656.	11.97	1.81	135740.	98.	29470.	10190.

TEST TS-6, THROTTLE STEP INCREASE (CLOSED LOOP), IDLE TC 14,000 H.P.

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3COT	QE	PENG
(SEC)	(°)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
0.0	2.1	1507.	2320.	5274.	635.	436.	0.95	1.06	11777.	C.	2329.	282.
0.1	3.1	1507.	2320.	5313.	635.	440.	0.95	1.06	11777.	-10.	2144.	257.
0.2	2.6	1568.	2320.	5313.	635.	438.	0.95	1.06	11188.	-8.	2189.	263.
0.3	5.1	1447.	2320.	5274.	616.	438.	0.95	1.06	12267.	-8.	2208.	265.
0.4	22.6	1628.	2291.	5313.	635.	438.	0.95	1.06	11777.	10.	2603.	313.
0.5	34.4	1688.	2291.	5313.	635.	459.	0.95	1.06	12267.	15.	2778.	334.
0.6	50.3	2231.	2320.	5351.	635.	507.	1.14	1.08	11777.	15.	2778.	336.
0.7	54.9	2412.	2349.	5351.	635.	534.	1.33	1.09	12267.	23.	2973.	362.
0.8	54.4	2231.	2436.	5390.	635.	557.	1.33	1.09	12267.	31.	3149.	383.
0.9	54.9	2050.	2436.	5390.	655.	576.	1.33	1.09	12267.	38.	3364.	412.
1.0	54.9	2110.	2494.	5467.	635.	592.	1.52	1.10	12267.	46.	3535.	436.
1.1	54.4	2110.	2523.	5467.	655.	599.	1.52	1.10	12757.	62.	3890.	485.
1.2	54.4	2291.	2552.	5505.	655.	608.	1.52	1.10	12267.	62.	3871.	488.
1.3	54.4	2352.	2581.	5544.	674.	610.	1.52	1.10	12267.	62.	3871.	494.
1.4	53.9	2472.	2610.	5582.	693.	617.	1.52	1.10	11777.	54.	3675.	472.
1.5	53.9	2533.	2639.	5621.	674.	620.	1.52	1.10	12267.	46.	3500.	452.
1.6	53.9	2593.	2639.	5698.	674.	620.	1.52	1.10	12267.	38.	3324.	431.
1.7	53.9	2593.	2697.	5736.	674.	622.	1.52	1.10	12267.	38.	3368.	439.
1.8	53.4	2653.	2755.	5813.	693.	626.	1.52	1.10	12267.	46.	3543.	465.
1.9	52.8	2653.	2784.	5852.	712.	624.	1.71	1.12	12857.	46.	3567.	471.
2.0	53.4	2653.	2813.	5890.	693.	624.	1.71	1.12	12267.	54.	3766.	502.
2.1	52.8	2774.	2813.	5929.	693.	620.	1.90	1.13	12857.	85.	4512.	605.
2.2	53.4	2894.	2871.	6006.	712.	622.	1.90	1.13	12857.	108.	5101.	692.
2.3	52.8	2955.	2929.	6044.	712.	626.	1.90	1.13	13347.	123.	5535.	771.
2.4	53.4	3015.	2987.	6083.	751.	629.	2.09	1.14	14427.	154.	6340.	902.
2.5	53.9	3136.	3045.	6160.	789.	633.	1.90	1.13	14327.	162.	6618.	961.
2.6	53.9	3196.	3045.	6198.	770.	640.	2.09	1.14	15407.	139.	6174.	919.
2.7	53.4	3316.	3103.	6237.	789.	645.	2.28	1.16	15407.	139.	6257.	945.
2.8	52.8	3437.	3161.	6275.	809.	654.	2.28	1.16	15407.	139.	6344.	967.
2.9	52.3	3678.	3219.	6275.	809.	654.	2.47	1.17	16487.	123.	6060.	942.
3.0	51.8	3678.	3306.	6314.	828.	643.	2.28	1.16	16487.	123.	6151.	974.
3.1	52.8	3739.	3335.	6352.	847.	633.	2.47	1.17	17076.	131.	6441.	1034.
3.2	52.8	4040.	3393.	6429.	866.	624.	2.47	1.17	17666.	123.	6333.	1031.
3.3	52.3	4100.	3393.	6429.	866.	615.	2.47	1.17	18256.	116.	6268.	1034.
3.4	52.3	4161.	3451.	6429.	866.	610.	2.47	1.17	18156.	123.	6573.	1099.
3.5	52.3	4221.	3480.	6506.	886.	610.	2.66	1.18	19236.	131.	6879.	1165.
3.6	52.3	4342.	3567.	6583.	905.	610.	2.85	1.19	20316.	139.	7205.	1241.
3.7	52.3	4402.	3625.	6622.	924.	601.	3.04	1.21	20905.	139.	7374.	1292.
3.8	52.8	4462.	3654.	6660.	943.	594.	3.04	1.21	21985.	146.	7720.	1375.
3.9	52.3	4703.	3683.	6699.	943.	587.	3.23	1.22	22375.	146.	7913.	1427.
4.0	51.8	4824.	3741.	6699.	963.	580.	3.42	1.23	23455.	154.	8278.	1517.
4.1	51.8	4945.	3828.	6737.	963.	576.	3.61	1.25	25125.	162.	8643.	1609.
4.2	52.3	5125.	3857.	6776.	1091.	569.	3.61	1.25	25615.	193.	9562.	1815.
4.3	51.8	5246.	3915.	6814.	1020.	562.	3.61	1.25	26694.	208.	10110.	1957.
4.4	52.3	5367.	3944.	6853.	1039.	555.	3.61	1.25	27774.	231.	10826.	2151.
4.5	53.9	5427.	3973.	6930.	1059.	551.	4.18	1.28	28364.	254.	11590.	2353.
4.6	54.4	5603.	4031.	6968.	1097.	544.	4.18	1.28	29834.	285.	12509.	2604.
4.7	54.9	5664.	4089.	7007.	1116.	544.	4.37	1.30	31503.	285.	12750.	2729.
4.8	54.4	5849.	4147.	7045.	1155.	544.	4.37	1.30	32093.	300.	13385.	2953.
4.9	53.9	6151.	4234.	7122.	1193.	587.	4.75	1.32	33763.	316.	14024.	3166.
5.0	53.9	6573.	4350.	7161.	1232.	649.	5.13	1.35	35432.	331.	14679.	3400.

TEST TS-6 (CONTINUED)

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3DOT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SQ IN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
5.1	53.4	6934.	4437.	7238.	1232.	693.	5.70	1.39	37002.	362.	15752.	3762.
5.2	52.8	7537.	4582.	7315.	1270.	714.	6.46	1.44	39062.	431.	17845.	4382.
5.3	51.8	8140.	4727.	7392.	1328.	741.	7.41	1.50	42301.	493.	19805.	5052.
5.4	51.3	8683.	4872.	7430.	1386.	760.	8.36	1.57	45540.	562.	22005.	5872.
5.5	50.8	9226.	4988.	7546.	1482.	778.	9.12	1.62	49269.	631.	24295.	6768.
5.6	50.3	10010.	5075.	7661.	1540.	787.	9.69	1.66	52409.	662.	25810.	7530.
5.7	50.3	10432.	5220.	7738.	1578.	804.	10.45	1.71	56728.	678.	27037.	8265.
5.8	49.8	10975.	5394.	7815.	1675.	820.	11.21	1.76	62517.	708.	28682.	9125.
5.9	49.8	11758.	5539.	7892.	1752.	838.	12.16	1.83	67326.	732.	30330.	10049.
6.0	50.8	12301.	5626.	7969.	1809.	859.	13.11	1.89	72725.	747.	31904.	11039.
6.1	50.8	12784.	5771.	8046.	1886.	877.	14.06	1.96	80283.	785.	34120.	12331.
6.2	49.8	13266.	5916.	8123.	1963.	889.	14.82	2.01	87152.	801.	35895.	13525.
6.3	49.8	13507.	6032.	8162.	2079.	889.	15.39	2.05	95790.	801.	37368.	14682.
6.4	50.3	13688.	6061.	8200.	2156.	891.	15.96	2.09	102758.	762.	37943.	15465.
6.5	50.3	13689.	6090.	8239.	2233.	891.	16.53	2.12	109336.	716.	38275.	16163.
6.6	49.6	13748.	6119.	8315.	2271.	893.	17.10	2.16	116405.	647.	38026.	16502.
6.7	49.8	13748.	6177.	8354.	2348.	896.	17.67	2.20	121704.	608.	38412.	17092.
6.8	49.2	13688.	6206.	8393.	2387.	893.	17.86	2.21	128772.	562.	38531.	17512.
6.9	49.8	13748.	6264.	8354.	2445.	893.	18.24	2.24	134171.	554.	39433.	18356.
7.0	49.2	13809.	6293.	8354.	2483.	898.	18.43	2.25	138490.	539.	40057.	19057.
7.1	49.2	13869.	6322.	8393.	2560.	898.	18.43	2.25	143199.	531.	40678.	19800.
7.2	48.7	13929.	6409.	8393.	2618.	900.	18.62	2.27	145948.	501.	40620.	20159.
7.3	48.7	13929.	6409.	8393.	2676.	900.	18.81	2.28	148598.	454.	40103.	20255.
7.4	48.7	13990.	6409.	8431.	2695.	898.	19.19	2.31	150167.	393.	39177.	20103.
7.5	49.2	13990.	6409.	8431.	2714.	907.	19.38	2.32	151837.	323.	38031.	19738.
7.6	48.7	13748.	6409.	8470.	2772.	909.	19.38	2.32	155076.	246.	36667.	19218.
7.7	48.7	13085.	6322.	8431.	2772.	875.	19.00	2.29	156746.	154.	34826.	18355.
7.8	48.7	10975.	6206.	8393.	2810.	808.	18.43	2.25	158315.	85.	33424.	17665.
7.9	48.7	8140.	6061.	8354.	2772.	732.	17.10	2.16	156746.	0.	31414.	16580.
8.0	48.7	6814.	5916.	8277.	2753.	695.	16.53	2.12	156256.	-46.	30085.	15859.
8.1	48.7	7598.	5771.	8200.	2753.	677.	15.77	2.07	153116.	-62.	29252.	15332.
8.2	48.7	8502.	5713.	8123.	2753.	675.	15.20	2.03	149977.	-62.	28676.	14988.
8.3	48.7	8804.	5626.	8085.	2733.	686.	14.82	2.01	146247.	-62.	28033.	14652.
8.4	49.8	8743.	5626.	8123.	2733.	707.	14.82	2.01	142418.	-31.	28155.	14695.
8.5	49.2	8924.	5655.	8085.	2753.	735.	14.82	2.01	140259.	-15.	27985.	14588.
8.6	48.7	9457.	5655.	8085.	2733.	758.	14.63	2.00	138689.	-23.	27360.	14260.
8.7	48.7	9883.	5684.	8085.	2733.	764.	14.82	2.01	137119.	-15.	27192.	14172.
8.8	48.7	9829.	5742.	8085.	2733.	771.	14.82	2.01	134960.	-8.	27091.	14100.
8.9	48.7	9643.	5742.	8046.	2733.	774.	15.01	2.02	133880.	-8.	26834.	13966.
9.0	48.7	9467.	5713.	8046.	2733.	776.	14.82	2.01	133390.	0.	26797.	13947.
9.1	48.7	9226.	5713.	8085.	2733.	776.	15.01	2.02	132310.	15.	26998.	14052.
9.2	48.7	8985.	5684.	8085.	2733.	764.	15.01	2.02	131820.	31.	27175.	14164.
9.3	48.7	8743.	5684.	8085.	2733.	758.	15.01	2.02	131231.	38.	27177.	14185.
9.4	49.7	8442.	5626.	8085.	2753.	748.	14.82	2.01	129561.	51.	27335.	14309.
9.5	48.7	8261.	5626.	8046.	2753.	741.	14.44	1.98	129071.	55.	27325.	14324.
9.6	48.7	8140.	5597.	8046.	2772.	737.	14.25	1.97	129071.	60.	27350.	14365.

TEST TS-7, THROTTLE STEP INCREASE (OPEN LOCP), IDLE TO 20,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	11.8	1628.	2175.	5120.	558.	447.	1.14	1.08	12367.	C.	2487.	264.
0.2	11.8	1568.	2175.	5120.	558.	447.	1.14	1.08	12367.	0.	2457.	261.
0.4	23.6	1628.	2175.	5120.	558.	445.	1.33	1.09	12367.	C.	2439.	259.
0.6	64.6	2171.	2233.	5159.	558.	514.	1.33	1.09	11777.	0.	2416.	257.
0.8	90.3	2171.	2262.	5236.	558.	562.	1.33	1.09	11777.	4.	2480.	264.
1.0	100.5	2171.	2320.	5274.	558.	590.	1.33	1.09	11777.	8.	2563.	272.
1.2	100.0	2231.	2378.	5351.	558.	603.	1.33	1.09	11777.	15.	28C2.	300.
1.4	100.0	2231.	2436.	5428.	558.	610.	1.33	1.09	12267.	27.	3128.	337.
1.6	100.5	2352.	2465.	5505.	577.	613.	1.33	1.09	13347.	42.	3566.	39C.
1.8	100.0	2472.	2523.	5582.	577.	617.	1.52	1.1C	13347.	5C.	3872.	431.
2.0	100.5	2593.	2610.	5698.	597.	617.	1.52	1.1C	13937.	65.	4334.	496.
2.2	100.C	2653.	2668.	5736.	616.	624.	1.71	1.12	15017.	77.	4707.	545.
2.4	100.0	2774.	2726.	5852.	635.	629.	1.71	1.12	15017.	89.	5125.	616.
2.6	100.0	2894.	2813.	5929.	635.	640.	1.90	1.13	16096.	96.	5474.	678.
2.8	100.0	3196.	2900.	6006.	674.	654.	2.09	1.14	17176.	119.	6174.	792.
3.0	100.5	3497.	3016.	6083.	693.	661.	2.28	1.16	18256.	127.	6586.	874.
3.2	100.5	3739.	3161.	6198.	732.	659.	2.66	1.18	19336.	135.	713C.	993.
3.4	100.0	3919.	3335.	6352.	751.	647.	2.85	1.19	20905.	142.	7541.	1089.
3.6	100.0	4161.	3480.	6468.	809.	633.	3.04	1.21	23065.	154.	8148.	1224.
3.8	100.C	4462.	3596.	6545.	809.	620.	3.23	1.22	25224.	142.	8252.	1282.
4.0	100.0	4703.	3683.	6622.	847.	601.	3.42	1.23	26794.	135.	8594.	1392.
4.2	100.0	4884.	3770.	6699.	866.	587.	3.61	1.25	28464.	127.	8781.	1461.
4.4	100.0	5125.	3828.	6776.	924.	567.	3.99	1.27	31603.	115.	9011.	1539.
4.6	100.0	5487.	3915.	6814.	924.	551.	4.18	1.28	34253.	131.	9899.	1727.
4.8	100.5	5728.	4031.	6853.	924.	548.	4.56	1.31	37492.	185.	11770.	2088.
5.0	100.0	6151.	4118.	7007.	943.	578.	5.13	1.35	40141.	262.	14343.	2681.
5.2	100.0	6995.	4379.	7122.	943.	689.	6.27	1.43	44460.	366.	1777C.	3582.
5.4	100.0	8140.	4698.	7353.	1174.	748.	7.41	1.50	51919.	504.	22311.	4923.
5.6	100.C	9407.	5017.	7430.	1309.	797.	8.93	1.61	60557.	593.	26247.	6407.
5.8	100.0	10673.	5278.	7661.	1424.	829.	10.83	1.74	71844.	651.	30022.	8209.
6.0	100.0	12060.	5539.	7854.	1559.	875.	12.73	1.87	87841.	676.	33613.	10078.
6.2	100.C	13145.	5800.	8C08.	1713.	907.	14.25	1.97	105607.	67C.	36756.	11963.
6.4	100.0	13507.	6032.	8123.	1867.	9C9.	15.77	2.07	125923.	612.	38933.	13614.
6.6	100.0	13628.	6148.	8239.	1983.	907.	16.91	2.15	143099.	551.	40785.	15160.
6.8	100.0	13748.	6235.	8316.	2060.	896.	17.67	2.20	158706.	477.	42102.	16419.
7.0	100.0	13869.	6264.	8316.	2137.	902.	18.05	2.23	168913.	40E.	42902.	17360.
7.2	100.5	13929.	6322.	8354.	2194.	914.	18.62	2.27	179711.	343.	43317.	18036.
7.4	100.0	13929.	6351.	8393.	2252.	914.	19.00	2.29	185110.	289.	43454.	18571.
7.6	100.5	13929.	6380.	8393.	2291.	912.	19.38	2.32	190508.	250.	43662.	19076.
7.8	100.0	13990.	6380.	8431.	2348.	916.	19.57	2.33	192668.	223.	43743.	19464.
8.0	100.5	13869.	6409.	8431.	2387.	928.	19.76	2.34	195907.	192.	43605.	19722.
8.2	100.5	13809.	6438.	8470.	2406.	923.	19.95	2.36	196987.	155.	43116.	19786.
8.4	100.5	13809.	6438.	8431.	2445.	932.	20.14	2.37	199146.	127.	42804.	19862.
8.6	100.5	13748.	6467.	8508.	2464.	937.	20.33	2.38	199636.	111.	4256C.	19850.
8.8	100.0	13688.	6438.	8470.	2483.	932.	20.33	2.38	200716.	90.	4222E.	19811.

TEST TS-8, THROTTLE STEP INCREASE (OPEN LOOP), 4,000 TO 11,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	45.1	4161.	4640.	7392.	1501.	541.	7.03	1.48	79693.	C.	16037.	4585.
0.1	45.1	4161.	4611.	7353.	1501.	544.	7.03	1.48	79793.	25.	16667.	4765.
0.2	49.8	4402.	4611.	7353.	1501.	541.	7.03	1.48	79793.	54.	17221.	4936.
0.3	61.6	4945.	4640.	7392.	1501.	555.	7.03	1.48	79203.	100.	18298.	5271.
0.4	67.7	6452.	4698.	7430.	1521.	615.	7.60	1.52	79203.	162.	19808.	5765.
0.5	67.7	8563.	4872.	7469.	1540.	716.	8.55	1.58	80283.	223.	21426.	6330.
0.6	68.2	9648.	5046.	7584.	1578.	774.	9.31	1.63	82442.	285.	23217.	6995.
0.7	68.2	9708.	5162.	7661.	1617.	790.	9.88	1.67	85092.	331.	24850.	7651.
0.8	68.2	9166.	5336.	7738.	1655.	794.	10.64	1.72	88821.	370.	26438.	8334.
0.9	68.2	8683.	5423.	7777.	1694.	778.	11.21	1.76	93630.	393.	27758.	8953.
1.0	68.2	8683.	5481.	7815.	1732.	760.	11.73	1.80	97949.	400.	28793.	9519.
1.1	68.2	8804.	5510.	7854.	1771.	744.	12.16	1.83	102169.	400.	29658.	10044.
1.2	68.2	8683.	5510.	7892.	1829.	732.	12.35	1.84	106487.	385.	30128.	10424.
1.3	68.7	8502.	5539.	7892.	1867.	721.	12.54	1.85	110316.	354.	30160.	10663.
1.4	68.2	8382.	5568.	7892.	1886.	712.	12.73	1.87	114046.	308.	29841.	10719.
1.5	68.7	8321.	5568.	7892.	1925.	705.	12.73	1.87	116695.	262.	29435.	10724.
1.6	68.2	8261.	5568.	7931.	1925.	698.	12.92	1.88	119934.	208.	28806.	10601.
1.7	68.7	9201.	5568.	7931.	1963.	693.	13.11	1.89	122584.	177.	28641.	10624.
1.8	68.2	9201.	5568.	7892.	1953.	691.	13.11	1.89	125233.	154.	28588.	10667.
1.9	68.7	8201.	5597.	7931.	1963.	689.	13.11	1.89	127393.	146.	28815.	10838.
2.0	68.2	8080.	5568.	7931.	1983.	686.	13.11	1.89	128473.	154.	29362.	11128.
2.1	68.2	9080.	5568.	7931.	2002.	684.	13.11	1.89	130042.	165.	29953.	11455.
2.2	68.7	8020.	5597.	7931.	2040.	684.	13.30	1.90	131712.	165.	30254.	11665.
2.3	68.2	9020.	5568.	7931.	2040.	684.	13.30	1.90	132202.	162.	30335.	11809.
2.4	68.7	8020.	5568.	7931.	2060.	684.	13.30	1.90	133871.	146.	30165.	11830.
2.5	68.2	8020.	5597.	7931.	2079.	682.	13.30	1.90	134951.	116.	29617.	11681.
2.6	68.7	7960.	5597.	7931.	2079.	679.	13.30	1.90	134461.	77.	28937.	11455.
2.7	68.7	7960.	5568.	7931.	2098.	682.	13.30	1.90	135541.	54.	28541.	11319.
2.8	68.7	7839.	5568.	7931.	2079.	684.	13.30	1.90	137111.	31.	28125.	11154.
2.9	68.2	7899.	5568.	7931.	2079.	684.	13.11	1.89	137111.	23.	28056.	11147.
3.0	68.2	7899.	5568.	7931.	2079.	682.	13.30	1.90	137700.	31.	28254.	11242.
3.1	68.2	7899.	5568.	7931.	2078.	684.	13.11	1.89	137111.	40.	28538.	11359.
3.2	68.2	7899.	5568.	7931.	2098.	684.	13.11	1.89	137111.	36.	28502.	11387.
3.3	68.2	7960.	5539.	7931.	2098.	686.	13.11	1.89	137700.	45.	28706.	11495.
3.4	68.2	7839.	5568.	7931.	2117.	684.	13.30	1.90	138780.	47.	28793.	11538.

TEST TS-9, THROTTLE STEP INCREASE (CLOSED LDCP), 6,000 TC 14,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPH	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	19.5	5005.	4901.	7623.	1694.	576.	8.74	1.59	97958.	C.	19650.	6338.
0.1	19.5	5005.	4901.	7661.	1694.	574.	8.36	1.57	97858.	C.	19632.	6332.
0.2	19.5	5005.	4901.	7623.	1694.	576.	8.55	1.58	97368.	C.	19621.	6329.
0.3	19.5	5005.	4872.	7661.	1694.	576.	8.55	1.58	97368.	C.	19617.	6327.
0.4	19.5	5005.	4843.	7623.	1694.	576.	8.36	1.57	97368.	E.	19749.	6370.
0.5	19.5	5065.	4872.	7661.	1694.	578.	8.55	1.58	97858.	3E.	20471.	6603.
0.6	28.2	5543.	4872.	7623.	1694.	590.	8.74	1.59	96778.	85.	21544.	6965.
0.7	32.3	5663.	4959.	7700.	1694.	645.	9.31	1.63	97858.	146.	23078.	7528.
0.8	32.3	9623.	5104.	7777.	1713.	732.	10.07	1.69	97858.	254.	25772.	8520.
0.9	32.3	10432.	5307.	7854.	1771.	810.	11.40	1.78	100607.	370.	28815.	9696.
1.0	31.8	11457.	5452.	7931.	1809.	870.	12.35	1.84	103747.	462.	31525.	10931.
1.1	31.8	12120.	5597.	7969.	1849.	912.	13.49	1.92	106986.	547.	34277.	12287.
1.2	31.8	12663.	5713.	8085.	1963.	944.	14.63	2.00	112875.	624.	37066.	13722.
1.3	32.3	12964.	5829.	8123.	2021.	946.	15.01	2.02	118274.	624.	38235.	14631.
1.4	31.8	13206.	6032.	8200.	2079.	946.	15.77	2.07	126322.	608.	39202.	15518.
1.5	32.3	13326.	6148.	8239.	2137.	944.	16.34	2.11	132800.	585.	3999E.	16244.
1.6	32.8	13387.	6206.	8316.	2194.	939.	17.10	2.16	139769.	547.	40525.	16875.
1.7	32.8	13447.	6264.	8316.	2233.	937.	17.48	2.19	145757.	4E5.	40428.	17218.
1.8	31.8	13447.	6293.	8393.	2291.	939.	17.86	2.21	153316.	435.	40634.	17664.
1.9	31.8	13507.	6351.	8354.	2329.	935.	18.43	2.25	158714.	362.	40055.	17706.
2.0	32.3	13145.	6351.	8393.	2368.	925.	18.24	2.24	164113.	262.	38820.	17387.
2.1	32.3	12000.	6264.	8354.	2387.	861.	17.67	2.20	169022.	154.	37124.	16737.
2.2	32.3	9949.	6177.	8316.	2387.	783.	16.72	2.14	171771.	46.	35212.	15874.
2.3	32.3	7658.	6032.	8200.	2368.	718.	16.34	2.11	172261.	-46.	33346.	14985.
2.4	32.3	6754.	5887.	8162.	2329.	679.	15.39	2.05	172261.	-100.	32142.	14349.
2.5	31.8	7055.	5771.	8123.	2329.	668.	15.01	2.02	170102.	-116.	31573.	14003.
2.6	31.8	7779.	5713.	8085.	2310.	670.	14.63	2.00	169612.	-108.	31406.	13859.
2.7	31.8	8382.	5684.	8046.	2310.	684.	14.44	1.98	166372.	-85.	31522.	13864.
2.8	32.3	8743.	5655.	8046.	2310.	702.	14.44	1.98	163723.	-62.	3161E.	13883.
2.9	32.3	8985.	5626.	8085.	2291.	723.	14.44	1.98	162053.	-46.	31515.	13815.
3.0	31.8	9166.	5655.	8123.	2310.	744.	14.44	1.98	159404.	-23.	31675.	13862.
3.1	31.8	9346.	5684.	8123.	2291.	755.	14.63	2.00	158324.	-31.	31235.	13648.
3.2	32.3	9467.	5713.	8123.	2291.	767.	14.63	2.00	157244.	-15.	31352.	13738.
3.3	31.8	9588.	5742.	8085.	2291.	769.	14.82	2.01	157244.	0.	31656.	13807.
3.4	32.3	9527.	5771.	8085.	2310.	774.	14.82	2.01	157145.	15.	31940.	13955.
3.5	32.8	9467.	5771.	8123.	2271.	776.	15.20	2.03	157244.	E.	31745.	13893.
3.6	32.3	9346.	5771.	8123.	2310.	771.	15.20	2.03	156655.	46.	32579.	14282.
3.7	32.3	9226.	5771.	8123.	2310.	764.	14.82	2.01	156754.	38.	32427.	14215.
3.8	32.3	8985.	5742.	8162.	2310.	760.	15.01	2.02	156165.	31.	3222E.	14199.
3.9	32.3	8864.	5742.	8162.	2310.	755.	15.01	2.02	157734.	23.	32076.	14132.
4.0	31.8	8743.	5742.	8123.	2329.	753.	14.82	2.01	156655.	23.	32053.	14121.
4.1	32.3	8623.	5742.	8085.	2310.	746.	14.63	2.00	157244.	-E.	31327.	13802.
4.2	31.8	8502.	5713.	8085.	2310.	741.	14.44	1.98	156165.	-8.	31264.	13774.
4.3	31.3	8442.	5713.	8046.	2310.	739.	14.44	1.98	155575.	-10.	31205.	13725.
4.4	30.8	8442.	5742.	8085.	2310.	737.	14.63	2.00	156165.	-13.	3106E.	13665.

TEST TS-10, THROTTLE STEP INCREASE (OPEN LOOP), 10,000 TO 22,000 H.P.

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3COT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
0.0	76.9	6633.	5191.	7777.	2098.	663.	11.21	1.76	120433.	C.	24241.	9714.
0.1	90.3	7477.	5220.	7777.	2098.	686.	11.78	1.80	120333.	13E.	2745E.	11046.
0.2	100.0	9165.	5336.	7854.	2117.	748.	12.73	1.87	120923.	187.	28735.	11669.
0.3	101.6	10975.	5481.	7931.	2137.	836.	13.49	1.92	122003.	280.	31164.	12816.
0.4	102.1	12663.	5655.	8009.	2214.	900.	14.63	2.00	124652.	372.	33753.	14128.
0.5	102.1	13206.	5771.	8085.	2233.	930.	15.39	2.05	128481.	416.	35410.	15133.
0.6	101.6	13206.	5916.	8123.	2291.	942.	16.15	2.10	132701.	462.	37264.	16308.
0.7	101.6	13206.	6032.	8239.	2348.	951.	16.72	2.14	137020.	485.	38703.	17250.
0.8	101.6	13206.	6119.	8239.	2406.	946.	17.48	2.19	141928.	485.	39654.	18051.
0.9	101.6	13326.	6177.	8277.	2425.	948.	17.86	2.21	147327.	462.	40189.	18678.
1.0	102.1	13387.	6206.	8316.	2483.	937.	18.05	2.23	152136.	470.	41407.	19608.
1.1	102.1	13507.	6293.	8316.	2541.	939.	18.81	2.28	159105.	447.	41899.	20179.
1.2	102.1	13567.	6322.	8354.	2579.	939.	19.00	2.29	162934.	40E.	41976.	20586.
1.3	102.1	13567.	6351.	8393.	2618.	944.	19.19	2.31	167253.	370.	41971.	20891.
1.4	102.1	13507.	6351.	8393.	2656.	937.	19.57	2.33	171082.	339.	42035.	21169.
1.5	102.1	13507.	6351.	8393.	2676.	939.	19.76	2.34	173831.	293.	41637.	21182.
1.6	102.6	13507.	6351.	8393.	2695.	932.	19.76	2.34	178150.	254.	41308.	21227.
1.7	102.1	13447.	6380.	8431.	2714.	928.	19.76	2.34	179230.	231.	41307.	21408.
1.8	102.1	13387.	6409.	8470.	2753.	921.	19.95	2.36	180899.	216.	41414.	21615.
1.9	101.6	13447.	6380.	8470.	2772.	928.	19.95	2.36	184138.	185.	41087.	21595.
2.0	102.1	13567.	6380.	8470.	2772.	932.	20.14	2.37	185218.	162.	40912.	21653.
2.1	102.1	13507.	6380.	8470.	2791.	925.	20.14	2.37	187477.	154.	41044.	21813.
2.2	101.6	13387.	6380.	8470.	2810.	925.	20.33	2.38	187967.	139.	40914.	21834.
2.3	102.1	13326.	6351.	8431.	2810.	925.	20.33	2.38	188557.	123.	40761.	21872.
2.4	101.6	13387.	6380.	8393.	2830.	925.	20.33	2.38	189637.	131.	41062.	22124.
2.5	102.1	13326.	6380.	8393.	2849.	923.	20.33	2.38	190127.	131.	41193.	22285.
2.6	102.1	13326.	6380.	8470.	2849.	923.	20.33	2.38	190617.	116.	40972.	22286.
2.7	102.1	13145.	6351.	8470.	2868.	919.	20.33	2.38	191207.	123.	41210.	22506.
2.8	102.6	13085.	6351.	8431.	2887.	921.	20.33	2.38	191796.	116.	41122.	22518.
2.9	102.1	13085.	6380.	8508.	2887.	928.	20.33	2.38	191207.	92.	40615.	22362.

TEST TS-10 (CONTINUED)

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3DOT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SQIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
3.0	101.6	13085.	6380.	8470.	2887.	925.	20.33	2.38	192286.	85.	40443.	22324.
3.1	102.1	13025.	6380.	8470.	2926.	928.	20.14	2.37	191207.	77.	40311.	22281.
3.2	101.6	13025.	6409.	8431.	2907.	932.	20.33	2.38	191207.	54.	39785.	22048.
3.3	101.6	13025.	6380.	8470.	2907.	932.	20.52	2.40	192876.	77.	40311.	22370.
3.4	102.1	12784.	6351.	8431.	2926.	930.	20.33	2.38	191207.	123.	41364.	22984.
3.5	102.1	12904.	6380.	8431.	2907.	925.	20.52	2.40	192286.	162.	42218.	23614.
4.0	101.6	12844.	6380.	8431.	2945.	932.	20.52	2.40	191207.	42.	39322.	22196.
4.5	101.6	12663.	6351.	8508.	3003.	932.	20.33	2.38	190617.	54.	39445.	22470.
5.0	101.6	12542.	6322.	8470.	3041.	932.	20.33	2.38	188947.	57.	39318.	22597.
5.5	101.6	12542.	6322.	8431.	3061.	928.	20.52	2.40	187378.	55.	39105.	22732.
6.0	102.1	12361.	6351.	8508.	3041.	928.	20.33	2.38	187278.	52.	38814.	22762.
6.5	101.6	12603.	6322.	8470.	3118.	932.	20.33	2.38	186788.	52.	38616.	22816.
7.0	102.1	12482.	6322.	8470.	3138.	932.	20.33	2.38	185118.	46.	38346.	22797.
7.5	101.6	12361.	6293.	8393.	3157.	932.	20.52	2.40	184039.	40.	38059.	22822.
8.0	101.6	12422.	6293.	8393.	3157.	932.	20.33	2.38	184138.	35.	37828.	22822.
8.5	101.6	12422.	6264.	8470.	3176.	932.	20.33	2.38	183648.	34.	37706.	22831.
9.0	101.6	12361.	6264.	8470.	3215.	932.	20.33	2.38	183648.	28.	37463.	22766.
9.5	102.1	12422.	6264.	8431.	3195.	935.	20.33	2.38	182959.	25.	37306.	22780.
10.0	101.6	12422.	6293.	8393.	3215.	937.	20.33	2.38	181489.	25.	37235.	22821.
10.5	101.6	12361.	6264.	8393.	3234.	925.	20.33	2.38	181979.	25.	37128.	22835.
11.0	101.6	12301.	6264.	8431.	3234.	932.	20.33	2.38	181979.	20.	36960.	22813.
11.5	101.6	12301.	6235.	8431.	3272.	930.	20.14	2.37	180899.	18.	36830.	22813.
12.0	101.1	12181.	6235.	8393.	3253.	930.	20.33	2.38	181389.	14.	36661.	22736.
12.5	101.6	12241.	6235.	8393.	3272.	928.	20.14	2.37	179130.	11.	36461.	22665.
13.0	101.6	12181.	6206.	8431.	3253.	925.	20.14	2.37	180409.	6.	36269.	22546.
13.5	101.1	12181.	6206.	8393.	3272.	925.	19.95	2.36	178740.	6.	36142.	22494.
14.0	101.1	12181.	6206.	8393.	3272.	923.	19.95	2.36	178740.	3.	36037.	22428.
14.5	101.1	11939.	6177.	8431.	3272.	921.	19.95	2.36	178250.	4.	35977.	22417.
15.0	101.1	11939.	6177.	8354.	3272.	919.	19.76	2.34	178250.	3.	35932.	22389.

TEST TS-11, THROTTLE STEP INCREASE (CLOSED LOOP), 15,000 TO 19,000 H.P.

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N300T	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SGIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
0.0	27.7	9045.	5771.	8277.	2348.	771.	14.63	2.00	165583.	C.	33195.	14925.
0.1	30.3	9045.	5771.	8239.	2348.	771.	14.63	2.00	165093.	-13.	32873.	14760.
0.2	29.8	9105.	5771.	8239.	2387.	771.	14.63	2.00	164603.	-18.	32722.	14680.
0.3	29.2	9045.	5742.	8239.	2348.	771.	14.63	2.00	164503.	-41.	32113.	14407.
0.4	29.2	9045.	5742.	8277.	2348.	769.	14.25	1.97	164113.	-27.	32391.	14508.
0.5	30.8	9045.	5742.	8239.	2348.	769.	14.44	1.98	163523.	C.	33025.	14719.
0.6	34.9	9346.	5742.	8239.	2329.	781.	14.82	2.01	164013.	23.	33555.	15000.
0.7	35.4	10914.	5829.	8277.	2329.	838.	15.39	2.05	165093.	77.	34998.	15701.
0.8	35.4	12603.	5945.	8354.	2368.	912.	16.34	2.11	165683.	169.	37427.	16873.
0.9	35.4	13507.	6061.	8393.	2406.	946.	17.10	2.16	168332.	216.	38915.	17715.
1.0	36.4	13567.	6119.	8431.	2406.	958.	17.48	2.19	171572.	246.	40181.	18557.
1.1	35.4	13447.	6148.	8470.	2445.	965.	18.05	2.23	174811.	253.	41925.	19577.
1.2	36.4	13387.	6264.	8508.	2502.	965.	18.43	2.25	179130.	300.	42815.	20212.
1.3	35.9	13387.	6293.	8547.	2502.	958.	18.81	2.28	182859.	276.	42827.	20501.
1.4	36.4	13507.	6322.	8547.	2541.	958.	19.00	2.29	186098.	254.	43171.	20887.
1.5	36.4	13507.	6380.	8547.	2579.	951.	19.19	2.31	189338.	223.	43077.	20999.
1.6	36.4	13387.	6380.	8585.	2579.	951.	19.19	2.31	192087.	162.	42218.	20735.
1.7	35.9	13085.	6409.	8585.	2599.	946.	19.19	2.31	194246.	116.	41575.	20513.
1.8	35.4	12361.	6351.	8547.	2599.	909.	19.00	2.29	196406.	77.	41005.	20260.
1.9	36.4	10854.	6264.	8547.	2599.	855.	18.62	2.27	196406.	31.	40126.	19855.
2.0	36.9	9949.	6206.	8470.	2599.	831.	18.05	2.23	196896.	-8.	39292.	19442.
2.1	36.4	9648.	6119.	8431.	2599.	808.	17.67	2.20	196406.	-23.	38830.	19185.
2.2	35.9	10251.	6119.	8431.	2599.	804.	17.29	2.18	195326.	-46.	38130.	18783.
2.3	36.9	10733.	6061.	8431.	2579.	813.	17.29	2.18	193657.	-62.	37562.	18476.
2.4	35.4	11095.	6061.	8470.	2560.	833.	17.29	2.18	192087.	-54.	37501.	18391.
2.5	36.4	11276.	6032.	8431.	2579.	840.	17.29	2.18	191497.	-23.	38025.	18594.
2.6	35.9	11698.	6090.	8431.	2560.	870.	17.67	2.20	190517.	-15.	38078.	18618.
2.7	35.9	11819.	6119.	8470.	2560.	875.	17.48	2.19	191007.	8.	38561.	18911.
2.8	35.5	11638.	6119.	8470.	2579.	875.	17.67	2.20	190517.	31.	39072.	19162.
2.9	36.4	11457.	6119.	8431.	2599.	877.	17.86	2.21	191007.	31.	39072.	19190.
3.0	35.9	11336.	6119.	8431.	2579.	870.	17.86	2.21	191107.	15.	38678.	19025.
3.1	36.5	11216.	6119.	8470.	2579.	870.	17.86	2.21	190517.	23.	38853.	19111.
3.2	36.9	11095.	6148.	8470.	2579.	859.	17.86	2.21	189927.	19.	38766.	19068.
3.3	36.4	11035.	6119.	8470.	2579.	859.	17.67	2.20	190517.	18.	38713.	19070.
3.4	36.4	10914.	6119.	8431.	2599.	852.	17.48	2.19	191007.	22.	38814.	19134.
3.5	36.4	10975.	6090.	8431.	2599.	850.	17.48	2.19	190517.	30.	39022.	19261.

TEST TS-12, THROTTLE STEP INCREASE (CLOSED LOOP), 15,000 TO 23,000 H.P.

T (SEC)	L (°)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PEAG (HP)
0.0	29.8	9105.	5800.	8277.	2329.	778.	14.82	2.01	166372.	0.	33485.	14810.
0.1	29.2	9105.	5800.	8277.	2329.	778.	14.82	2.01	166862.	-3.	33404.	14784.
0.2	29.2	9045.	5800.	8277.	2310.	776.	14.82	2.01	166372.	-10.	33214.	14706.
0.3	29.8	9045.	5800.	8239.	2329.	771.	14.82	2.01	166372.	-10.	33214.	14682.
0.4	28.7	9045.	5800.	8316.	2329.	771.	14.82	2.01	165783.	-21.	32926.	14530.
0.5	28.2	9045.	5771.	8239.	2310.	769.	14.82	2.01	166372.	-31.	32687.	14425.
0.6	28.2	8985.	5742.	8239.	2310.	774.	14.63	2.00	165882.	-23.	32835.	14468.
0.7	28.2	8985.	5742.	8239.	2310.	778.	14.82	2.01	165882.	-15.	33038.	14531.
0.8	28.2	8985.	5771.	8239.	2310.	783.	14.82	2.01	165783.	-8.	33154.	14600.
0.9	28.2	8985.	5742.	8239.	2310.	778.	14.63	2.00	166372.	15.	33716.	14830.
1.0	29.8	9045.	5742.	8239.	2310.	778.	14.82	2.01	165882.	54.	34570.	15230.
1.1	31.8	9527.	5771.	8239.	2310.	792.	15.20	2.03	165783.	100.	35691.	15776.
1.2	36.9	10552.	5800.	8277.	2329.	836.	15.77	2.07	165293.	146.	36834.	16390.
1.3	39.5	12120.	5887.	8354.	2348.	891.	16.53	2.12	167452.	193.	38191.	17162.
1.4	40.0	13266.	6032.	8354.	2387.	946.	17.10	2.16	168632.	231.	39486.	17918.
1.5	39.5	13567.	6177.	8393.	2425.	965.	17.67	2.20	173441.	246.	40407.	18542.
1.6	40.0	13567.	6264.	8431.	2425.	971.	18.05	2.23	176190.	246.	41106.	19074.
1.7	40.0	13567.	6322.	8508.	2464.	969.	18.62	2.27	179429.	254.	42043.	19703.
1.8	40.0	13787.	6322.	8547.	2483.	965.	19.00	2.29	184828.	235.	42407.	20051.
1.9	40.0	13507.	6380.	8547.	2502.	969.	19.38	2.32	188067.	223.	42727.	20421.
2.0	40.0	13628.	6409.	8585.	2541.	969.	19.57	2.33	190717.	216.	43202.	20807.
2.1	40.5	13688.	6438.	8624.	2560.	967.	19.76	2.34	192876.	200.	43352.	21057.
2.2	40.5	13743.	6438.	8624.	2560.	967.	19.76	2.34	195625.	177.	43363.	21202.
2.3	40.5	13869.	6467.	8662.	2579.	965.	19.95	2.36	198275.	177.	43821.	21555.
2.4	40.0	13929.	6467.	8624.	2599.	965.	20.14	2.37	200434.	165.	44060.	21801.
2.5	40.0	13869.	6467.	8624.	2618.	969.	20.14	2.37	202104.	162.	44255.	22060.
2.6	39.5	13869.	6467.	8624.	2637.	971.	20.52	2.40	203184.	154.	44408.	22266.
2.7	39.5	13869.	6496.	8662.	2656.	971.	20.52	2.40	204853.	146.	44457.	22441.
2.8	39.5	13869.	6496.	8662.	2656.	971.	20.33	2.38	206423.	123.	44151.	22385.
2.9	40.0	13869.	6496.	8701.	2676.	967.	20.52	2.40	207013.	108.	44038.	22404.
3.0	39.5	13869.	6525.	8624.	2676.	967.	20.52	2.40	207602.	92.	43864.	22380.
3.1	39.5	13929.	6525.	8701.	2695.	965.	20.71	2.41	208092.	85.	43795.	22411.
3.2	40.0	13929.	6525.	8739.	2695.	960.	20.71	2.41	209272.	77.	43754.	22452.
3.3	39.5	13869.	6525.	8739.	2695.	967.	20.52	2.40	209172.	65.	43705.	22493.
3.4	40.0	13929.	6525.	8662.	2714.	969.	20.71	2.41	210252.	65.	43835.	22624.
3.5	40.0	13929.	6496.	8624.	2714.	971.	20.71	2.41	210842.	65.	43878.	22676.
3.6	40.0	13929.	6496.	8624.	2733.	969.	20.90	2.42	211332.	65.	43946.	22776.
3.7	40.0	13929.	6525.	8624.	2714.	971.	20.71	2.41	210252.	62.	43754.	22761.
3.8	40.0	13929.	6525.	8624.	2733.	974.	20.52	2.40	210842.	65.	43965.	22917.
3.9	40.5	13929.	6525.	8624.	2753.	978.	20.90	2.42	210842.	62.	43774.	22847.
4.0	39.5	13929.	6525.	8624.	2753.	978.	20.90	2.42	210842.	46.	43451.	22742.
4.1	40.0	13929.	6525.	8624.	2753.	976.	20.90	2.42	210842.	31.	43100.	22590.
4.2	40.0	13929.	6525.	8662.	2753.	978.	20.71	2.41	210941.	31.	43100.	22590.
4.3	40.0	13929.	6525.	8624.	2753.	981.	20.90	2.42	210842.	23.	42948.	22510.
4.4	40.0	13990.	6525.	8624.	2753.	983.	20.90	2.42	210842.	23.	42972.	22554.
4.5	40.5	13990.	6525.	8624.	2753.	978.	20.90	2.42	211431.	31.	43171.	22691.
4.6	40.0	13929.	6525.	8624.	2772.	976.	20.90	2.42	211431.	46.	43526.	22909.
4.7	40.0	13929.	6525.	8624.	2772.	978.	20.90	2.42	211531.	40.	43418.	22884.
4.8	40.5	13929.	6525.	8624.	2772.	981.	20.90	2.42	210941.	36.	43316.	22894.
4.9	40.5	13990.	6554.	8624.	2772.	985.	20.90	2.42	211431.	35.	43297.	22892.
5.0	40.5	13990.	6554.	8662.	2791.	985.	20.90	2.42	211431.	34.	43259.	22885.

TEST TP-1, THROTTLE PULSE (1%) AT 4,000 H.P. (OPEN LOOP)

T (SEC)	L (?)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	45.7	4100.	4495.	7276.	1675.	546.	6.46	1.44	69776.	C.	14065.	4504.
0.1	45.1	4100.	4495.	7315.	1675.	546.	6.46	1.44	70366.	-6.	13943.	4459.
0.2	45.7	4040.	4524.	7353.	1694.	546.	6.46	1.44	69776.	3.	14155.	4526.
0.3	45.7	4040.	4524.	7315.	1675.	548.	6.46	1.44	70366.	-5.	14004.	4476.
0.4	45.7	4040.	4524.	7353.	1675.	546.	6.65	1.45	70366.	-2.	14077.	4509.
0.5	46.2	3919.	4524.	7315.	1675.	548.	6.46	1.44	70266.	C.	14164.	4527.
0.6	46.2	3919.	4495.	7315.	1674.	548.	6.46	1.44	70366.	C.	14184.	4533.
0.7	46.2	3987.	4524.	7315.	1675.	548.	6.46	1.44	70856.	-15.	13829.	4420.
0.8	46.2	3980.	4495.	7276.	1675.	548.	6.46	1.44	70856.	-8.	14024.	4482.
0.9	46.2	4100.	4495.	7276.	1675.	546.	6.46	1.44	70266.	-8.	14063.	4484.
1.0	47.2	4161.	4495.	7315.	1675.	548.	6.65	1.45	70756.	-8.	14059.	4483.
1.1	47.7	4402.	4495.	7315.	1675.	553.	6.65	1.45	71346.	-8.	14055.	4482.
1.2	48.7	4583.	4524.	7315.	1675.	555.	6.46	1.44	70756.	C.	14251.	4544.
1.3	49.8	4764.	4582.	7315.	1675.	562.	6.46	1.44	70756.	C.	14251.	4544.
1.4	50.3	4945.	4582.	7353.	1675.	571.	6.65	1.45	70756.	C.	14227.	4537.
1.5	50.3	5125.	4611.	7353.	1675.	578.	7.03	1.48	70756.	15.	14578.	4649.
1.6	50.8	5246.	4640.	7353.	1675.	583.	7.03	1.48	70756.	38.	15128.	4824.
1.7	51.8	5367.	4640.	7430.	1675.	590.	7.03	1.48	70756.	62.	15674.	5021.
1.8	52.3	5427.	4698.	7430.	1675.	597.	7.22	1.49	71346.	100.	16639.	5367.
1.9	52.3	5548.	4727.	7392.	1713.	599.	7.22	1.49	71246.	135.	17647.	5731.
2.0	53.4	5548.	4727.	7430.	1732.	606.	7.41	1.50	72915.	146.	17996.	5910.
2.1	53.4	5487.	4756.	7430.	1732.	608.	7.60	1.52	73995.	146.	18189.	6040.
2.2	53.9	5548.	4814.	7469.	1771.	610.	7.79	1.53	75075.	146.	18387.	6146.
2.3	53.9	5487.	4843.	7507.	1771.	613.	7.98	1.54	76155.	123.	18053.	6074.
2.4	53.9	5487.	4814.	7546.	1771.	613.	8.36	1.57	76155.	100.	17720.	6001.
2.5	53.9	5487.	4843.	7546.	1790.	606.	8.17	1.56	77724.	100.	17914.	6093.
2.6	53.9	5487.	4872.	7546.	1790.	606.	8.36	1.57	78804.	92.	17908.	6117.
2.7	53.9	5427.	4872.	7507.	1809.	603.	8.36	1.57	79884.	92.	18077.	6215.
2.8	53.9	5367.	4901.	7546.	1809.	601.	8.55	1.58	80374.	100.	18379.	6346.
2.9	53.9	5246.	4930.	7546.	1829.	597.	8.36	1.57	80374.	108.	18705.	6499.
3.0	53.9	5125.	4930.	7546.	1829.	597.	8.55	1.58	80864.	108.	18831.	6585.
3.1	52.8	5125.	4872.	7546.	1848.	592.	8.36	1.57	82533.	116.	19113.	6725.
3.2	52.3	5065.	4872.	7546.	1867.	592.	8.36	1.57	83023.	108.	19064.	6750.
3.3	52.3	5005.	4872.	7546.	1867.	585.	8.55	1.58	83023.	92.	18839.	6712.
3.4	51.3	5005.	4872.	7546.	1896.	578.	8.55	1.58	83513.	85.	18746.	6706.
3.5	50.8	4945.	4872.	7546.	1886.	569.	8.36	1.57	84003.	69.	18482.	6625.

TEST TF-1 (CONTINUED)

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3COT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DFGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
3.6	50.3	4884.	4843.	7507.	1886.	564.	8.36	1.57	84593.	46.	18042.	6494.
3.7	49.8	4824.	4814.	7507.	1886.	562.	8.36	1.57	85183.	31.	17759.	6405.
3.8	49.2	4824.	4814.	7507.	1906.	555.	8.36	1.57	85183.	23.	17630.	6359.
3.9	48.7	4764.	4785.	7507.	1906.	551.	8.36	1.57	85183.	-8.	16952.	6114.
4.0	48.7	4703.	4756.	7469.	1846.	544.	7.98	1.54	85183.	-31.	16382.	5908.
4.1	48.7	4643.	4727.	7469.	1846.	541.	7.98	1.54	85183.	-38.	16139.	5797.
4.2	48.2	4583.	4727.	7469.	1886.	539.	7.98	1.54	84103.	-46.	15877.	5680.
4.3	47.7	4522.	4727.	7469.	1867.	537.	7.79	1.53	83513.	-54.	15615.	5574.
4.4	47.7	4522.	4698.	7469.	1867.	537.	7.79	1.53	83023.	-54.	15508.	5525.
4.5	47.7	4402.	4698.	7469.	1867.	532.	7.98	1.54	83023.	-46.	15621.	5554.
4.6	47.7	4402.	4669.	7430.	1867.	534.	7.79	1.53	82533.	-54.	15339.	5431.
4.7	47.2	4342.	4669.	7430.	1867.	541.	7.41	1.50	82533.	-62.	15076.	5327.
4.8	47.2	4342.	4640.	7392.	1829.	546.	7.60	1.52	80864.	-65.	14861.	5229.
4.9	46.7	4342.	4640.	7392.	1848.	551.	7.41	1.50	80864.	-54.	15125.	5300.
5.0	46.7	4281.	4640.	7392.	1829.	551.	7.41	1.50	82043.	-69.	14688.	5125.
5.1	47.2	4342.	4640.	7430.	1829.	553.	7.41	1.50	80374.	-65.	14668.	5118.
5.2	47.2	4281.	4640.	7430.	1829.	555.	7.41	1.50	80374.	-62.	14800.	5132.
5.3	47.2	4221.	4582.	7392.	1829.	548.	7.22	1.49	80374.	-62.	14646.	5057.
5.4	46.2	4221.	4582.	7392.	1790.	548.	7.03	1.48	79784.	-85.	14033.	4835.
5.5	46.2	4161.	4553.	7392.	1790.	551.	7.22	1.49	78214.	-62.	14472.	4965.
5.6	46.2	4100.	4553.	7353.	1809.	551.	7.03	1.48	78214.	-46.	14653.	5008.
5.7	46.2	4100.	4582.	7353.	1790.	555.	7.03	1.48	78214.	-46.	14587.	4972.
5.8	46.2	4161.	4582.	7353.	1771.	555.	7.03	1.48	77135.	-38.	14679.	5004.
5.9	46.2	4161.	4582.	7353.	1790.	555.	7.03	1.48	77135.	-23.	14967.	5091.
6.0	46.2	4161.	4553.	7353.	1790.	555.	7.03	1.48	76155.	-31.	14685.	4984.
6.1	45.7	4221.	4553.	7392.	1790.	555.	7.03	1.48	76645.	-38.	14423.	4885.
6.2	46.2	4221.	4553.	7392.	1771.	555.	7.03	1.48	75565.	-38.	14336.	4845.
6.3	46.2	4221.	4553.	7353.	1752.	555.	7.03	1.48	74975.	-31.	14444.	4871.
6.4	46.2	4221.	4553.	7353.	1771.	557.	7.03	1.48	74975.	-15.	14712.	4950.
6.5	46.2	4221.	4553.	7353.	1771.	562.	7.03	1.48	74485.	-8.	14868.	5003.
6.6	46.2	4221.	4553.	7353.	1771.	557.	7.03	1.48	74585.	0.	15024.	5066.
6.7	46.2	4221.	4524.	7315.	1771.	557.	7.03	1.48	75075.	8.	15180.	5119.
6.8	46.2	4161.	4582.	7353.	1771.	557.	7.03	1.48	74485.	8.	15204.	5127.
6.9	46.2	4221.	4553.	7315.	1771.	562.	7.03	1.48	74485.	0.	15036.	5070.
7.0	46.2	4221.	4553.	7315.	1771.	562.	7.03	1.48	75075.	0.	15016.	5064.

TEST TP-2, THROTTLE PULSE (37%) AT 10,000 H.P. (CLOSED LCCP)

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LR/SCIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PEAG (HP)
0.0	34.9	6633.	5249.	7931.	2541.	672.	11.40	1.78	105989.	C.	21245.	10279.
0.1	34.9	6693.	5249.	7931.	2541.	672.	11.40	1.78	105499.	C.	21237.	10275.
0.2	35.4	6693.	5220.	7931.	2541.	675.	11.21	1.76	105499.	-8.	21057.	10188.
0.3	35.4	6633.	5220.	7931.	2541.	672.	11.40	1.78	105499.	-8.	21017.	10168.
0.4	35.4	6633.	5220.	7931.	2541.	670.	11.40	1.78	105499.	C.	21149.	10217.
0.5	35.9	6693.	5220.	7931.	2541.	672.	11.40	1.78	105009.	15.	21477.	10375.
0.6	37.4	6934.	5249.	7931.	2522.	677.	11.78	1.8C	104419.	54.	22335.	10806.
0.7	38.5	7417.	5278.	7969.	2541.	700.	11.78	1.80	104909.	131.	24125.	11709.
0.8	40.0	9226.	5423.	8008.	2560.	783.	12.73	1.87	105009.	208.	26006.	12716.
0.9	40.5	11155.	5568.	8085.	2579.	866.	13.87	1.94	106479.	253.	28237.	13993.
1.0	43.6	12542.	5713.	8200.	2637.	921.	15.01	2.02	108048.	385.	30730.	15453.
1.1	47.2	13206.	5858.	8239.	2695.	953.	15.77	2.07	111877.	454.	32866.	16817.
1.2	47.7	13387.	5974.	8316.	2733.	967.	16.53	2.12	114527.	493.	34411.	17960.
1.3	47.7	13447.	6090.	8393.	2791.	969.	17.10	2.16	118846.	531.	35995.	19158.
1.4	47.7	13447.	6177.	8431.	2849.	967.	17.86	2.21	123065.	531.	36705.	19911.
1.5	47.7	13507.	6235.	8470.	2907.	965.	18.05	2.23	125715.	501.	36777.	20354.
1.6	47.7	13628.	6322.	8508.	2964.	962.	18.81	2.28	129444.	435.	36095.	20296.
1.7	47.7	13447.	6322.	8547.	3022.	946.	18.81	2.28	133763.	354.	34831.	19839.
1.8	47.7	11638.	6235.	8508.	3022.	861.	17.86	2.21	136902.	223.	32427.	18613.
1.9	48.2	8563.	6090.	8470.	3041.	783.	17.10	2.16	139552.	92.	29854.	17201.
2.0	48.2	5728.	5916.	8316.	3022.	707.	16.15	2.10	140142.	-54.	26653.	15341.
2.1	46.2	4281.	5655.	8239.	3022.	629.	15.20	2.03	139652.	-177.	23782.	13581.
2.2	40.0	3618.	5481.	8123.	2984.	551.	13.68	1.93	138082.	-300.	20619.	11636.
2.3	39.0	3075.	5249.	8008.	2926.	493.	12.73	1.87	134353.	-385.	18152.	10113.
2.4	39.0	3015.	5133.	7892.	2868.	472.	11.40	1.78	130623.	-447.	16041.	8784.
2.5	39.0	2894.	4988.	7815.	2830.	456.	10.64	1.72	126894.	-470.	14765.	7944.
2.6	38.5	2593.	4843.	7738.	2772.	445.	9.88	1.67	122085.	-485.	13620.	7199.
2.7	38.5	2352.	4785.	7700.	2733.	440.	9.12	1.62	119436.	-477.	13022.	6768.
2.8	38.5	2472.	4640.	7661.	2676.	431.	8.55	1.58	114627.	-470.	12424.	6348.
2.9	38.5	2955.	4582.	7584.	2637.	438.	8.17	1.56	111387.	-439.	12440.	6246.

TEST TP-2 (CONTINUED)												
T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3DOT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
3.0	39.0	4522.	4553.	7584.	2599.	484.	8.17	1.56	107658.	-408.	12451.	6143.
3.1	38.5	6030.	4582.	7584.	2541.	553.	8.17	1.56	105009.	-362.	12948.	6302.
3.2	38.5	6633.	4640.	7623.	2502.	601.	8.17	1.56	102259.	-263.	14034.	6749.
3.3	36.9	7055.	4727.	7623.	2502.	645.	8.55	1.58	100789.	-193.	15905.	7579.
3.4	38.5	7658.	4814.	7700.	2483.	705.	9.31	1.63	99120.	-108.	17532.	8315.
3.5	38.0	8864.	4988.	7815.	2483.	785.	9.88	1.67	97450.	-15.	19445.	9237.
3.6	37.4	9588.	5133.	7854.	2483.	840.	10.83	1.74	97450.	62.	21129.	10067.
3.7	36.9	9648.	5220.	7931.	2522.	854.	11.40	1.78	97450.	123.	22592.	10831.
3.8	37.4	9166.	5365.	7969.	2541.	852.	11.78	1.80	99020.	139.	23053.	11139.
3.9	37.4	8261.	5423.	8008.	2560.	815.	12.35	1.84	100590.	135.	23326.	11337.
4.0	37.4	7417.	5423.	8008.	2560.	778.	12.16	1.83	101180.	116.	23032.	11244.
4.1	37.4	6573.	5365.	8008.	2579.	721.	12.16	1.83	103239.	85.	22499.	11018.
4.2	36.9	5789.	5307.	7969.	2579.	679.	11.78	1.80	103239.	31.	21401.	10495.
4.3	36.9	5367.	5249.	7931.	2579.	649.	11.59	1.79	103239.	-8.	20606.	10106.
4.4	37.4	5125.	5191.	7892.	2579.	617.	11.02	1.75	103829.	-38.	19865.	9713.
4.5	37.4	5125.	5167.	7892.	2560.	603.	10.83	1.74	103239.	-65.	19123.	9322.
4.6	37.4	5306.	5133.	7815.	2541.	594.	10.45	1.71	102259.	-92.	18514.	8998.
4.7	37.4	5548.	5133.	7854.	2541.	603.	10.26	1.70	102259.	-92.	18364.	8885.
4.8	38.0	5789.	5104.	7854.	2541.	617.	10.45	1.71	101180.	-85.	18413.	8868.
4.9	37.4	6030.	5075.	7854.	2522.	633.	10.26	1.70	100100.	-65.	18678.	8968.
5.0	37.4	6271.	5075.	7815.	2502.	652.	10.45	1.71	100100.	-38.	19273.	9240.
5.1	38.0	6512.	5104.	7854.	2502.	668.	10.45	1.71	100100.	C.	20107.	9640.
5.2	38.0	6814.	5133.	7854.	2522.	682.	10.64	1.72	99610.	31.	20809.	9992.
5.3	38.0	6814.	5191.	7892.	2541.	693.	10.83	1.74	100100.	46.	21160.	10191.
5.4	38.0	6814.	5220.	7892.	2541.	695.	11.02	1.75	100100.	46.	21180.	10232.
5.5	37.4	6814.	5220.	7892.	2541.	698.	11.40	1.78	100100.	38.	21044.	10181.
5.6	37.4	6633.	5249.	7931.	2541.	698.	11.40	1.78	100590.	23.	20756.	10042.
5.7	37.4	6573.	5249.	7931.	2541.	689.	11.21	1.76	100590.	8.	20448.	9893.
5.8	37.4	6392.	5249.	7931.	2541.	684.	11.40	1.78	101670.	C.	20336.	9839.
5.9	37.4	6211.	5220.	7931.	2541.	677.	11.21	1.76	101180.	C.	20364.	9852.
6.0	37.4	6151.	5220.	7931.	2541.	670.	11.21	1.76	101670.	0.	20410.	9875.

TEST TP-3, THROTTLE PULSE (6%) AT 10,000 H.P. (OPEN LOOP)

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	66.2	6452.	5133.	7777.	2406.	661.	11.40	1.78	108148.	C.	21897.	10112.
0.1	66.7	6573.	5162.	7777.	2425.	661.	11.21	1.76	109328.	25.	22552.	10415.
0.2	67.2	6512.	5162.	7777.	2445.	663.	11.40	1.78	109228.	23.	22414.	10368.
0.3	68.7	6693.	5191.	7777.	2425.	661.	11.59	1.79	108838.	23.	22481.	10432.
0.4	69.7	6934.	5191.	7815.	2445.	675.	11.59	1.79	108738.	31.	22676.	10522.
0.5	69.3	7115.	5191.	7777.	2445.	682.	11.78	1.80	109818.	31.	22680.	10524.
0.6	69.8	7296.	5162.	7777.	2425.	691.	11.78	1.80	109818.	23.	22568.	10489.
0.7	69.8	7236.	5220.	7815.	2445.	693.	11.78	1.80	109328.	38.	22982.	10698.
0.8	69.3	7175.	5249.	7815.	2445.	691.	11.78	1.80	110407.	46.	23261.	10817.
0.9	69.8	7236.	5249.	7815.	2464.	693.	11.97	1.81	110308.	46.	23221.	10860.
1.0	70.3	7357.	5278.	7854.	2464.	695.	12.16	1.83	110897.	46.	23260.	10896.
1.1	70.3	7296.	5249.	7815.	2464.	695.	11.97	1.81	110308.	46.	23300.	10931.
1.2	70.3	7296.	5307.	7892.	2464.	695.	11.97	1.81	110308.	38.	23164.	10884.
1.3	69.3	7357.	5278.	7815.	2464.	693.	11.97	1.81	111387.	38.	23203.	10920.
1.4	70.3	7236.	5278.	7892.	2483.	689.	11.97	1.81	111288.	38.	23314.	10989.
1.5	69.3	7236.	5278.	7815.	2483.	691.	12.16	1.83	111877.	31.	23221.	10962.
1.6	68.7	7055.	5249.	7815.	2483.	684.	11.97	1.81	113057.	31.	23306.	11020.
1.7	68.7	6995.	5249.	7815.	2483.	684.	12.16	1.83	112367.	31.	23355.	11043.
1.8	67.7	6814.	5249.	7815.	2483.	672.	11.97	1.81	113547.	23.	23223.	10997.
1.9	67.2	6693.	5249.	7815.	2483.	668.	11.78	1.80	112467.	23.	23219.	11012.
2.0	67.2	6754.	5249.	7854.	2502.	663.	11.78	1.80	112957.	15.	23063.	10939.
2.1	67.2	6754.	5220.	7854.	2502.	666.	11.78	1.80	112957.	-8.	22533.	10703.
2.2	67.2	6633.	5249.	7815.	2483.	666.	11.59	1.79	112857.	-23.	22158.	10509.
2.3	66.7	6512.	5220.	7777.	2502.	663.	11.78	1.80	113447.	-23.	22138.	10467.
2.4	66.7	6512.	5220.	7777.	2464.	661.	11.40	1.78	111877.	-46.	21616.	10204.
2.5	66.7	6452.	5162.	7815.	2464.	661.	11.59	1.79	112467.	-46.	21600.	10197.
2.6	66.2	6452.	5191.	7777.	2483.	661.	11.40	1.78	113057.	-38.	21736.	10229.
2.7	66.2	6452.	5162.	7777.	2483.	659.	11.40	1.78	112467.	-46.	21561.	10131.
2.8	66.2	6452.	5133.	7777.	2464.	656.	11.40	1.78	112467.	-62.	21123.	9910.
2.9	65.7	6452.	5133.	7777.	2445.	654.	11.21	1.76	111877.	-54.	21211.	9920.
3.0	66.2	6452.	5133.	7738.	2445.	659.	11.40	1.78	110308.	-54.	21168.	9869.
3.1	65.7	6452.	5133.	7738.	2445.	661.	11.40	1.78	110897.	-46.	21213.	9875.
3.2	66.2	6392.	5104.	7777.	2445.	661.	11.40	1.78	111387.	-33.	21481.	9983.
3.3	66.2	6452.	5133.	7738.	2445.	661.	11.59	1.79	109228.	-21.	21696.	10083.
3.4	65.7	6452.	5104.	7738.	2425.	659.	11.40	1.78	110897.	-18.	21765.	10111.
3.5	65.7	6392.	5104.	7738.	2445.	659.	11.40	1.78	108738.	-9.	21846.	10143.

TEST TP-4, THROTTLE PULSE (98) AT 10,000 H.P. (OPEN LOOP)

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3COT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
0.0	67.2	6573.	5220.	7777.	2483.	666.	11.59	1.79	109228.	C.	21811.	10313.
0.1	67.2	6633.	5191.	7777.	2483.	668.	11.21	1.76	107558.	C.	2173C.	10274.
0.2	67.2	6633.	5220.	7738.	2483.	666.	11.21	1.76	108638.	8.	21909.	10359.
0.3	67.2	6633.	5220.	7777.	2483.	666.	11.40	1.78	106869.	15.	2208C.	10440.
0.4	68.2	6693.	5191.	7777.	2483.	670.	11.21	1.76	108148.	23.	22275.	10549.
0.5	69.3	7055.	5249.	7777.	2483.	682.	11.40	1.78	109128.	31.	22467.	10656.
0.6	69.8	7236.	5249.	7777.	2502.	689.	11.21	1.76	108048.	46.	22952.	10903.
0.7	71.3	7357.	5249.	7815.	2502.	698.	11.78	1.80	109028.	54.	23254.	11063.
0.8	72.3	7658.	5278.	7777.	2502.	707.	11.78	1.80	110208.	62.	23496.	11213.
0.9	72.8	7899.	5394.	7815.	2502.	714.	12.16	1.83	111288.	69.	23778.	11382.
1.0	72.8	7899.	5394.	7854.	2522.	723.	12.35	1.84	110798.	85.	2422C.	11629.
1.1	72.8	7899.	5394.	7815.	2541.	725.	12.54	1.85	110698.	85.	24331.	11718.
1.2	72.3	7839.	5394.	7892.	2541.	723.	12.54	1.85	111288.	85.	24418.	11814.
1.3	71.8	7718.	5423.	7892.	2541.	718.	12.54	1.85	112957.	92.	24739.	12005.
1.4	70.8	7537.	5423.	7854.	2560.	712.	12.54	1.85	113447.	85.	24781.	12062.
1.5	70.3	7236.	5365.	7892.	2560.	700.	12.54	1.85	114427.	77.	24885.	12170.
1.6	69.8	7176.	5365.	7892.	2579.	689.	12.54	1.85	116097.	65.	24797.	12142.
1.7	69.3	7055.	5394.	7892.	2599.	686.	12.73	1.87	118356.	46.	24444.	12006.
1.8	67.2	6814.	5307.	7777.	2560.	668.	12.16	1.83	115017.	15.	23809.	11711.
1.9	67.2	6633.	5365.	7815.	2599.	666.	12.35	1.84	117766.	15.	23785.	11682.
2.0	67.2	6512.	5307.	7854.	2579.	661.	12.35	1.84	116097.	-8.	23168.	11362.
2.1	67.2	6392.	5278.	7815.	2560.	656.	11.97	1.81	115507.	-15.	23012.	11302.
2.2	67.2	6392.	5249.	7815.	2579.	659.	11.78	1.80	116097.	C.	23276.	11415.
2.3	66.7	6392.	5249.	7854.	2579.	661.	11.97	1.81	115507.	C.	23185.	11372.
2.4	67.2	6452.	5249.	7815.	2579.	659.	11.78	1.80	115607.	-23.	2260C.	11100.
2.5	66.7	6452.	5249.	7815.	2579.	659.	11.78	1.80	113937.	-31.	22341.	10957.
2.6	66.7	6512.	5220.	7815.	2579.	656.	11.40	1.78	113937.	-46.	21904.	10710.
2.7	67.2	6452.	5162.	7815.	2560.	659.	11.78	1.80	114037.	-77.	21115.	10293.
2.8	66.7	6392.	5191.	7815.	2541.	666.	11.78	1.80	113347.	-100.	20616.	10020.
2.9	67.2	6512.	5220.	7777.	2541.	666.	11.40	1.78	113447.	-108.	20381.	9861.
3.0	67.7	6512.	5249.	7777.	2541.	668.	11.40	1.78	114627.	-108.	20227.	9727.
3.1	66.7	6512.	5191.	7777.	2522.	661.	11.40	1.78	112467.	-108.	20097.	9620.
3.2	66.2	6331.	5162.	7700.	2483.	663.	11.21	1.76	110208.	-10C.	20123.	9603.
3.3	65.7	6392.	5191.	7700.	2483.	663.	11.21	1.76	110108.	-65.	20691.	9844.
3.4	65.7	6452.	5133.	7738.	2502.	661.	11.21	1.76	109718.	-36.	21234.	10071.
3.5	66.7	6452.	5162.	7738.	2502.	666.	11.21	1.76	109128.	-26.	21441.	10177.
3.6	66.2	6392.	5133.	7700.	2483.	663.	11.21	1.76	109228.	-9.	21793.	10358.

TEST TP-5, THROTTLE PULSF (19%) AT 10,000 H.P. (OPEN LOGF)

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SQIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	67.2	6452.	5220.	7777.	2368.	656.	11.21	1.76	107758.	0.	21844.	9901.
0.1	71.3	6754.	5191.	7777.	2387.	661.	11.21	1.76	108838.	35.	22659.	10277.
0.2	72.8	7176.	5220.	7815.	2387.	684.	11.59	1.79	109328.	44.	22874.	10396.
0.3	74.4	7658.	5220.	7815.	2387.	707.	11.59	1.79	108838.	67.	23488.	10709.
0.4	75.9	8140.	5307.	7854.	2406.	730.	11.97	1.81	109328.	102.	24375.	11152.
0.5	76.4	8442.	5365.	7892.	2406.	746.	12.35	1.84	109917.	131.	25148.	11559.
0.6	77.5	8623.	5423.	7892.	2425.	751.	12.73	1.87	110997.	162.	26063.	12075.
0.7	80.0	8743.	5452.	7931.	2445.	753.	12.92	1.88	112077.	185.	26807.	12517.
0.8	79.0	8904.	5510.	7931.	2483.	764.	13.30	1.90	114137.	208.	27613.	13016.
0.9	79.5	8985.	5510.	7931.	2502.	758.	13.68	1.93	114726.	208.	27913.	13259.
1.0	80.0	9045.	5568.	7969.	2522.	760.	13.87	1.94	116886.	200.	28014.	13430.
1.1	80.0	8985.	5568.	8008.	2522.	764.	14.25	1.97	118456.	193.	28115.	13584.
1.2	79.5	8985.	5597.	8008.	2560.	764.	14.25	1.97	118946.	193.	28415.	13812.
1.3	80.0	8924.	5597.	8008.	2579.	760.	14.44	1.98	121105.	185.	28500.	13956.
1.4	80.0	8804.	5626.	8008.	2579.	753.	14.44	1.98	122185.	169.	28385.	14004.
1.5	78.5	8683.	5626.	8046.	2618.	748.	14.63	2.00	123265.	169.	28622.	14226.
1.6	77.5	8502.	5597.	8008.	2618.	744.	14.63	2.00	124344.	139.	28137.	14046.
1.7	76.9	8442.	5626.	8008.	2656.	735.	14.63	2.00	124834.	116.	27804.	13962.
1.8	76.4	8261.	5568.	8008.	2637.	718.	14.44	1.98	126504.	77.	27053.	13604.
1.9	76.4	8140.	5568.	8008.	2656.	716.	14.25	1.97	126994.	54.	26633.	13432.
2.0	74.4	7899.	5539.	7969.	2637.	716.	14.06	1.96	126404.	23.	26018.	13122.
2.1	73.4	7899.	5539.	8008.	2656.	707.	14.06	1.96	126994.	23.	26037.	13132.
2.2	72.8	7658.	5539.	7969.	2656.	693.	13.87	1.94	126994.	0.	25451.	12856.
2.3	72.3	7477.	5481.	7969.	2637.	684.	13.68	1.93	126994.	-8.	25320.	12788.
2.4	72.3	7357.	5481.	7931.	2656.	679.	13.49	1.92	126504.	-15.	25061.	12639.
2.5	71.8	7357.	5452.	7931.	2656.	677.	13.49	1.92	126504.	-23.	24803.	12491.
2.6	71.3	7357.	5423.	7931.	2637.	679.	13.30	1.90	124934.	-46.	24170.	12154.
2.7	70.8	7296.	5394.	7931.	2637.	679.	13.11	1.89	124934.	-46.	24040.	12071.
2.8	69.8	7176.	5394.	7892.	2618.	679.	12.92	1.88	124344.	-46.	23890.	11961.
2.9	68.7	6934.	5365.	7892.	2637.	677.	12.92	1.88	123265.	-46.	23783.	11890.
3.0	68.2	6693.	5307.	7892.	2618.	668.	12.54	1.85	122775.	-65.	23083.	11523.
3.1	67.7	6452.	5278.	7854.	2618.	661.	12.35	1.84	122285.	-65.	22933.	11431.
3.2	67.7	6331.	5278.	7854.	2618.	656.	12.35	1.84	120615.	-73.	22675.	11237.
3.3	67.7	6331.	5249.	7854.	2599.	654.	12.16	1.83	120615.	-85.	22238.	10988.
3.4	67.2	6331.	5249.	7854.	2560.	654.	11.97	1.81	119045.	-96.	21871.	10782.
3.5	67.7	6331.	5220.	7854.	2579.	654.	11.78	1.80	118456.	-77.	22247.	10926.

TEST TP-6, THROTTLE PULSE (448) AT 20,000 H.P. (CLOSED LCCP)

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SQIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	46.7	10372.	6032.	8393.	3041.	850.	17.67	2.20	164867.	0.	33222.	19239.
0.1	46.7	10552.	6061.	8431.	3041.	850.	17.48	2.19	164867.	10.	33423.	19356.
0.2	46.2	10372.	6061.	8431.	3041.	852.	17.86	2.21	165947.	15.	33588.	19451.
0.3	46.2	10432.	6032.	8431.	3041.	852.	17.67	2.20	164867.	31.	33982.	19704.
0.4	48.2	10914.	6061.	8431.	3041.	861.	18.05	2.23	165947.	54.	34635.	20111.
0.5	52.8	12060.	6119.	8508.	3061.	914.	18.81	2.28	165947.	92.	35603.	20723.
0.6	56.4	13206.	6032.	8508.	3061.	958.	19.00	2.29	168107.	123.	36475.	21313.
0.7	58.0	13507.	6264.	8547.	3080.	969.	19.38	2.32	168107.	162.	37574.	22090.
0.8	58.0	13688.	6322.	8662.	3099.	978.	19.57	2.33	169186.	193.	38536.	22797.
0.9	63.1	13447.	6380.	8662.	3138.	981.	20.14	2.37	171346.	208.	39146.	23331.
1.0	63.1	13326.	6438.	8701.	3157.	985.	20.33	2.38	172426.	193.	39057.	23449.
1.1	63.6	13507.	6409.	8662.	3176.	988.	20.71	2.41	174585.	185.	39186.	23670.
1.2	63.6	13507.	6467.	8701.	3195.	985.	20.71	2.41	174585.	162.	38876.	23568.
1.3	63.6	13688.	6467.	8662.	3195.	985.	20.71	2.41	176745.	146.	38825.	23653.
1.4	65.2	13628.	6467.	8701.	3195.	988.	21.09	2.43	176745.	139.	38914.	23791.
1.5	66.2	13688.	6496.	8739.	3234.	985.	21.09	2.43	179984.	146.	39394.	24199.
1.6	65.2	13628.	6496.	8739.	3234.	988.	21.28	2.45	181064.	139.	39435.	24341.
1.7	65.7	13689.	6496.	8739.	3272.	985.	21.28	2.45	182143.	146.	39871.	24727.
1.8	63.1	13629.	6525.	8739.	3272.	992.	21.28	2.45	182143.	123.	39475.	24568.
1.9	60.5	13688.	6525.	8739.	3272.	994.	21.28	2.45	183223.	108.	39211.	24518.
2.0	58.0	13748.	6496.	8739.	3292.	992.	20.90	2.42	183223.	100.	39166.	24519.
2.1	58.0	13628.	6525.	8701.	3311.	985.	21.47	2.46	183223.	77.	38726.	24300.
2.2	56.4	13628.	6525.	8701.	3292.	988.	21.47	2.46	185383.	54.	38330.	24136.
2.3	56.4	13628.	6496.	8701.	3311.	988.	21.47	2.46	184303.	46.	38241.	24080.
2.4	56.4	13567.	6525.	8701.	3330.	994.	21.47	2.46	186462.	23.	37888.	23886.
2.5	54.4	13567.	6496.	8739.	3292.	994.	21.47	2.46	185383.	-38.	36527.	23028.
2.6	53.9	13025.	6496.	8662.	3330.	978.	20.90	2.42	187542.	-77.	35653.	22476.
2.7	52.3	9889.	6322.	8662.	3292.	868.	19.76	2.34	186462.	-154.	33808.	21165.

TEST TP-6 (CONTINUED)												
T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3DOT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
2.8	51.3	6392.	6148.	8508.	3292.	776.	18.62	2.27	185383.	-216.	32187.	20032.
2.9	50.3	4824.	5945.	8470.	3234.	721.	17.67	2.20	183223.	-285.	30125.	18553.
3.0	48.7	5970.	5887.	8393.	3195.	702.	17.10	2.16	179984.	-316.	28906.	17630.
3.1	48.2	7960.	5742.	8316.	3157.	700.	16.34	2.11	175665.	-331.	27904.	16814.
3.2	47.2	8201.	5713.	8277.	3138.	714.	15.96	2.09	173505.	-308.	27736.	16530.
3.3	47.2	8020.	5713.	8277.	3099.	735.	15.58	2.06	169186.	-285.	27654.	16335.
3.4	47.2	8502.	5655.	8239.	3061.	764.	15.58	2.06	165947.	-246.	27967.	16401.
3.5	47.2	9276.	5713.	8200.	3061.	792.	15.58	2.06	164867.	-193.	28675.	16711.
3.6	47.2	10432.	5742.	8277.	3041.	831.	15.96	2.09	161628.	-146.	29337.	16990.
3.7	47.2	11035.	5829.	8316.	3041.	866.	16.34	2.11	160548.	-100.	30086.	17379.
3.8	46.7	11216.	5916.	8316.	3003.	900.	16.91	2.15	159469.	-62.	30790.	17763.
3.9	46.7	11336.	5945.	8393.	3022.	896.	16.91	2.15	158389.	-15.	31800.	18346.
4.0	46.7	10854.	5974.	8393.	3041.	896.	17.10	2.16	160548.	15.	32455.	18726.
4.1	47.7	10010.	6003.	8393.	3041.	863.	17.10	2.16	160548.	15.	32502.	18775.
4.2	47.2	9527.	5974.	8354.	3041.	843.	17.48	2.19	159469.	0.	32238.	18669.
4.3	47.2	9166.	5945.	8393.	3022.	831.	17.10	2.16	160548.	-15.	31930.	18468.
4.4	46.7	9286.	5916.	8393.	3061.	820.	16.72	2.14	160548.	-31.	31579.	18218.
4.5	46.2	9467.	5916.	8316.	3022.	820.	16.72	2.14	161628.	-65.	30745.	17692.
4.6	45.7	9829.	5916.	8354.	3003.	824.	16.72	2.14	160548.	-65.	30745.	17670.
4.7	46.2	10010.	5887.	8316.	3003.	827.	16.91	2.15	160548.	-54.	31053.	17778.
4.8	46.2	10130.	5916.	8316.	3003.	836.	16.91	2.15	160548.	-46.	31185.	17831.
4.9	46.2	10130.	5916.	8354.	3003.	840.	16.91	2.15	159469.	-46.	31141.	17806.
5.0	46.2	10130.	5974.	8354.	3003.	847.	16.91	2.15	160548.	-15.	31800.	18159.
5.1	46.2	10130.	5945.	8393.	3003.	852.	17.10	2.16	159469.	-10.	31932.	18211.
5.2	46.2	10130.	5974.	8354.	2984.	852.	16.91	2.15	159469.	-13.	31945.	18242.
5.3	46.2	10130.	5974.	8393.	2984.	856.	17.10	2.16	160548.	-6.	32081.	18314.
5.4	46.2	10130.	5974.	8354.	3022.	845.	17.10	2.16	161628.	4.	32379.	18474.

TEST TP-7, THROTTLE PULSE (9%) AT 20,000 H.P. (OPEN LOOP)

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3DOT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DFGF)	(LB/SQIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
0.0	102.6	10673.	6090.	8470.	2849.	863.	18.24	2.24	179212.	C.	35830.	19436.
0.1	102.6	10673.	6061.	8431.	2849.	863.	18.05	2.23	178232.	-10.	35558.	19289.
0.2	102.1	10673.	6032.	8431.	2849.	861.	18.43	2.25	177152.	-8.	35507.	19261.
0.3	102.6	10673.	6032.	8431.	2849.	861.	18.43	2.25	177152.	-8.	35385.	19169.
0.4	102.1	10613.	6061.	8431.	2849.	859.	18.43	2.25	175583.	C.	35454.	19206.
0.5	102.1	10552.	6061.	8431.	2830.	854.	18.43	2.25	176172.	C.	35391.	19172.
0.6	101.6	10552.	6032.	8431.	2849.	854.	18.43	2.25	175583.	31.	36073.	19568.
0.7	101.6	10552.	6032.	8470.	2849.	854.	18.43	2.25	175583.	54.	36643.	19878.
0.8	101.6	10552.	6032.	8470.	2868.	850.	18.43	2.25	176662.	65.	37034.	20171.
0.9	102.6	10613.	6003.	8470.	2849.	854.	18.43	2.25	176662.	65.	37097.	20287.
1.0	103.1	10673.	6003.	8470.	2887.	859.	18.62	2.27	177152.	77.	37375.	20496.
1.1	104.1	10854.	6032.	8470.	2907.	868.	18.81	2.28	177152.	54.	36912.	20267.
1.2	106.2	11216.	6032.	8508.	2887.	891.	19.00	2.29	178232.	23.	36269.	19940.
1.3	109.3	11698.	6090.	8508.	2887.	912.	19.19	2.31	178132.	15.	36176.	19889.
1.4	110.8	12542.	6148.	8547.	2868.	937.	19.38	2.32	178132.	15.	36202.	19921.
1.5	111.3	13266.	6206.	8547.	2887.	960.	19.76	2.34	179212.	23.	36604.	20124.
1.6	110.8	13266.	6235.	8585.	2887.	967.	19.95	2.36	179802.	38.	37172.	20464.
1.7	111.3	13266.	6322.	8585.	2907.	967.	20.33	2.38	181862.	65.	38135.	21050.
1.8	111.3	13206.	6322.	8585.	2907.	967.	20.52	2.40	183531.	77.	38594.	21360.
1.9	111.3	13145.	6380.	8624.	2907.	965.	20.90	2.42	184611.	92.	39245.	21809.
2.0	111.8	12964.	6380.	8585.	2926.	962.	21.09	2.43	186280.	108.	39865.	22210.
2.1	111.3	12904.	6409.	8585.	2945.	960.	21.09	2.43	187360.	123.	40457.	22628.
2.2	111.8	12784.	6409.	8547.	2945.	960.	21.09	2.43	188440.	123.	40698.	22882.
2.3	111.8	12784.	6467.	8547.	2964.	955.	21.28	2.45	189520.	131.	41090.	23224.
2.4	111.3	12723.	6438.	8547.	2984.	951.	21.09	2.43	190599.	123.	41088.	23313.
2.5	110.8	12542.	6438.	8508.	3003.	944.	20.90	2.42	191679.	92.	40536.	23089.
2.6	108.8	12361.	6409.	8508.	3003.	937.	20.71	2.41	191679.	46.	39594.	22610.
2.7	107.2	12000.	6380.	8470.	3003.	930.	20.71	2.41	192169.	8.	38740.	22122.
2.8	105.7	11578.	6293.	8470.	3003.	919.	20.33	2.38	192269.	-38.	37667.	21455.
2.9	104.7	11336.	6293.	8431.	2984.	889.	20.14	2.37	191189.	-85.	36575.	20779.
3.0	103.6	11155.	6177.	8431.	2964.	873.	19.95	2.36	191189.	-116.	35770.	20243.
3.1	103.1	11035.	6206.	8470.	2964.	863.	19.76	2.34	190699.	-112.	35712.	20105.
3.2	102.6	10794.	6177.	8431.	2945.	854.	19.38	2.32	189619.	-116.	35454.	19856.
3.3	102.1	10613.	6119.	8393.	2926.	854.	19.33	2.32	188639.	-115.	35366.	19768.
3.4	102.1	10492.	6090.	8431.	2907.	852.	19.00	2.29	186970.	-103.	35543.	19802.

TEST LC-1, LOAD TORQUE CHANGE (OPEN LOOP), CONSTANT THROTTLE AT 5,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SCIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	46.7	4342.	4582.	7353.	1752.	557.	6.84	1.47	73405.	C.	1472C.	4910.
1.0	46.7	4402.	4611.	7353.	1752.	553.	6.84	1.47	72326.	1.	14806.	4952.
2.0	46.7	4462.	4582.	7353.	1752.	553.	7.03	1.48	73895.	C.	14842.	4961.
3.0	46.7	4402.	4611.	7353.	1771.	548.	7.03	1.48	74485.	-1.	14955.	4999.
4.0	46.7	4522.	4611.	7353.	1752.	553.	6.84	1.47	74975.	-4.	15054.	5021.
5.0	46.2	4522.	4611.	7430.	1752.	555.	7.03	1.48	76645.	-5.	15201.	5059.
6.0	47.2	4462.	4611.	7392.	1732.	553.	7.03	1.48	76645.	-8.	15285.	5053.
7.0	47.2	4522.	4640.	7392.	1732.	555.	7.03	1.48	78314.	-11.	1539C.	5066.
8.0	47.2	4522.	4611.	7392.	1713.	553.	7.03	1.48	78314.	-13.	15405.	5025.
9.0	47.2	4522.	4640.	7430.	1713.	555.	6.84	1.47	78904.	-12.	15513.	5015.
10.0	47.2	4522.	4640.	7392.	1675.	553.	6.84	1.47	78314.	-12.	15493.	4963.
11.0	47.2	4522.	4669.	7392.	1655.	553.	7.03	1.48	78904.	-9.	15501.	4943.
12.0	47.2	4522.	4640.	7392.	1655.	553.	6.84	1.47	77824.	-4.	15556.	4938.
13.0	47.2	4522.	4640.	7392.	1675.	553.	6.84	1.47	76744.	2.	15636.	4963.
14.0	47.2	4583.	4669.	7392.	1675.	555.	7.03	1.48	77234.	5.	15595.	4984.
15.0	47.2	4522.	4669.	7430.	1675.	553.	7.22	1.49	77234.	8.	15598.	5020.
16.0	47.2	4462.	4640.	7430.	1713.	553.	7.22	1.49	76155.	9.	15633.	5054.
17.0	47.2	4522.	4669.	7430.	1713.	555.	7.22	1.49	76155.	7.	15557.	5052.
18.0	47.2	4522.	4669.	7430.	1713.	553.	7.22	1.49	76744.	6.	15498.	5056.
19.0	47.2	4522.	4669.	7430.	1713.	557.	7.22	1.49	76645.	5.	15502.	5057.

TEST LC-2, LOAD TORQUE CHANGE (CLOSED LOOP), CONSTANT THROTTLE AT 10,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SQIN)	EPR	QL (LB-FT)	N3COT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	32.8	6151.	5133.	7777.	2406.	647.	10.83	1.74	100100.	C.	20416.	9354.
1.0	32.8	6331.	5191.	7777.	2406.	652.	10.83	1.74	101769.	C.	20610.	9443.
2.0	32.8	6392.	5162.	7815.	2406.	652.	11.02	1.75	102749.	C.	2081C.	9534.
3.0	32.3	6452.	5191.	7815.	2406.	663.	11.21	1.76	105399.	C.	21133.	9682.
4.0	32.3	6512.	5191.	7815.	2406.	668.	11.21	1.76	107459.	-1.	21558.	9877.
5.0	32.8	6633.	5220.	7892.	2406.	672.	11.40	1.78	108148.	-2.	2198E.	10074.
6.0	32.8	6814.	5249.	7892.	2406.	679.	11.78	1.80	112758.	-3.	22397.	10245.
7.0	32.8	6874.	5307.	7892.	2406.	679.	11.78	1.80	114327.	-3.	2274C.	10369.
8.0	32.8	6754.	5278.	7892.	2387.	679.	11.78	1.80	115997.	-3.	23036.	10487.
9.0	32.3	6814.	5307.	7892.	2368.	682.	11.97	1.81	115997.	-2.	23142.	10535.
10.0	32.8	6874.	5307.	7892.	2387.	679.	11.78	1.80	115507.	2.	23161.	10544.
11.0	32.8	6754.	5278.	7892.	2406.	682.	11.78	1.80	114527.	3.	2294E.	10463.
12.0	32.8	6633.	5278.	7892.	2406.	672.	11.78	1.80	113057.	3.	22617.	10345.
13.0	32.8	6512.	5249.	7892.	2406.	668.	11.59	1.79	109818.	3.	22242.	1019C.
14.0	32.8	6512.	5249.	7854.	2406.	668.	11.21	1.76	107758.	2.	21779.	9978.
15.0	32.8	6452.	5191.	7815.	2406.	663.	11.02	1.75	106188.	1.	21337.	9776.
16.0	32.3	6452.	5162.	7815.	2406.	659.	11.02	1.75	103439.	C.	210CC.	9621.
17.0	32.3	6331.	5162.	7815.	2406.	661.	10.83	1.74	102949.	C.	20833.	9545.
18.0	32.3	6271.	5133.	7777.	2406.	656.	10.83	1.74	101869.	C.	2066C.	9466.

TEST LC-3, LOAD TORQUE VARIATION (CLOSED LOOP), CONSTANT THROTTLE AT 10,000 H.P.

T	L	WF	N1	N2	N3	TT7	PT7	EPR	QL	N3COT	QE	PENG
(SEC)	(%)	(LB/HR)	(RPM)	(RPM)	(RPM)	(DEGF)	(LB/SCIN)		(LB-FT)	(RPM/S)	(LB-FT)	(HP)
0.0	-2.6	6211.	5104.	7700.	2329.	661.	10.45	1.71	105117.	C.	21281.	9412.
1.0	-1.0	6331.	5133.	7738.	2310.	656.	10.83	1.74	106197.	-3.	21280.	9399.
2.0	-0.5	6331.	5104.	7738.	2329.	659.	10.64	1.72	106197.	-3.	21464.	9472.
3.0	-0.5	6452.	5104.	7700.	2310.	666.	10.45	1.71	107277.	-3.	21784.	9581.
4.0	0.0	6573.	5133.	7738.	2310.	668.	10.83	1.74	110416.	-2.	22181.	9756.
5.0	0.0	6573.	5133.	7777.	2291.	672.	10.83	1.74	113066.	-2.	22655.	9965.
6.0	-0.5	6754.	5191.	7738.	2310.	672.	11.21	1.76	115715.	1.	23241.	10222.
7.0	0.0	6934.	5191.	7738.	2329.	679.	11.59	1.79	117775.	1.	23714.	10430.
8.0	0.0	7055.	5278.	7854.	2310.	682.	11.59	1.79	120524.	1.	24145.	10637.
9.0	0.0	7055.	5307.	7815.	2310.	686.	11.97	1.81	122194.	2.	24314.	10712.
10.0	-0.5	7055.	5278.	7854.	2310.	691.	11.59	1.79	123763.	4.	24637.	10854.
11.0	0.0	7176.	5365.	7815.	2310.	691.	11.02	1.75	119045.	4.	24775.	10951.
12.0	0.0	7115.	5365.	7854.	2329.	691.	11.78	1.80	124943.	5.	24838.	11016.
13.0	0.5	7055.	5336.	7854.	2348.	691.	11.97	1.81	123963.	7.	24688.	10967.
14.0	1.0	6995.	5336.	7892.	2349.	689.	12.16	1.83	122883.	6.	24612.	10969.
15.0	0.0	6754.	5278.	7815.	2329.	679.	11.78	1.80	119154.	6.	24146.	10797.
16.0	1.0	6814.	5278.	7854.	2348.	682.	11.78	1.80	117584.	6.	23609.	10574.
17.0	0.5	6452.	5220.	7777.	2368.	670.	11.21	1.76	113365.	8.	22911.	10295.
18.0	0.0	6331.	5191.	7815.	2368.	661.	10.83	1.74	109735.	8.	22188.	10019.
19.0	0.5	6211.	5133.	7738.	2387.	654.	10.83	1.74	105516.	8.	21484.	9733.
20.0	1.0	6030.	5133.	7738.	2387.	652.	10.64	1.72	101197.	8.	20764.	9437.
21.0	1.0	5970.	5104.	7777.	2387.	649.	10.26	1.70	99627.	6.	20042.	9138.
22.0	0.5	5789.	5133.	7738.	2406.	640.	10.26	1.70	95898.	5.	19484.	8898.
23.0	0.5	5668.	5075.	7738.	2406.	636.	10.07	1.69	92659.	3.	18934.	8661.
24.0	0.5	5608.	5046.	7700.	2406.	631.	9.88	1.67	92069.	1.	18510.	8481.
25.0	1.0	5427.	5017.	7700.	2406.	629.	9.69	1.66	88830.	-1.	18293.	8368.
26.0	0.5	5548.	5046.	7661.	2406.	631.	9.50	1.65	90400.	-3.	18272.	8345.
27.0	0.5	5789.	5017.	7661.	2387.	631.	9.69	1.66	91380.	-6.	18340.	8362.
28.0	0.0	5789.	5017.	7700.	2387.	636.	9.69	1.66	93439.	-7.	18713.	8505.
29.0	0.0	5909.	5046.	7700.	2387.	640.	9.88	1.67	95499.	-9.	19141.	8657.
30.0	0.5	6090.	5104.	7738.	2368.	645.	10.26	1.70	98539.	-11.	19607.	8839.
31.0	0.0	6271.	5133.	7738.	2348.	652.	10.45	1.71	102368.	-11.	20195.	9045.
32.0	-0.5	6331.	5104.	7777.	2348.	649.	10.64	1.72	103838.	-10.	20848.	9292.
33.0	-0.5	6392.	5104.	7738.	2310.	666.	10.64	1.72	108057.	-10.	21452.	9529.
34.0	0.0	6693.	5162.	7777.	2329.	668.	11.02	1.75	111296.	-7.	22055.	9765.
35.0	0.0	6754.	5220.	7815.	2329.	677.	11.02	1.75	113556.	-5.	22624.	9984.
36.0	-0.5	6814.	5220.	7777.	2310.	675.	11.21	1.76	115615.	-2.	23024.	10161.
37.0	0.0	6874.	5220.	7777.	2310.	679.	11.40	1.78	116695.	0.	23278.	10273.
38.0	1.0	6754.	5220.	7815.	2310.	679.	11.59	1.79	116695.	3.	23416.	10350.
39.0	-0.5	6633.	5191.	7815.	2329.	677.	11.40	1.78	116305.	5.	23390.	10356.
40.0	0.5	6693.	5191.	7815.	2348.	677.	11.40	1.78	115225.	6.	23198.	10305.
41.0	-0.5	6573.	5162.	7777.	2329.	670.	11.21	1.76	113655.	5.	22885.	10216.
42.0	-0.5	6331.	5191.	7738.	2348.	666.	10.83	1.74	111496.	6.	22529.	10074.
43.0	-1.0	6452.	5162.	7815.	2368.	663.	10.83	1.74	109336.	5.	22326.	9983.
44.0	-1.0	6331.	5104.	7777.	2348.	663.	10.83	1.74	107177.	3.	22062.	9892.

TEST LC-4, LOAD TORQUE CHANGE (OPEN LOOP), CONSTANT THROTTLE AT 10,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SQIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	66.2	6452.	5075.	7777.	2560.	661.	11.40	1.78	103738.	C.	20859.	10270.
1.0	67.2	6573.	5104.	7777.	2599.	663.	11.40	1.78	103738.	C.	20866.	10286.
2.0	67.2	6573.	5104.	7777.	2599.	663.	11.40	1.78	103738.	-2.	20875.	10283.
3.0	67.2	6573.	5075.	7815.	2599.	666.	11.40	1.78	103738.	-5.	20951.	10321.
4.0	67.2	6573.	5075.	7777.	2579.	661.	11.40	1.78	105308.	-10.	21016.	10307.
5.0	67.2	6573.	5075.	7815.	2560.	663.	11.59	1.79	107368.	-15.	21154.	10312.
6.0	67.2	6452.	5104.	7815.	2541.	663.	11.40	1.78	108348.	-21.	21367.	10322.
7.0	67.2	6573.	5104.	7815.	2522.	663.	11.59	1.79	110017.	-24.	21569.	10309.
8.0	67.2	6633.	5133.	7815.	2483.	666.	11.40	1.78	112077.	-27.	21668.	10245.
9.0	67.2	6573.	5075.	7815.	2445.	666.	11.40	1.78	112077.	-26.	21816.	10203.
10.0	67.2	6512.	5104.	7815.	2425.	663.	11.40	1.78	111587.	-23.	21950.	10137.
11.0	67.2	6573.	5133.	7815.	2406.	663.	11.40	1.78	111587.	-18.	21996.	10078.
12.0	67.2	6573.	5133.	7815.	2368.	663.	11.21	1.76	111587.	-12.	22034.	10046.
13.0	67.2	6512.	5075.	7815.	2397.	663.	11.40	1.78	110607.	-3.	22098.	10060.
14.0	67.2	6512.	5133.	7815.	2387.	666.	11.40	1.78	109527.	4.	22051.	10054.
15.0	67.2	6573.	5104.	7815.	2406.	663.	11.40	1.78	107957.	E.	21903.	10051.
16.0	67.2	6573.	5133.	7815.	2425.	663.	11.40	1.78	106487.	11.	21716.	10029.
17.0	67.7	6573.	5104.	7815.	2445.	663.	11.40	1.78	105507.	13.	21618.	10023.
18.0	67.2	6573.	5075.	7815.	2464.	663.	11.21	1.76	104428.	12.	21471.	9994.

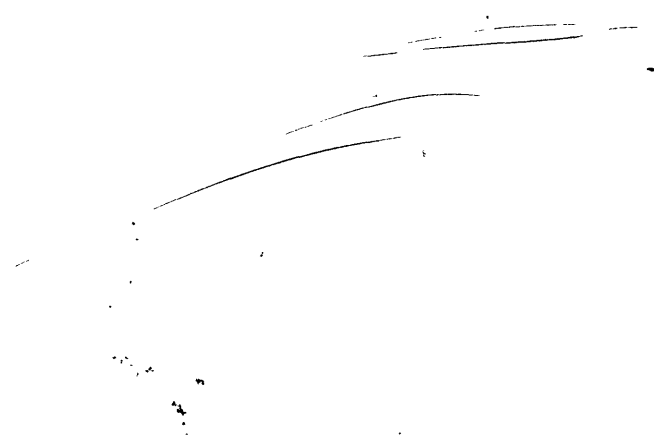
TEST LC-5, LOAD TORQUE CHANGE (CLOSED LOOP), CONSTANT THROTTLE AT 20,000 H.P.

T (SEC)	L (%)	WF (LB/HR)	N1 (RPM)	N2 (RPM)	N3 (RPM)	TT7 (DEGF)	PT7 (LB/SQIN)	EPR	QL (LB-FT)	N3DOT (RPM/S)	QE (LB-FT)	PENG (HP)
0.0	41.0	10492.	6061.	8508.	2945.	856.	17.67	2.20	166654.	C.	33614.	18932.
1.0	40.5	10552.	6061.	8508.	2964.	861.	17.67	2.20	166654.	-1.	33716.	18969.
2.0	40.5	10673.	6061.	8508.	2964.	856.	18.05	2.23	168224.	-2.	33890.	19055.
3.0	40.5	10673.	6090.	8547.	2945.	868.	18.05	2.23	169794.	-3.	34214.	19237.
4.0	40.5	10975.	6119.	8547.	2945.	877.	18.24	2.24	172443.	-3.	34720.	19496.
5.0	40.5	11336.	6177.	8585.	2945.	884.	18.43	2.25	175583.	-4.	35268.	19752.
6.0	40.5	11517.	6206.	8585.	2945.	898.	18.81	2.28	179312.	-3.	35866.	20060.
7.0	40.5	11638.	6235.	8585.	2926.	902.	19.00	2.29	182061.	-2.	36357.	20308.
8.0	40.5	11699.	6264.	8585.	2926.	902.	19.19	2.31	184221.	-1.	36700.	20527.
9.0	40.5	11758.	6264.	8585.	2926.	902.	19.38	2.32	184221.	1.	36790.	20578.
10.0	41.0	11579.	6293.	8624.	2964.	902.	19.38	2.32	183241.	2.	36640.	20494.
11.0	40.5	11457.	6206.	8508.	2945.	891.	18.81	2.28	180691.	1.	36179.	20262.
12.0	40.0	11095.	6177.	8547.	2926.	884.	18.62	2.27	177452.	C.	35688.	20013.
13.0	39.5	10914.	6119.	8508.	2945.	882.	18.24	2.24	173623.	C.	35167.	19695.
14.0	40.0	10854.	6119.	8508.	2945.	877.	18.24	2.24	172443.	-1.	34678.	19396.
15.0	40.0	10733.	6090.	8508.	2945.	868.	17.86	2.21	170284.	-3.	34247.	19155.
16.0	40.0	10613.	6090.	8508.	2926.	863.	17.86	2.21	169204.	-2.	34104.	19062.
17.0	40.0	10552.	6032.	8470.	2926.	861.	17.86	2.21	167534.	-2.	33943.	18952.

Appendix B

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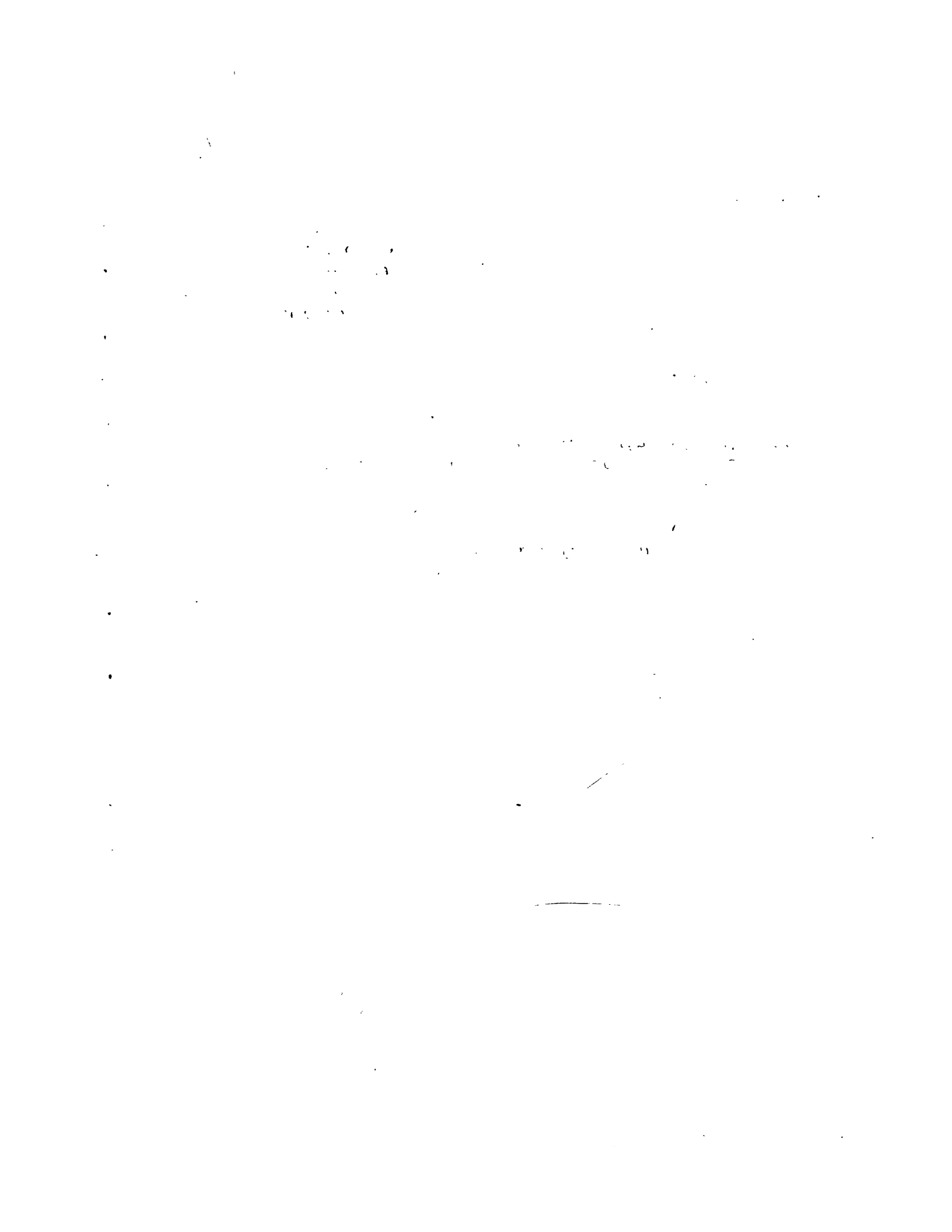


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This report presents the results of transient tests on a 25,000 horsepower marine gas-turbine engine. The Pratt & Whitney FT4A-2 was used for the tests because of its availability at the engine-test installation at the Philadelphia Division, Naval Ship Engineering Center. Engine loading was accomplished by a water brake with power levels ranging from zero to 23,000 horsepower. Throttle commands consisted of step changes and triangular throttle pulses at several power levels for the engine with an operational speed governor and with the governor disabled. Several load torque variations at various power levels with a constant throttle setting were also performed. The eight parameters recorded as a function of time during the transient tests are: throttle lever position, fuel flow rate, low-pressure compressor speed, high-pressure compressor speed, engine (free turbine) speed, gas generator discharge total temperature, gas generator discharge total pressure, and load torque. From these data the following additional data were computed in 0.1 second time intervals: engine pressure ratio, engine acceleration, engine torque, and engine power.

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14.

KEY WORDS

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 Temperatures
 Controls
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 Moments of Inertia

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<p>1. Engines 2.. Gas Turbines 3. Testing 4. Transient Tests I. Rubis, C. J. II. Title.... III. Report 3064</p>	<p>1. Engines 2. Gas Turbines 3. Testing 4. Transient Tests I. Rubis, C. J. II. Title.... III. Report 3064</p>
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