Power Turbine Repair Meeting Agenda

- Project Description
- LM5000 Design
- New Source Review Criteria
  - Nature
  - Extent
  - Purpose
  - Frequency
  - Cost
- Conclusion

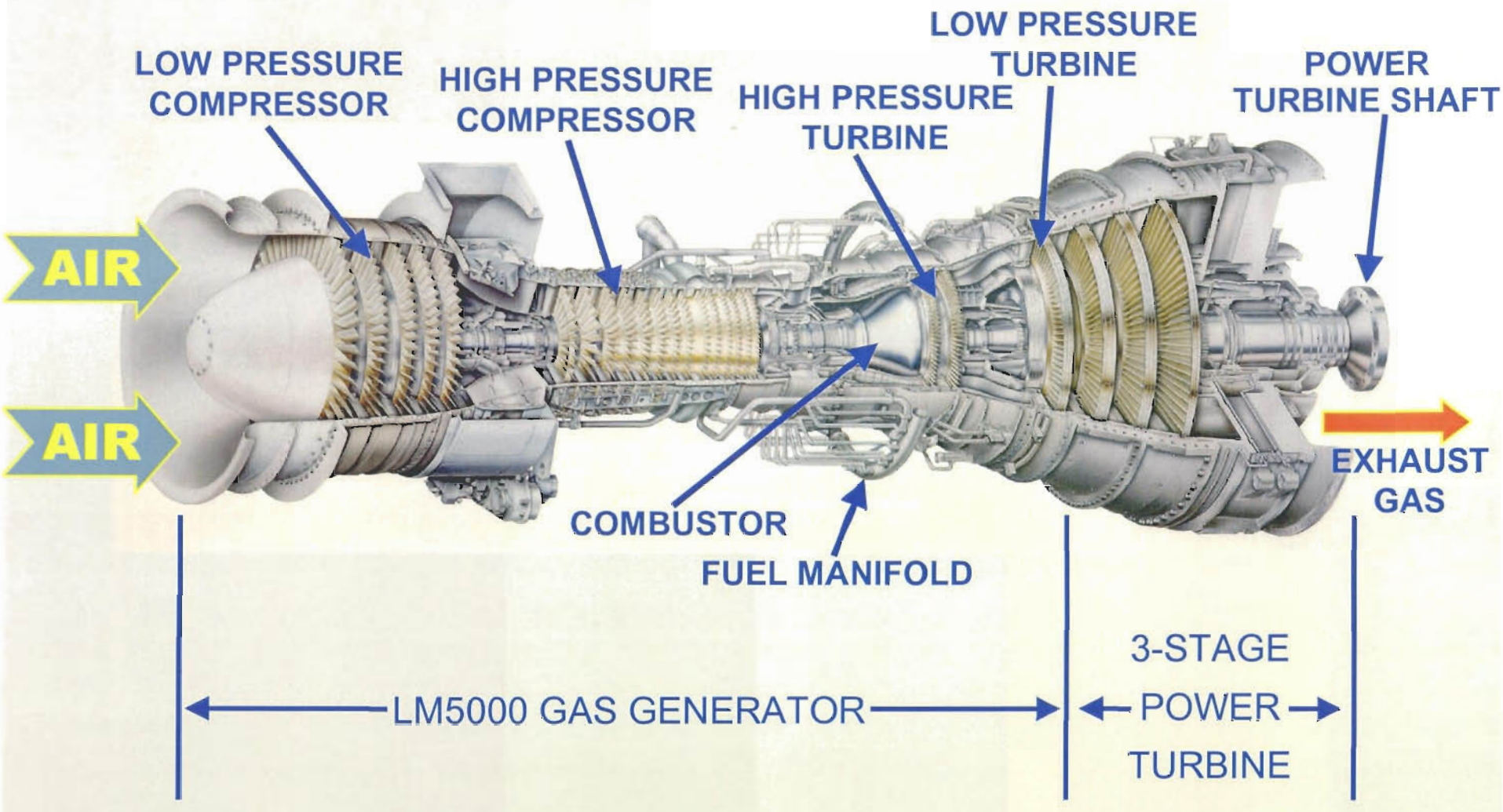
Reedy Creek Improvement District
November 16, 2000

Project Description

- Power Turbine Oil Contamination - September 28, 2000
  - Probable Cause: Seal/Liner Failure
  - Probable Bearing Damage
  - Repairs Require Maintenance Depot Overhaul
- Decision to Exchange Power Turbine - Early October
- Exchange Completed November 9
- Startup Test Scheduled for November 20

Component Failure Required Maintenance Action

LM5000 Gas Turbine Generator Configuration and Design



LM5000 Gas Turbine Generator Configuration and Design

- Designed for Modularity
  - Lightweight

"...The design features of modern aircraft derivative turbines in conjunction with maintenance oriented packaging techniques help owners achieve unit availability of 95 - 97 percent...In the event of a serious engine failure, the owner of the LM5000 package has a fallback position of complete engine removal and replacement. A lease engine can be installed and online within 48 hours and customer's operations can return to normal while the engine is being repaired ..."

1987 Stewart and Stevenson bid proposal

LM5000 Gas Turbine Generator Configuration and Design

- Designed for Modularity
  - Lightweight
  - Small Size


TRAILERS
317 477 3411
OCT 20 2000


BRODERSON
OCT 20 2000

LM5000 Gas Turbine Generator Configuration and Design

- Designed for Modularity
  - Lightweight
  - Small Size
- On-site Repairs Not Possible

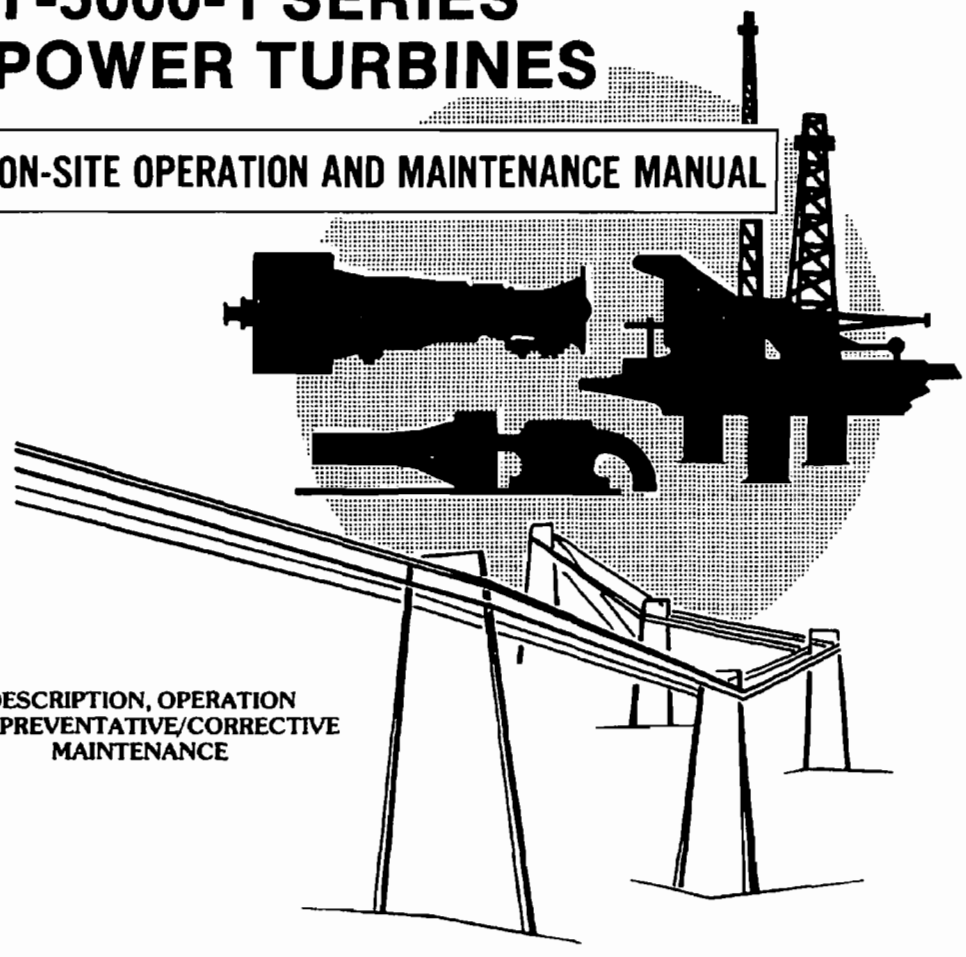
GEK 95450
NOVEMBER 1985

MARINE AND INDUSTRIAL ENGINE DIVISION

INDUSTRIAL GAS TURBINES

T-5000-1 SERIES POWER TURBINES

ON-SITE OPERATION AND MAINTENANCE MANUAL



DESCRIPTION, OPERATION
AND PREVENTATIVE/CORRECTIVE
MAINTENANCE

GENERAL ELECTRIC

"CHAPTER I: INTRODUCTION

1-1. GENERAL INFORMATION

1-1.1. Purpose and Scope of Technical Manual. This manual is to be used for on-site installation, operation and maintenance of the T-5000-1 Power Turbine designed by the General Electric Company…**This manual contains all authorized maintenance tasks that may be performed on-site**…"

Source: T-5000-1 Series Power Turbines On-Site Operation and Maintenance Manual, GEK 95450, November 1985

"CHAPTER VI: CORRECTIVE MAINTENANCE

6-1.2. Levels of Maintenance

Level 1 maintenance tasks cover all work on the exterior of the installed power turbine plus scheduled inspections, cleaning (water wash) and removal/replacement of the power turbine, accelerometer, speed transducer and the lube pump."

Source: T-5000-1 Series Power Turbines On-Site Operation and Maintenance Manual, GEK 95450, November 1985

LM5000 Power Turbine Configuration and Design

- Designed for Modularity
  - Lightweight
  - Small Size
- On-site Repairs Not Possible
- Maintenance Decision - 2 Options
  - Repair Failed Power Turbine at Depot
  - Install Depot-reconditioned ("Exchange") Power Turbine

By Design, Exchange = Repair

Nature of Project

Routine component maintenance at 73,000 hours

- General Electric Recommends Depot Overhaul at 50,000 hours
  - Maintenance Interval Determined by Actual Conditions
  - Most Users Get More Than 50K hours
  - Exchange Power Turbine Program Reflects This Approach
- PT exchange is with exact duplicate
- Exchange required three weeks
- Work was performed with plant operation and maintenance staff

Not an Upgrade - a Repair

Extent of Project
Single Component Maintenance

- Power Turbine Is Only One Part of the Emissions Unit
- PT Does Not, in Itself, Create Any Emissions
- Exchange Took Only Three Weeks to Complete
- No Additional Parts Needed for This Work
- Exchange PT Is Exact Duplicate of Original

Repair Limited to a Single Component

Purpose of Project

Maintenance of a failed component

- Repair Broken Parts to Return Unit to Service
- Unit Needs to Return to Service for Economic and Operational Reasons
- Operational Needs Include Requirement for Steam for District Cooling and District Heating
- No Changes to the Emissions Unit's Fuel Consumption, Hours of Operation, Emissions, Efficiency, or Power Output
- No Additional Life Expectancy for the Emission Unit Will Result From This Maintenance Activity

Keep Plant Operating in Its Present Condition

Frequency of Project

Repair/Exchange is Frequent and Expected

- Repair/Exchange of a Power Turbine Is Expected Every 50,000 Hours by General Electric's Design Criteria
- Some Units Have Gone in Excess of 50,000 Hours Before Overhaul
- GE Established a Power Turbine Exchange Program Due to Fleet's PT Hours Increasing to >50,000 Hours
- In a Plant Life Anticipated to Be a Minimum of 20 Years, With 95% Availability, a PT Overhaul Can Be Expected Every 6 Years

Repair Frequency Consistent With Design Life

Cost of Project

	Option	
	Exchange	Repair
Exchange PT	$1.9 M	-------
Core Credit	$0.8 M	-------
Repair	-------	$0.9 M
Effective Cost	$1.1 M	$0.9 M
Plant Replacement Cost	$45 M	
Percent	2.4%	2.0%

Costs are Modest in Absolute and Relative Terms

Conclusion

- Power Turbine Failure Necessitated Repair
- Design Is Modular, Intended for Component Replacement
- Design Life ~ 50,000 Hours
- Exchange vs. Repair an Engineering Economic Decision
- No Performance Changes Will Result
- Cost Is 2.4% of Plant Replacement Cost
- Funded From Operating Expense Budget--Not Capital
- All Work Was Performed by Plant Operating/Maintenance Staff

Power Turbine Repair/Exchange is Routine