FIELD MANUAL
NO 1-506

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 30 November 1990

FUNDAMENTALS OF AIRCRAFT POWER PLANTS

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*This publication supersedes FM 1-506, 21 December 1984.

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PREFACE

This manual provides information on the operation, components, and systems of aircraft power plants. The turbine engine is relatively new to the aviation field and its technology is growing rapidly. This manual will bring users up-to-date on new developments in the field.

Propellers have been deleted from this manual since the Army no longer works on them.

This manual is for use by Army aviation mechanics worldwide.

For specific instructions on the aircraft power plants in particular types and models of aircraft, refer to applicable maintenance manuals. Should the information in this field manual and that in a specific aircraft maintenance manual conflict, the latter takes precedence.

The proponent of this publication is HQ TRADOC. Submit changes for improving this publication on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward it to Assistant Commandant, US Army Aviation Logistics School, ATTN ATSQ-LTD-L, Fort Eustis, Virginia 23604-5421.

Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

PART ONE. FUNDAMENTALS OF POWER PLANTS

CHAPTER 1

BASIC REQUIREMENTS

Aircraft power plants must meet exacting requirements for dependability and endurance. Many difficult engineering problems have been overcome in an effort to satisfy these requirements with further advances being made each day. Requirements imposed on aircraft power plants in an effort to obtain engines suitable for aircraft include –

- Reliabtity.
- Durability.
- Compactness.
- Low weight per horsepower.
- High specific power output.
- Reasonable cost.
- High thermal efficiency.
- Freedom from vibration.
- Ease of maintenance.
- Operating flexibility.

DEFINITION OF TERMS

Reliability

Reliability is the most important fundamental power plant requirement. In the air each working part, no matter how small is important. Only by careful attention to the smallest detail can aircraft power plant manufacturers and mechanics assure power plant reliability.

Durability

Durability is the measure of reliable engine life. The durability realized by an engine depends largely on the type or condition of operation. Intelligent application of operation and maintenance procedures results in greatly improved power plant durability.

Compactness

Compactness is essential to power plant design in order to lower parasitic drag and to attain higher speeds. The overall form an engine takes is determined to a high degree by the compactness required. The degree of compactness that may be achieved is limited by the physical requirements of the engine. For example, compactness is limited on radial air-cooled engines duet to the frontal area required for sufficient cooling of engine cylinders.

Low Weight per Horsepower

Minimum weight per horsepower (HP) is a primary requirement in aeronautics. The weight of a power plant must be kept as low as possible. This allows the aircraft to carry a large useful load with a satisfactory margin of safety in proportion to gross weight. The larger modern aircraft reciprocating engines have attained a horsepower-to-weight ratio of 1 horsepower to 1 pound weight. Gas turbine engines currently used by the Army have a greater horsepower-to-weight ratio. A good example is the T-55-L-712, which develops 4500 shaft horsepower (SHP) and weighs 750 pounds(dry) (6.0 HP per pound).

High Specific Power Output

Power output is based on engine size, RPM, and weight for the fuel-air mixture. Size and RPM are limited in the reciprocating engine. Therefore, an increase in the effective working pressure in the cylinders is one of the most valuable ways to increase the specific power output. Greater pressure increases are possible by supercharging the engine (comprising the mixture before it enters the cylinders). The limiting factors in increasing cylinder pressure are resistance of the fuel to detonation and the maximum allowable cylinder pressure.

Reasonable Cost

Despite perfection of design and quality of workmanship, no power plant will be desirable if it is too costly in a competitive market. A primary factor determining the usefulness of an engine is its cost. Because of