EROSION OF PROPELLER BLADES FOR TURBOPROP ENGINES

By

Eng.: Mohamed Badr Saad Farghaly

A Thesis Submitted To The
Faculty of Engineering at Cairo University
In Partial Fulfillment Of The
Requirement for the Degree Of
MASTER OF SCIENCE
In
AEROSPACE ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2012

EROSION OF PROPELLER BLADES FOR TURBOPROP ENGINES

By

Eng.: Mohamed Badr Saad Farghaly

A Thesis Submitted To The
Faculty of Engineering at Cairo University
In Partial Fulfillment Of The
Requirement for The Degree Of
MASTER OF SCIENCE
In
AEROSPACE ENGINEERING

Under the Supervision of

Dr. Ahmed F. Abdel Azim El-Sayed,

Professor, Mechanical Power Department
Faculty of Engineering
Zagazig University, Egypt.

Dr. Galal B. Salem,

Professor, Aerospace Department
Faculty of Engineering
Cairo University, Egypt

Dr. Hesham M. El-Banna

Assistant Professor, Aerospace Department
Faculty of Engineering
Cairo University, Egypt

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT

2012

EROSION OF PROPELLER BLADES FOR TURBOPROP ENGINES

By

Eng.: Mohamed Badr Saad Farghaly

A Thesis Submitted To the Faculty of Engineering at Cairo University in
Partial Fulfillment of the Requirement for the Degree Of
MASTER OF SCIENCE
In
AEROSPACE ENGINEERING

Approved by the Examining committee

Prof. Dr. Nabil H. Mostafa External Examiner
Professor, Mechanical Power Department
Faculty of Engineering, Zagazig University, Egypt.

Prof. Dr. Ibrahim M. Shabaka Internal Examiner
Professor, Aerospace Department
Faculty of Engineering, Cairo University, Egypt

Prof. Dr. Ahmed F. Abdel Azim El-Sayed, Thesis Main Advisor
Professor, Mechanical Power Department
Faculty of Engineering, Zagazig University, Egypt.

Prof. Dr. Galal B Salem Thesis Main Advisor
Professor, Aerospace Department
Faculty of Engineering, Cairo University, Egypt

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2012

Abstract

The main purpose of this work has been to study the dynamic behavior of solid particles entrained by subsonic air flow on propeller blades that causes the erosion phenomenon. The effects of the particle size, impact location, and initial particle velocity on its trajectory are discussed. The erosion rate model is constructed by creating C++ program subroutine which is combined to FLUENT ® main program and consequently predicts the erosion rate, penetration rate, and impact frequency. Finally the blade life time is estimated.