1. Record Nr. UNINA9910678174803321

Autore	Gregory James W.
Titolo	Introduction to flight testing / / James W. Gregory, Tianshu Liu
Pubbl/distr/stampa	Hoboken, New Jersey : , : Wiley, , [2021] ©2021
ISBN	1-118-94980-3 1-118-94979-X 1-118-94981-1
Edizione	[First edition.]
Descrizione fisica	1 online resource (355 pages)
Collana	Aerospace
Disciplina	629.13453
Soggetti	Airplanes - Flight testing
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- About the Authors -- Series Preface -- Preface -- Acknowledgements -- About the Companion Website -- Chapter 1 Introduction -- 1.1 Case Study: Supersonic Flight in the Bell XS1 -- 1.2 Types of Flight Testing -- 1.2.1 Scientific Research -- 1.2.2 Experimental Flight Test -- 1.2.3 Developmental Test and Evaluation -- 1.2.4 Operational Test and Evaluation -- 1.2.5 Airworthiness Certification -- 1.3 Objectives and Organization of this Book -- References -- Chapter 2 The Flight Environment: Standard Atmosphere -- 2.1 Earth's Atmosphere -- 2.2 Standard Atmosphere Model -- 2.2.1 Hydrostatics -- 2.2.2 Gravitational Acceleration and Altitude Definitions -- 2.2.3 Temperature -- 2.2.4 Viscosity -- 2.2.5 Pressure and Density -- 2.2.6 Operationalizing the Standard Atmosphere -- 2.2.7 Comparison with Experimental Data -- 2.3 Altitudes Used in Aviation -- References -- Chapter 3 Aircraft and Flight Test Instrumentation -- 3.1 Traditional Cockpit Instruments -- 3.1.1 GyroscopicBased Instruments -- 3.1.2 PressureBased Instruments -- 3.1.3 Outside Air Temperature -- 3.1.4 Other Instrumentation -- 3.2 Glass Cockpit Instruments -- 3.3 Flight Test Instrumentation -- 3.3.1 Global Navigation Satellite System -- 3.3.2 Accelerometers -- 3.3.3 Gyroscopes -- 3.3.4 Magnetometers -- 3.3.5 Barometer -- 3.3.6 Fusion of Sensor Data Streams -- 3.4

Summary -- References -- Chapter 4 Data Acquisition and Analysis -- 4.1 Temporal and Spectral Analysis -- 4.2 Filtering -- 4.3 Digital Sampling: Bit Depth Resolution and Sample Rate -- 4.4 Aliasing -- 4.5 Flight Testing Example -- 4.6 Summary -- References -- Chapter 5 Uncertainty Analysis -- 5.1 Error Theory -- 5.1.1 Types of Errors -- 5.1.2 Statistics of Random Error -- 5.1.3 Sensitivity Analysis and Uncertainty Propagation -- 5.1.4 Overall Uncertainty Estimate.
5.1.5 Chauvenet's Criterion for Outliers -- 5.1.6 Monte Carlo Simulation -- 5.2 Basic Error Sources in Flight Testing -- 5.2.1 Uncertainty of Flight Test Instrumentation -- 5.2.2 Example: Uncertainty in Density (Traditional Approach) -- 5.2.3 Example: Uncertainty in True Airspeed (Monte Carlo Approach) -- References -- Chapter 6 Flight Test Planning -- 6.1 Flight Test Process -- 6.2 Risk Management -- 6.3 Case Study: Accept No Unnecessary Risk -- 6.4 Individual Flight Planning -- 6.4.1 Flight Area and Airspace -- 6.4.2 Weather and NOTAMs -- 6.4.3 Weight and Balance -- 6.4.4 Airplane PreFlight -- 6.5 Conclusion -- References -- Chapter 7 Drag Polar Measurement in Level Flight -- 7.1 Theory -- 7.1.1 Drag Polar and Power Required for Level Flight -- 7.1.2 The PIW-VIW Method -- 7.1.3 Internal Combustion Engine Performance Additional details are available in an online supplement, "Basic Performance Prediction of Internal Combustion Engines." -- 7.1.4 Propeller Performance -- 7.2 Flight Testing Procedures -- 7.3 Flight Test Example: Cirrus SR20 -- References -- Chapter 8 Airspeed Calibration -- 8.1 Theory -- 8.1.1 True Airspeed -- 8.1.2 Equivalent Airspeed -- 8.1.3 Calibrated Airspeed -- 8.1.4 Indicated Airspeed -- 8.1.5 Summary -- 8.2 Measurement Errors -- 8.2.1 Instrument Error -- 8.2.2 System Lag -- 8.2.3 Position Error -- 8.3 Airspeed Calibration Methods -- 8.3.1 BoomMounted Probes -- 8.3.2 Trailing Devices and Pacer Aircraft -- 8.3.3 GroundBased Methods -- 8.3.4 Global Positioning System Method -- 8.4 Flight Testing Procedures -- 8.5 Flight Test Example: Cirrus SR20 -- References -- Chapter 9 Climb Performance and Level Acceleration to Measure Excess Power -- 9.1 Theory -- 9.1.1 Steady Climbs -- 9.1.2 Energy Methods -- 9.2 Flight Testing Procedures -- 9.2.1 Direct Measurement of Rate of Climb -- 9.2.2 Measurement of Level Acceleration.
9.3 Data Analysis -- 9.4 Flight Test Example: Cirrus SR20 -- References -- Chapter 10 Glide Speed and Distance -- 10.1 Theory -- 10.1.1 Drag Polar -- 10.1.2 Gliding Flight -- 10.1.3 Glide Hodograph -- 10.1.4 Best Glide Condition -- 10.2 Flight Testing Procedures -- 10.3 Data Analysis -- 10.4 Flight Test Example: Cirrus SR20 -- References -- Chapter 11 Takeoff and Landing -- 11.1 Theory -- 11.1.1 Takeoff Ground Roll -- 11.1.2 Landing Ground Roll -- 11.1.3 Rotation Distance -- 11.1.4 Transition Distance -- 11.1.5 Climb Distance -- 11.1.6 Total Takeoff and Landing Distances -- 11.1.7 Simple Estimations -- 11.2 Measurement Methods -- 11.3 Flight Testing Procedures -- 11.3.1 Standard Flight Procedures -- 11.3.2 Flight Test Procedures -- 11.3.3 Data Acquisition -- 11.3.4 Data Analysis -- 11.4 Flight Test Example: Cessna R182 -- References -- Chapter 12 Stall Speed -- 12.1 Theory -- 12.1.1 Viscous Boundary Layers -- 12.1.2 Flow Separation -- 12.1.3 TwoDimensional Stall Characteristics -- 12.1.4 ThreeDimensional Stall Characteristics -- 12.1.5 Stall Control -- 12.1.6 Stall Prediction -- 12.2 Flight Testing Procedures -- 12.2.1 Flight Characteristics -- 12.2.2 Data Acquisition -- 12.3 Data Analysis -- 12.4 Flight Test Example: Cirrus SR20 -- References -- Chapter 13 Turning Flight -- 13.1 Theory -- 13.2 Flight Testing Procedures -- 13.2.1 Airworthiness Certification -- 13.2.2 Educational Flight Testing -- 13.2.3 Piloting -- 13.2.4 Instrumentation

and Data Recording -- 13.3 Flight Test Example: Diamond DA40 -- References -- Chapter 14 Longitudinal Stability -- 14.1 Static Longitudinal Stability -- 14.1.1 Theory -- 14.1.2 Trim Condition -- 14.1.3 Flight Testing Procedures -- 14.1.4 Flight Test Example: Cirrus SR20 -- 14.2 Dynamic Longitudinal Stability -- 14.2.1 Theory -- 14.2.2 Flight Testing Procedures -- 14.2.3 Flight Test Example: Cirrus SR20.
References -- Chapter 15 LateralDirectional Stability -- 15.1 Static LateralDirectional Stability -- 15.1.1 Theory -- 15.1.2 Directional Stability -- 15.1.3 Lateral Stability -- 15.1.4 Flight Testing Procedures -- 15.1.5 Flight Testing Example: Cirrus SR20 -- 15.2 Dynamic Lateral Directional Stability -- 15.2.1 Theory -- 15.2.2 Flight Testing Procedures -- 15.2.3 Flight Test Example: Cirrus SR20 -- Nomenclature -- Acronyms and Abbreviations -- References -- Chapter 16 UAV Flight Testing1 -- 16.1 Overview of Unmanned Aircraft -- 16.2 UAV Design Principles and Features -- 16.2.1 Types of Airframes -- 16.2.2 UAV System Architecture -- 16.2.3 Electric Propulsion -- 16.2.4 Command and Control (C2) Link -- 16.2.5 Autonomy -- 16.3 Flight Regulations -- 16.4 Flight Testing Principles -- 16.4.1 Air Data Instrumentation -- 16.4.2 UAV Flight Test Planning -- 16.4.3 Piloting for UAV Flight Testing -- 16.5 Flight Testing Examples with the Peregrine UAS -- 16.5.1 Overview of the Peregrine UAS -- 16.5.2 Propulsion System Characterization -- 16.5.3 Specific Excess Power: Level Acceleration and Rate of Climb -- 16.5.4 Glide Flight Tests -- 16.6 Flight Testing Examples with the Avanti UAS -- 16.6.1 Overview of the Avanti UAS -- 16.6.2 CoastDown Testing for the Drag Polar -- 16.6.3 Radio Range Testing -- 16.6.4 Assessment of Autonomous System Performance -- 16.7 Conclusion -- References -- Appendix A Standard Atmosphere Tables -- Appendix B Useful Constants and Unit Conversion Factors -- Reference -- Appendix C Stability and Control Derivatives for a Notional GA Aircraft -- Reference -- Index -- EULA.

Sommario/riassunto

Introduction to Flight Testing provides a concise introduction to the basic flight testing methods employed on general aviation aircraft and unmanned aerial vehicles for courses in aeronautical engineering. There is particular emphasis on the use of modern on-board instruments and inexpensive, off-the-shelf portable devices that make flight testing accessible to nearly any student.