Contents

	Page
Executive Summary	**iii**
Synthèse	**iv**
Preface	**viii**
Foreword/Acknowledgements	**ix**
List of Figures	**x**
List of Tables	**xi**
List of Data Cards	**xii**
Acronyms, Symbols and Abbreviations	**xiv**
1.0. INTRODUCTION	**1**
2.0. AIR-TO-AIR AND AIR-TO-GROUND RADAR SYSTEMS TESTING	**4**
2.1. INTRODUCTION TO RADAR THEORY	**4**
2.1.1. General	4
2.1.2. Pulsed Radars	4
2.1.3. Doppler Radars	9
2.1.4. Pulse Doppler Radars	10
2.1.5. Advanced Techniques	11
2.1.5.1. Pulse Compression	11
2.1.5.2. Doppler Beam Sharpening	11
2.1.5.3. FM Ranging	12
2.1.6. Displays	12
2.1.7. Analog Versus Digital Displays	13
2.1.8. Radar Tracking	13
2.1.9. Missions	15
2.1.10. Radar Systems Human Factors	15
2.1.11. The Sample Radar System	16
2.2. AIR-TO-AIR AND AIR-TO-GROUND RADAR TEST TECHNIQUES	**16**
2.2.1. Preflight and Built-in-Tests	16
2.2.2. Controls and Displays	20
2.3. AIR-TO-AIR RADAR TEST TECHNIQUES	**25**
2.3.1. Scan Rate	25
2.3.2. Scan Angle Limits	27
2.3.3. Elevation Angle Limits	29
2.3.4. Tracking Rate Limits	32
2.3.5. Antenna Stabilization Limits	34
2.3.6. Minimum Range	38
2.3.7. Range and Bearing Accuracy	40
2.3.8. Range and Bearing Resolution	43
2.3.9. Maximum Detection Range	46
2.3.10. Maximum Unambiguous Range	49
2.3.11. Maximum Acquisition Range	51
2.3.12. Blind Ranges	53
2.3.13. Groundspeed/Course/Altitude Accuracy	55
2.3.14. Velocity Resolution	62
2.3.15. Blind Speeds	64
2.3.16. Air Combat Modes	68
2.3.17. False Alarm Rate	70
2.3.18. Track File Capacity	73
2.3.19. Mission Utility and Integration	75
2.3.20. Introduction to Advanced Air-to-Air Radar Test Techniques	78

2.4. AIR-TO-GROUND RADAR TEST TECHNIQUES **82**
2.4.1. Scan Rate 82
2.4.2. Scan Angle Limits 85
2.4.3. Elevation Angle Limits 88
2.4.4. Antenna Stabilization Limits 90
2.4.5. Minimum Range 94
2.4.6. Doppler Beam Sharpened Notch Width 96
2.4.7. Range and Bearing Accuracy 98
2.4.8. Range and Bearing Resolution 101
2.4.9. Maximum Detection Range 108
2.4.10. Mapping Quality and Consistency 111
2.4.11. Mission Utility and Integration 113
2.4.12. Introduction to Advanced Air-to-Ground Radar Test Techniques 115

3.0. AIRBORNE NAVIGATION SYSTEMS TESTING **118**

3.1. INTRODUCTION TO NAVIGATION THEORY **118**
3.1.1. General 118
3.1.2. Inertial Navigation Systems 119
3.1.3. OMEGA 123
3.1.4 Tactical Air Navigation 126
3.1.5. Missions 127
3.1.6. Navigation System Human Factors 128
3.1.7. The Flyover Method 128

3.2. NAVIGATION SYSTEMS TEST TECHNIQUES **129**
3.2.1. Preflight and Built in Tests 129
3.2.2. Controls and Displays 133

3.3 INERTIAL NAVIGATION SYSTEMS TEST TECHNIQUES **138**
3.3.1. Initialization and Alignment 138
3.3.2. Static Position Accuracy 143
3.3.3. Dynamic Non-maneuvering Position Accuracy 145
3.3.4. Dynamic Maneuvering Position Accuracy 151
3.3.5. Dynamic Update Performance 158
3.3.6. Mission Utility and Integration 163
3.3.7. Introduction to Advanced Inertial Navigation System Test Techniques 166

3.4. OMEGA NAVIGATION SYSTEM TEST TECHNIQUES **169**
3.4.1. Initialization 169
3.4.2. Dynamic Position Accuracy 172
3.4.3. Lane Ambiguity Resolution 178
3.4.4. Mission Utility and Integration 180
3.4.5. Introduction to Advanced OMEGA Navigation System Test Techniques 182

3.5 COUPLED GLOBAL POSITIONING SYSTEM/INERTIAL NAVIGATION SYSTEM **184**
3.5.1. General 184
3.5.2. Space Segment 184
3.5.3. Control Segment 184
3.5.4. User Segment 184
3.5.5. Selective Availability 185
3.5.6. Accuracies 185
3.5.7. Precise Space Positioning Instrumentation 187
3.5.8. Sample System 187

3.6 GLOBAL POSITIONING SYSTEM TEST TECHNIQUES **188**
3.6.1. Initialization and Alignment 188
3.6.2. Static Position Accuracy 204
3.6.3. Dynamic Non-maneuvering Position Accuracy 206
3.6.4. Dynamic Maneuvering Position Accuracy 212
3.6.5. Navigation Performance in Overwater/Multipath Environment 219
3.6.6. Mission Utility and Integration 222
3.6.7. Introduction to Advanced Coupled Global Positioning System/Inertial Navigation System Test Techniques 225

4.0. ELECTRO-OPTICAL SYSTEM TESTING **228**

4.1. INTRODUCTION TO ELECTRO-OPTICAL THEORY **228**
4.1.1. General 228
4.1.2. Infrared Systems 228
4.1.3. Electro-Optical System Human Factors 235

4.2. ELECTRO-OPTICAL SYSTEMS TEST TECHNIQUES **235**
4.2.1. Preflight and Built in Tests 235
4.2.2. Controls and Displays 239
4.2.3. Instantaneous Field of View 244
4.2.4. FLIR Slew Limits 247
4.2.5. Slew Rates 250
4.2.6. FLIR Pointing Accuracy 254
4.2.7. Field of Regard 258
4.2.8. Line of Sight Drift Rate 262
4.2.9. FLIR Resolution 265
4.2.10. FLIR Maximum Range 278
4.2.11. Mission Utility and Integration 281
4.2.12. Introduction to Advanced Electro-Optical System Test Techniques 283

5.0. STORES MANAGEMENT SET TESTING **284**

5.1. INTRODUCTION TO STORES MANAGEMENT SET THEORY **284**
5.1.1. General 284
5.1.2. Stores Management Set Architecture 284
5.1.3. Controls and Displays 285
5.1.4. Missions 287

5.2. STORES MANAGEMENT SET TEST TECHNIQUES **288**
5.2.1. Stores Management Set Integration Ground Tests 288
5.2.2. Preflight and Built-In-Tests 290
5.2.3. Controls and Displays 293
5.2.4. Mission Utility and Integration 298
5.2.5. Introduction to Advanced Stores Management Set Test Techniques 302

6.0. FLIGHT PLANNING **304**

7.0. CASE STUDY **305**

7.1. INTRODUCTION **305**

7.2. AIR-TO-GROUND RADAR RESOLUTION USING A MINIMUM OF INSTRUMENTATION **305**
7.2.1. Background 305
7.2.2. The Test Article 306
7.2.3. Theoretical Resolution 306
7.2.4. Designing the Test 310
7.2.5. Data Cards 312
7.2.6. Summary 322

8.0. CONCLUSIONS AND RECOMMENDATIONS **322**

REFERENCES **323**

ANNEX
AGARD Flight Test Instrumentation and Flight Test Techniques Series **A-1**

Preface

Lieutenant General "Jimmy Doolittle" is most often remembered for his famed raid on Japan using B-25 aircraft launched from the deck of the Navy aircraft carrier *Hornet*; however, this amazing man's contributions to aviation hardly ended there. Besides being the first person to be awarded a Sc.D. in Aeronautical Science from the Massachusetts Institute of Technology, he was arguably the father of the discipline that is now called Avionics. He placed the first instrument flight equipment in an aircraft, performed the first long distance flight using instruments alone and even performed the first instrument approaches [ref. 58]. It seems likely, however, that even he could not have imagined the proliferation of avionics equipment in modern aircraft, particularly military aircraft.

Modern military aircraft rely heavily on highly complex electronic systems to make them effective weapons in a world filled with equally sophisticated counter systems. These components can add up to as much as 80% of the aircraft price tag. As new systems are developed, numerous tests are necessary to provide feedback in the iterative design process and to ensure that design parameters are met. Unfortunately, little has been written on the techniques for testing these systems. Even today, test pilot training programs stress aircraft performance and handling qualities testing, while the majority of test work revolves around avionics testing. This book is an attempt to put in print the rudimentary knowledge necessary for a test pilot or engineer to develop and execute a cost effective and quick test of a modern avionics system.

Préface

Le général "Jimmy Doolittle" est plus souvent connu pour son fameux raid sur le Japon à bord d'un B25 lancé du porte-avions *Hornet*; cependant, la contribution de cet homme remarquable à l'aviation ne s'arrête pas là.

Non seulement il est la première personne à avoir reçu un doctorat en sciences aéronautiques du MIT, mais il est également, sans conteste, le père de cette discipline que l'on appelle maintenant l'avionique. Il est le premier à avoir équipé un avion pour le vol aux instruments, effectué le premier vol longue distance en volant uniquement aux instruments et même effectué les premières approches aux instruments (réf. 58). Il semble probable malgré tout qu'il n'aurait pas pu imaginer l'essort de l'avionique dans les avions modernes, particulièrement les avions d'armes.

Les avions militaires modernes dépendent largement de systèmes électroniques complexes pour les rendre efficaces dans un monde rempli de systèmes adverses également sophistiqués. Ces systèmes peuvent représenter jusqu'à 80% du prix de l'avion. Au fur et à mesure du développement de ces systèmes, de nombreux essais deviennent nécessaires pour assurer un retour d'information dans le processus itératif de conception et pour s'assurer que les spécifications sont remplies. Malheureusement, il y a peu d'écrits sur ces techniques d'essais. Même aujourd'hui, les programmes d'instruction des pilotes d'essais insistent davantage sur les aspects performances et qualités de vol, alors que l'essentiel des essais en vol concerne les systèmes avioniques. Ce manuel est une tentative pour décrire les connaissances de base utiles à un pilote ou à un ingénieur d'essais pour concevoir et exécuter un programme d'essais de ces systèmes modernes qui soit rapide et d'un bon rapport qualité-coût.

Foreword

This book is intended as an introductory document to the subject of avionics flight testing. The target reader is the novice tester, desiring an initial exposure to the subject. Reference is made throughout the book to more in-depth documents, where they exist. In practical application, the new tester should use this book as a primer and then refer to the more detailed documents relating to the class of avionics under test or to the experience of more senior testers.

The first chapter provides a detailed discussion of the content and utility of the book. Chapters two through five provide a discussion of the theory and techniques for testing airborne air-to-air and air-to-ground radar, airborne navigation systems, electro-optical systems, and stores management sets, respectively. Each chapter begins with an introduction to the theory of operation of each class of system with sufficient detail to understand the test techniques which are next presented. Each test technique is developed in a largely self-contained fashion. Chapter six is a discussion of general considerations for developing a flight test profile combining some number of the previously described techniques. Chapter seven is a detailed case study and chapter eight includes some conclusions and recommendations.

As mentioned above, this book is intended as an introductory document for the novice. As such, caution should be exercised when directly applying the techniques provided here. Further research is warranted in most cases including more advanced documents relating to the theory and testing of the class of avionics in question. Chapter one points out that adequate references do not exist for every class of avionics, in these cases, it is important to search out persons with practical experience in testing similar systems.

Acknowledgements

A number of people have contributed directly or indirectly to this book. First, I would like to recognize Bob Richards, J.J. McCue, Tim Lenahan, George Masters and the entire U.S. Naval Test Pilot School staff, circa 1988, for their excellent introduction to the flight test process. Their classroom instruction and textbooks were the major source of the information in this document. Next, I would like to thank Professors Lou Schmidt, Rick Howard and Eric Pagenkopf for the early editing as well as the superb classroom instruction in the more rigorous side of engineering. Lt Bob Curbeam, USN, wrote the chapter on stores management system testing and I want to acknowledge and thank him for his rapid and concise efforts. Good job for a fighter guy. Next, I would like to thank Sarah Brenzo and June Norris for the excellent final editing and type setting. Finally, I would like to thank my wife Gena for hanging in there during the hours I spent in writing and editing.

List of Figures

Figure 1 Categories of Avionics
Figure 2 Two Dimensional Antenna Sidelobe Pattern
Figure 3 Airborne Pulse Doppler Return Spectrum
Figure 4 Sample Display Formats
Figure 5 Sample ΔV_{ic} Instrument Correction Plot
Figure 6 Sample ΔV_{pos} Position Error Plot
Figure 7 True Mach Number M_t From V_c and h_{pc}
Figure 8 OMEGA Transmission Format
Figure 9 OMEGA Fix
Figure 10 Control Segment Components
Figure 11 The Global Positioning System Concept
Figure 12 The Electromagnetic Spectrum
Figure 13 Space Domain Filtering
Figure 14 Infrared Atmospheric Transmittance at Sea Level
Figure 15 Sample Forward Looking Infrared Radar
Figure 16 Sample Rectilinear Plot
Figure 17 Typical Collimator/Bar Target Combination
Figure 18 Sample Heated Ground Bar Target
Figure 19 Line of Sight Jitter
Figure 20 FLIR Spatial Frequency Response
Figure 21 Ground Resolvable Differential Temperature Versus Spatial Frequency
Figure 22 Airborne and Ground Resolvable Differential Temperature Versus Spatial Frequency
Figure 23 Generic Stores Management Set Block Diagram
Figure 24 Azimuth Resolution for Targets of Known Separation
Figure 25 Fictional Air-to-Ground Resolution Array Diagram
Figure 26 Relationship of Display Dimensions, Scale Sizes and Pixel Grid
Figure 27 Radar Resolution Array Horizontal Beam Width
Figure 28 Radar Resolution Array Vertical Beam Width

List of Tables

Table I	Additional Assets or Instrumentation for use in Advanced Air-to-Air Radar Tests
Table II	Additional Assets or Instrumentation for Use in Advanced Air-to-Ground Radar Tests
Table III	Omega Ground Stations
Table IV	Additional Assets or Instrumentation for use in Advanced Inertial Navigation Systems Tests
Table V	Additional Assets or Instrumentation for Use in Advanced OMEGA Tests
Table VI	Typical GPS Linear and Angular Dynamic Limits
Table VII	Additional Assets or Instrumentation for Use in Advanced Coupled Global Positioning/Inertial Navigation System Tests
Table VIII	Additional Assets or Instrumentation for Use in Advanced Electro-Optical Systems Tests
Table IX	Additional Assets or Instrumentation for Use in Advanced Stores Management Set Tests
Table X	Theoretical Azimuth Resolution for All Air-to-Ground Radar Modes and All Azimuth Resolution Target Separations
Table XI	Theoretical Display Resolution
Table XII	Comparison of Radar and Display Theoretical Range Resolution
Table XIII	Comparison the Radar and Display Theoretical Azimuth Resolution

List of Data Cards

Card 1: Preflight/Turn on Data Card
Card 2: Built In Tests Data Card
Card 3: Controls Data Card
Card 4: Displays Data Card
Card 5: Air-to-Air Scan Rate Data Card
Card 6: Air-to-Air Scan Angle Limits Data Card
Card 7: Air-to-Air Elevation Angle Limits Data Card
Card 8: Tracking Rate Limits Data Card
Card 9: Air-to-Air Antenna Stabilization Limits Data Cards
Card 10: Air-to-Air Minimum Detection And Tracking Range Data Card
Card 11: Air-to-Air Range And Bearing Accuracy Data Card
Card 12: Air-to-Air Range And Bearing Resolution Data Card
Card 13: Air-to-Air Maximum Detection Range Data Card
Card 14: Maximum Unambiguous Range Data Card
Card 15: Maximum Acquisition Range Data Card
Card 16: Blind Ranges Data Card
Card 17: Groundspeed/Course/Altitude Data Cards
Card 18: Velocity Resolution Data Card
Card 19: Blind Speeds Data Cards
Card 20: Air Combat Maneuvering Modes Data Card
Card 21: False Alarm Rate Data Card
Card 22: Track File Capacity Data Card
Card 23: Air-to-Air Mission Utility And Integration Data Card
Card 24: Air-to-Ground Scan Rate Data Card
Card 25: Air-to-Ground Scan Angle Limits Data Card
Card 26: Air-to-Ground Elevation Angle Limits Data Card
Card 27: Air-to-Ground Antenna Stabilization Limits Data Cards
Card 28: Air-to-Ground Minimum Range Data Card
Card 29: Doppler Beam Sharpened Notch Width Data Card
Card 30: Air-to-Ground Range and Bearing Resolution Data Cards
Card 31: Air-to-Ground Maximum Detection Range Data Card
Card 32: Mapping Quality and Consistency Data Card
Card 33: Air-to-Ground Mission Utility and Integration Data Card
Card 34: Navigation System Preflight/Turn On Data Card
Card 35: Navigation System Built In Test Data Card
Card 36: Navigation System Controls Data Card
Card 37: Navigation System Displays Data Card
Card 38: Initialization and Alignment Data Cards
Card 39: Static Position Accuracy Data Card
Card 40: Dynamic Non-maneuvering Position Accuracy Data Cards
Card 41: Dynamic Maneuvering Position Accuracy Data Cards
Card 42: Dynamic Update Performance Data Cards
Card 43: INS Mission Utility and Integration Data Card
Card 44: OMEGA Initialization Data Card
Card 45: Dynamic Position Accuracy Data Cards
Card 46: Lane Ambiguity Resolution Data Card
Card 47: OMEGA Mission Utility and Integration Data Card
Card 48: Initialization and Alignment Ground Test Data Cards
Card 49: Initialization and Alignment Airborne Data Cards
Card 50: Static Positioning Accuracy Data Card
Card 51: Dynamic Non-maneuvering Position Accuracy Data Cards
Card 52: Dynamic Maneuvering Position Accuracy Data Cards
Card 53: Navigation Performance in Overwater/Multipath Environment
Card 54: GPS/INS Mission Utility and Integration Data Card
Card 55: Preflight/Turn On Data Card
Card 56: Built In Tests Data Card
Card 57: Controls Data Card

Card 58: Displays Data Card
Card 59: Instantaneous Field of View Data Cards
Card 60: FLIR Slew Limits Data Card
Card 61: Slew Rates Data Cards
Card 62: FLIR Pointing Accuracy Data Cards
Card 63: Field of Regard Data Cards
Card 64: FLIR Line of Sight Drift Rate Data Cards
Card 65: FLIR Resolution Data Cards
Card 66: FLIR Maximum Range Data Card
Card 67: FLIR Mission Utility and Integration Data Card
Card 68: Integration Ground Test
Card 69: Preflight/Turn On Data Card
Card 70: Built In Tests Data Card
Card 71: Controls Data Card
Card 72: Displays Data Card
Card 73: SMS Air-To-Air Mission Utility And Integration Data Card
Card 74: SMS Air-To-Ground Mission Utility and Integration Data Card
Card 75: Case Study 1 Data Card 1
Card 76: Case Study 1 Data Card 2
Card 77: Case Study 1 Data Card 3
Card 78: Case Study 1 Data Card 4
Card 79: Case Study 1 Data Card 5
Card 80: Case Study 1 Data Card 6
Card 81: Case Study 1 Data Card 7
Card 82: Case Study 1 Data Card 8

Acronyms, Symbols and Abbreviations

A = antenna capture Area

a = local speed of sound

ACM = Air Combat Maneuvering

ACP = Armament Control Panel

AGARD = Advisory Group for Aerospace Research and Development

AGL = Above Ground Level

ALT = ALTitude to begin air-to-ground resolution array test run

AMTI = Airborne Moving Target Indicator

avg_{lat} = average of the latitude of two radar targets

BIT = Built In Test

B_n = noise band width

$B_{scan\ deg}$ = angular width of the B scan display in degrees

$B_{scan\ in}$ = linear width of the B scan display in inches

CAD = Cartridge Activated Device

CAP = Combat Air Patrol

CPA = Closest Point of Approach

C = speed of light

CRT = Cathode Ray Tube

db = decibel

DBS = Doppler Beam Sharpening

DDL = Dispersive Delay Line

deg = degree

DEP = Design Eye Position

DLC = Delay Line Canceler

DME = Distance Measuring Equipment

DOD = Department of Defense

DR = Dead Reckoning

drift Δh = measured angular horizontal drift

drift Δv = measured angular vertical drift

$drift_h$ = measured horizontal drift

$drift_v$ = measured vertical drift

ECM = Electronic CounterMeasures

EHF = Extremely High Frequency

EO = Electro-Optical

ESM = Electronic Support Measures

EW = Electronic Warfare

f = frequency in hertz

FCS = Fire Control Set

f_{dt} = doppler shift due to target radial velocity

FL_c = focal length of the collimator (folded path length from target to mirror)

FLIR = Forward Looking Infrared Radar

FM = Frequency Modulation

F_n = noise figure

F_0 = transmitted carrier frequency

FRL = Fuselage Reference Line

ft = feet

g = acceleration due to Gravity

G = directive gain of the antenna

GDOP = Geometric Dilution Of Precision

GHZ = Gigahertz

GPS = Global Positioning System

h = horizontal measurement of FLIR IFOV projected onto wall

H = altitude above the terrain in feet

HF = High Frequency

HOTAS = Hands On Throttle And Stick

h_{pc} = calibrated pressure altitude

HPD = Probability of Detection

h_{pi} = indicated pressure altitude

h_{po} = observed pressure altitude

HUD = Head Up Display

HZ = hertz

IFF = Interrogator Friend or Foe

IFOV = Instantaneous Field Of View

$IFOV_h$ = Instantaneous Field Of View horizontal dimension

$IFOV_v$ = Instantaneous Field of View vertical dimension

IFR = Instrument Flight Rules

IMC = Instrument Meteorological Conditions

in = inch

INS = Inertial Navigation System

IR = InfraRed

k = Boltzman's constant

KHZ = Kilohertz

KIAS = Knots Indicated AirSpeed

KOAS = Knots Observed AirSpeed

KW = Kilowatt

l = distance from FLIR aperture to crosshair intersection mark

l = distance to initial crosshair position for line of sight drift rate testing

L = receiver loss factor

LASER = Light Amplification through Stimulated Emission of Radiation

LED = Light Emitting Diode

LF = Low Frequency

LORAN = Long Range Navigation

LAT = the numerical average of the latitude of the two surveyed points

lb_f = pounds force

lb_m = pounds mass

m = meter

M = Mach number

MC = Mission Computer

MF = Medium Frequency

$M_{bearing}$ = actual magnetic bearing from the flyover point to the radar target

MHz = megahertz

MIN = MINutes

MRΔT = Minimum Resolvable differential Temperature

MSL = Mean Sea Level

M_t = true Mach number

NFOV = Narrow Field Of View

nm = nautical mile

$NOTCH_{deg}$ = angular width of the DBS notch

$NOTCH_{in}$ = linear width of the DBS notch on the B-scan display

OAT_i = indicated Outside Air Temperature

OAT_o = observed Outside Air Temperature

P = transmitted power of the radar

PAL = Positive Arm Latch

PCA = Polar Cap Attenuation

PD = Probability of Detection

PMA = Program Manager for Aviation

PIREP = Pilot REPort of the weather

PPI = Planned Position Indicator

PPS = Pulses Per Second

P_{rep} = the TACAN derived range from the beginning of the peak of the sawtooth

PRF = Pulse Repetition Frequency

PRI = Pulse Repetition Interval

PW = Pulse Width

R = gas constant for air, 53.35 $(ft)(lb_f)/(lb_m)(°R)$

rad = radians

Radar = Radio Detection and Ranging

R_b = target range at breakout

RF = Radio Frequency

$R_{horizon}$ = radar horizon

r = angular resolution of the FLIR

rms = root meas square

R_{max} = maximum radar range

$R_{max\ unamb}$ = theoretical unambiguous maximum range

R_{min} = theoretical minimum range

$R_{min\ res}$ = theoretical minimum range resolution

R_{rep} = the TACAN derived range from the beginning of the peak of the sawtooth

R_{sf} = response of scanning FLIR

R_t = Range from the target

R_{target} = radar derived range to the targets

$R_{test\ begin}$ = minimum range between test airplane and target for azimuth resolution testing

RΔT = Resolvable differential Temperature

S = across azimuth target Separation

SA = Selective Availability

SA = Situational Awareness

SEP = Spherical Error Probable

SF_{co} = cutoff Spatial Frequency

SF_{coa} = SF_{co} airborne

SF_{cog} = SF_{co} ground

SF_t = Spatial Frequency of the Target

SHF = Super High Frequency

SID = Sudden Ionospheric Disturbance

SMP = Stores Management Processor

SMS = Stores Management Set

S/N = Signal to Noise ratio

$(S/N)_{min}$ = minimum signal to noise ratio

STT = Single Target Track

T = absolute temperature

t_a = ambient temperature

TACAN = Tactical Air Navigation

$T_{bearing}$ = actual true bearing from the flyover point to the radar target

TEMP = Test and Evaluation Master Plan

TPC = Tactical Pilotage Chart

TWS = Track While Scan

UHF = Ultra High Frequency

v = vertical dimension of IFOV projected onto wall

V = magnetic variation

V&V = Validation and Verification

V_c = calibrated airspeed

V_i = indicated airspeed

VHF = Very High Frequency

VID = Visual Identification

VMC = Visual Meteorological Conditions

VLF = Very Low Frequency

V_o = observed airspeed

VS = Velocity Search

V_t = true airspeed

W = Watt

WP = WayPoint

W_k = Width of one bar and one space in target template

WFOV = Wide Field Of View

Δ_{res} = measured angular resolution of the radar

Δh_{pic} = pressure altitude instrument correction

Δh_{pos} = pressure altitude position error correction

Δ_{Lat} = the difference between the latitude of the surveyed points in degrees

Δ_{Long} = the difference between the longitude of the surveyed points in degrees

Δnm = the difference in nautical miles between the surveyed points along the true north-south or east-west axis

ΔOAT_{ic} = Outside Air Temperature instrument correction

Δres = measured angular resolution

ΔT = temperature differential

ΔV_{ic} = airspeed instrument error correction

ΔV_{pos} = airspeed position error correction

γ = ratio of specific heats, 1.4

γ = aircraft flight path angle

λ = wavelength

μ = microns

μsec = microsecond

σ = radar cross section

σdesired = desired radar cross section

σ = test target radar cross section

θ = test radar advertised antenna beam width

$^\circ$ = degrees

$^\circ$ R = degrees Rankine