Monopulse Beacon Test Set (MBTS)

Selected by the FAA to certify and maintain its inventory of Monopulse Beacon Radars.

New for 2003 – Enhanced Roll-Call Capability, Improved Operator Interface, and Interlaced Secondary Target Replies

Description

By the year 2005, all FAA Air Traffic Control Beacon Interrogator (ATCBI) radars will be monopulse capable, working with both Air Traffic Control Radar Beacon Systems (ATCRBS) and Mode Select Beacon System (Mode S) transponders. These systems obtain a variety of flight status information, such as aircraft identification, altitude, airspeed, and heading, directly from the enroute aircraft.

The higher level of radar system complexity necessitates sophisticated maintenance and certification tools. As a result, Freestate Electronics has developed a Monopulse Beacon Test Set (MBTS) to meet these requirements. The test set provides all the functions necessary to verify the performance of both ATCRBS and Mode S transponder radar system performance, and it provides technicians with the capability to perform sophisticated maintenance procedures, such as the measurement of Overall System Sensitivity (OSS) by remote operation.

Features

- Simulates the monopulse radar characteristics of up to 32 targets per scan (64 with interlaced secondary targets enabled)
- ATCRBS and Mode S capable (Roll-Call and All-Call)
- Continuous Wave (CW) and pulsed RF operating modes
- Target replies triggered by internal, external, or decoded RF interrogations
- Azimuth information synchronized to antenna pedestal data
- GPIB and serial control interfaces
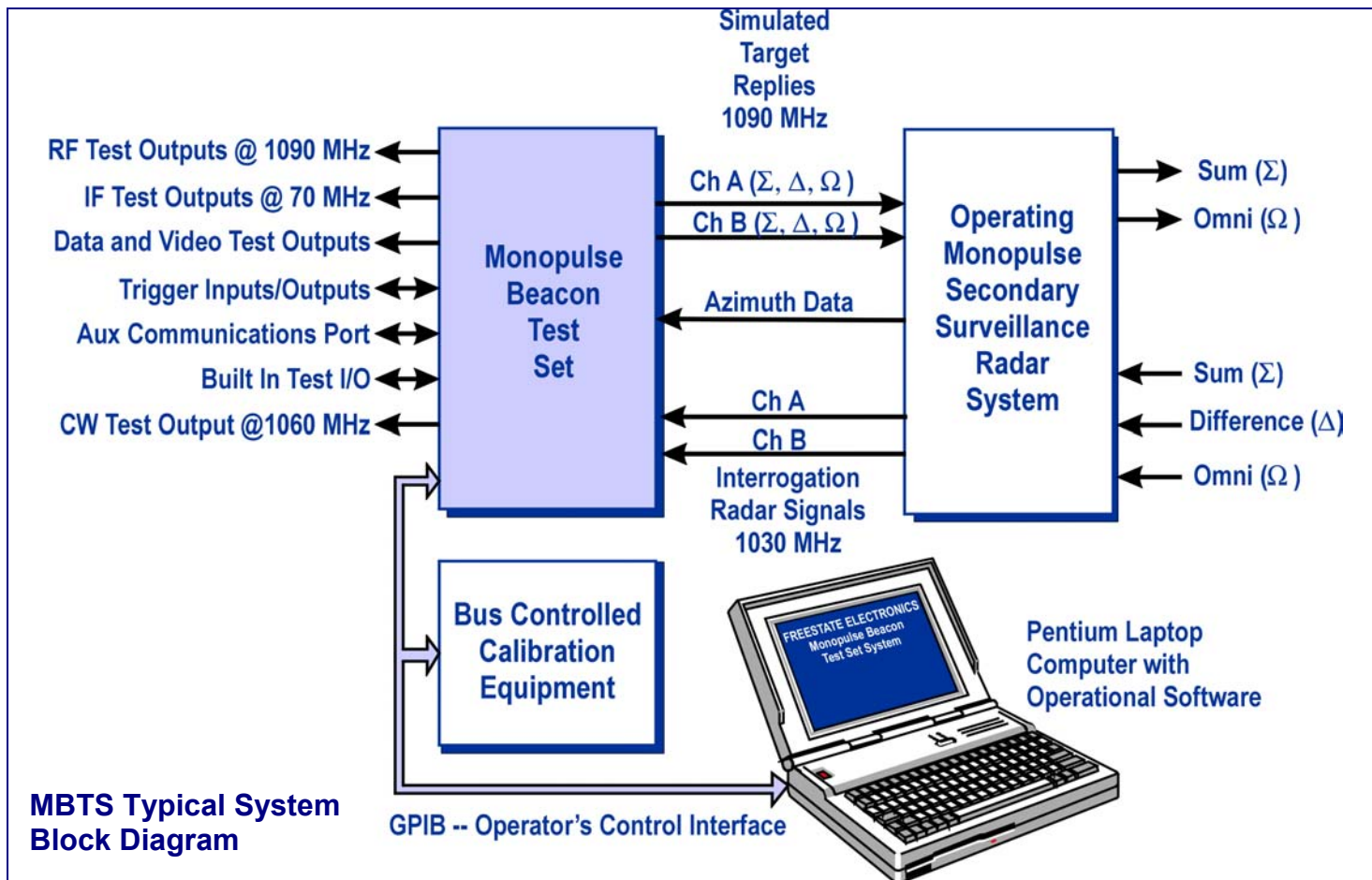- LabVIEW® based operator control interface

Operation

The MBTS System includes a Pentium based laptop computer with custom, LabVIEW® based, virtual instrument control software.

Construction

The MBTS consists of a standard 7-inch high, 19-inch wide, rackmount chassis with eight digitally controlled VXI plug-in modules. The chassis provides power, cooling, and module interconnects. The photos show typical module construction.

The construction techniques provide exceptionally high module-to-module RF isolation and integrity, yet permit very easy system maintenance. A Mean Time To Repair (MTTR) of less than five minutes is achieved through a comprehensive built-in-test process, the inclusion of numerous RF and digital signal test ports and status indicators, and the use of simple-to-replace modules with "blind-mate" connectors. Only a screwdriver is required to replace a module.

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RF Test Outputs @ 1090 MHz
IF Test Outputs @ 70 MHz
Data and Video Test Outputs
Trigger Inputs/Outputs
Aux Communications Port
Built In Test I/O
CW Test Output @1060 MHz

Monopulse Beacon Test Set

Simulated Target Replies 1090 MHz

Ch A (Σ, Δ, Ω)
Ch B (Σ, Δ, Ω)

Azimuth Data

Ch A
Ch B

Interrogation Radar Signals 1030 MHz

Operating Monopulse Secondary Surveillance Radar System

Sum (Σ)
Omni (Ω)

Sum (Σ)
Difference (Δ)
Omni (Ω)

Bus Controlled Calibration Equipment

FREESTATE ELECTRONICS Monopulse Beacon Test Set System

Pentium Laptop Computer with Operational Software

MBTS Typical System Block Diagram

GPIB -- Operator's Control Interface

Characteristics at a Glance

Interrogation Input and Output Signal Simulation Types	ATCRBS 3/A, 2, B, or C; ATCRBS/Mode S All-Call; Mode S Only All-Call; and Mode S Roll-Call
Target Reply RF Outputs (1080 MHz to 1100 MHz in 200 kHz Increments)	Two Channels (A and B) - Sum, Delta, and Omni
RF Level Controls	Sum, -85 dBm to +10 dBm Delta/Sum Ratio, +12 dB to -42 dB Sum/Omni Ratio, +20 dB to -27 dB
Primary Target Controls	Range, Azimuth, Antenna Beamshape, Reply Parameters (Code, Altitude, SPI, Alert, F_1, F_2, ID, X)
Secondary Target Controls	Range, Speed, Reply Parameters (Code, Altitude, SPI, Alert, F_1, F_2, ID, X)
Monopulse Signal Controls	Sum/Omni Ratio, Delta/Sum Ratio, and Delta/Sum Phase
Azimuth Input Data	Balanced RS-422 or Unbalanced 75 Ohm ACP/IACP and ARP
Operating Modes	CW, Constant Range Ring, Azimuth Gated Target, BIT, and Boresight Calibration
Test Outputs	1090 MHz – Channel A and B (Sum, Delta and Omni) 70 MHz – Reply IF (Sum, Delta and Omni) 1060 MHz – MSSR Antenna Cal and Alignment Signal Demodulated DPSK, PAM, and LOG VIDEO
Control Interfaces	IEEE-488 and RS-232