CT-ACD
33092/4

COPY

DOT/FAA/CT-ACD33092/4

EVALUATION OF THE PERFORMANCE OF THE PRECISION DISTANCE MEASURING EQUIPMENT (DME/P) TRANSPONDER ASSOCIATED WITH THE MILITARY MOBILE MICROWAVE LANDING SYSTEM (MMLS)

Cliff Mackin

FEDERAL AVIATION ADMINISTRATION

JUL 6 1992

TECHNICAL CENTER LIBRARY
ATLANTIC CITY INT'L AIRPRT, NJ 08405

June 1992

Engineering, Research, and Development Service
Concepts Analysis Division
FAA Technical Center
Atlantic City International Airport, NJ 08405

SUBJECT

Evaluation of the performance of the Precision Distance Measuring Equipment (DME/P) transponder associated with the Military Mobile Microwave Landing System (MMLS).

BACKGROUND

During October 1991, personnel from the Guidance and Airborne Systems Branch (ACD-330) of the FAA Technical Center (FAATC) conducted a series of engineering flight tests to evaluate the performance of the DME/P transponder associated with the MMLS. The flight tests were conducted at the Niagara Falls International Airport in New York, the site of the Bell/Textron facility that designed and built the MMLS under a contract with the United States Air Force. The unit under test was the first production model of the MMLS.

The MMLS was deployed in a collocated configuration serving runway 28 at the Niagara Falls International Airport and was sited with a 914 foot backset from and a 150 foot offset to the approaching pilot's right of the threshold of runway 28. The DME/P transponder was integrally mounted with the MLS azimuth equipment. At the time that the flight test described in this report was conducted, the physical mounting of the MMLS DME/P transponder antenna on the MMLS azimuth subsystem had not been finalized. However, the antenna mount was fully functional in a prototype configuration.

Flight data from the MMLS DME/P were collected using the FAATC MLS instrumented test bed Convair 580 aircraft, N-49, with a prototype civil DME/P interrogator manufactured by Standard Elektrik Limited of Germany. Tracking and precision ranging was provided by the FAATC Single Point Optical Ranging Tracker.

RESULTS

Figure 1. shows a typical example of the raw error of the MMLS DME/P. In the tested configuration the system provided accurate range information beyond the specified 15 nautical miles (nmi) to at least 20 nmi. At a ground range of 8 nmi, a clear transition between the Initial Approach (IA) mode and the Final Approach (FA) mode can be seen on figure 1. The data presented in all figures has had the aircraft antenna cable delays removed. The FA mode carried a bias of approximately +85 feet, and the IA mode showed a bias of approximately +50 feet.

Figure 2. shows the data in figure 1. after passing through a path following error (PFE) filter. The International Civil Aviation Organization (ICAO) DME/P system PFE tolerances are also displayed on the plot. It can be seen that the MMLS PFE was well in tolerance in both the IA and FA modes.

Figure 3. shows the data in figure 1. after passing through a control motion noise (CMN) filter. The ICAO DME/P system CMN tolerances are also displayed on the plot. It can be seen that the MMLS CMN was also well in tolerance in both the FA and IA modes.

CONCLUSIONS

In the tested configuration, the MMLS DME/P transponder:

1. met all ICAO system tolerances for PFE and CMN in both the IA and FA modes;
2. was found to be fully compatible with a DME/P interrogator designed for civilian use, and;
3. provided accurate range information beyond the specified 15 nmi to at least 20 nmi.

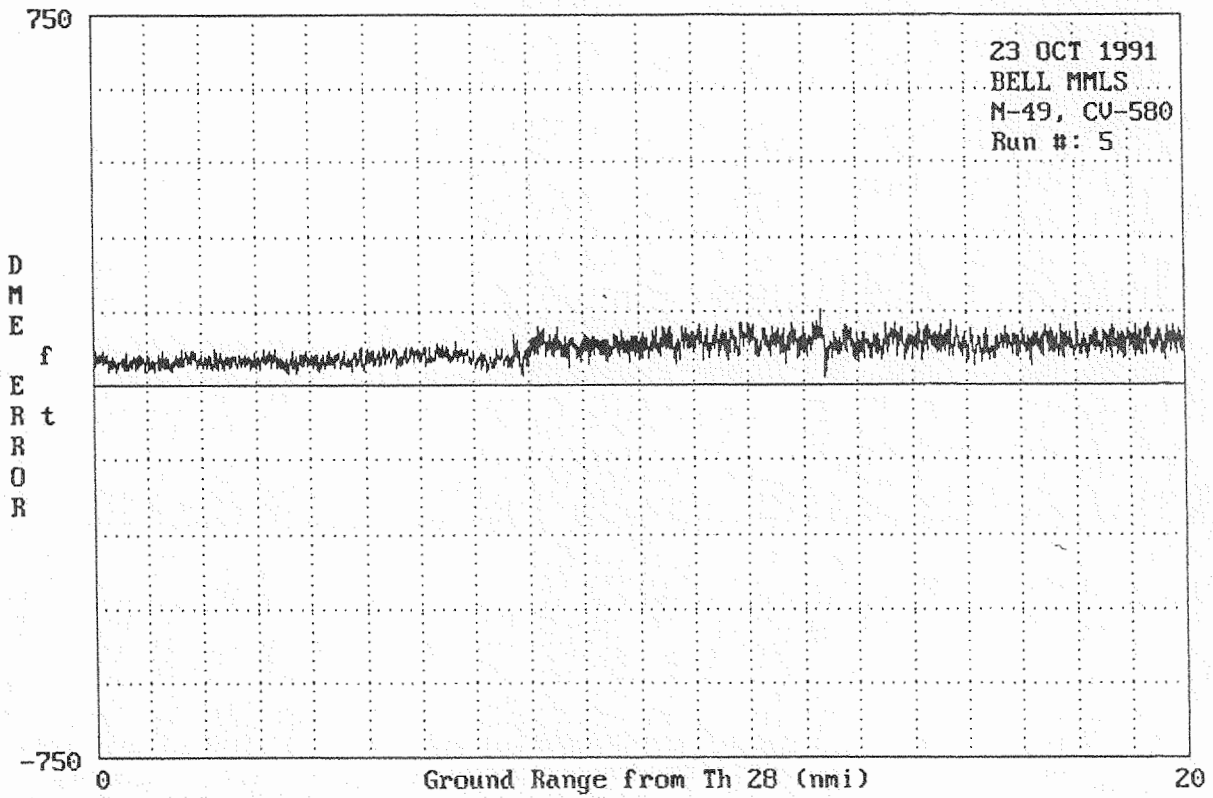
750
-750
DME ERROR
f t
0
20
Ground Range from Th 28 (nmi)
23 OCT 1991
BELL MMLS
N-49, CV-580
Run #: 5

Figure 1.

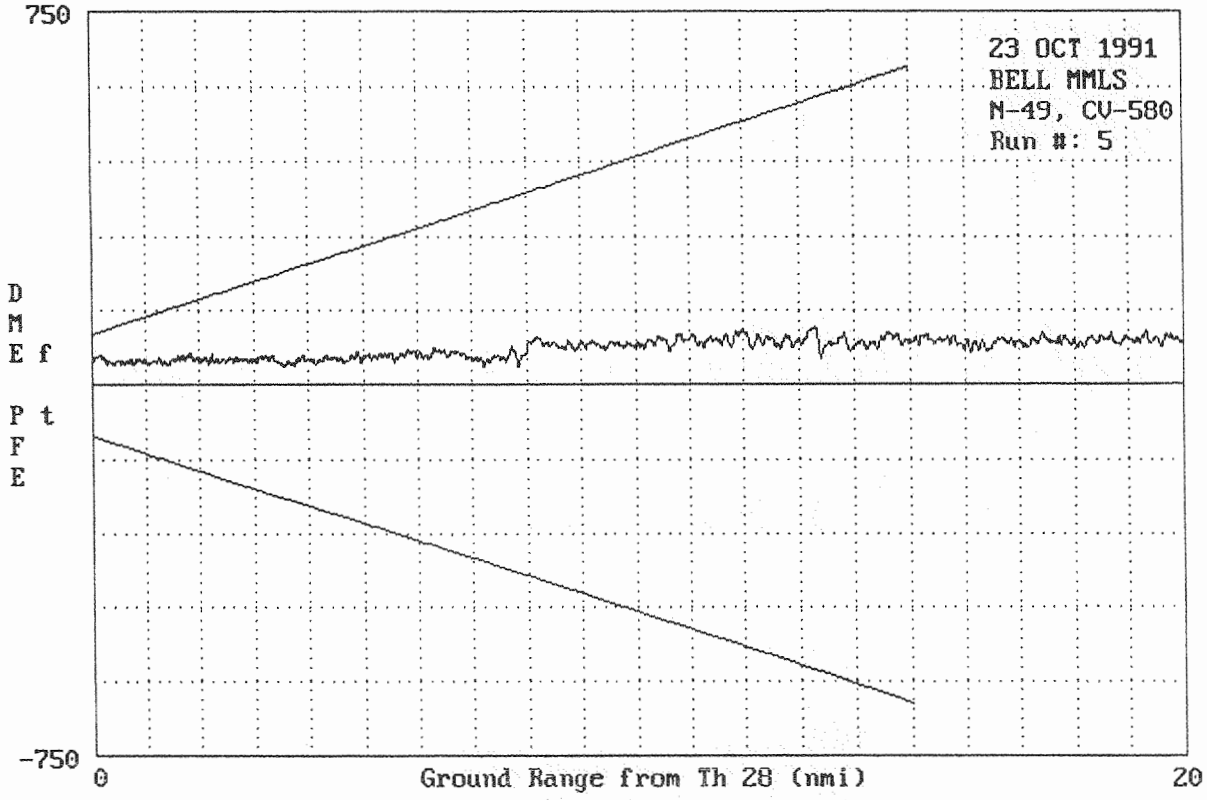
750
-750
D
M
E f
P t
F
E
23 OCT 1991
BELL MMLS
N-49, CV-580
Run #: 5
0
Ground Range from Th 28 (nmi)
20

Figure 2.

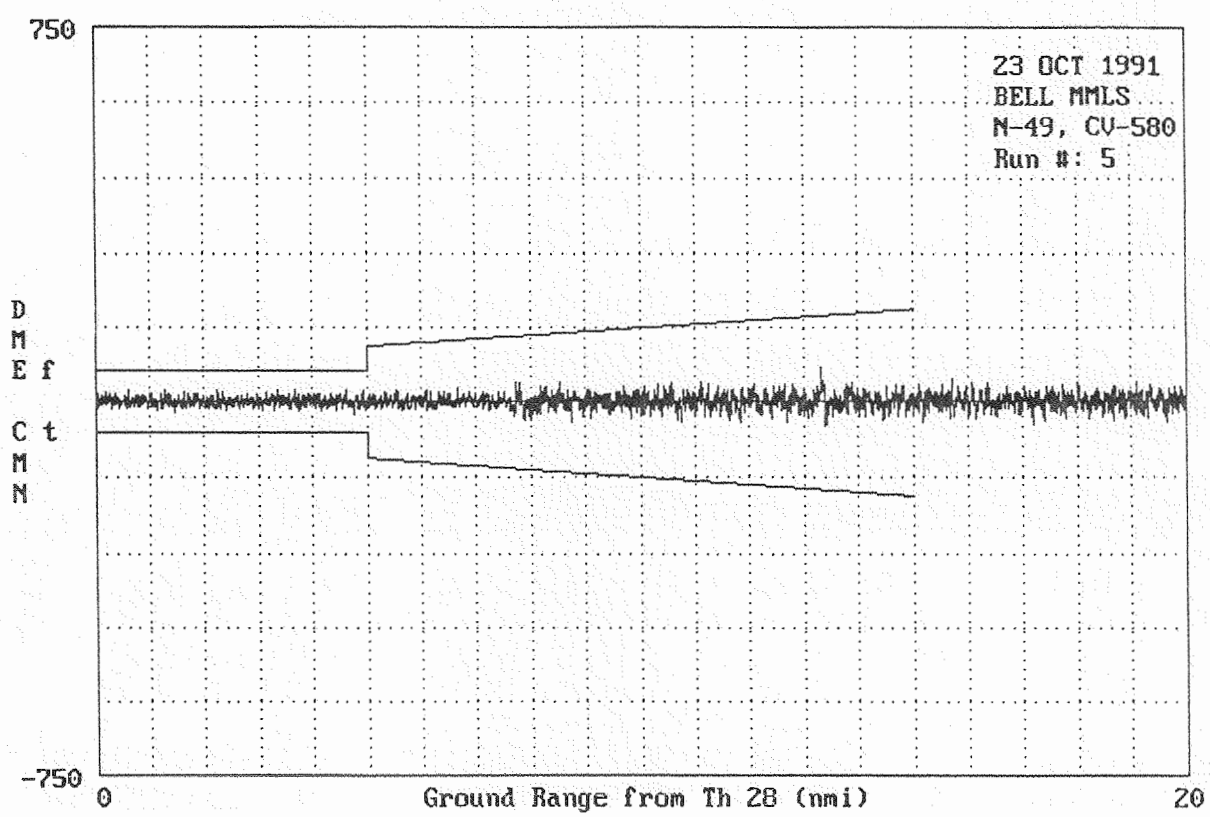
750
-750
D
M
E f
C t
M
N
0
Ground Range from Th 28 (nmi)
20
23 OCT 1991
BELL MMLS
N-49, CV-580
Run #: 5

Figure 3.