

MOBILE ALL TERRAIN TELEMETRY AND DATA DISPLAY VANS

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ABSTRACT

The 412th Test Wing, Range Division has developed an all-terrain van system to receive real-time telemetry and also to display the processed data for remote location flight-testing. The vans are refurbished Ground Launch Cruise Missile (GLCM), Launch Control Centers (LCC). The vans were a joint development effort between the Range and the Advanced Fighter Technology Integration (AFTI) program office. The van systems were specifically designed to support Ground Collision Avoidance System (GCAS) testing. However, the van systems have been successfully used to support other customers, with remote telemetry needs, due to the systems Commercial Off the Shelf (COTS) design. This document will describe the design, layout and rationale for the systems design. This paper will also provide the systems capabilities with top-level block diagrams.

KEY WORDS

Mobile, Telemetry, Data Processing, GLCM, ADAPS

INTRODUCTION

Since the drastic cutbacks in the Defense Budget many projects have had to do more with less. These reductions trickle down to the support agencies as well. Couple these reductions with the need to support hazardous low altitude flight-testing in remote areas with unimproved roads, at best and the solution becomes all terrain telemetry and data display systems.

MOBILE SYSTEMS

The Range was presented with a requirement to provide real-time telemetry support for the AFTI/F-16 project. Specifically, for hazardous test flights related to the Ground Collision Avoidance System (GCAS). The GCAS flight tests required the aircraft to fly,

at points, to within 50 feet of the ground. The fixed site TM systems we operate could not provide adequate coverage that low to the ground and would make real-time safety calls impossible. Therefore, the Range & AFTI developed a three-phase approach to fulfilling the AFTI/GCAS requirement.

The decision to use the GLCM LCCs as the trailer platforms was quite easy. First, the vans were free and were on hand eliminating any procurement difficulties and allowed us to begin work immediately. Second, the GLCMs are specifically designed for the all terrain environment. Third, the GLCM vans came complete with the M.A.N. 1013 tractors, which are also well equipped to operate on unimproved roads as well as off road.

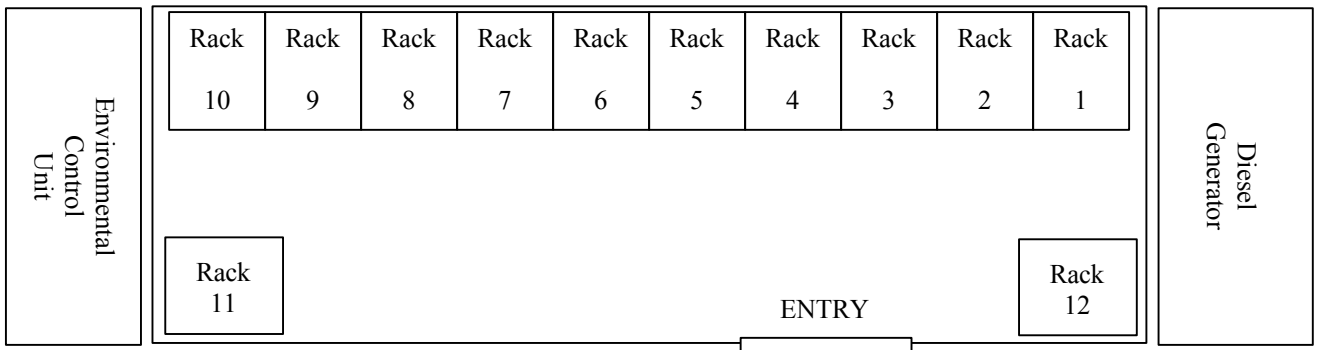
The GLCM vans required changes to its power and cooling systems. First, the 60 KW/400 Hz gas turbine generator was removed and aluminum plates added to create an 8' X 10' platform on the forward end of the trailer. Then a 60 KW/60 Hz, 120-208 VAC – three-phase diesel generator was added. Secondly, the aft equipment box was removed and a commercial Environmental Control Unit (ECU) was installed to provide heating and cooling. The ECU has a cooling capacity of 5 tons and also contains 10 10KW heating elements.



GLCM Van & M.A.N. 1013 Tractor

PHASE I – ALL IN ONE

The first Phase of the trailer build was to incorporate the use of a PC based decommutator systems to provide Real-time data display for the Flight Test Engineers (Figure 1). The system was self-contained within one van that included TM data acquisition, processing and recording equipment.



Phase 1 Telemetry Van Equipment Layout
Figure 1

Rack 1: Test & Calibration Equipment

Rack 3: Antenna Control

Rack 5: Telemetry Data Recording

Rack 7: Strip-chart Recorders

Rack 9: Video Data Recording & Distribution

Rack 11: Signal Conditioning & Decryption

Rack 2: Telemetry Receiver Group1

Rack 4: Telemetry Receiver Group 2

Rack 6: PC Decomm System 1

Rack 8: PC Decomm System 2

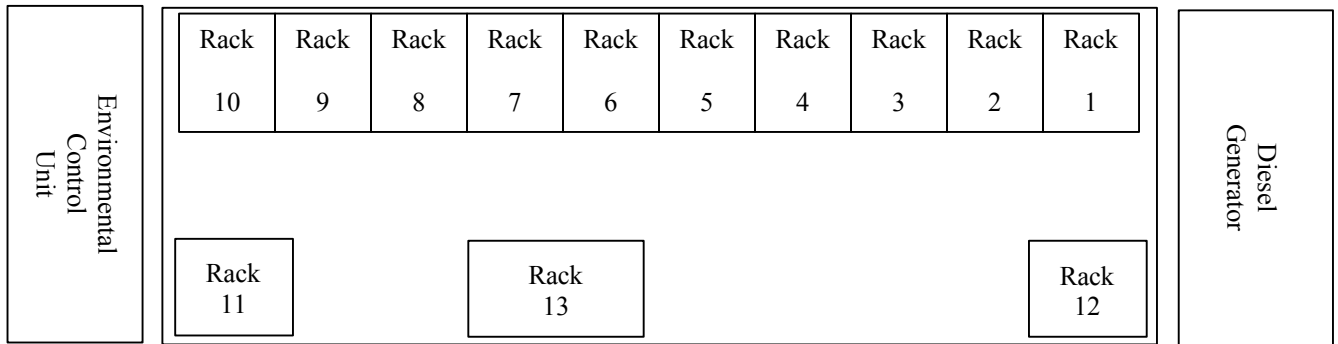
Rack 10: Strip-chart Recorders

Rack 12: Power Distribution & Monitoring

After the completion of the very successful first phase of GCAS testing it was determined that additional data processing and display capability was needed as well as room for additional Flight Test Engineers. This began Phase two of the Mobile All Terrain TM systems design.

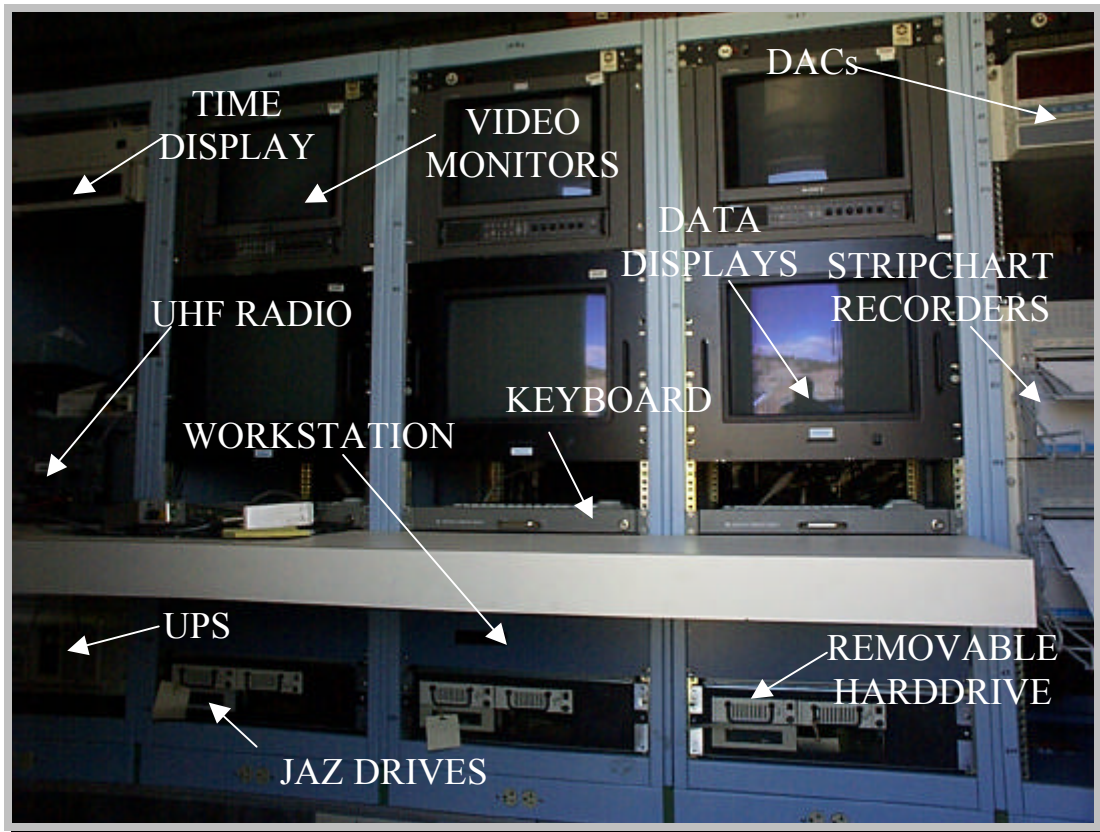
PHASE II – TM VAN MOD & 6 POSITION DATA DISPLAY VAN BUILD-UP

Phase Two incorporates the use of two GLCM LCC vans. The TM acquisition and data processing van is the original TM van mentioned above, with additional equipment. The additional equipment is contained in one rack. Rack 13 (Figure 2) was added to hold the data decommutator and UMN, key elements to the ADAPS data processing system. Fiber-optic transmitters and receivers were also added to Rack 3 to provide a fiber-optic interface between the two vans. The fiber-optic umbilical between the two vans contains 36 multi-mode fibers. The umbilical provides TM data, video and audio connections between the vans and allows for a maximum of 240 feet separation between them.

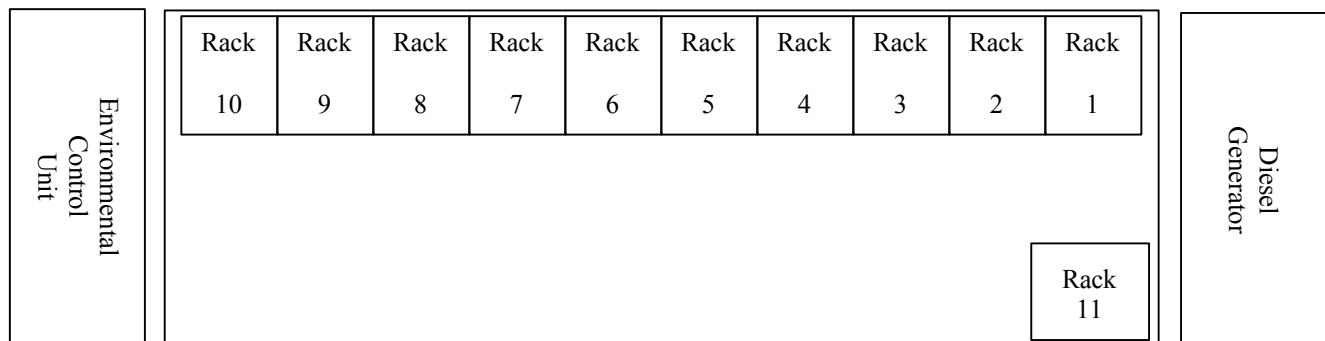


**Telemetry Van Equipment with Equipment Additions
Figure 2**

The Data Display Van is configured with 6 user workstations (Figure 3 & 4). The workstations display real-time data processed on board the TM Acquisition Van. The data is displayed in user selectable formats (dial gages, bar graphs, digital, etc.) or printed on 3 eight channel thermal strip chart recorders.



**Phase 2 Data Display Van Workstations Racks 4,5 & 6
Figure 3**



**Phase 2 Data Display Van Rack Layout
Figure 4**

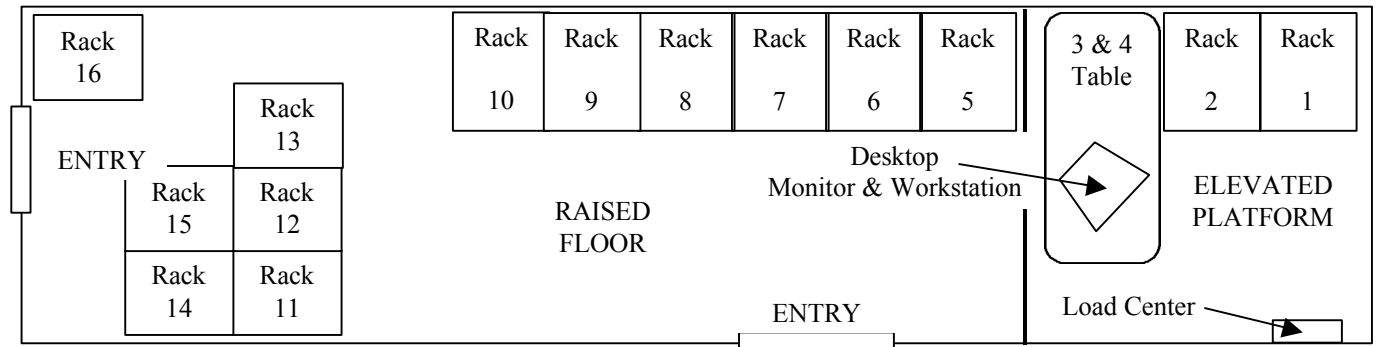
- | | |
|---|---|
| <p>Rack 1: UMN
 Rack 3: DACs & Strip-chart Recorders
 Rack 5: Display Station 2
 Rack 7: UPS, UHF Comm & Audio Amp
 Rack 9: Display Station 5
 Rack 11: Power Distribution & Monitoring</p> | <p>Rack 2: Fiber Optic Equipment
 Rack 4: Display Station 1
 Rack 6: Display Station 3
 Rack 8: Display Station 4
 Rack 10: Display Station 6</p> |
|---|---|



6 Position Data Display Van

Phase III – 12 POSITION DATA DISPLAY VAN

The third and final phase of the All Terrain Mobile Van System is to build a larger Data Display Van. This larger van will have the capability of supporting 12 user workstations. In keeping with the ranges ability to reuse existing assets we have refurbished a Pershing Missile Shop Set trailer. This van is 35 feet long with the entire length usable. The van is fitted with a false floor for cable runs and cooling air distribution. The van uses two 3-ton cooling units slung below the trailer. The 30 KW diesel generator is fitted to a swing-out maintenance platform secured to the forward end of the trailer.



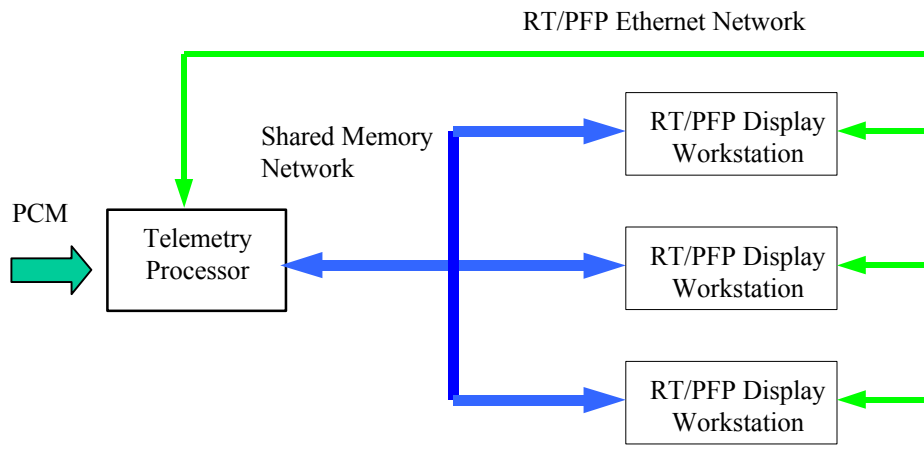
12 Position Data Display van Layout
Figure 5

Rack 1: RT/PFP Workstation
Rack 3: RT/PFP Workstation
Rack 5: RT/PFP Workstation
Rack 7: Strip-chart Recorders (2)
Rack 9: RT/PFP Workstation
Rack 11: RT/PFP Workstation
Rack 13: RT/PFP Workstation
Rack 15: Strip-chart Recorders (2)

Rack 2: RT/PFP Workstation
Rack 4: Removable Table
Rack 6: RT/PFP Workstation
Rack 8: RT/PFP Workstation
Rack 10: Strip-chart Recorders (2)
Rack 12: Strip-chart Recorders (2)
Rack 14: Strip-chart Recorders (2)
Rack 16: UMN & F.O. Interfaces

Data Display/Processing System

After the PCM Telemetry data is received and decrypted it is sent to the RT/PFP telemetry processor system (Figure 6). After processing the data it is transferred to the user RT/PFP workstations by a Universal Memory Network (UMN) shared memory system. An Ethernet network is also used to command and control the RT/PFP system. The RT/PFP enhanced version of the DataViews software package is used to display telemetry on a SGI Indigo Workstation. Workstation display configuration can be changed in real-time by the users if needed. Engineering Units data can be recorded on the telemetry processor or by each individual workstation.



Data Display System Block Diagram
Figure 6

CONCLUSION

The mobile systems we have developed, tested, deployed and used are extremely versatile and highly successful. They are designed for small groups with specific test requirements. We can accommodate test programs with limited funding on short notice and return quality data products. Our customers do not have to wait weeks or even days for their data, they leave with the data when the mission has been completed.

With the use of the UMN we can link not only our Data Display vans but also our Range Safety van which all share the same interfaces.

When our customer's project is a success, and has grown, and requires additional support infrastructure the Range Control Rooms are ready and use the same RT/PFP system on a larger scale.

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