

# **Distributed Instrumentation**

## **A 'Mini-' Range Instrumentation System**

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### **ABSTRACT**

In a test environment where several projects are vying for time for their test program, how do you support the programs who are waiting their turn in line? Or the program which only wants telemetry support in his assembly area, and doesn't want to pay for the entire range? The answer is a 'mini-' range instrumentation facility without the expensive tracking and relay systems. Distributed Instrumentation allows for 1) Project dedicated support; 2) Project unique support; and 3) Project favorable costs. Distributed Instrumentation is a network of instrumentation capabilities which can be catalog selected and integrated into a project friendly system, and can support the project's particular requirements and time schedule.

### **INTRODUCTION**

The now generation weapon systems are becoming more complex in both capability and performance. This complexity is in many instances driving the state-of-the-art in technology and in man-power. Everyone and everything needs to work better, faster, harder, longer, and smarter than any of its predecessors. The manpower needs to be better trained, the operators need to be higher educated, the support systems more intelligent. With the use of higher trained manpower the personnel costs have soared. The costs of labor intensive efforts need to be reduced. Automation, while it can be the answer to a lot of cost savings, has become a long lead item because of electronic interface and integration, and software development.

As a result of the technology explosions, the testing has become more broadband, complex, and all encompassing than before. The cost of an hour of range time at any test complex or range is skyrocketing higher than the altitude specifications of the systems being developed. Selection of a test range to test that wonder weapon is not minimized by the expensive 'Buck Rogers' centralized processing and display approach for 'range

management and project control' which is generally the current approach. This approach has a tendency to maximize test costs and provides, for the most part, basic project window dressing.

Large test programs typically involve a lot of 'small time' activity, typically in excess of 90 percent. There are never-ending system tests, calibration runs, system or component trouble-shooting, performance monitoring, and others. It is not necessary or desirable that one stand in line and wait for the entire range telemetry support to be **scheduled** for every in-house, closed-loop test which ideally needs to be run on **demand**. What is needed is a support system which would be available on a **project dedicated basis** which has been configured to meet the **projects requirements**. Hardware can be configured and software developed to provide a standard data product. There is no need for **expensive complicated tracking antenna arrays, radar networks, massive data relay networks, precision pointing devices, super computers, and fancy central displays** ("ECTAARNMDRNPPDSCAFCD") for a hard-wired, closed-loop test from the assembly building next door, especially when you want to do it now. Yet, that is essentially what you get because there is no substantial stand-alone capability for any of the component pieces. It is best to save the "ECTAARNMDRNPPDSCAFCD" support for the actual mission when general, whole range coverage is required.

## **GENERAL RANGE INSTRUMENTATION**

Let us first look at "ECTAARNMDRNPPDSCAFCD". This is a large system of range instrumentation which is structured like an old covered wagon wheel. It generally has a centralized processing and display system at the hub which consists of one or many, large or small computers. This central facility then connects to outboard radar systems, telemetry tracking stations, tracking telescopes, fixed camera stations, flight and range safety monitors, and data reduction and analysis facilities. It is for the most part device dedicated; i.e., configuration controlled devices move from project to project in order to provide canned support for a mission. It is usually high in overhead and tremendously energy intensive. It also suffers from the problem that when the central unit is down, the range is down. The greatest problem, however, is that it can usually support only one mission at a time. It is generally capable of:

- Central real-time display and plotting
- Weapon System position/velocity/acceleration data
- Target system position/velocity/acceleration data
- Reference positions
- Mapping
- Telemetry Data Acquisition
- Remote pointing of tracking devices
- Correlation of range safety data for command destruct

Time/event sequencing  
Feeding the ego of project management

## **PROJECT OWNED RANGE INSTRUMENTATION**

A project owned range instrumentation system becomes extremely expensive when you consider the cost of extensive radar networks, telemetry tracking systems, communications systems, and the like. It is also mind-boggling to consider what a test range would look like if every project showed up with a complete range instrumentation system. The frequency interference alone would be intolerable. The energy requirements would be unmanageable. And the drain on the U. S. Treasury would be reflected in the wrath of the taxpayer. It is obvious that the concept of project dedicated, total systems is neither operationally feasible, nor time effective, nor cost effective.

## **DISTRIBUTED INSTRUMENTATION**

So what is **Distributed Instrumentation**?

It's project friendly.

It's based on project needs and requirements.

It's more affordable.

It's expandable and compressable.

It's a combination of individualized specialized project dedicated support and "ECTAARNMDRNPPDSCAFCD".

It's tailorable to suit the projects' requirements, ---- and pocketbook.

The heart of Distributed Instrumentation is a project dedicated support capability (in difference to a project owned instrumentation system). This serves the project as a home base or 'mini-' range environment which basically they can then control. It is a concatenation of that dedicated general support required from "ECTAARNMDRNPPDSCAFCD" with the project unique requirements. It can be a basic telemetry ground station; hardwire ground instrumentation; video tracking or performance systems; a vehicle performance monitoring system; real-time decision making; environmental monitoring systems; support status indicator; or any combination thereof. The system is configured to the project's support requirements, and is not burdened with unnecessary appendages. Once the system is assembled, standard data products can be defined which will serve the entire test.

The project dedicated system can be directly interfaced with the "ECTAARNMDRNPPDSCAFCD" for testing which requires the use of the full range. Evaluating the marriage of the two from the viewpoint of the data requirements, the ideal solution is get the data in a format which is compatible with the standard data product

already designed. The easiest way to accomplish this is to reduce all the data in the same place. The obvious place to do this is in the system which was designed around project requirements, which already has a standard data products support requirement.

This in turn minimizes the amount of support and the amount of time that “ECTAARNMDRNPPDSCAFCD” must be scheduled (and paid). Range telemetry data, tracking information, and video data can be relayed to the project system in real-time. Therefore the only data processing requirements are for that which is required for range control and range safety, which is done in realtime for the most part,. Collective range tracking and optic data (the final picture) can be reported post mission in such a manner that it can be merged with other data obtained.

Data reports and software can be developed which will allow for the analysis of the system under test from calibration, through test and certification, flight readiness checks, final flight, and post mission checks. All of the data from various phases can then be easily compared, and the final results more quickly and reliably detailed.

## **SUMMARY**

**Distributed Instrumentation** is a solution to the problem of complete project support. It offers project friendly support at a project favorable cost. It provides for a continuity of testing while minimizing ‘wait’ time. It allows for concurrent testing on the range. It provides a superior final product, in this case test data, at a more cost effective price.