

SOFTWARE USED IN THE WIND TUNNEL DIVISION

A mixture of software is used in the Wind Tunnel Division. The majority of the data systems and control systems application software has been developed in-house. A limited number of the technical systems use Commercial Applications that are configured by in-house staff. All in-house developed software and all commercial software packages are furnished by the government. No software used in the Wind Tunnel Division is provided by the contractor. All software created by the contractor as part of the current contract is owned by the Government.

The following is a summary of the major Operating Systems, Databases, Programming Environments, and Commercial Applications currently used :

Operating Systems:

Solaris, LYNX OS, Labview Real Time, Linux (REDHAT, CENTOS), ROCKS/CENTOS (Cluster), Windows 7, Windows Server 2003, DOS, Apple OS

Databases:

Interbase, Firebird (Open source version of Interbase), Filemaker, MYSQL

Programming Environments and/or Commercial Applications:

CLEARCASE, C/C++, Fortran, IDL, JAM, PERL, Labview, Matlab, TekPlot, UWAL, PyDatamine, DESL, DAC_Express, OVATION (Emerson), MATRIX X, Logic Master (GE FANUC), MAXIMO, ADEPT, Microsoft Office Applications, Microsoft Project, Solid Works, MACDRAFT, Vector Works

The following is a listing of the custom in-house developed applications:

Standard Data System (SDS) – There are six nearly identical Standard Data Systems. Standard Data Systems use in-house developed software. The acquisition portion of the SDS Systems use software developed in C/C++ and runs on multiple LYNX OS (real time) platforms. Newer acquisition portions are being developed which will use the Labview and C/C++ programming environment. These newer acquisition portions of SDS will run on Labview Real Time platforms. The main System Processor of SDS uses in-house software developed in C/C++, Fortran, JAM, IDL, and PERL. The bulk of the computational software is in C/C++ with a small amount in Fortran. The alphanumeric User interfaces are built using JAM. The Graphical User Interfaces are built using IDL. The main System Processor utilizes the Interbase relational database product at its core. This main System Processor software runs on a Solaris platform. The storage portion of SDS uses software developed in-house using C/C++ and uses the Open Source version of the Interbase relational database call Firebird. The storage portion of SDS uses a LINUX (REDHAT)

Operating System. User interfaces are a mixture of Tektronix X-Terminals, MacMini's running Apple OS, and PC's running Windows 7 platforms. All user interfaces run X-Windows. The MacMini's and PC platforms also use standard Microsoft Office Applications in addition to X-terminal emulators.

Dynamic Data System - The Dynamic Data System uses in-house developed software. The acquisition portion of the system uses software developed in the Labview programming environment and run on Windows 7 platforms. The dynamic data processing portion of the system use in-house software developed in C/C++ and IDL. Dynamic Data Processing runs on either Linux or Windows 7 platforms. Dynamic data storage portion of the system uses software developed in C/C++ and IDL. The data storage runs on a Linux Server. This Linux Server uses either the Linux OS (REDHAT) file structure or uses a Firebird Relational Database.

Schlieren/Shadowgraph Data System - The Schlieren/Shadowgraph Data System uses in-house software developed in the Labview programming environment and runs on a Windows 7 platform.

Infrared (IR) Data System – The IR System uses in-house software developed in the Labview programming environment and runs on a Windows 7 platform.

Data System Coordinator – The Data System Coordinator manages the interactions between the Standard Data System and other test dependent data systems like the Dynamic Data System, the Schlieren Data System, the IR Data System, Pressure Sensitive Paint Data System, and test dependent model controls systems (e.g., inlet plug controllers, flap controllers, etc.). The Data System Coordinator is a Labview based running on a Windows 7 platform and uses in-house developed software.

Test Dependent Safety Systems – This group of systems are used to monitor test dependently critical loads on the wind tunnel test article. They include a Safety-of-Flight System, a Flight Recorder System, and a Balance Load Alarm Monitoring System (BLAMS). The primary sensor monitored/measured by these systems is the main force measurement sensor (i.e., the wind tunnel balance) but can include other sensors such as sting strain gages, flap moment gages, etc. The software for these system have been developed in-house using a mixture of Labview, C/C++ running on Windows 7, Labview Real Time, and DOS based systems.

Facility Control Systems – This group of systems include the systems that perform the primary control of the facility and the health monitoring of major rotating machinery that is part of the wind tunnel. The control system is predominantly a Ovation (Emerson) control system running on Sun Solaris computers supplemented with a mixture of DOS based and PLC based subsystems. The software running on these systems was developed in-house

using C/C++ and Matrix X for the Solaris portions, C for the DOS based systems, and Logic Master for the PLC's. The exception to the above is the vibration monitoring systems which use standard Bentley-Nevada Vibration Monitoring software which are only configured by in-house staff.

The following is a listing of the systems using predominantly commercial (or out-of-house developed) applications that are configured by in-house staff:

Pressure Sensitive Paint (PSP) Data System - The PSP System architecture was developed by the Air Force at AEDC. The custom software for this system was created by AEDC. In-house staff only configures this software. Note, this system is based on a "Cluster" concept where 9 computers are linked together using the ROCKS/CENTOS (Cluster) Operating System. Special System Administration skills are used to manage this system.

IT Security Systems – Information Technology (IT) security systems are utilized in the wind tunnel data systems. Two types are currently used – Data Diodes and Firewalls. These systems run commercial applications and are only configured by in-house staff.

Aeronet Systems (Customer Analysis Environment) – The Aeronet Systems consist of Linux based data server feeding a group of PC's typically running commercial analysis applications like Matlab, TekPlot, UWAL, PyDatamine, DESL, etc. which are configured by wind tunnel customers. These PC's are supplied to customers for their exclusive use during their test's occupancy at the wind tunnel and typically run Windows 7, or Linux (REDHAT) operating systems. In-house staff configures these systems but does not develop analysis software for customers to use on the Aeronet Systems.

The following are Support Systems – This group of systems includes Business Servers, Maintenance Management System (MAXIMO) Server, and Engineering Document Management Server and the commercial applications that run on these servers such as Microsoft Office Applications, SolidWorks, MACDRAFT, VectorWorks, Microsoft Project, Matlab, etc. No custom programming was performed on creation of these systems.

TSF Customized Software				
TSF Area	Software Name	Function	Software Language	Software Developer
Arc Jets	Multifunction Arc Jet Instrumentation and Computation (MAJIC)	Software for Arc Jet Data Acquisition System (AJ-DAS) acquiring model and facility data and pulling in data from the flow control and other systems	Lab VIEW/ LabWindowsCVI +GE communications software	NASA in house
Arc Jets	Null-Point Data Processor	1-D finite element analysis to calculate heat flux from a null-point calorimeter temperature trace in a MAJIC data set.	Lab VIEW	NASA in house
Arc Jets	N234 / N238 Air/Argon Gas Flow Control System	Flow control PLCs running on GE 90-70 system hardware and accessed via PC HMI.	GE (FANUC) Proficy / CIMPPLICITY	NASA in house and third party
Arc Jets	Arc Jet Air System (AJAS) Control System	Control of compressors and valves used to supply high pressure air to the arc jet facilities.	Emersion Ovation Expert Distributed Control System	NASA in house
Arc Jets	AHF Model Insertion System (Hydra)	5-model support carriage control software.	LabVIEW + MTS Motion Controller	NASA in house
Arc Jets	IHF Overhead Swing-arm and Tilt-table (Cerberus)	3 Swing-arms + 1 Tilt-Table model support control.	LabVIEW (HMI), LabVIEW RT (Master/Safety System), RMC Tools (Motion Controller)	NASA in house
Arc Jets	75 MW Power Supply Control System	Operates power supply for the IHF arc jet	GE CIMPPLICITY + High-Speed Control: LabVIEW	Third party
Arc Jets, Steam Vacuum System	Data Acquisition System (SVS-DAS)	Acquires diagnostic data from the vacuum system instrumentation	Lab VIEW	NASA in house
Arc Jets, Steam Vacuum System	Steam Vacuum System (SVS) Control Systems	SVS Boiler Control, Burner Management, and Vacuum Ejector Control Systems (3 independent, but linked systems).	Allen Bradley RSLogix	Third party

Arc Jets, Steam Vacuum System	SVS Exhaust Nitric Oxide Scrubber System	Controls a pollution control system that scrubs NOx generated by arc jet operation from vacuum system exhaust.	Allen Bradley RSLogix	Third party
Ballistic Range	Ballistic Range Counter Interface	Uses time-of-flight counters' HPIB interface to download intervals and calculate projectile flight time.	LabVIEW	NASA in house
Ballistic Range	Vacuum – Data Acquisition System (V-DAS)	Support DAQ system monitoring the pump-down of the EAST.	LabVIEW	NASA in house
Ballistic Range, EAST facility	Igor-Impax Import (I3)	Reads EAST facility COTS DAS file from Impax high-speed data system into IGOR data analysis software.	LabVIEW	NASA in house
Other, mARC facility	mARC DAS	Data system for the miniature Arc Jet testbed	LabVIEW	NASA in house