

Aegis, Inc.

Capabilities Document

Personnel, Experience, and Capabilities

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Capabilities

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1 The Company

AEGIS Incorporated specializes in hardware and software for embedded systems, particularly in the areas of high-speed data capture, signal processing and networked management of remote systems.

We are primarily a services company, consulting in the areas highlighted in the left sidebar. Our primary focus is in embedded software and hardware for signal processing and we have extensive experience with DSP's, FPGA's, modulation, encoding (e.g. error-control codes) and GSM.

We also have one product released and others in pre-production. Our released product is called the "NRC", which provides data forwarding and receiver remoting capabilities across a WAN. More information is available in this document and even more on our website (www.aegis-inc.net).

Aegis personnel have over forty years of SIGINT experience in solving the most demanding real-time data access problems with the latest technology and value-added support services.

When combining this extensive experience with the knowledge and understanding obtained by decades of direct experience in the Intelligence Community, AEGIS provides a unique perspective for understanding the demanding requirements placed on systems to include the need for Quick Reaction Capabilities (QRC), and unique size and power constraints.

2 Experience

Embedded design with FPGA's and Linux

We have designed and produced systems using embedded microcontrollers, CPU's, and FPGA's. These designs have used MMU-based architectures with embedded linux (Gentoo) to performs signals acquisition and processing. We have written device drivers with linux 2.4 & ported code to the 2.6 kernel. Our personnel have extensive experience with the latest FPGA design tools and methods. We have designed with both Altera (Flex) and Xilinx (Virtex, Spartan, etc.) components using Synplicity, Modelsim, Quartus, and similar software platforms.

Our designed have exercised the fullest functionality of the above families, maximizing gate usage and still optimizing performance (up to 1M gate parts).

GSM

Aegis has experience with GSM protocols and designing systems to work within GMS networks. We understand the air-interface and how to program DSP technologies to interface to the GSM network, to include the GSM 4.07/4.08 protocol, GPRS, 1xRTT.

High-speed bit-stream processing

Aegis has experience processing SDH/SONET traffic operating at up to 622 Mbps using a combination of FPGA and ASIC parts. We have written VHDL software to perform protocol processing (IP, ATM, TCP, etc.), to include *bit correlation* and demultiplexing functions. The solution used compact PCI (cPCI) hardware and performed optical to electrical (LVTTTL) conversion. Software tools used included: Synplicity, Altera (Quartus), and ModelSim (Windows NT platform).

We have also written VHDL and C software to process demodulated bitstreams from custom communication devices. This design incorporated demultiplexing techniques and included majority logic decoding for bit stuffing and removal as well as synchronization state machines. This solution was on a custom board integrating a Texas Instruments (TI) C60 DSP and two Altera FPGA's.

We have designed and implemented circuitry to handle RS232, RS422, ECL, pECL and other differentially encoded data streams.

We have designed and developed systems using fast I/O cards from EDT (specifically the EDT-PCD-60).

Wideband signal analysis and narrow- band FFT algorithm

Fast-Fourier Transforms (FFT's)

development

Aegis personnel have written many signal processing solutions that use FFT-based algorithms (both fast Fourier transforms as well as fast time-domain analysis functions). We have experience with design limitations of FFT's and their implementation (i.e. one large FFT vs. multiple concatenated FFT's with a smoothing function between boundaries). These solutions have been implemented on both hardware (DSP's) and in software (Windows, Unix) platforms.

FFT Spectrum Analyzers

Further, we are familiar with commercially available tools from Agilent, Tektronix, Rhode and Schwartz and other vendors for processing RF inputs using FFT-based spectrum analyzers. We have used these products as standalone devices or in a chassis-mounted configuration, controlling them via a custom language interface to perform measurements and retrieve data sets.

Analysis Tools and Development

We have written waterfall, power spectral, and other frequency-domain displays. Our signals analysis experience includes Z and DFT transforms. Furthermore, we have coding experience with FIR and IIR filtering, histogram and other statistical analysis methods, pattern-recognition.

Aegis personnel have written software and designed systems for various signal processing efforts: emitter identification, eigenspectrum analysis, speaker recognition, interference reduction, image processing, and optical character recognition.

Peak-Detection and Signal Recognition

We have programmed the Tektronix 3052 to automatically detect and display frequency-hopping signals in the gigahertz band. We have implemented signal recognition algorithms on the HP BLACKBIRD (signal survey system) to detect multi-tone modems and similar signals (using a hybrid peak-detection algorithm).

High-speed digitizers

Product Experience and Knowledge

We have design and system experience with Pentek, Bittware, Gage, and Agilent A/D conversion products. We have written software to configure, control, and process data from these products. We have a close working relationship with Bittware and can provide customized Bittware solutions for digitizing, processing, and data storage.

Previous High-Speed Digitizer Work

Aegis has performed previous work in creating a PC-based digital signal analyzer. This product had a 10MHz bandwidth with up to 72dB dynamic range. It used a 12-bit Analog Devices A/D (20MS/s) incorporated on a custom 16-bit ISA card. There

were anti-aliasing filters on the card and the assembly drivers allowed direct to memory DMA transfers. The continuous data stream was written to PC memory where it was processed (FFT) and subsequently displayed in waterfall format for user interaction. In the proof-of-concept model the user was permitted to “zoom” into the display as well as modify the display threshold so that only signals above a given peak were displayed.

*DSP tools and systems
knowledge*

Algorithm and Coding

Aegis personnel have extensive experience implementing signal processing algorithms in C, C++, and assembly languages. Furthermore, we have incorporated these code segments into hardware (DSP-based) and software signal processing and analysis solutions.

Commercial and Government Tools

Aegis has used similar commercial products such as MATLAB, LabView, and Mathematica as algorithm test beds and analysis tools. We have incorporated our software into these frameworks for fine-tuning and adjustment. In addition to these commercial products, Aegis has integrated signal processing software into tools (MIDAS2K, MARTES and CHALK) used throughout the intelligence analysis community.

Driver Development

Further, we have device-driver experience in both the PC and UNIX environments, allowing us to create data and control paths for ISA, PCI, or SBUS cards to host-based software. We are familiar with industry standard (Borland, Microsoft, Symantec, etc.) coding tools and most commonly used languages.

*Advanced wideband
in-field recording and
digitization*

Fielding Systems and RF

We are familiar with the system-level tradeoffs encountered when designing fieldable equipment: power, size, ruggedability, and have made multiple systems for the intelligence community that have been fielded around the world. Furthermore, we have experience with front-end RF design, understanding the selection process for pads, filters, low-noise amplifiers, mixers, and RF switches.

Digitizers

Aegis has developed customized digitizers using PC-based cards as well as used a variety of commercial recording products. We have experience with solid-state

recording devices, hard-disk based units, and commercial tape recorders (for example the DTR-6 and DTR-8 Metrum-Datatape recorders).

Other Aegis experience includes sequential access SCSI storage devices using specialized bios routines to enhance data throughput and reliability.

Data Transfer

In our custom designs, we have written software to transfer data across the PCI, ISA, and VME busses, providing raw data storage as well as a database of signal-related information (SRI). This SRI included frequency, bandwidth, duration and time/date stamp.

We have integrated commercial products with custom front-end conditioning and pre-processing to meet specialized storage requirements.

Advanced signals

collection and control

Data Forwarding

Aegis personnel have extensive experience in data forwarding and equipment control techniques within the intelligence community. We have worked with a variety of collection equipment in remoted sites and were involved with designing and establishing specifications for the existing control and forward mechanisms used in TAG today. We understand the bandwidth tradeoffs of the many transports currently available, as well as the sensitive nature of the information and equipment involved.

Adaptive filtering

techniques

Aegis personnel have years of experience with noise removal and filtering techniques. We have incorporated neural networks to implement pattern recognition techniques on various types of data sets.

Aegis has experience coding LMS filtering algorithms for use within equalizers and matched filtering techniques for processing HF signals.

We have extracted video signals in poor signal conditions (performed in-depth analysis of video signals masked by TEMPEST techniques and designed DSP-based algorithms to defeat such masking). We have developed noise-filtering algorithms for use in telephony and speech signals.

We have designed software for technical surveillance counter-measures (TSCM) spectrum analyzer control system.

*Network tools and
systems experience*

We have network skills and experience in the following areas:

Design, Configuration, Management: Aegis personnel have experience with integrated NT and UNIX networks. We have implemented resource sharing using NFS, TFTP, FTP, and SAMBA. We have configured Unix on Sun(SunOS & Solaris), HP(HP-UX), DEC(VMS), and Intel(Linux) platforms. We are familiar with troubleshooting methods using software and hardware network diagnosis tools.

Protocol Analysis: Aegis has used different protocol analysis tools to ascertain types of network traffic. We have examined data streams at the physical, data link, and transport layers. We understand the seven-layer OSI model and can design or comprehend systems that require or use it.

Development: We have developed systems that require network connectivity for data transfer and control. We have written software and designed hardware to integrate into well-known network solutions (such as a T1, LAN, WAN, or satellite). We are familiar with system-level tradeoffs of different network solutions for transporting data (such as bandwidth, reliability, latency, session-oriented vs. connection-less links, etc.).

We have written remote applications implementing graphical interfaces, drivers, and control software across world-wide networks. We have written daemon processes for process and equipment monitoring and control. These solutions are indicators of Aegis' extensive knowledge of network programming using Perl, Tcl/Tk, and C.

*Advanced Analytic
Software development*

Aegis personnel have extensive experience with the application of signal analysis and processing theory to real-world problems. We have written software modules for filters, equalizers, bit synchronizers, demodulators, and similar tools. We understand the modular approach to problem solving and have designed solutions allowing a flow of data to be processed in modules, incorporating modules as required or to provide a hierarchical capability.

Data Warehousing

Experienced in designing, developing and implementing Corporate Data Warehousing solutions. Specific experience includes mapping legacy specifications into Enterprise Data Warehouse requirements paying close attention to data extraction, transformation, and loading (ETL), database modeling, data marts, and meta data management. Also experienced with operational issues especially as they relate to the Online Analytical Processing (OLAP) environment: query performance, security, backup and error recovery, service level agreements (SLA), scalability and configuration management.

*Client-Server
Computing*

Demonstrated ability to design, develop and deploy client/server applications using distributed computing methodologies. This includes multiple tier implementations of application and database objects throughout the Enterprise. Also experienced in migrating traditional third generation language batch oriented applications into the forth generation language paradigm. Experienced in developing client/server applications for transactional systems, decision support systems, adhoc query and report generation systems, and business intelligence systems.

*Internet/Intranet Web
Solutions*

Hands on experience in building Intranet and Internet solutions designed to support a wide variety of business needs. Specific experience with the following Intranet and Internet related technologies:

- Integrating web delivery systems with existing legacy business processes.
- Development of applications that generate dynamic html content based on user needs.
- Implementation of Data Warehousing OLAP over the web.
- Architecting for supply-chain management and customer management web sites.
- Rapid Prototyping of Internet/Intranet solutions.

*PBX Architecture and
Installation*

Aegis has installed and maintained, in numerous sites, Avaya Definity telephone switches (enterprise-level). We have worked in customer sites to gather requirements, create telephony and data architectures and install the same.

We understand how to integrate these solutions as well as how to move the resulting voice and data off campus into existing telephony and data networks (with such technologies as microwave and satellite).

3 Products

*NRC – Networked
Receiver Controller*

NRC

The NRC (*Networked Receiver Controller*) is a hardware device that controls up to 8 homogeneous or heterogeneous receivers and places the VGC data from the receivers on a TCP/IP network. The receivers are controlled by either independent RS-232 or Ethernet connections. The control and data from each receiver is provided to the user via TCP/IP socket connections.

IR&D Telephony Test System

Currently being developed

Digital Data collection System

Currently being developed

4 Capabilities

QRC Capability

Quick-Reaction

Aegis has access to complete QRC prototyping and production facilities with the capability to provide the fabrication of parts, the manufacture of circuit card assemblies, the assembly of equipment and inter-connecting cables, and the integration of equipment into systems and subsystems. Work is performed in accordance with MIL-STD-454 workmanship standards.

Equipment in the assembly shop is available for specialized, standard and custom cable and wiring applications, PCB fabrication and assembly, and chassis assembly/black box fabrication. Machine and hand tools are available for a wide variety of pins and cable types.

Local engineering office (within one hour driving distance Northern Virginia and Baltimore).

Local Office

The Aegis corporate office is conveniently located midway along the Baltimore and Washington corridor.

Provide ready-to-use NSA-approved SCIF.

NSA-Approved SCIF

Aegis has access to dedicated secure facilities (SCIF), starting at 350 sq. feet, for classified efforts. All spaces are NSA-approved and have controlled access (limited to those staff supporting the effort). Sign-in logs and cipher locks are located on all entry and equipment doors. Access is controlled and monitored according to NSA Security regulations.