

## Using VHDL as a System Specification

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### Abstract

This presentation will highlight Honeywell's experience in using VHDL as a specification for a graphics display system. During the Graphics Processor Definition (GPD) Program, Honeywell developed a VHDL performance model which embodied the characteristics of the system architecture. During the next phase of the program, the Cockpit Display Generator (CDG) contract, Honeywell is developing a functional model of the architecture. The VHDL model is being used, in conjunction with the Segment Definition Document (SDD), and various 2167A documents, to fully specify the system. This presentation highlights how VHDL fits in with this process, how the use of VHDL affects the traditional specification and documentation method, the problems encountered during this process and their implications, and recommendations for changes required to make a VHDL specification process a reality. The technical details of our methodology were presented during the performance modeling tutorial at this conference.

The VHDL methodology during Phase 1 was based on the use of a configurable library of generic components. These components were characterized with performance characteristics taken from the SDD. In addition, software tasks for the processor model were also extracted from the SDD. This allowed the system performance model to model both the hardware and software characteristics of the system. During Phase 2, the performance model is now being fleshed out with functional details. A documentation methodology is being developed to describe the hardware requirements in conjunction with the VHDL model. The existing 2167A documentation methodology needs to be updated to reflect these new system design processes based on the use of VHDL.

In order for the government to use VHDL as a specification mechanism, the involved agencies need to have a VHDL infrastructure in place. This includes tools, libraries, process, as well as a trained staff. The proposed Air Force procurement strategy of requiring top-down VHDL methodology implies that both the government agencies and contractors need to be prepared to deal with this process. Developing and evaluating VHDL specifications requires a significant investment in the infrastructure previously mentioned. In addition, many standard practices, such as IEEE 1164, are needed to make this scenario a reality. Tools are needed to support this methodology including faster simulators, documentation support tools, and requirements traceability. Commercial system design tools in this area are sparse and poorly integrated.

1. *A VHDL Performance Modeling Environment*, Fred Rose and Todd Carpenter, Fall 1991 VIUF Conference.
2. *VHDL Design and Simulation for Air Borne Graphics Generation Requirements*, Jerry Meyers, NAECON, May 1991.

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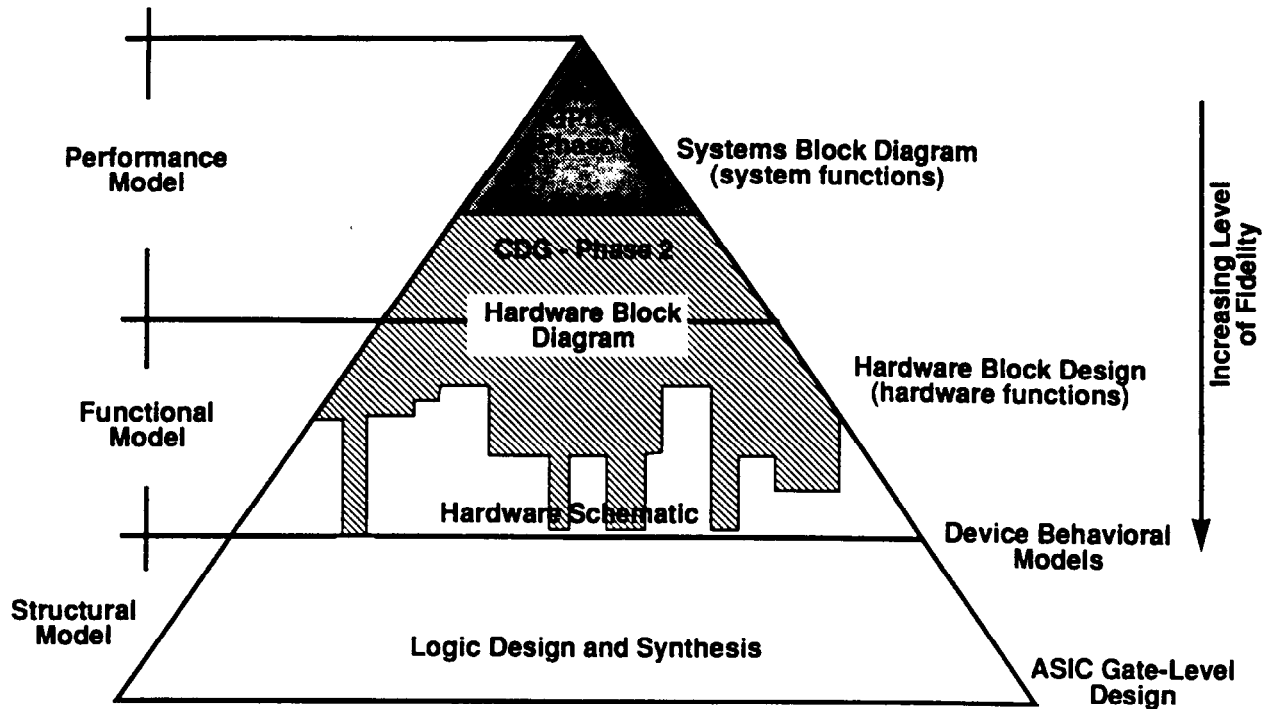
## Introduction

- Experience, implications, and recommendations
- Based on a top-down design approach, utilizing VHDL for a graphics processor
  - Phase 1 - Graphics Processor Definition (GPD) - Architectural Definition
  - Phase 2 - Cockpit Display Generator (CDG) - Architectural Implementation
- Multiple levels of VHDL
  - Phase 1 was performance model
  - Phase 2 is a functional model (under development)
- Talk focussed on contracting and specification aspect of using VHDL
  - Not restricted to DoD

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# Top Down VHDL Model



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## VHDL as a Specification - Phase I

- A Segment Design Document (SDD) was developed to specify a hardware/software architecture which fulfilled requirements
- A VHDL performance model developed to validate proposed architecture
  - Evaluate latency requirements
  - Evaluate throughput, utilizations, etc.
  - Modeling both hardware and software
- VHDL model contained references pointing back to the SDD
- VHDL model embodies performance characteristics of the architecture as well as the structure

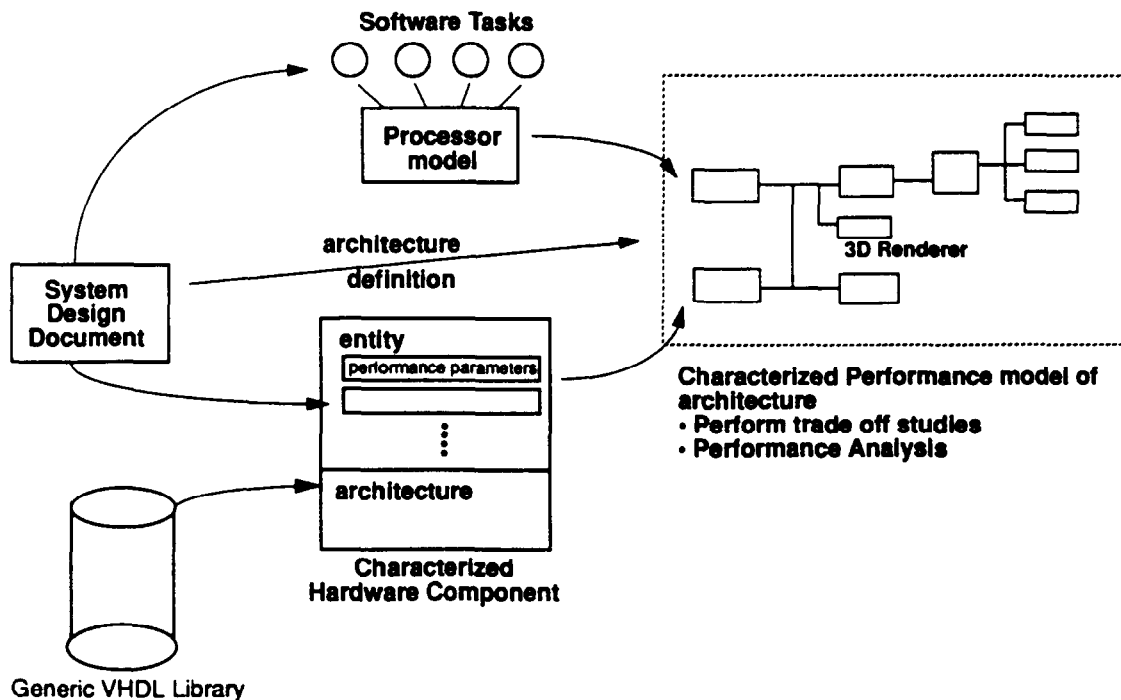
# VHDL Methodology - Phase 1

- Develop a configurable library of generic components
- Symbols created for library elements on Vantage system
  - Model captured and configured graphically
- Determine the depth of architecture to be modeled
- Configure components according to the architecture specification
  - Characterize processors, buses, etc.
  - Characterize data input
  - Characterize system software
  - Characterize output requirements
- Simulation
  - Performance verification
  - Architectural trade studies

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## Capturing the System Model



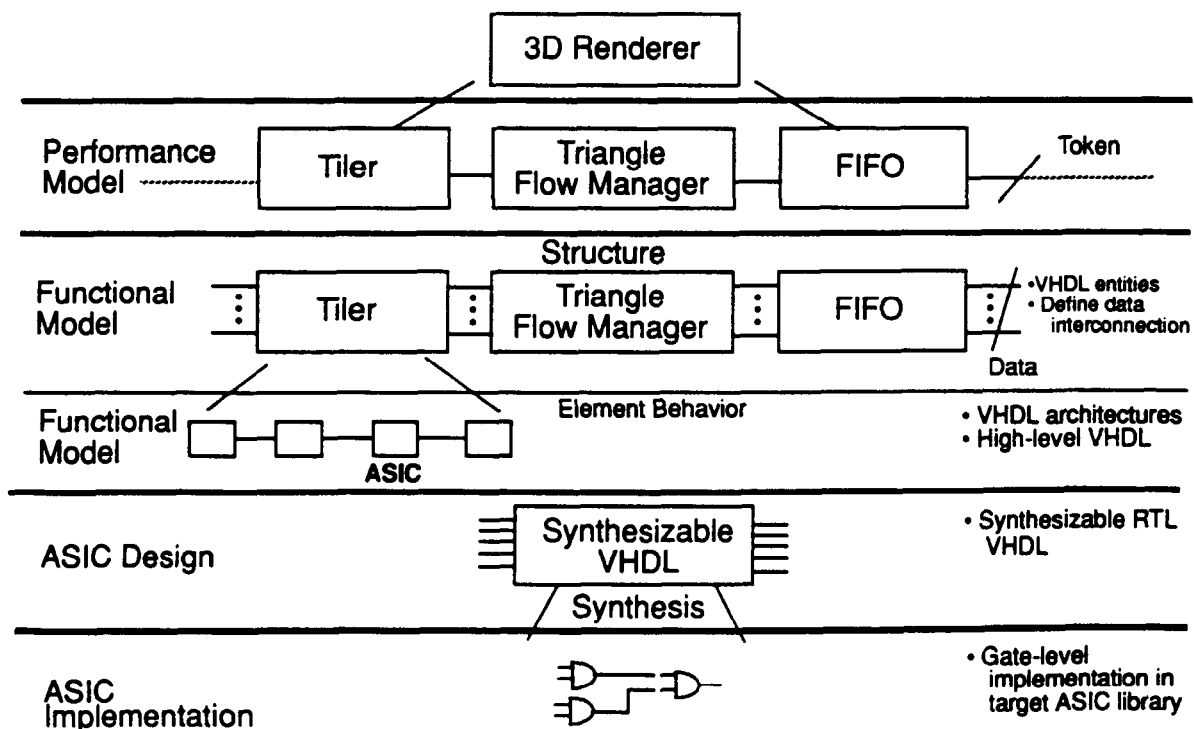
# VHDL as a Specification - Phase 2

- Develop detailed design of the architecture
- VHDL model contains functional aspects of architecture
- Use VHDL to facilitate development of architecture
  - Refine performance model to perform system level trade studies
  - Develop functional model to realize hardware design implementation
  - Develop VHDL behavioral models of ASICs
- Develop VHDL hybrid modeling technique
  - Performance and functional level VHDL models
- Develop design and documentation methodology
  - Documentation being developed to describe the hardware requirements
  - Similar to a software requirement specification

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## Implementing the System Model



# Implications

- **Contractors and government agencies need VHDL infrastructure in place**
  - **Tools, libraries, process, and people**
- **Getting an RFP with a VHDL specification is significantly different than VHDL synthesis-based ASIC design**
- **Likely scenario is getting a testbench with stimulus/response**
  - **Need to quickly put together a proposed architecture or implementation to show feasibility**
  - **VHDL formalizes this process**
  - **Design fleshed out during actual contract**
- **Government agencies and contractors need to be prepared to deal with this**
  - **Both developing and evaluating**
- **Developing a VHDL model as part of a proposal response is not impossible**
  - **We have done it twice successfully responding to primes**
- **Specification still has documentation associated with it**

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# Recommendations

- **Just do it!**
- **Standard practices ala IEEE 1164 MVL9 state system needed for**
  - **Performance modeling**
  - **Testbenches**
  - **Libraries including attributes and generics**
- **Government documentation requirements need to be updated to reflect this new process**
- **Tools needed to support this methodology**
  - **Including faster simulators/accelerators**
  - **Commercial system design tools poorly integrated**
  - **Documentation support**
  - **Requirements traceability**

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