Vertical Landing Aids Design and Test Tool Utilizing Microsoft Flight Simulator™ Visualization and Virtual Reality

The 4th IASTED International Conference on

MODELLING, SIMULATION, & OPTIMIZATION

~MSO 2004~

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Table of Contents

- **Objectives**
- Approach
- Solution Overview
- MS flight Simulator: Benefits, Enhancements & Limitations
- Design
- Phase I Prototype
- Status & Deliverables

Objectives (from Topic)

- Develop an analytic test tool that can be used to support (VTOL)/rotorcraft ship VLA analysis and testing
  - Fly specific aircraft shipboard approaches on a personal computer with a realistic view from the cockpit
  - Adjust ship VLA components and environment lighting
  - Useable at test team member's work area

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Approach Overview

- Leverage team members core competencies and experience
- Exploit and system integrate COTS tools
  - Start with lower cost, rapidly testable options
  - If current option not satisfactory for some capability, then consider higher-end option
  - Continue

Team Approach

- Stottler Henke
  - Operator Machine Interface Assistant for MH-60S/R Helicopters
  - Piloted Approach Decision Aid Logic System
  - An Intelligent Tutoring System Approach to Adaptive Instructional Systems for Helicopter Training
    - Uses MS Flight Simulator
- Consultants
  - MS Flight Simulator & Graphics Expert
  - Subject Matter Expert

Iterative Development

- Design, implement, evaluate, repeat
- Keeps client in the loop
- Allows for more feedback and guidance

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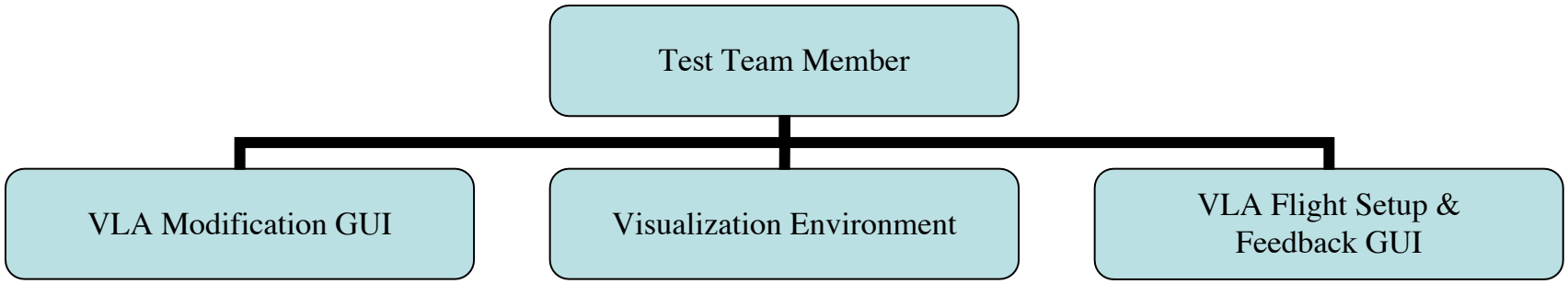
Solution Overview: Interactions



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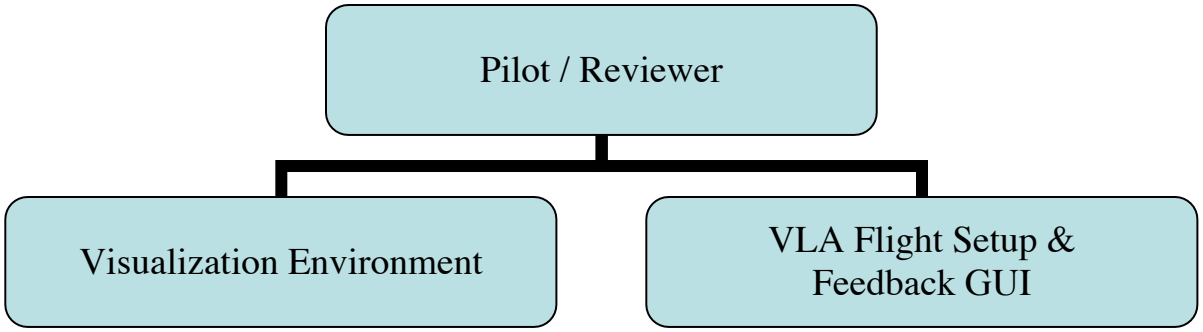
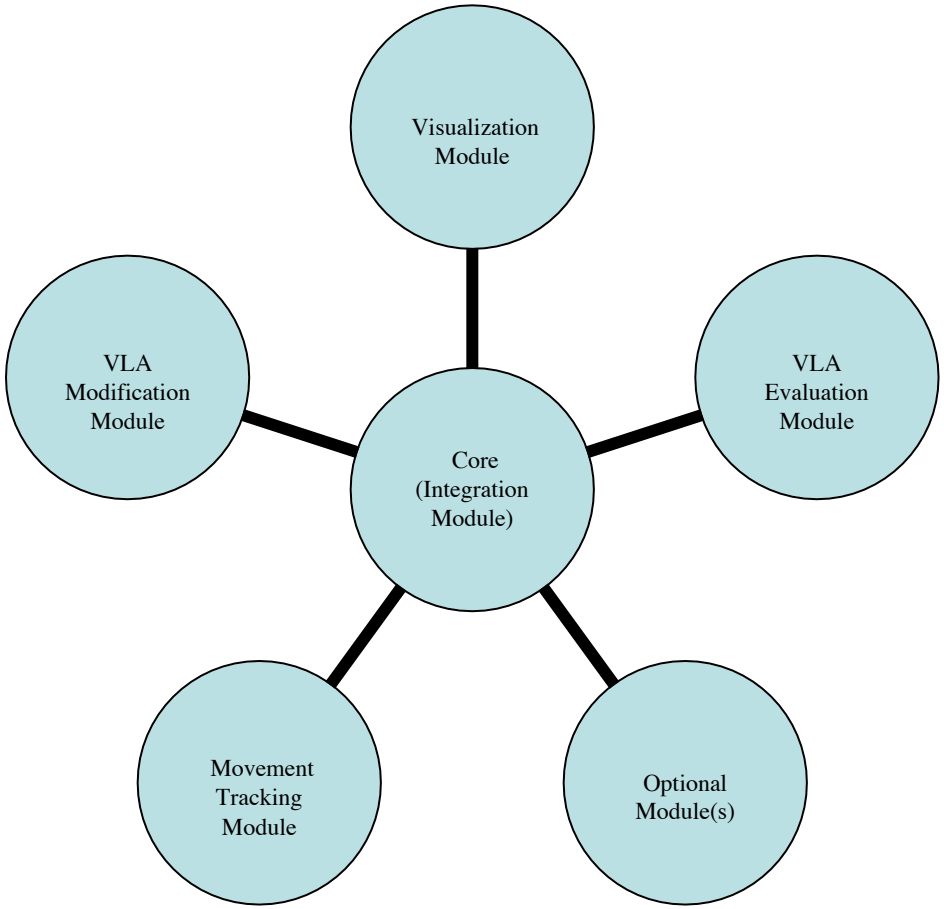
Optional:
Pilot / Reviewer High-Level Interactions



VERTICAL Architecture



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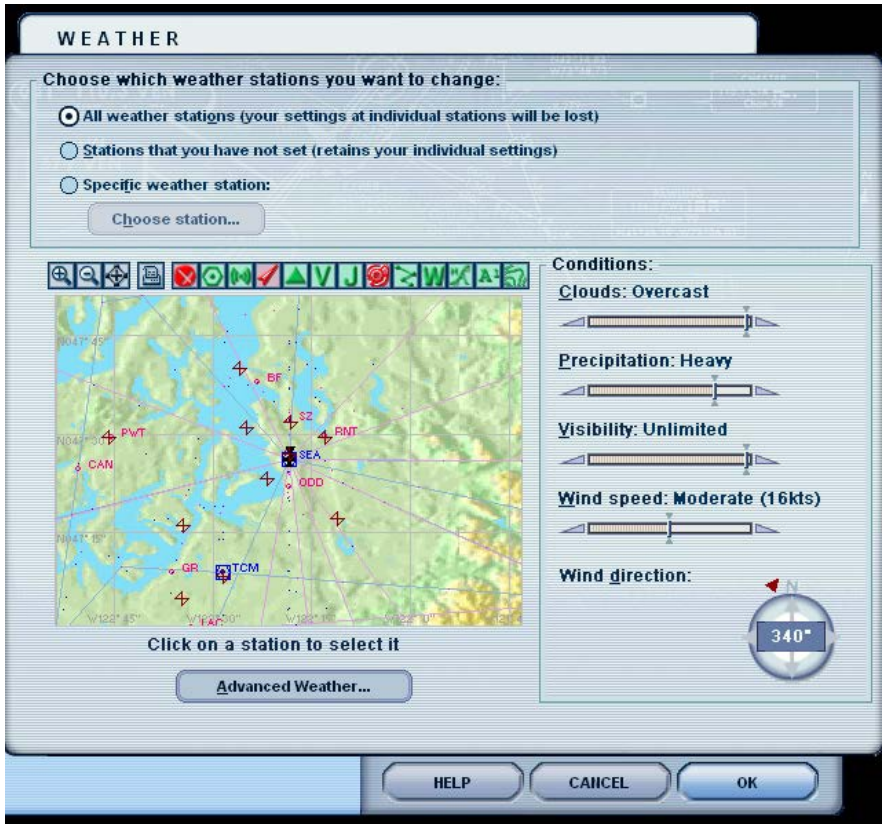
MS FS: Benefits

- Low cost: ~$50 per seat
- Relatively open platform
  - API & FSUIPC
- Real world & user setable weather
- PC-based & supported by other products
  - E.g., Graphics cards, Motion trackers
- Many low-cost add-ons available
- 2 year upgrade cycle
  - This project migrated from 2002 to 2004

Real World & User Setable Weather



Example Add-On: Improved Water Effects

Other Add-Ons

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MS FS: VERTICAL Enhancements

- Light Controls
  - Color
  - Intensity
- High-definition model of LHD
- Ship Motion
  - Control of Ship Motion
  - Video – Ship Motion

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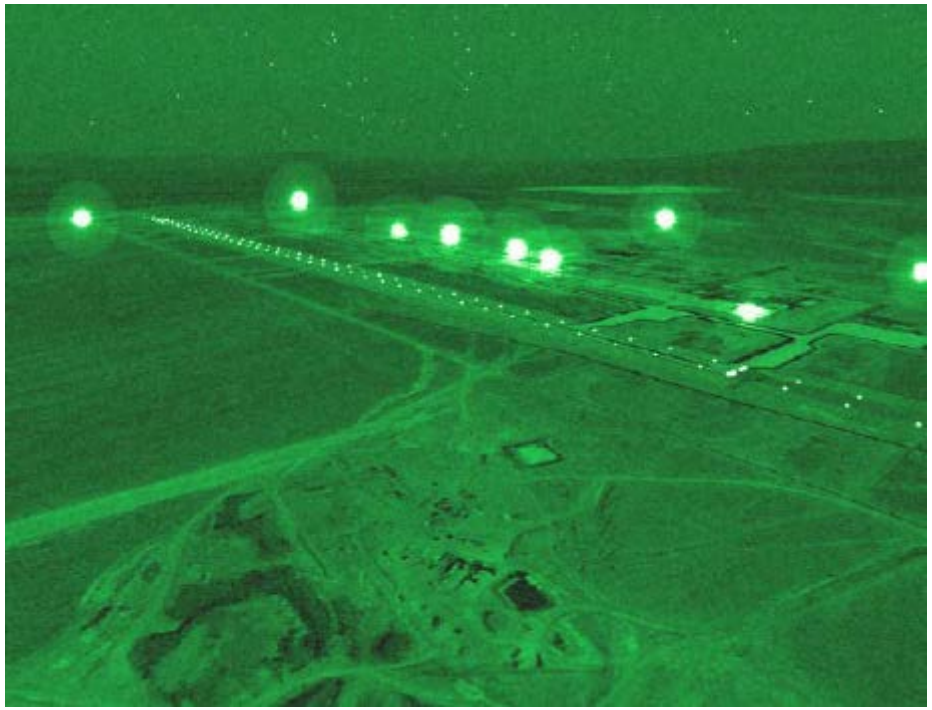
MS FS: Limitations

- NVG capability
- Chromaticity and Photometric
  - Need to investigate quality versus other COTS tools



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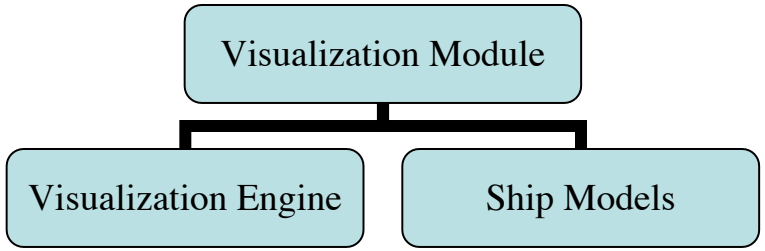
Visualization Module: Components

- Models independent from Visualization Engine
- Ship Models Generated
  - Output to MS Flight Simulator
  - Output to OpenFlight



Multiple Configurations

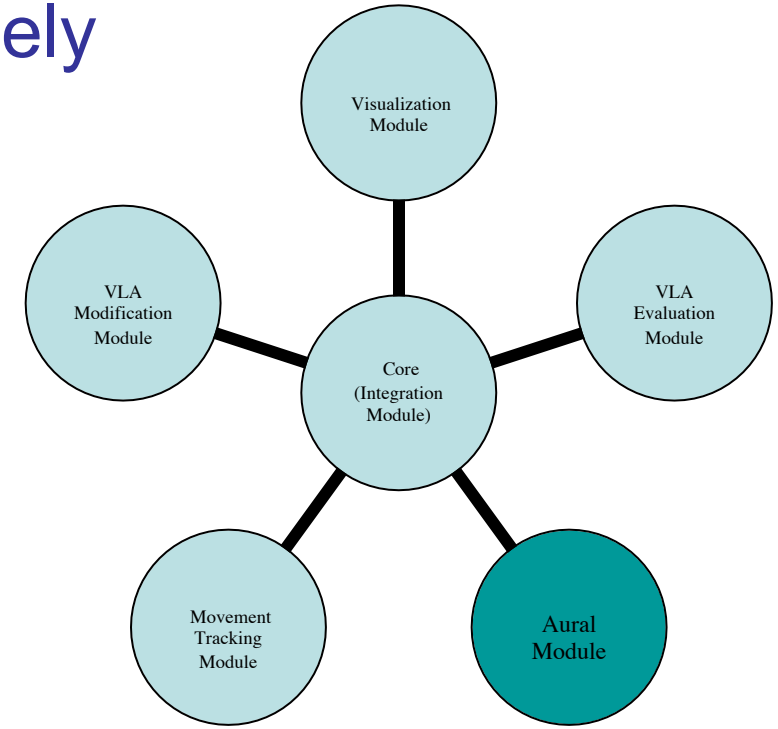
- Low-end version on many desktops
  - E.g. utilize MS FS
- High-end version
  - More detailed analysis
  - NVG analysis / more detailed NVG

ESIs Retain Modularity

- External System Interfaces (ESIs) allow modules to be plug and play.
- E.g., Visualization Module & VLA Modification Module. Prototype has
  - Visualization Module in MS Flight Simulatior 2004
  - VLA Modification Module in Java
    - Data stored in XML
  - ESI is FSUIPC

Optional Modules: Easy to Add

- Aural module
  - Provide audio to simulate real-world conditions more closely



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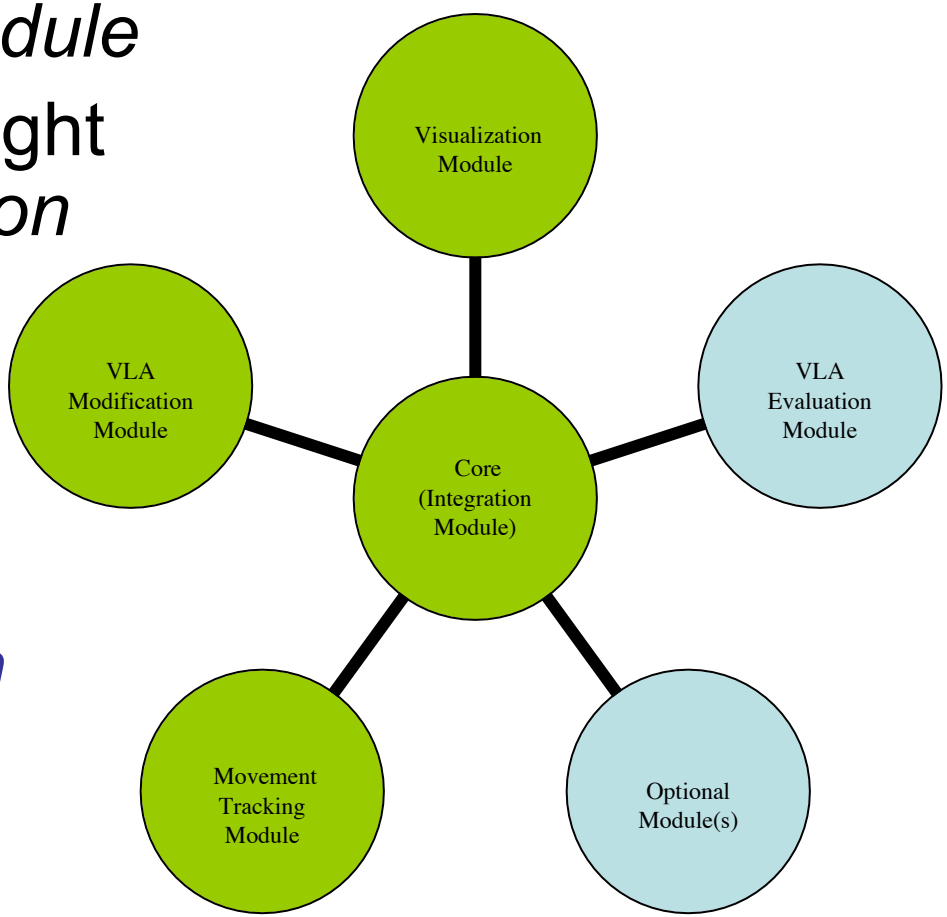
Phase I Prototype

- *VLA Modification Module*
- Combine with MS Flight Simulator *Visualization Module*
- *Movement Tracking Module*
  - *HMD*
  - *InterSense motion tracker*
  - *TrackIR²*



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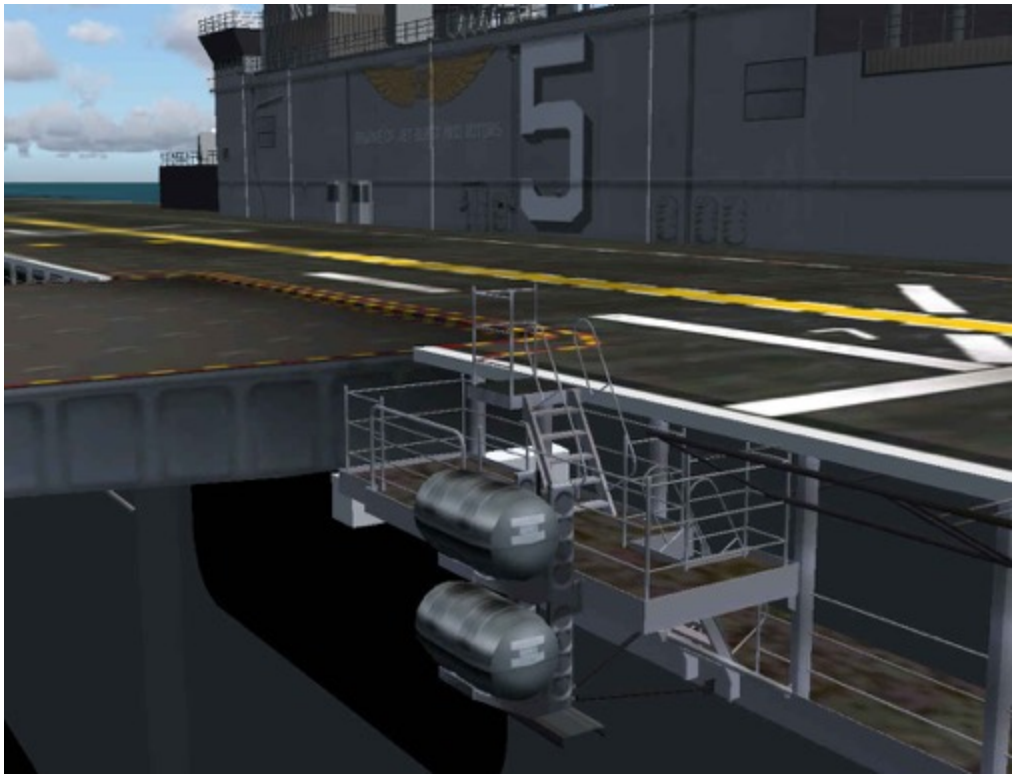
Visualization Module

- *MS FS 2004*
  - High-definition model of LHD
  - Ship Motion
  - ESI (FSUIPC) interface to VLA Modification Module
  - Configurable Lights
    - Lights can be dependent on other conditions
    - Video

High-definition model of LHD



- Video – LHD Model

Weather & Time of Day: E.g. Fog

Video: Foggy Flyby

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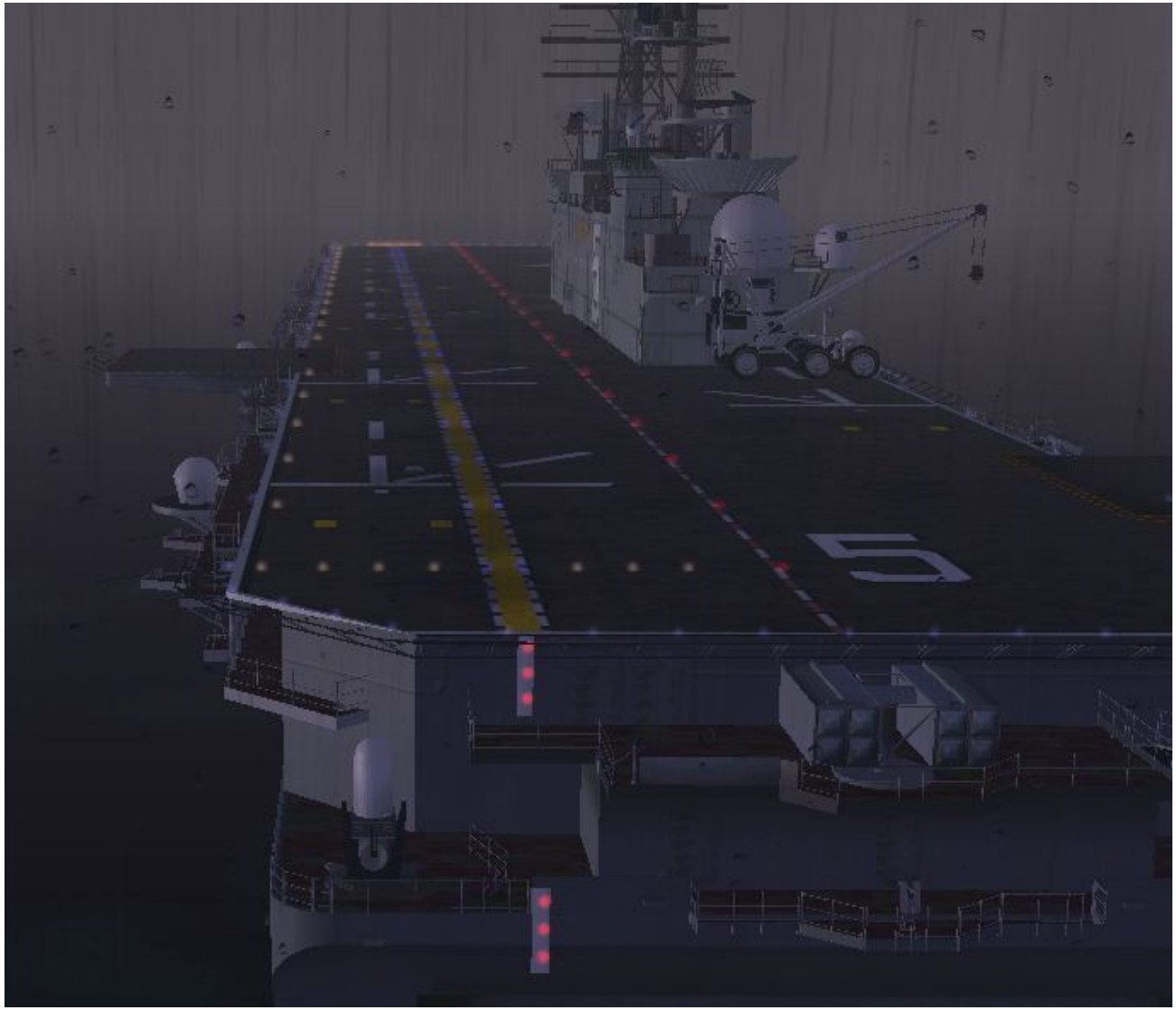
Field of View:
From cockpit: Unoccluded



Field of View:
From Any Spot Outside of Aircracft

Field of View: Harrier
From cockpit: Showing Cockpit

Field of View: MH-60S/R
From cockpit: Showing Cockpit

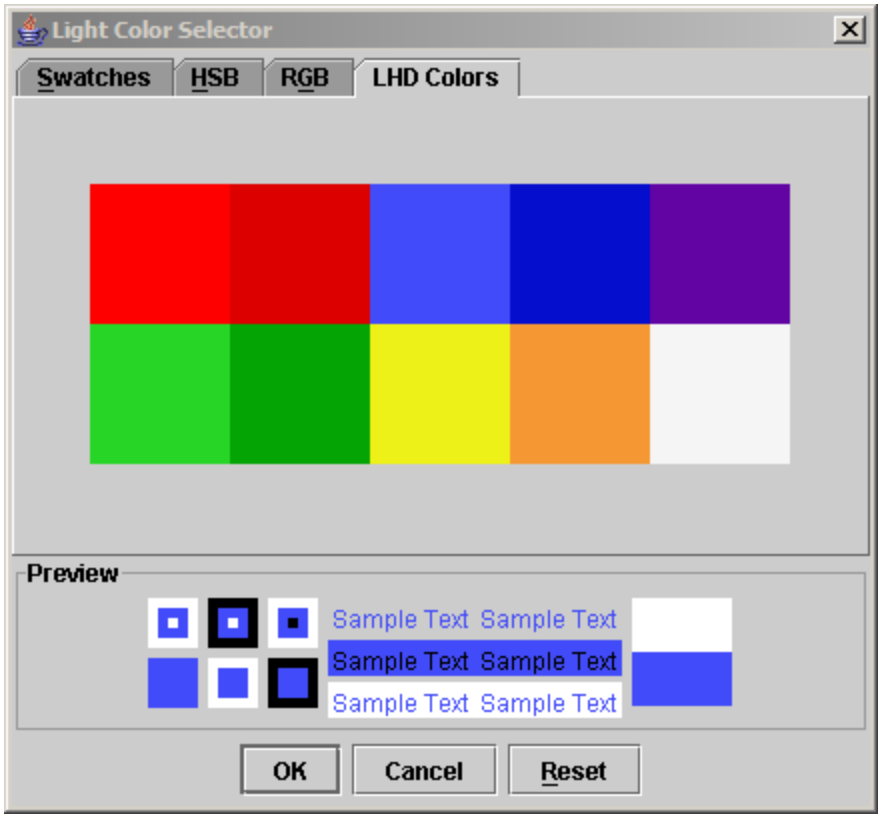
Aircraft

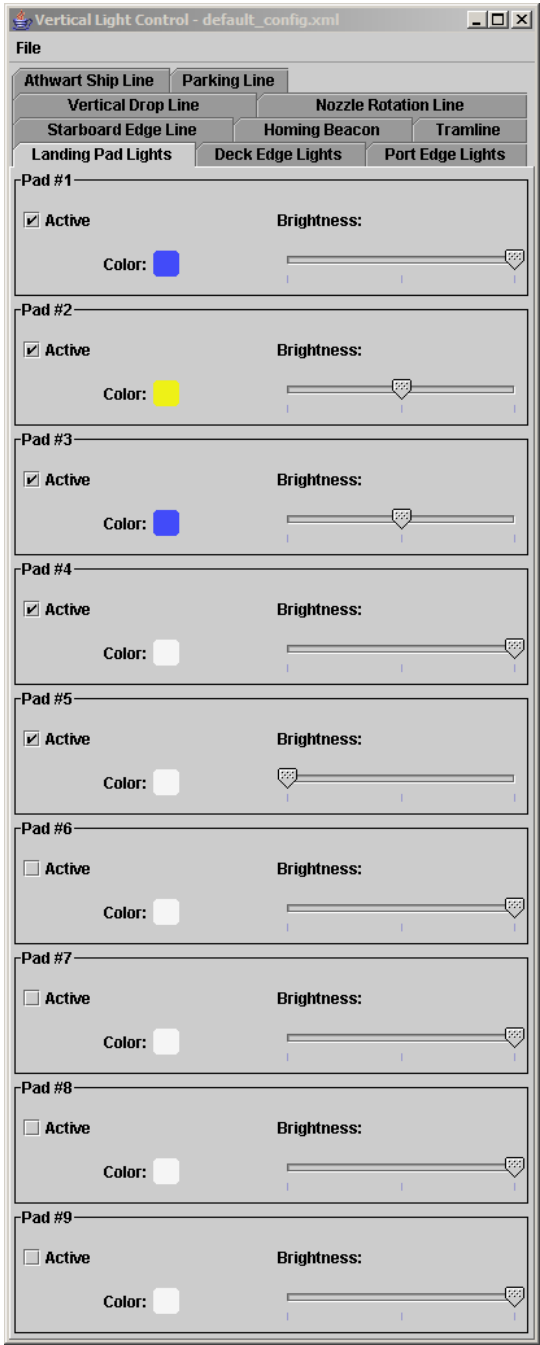
- Most Navy / Marine aircraft available
- More can be built

Example: Landings

Images

VLA Modification Module





VLA Modification Module (2)

- *Includes ability to save and load different configurations*
- *Configurations saved in XML file, independent of Visualization Module (e.g., MS Flight Simulator)*
- Drop Line, Athwart Ship Line, Homing Beacon (Video)

Movement Tracking Module

- Head-Mounted Display
- Motion Tracking (E.g., by InterSense)

NVISOR SX

NVIS
New Virtual Imaging Systems

High-Resolution, Wide Field-of-View
Head-Mounted Display

1280 x 1024 Pixels / Eye
24 Bit Color
Stereoscopic
60 degree diagonal field-of-view
Motion Tracking Available

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Status & Deliverables

- Phase I Prototype
  - High definition LHD Ship Model
  - Light Control GUI
    - Windows Installer
- User's Manual
- Architecture

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