

MICHIGAN STATE

U N I V E R S I T Y

Project Plan

NextGen Aircraft Taxi Assistance

The Capstone Experience

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Project Overview

- Primary Objective: to safely guide grounded aircraft from their current location on the ground to their point of arrival or departure
 1. Synthetic Vision Display
 2. Lateral Map Display
 3. XRUC-RR Weather Converter
 4. ATC Visual Guidance



Functional Specifications

- ATC Visual Guidance: provides interface for sending routing information to grounded aircraft
 - 2D map of an airport with clickable runways and taxiways
- SVD overlay: provides intuitive guidance queues (i.e. green arrows) for grounded aircraft
- LMD: shows 360° view of surrounding environment, including other aircraft & their planned routes
- XRUC-RR Weather Converter will be a standalone plugin that converts X-Plane generated weather to RUC & RR data formats
 - will export RUC & RR data to file

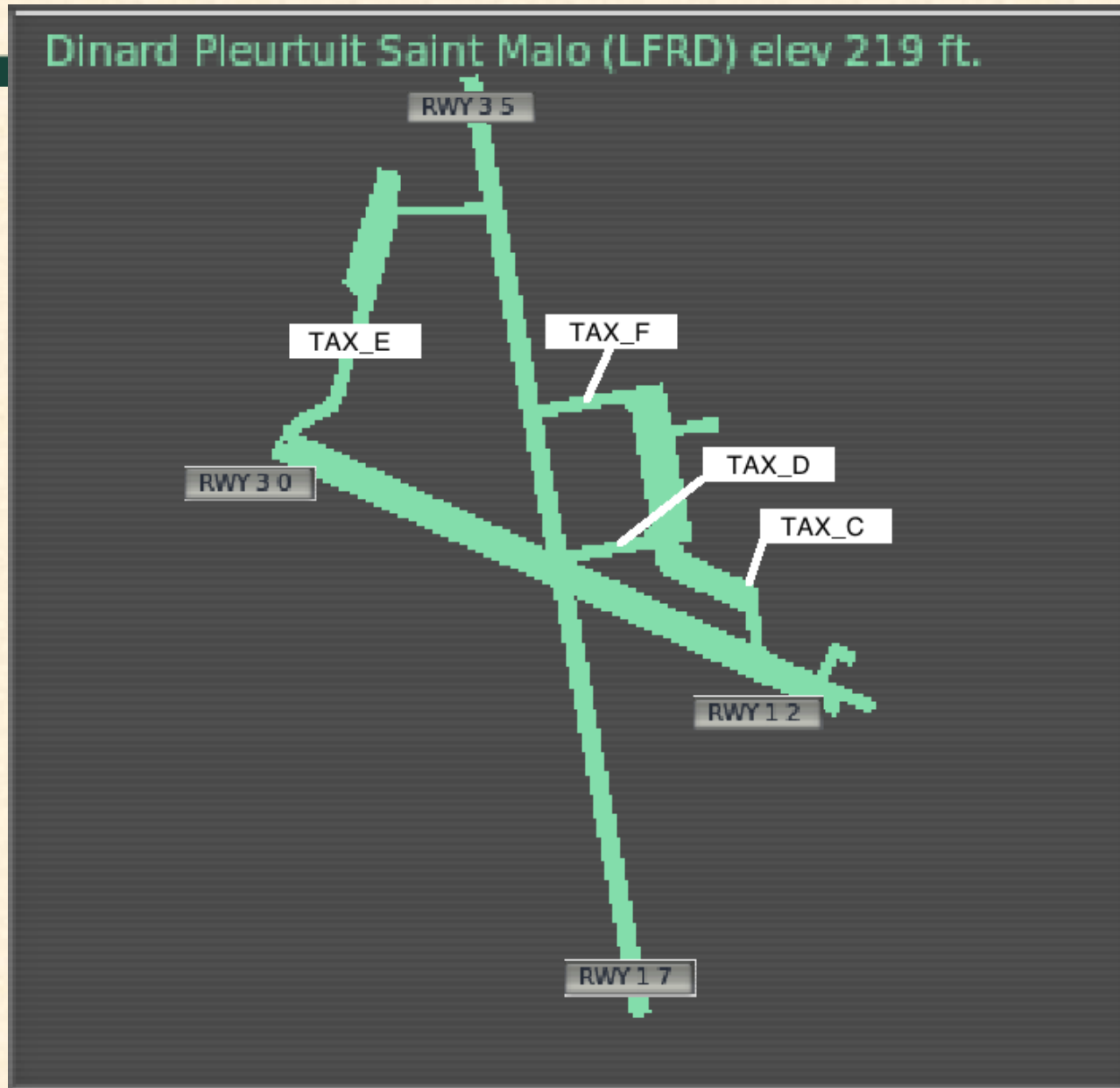


Design Specifications

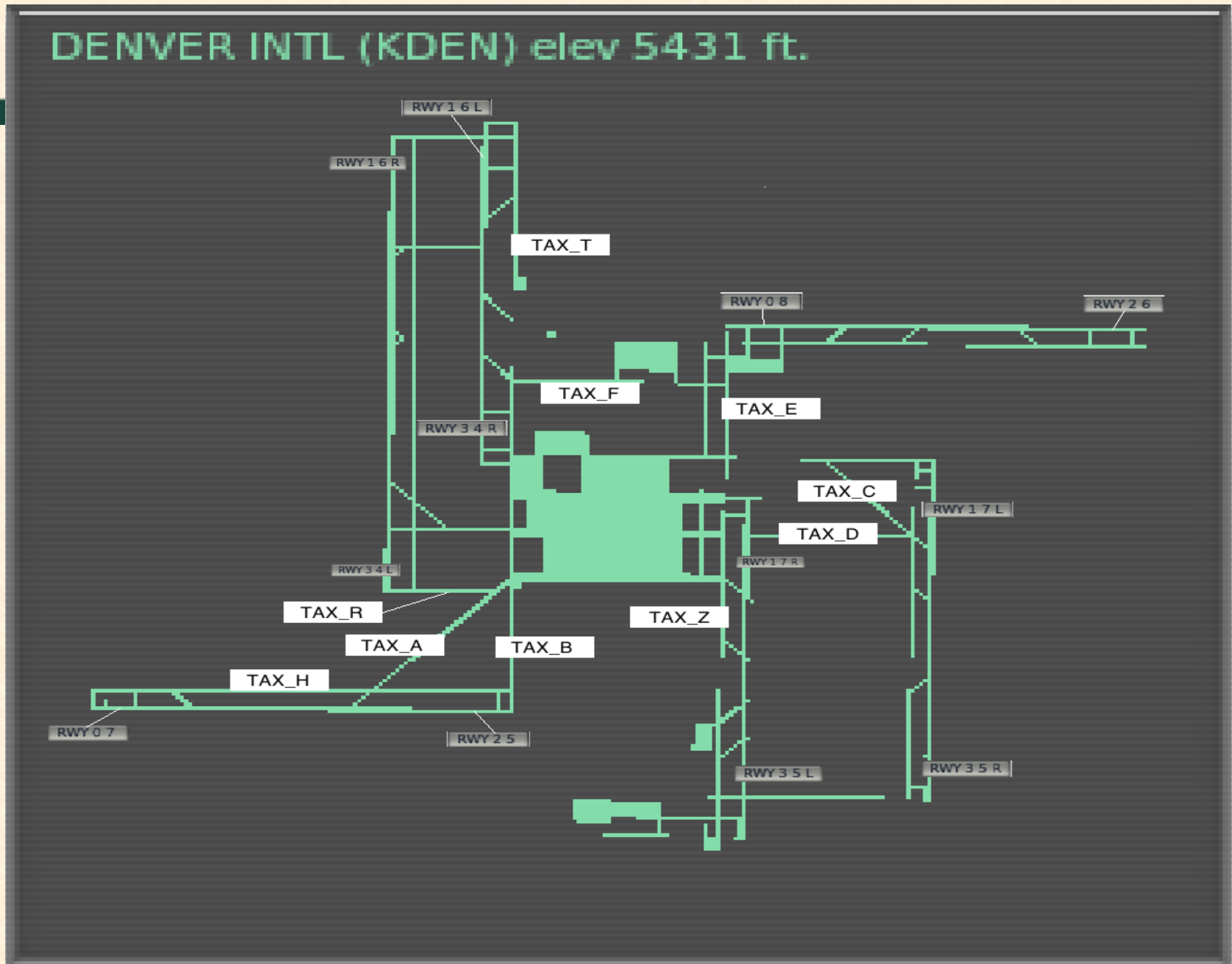
- Need to use X-Tools to parse and label airport runway and taxi data
- Create graph data structure based off of runway data
- Low-level AI to navigate this structure
- TCP network architecture for flight & terrain data
- OpenGL code to draw navigation GUI



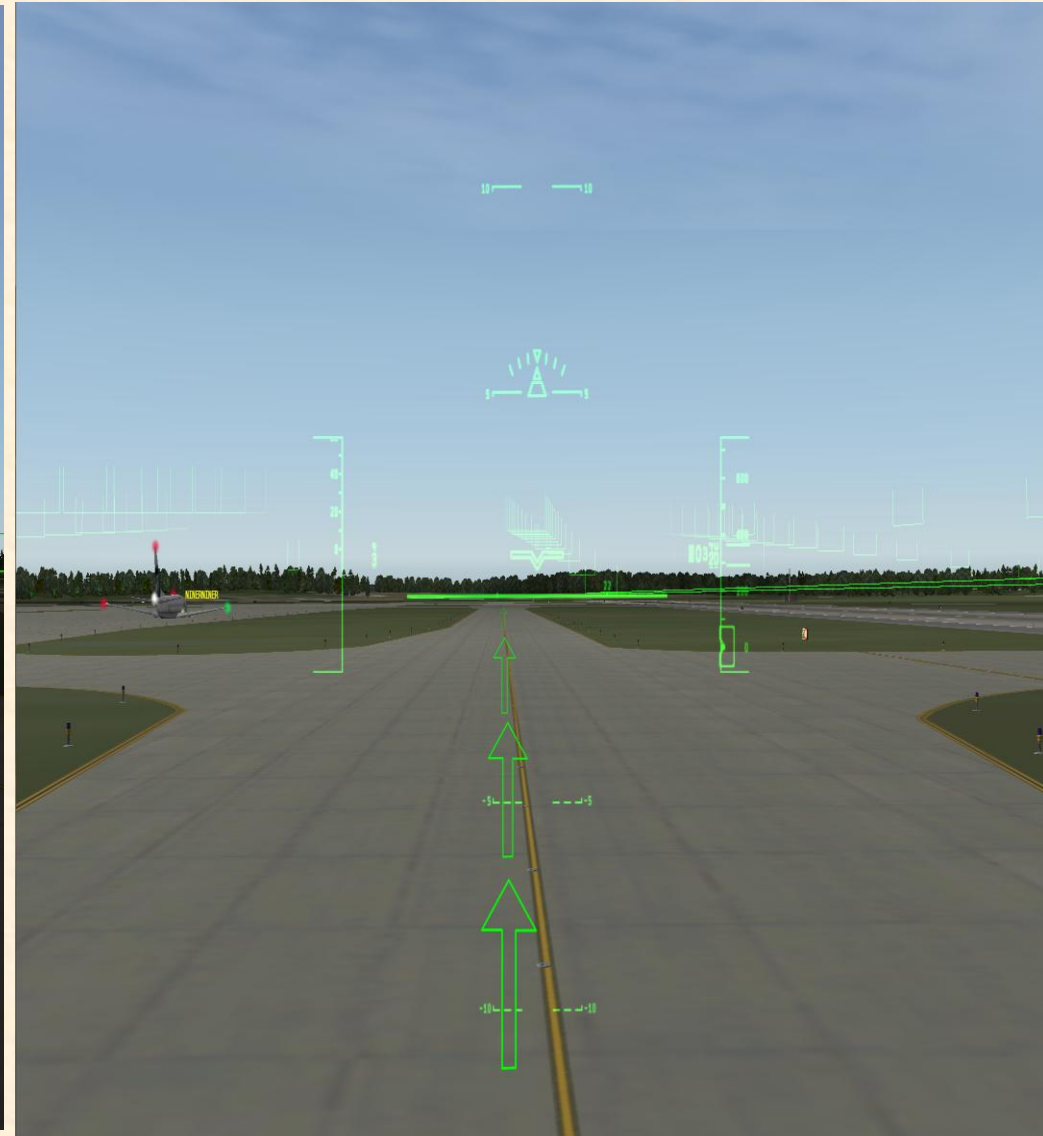
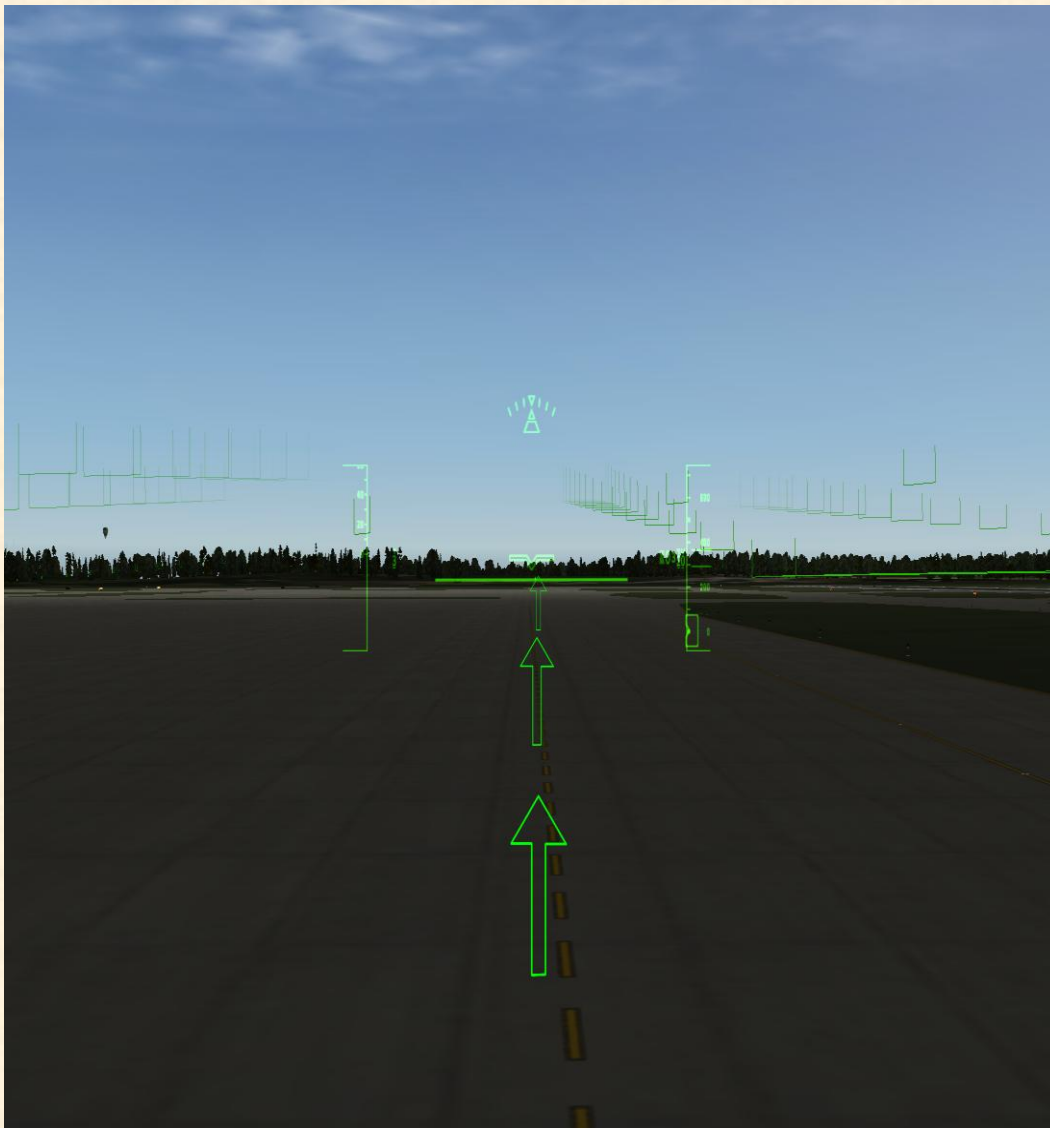
Screen Mockups - ATC VG



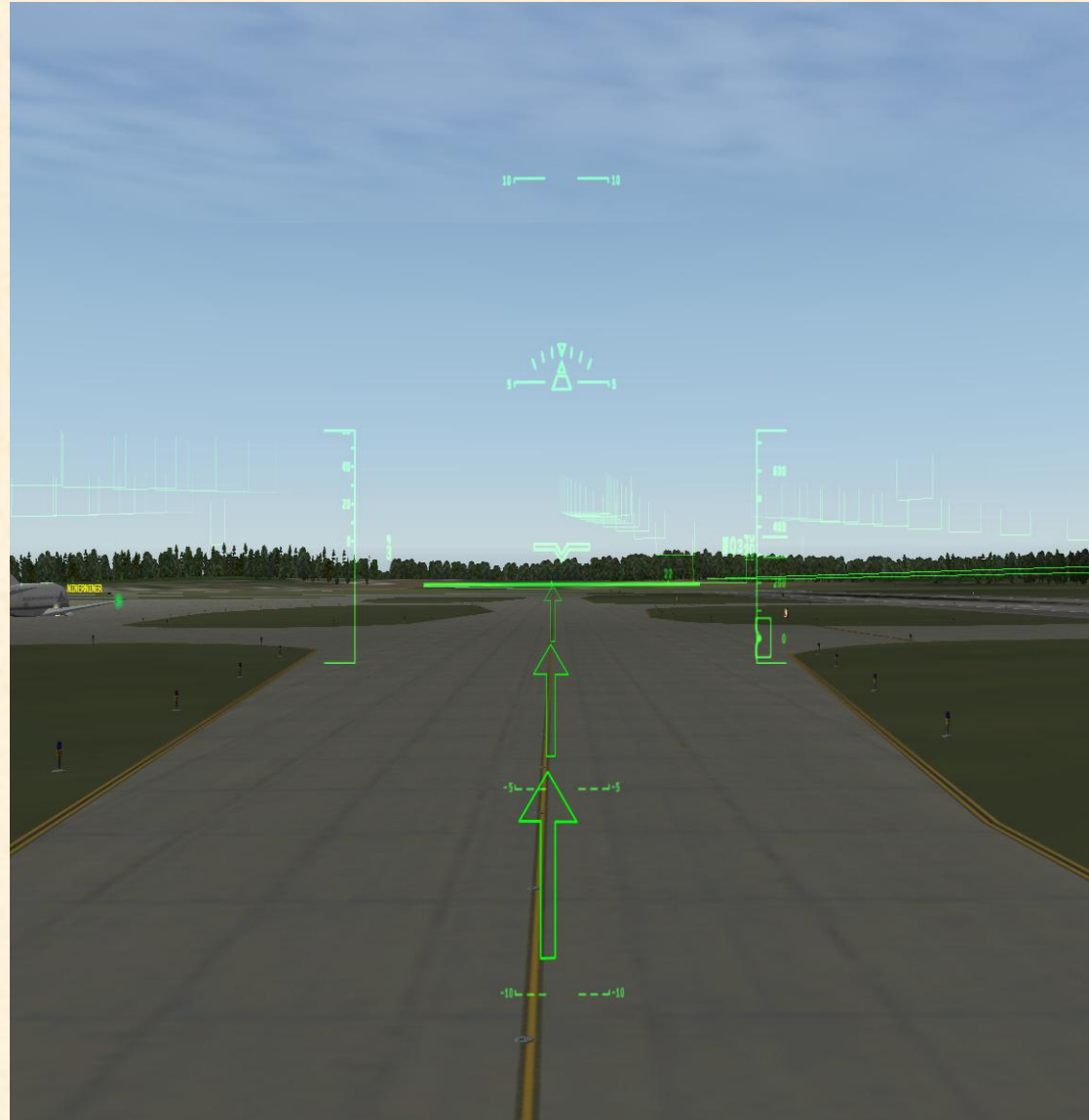
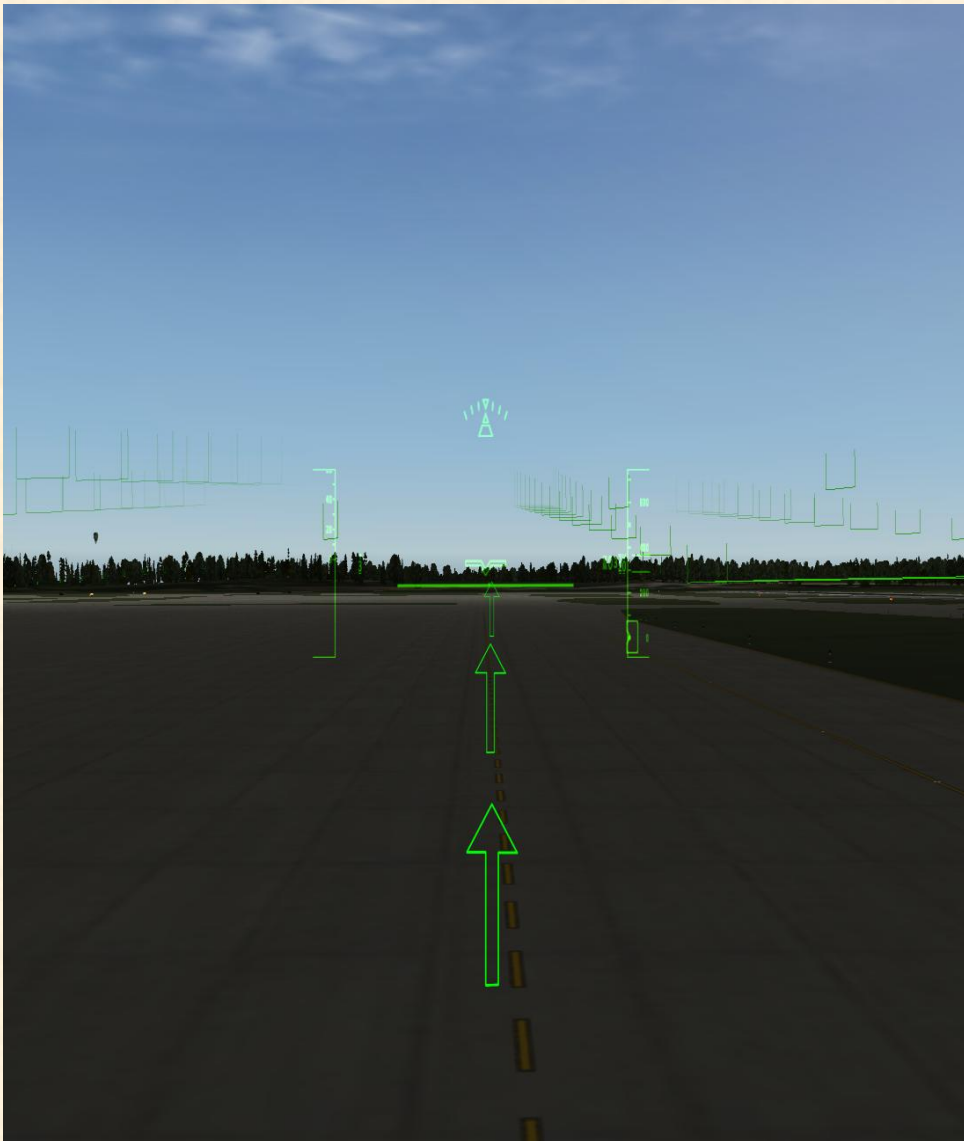
Screen Mockups - ATC VG



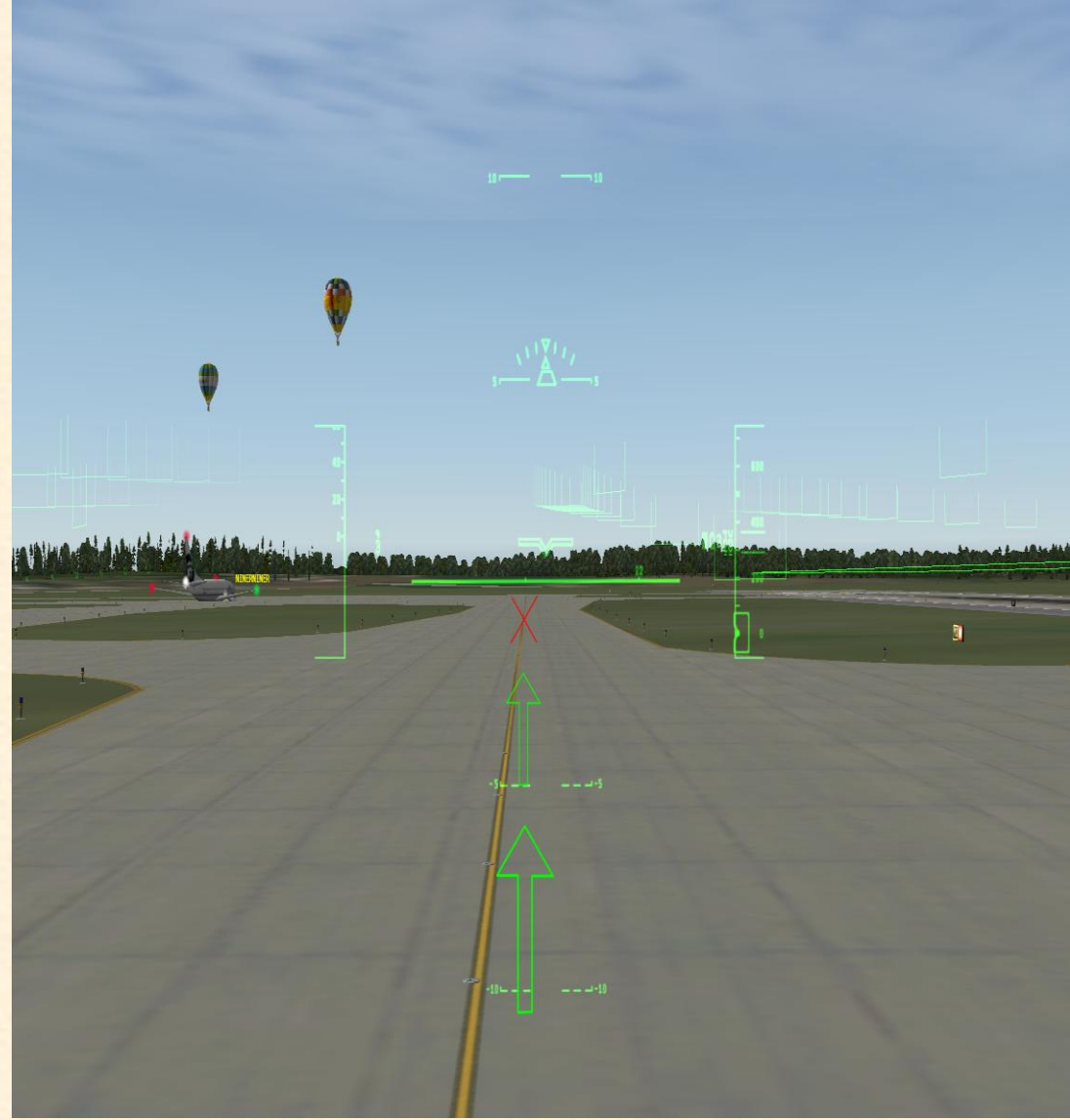
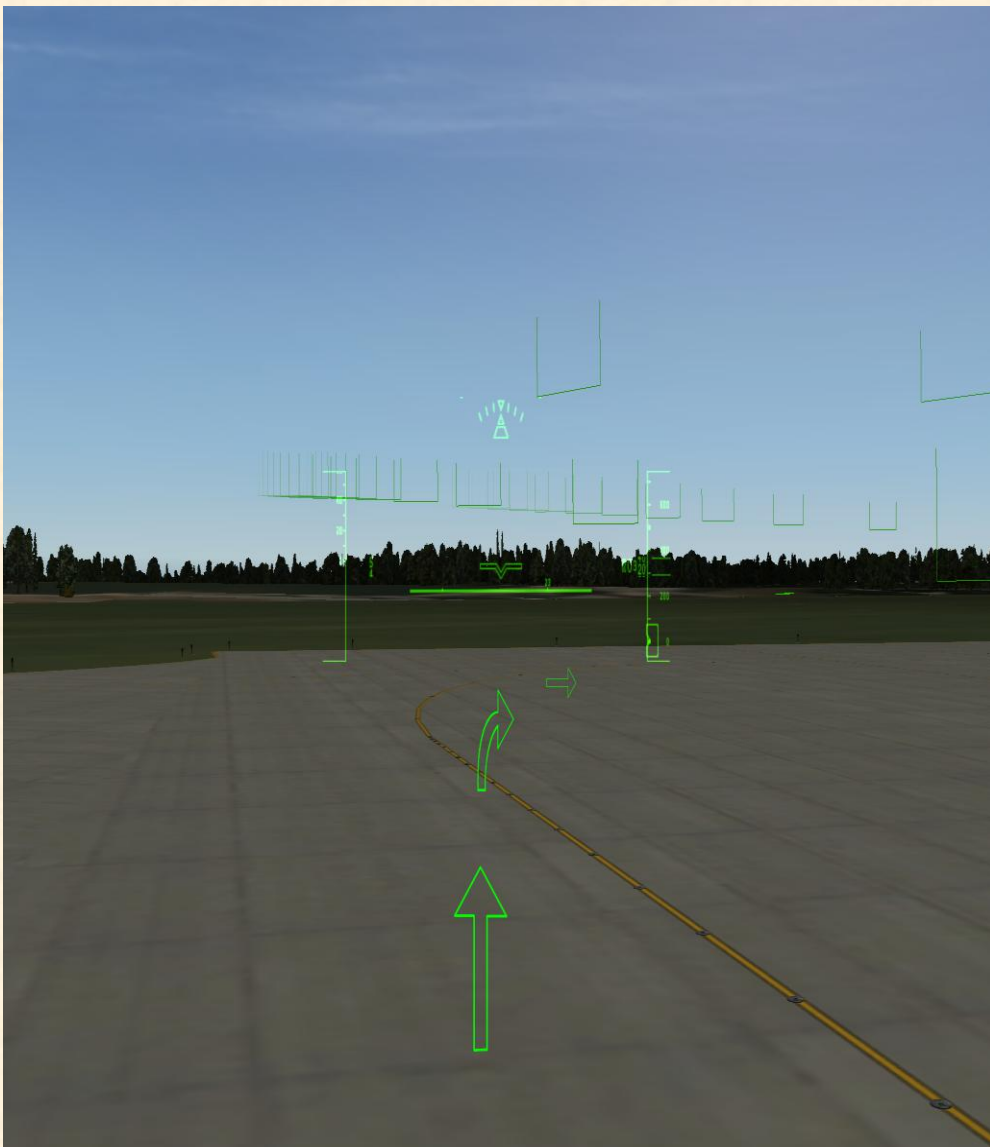
Screen Mockups



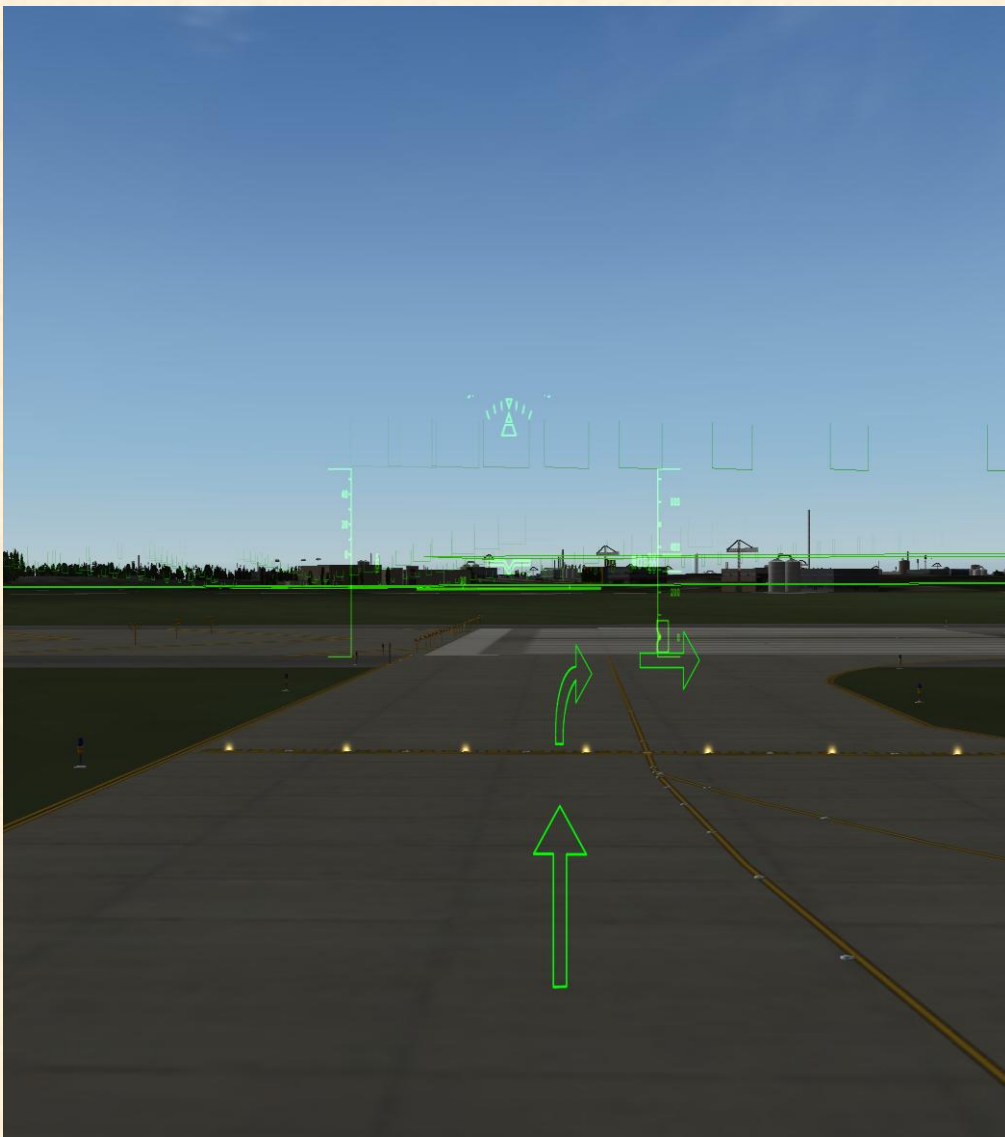
Screen Mockups



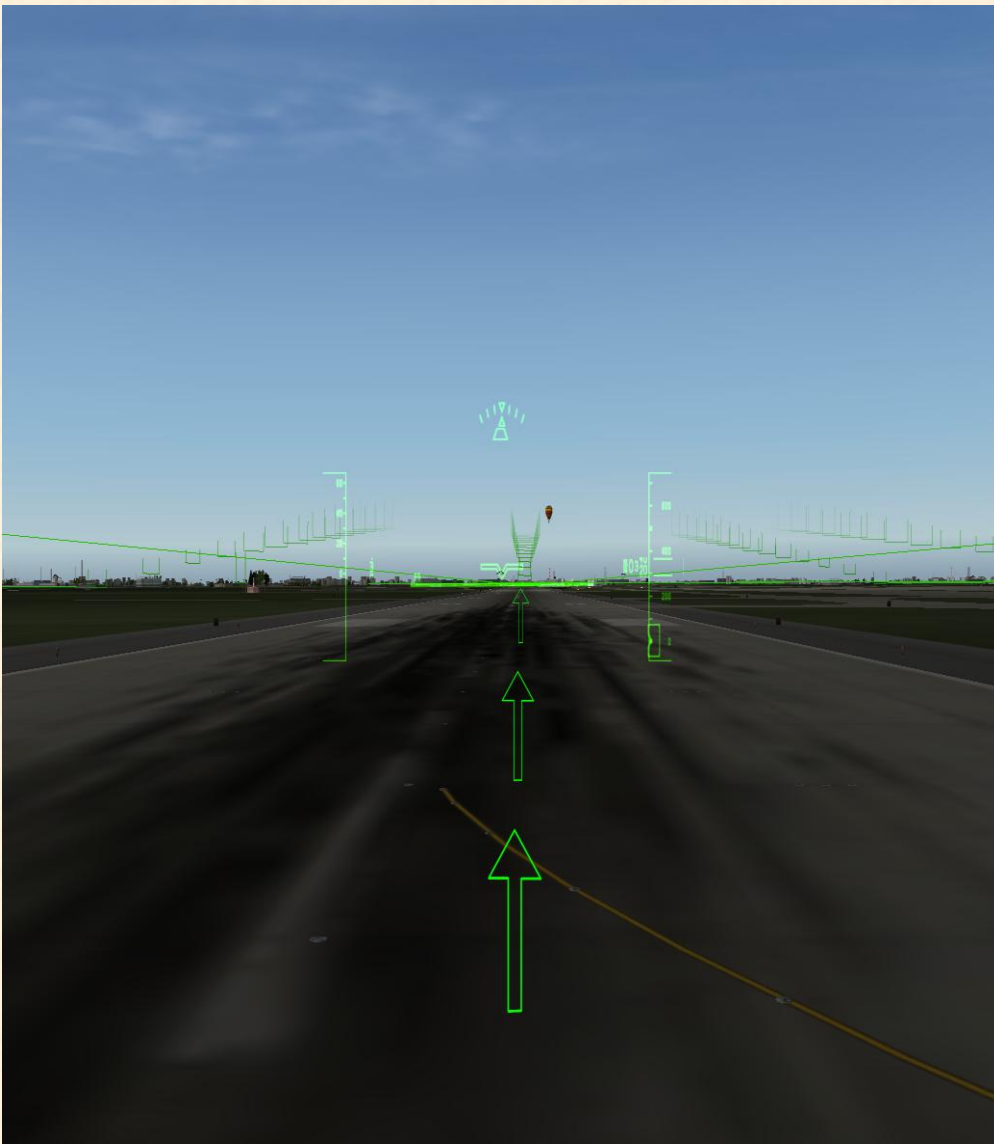
Screen Mockups



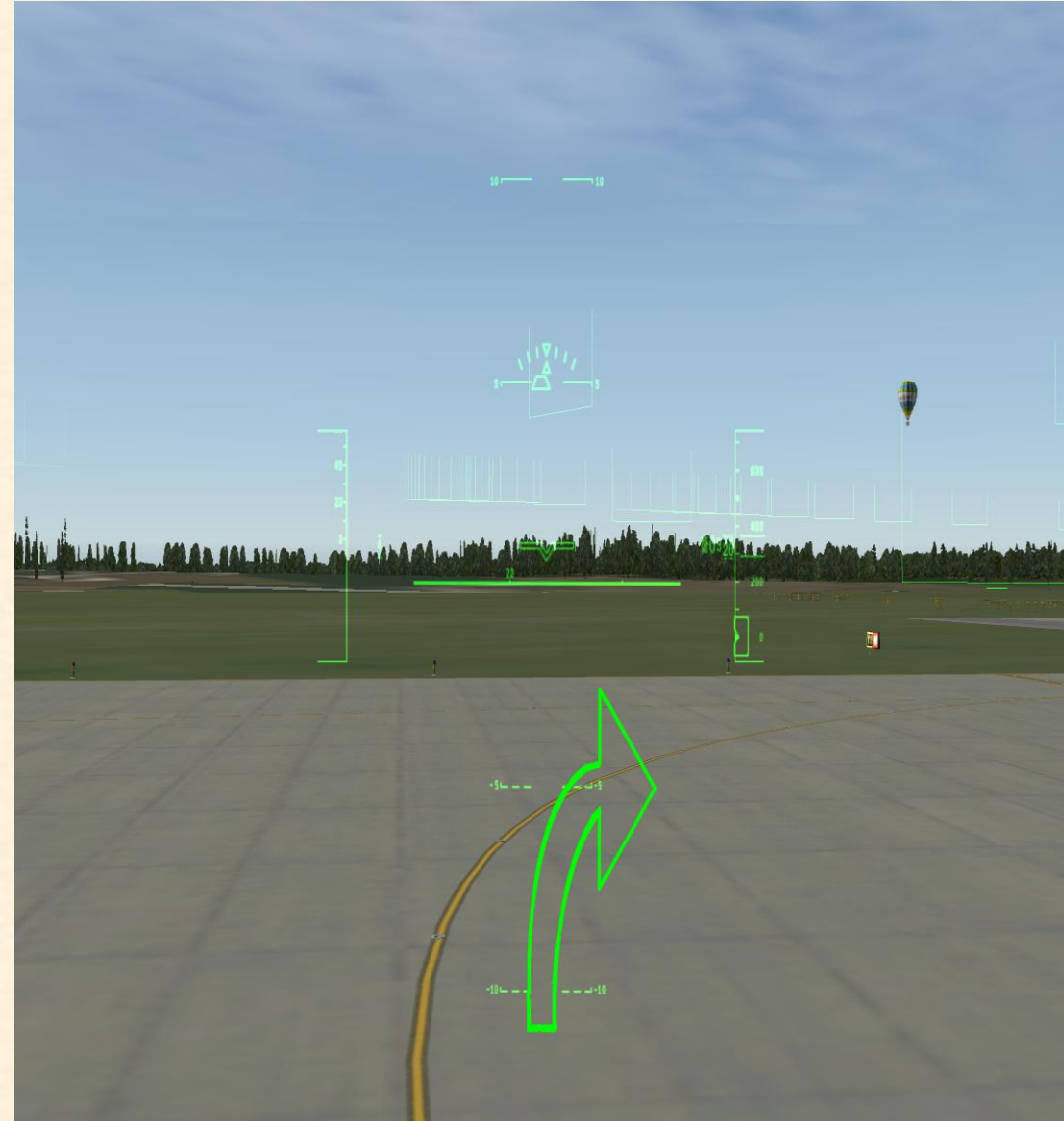
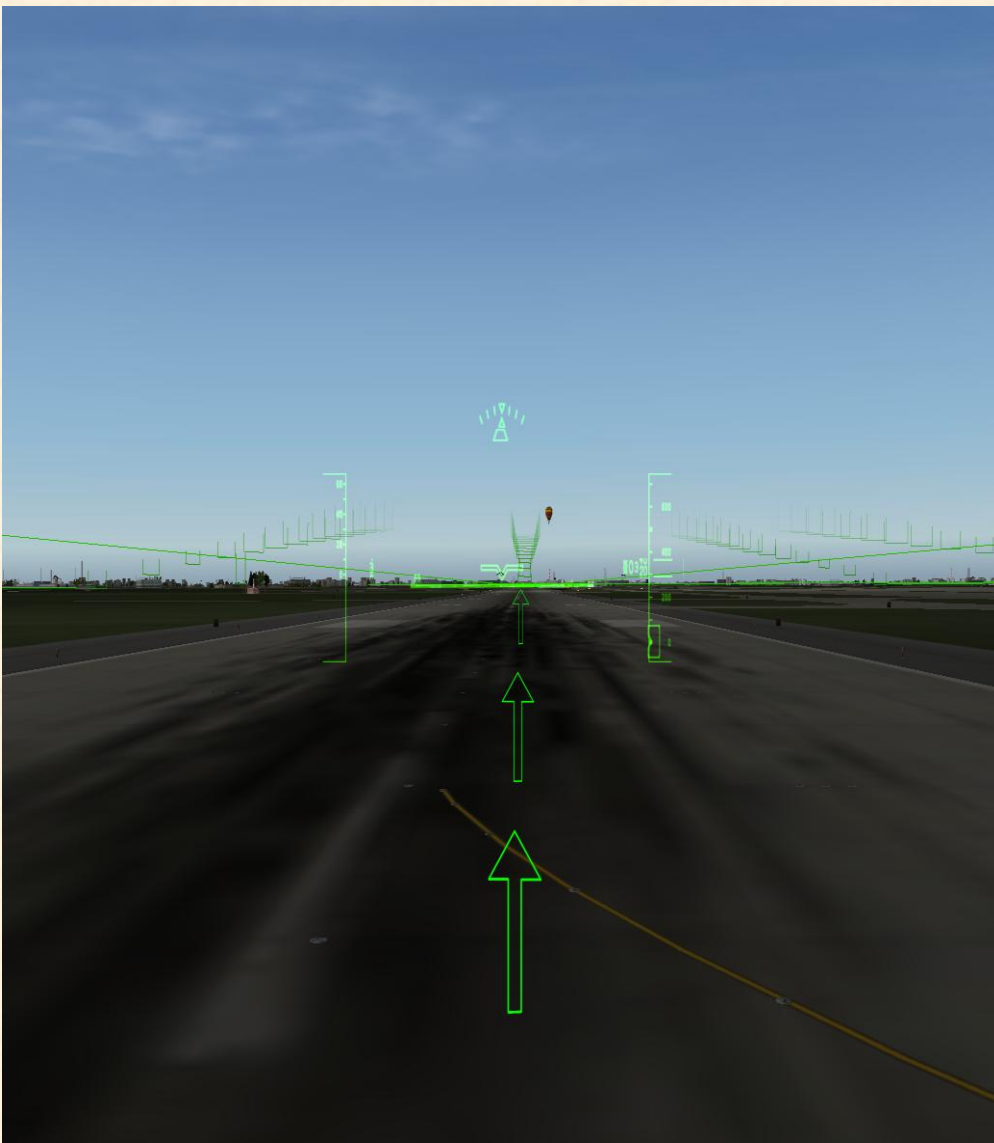
Screen Mockups



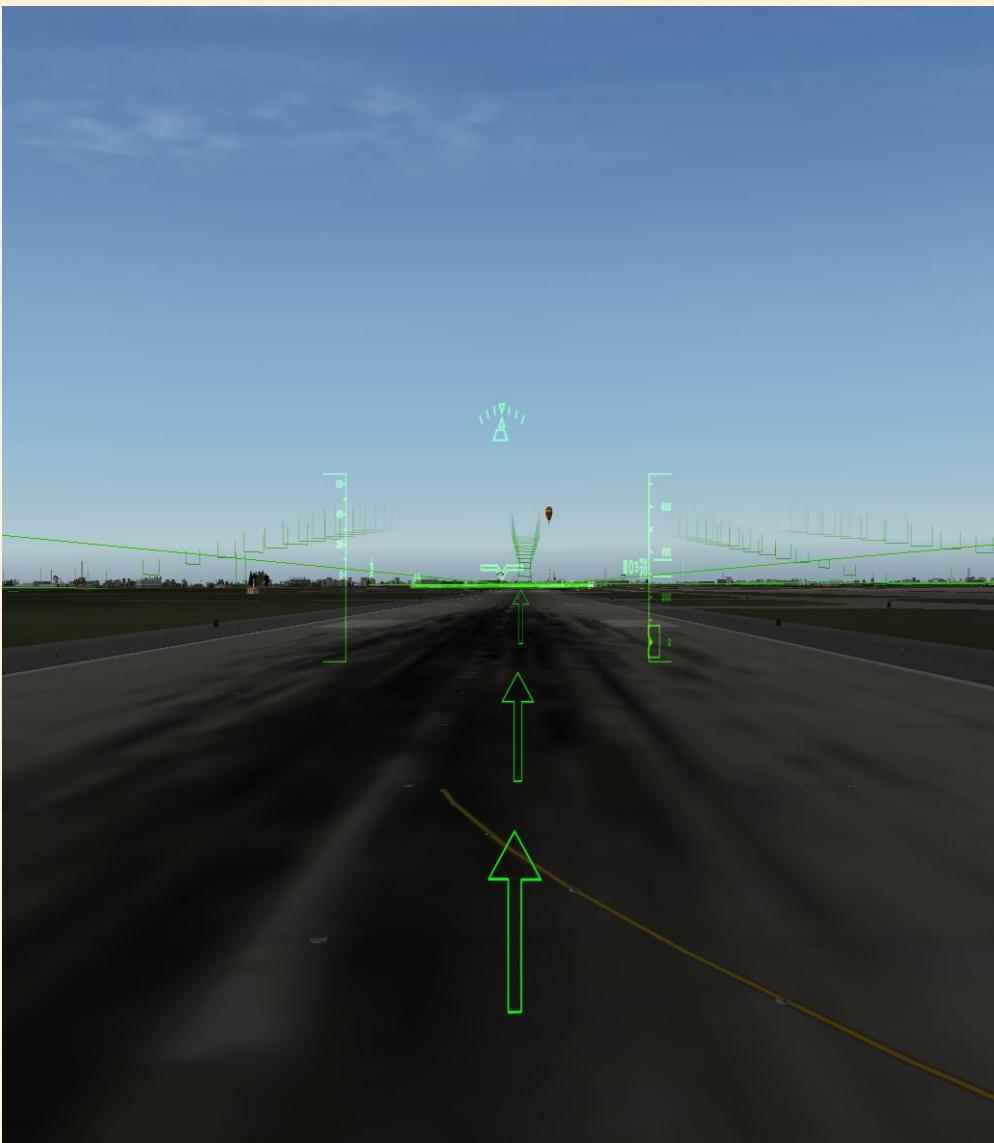
Screen Mockups



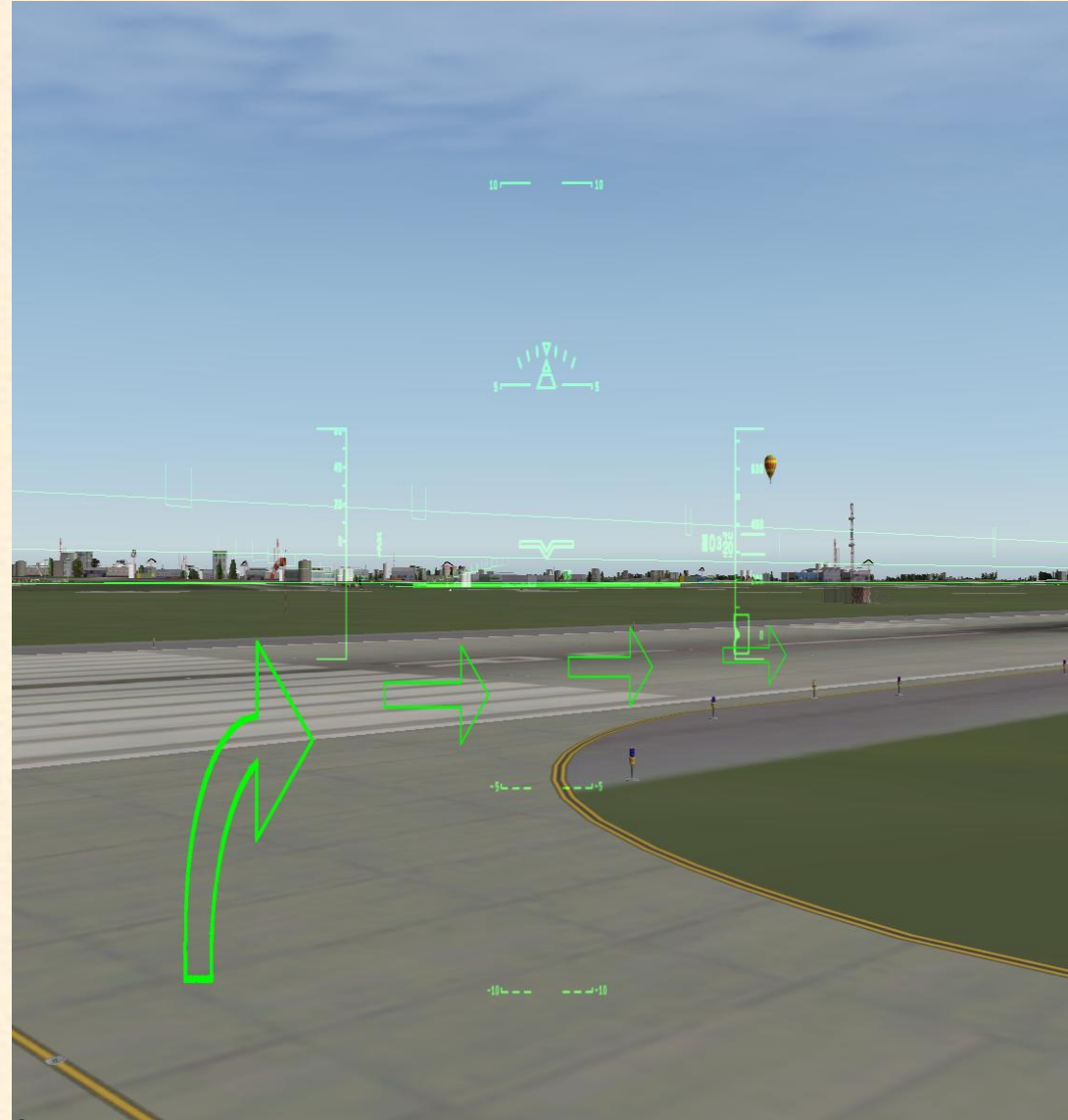
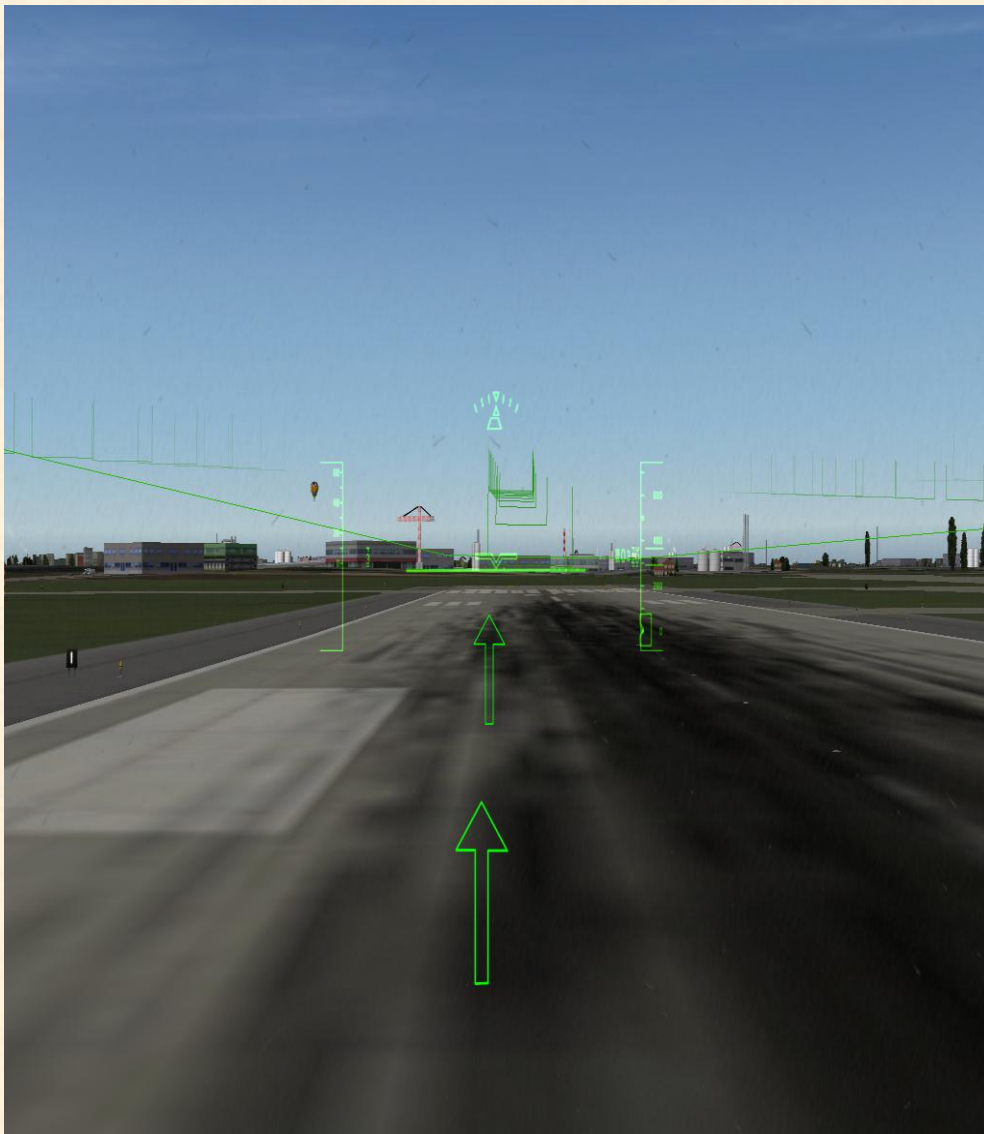
Screen Mockups



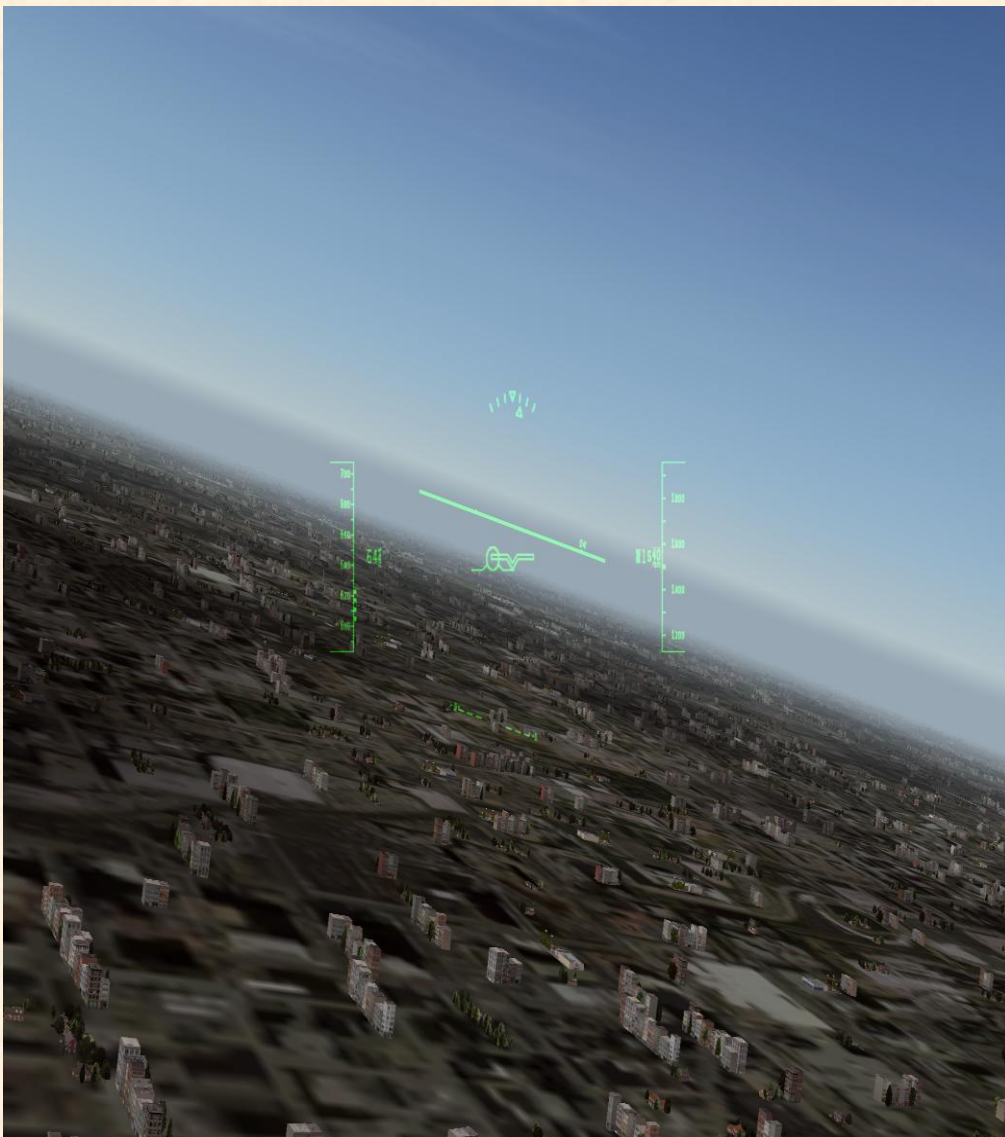
Screen Mockups



Screen Mockups



Screen Mockups



Technical Specifications

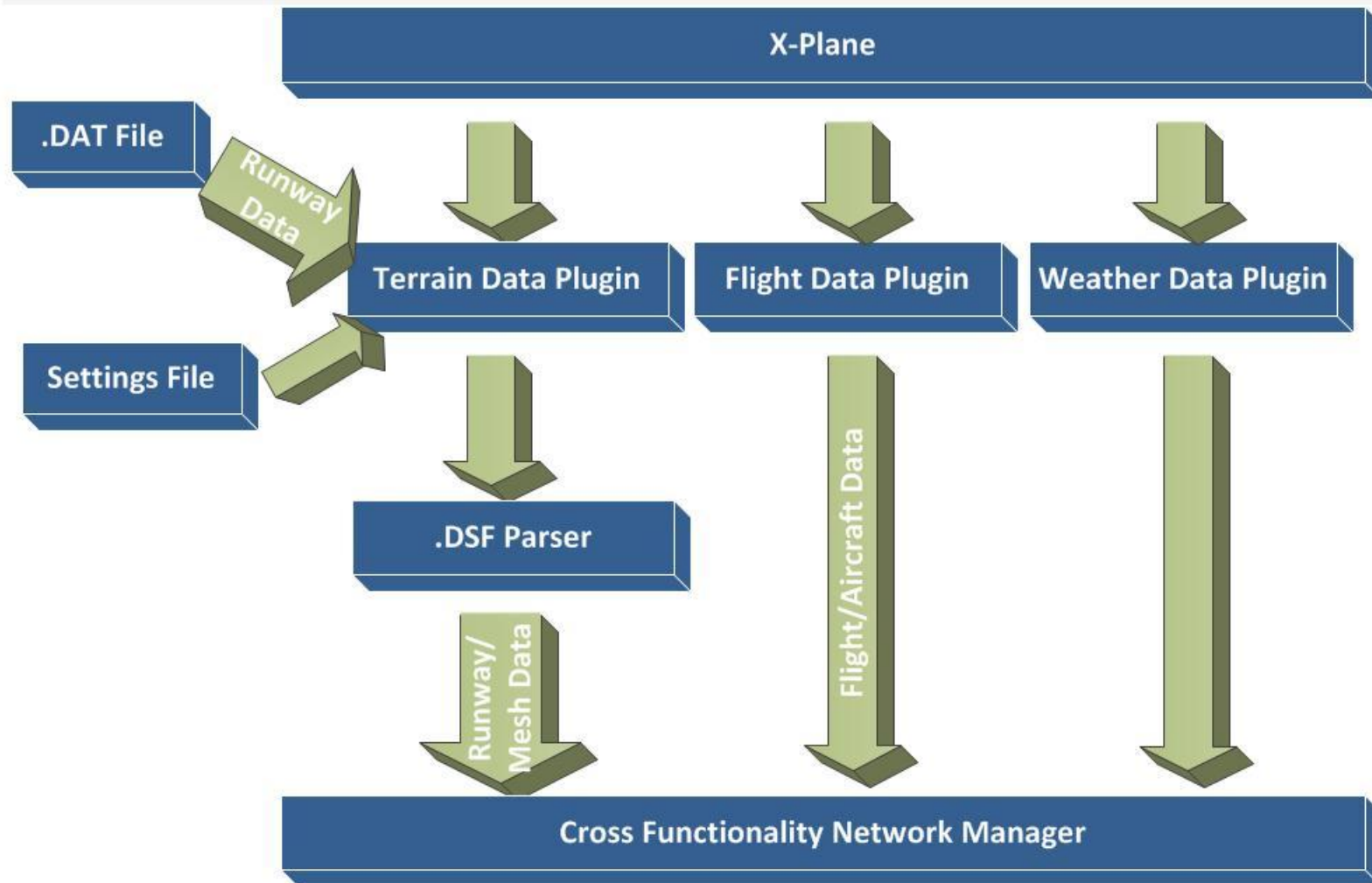
- Machine 1:
 - X-Plane is running on this machine
 - Sends location data over network to client on machine 2
- Machine 2:
 - Plane is guided from this machine
 - Receives location data from machine 1
 - Runs & Renders ATC Visual Guidance, Synthetic Vision Display, & Lateral Map Display



System Architecture

X-Plane Process

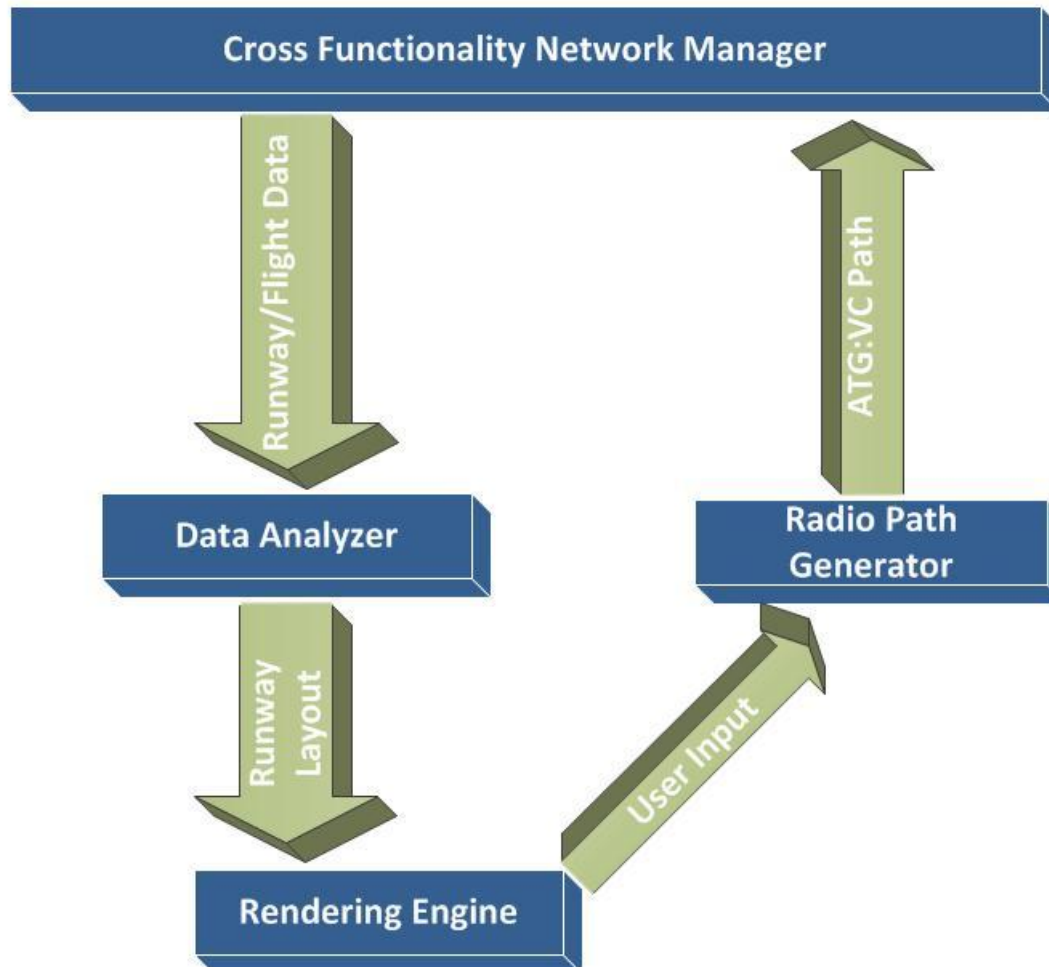
September 20, 2011



System Architecture

ATC:VG

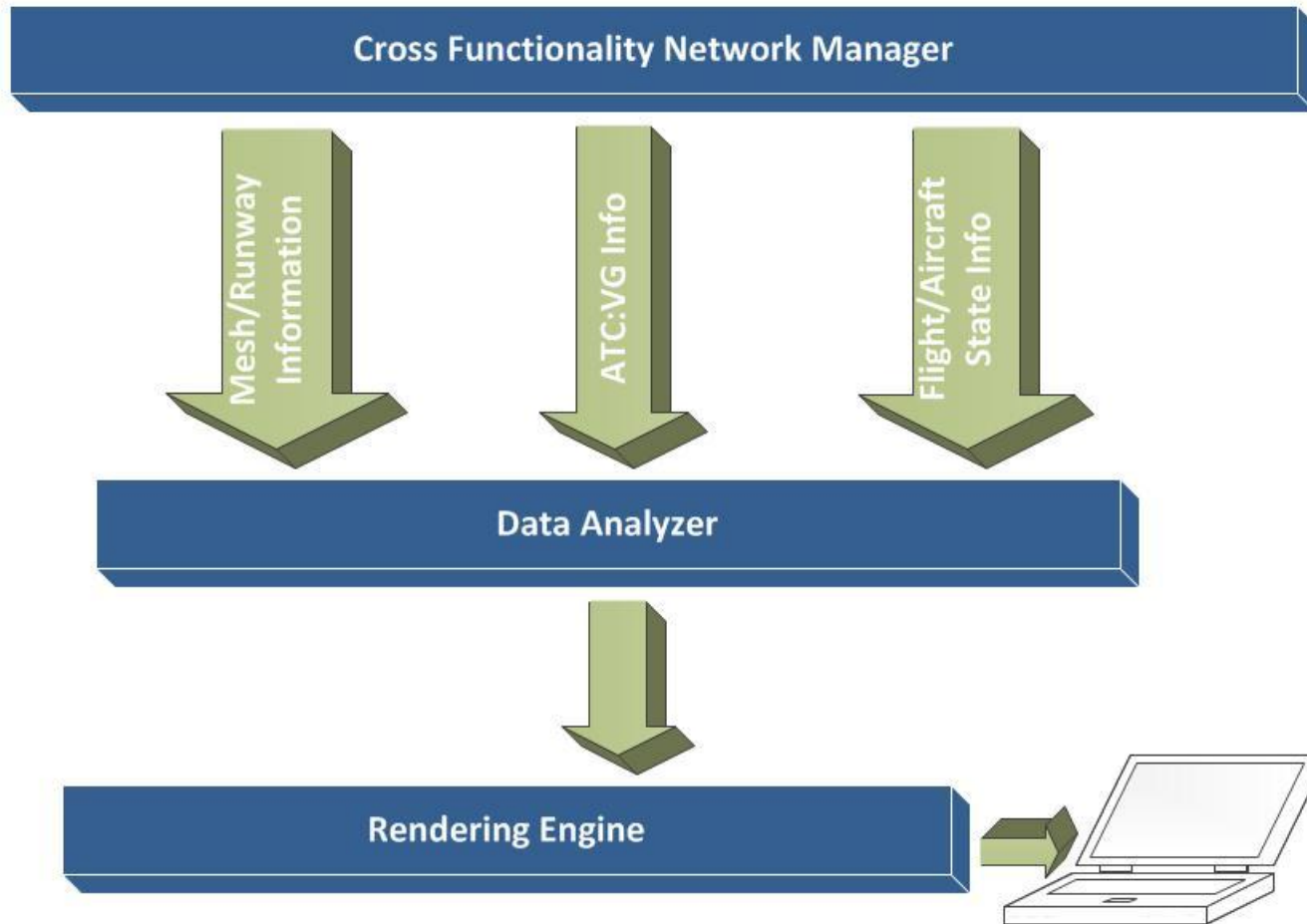
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System Architecture

SVD

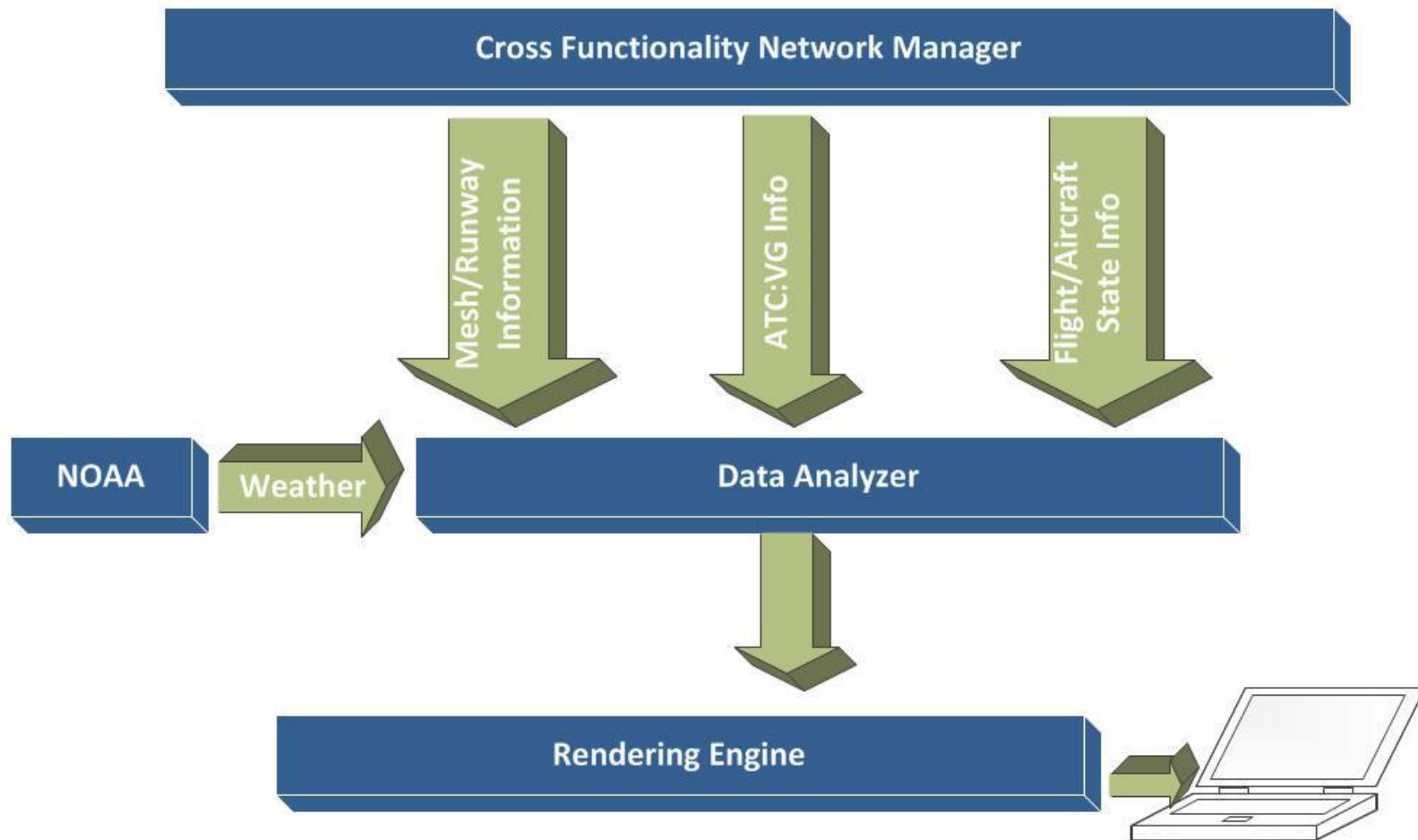
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System Architecture

LMD

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System Architecture

XRUC-RR

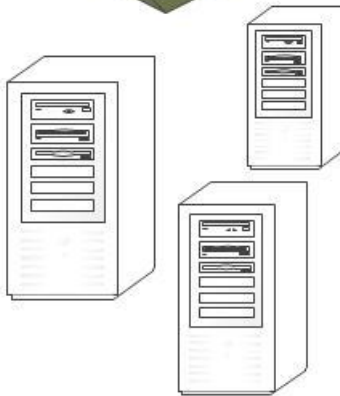
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Cross Functionality Network
Manager



Weather Converter

Weather
Data



RUC/RR File



System Components

- **Hardware Platforms**
 - One machine running X-Plane and custom installed plugins
 - One machine running client rendering program
 - Machines networked to stream data
- **Software Platforms / Technologies**
 - TFS - Team Foundation Server
 - X-Plane 9
 - Realistic flight simulator to be used as data source to drive SVD, LMD, ATC Visual Guidance, and the XRUC-RR Weather Converter
 - Visual Studio 2008
 - OpenGL, GLUT
 - X-Tools



Testing

- Repeatable runway scenarios
- Test path finding on multiple airport .dat files
- Use 3rd party software to read XRUC output
- View application response based off user input
- Create edge cases, uncommon scenarios



Risks

- 4D path prediction -- mitigated
 - introduced ATC Visual Guidance plugin to handle routing
- X-Plane responsiveness -- mitigated
 - rebuilt machine, runs smoothly
- Time
- Maintainability of previous semester's code
- Representing taxiways as navigable paths
- OpenGL bugs

