# University of West Florida
# School of Science and Engineering
# Unmanned Systems Group


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# Unmanned Systems Group Vision Statement

- With respect to **Unmanned Systems**, the vision of the University of West Florida is Clear:

***To become the best regional comprehensive university in America***

- This requires a commitment by those who deeply believe in **UWF**, its success, and to understand that investments today will create great futures for our students, university, and region tomorrow.

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# Unmanned Systems

*An Innovative New Beginning for the Schools of Science and Engineering*

In response to the escalating need for graduates who can meet rapidly changing industry demands in scientific fields critical to building and maintaining a strong regional and national economy, the University of West Florida has established a new School of Science and Engineering

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*School of Science and Engineering*

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*School of Science and Engineering*


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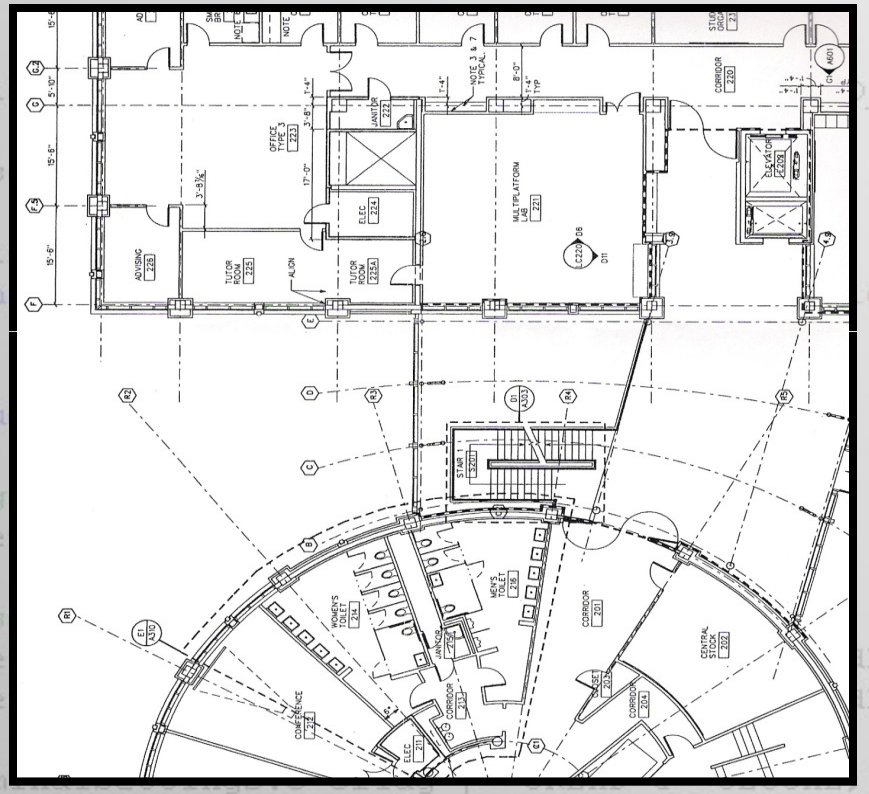
# *School of Science and Engineering Unmanned Systems Lab*



- Maximum visibility on 1st floor of 4-story atrium behind glass enclosure
- Focal point of both North and South entrance ways, elevator, and stairway
- Averaging 1 new applicant per day
- Equipped with oscilloscopes, logic analyzers, DVM's and other test equipment not unlike industry

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## *School of Science and Engineering*

Successful 21st century science, technology, engineering, and math (STEM) programs ***must*** focus attention on learning environments in which all students have ample opportunity for practicing science and sharing their discoveries.

***UWF's New School of Science and Engineering is answering that need!***

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## *UWF's School of Science and Engineering and PKAL*

The philosophy and concepts guiding UWF's new School of Science and Engineering are based on Project Kaleidoscope (PKAL), the national initiative funded by the National Science Foundation and the Keck Foundation. Their mission and activities support and enhance collaborative and interdisciplinary education for those disciplines of STEM.

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# UWF Unmanned Systems Laboratory

The UWF Unmanned Systems Laboratory is the proud home of an award-winning Autonomous Water Vehicle team and Unmanned Aerial Systems team as well as the Unmanned Ground Systems and Tour Robot Project for the new School of Science and Engineering. This school is active in engineering research in partnership with local business, other universities, and government agencies.

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# Unmanned Systems—Goals

- Inspire students to achieve their full potential through an engineering experience.
- To develop research, development, and management skills to enhance for greater industry acceptance.
- Greater retention of pre-engineering students.
- Achieve purposeful and sustainable growth.

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# Method to Accomplish the Mission through Engineering Projects

- Unmanned Systems Projects must:
  - Require research to accomplish the mission
  - Require development of systems to accomplish the mission
  - Develop student management skills
  - Require a teams of students and teamwork
  - Have a deadline
  - Have budget limitations
- Success of Project produces team awards and increase status of the overall program

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# http://robotics.ece.uwf.edu/home.php#


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# Autonomous Unmanned Vehicles Systems International (AUVSI)

## Unmanned Aerial Systems (UAS)
## AUVSI Competition 2009

# Unmanned Aerial Systems (UAS)

- Competed and placed 2nd in Flight Competition out of 25 Colleges and Universities in the Association for Unmanned Vehicle Systems International (AUVSI)—June 2009
- AUVSI is the world's largest noon-profit organization devoted exclusively to advancing the unmanned systems
- Received $8000.00 in prize money
- Placed among large well-known universities
- Completed more bonus tasks than any other university in the history of the competition
- Only aircraft that took off, performed the mission and landed without any action from the safety operator
- Primary objectives of the competition were for each team to build an unmanned aircraft to fly autonomously, navigate a specified course and use onboard sensors to locate and assess a series of man made objects on the ground prior to returning to the launch point for landing.

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**UWF's 2009 UAS Team**

(Left to Right, Clint Edmonson, Niel Edmunson, Eric Becker, Steve Long, David Algeo)

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*AUVSI 2009*

**Cornell University**

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*AUVSI 2009*

**Embry-Riddle Aeronautical University**

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*AUVSI 2009*

**University of New Delhi, India**

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***AUVSI 2009***

**Johns Hopkins University**

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## *AUVSI 2009*

**Mississippi State**

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## *AUVSI 2009*

**North Carolina State**

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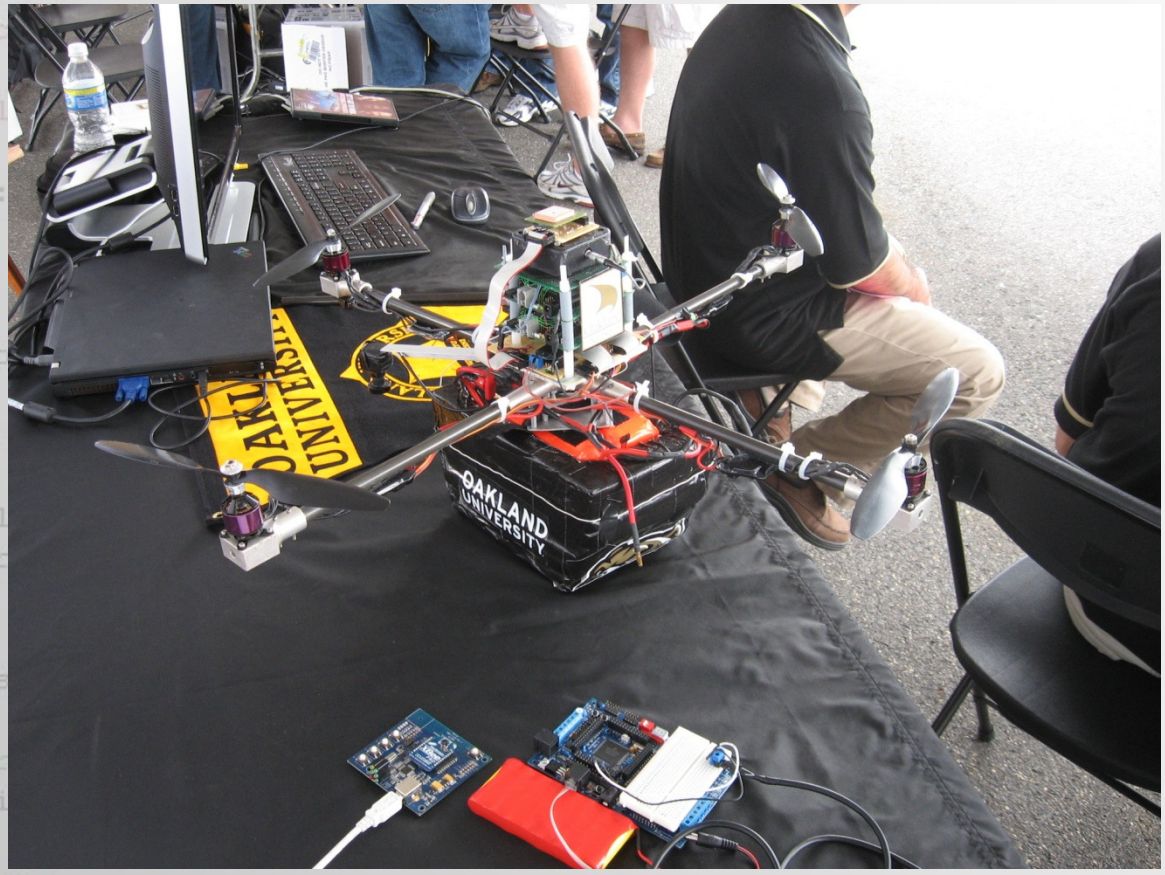


## *AUVSI 2009*

**Oakland University**

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## *AUVSI 2009*

**University of California at San Diego**

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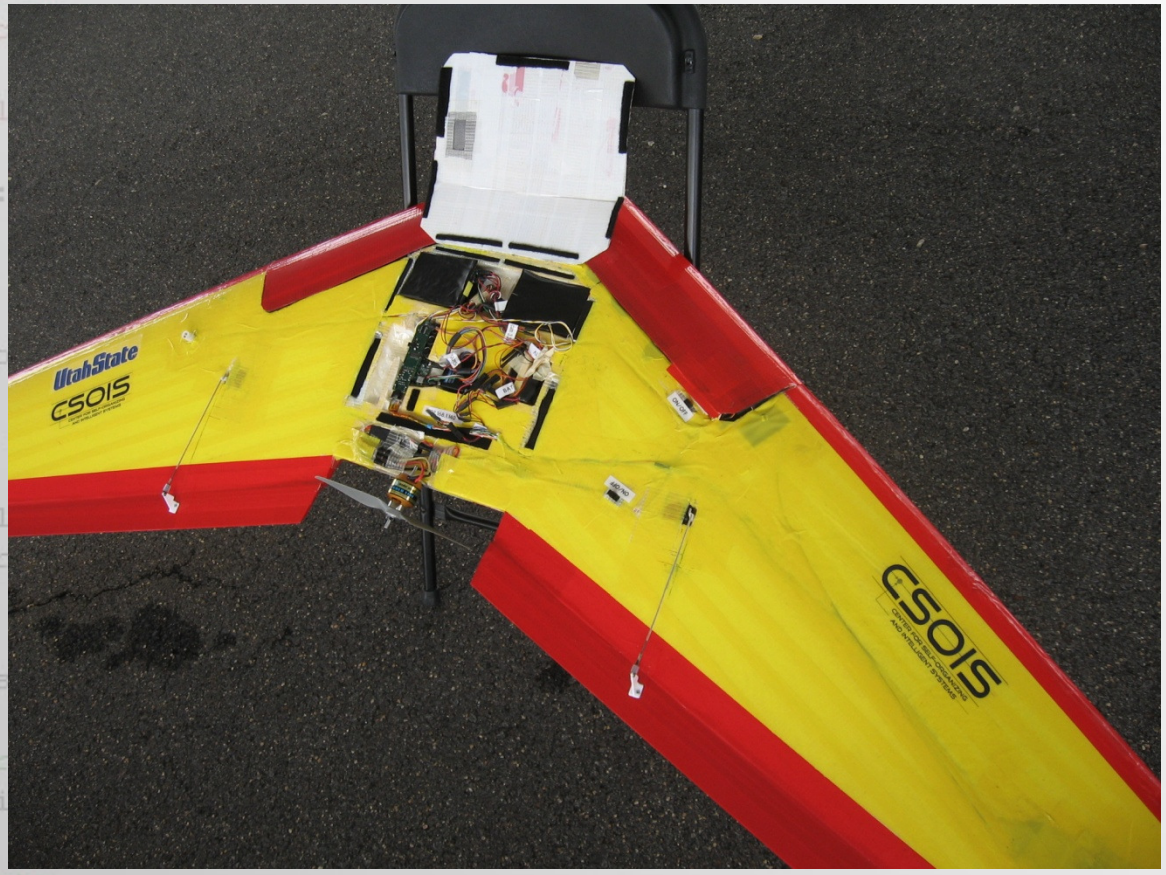


## *AUVSI 2009*

**University of Utah**

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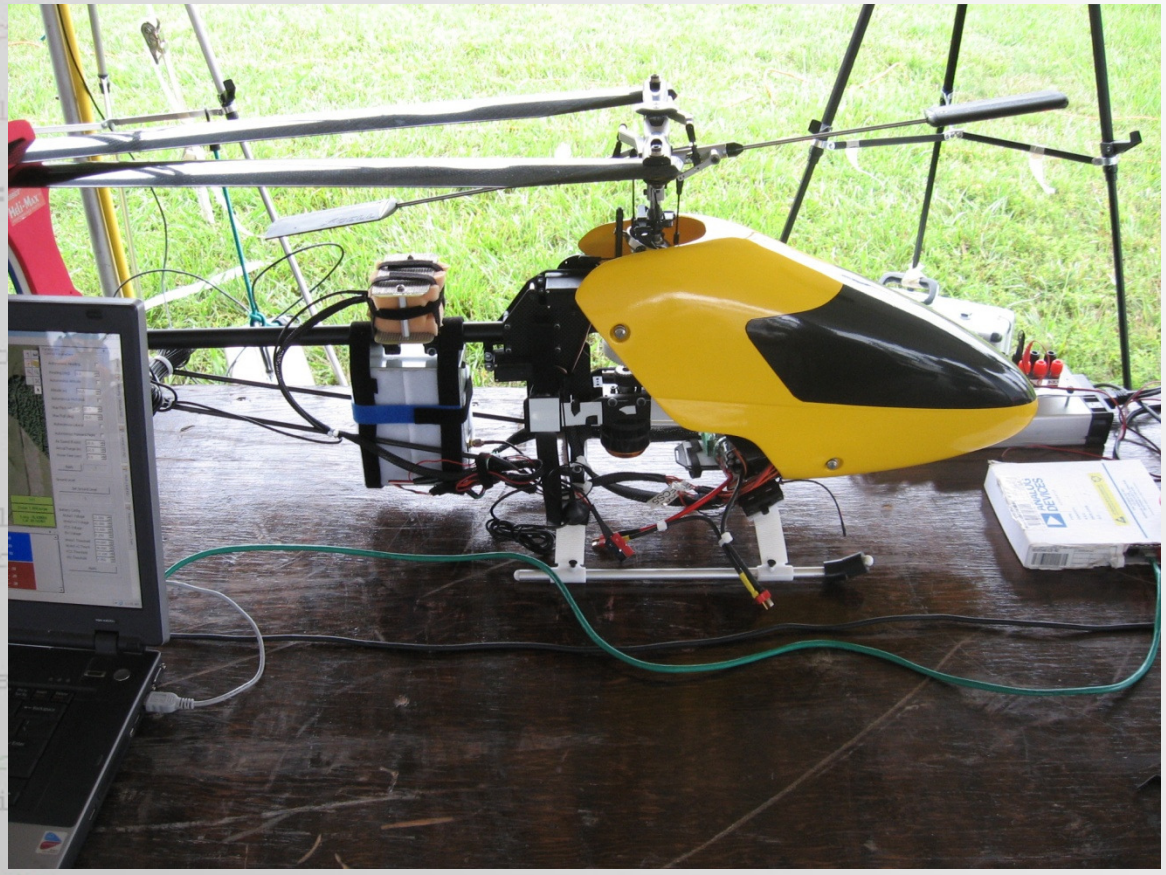

***AUVSI 2009***

**Virginia Commonwealth University**

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## *AUVSI 2009*

**UWF Control Station**

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## *AUVSI 2009*

**UWF Ready to Take Flight**

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## *AUVSI 2009*

**UWF Award Ceremony—2nd in Flight—4th Overall**

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## *AUVSI 2009*

**UWF Team and the "Whole Package"**

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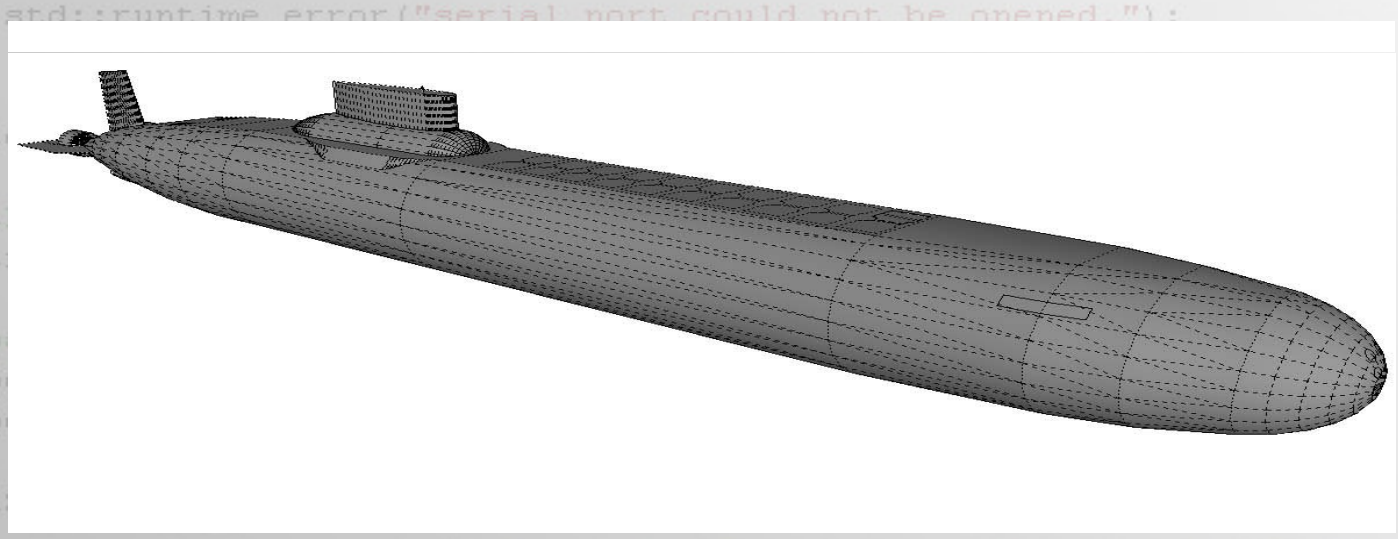
# School of Science and Engineering
# Autonomous Underwater Vehicle (AUV)



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# AUVSI Goals

The goals of the AUVSI student competitions are to provide opportunities for students to experience the challenges of system engineering, to develop skill in accomplishing realistic missions with autonomous vehicles and to foster relationships between young engineers and the organizations developing and producing autonomous vehicle technologies.

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# AUVSI Student Competitions

The primary emphases of the AUVSI student competitions are learning and outreach. These events are not grand challenges designed explicitly to progress the state-of-the-art. The objective is to produce the people who will push the envelope in the future. Major innovations may be spawned in these events, but this is a by-product, not an objective. Most important are gaining an appreciation for the trade offs inherent in any system design and the lessons learned in transitioning from a working bench prototype to operating reliably in the real world.

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# Experience in AUVSI Student Competitions

The legacy of the student competitions can be found today throughout government and industry. Employers and venture capitalists seek out prospects with the kind of resourcefulness and team management experience that former competitors offer.

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# International Autonomous Underwater Vehicle Competition

Hosted by AUVSI and the Space and Naval Warfare Systems Center
SSC SD TRANSDEC Facility
San Diego, CA

# AUV 2009 “Mission”

Your mission, should you choose to accept it, is the following: Land on the beach and fire off a flare for the forces still in the water (to blind the enemy's night vision), and proceed under the barb wire. From there you have one of two choice: Head towards the targets for the bombing run, or head towards the machine gun nests. For the bombing run, you'll have the possibility to mark a primary and secondary target, or if you can't locate those, there are also two targets of opportunity. For the machine gun nest, you'll be required to lob up to two grenades into a small square opening. Finally, an operative has marked the building with the correct briefcase which contains the secret documents with a pinger. You are to follow the pinger, retrieve the briefcase, and head to the rooftop for extraction.

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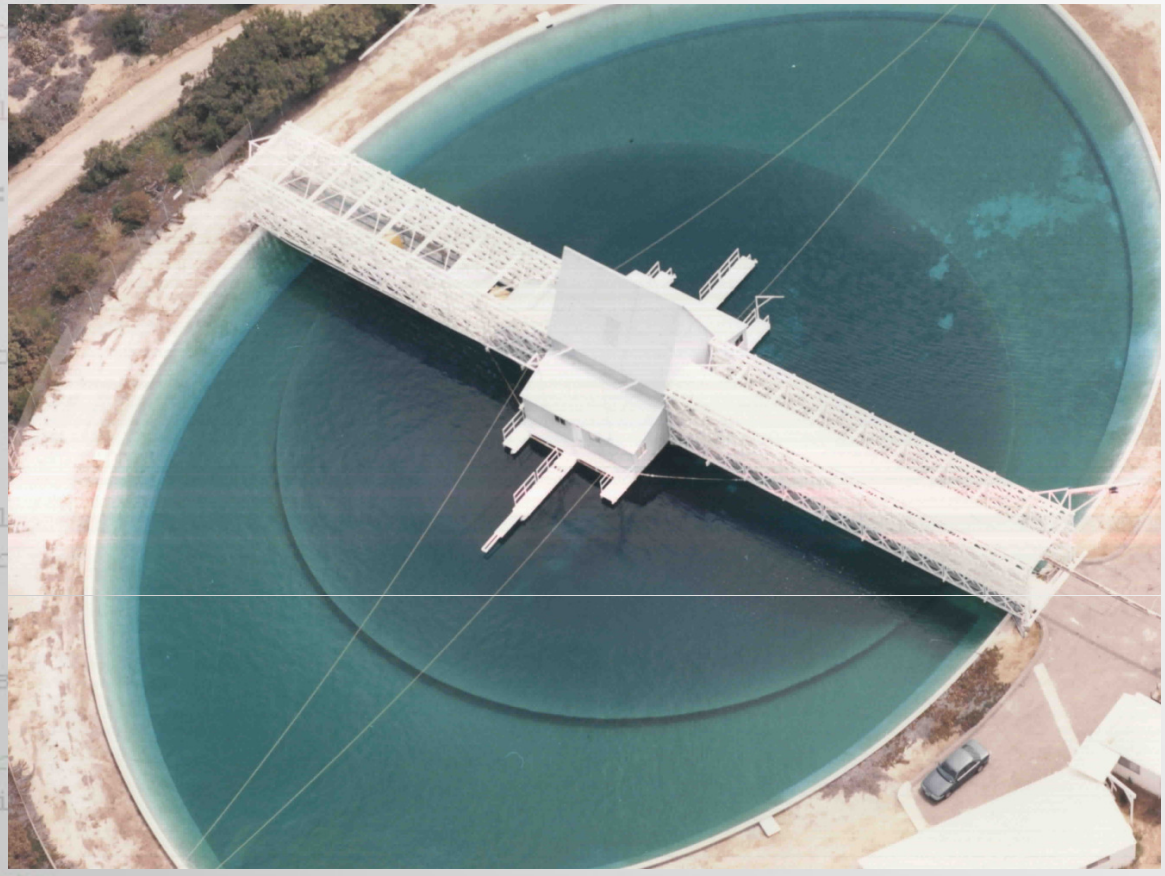

**Aerial Photo of SPAWAR Facility**

*The bridge structure has no piers or supports in the pond.*

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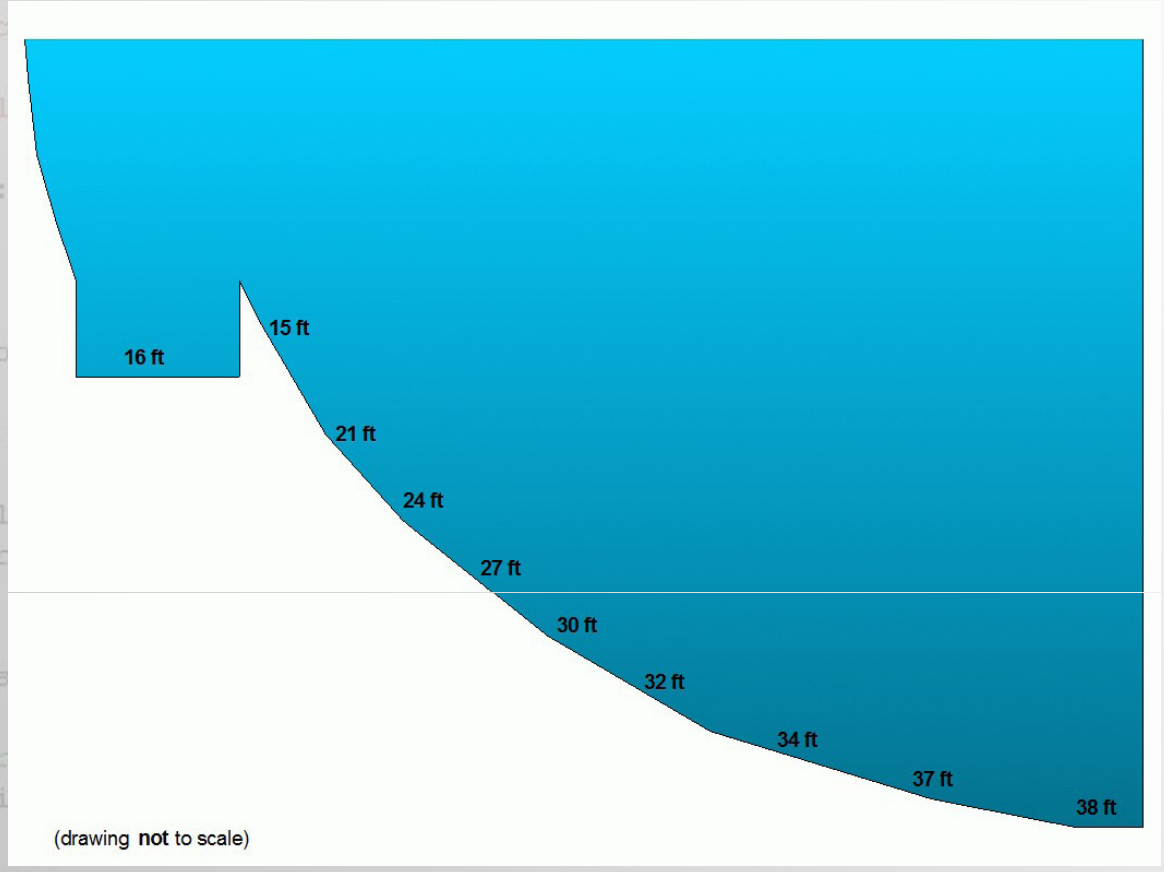


**Cross Section of Arena**

*The "acoustic trap" varies in width around the pond.*

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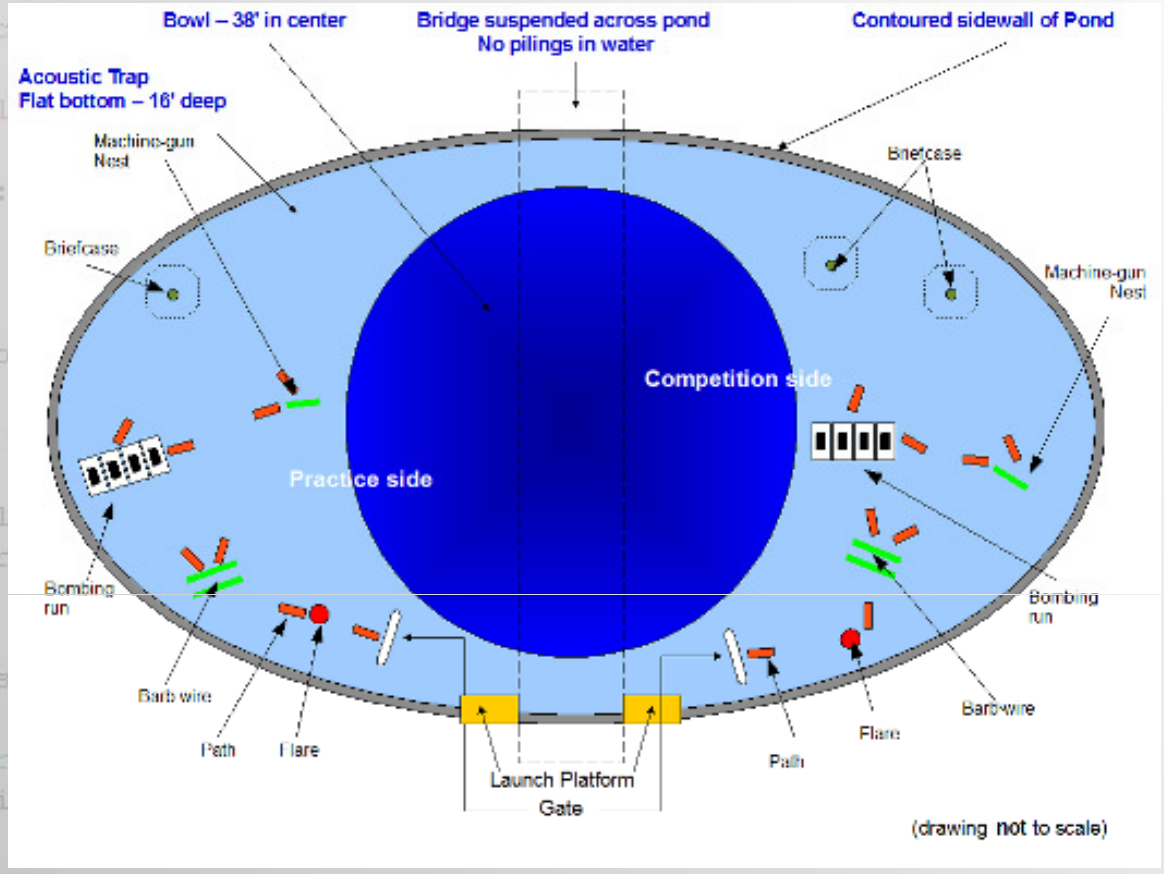


## General Layout of Arena

*The arena is split into a competition side and a practice side.*

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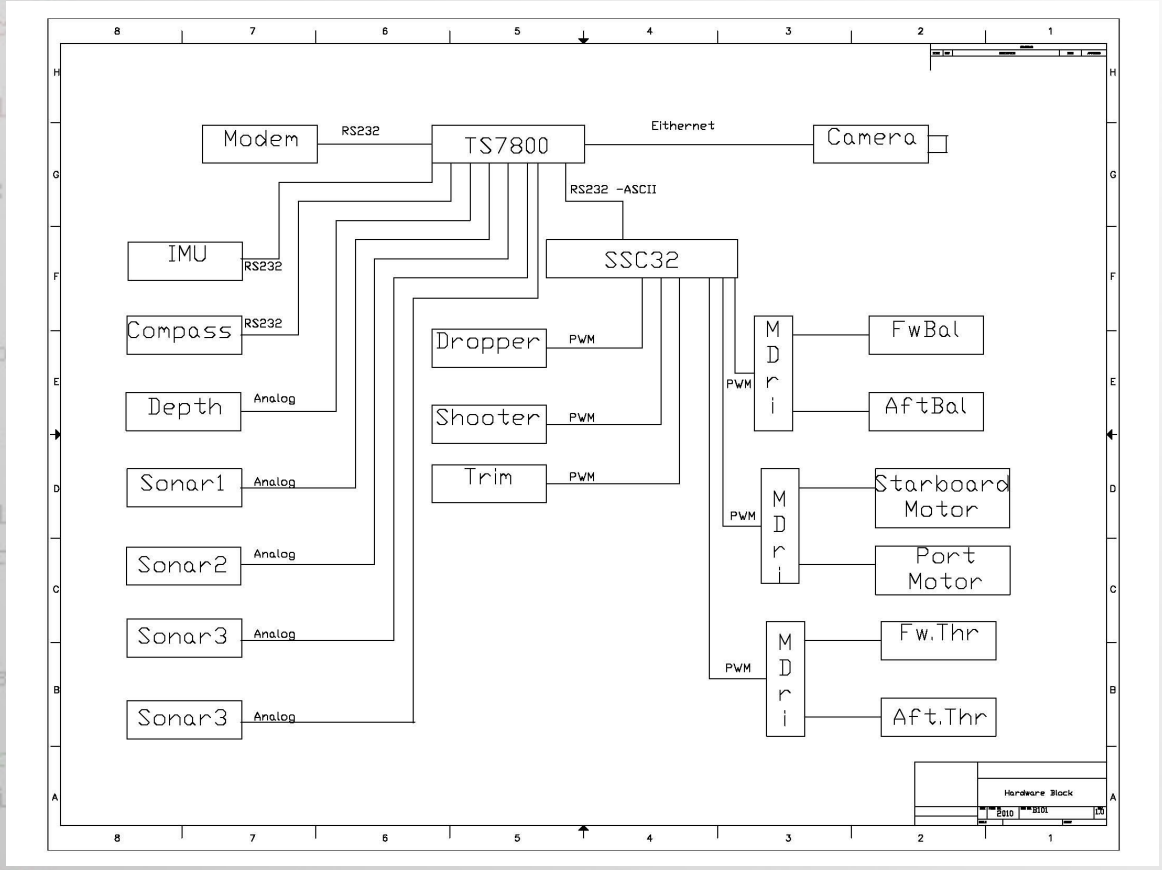


**AUV Block Diagram**

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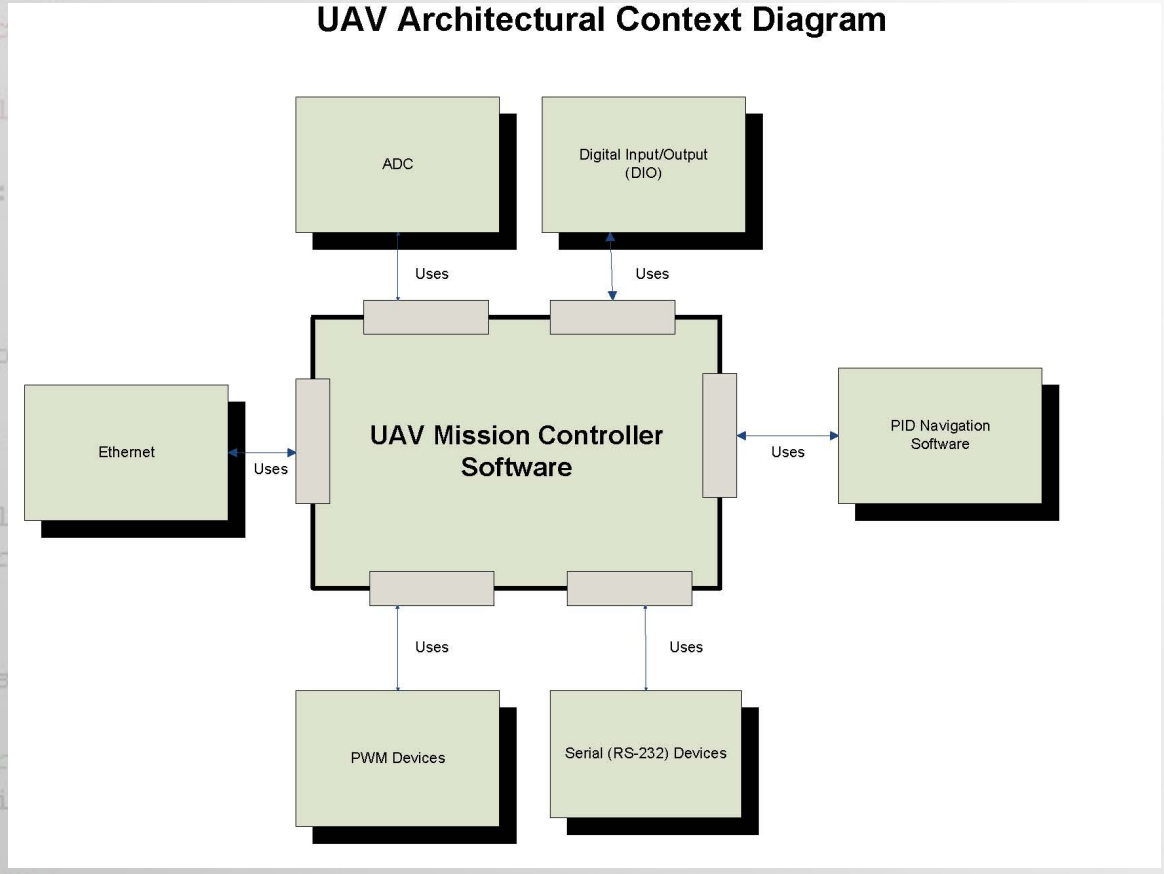


# AUV UML-Based Context Diagram

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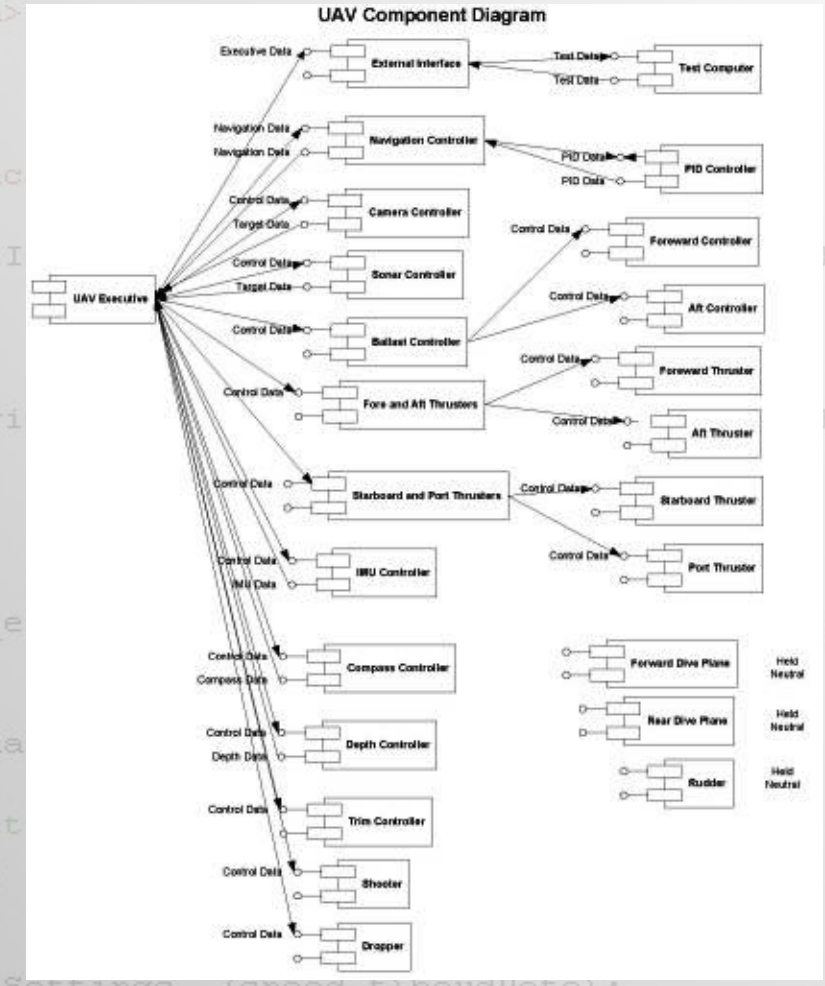


**AUV UML-Based Component Diagram**

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# School of Science and Engineering
# Unmanned Ground Systems/Tour Robot

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# What is a Tour Robot!?

- Human-sized autonomous robot
- Intended to take prospective students on tours of the new state-of-the-art Science and Engineering building
- Currently being designed and built by UWF students
- Joint effort by the UWF Electrical & Computer Engineering, Computer Science and Art Departments

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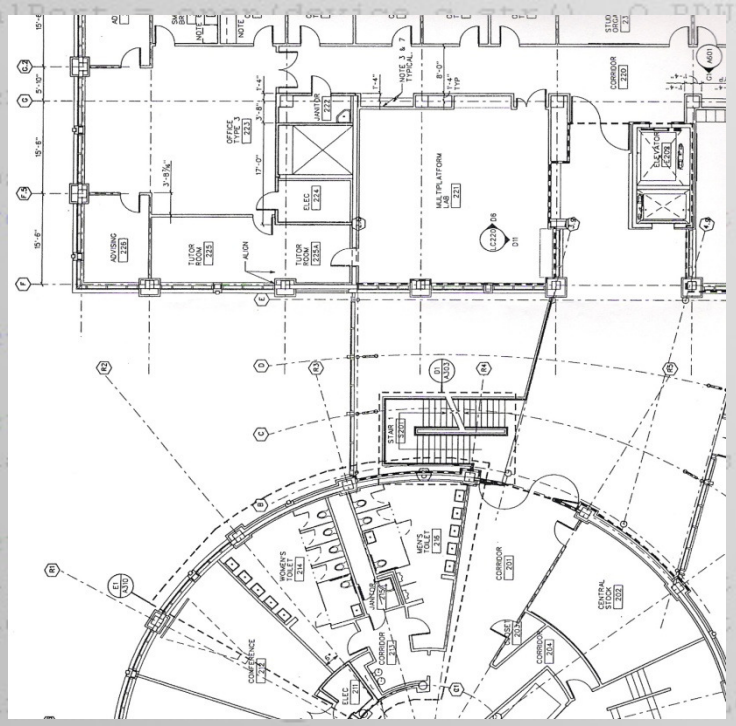
# UWF Commitment to Tour Robot

## Science and Engineering building considerations:



- Floor tile plan designed to accommodate robot navigation
- Solar panels on roof to provide all power for Tour Robot

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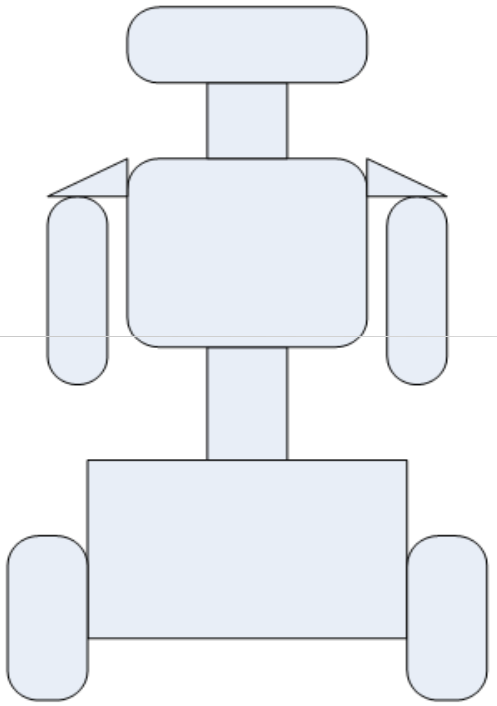
# High Level Design



**Speech and Vision**

- Speech Synthesis
- Speech Recognition
- Object Detection

**Main Controller**

- Percept Interpretation
- Decision Making
- Route Planning
- Natural Language Processing

**Base Controller**

- Power Distribution and Monitoring
- Motor Control
- Infrared Sensors
- Proximity Sensors
- Color Sensors

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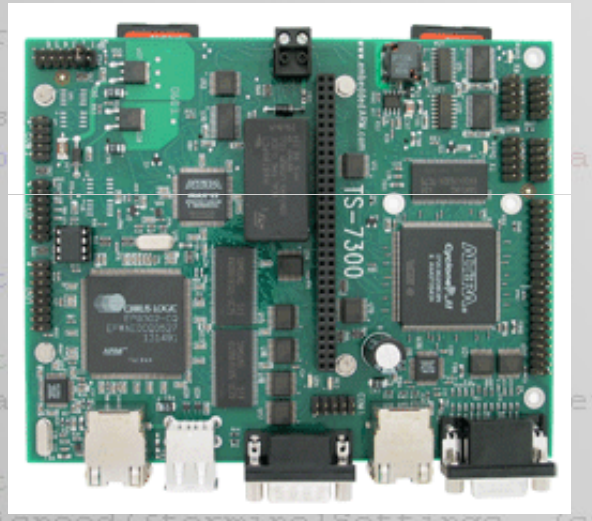
# Base Controller

Designed to provide the Main Controller with a generic interface to sensors and actuators.




TS-7300 ARM-9 Embedded SBC

- Interfaces with various sensors (infrared, proximity, color, etc.) using PC/104 expansion bus, serial ports and digital I/O ports.
- Actuates motors using servo controller and motor drivers.
- Communicates with Main Controller using Ethernet communication.

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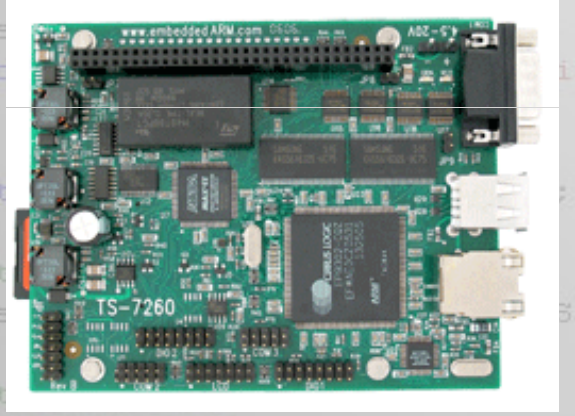
# Main Controller

Intended to perform more complex decision-making software operations requiring significant computation.




TS-7260 ARM-9 Embedded SBC

- Communicates with both the Base Controller and the Speech/Vision Controller to interpret the environment
- Searches for suitable sequences of actions that will achieve goals
- Responds to the environment by signaling the Base Controller and Speech/Vision Controller to activate actuators.

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# Speech/Vision Controller

Intended to provide an engaging machine-to-human interface.

## Goals:

- Synthesize speech for leading tours
- Perform speech recognition to achieve an interactive experience
- Attempt to recognize movement of humans
- Attempt to detect and make note of objects within the environment

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# Learning Opportunities

- Practical, hands-on, team-oriented product development
- Embedded, real-time hardware and software development
- General robotics
- Network communication
- Sensor interfacing
- Intelligent Agents
- Speech and Image Processing
- Structural and aesthetic design
- Human-machine interface development

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# Questions?


| | | |
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