

# Modular R.O.V for Sub-Sea Operations

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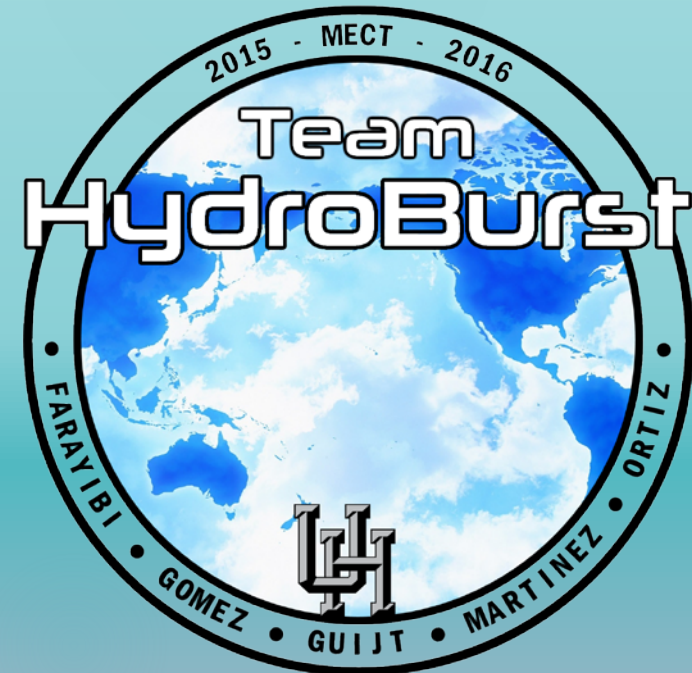
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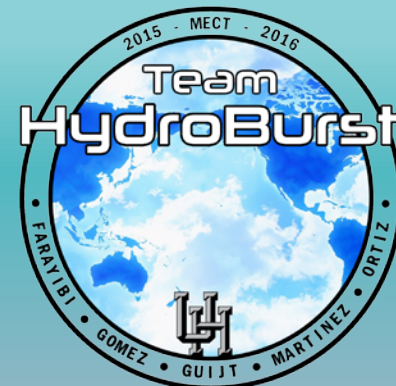
INTRODUCTORY  
PRESENTATION

09/28/2015



# ROV Presentation Outline

- ▶ What is an ROV?
- ▶ A Brief History of ROVs
- ▶ The Problem in the Industry
- ▶ Project Goals
- ▶ The MATE Competition
- ▶ ROV Systems
- ▶ Basic Frame Designs
- ▶ Design Comparison and Selection Criteria
- ▶ CAD Designs
- ▶ Project Timeline
- ▶ Estimated Expenditures
- ▶ Goals for the next presentation
- ▶ Questions/Comments

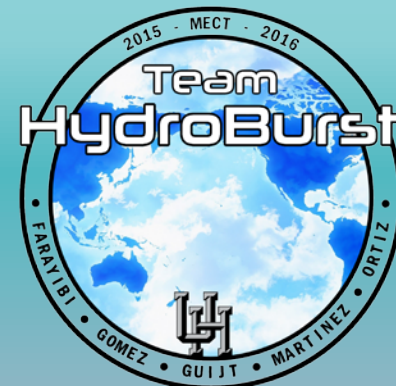


# What is an ROV?

- ▶ [R] – Remotely
- ▶ [O] – Operated
- ▶ [V] – Vehicle
  
- ▶ Used in:
  - ▶ National Defense.
  - ▶ Resource Extraction.
  - ▶ Science.
  - ▶ Telecommunications.
  - ▶ Search and Recovery.



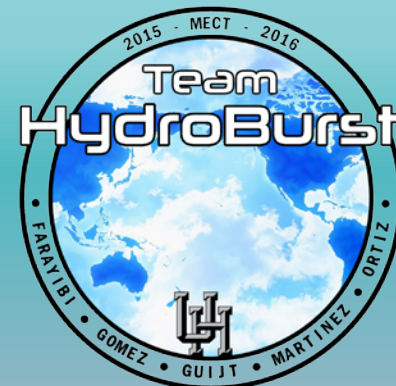
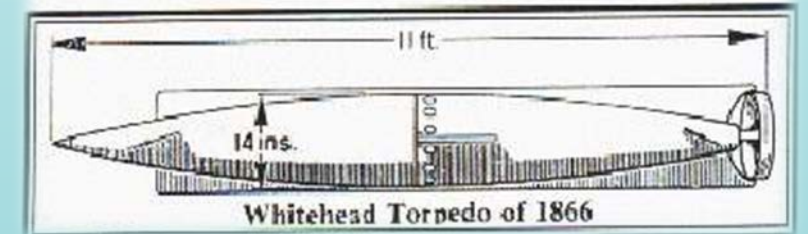
- ▶ Construction, Inspection, and Maintenance.
- ▶ Archaeology
- ▶ Recreation and Entertainment.
- ▶ Education.



# A Brief History of ROVs

- ▶ Existed in one form or another since 1860s.
- ▶ In 1953 the first tethered ROV was developed.
- ▶ During the 1960s the Navy funded advances in the Remotely Operated Vehicles.
- ▶ During the 1970s and 1980s, commercial firms started utilizing ROVs in subsea drilling operations.
- ▶ ROVs now operate at 10,000 feet to support drilling.
- ▶ Record depth of almost 35,791 feet reached by the Japanese Kaiko Ultra-Deep ROV in 1995

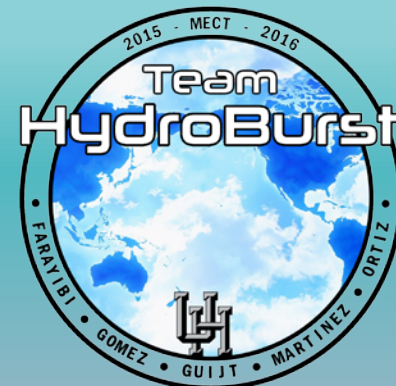
The Whitehead-Luppis Torpedo



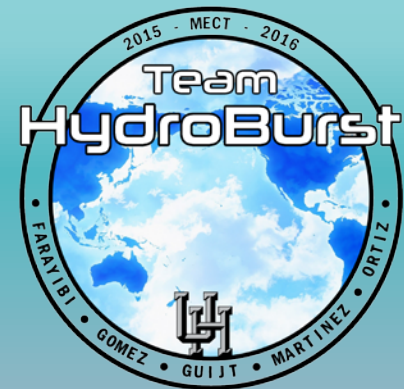


# The Problem in the Industry

- ▶ ROVs can be Bulky to fit all the sensors and devices.
- ▶ Larger and heavier designs require stronger motors to overcome the weight and drag, leading to less maneuverability.

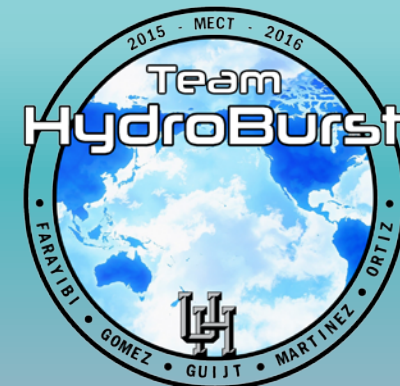


# Project Goals



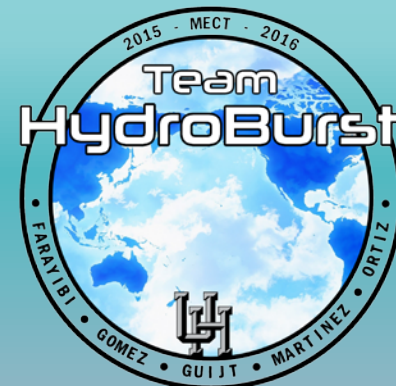
# 2016 Mate ROV Competition

- ▶ MATE Center was founded in 2001.
  - ▶ Teach STEM and prepare students for technical careers.
- ▶ Competition Classes:
  - ▶ Scout- Beginner
  - ▶ Navigator- Intermediate
  - ▶ Ranger- Moderate
  - ▶ Explorer- Advance



# ROV Systems

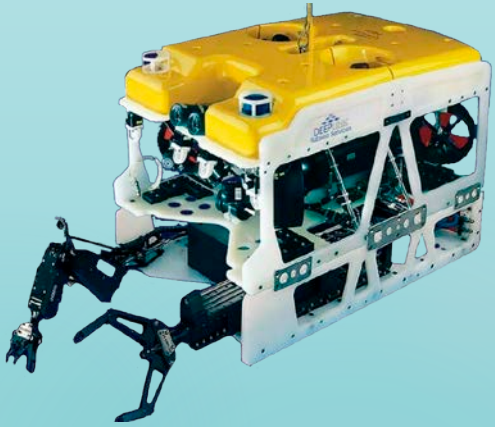
- ▶ Frame
- ▶ Control Systems
  - ▶ Micro-controller, Camera, Lights
- ▶ Propulsion Systems
- ▶ Buoyancy (Ballast vs. Foam)
- ▶ Deployment
  - ▶ How to get in and out of water.
- ▶ Tether Management System
- ▶ Operational Components:
  - ▶ Pressure Transducer
  - ▶ Water-Current Flow Meter
  - ▶ Control Arm





# Basic Frame Types

## Rectangular Prism



Pros:

Cons:

Pros:

Cons:

## Octagonal



## Cylindrical



Pros:

Cons:

Pros:

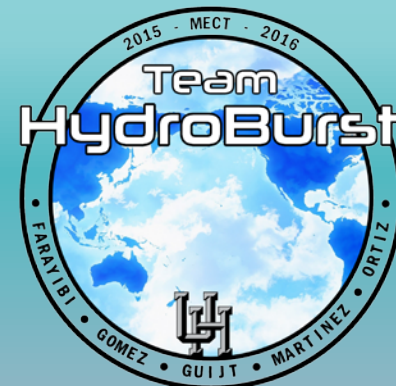
Cons:

## Flat

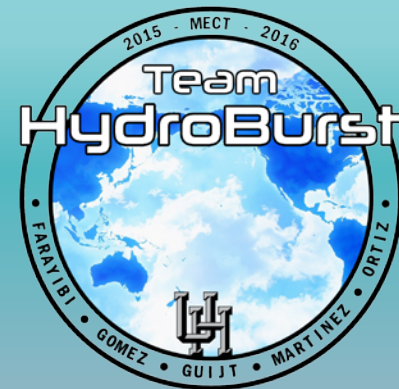
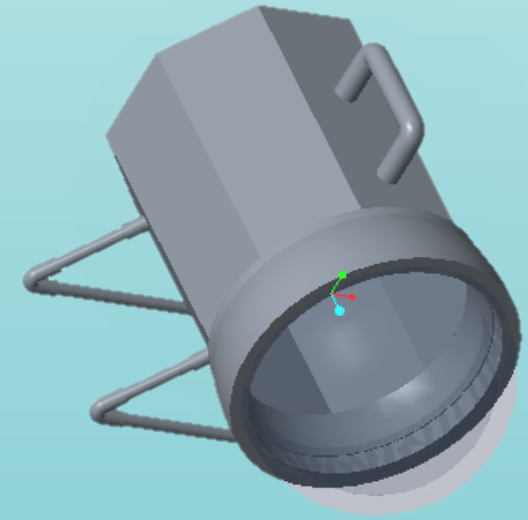
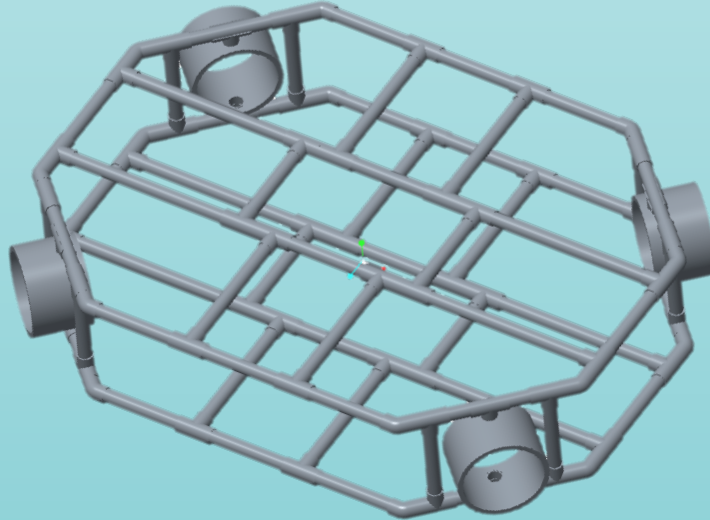
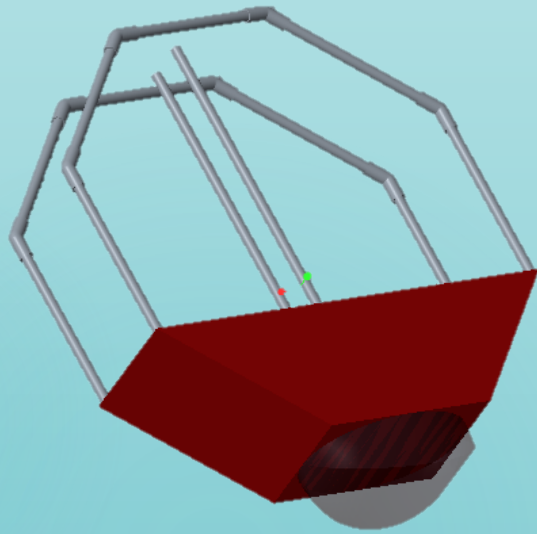


# Design Comparison and Selection Criteria

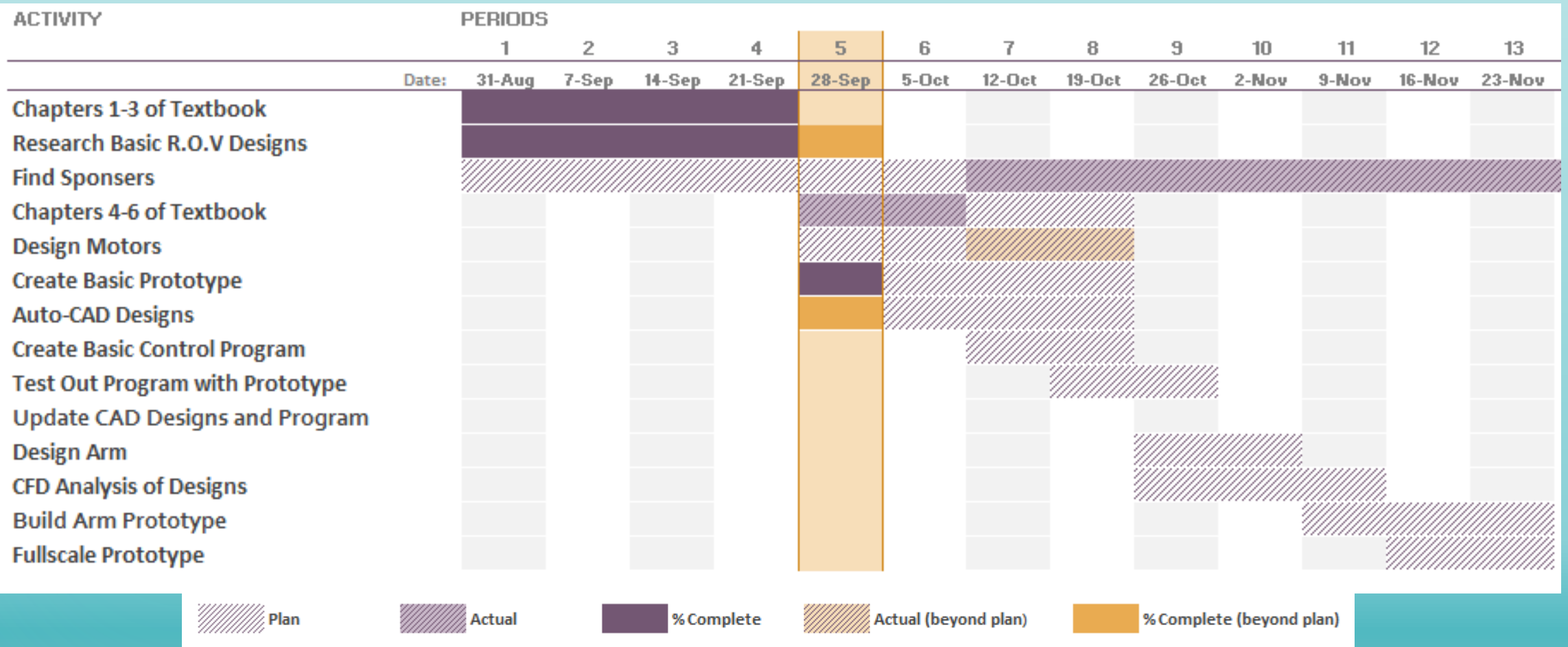
	Maneuverability	Hydro-dynamics	Internal Space Utilization	Modular Optimization	Corrosion Resistance	Totals
Rectangular	1	1	2	3	5	12
Cylindrical	3	4	3	1	5	16
Octagonal	4	3	2	3	5	17
Flat	2	3	3	2	5	16



# CAD Designs



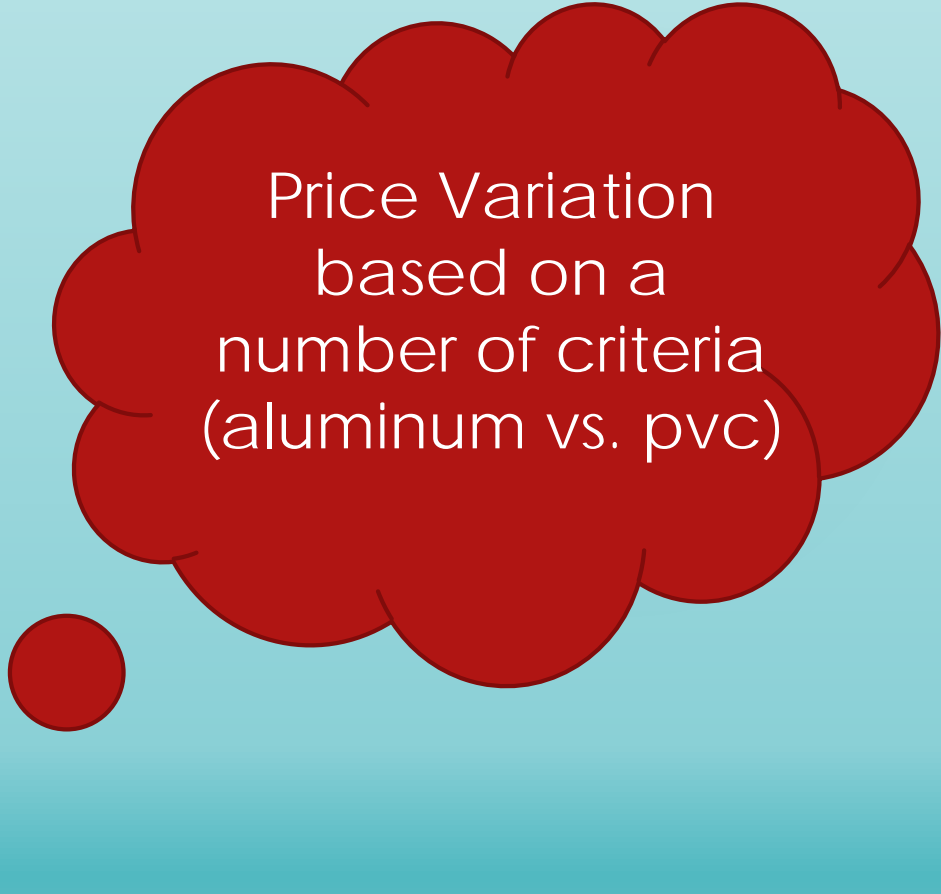
# Project Timeline





# Estimated Expenditures

- ▶ Frame → \$70 to \$300
  - ▶ CPVC (~\$70), PVC (~\$250), Aluminum (~\$150)
- ▶ Baseboard → \$50 to \$80
  - ▶ Plastic (~\$50), Aluminum (~\$80)
- ▶ Thrusters (Minimum 5, up to 8) → \$600 to \$2400
- ▶ Ballast → \$100 to \$400
- ▶ Watertight Enclosures → \$50 to \$200
- ▶ Controllers and Cables → \$200 to \$600
- ▶ Camera/s → \$50 to \$500
- ▶ Pressure Sensors → \$20 to \$200
- ▶ Arms → \$800 to \$2400

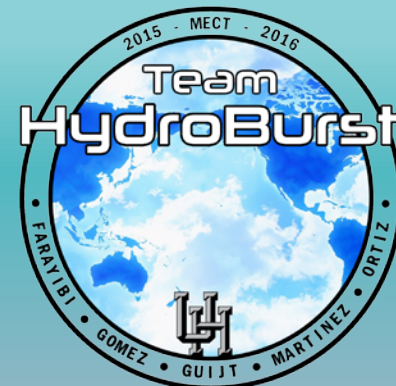


Price Variation  
based on a  
number of criteria  
(aluminum vs. pvc)

Total: Estimated Between \$1840 and \$7080

# Goals before Next Presentation

1. Stress Analysis of Designs.
2. CFD Analysis of Designs.
3. Search for Sponsors and Adviser.



# Thank You for Listening!

## Any Questions, Comments, or Concerns?

