TEAMER
IVC/ORPC Tow Body Camera System

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APL-UW

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PMEC
Pacific Marine Energy Center

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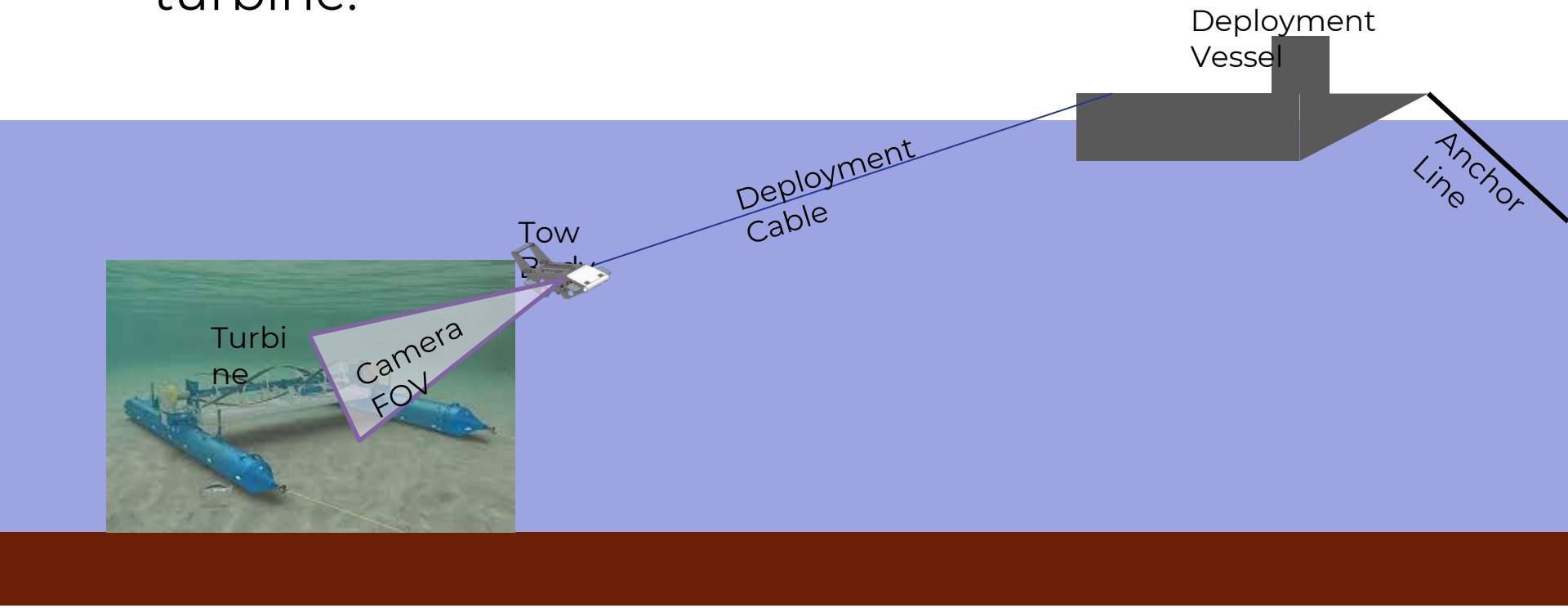
System Cartoon

- Camera system tow body to be deployed from a small vessel upstream or to the side of the RivGen turbine.

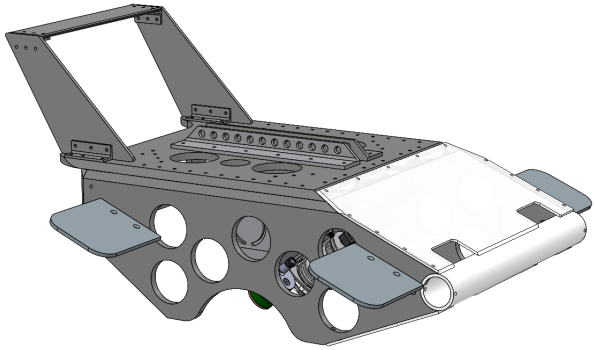


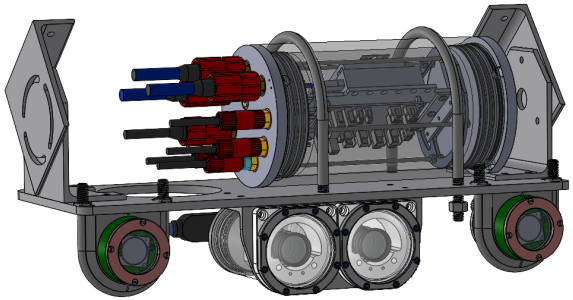
Design Specifications

- Environmental Operating Conditions:
  - Water temperature range: -1.0° to 15°C
  - Peak current speed: 2.6 m/s (assuming stationary vessel)
  - Current range: 1.6 to 2.4 m/s
  - % turbulence: 18 to 25%
- Field of view: [degrees vertical and horizontal] 25deg
  - Focal range: [m] 1m to 5m (assuming you are looking straight down)
  - 7.5m to 12m (assuming you are looking at an angle)
  - Preference is: angle
- Deployment duration: [hours/days/weeks]
  - In the water at least a week ahead of the smolt outmigration (ice-out limited)
  - In the water during priority periods; May 21- June 10 and June 25-July 15
  - Up to 8 hours a day during priority periods while device is operating
  - 100% duty cycle while onsite

System Overview

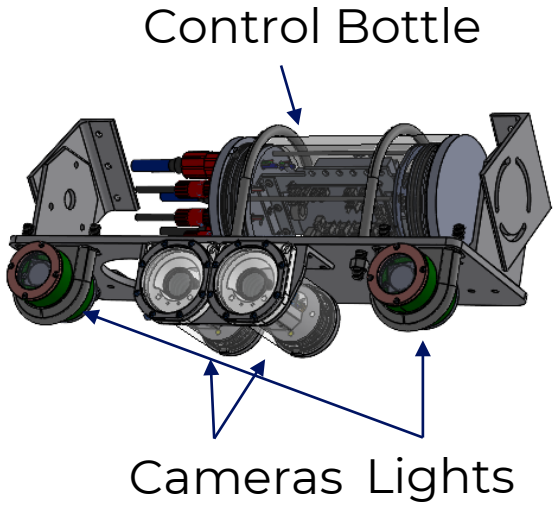
- Camera System
  - Stereo machine vision cameras with 2 high power LED lights
  - Control bottle for power and comms distribution.
- Tow Body
  - Instrument configuration options for viewing angle adjustment
  - Adjustable elevators and pick point location for towing angle control
- Deck Controls
  - Single cable umbilical with 12 and 48 VDC power supplies
  - Control and data acquisition from laptop or similar computer

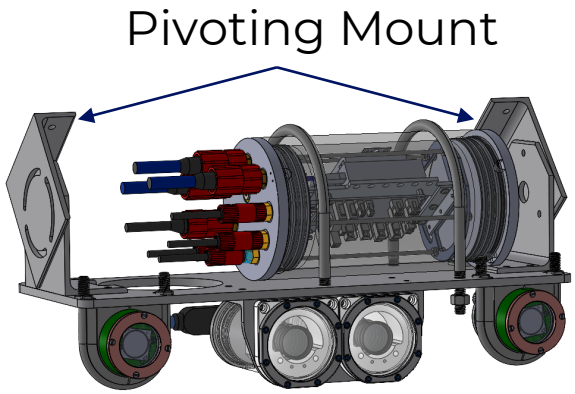




Camera System

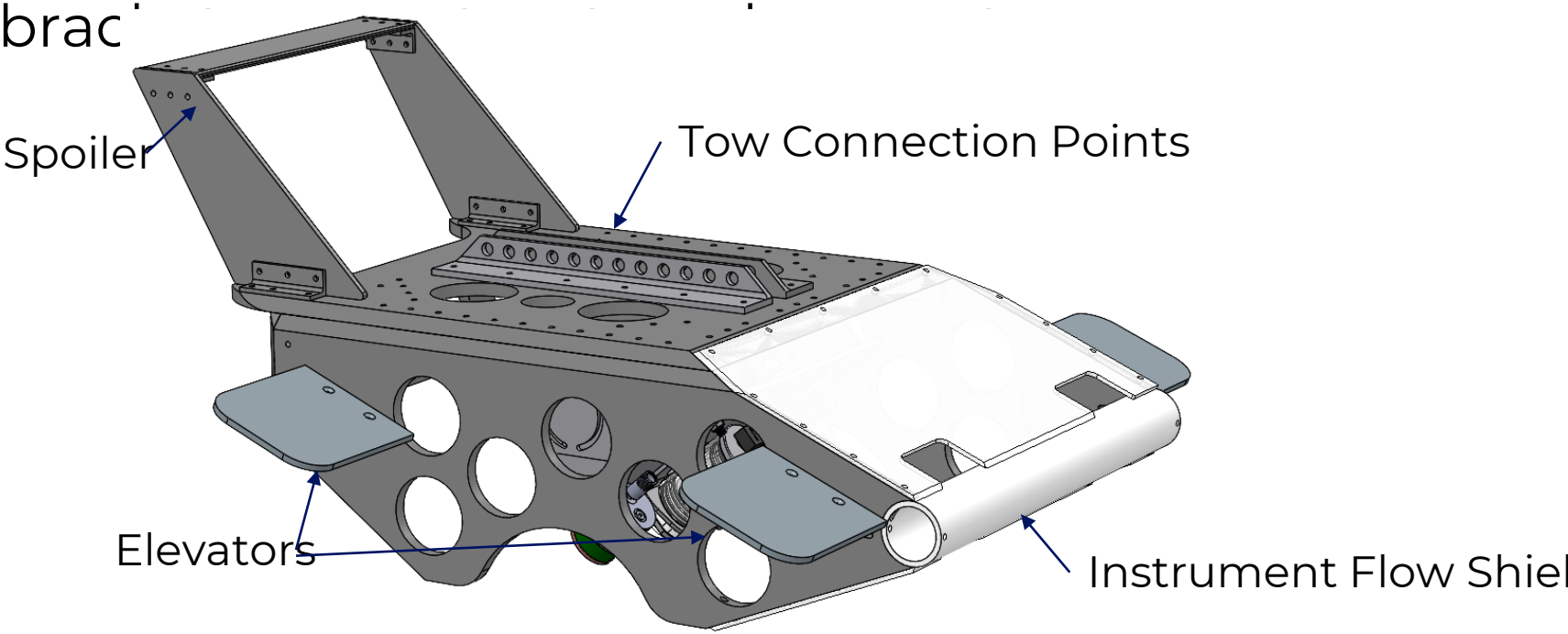
- Two options for instrumentation:
  - Both options fit this space and pattern, similar size housings
  - Option 1: APL build
  - Option 2: Outside build with Sexton camera housings, DSPL lights, and BlueRobotics control housing
- Blackfly S GigE 5 megapixel cameras
- High power LED lights with either continuous or strobed operation modes
- Controller for comms integration to a single cable, camera synchronization, and power switching to cameras and lights





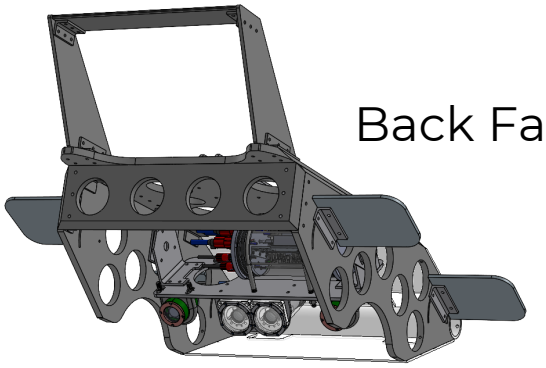
Tow Body

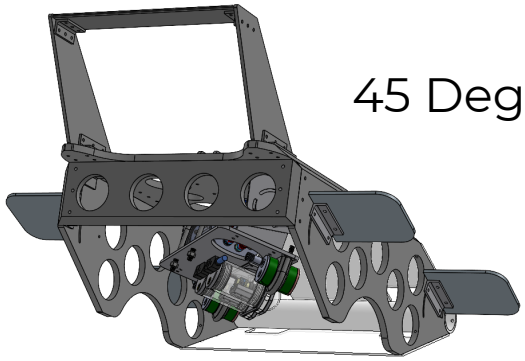
- Hydrodynamic profile independent of instrument orientation
- Built from waterjet or laser cut parts with simple L brac

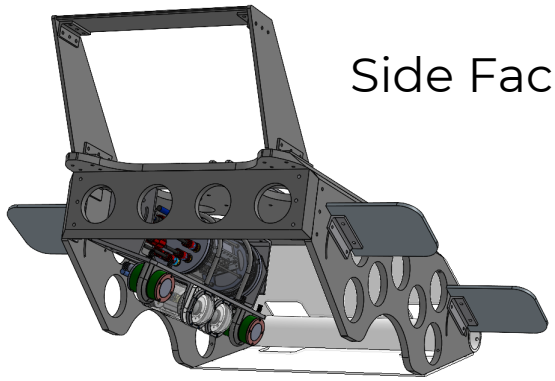


Tow Body Adjustments

- Camera system angle adjustment
- Camera system mounting options
  - Can be mounted for forward, back, 45 degrees or either side view orientations
- Tow point connection options
  - Adjusting tow point will change tow body orientation during operations
- Elevator angle adjustment (optional)
- Spoiler (optional)



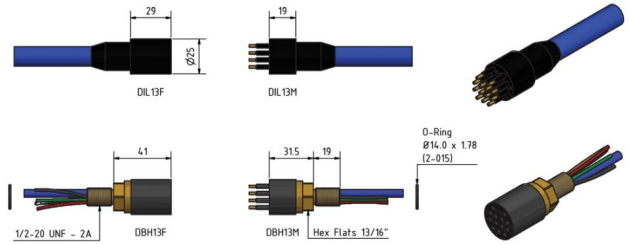




Umbilical/Tether

- SubConn 13 pin power and Ethernet cable
  - Cat 5e Ethernet connection
  - 4x power conductors
  - Strain relief on tow body end
- 3/8” spectra or similar on a 12 VDC winch on pivoting davit
- Backup float on short tether above tow body to limit depth

SubConn Power Ethernet Circular - 13 contacts



12 VDC Winch

Power Supply/Control Computer

- Computer: Laptop or similar with following specifications
  - 4 core CPU minimum
  - Network card with 1 GB ethernet port
  - NVIDIA graphics card with CUDA cores
  - Memory for data storage: ~1 TB per 8 hour day of continuous 10 FPS stereo images

Lenovo ThinkPad

- Power supply:
  - 2 kw ac generator or similar to plug in computer and DC converters
  - 48 VDC converter with minimum of 300 watts ($36)
  - 12 VDC converter with minimum of 50 watts ($36)

AC to DC 0-48 volt Power Supply

Bill of Materials

TEAMER IVC/ORPC Camera Tow Body: Summary			
	Cost		
	Option 1	Option 2	**Notes**
Camera System	$19,196	$18,153	
Tow Body	$2,805		
Deck Controls	$1,927		Does not include generator.
Fabrication and Assembly	$14,426		Support for ordering parts, fabrication of custom parts, and system assembly
Tank Testing	$10,991		In water testing to confirm operations and camera calibration
Field Testing	$7,246		Vessel testing to confirm tow orientation
Totals:	**$56,591**	**$55,548**	

- Google Drive Link: https://docs.google.com/spreadsheets/d/1wnk8dSNci1lF92r5RzfIuZxf9boBSjnzak7QTuPJObc/edit?usp=sharing

Fabrication Costs

- Primary cost is the camera system, best option for cost reduction would be to switch to BlueRobotics camera housings.
- APL testing support includes test tank calibration and vessel towing.

RV Inferno

UW Test Tank

Acknowledgements

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