

Title: Adaptive overhead tether system for freely moving swine

Team: Porcine Innovations Group (P.I.G.), BME 200/300

Date: 9/18/2026 - 9/24/2026

Client: Dr. Marco Failla Mulone

Advisor: Dr. Jonathan Soucy

P.I.G

Alisha Schaeffer, Team Lead, aaschaeffer@wisc.edu

Katelynn Johnson, Team Lead, kajohnson57@wisc.edu

Gabriela Medina Medina, BSAC, gmedinamedin@wisc.edu

Evan Hoffman, BPAG, ebhoffman2@wisc.edu

Catherine Sit, BWIG, casit@wisc.edu

Joshua Grauman, Communicator, jgrauman@wisc.edu

Problem statement

The UW-Madison Department of Neurosurgery is developing a chronic large-animal neuromonitoring platform using multiple intracranial catheters for continuous or repeated brain interstitial fluid sampling. A cranial fixation device that organizes and protects these catheters has already been developed; however, the lab requires the development of a complementary overhead system that manages tubing and cables extending from the cranial device, while simultaneously allowing the animal to move naturally within a stationary enclosure. The developed system needs to be able to dynamically follow the animal, maintain appropriate tubing length, minimize tensile and rotational forces, prevent entanglement or kinking, and allow normal behaviors.

Brief status update

After meeting with the client and design advisor, the team has developed three separate design ideas from initial design iterations. The team also developed design matrices and relevant criteria to evaluate these designs and their function and feasibility. The three matrices revolved around the tether system, harness device, and equipment platform.

Difficulties/advice requests

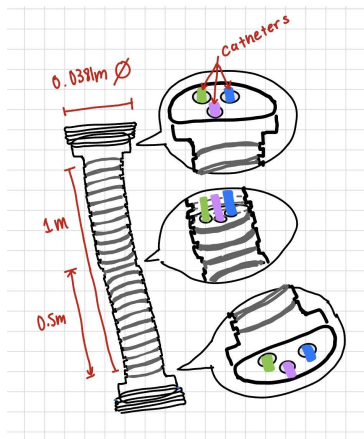
N/A

Current design

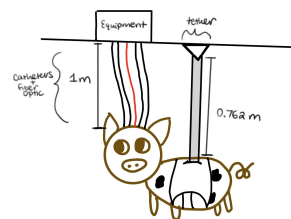
PRELIMINARY DESIGN MATRICES

TETHER DESIGN MATRIX

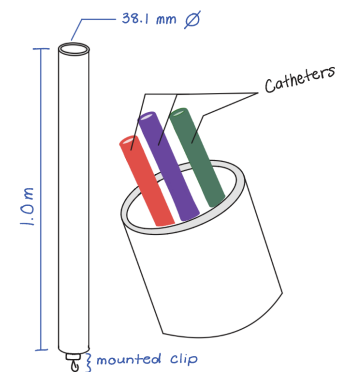
Design 1: Flexible Stainless Steel Cover



Design 2: By-the-Side Tether



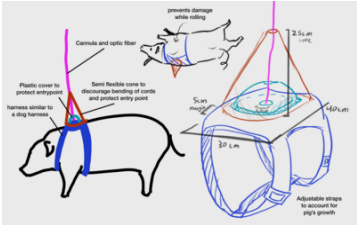
Design 3: Rigid Hollow Rod Cover



Design Criteria		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Catheter Organization	25	4/5	20	3/5	15	4/5	20
Fiber Optic Catheter Protection	20	4/5	16	2/5	8	4/5	16
Subject Safety	20	3/5	12	2/5	8	4/5	16
Comfort	15	2/5	6	4/5	12	2/5	6
Ease of Use	10	4/5	8	2/5	4	3/5	6
Cost	10	1/5	2	2/5	4	3/5	6
Total	100		64		51		70

HARNESS
DESIGN
MATRIX

Design 1: Traffic Cone
Harness



Design 2: PiggyBack
Harness

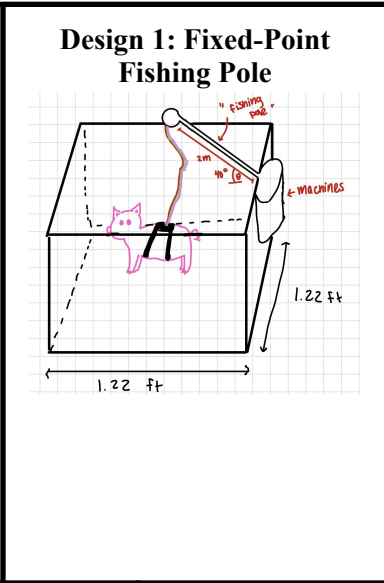
(w.i.p)

Design 3: Basket Harness

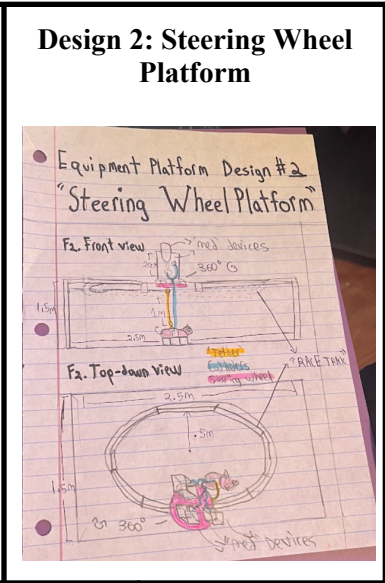


Design Criteria		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Fiber Optic Catheter Protection	25	4/5	20	3/5	15	2/5	10
Intracranial Catheter Fixation Device Integration	25	4/5	20	4/5	20	2/5	10
Safety	20	4/5	16	4/5	16	4/5	16
Cost	15	2/5	6	2/5	6	4/5	12
Comfort	15	4/5	12	4/5	12	4/5	12
Total	100	74		69		60	

EQUIPMENT PLATFORM DESIGN MATRIX



Design 2: Steering Wheel Platform



Design 3: Swine Zipline

Platform can spin to prevent tangling

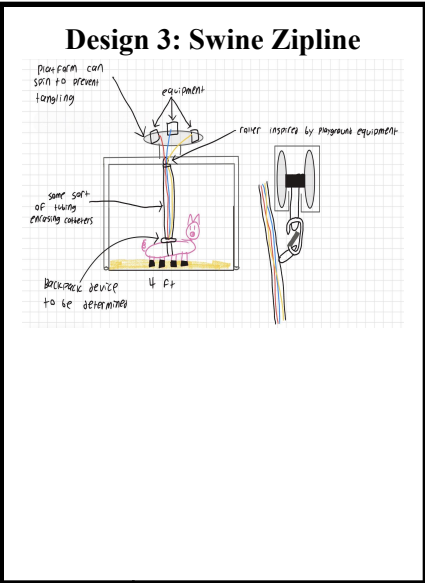
equipment

rover inspired by marginal equipment

some sort of wing enclosing containers

Blockade device to be determined

4 ft



Design Criteria		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Ease of Fabrication	30	4/5	24	4/5	24	3/5	18
Medical Equipment Integration	30	3/5	18	4/5	24	4/5	24
Safety	20	4/5	16	4/5	16	4/5	16
Comfort	10	2/5	4	4/5	8	4/5	8
Cost	10	5/5	10	3/5	6	2/5	4
Total	100	72		78		70	

Materials and expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1										
									\$0.00	
									\$0.00	
Category 2										
									\$0.00	
									\$0.00	
								TOTAL:	\$0.00	

Goals

Major team goals for the next week

1. Meet with DesignLab staff to overview proposed design and fabrication feasibility
2. Prepare for the preliminary presentation
3. Continue to do research to help with finalizing the design

Next week's individual goals

- Alisha Schaeffer
 - To work with group members to make CAD designs for the final design components
 - To start and make a template for the Preliminary Presentation Slides
 - To finalize the final design that the group chose
- Katelynn Johnson
 - Work on preliminary presentation deliverables.
 - Continue design research on materials and relevant standards.
- Gabriela Medina Medina
 - Work on preliminary presentation deliverables
 - Continue to research designs
 - Implement PDS feedback
- Evan Hoffman
 - Start to plan out our best design from the matrix
 - Work on preliminary design presentation
- Catherine Sit
 - Decide on final design plan for the device, combining and editing existing designs
 - Research materials and harness construction, particularly ones used on similar animals
- Joshua Grauman
 - Fix PDS based on comments left by advisor
 - Research specifically on the equipment platform design matrix 'winner'

Timeline

Task	September				October					November				December	
	10	16	18	25	2	7	16	23	30	6	20	26	30	4	9
Project R&D															
Empathize	X	X	X												
Background	X	X	X												
Prototyping															
Testings															
Deliverables															
Progress Reports	X	X	X												
PDS		X	X												
Design Matrix			X												
Prelim Presentation															
Prelim Deliverables															
Show and Tell															
Final Poster															
Final Deliverables															
Meetings															
Client		X													
Advisor	X	X	X												
Website															
Update	X	X	X												

Filled boxes = projected timeline

X = task was worked on or completed

Detailed accomplishments

Previous week's goals and accomplishments

Our team used the information gained from the initial client meeting to propose initial design ideas. The team used these initial designs to form three separate designs. The team then developed design matrices to evaluate these three designs based on standardized criteria to determine which design to move forward with.

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Alisha Schaeffer	9/9/2026	Brainstormed questions for client	0.5	1	1

		meeting to be used for PDS		5	6	
	9/4/2026	Created a calendar for the team to keep the team organized on deadlines and upcoming events to prepare for	0.5			
	9/16/2026	Worked on multiple sections of the PDS and edited the PDS as a whole	2			
	9/11/2026	Found sources that listed the specific measurements and numerical values needed for certain parts of the design	1			
	9/16/2026	Met with the client and PI of the lab	1.5			
	9/13/2026	Brainstormed questions for the client meeting	0.5			
	9/22/2026	Sketched Brainstormed Design Ideas	1	4.5	10.5	
	9/23/2026	Reviewed PDS comments and made edits	0.5			
	9/23/2026	Worked with team to revise design ideas and finalize the choices for the preliminary design matrices	1.5			
	9/24/2026	Sketched out the choices for the design matrices and helped evaluate for each design matrix	1.5			
	Katelynn Johnson	9/8/2026	Brainstormed questions for client meeting	0.5	1.5	11.5
		9/9/2026	Worked on timeline	0.5		
9/10/2026		Wrote Problem Statement	0.5			
9/13/2026		Worked on the PDS draft	1	4.5		
9/15/2026		Reviewed client-provided information.	1			
9/16/2026		Worked on the PDS draft	1			
9/17/2026		Worked on the PDS draft	1.5			
9/18/2026		Researched required medical equipment	1.5	5.5		
9/23/2026		Worked on initial designs	1			
9/24/2026		Reviewed PDS comments and made edits	0.5			
9/24/2026		Worked on design matrices	2.5			

Gabriela Medina Medina	9/10/2026	Brainstormed questions for client	0.5	1	1	
	9/10/26	Got started on researching current devices	0.5			
	9/13/26	Researched more Devices	2	3.25	10.25	
	9/13/26	Worked on PDS	1			
	9/17/2026	Worked on PDS	0.25	6		
	9/21/2026	Researched more competing designs & standards for PDS	2			
	9/23/2026	Worked on initial designs	3			
	9/24/2026	Sketched out fixed-point swivel platform system & the flexible steel cover tether designs for design matrixes	1			
Evan Hoffman	9/10/2026	Brainstorm client questions for meeting	0.5	1		4.5
	9/10/2026	Research current devices and solutions	0.5			
	9/17/2026	Researched standards about materials and safety concerns and worked on PDS	1.5	1.5		
	9/24/2026	Researched current devices and worked on initial design sketches	2	2		
Catherine Sit	9/10/2026	Researched current devices and similar problems and solutions	0.5	2.25	4.75	
	9/10/2026	Brainstormed questions for client	0.5			
	9/14/2026	Researched devices and cannula devices	1.5			
	9/17/2026	Worked on PDS	0.75			
	9/22/2026	Sketched design for swine harness	1.5	2.5		
	9/24/2026	Drew an updated design for swine harness with more specifications	1			
Joshua Grauman	9/10/26	Researched the catheter device used on pigs	.75	1	7.5	
	9/9/26	Communicated with the client about meeting times	.25			
	9/13/26	Worked on PDS with group members	1.25	3.5		
	9/16/26	Meeting with Client	1.5			

	9/17/26	Research & Work on PDS	.75	3	
	9/22/26	Sketched two basic designs of "Tether system" and "Piggyback"	1		
	9/23/26	Reviewed PDS comments and generated matrices w/ group	1.5		
	9/24/26	Sketched Steering wheel platform	.5		