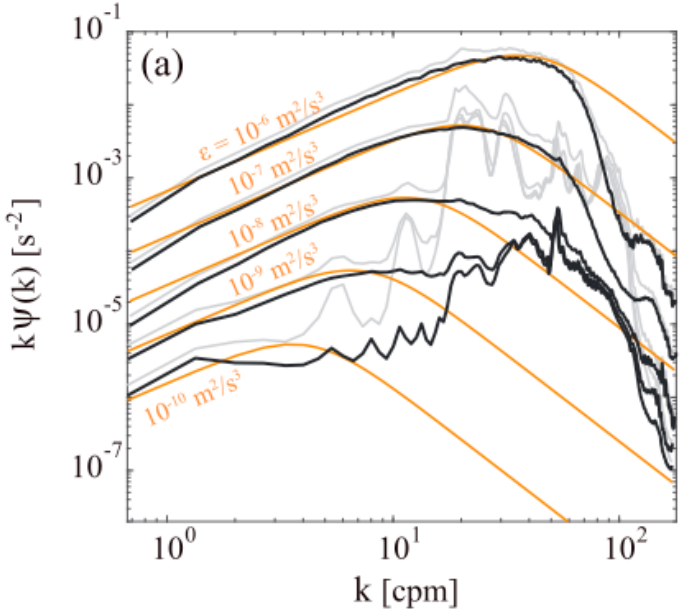
Basic requirements for microstructure turbulence measurements

- Sensor placement (unperturbed flow, extremely fragile sensors)

- Platform moving smoothly, at profiling speeds ~ 0.2 - 1 m/s
  (Taylor's "frozen" turbulence hypothesis + freq response of the probe, f = V * k)

- Quiet platform: minimal mechanical vibrations & electronic noise
  in the dissipation range

- Angle of attack: +/- 10 deg



MicroRider-1000-WW Specifications

Dimensions: ~ 1 m (w/probes)

Weight: 5.5 kg in air, ~0 kg in water

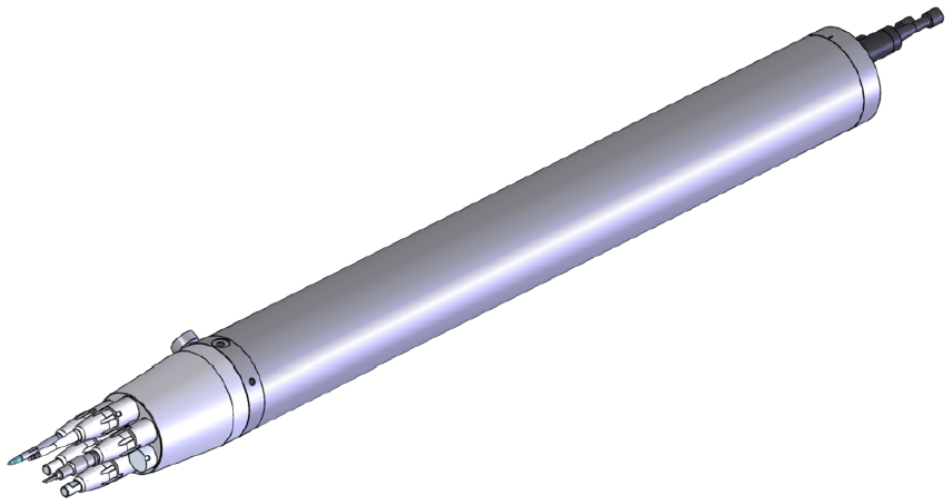
Power: 9-18 DVC supply,
Consumption ~ 1.4 W sampling, $10^{\wedge -5}$ sleep

Sampling rates:
Shear probes, 512 Hz
CTD, 64 Hz

Mode of Operation
(continuous vs cyclic sampling)

Data Storage ~ 64 GB

Outputs ~ 8192 bytes/s

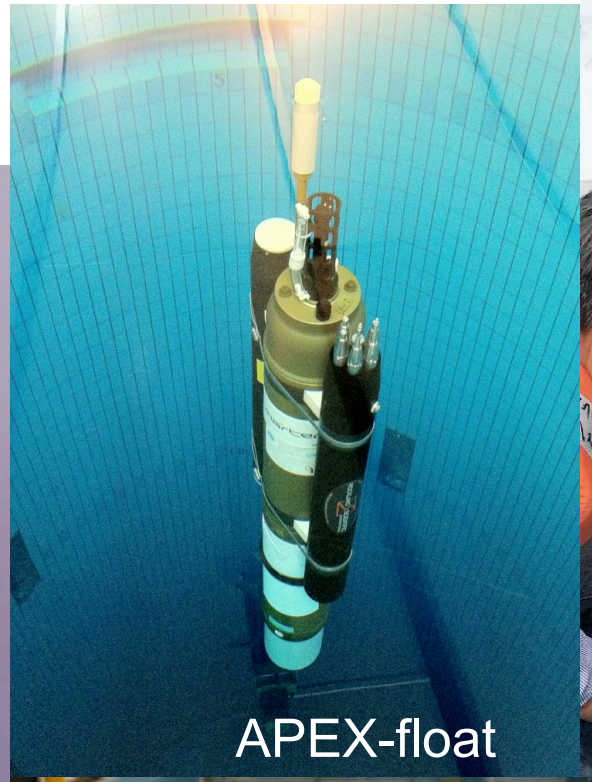


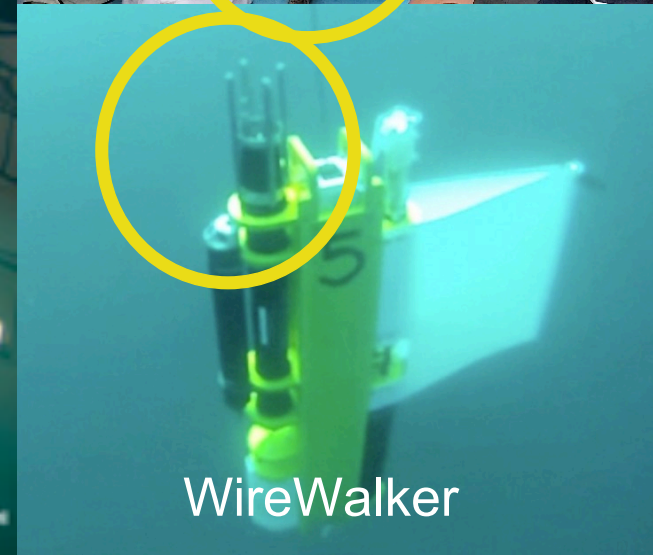
Sensors:

- ✓ 2 shear probes, 2 fast-response thermistors (FP07s, or χ-pods)
- ✓ 2 vibrational sensors and inclinometer

WireWalker Configuration

MicroRider-1000-WW





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High-energy Battery Pack

Pressure case dimensions:
89 mm diameter and 800 mm long

Rated to 1000m

Weight in seawater ~ 5 to 6 kg

14.8 VDC (Li-Ion), rechargeable

40 Ah / 592 Whrs of capacity
(~ 48 hours of continuous sampling)

Includes underwater cable between battery canister and MicroRider.

High-energy Battery Pack

Pressure Case Dimensions:
82.6 mm diameter and 533.4 mm long

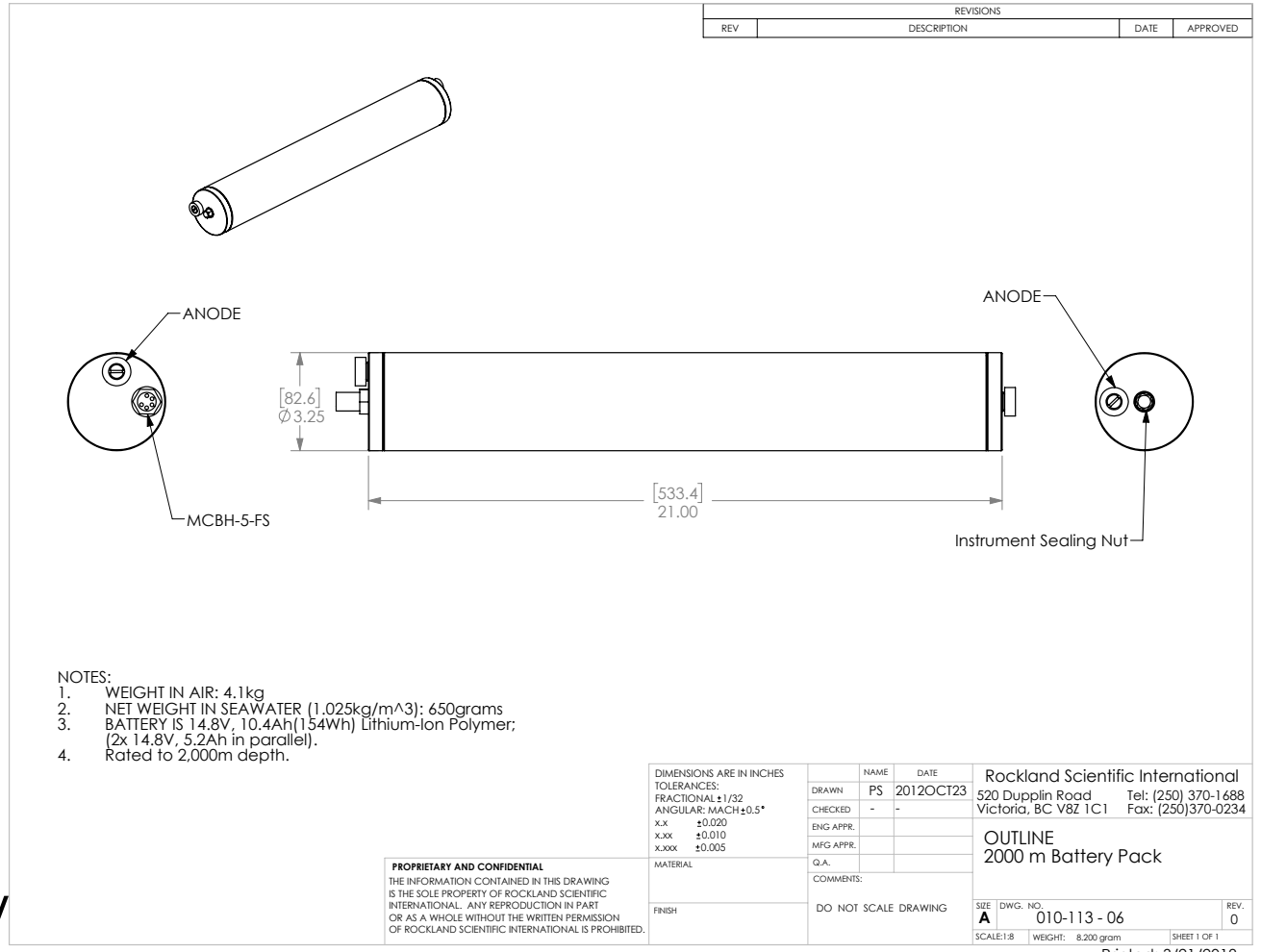
Rated to 2000 m

Weight: ~ 650 g in water

14.8 VDC (Li-Ion), rechargeable

10 Ah
~ 12 hours of continuous sampling

Includes underwater cable between battery canister and MicroRider.



Cyclic Sampling Mode

MR-WW can operate with a "cyclic sampling" routine

This is done via the internal clock (not pressure)

Pre-MR arrival Tasks

- CPF readiness, buoyancy control adjustments? Output for w_water?
- Design brackets (MR and battery pack), Paul Coenen asiggned to work on it
- Protective cage?
- Model float's stability with 5-6Kg battery pack (i.e.,weight in water).
- Cables, connectors. OK, cables between battery and MR provided.
- Tools, foam

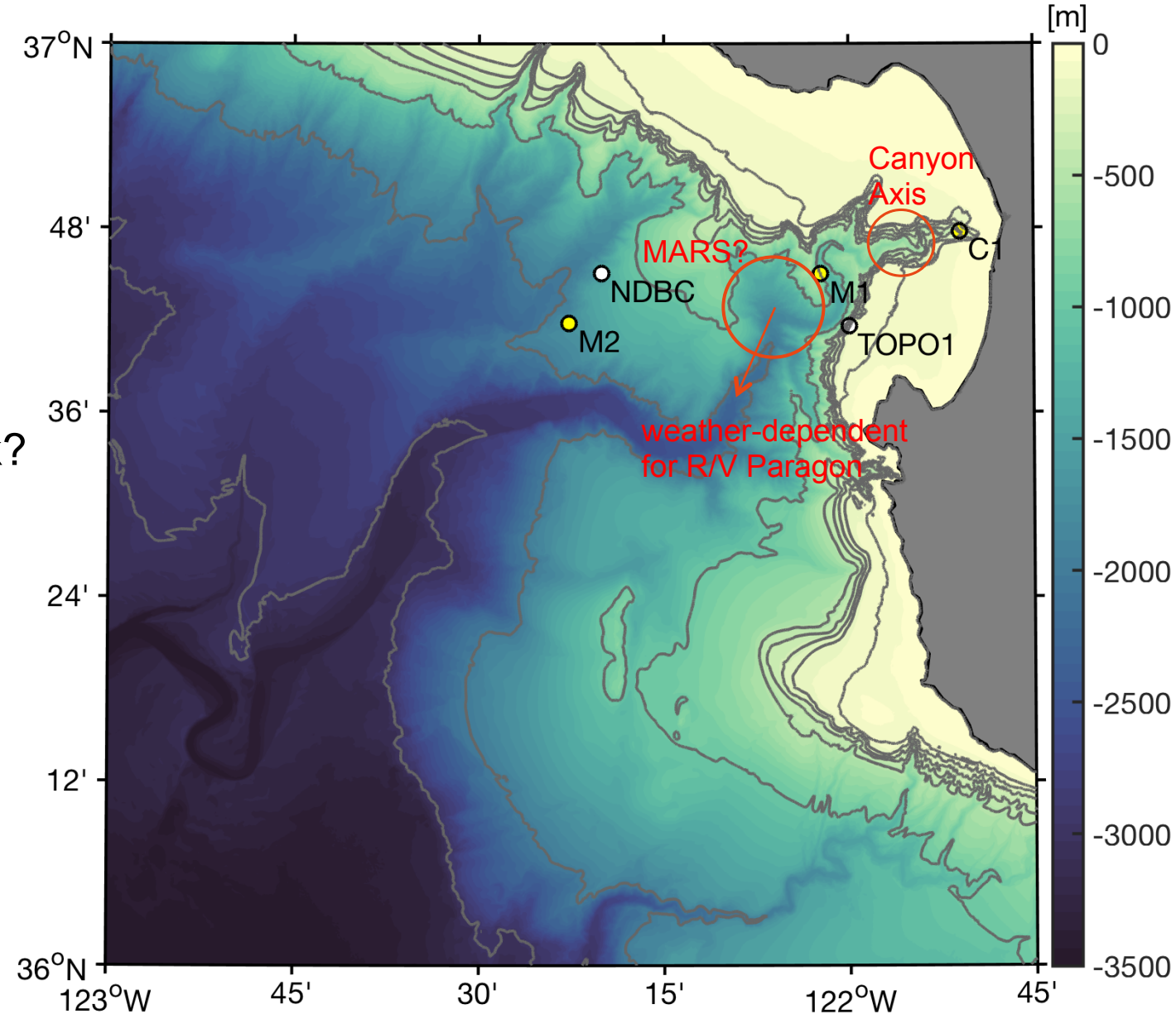
- Battery Power: # of profiles to 200m in cyclic mode, how long to fully recharge?

- ~~Data Telemetry?~~ (Evaluate/Discuss before May Proposal deadline)

- Go through the MicroRider-1000-WW Manual
- Instrument Communication protocols
- Familiarize with processing software: ODAS MATLAB Library and Zissou Essentials (Windows only)
- Data visualization and post-processing (VMP-250 Workshop Materials)
- Identification of mechanical noise & removal

Tasks TO DO
to meet June deadline

Feb Mar	CPF buoyancy control adjustments?
April	CPF in the water brackets
May	Place PO, which battery pack? protective cage?
June	Target for Deployments (CPF-MR)
…	
Oct	
Nov	
Dec	



/atlas.shore.mbari.org/ProjectLibrary/Mixing Rates – 902108 /Rockland_VMP-250 : Workshop Materials

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WBS Schedule

Paul

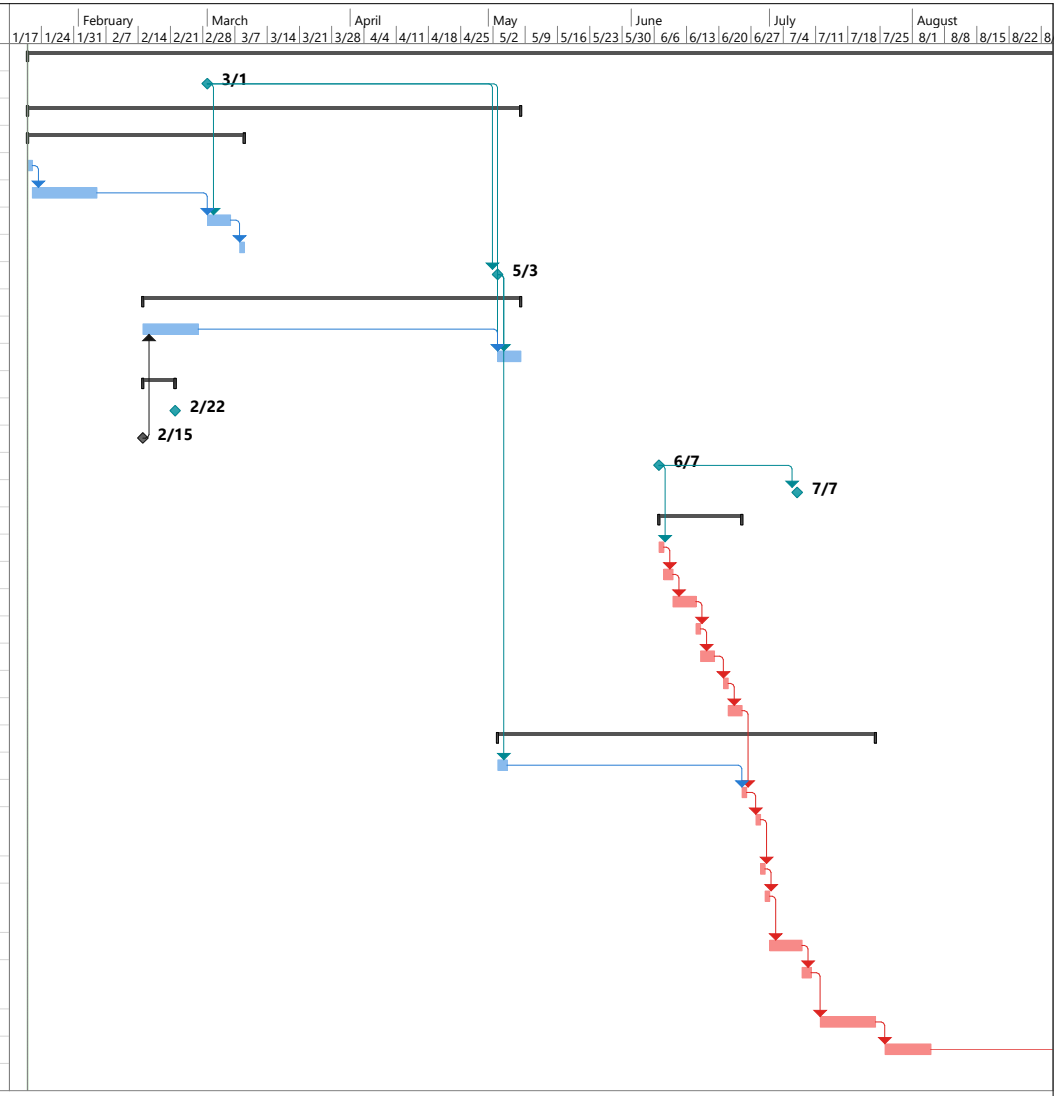
Gene

Magdalena

Gene
Magdalena
Science Tech
Yui
…

Magdalena
Gene

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**Turbulence Project**	**325 days?**	**Thu 1/21/21**	**Wed 4/20/22**	
2		MBARI open for req'd staff	0 days	Mon 3/1/21	Mon 3/1/21	
3		**CPF**	**77 days?**	**Thu 1/21/21**	**Fri 5/7/21**	
4		**Mechanical**	**33 days?**	**Thu 1/21/21**	**Mon 3/8/21**	
5		Get Paul/Mike Started	1 day?	Thu 1/21/21	Thu 1/21/21	
6		Bracket design	10 days	Fri 1/22/21	Thu 2/4/21	5
7		Bracket build	5 days	Mon 3/1/21	Fri 3/5/21	6,2
8		Bracket test fit	1 day	Mon 3/8/21	Mon 3/8/21	7
9		Finish Turbulence CPF	0 days	Mon 5/3/21	Mon 5/3/21	2FS+45 days
10		**Software**	**60 days**	**Mon 2/15/21**	**Fri 5/7/21**	
11		Modify software for new science mission	10 days	Mon 2/15/21	Fri 2/26/21	15
12		Test on benchtop simulator and test tank	5 days	Mon 5/3/21	Fri 5/7/21	11,2,9
13		**Science**	**5 days**	**Mon 2/15/21**	**Mon 2/22/21**	
14		Place Microrider PO	0 days	Mon 2/22/21	Mon 2/22/21	
15		Mission plan first draft	0 days	Mon 2/15/21	Mon 2/15/21	
16		Microrider arrives	0 days	Mon 6/7/21	Mon 6/7/21	
17		Ship Microrider back	0 days	Wed 7/7/21	Wed 7/7/21	16FS+22 days
18		**Integration**	**14 days**	**Mon 6/7/21**	**Thu 6/24/21**	
19		Bolt it all together	1 day	Mon 6/7/21	Mon 6/7/21	16
20		Stability tests	2 days	Tue 6/8/21	Wed 6/9/21	19
21		Run short missions in tank	3 days	Thu 6/10/21	Mon 6/14/21	20
22		Analyze data	1 day	Tue 6/15/21	Tue 6/15/21	21
23		Run longer mission in tank	3 days	Wed 6/16/21	Fri 6/18/21	22
24		Analyze data	1 day	Mon 6/21/21	Mon 6/21/21	23
25		Maybe re-run longer mission in tank	3 days	Tue 6/22/21	Thu 6/24/21	24
26		**At sea tests**	**60 days**	**Mon 5/3/21**	**Fri 7/23/21**	
27		Prerun science mission	2 days	Mon 5/3/21	Tue 5/4/21	9
28		1 day mission #1	1 day	Fri 6/25/21	Fri 6/25/21	25,27
29		Analyze data and modify mission profile as req'd	1 day	Mon 6/28/21	Mon 6/28/21	28
30		1 day mission #2	1 day	Tue 6/29/21	Tue 6/29/21	29
31		Analyze data and modify mission profile as req'd	1 day	Wed 6/30/21	Wed 6/30/21	30
32		Full mission #1	5 days	Thu 7/1/21	Wed 7/7/21	31
33		Analyze data and modify mission profile as req'd	2 days	Thu 7/8/21	Fri 7/9/21	32
34		Full mission #2	10 days	Mon 7/12/21	Fri 7/23/21	33
35		Write and publish papers	8 days	Mon 7/26/21	Wed 8/4/21	34
36		Accept Nobel Peace Prize	5 days	Thu 4/14/22	Wed 4/20/22	35FS+180 days



Project: TurbulenceSchedule
Date: Thu 1/21/21

Task
Split
Milestone
Summary
Project Summary
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
External Tasks
External Milestone
Deadline
Critical
Critical Split
Progress
Manual Progress

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Bench Tests

- Instrument communication
- RSI checklist

Tank Tests

- Float's stability
- Optimal profiling speed
- Consistent angle of attack
- Vibrations & electronic noise
- Clock's syncing for cyclic sampling

ideally,
2 weeks max
But likely 3 weeks!

At-sea engineering tests

- Deploy nearby, within the canyon axis for 2 days
  (recover to ensure data acquisition, data quality)
- Recharge battery overnight, redeploy the next day for 2 days

Science Missions (2 weeks)

- Gather as many ε(z) profiles as possible, 1-2 week deployments (MR battery-power dependent)
- As many BGC sensors as possible (optics, radiometer, isus would be a plus)
- Target depth ~200 m
- Capture the diurnal cycle (~ 1 profile every 1-2h)
- Phytoplankton blooming season, spring/fall when mixed layers can be deep (storms)
- High and low turbulence environments (e.g. Canyon axis and @ or past M1)
- CPF: “drift” vs “anchoring” mode?

Discussion

Platform (Plan A: CPF, Plan B: BOG-CPF)

Continuous vs cyclic sampling mode?

Deployment Strategy
(eng lab/at-sea test deployments vs science missions)
get as many ε(z) profiles as possible, capturing the diurnal cycle

Deployment Sites
upper water column (top ~200m), ideally deep mixed layers

Timeline
Phytoplankton blooming season, spring/fall (not too stratified or strong upwelling)