Benthic Observation System Concept Design Review (draft)

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Team & PIs

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- Kelly Benoit-Bird
- Mary Gleason (TNC)
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Design Team

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- Tyler Maricich (Collaborator)

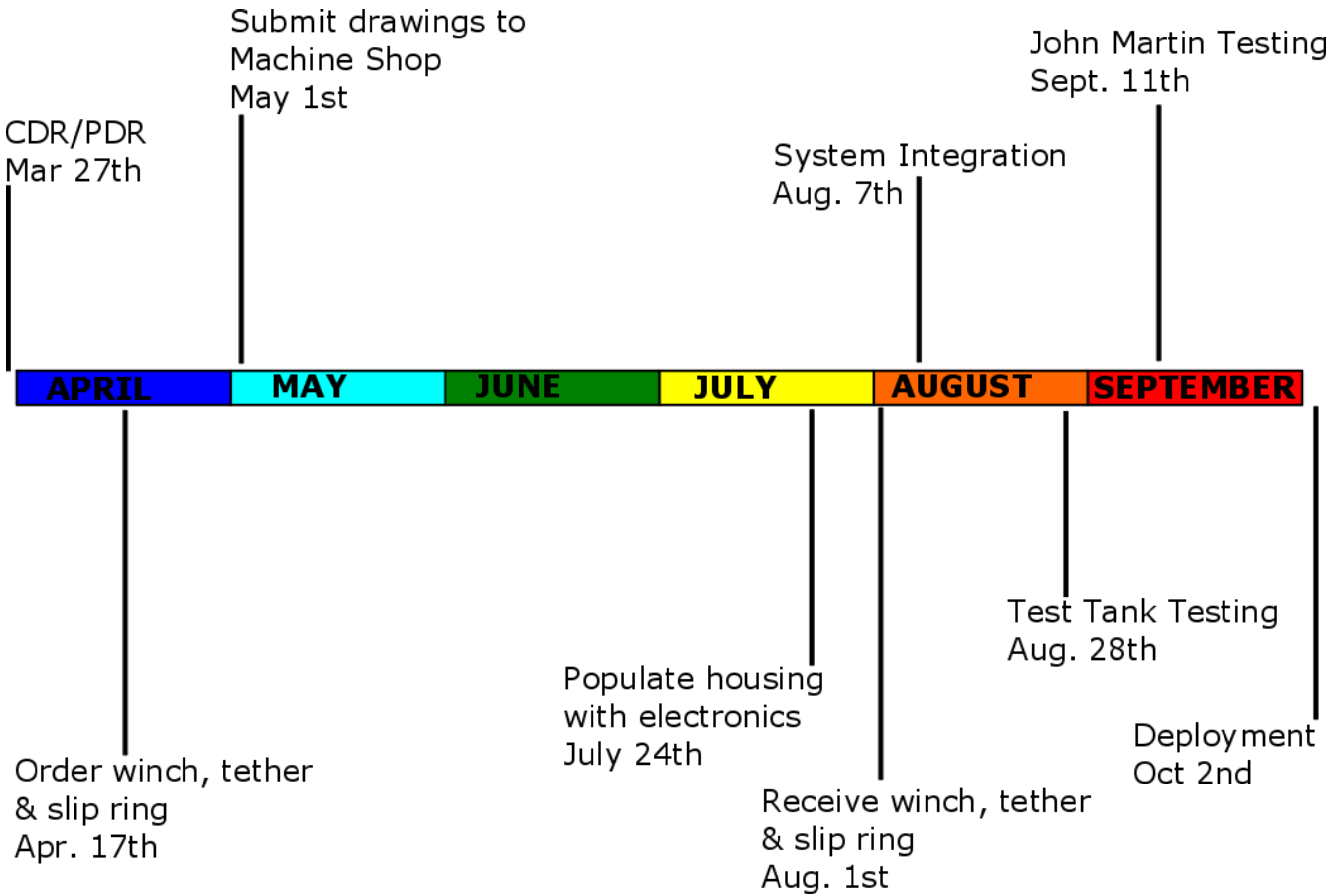
CDR Agenda

- Motivation behind the project
- Schedule
- Science use cases
- Functional requirements
- Derived requirements
- Summary

Motivation for Benthic Observation System

- Expressed desire for a modular platform which combines stereo imagery with contextual sensors
- Modifiable system can reduce the number expensive one-off specific systems
- Driven by an immediate need by The Nature Conservancy

Schedule


Submit drawings to
Machine Shop
May 1st
John Martin Testing
Sept. 11th
CDR/PDR
Mar 27th
System Integration
Aug. 7th
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
Test Tank Testing
Aug. 28th
Populate housing
with electronics
July 24th
Deployment
Oct 2nd
Order winch, tether
& slip ring
Apr. 17th
Receive winch, tether
& slip ring
Aug. 1st

Science Use Case: TNC

- Collaboration with NOAA-Fisheries to add visual component to the coast wide Fishery Resource Analysis and Monitoring (FRAM) trawl survey to assess “untrawlable” (rocky) habitats and inform fisheries stock assessments and management
- Provide density estimates (#/m^2) and size structure of 6-8 demersal species
  - yelloweye, cowcod, lingcod, canary, bocaccio, greenspot

Science Use Case: Barry

- Long term collaboration with The Monterey Bay National Marine Sanctuary (MBNMS) to study the benthic biological environment at Sur Ridge
- Characterize environmental conditions to help understand various processes
  - Feeding in relation to water flow
  - Predator-prey interactions
  - Temporal variation in benthic conditions

Science Use Case: Chavez

Science Use Case: Benoit-Bird

- The use of high resolution stereo video
  - assists in the interpretation of the data acquired via acoustic instruments
  - provides data on the behavior of the biota to the acoustic instruments themselves
    - Biota sizes range from Humboldt squid to larger mammals
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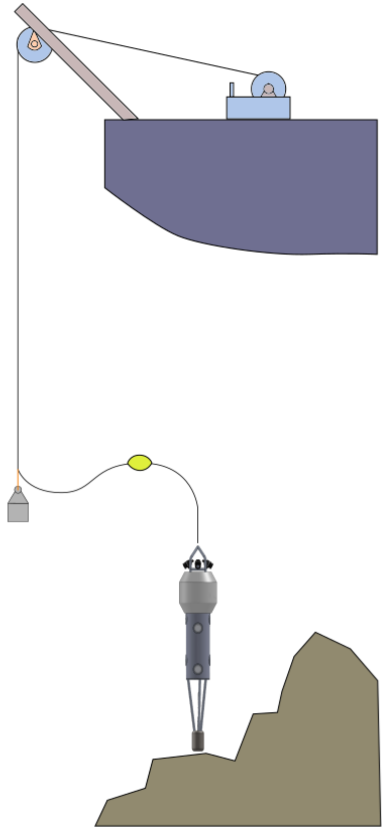
Common Functional Requirements

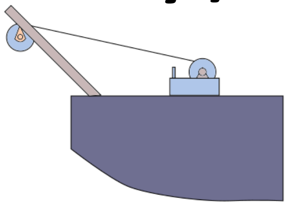
- The lander must provide the ability to identify, count, and size marine organisms by capturing video and/or still images.
- The lander must have the ability to interface and log various contextual sensors, such as O2, pH, ADCP, acoustic, and other novel sensors such as 3G-ESP.
- The lander must be a modular platform that can be reconfigured for various sensors and deployment scenarios.

Derived Requirements (TNC)

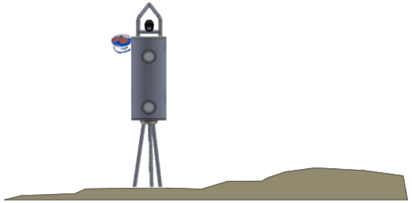
- Must operate tethered
- Must be depth rated to 300 meters
- Must operate in a benthic environment
- Must be able to land on or hover above rocky outcroppings
- Must capture stereo video
- Must have near 360 degrees of stereo video coverage
- Must be able to collect data from up to 30 sites within a normal operational ship day
- Must be able to be deployed from various vessels of opportunity
- Must provide real time telemetry data for positioning including video, depth, and heading



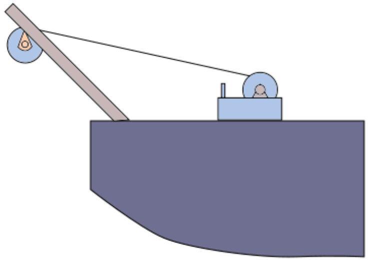
Derived Requirements (Barry)



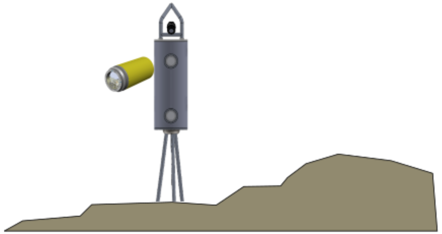
- Must operate autonomously
- Must be depth rated to 1500 meters
- Must operate in a benthic environment
- Must be able to sit on or near coral ridges
- Must capture stereo still images
- Must be able to operate from days to one year
- Must be able to be deployed from MBARI ships
- Must have O2, pH, ADCP, and CTD sensors



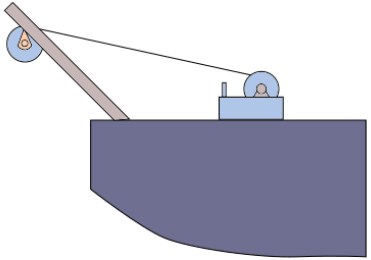
Derived Requirements (Chavez)



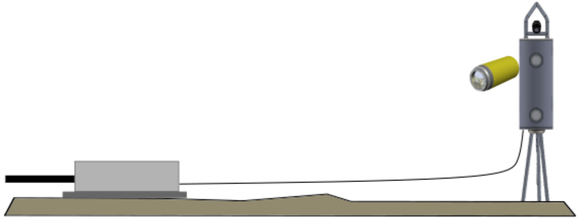
- Must operate autonomously
- Must be depth rated to 300 meters
- Must operate in a benthic environment
- Must be able to sit on seafloor
- Must capture stereo video
- Must be able to operate for 3-6 months
- Must be able to be deployed from MBARI ships
- Must have O2 and CTD sensors
- Must be able to interface the 3G-ESP
- Must be able to interface the EK60 Echosounder



Derived Requirements (Chavez)

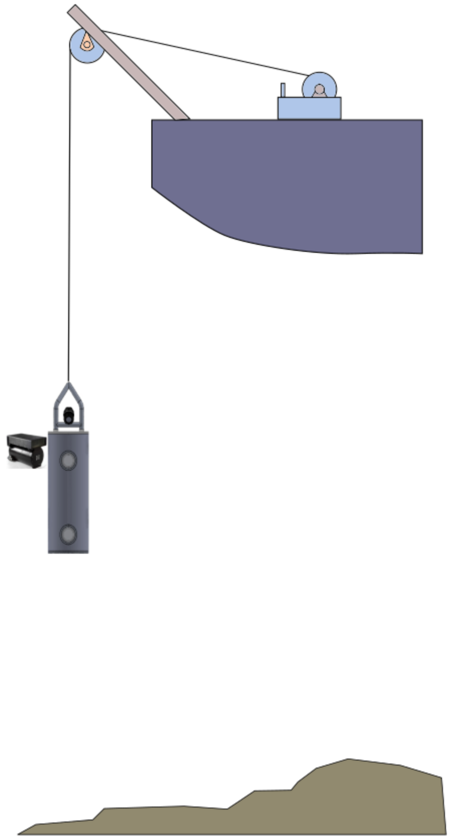


- Must operate tethered (to a cabled observatory)
- Must be depth rated to 300 meters
- Must operate in a benthic environment
- Must be able to sit on seafloor
- Must capture stereo video
- Must be able to operate for one year between maintenance
- Must be able to be deployed from MBARI ships
- Must have O2 and CTD sensors
- Must be able to interface the 3G-ESP
- Must be able to interface the EK60 Echosounder
- Must provide real time video/data



Derived Requirements (Benoit-Bird)

- Must operate tethered
- Must be depth rated to 300 meters
- Must operate in a mid-water environment
- Must be able to be suspended from a ship
- Must capture stereo video
- Must be able to operate 1-2 hours each at up to 5 sites per day from ships
- Must be able to be deployed from MBARI ships or various smaller vessels
- Must be able to interface the EK80 echosounder or similar
- Must provide real time video/data



Derived Requirements (Benoit-Bird)

- Must operate autonomous
- Must be depth rated to 300 meters
- Must operate in a mid-water environment
- Must be able to be suspended from a mooring
- Must capture stereo video
- Must be able to collect 5 minutes of video/data every 30 minutes for 3 months
- Must be able to be deployed from MBARI ships or various smaller vessels
- Must be able to interface the EK80 echosounder or similar

Operational Requirements Matrix

Requirement	TNC	Barry	Chavez	Benoit-Bird
Tethered	Yes	No	Yes	Yes
Autonomous	No	Yes	Yes	Yes
Depth 300 Meters	Yes	No	Yes	Yes
Depth 1500 Meters	No	Yes	No	No
Benthic	Yes	Yes	Yes	No
Mid-water	No	No	No	Yes
Stereo video	Yes	No	Yes	Yes
Stereo imaging	No	Yes	No	No
360 degrees coverage	Yes	No	No	No
Operate from MBARI ships	No	Yes	Yes	Yes
Operate from non-MBARI ships	Yes	No	No	Yes
O2 sensor	No	Yes	Yes	No (Nice)
pH probe	No	Yes	No (Nice)	No
CTD	No	Yes	Yes	No (Nice)
ADCP	No	Yes	No (Nice)	No
EK80 echosounder (or similar)	No	No	Yes	Yes
3G-ESP	No	No	Yes	No

Summary

- TNC: Preliminary design options studied – will be presented next
- MBARI Use Cases
  - Widely divergent sets of requirements
  - Large design gap between autonomous & tethered
    - Electrical energy required & software (data management)
  - Can this task be performed with existing hardware?
  - Can all requirements be met by one system?
- Recommendations
  - TNC: Proceed with PDR + build
  - MBARI: Further study needed