

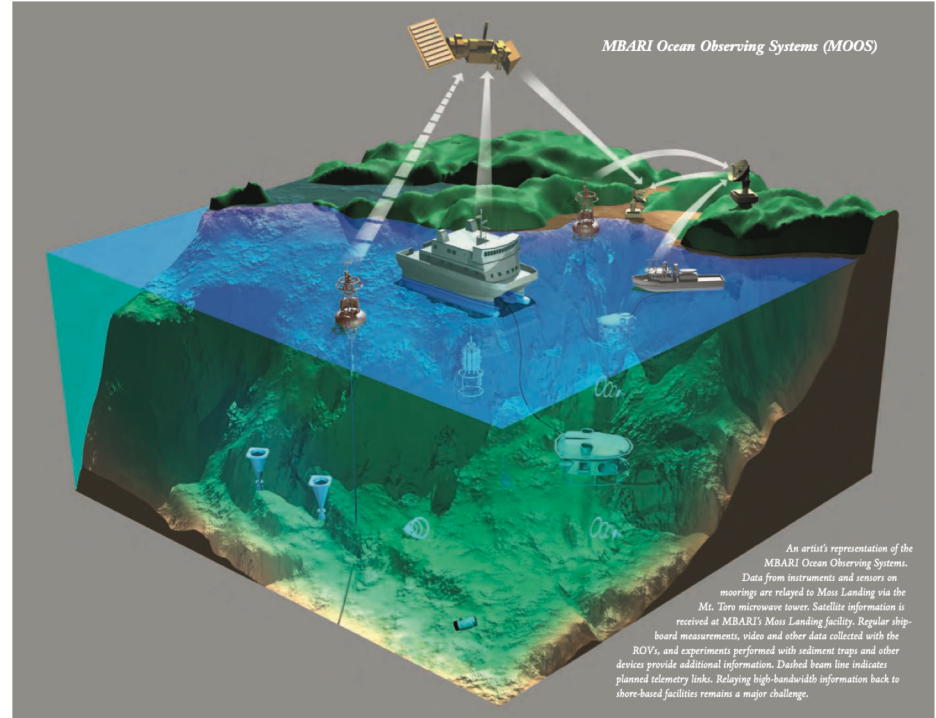
Telepresence on MBARI Research Vessels

2021 Proposal - Abstract Presentation

Telepresence at MBARI Revisited

History:

- 1991 - Early microwave demo as part of the first Macon expedition.
- 1993 - Installation of the microwave system on Mt. Toro.
- 1999 - Start of live link sessions with MBA
- Today - the Microwave system is still a critical system for the Rachel Carson, esp. for MARS operations.



A New Need

- COVID-19 Restrictions reduces labor force at-sea.
- Enforces new offshore paradigms for maximum productivity.
- Telepresence can enable non-physical contributions.
- Opportunity for expanded outreach.
- Other R/V Operations are facing similar issues.

OCEAN EXPLORATION TRUST



Science User Goals

Effective ROV dive participation must facilitate:

- Observation
- Discussion
- Decision making
- Annotation
- Situational Awareness
- Technical Support



The URI Innerspace Center, <https://innerspacecenter.org>

An effective solution must include:

- ROV Video at HD720 quality and low latency (< 10s).
- Audio for control room decision making
- Latent communication for annotation and non-mission-critical discussion.
- Contextual data presentation, i.e. attitude, location.

More information available in the requirements doc: <https://bit.ly/3f5Xz9U>

Telepresence Outreach Goals

- A. Bring the excitement and joy of discovery in the deep-sea to a larger audience.
- B. Share MBARI research and knowledge with the general public
- C. Bring greater awareness about the deep-sea to the general public

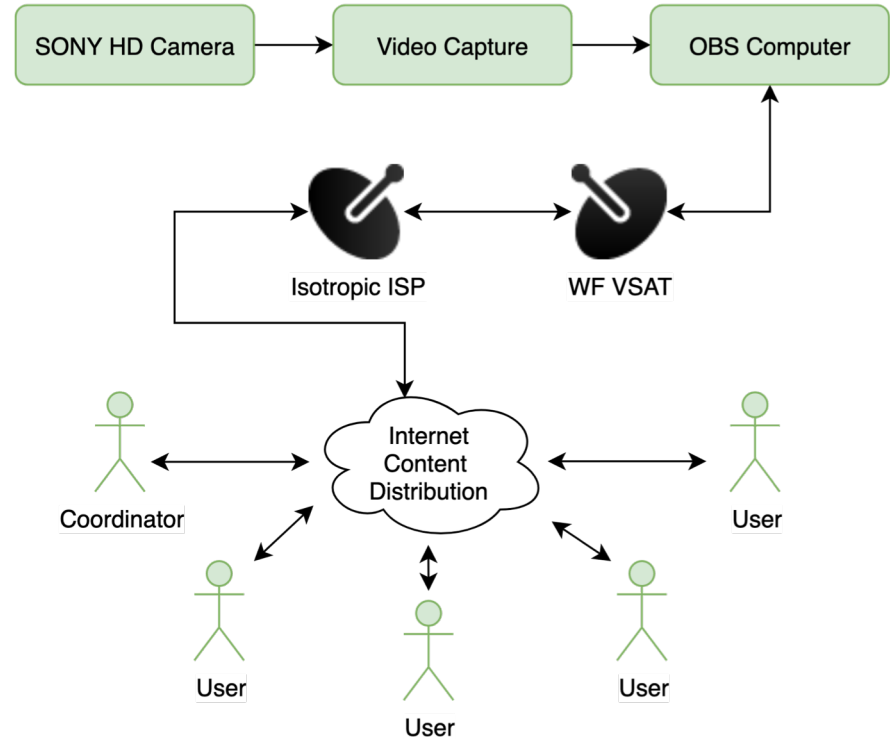


More information available in the outreach memo: <https://bit.ly/2AOaeQ7>

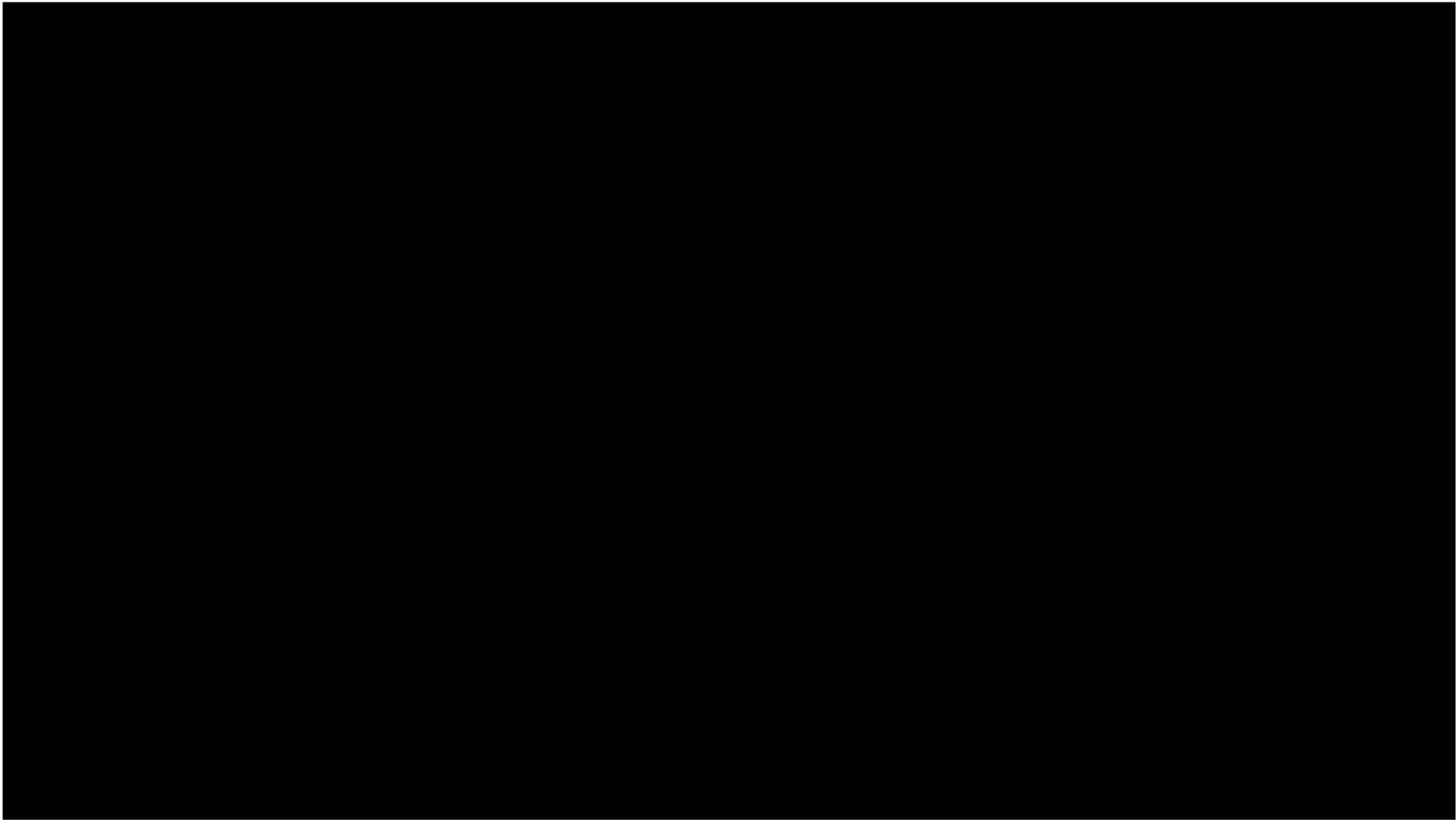
The State of Telepresence Capabilities

In May 2020, a scoping study was conducted to determine system readiness of ship-to-shore telecommunications for the added loads of telepresence. The key results are:

- The Flyer VSAT will work (proven)
 - Tested 5/29/20
 - 6 simultaneous users
 - Low latencies were possible
 - 1080p30 H.264 capable.
- The Carson is capable (unproven)
- Costs can be optimized for “as-needed” use.



More information available in the report brief: <https://bit.ly/3dWRVqR>



Web Hosted Telepresence Mock-up With Separate Data Pathway



CONTROL



CHAT

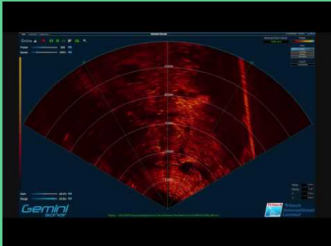
Kakani (18:02:01 UTC): Capture it! We need one at this depth and location.

TIME (UTC): 23:42:42
DIVE #: DR4242

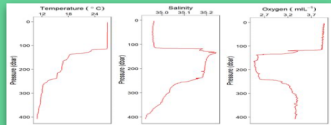
Navigation



SONAR



CTDO



Technical Deliverables (Year 1)

- A rack-mounted “turn-key” system:
 - Ancillary integration
 - Assembles video and data sources
 - Transmits to shore locations
- Operators:
 - Science personnel on ship, similar to VARS
 - Precruise training
- Pilot Obligations:
 - Ensuring video & data integrity
- Fixed shore-side targets
 - @ MBARI or through cloud services

Outreach Objectives (Year 2)

- 1-hour live streams through social media once per month.
- ITD Coordinated and hosted, with an interactive comment/answer
- Follow up with attendees to evaluate the success of the program.

Future Use

- Transition system into an asset allocated during cruise planning.
- Clear user training protocols.
- Data Storage restricted to outreach archival.

Project Team

- Kakani Katija
- David Caress
- Eric Martin
- Ben Erwin
- Heidi Cullen
- George Matsumoto
- Susan Von Thun

Questions

Supplemental Slides

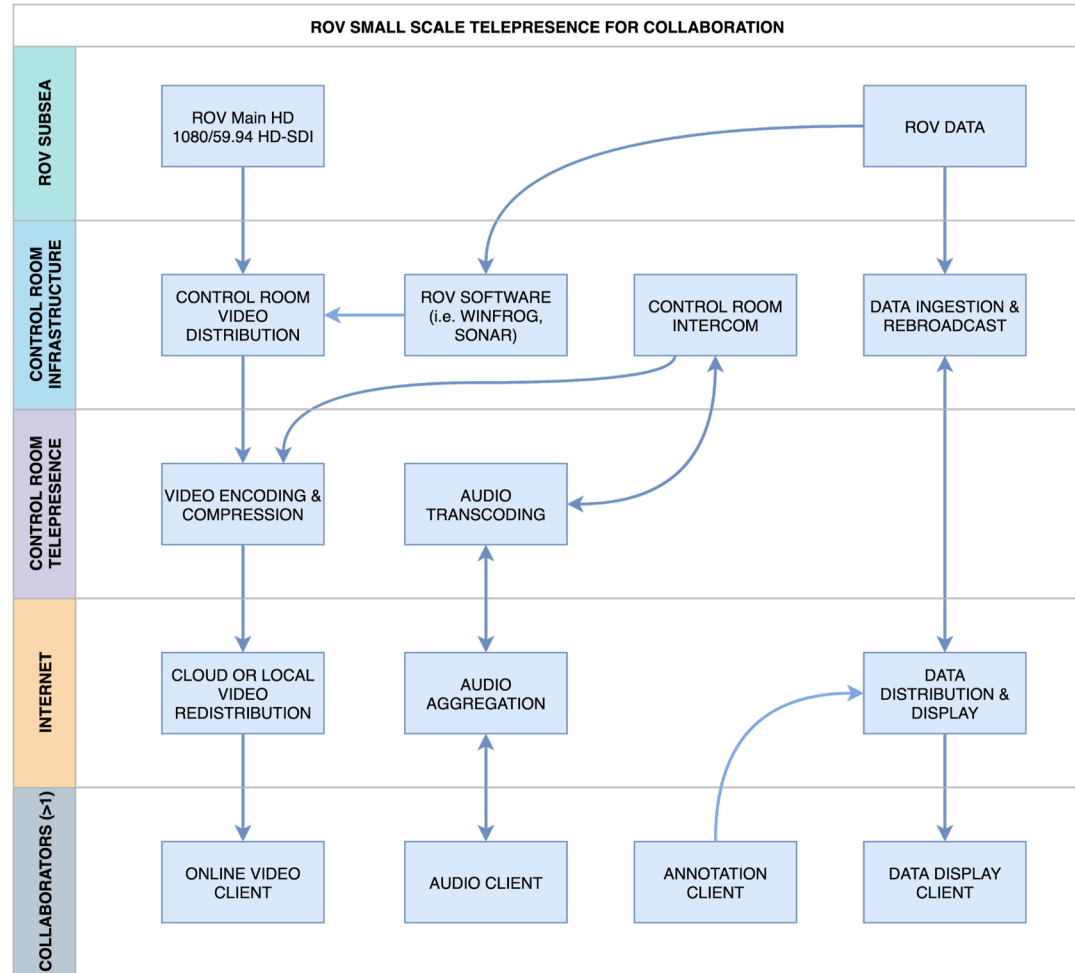
Streaming Tests Latency Results

Stream Target	Video Quality	Average Latency (s)
uri innerspace center	720p30	35.5
wowza cloud	1080p30	23.7
microsoft streams	720p30	27.7
facebook	1080p30	22.5
youtube	720p30	26.3
zoom	480p30	1.5
google meet	720p30	1.5

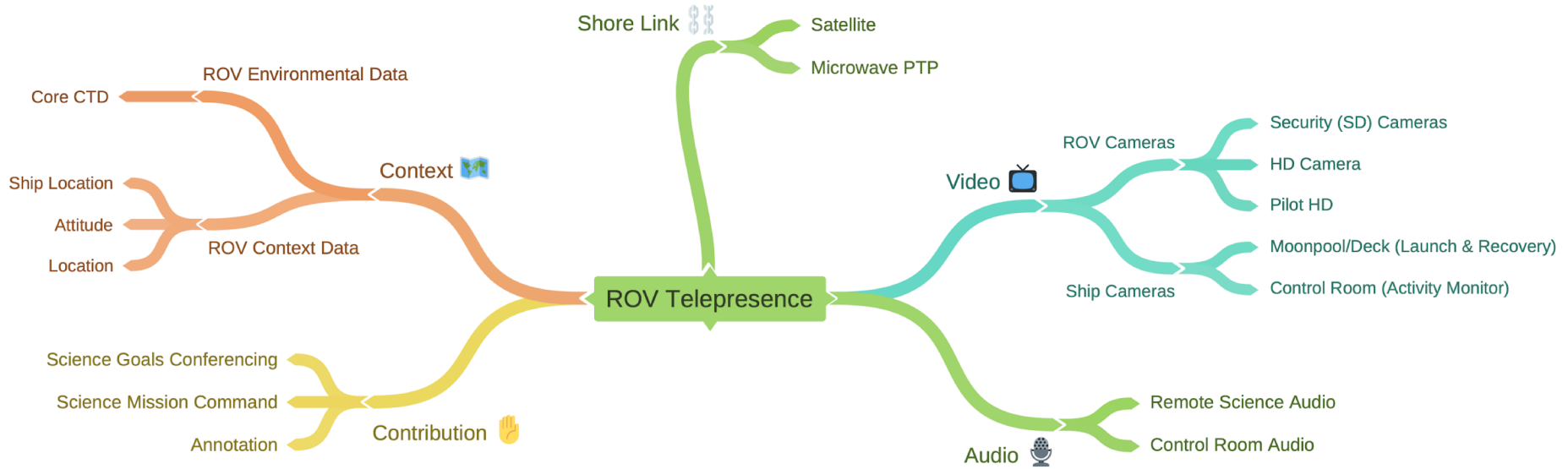
Budget

Function	Potential Item	Cost (\$)
Video/Audio Ingestion	Blackmagic Web Presenter or Decklink Duo 2	\$1,000
Video Adapters/Cabling		\$500
Audio Interface Components	Audiocom WM1000 for line tap	\$1,000
Audio Adapters/Cabling		\$500
Broadcast PC	NUC 9 Extreme with RTX2070	\$3,300
Chat Server	Skype/Zoom/XMPP	\$0
Professional Broadcaster Software	Wirecast	\$700
Cloud Restreaming	Wowza	\$2,400
WF Satellite Service (Outreach/year)	Isotropic	\$13,200
WF Satellite Service (per week of use)	Isotropic	\$5,600
	Total:	\$28,200

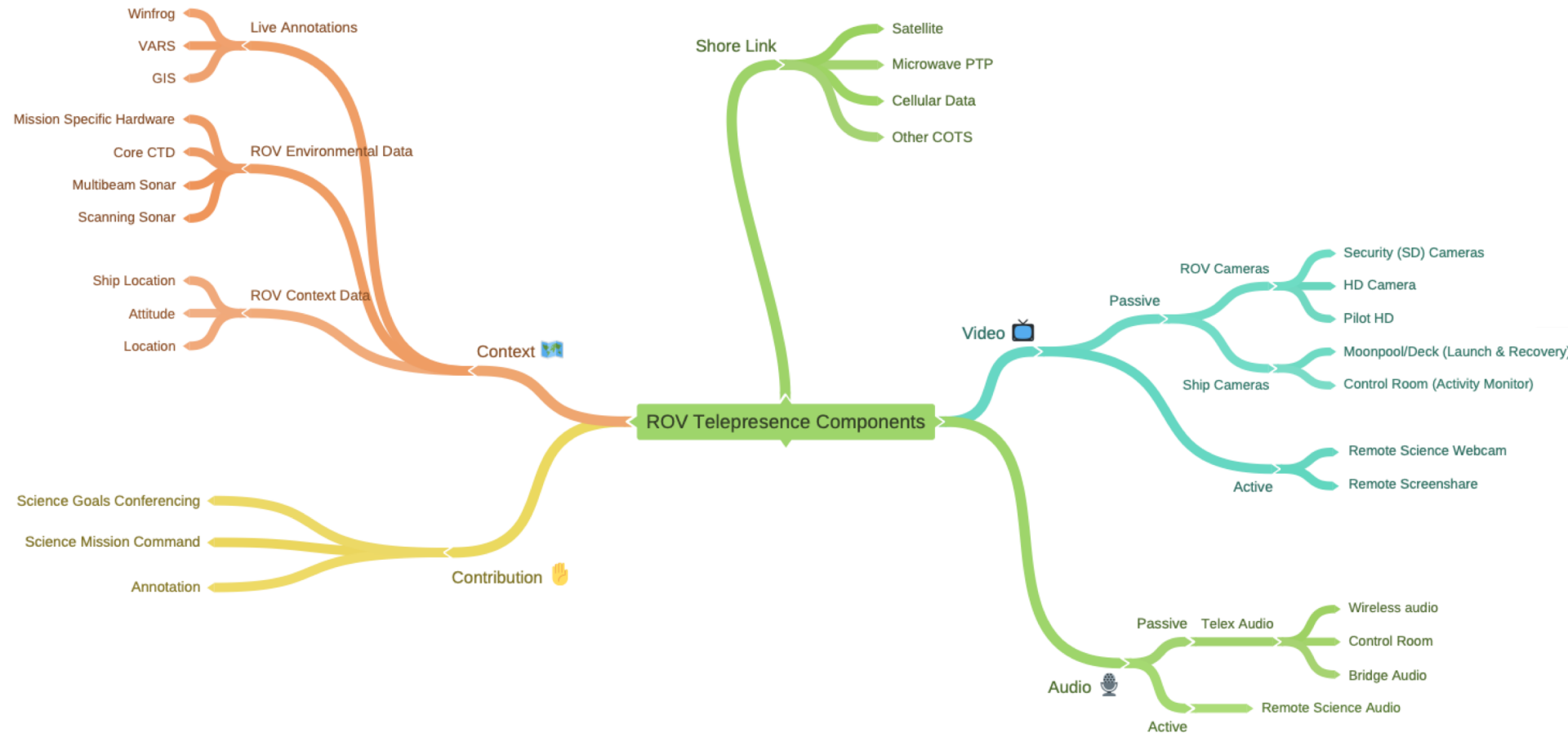
Data Pathways



Basic Telepresence Features



The Grand Challenge



Video Only Solution Using OBS

