The **iWhoiMicroModem** MOOS Instrument

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Team Members

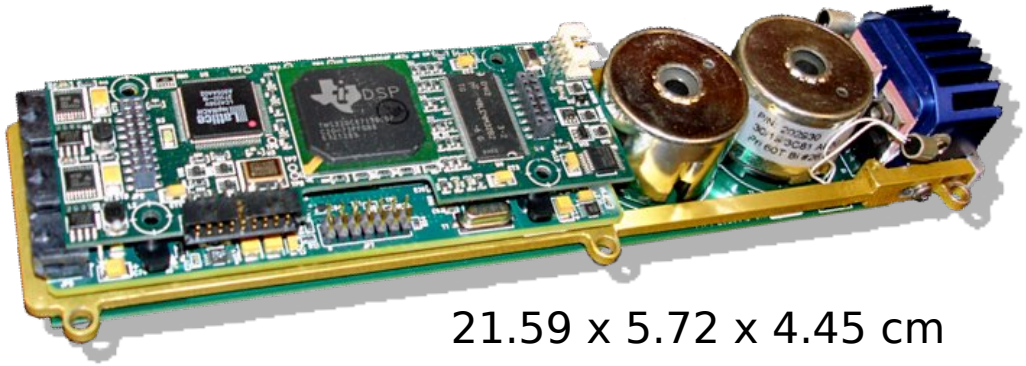
iWhoiMicroModem

WHOI Acoustic Micro-modem

- **W**oods **H**ole **O**ceanographic **I**nstitution

iWhoiMicroModem

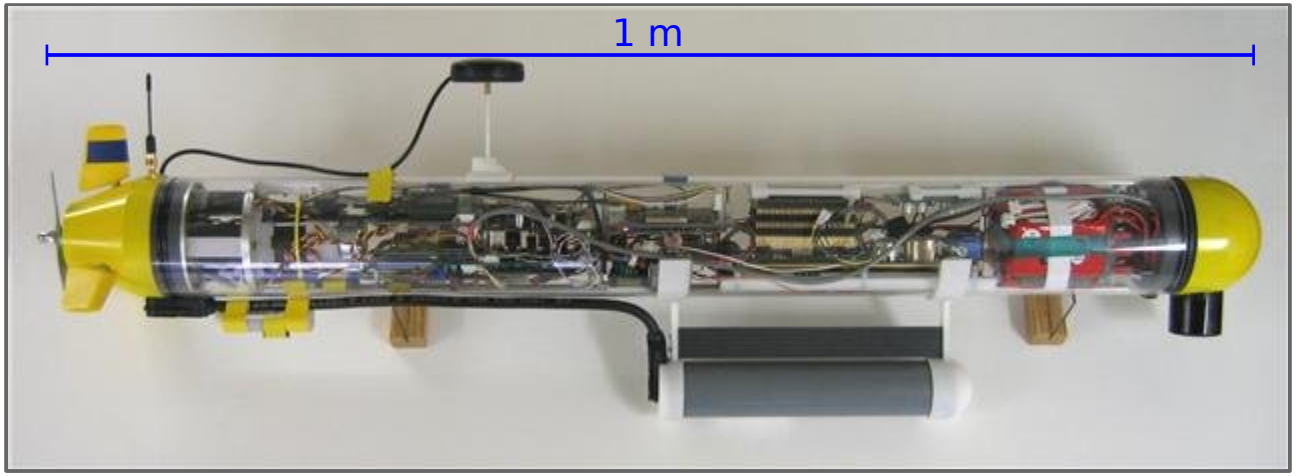
- MOOS application for interfacing with the WHOI Micro-modem
- Offers comprehensive access to modem functionality



21.59 x 5.72 x 4.45 cm

Background

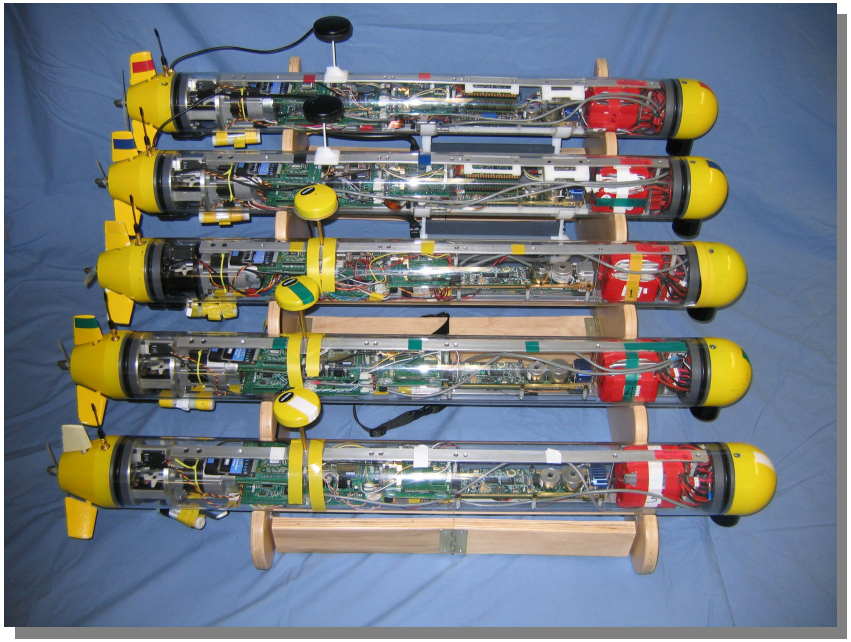
University of Idaho AUV



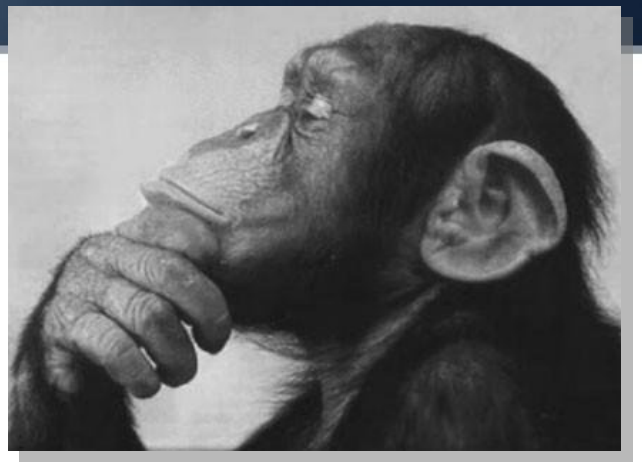
- Platform for developing collaborative, autonomous behaviors
- Current research: forward area assessment of marine vessel magnetic field signature

Modem Use In AUV

- Acoustic Navigation gives position while submerged
- Formation control via 13-bit mini-packets
- Less frequent ASCII, binary data transfer
- TDM used for media access control



Motivation



Existing WHOI software support in MOOS focuses on ASCII and binary data transfers

- Limited or no support for
  - Acoustic navigation
  - 13-bit User Mini-packets
  - Protocols other than CCL, DCCL

Prior Art

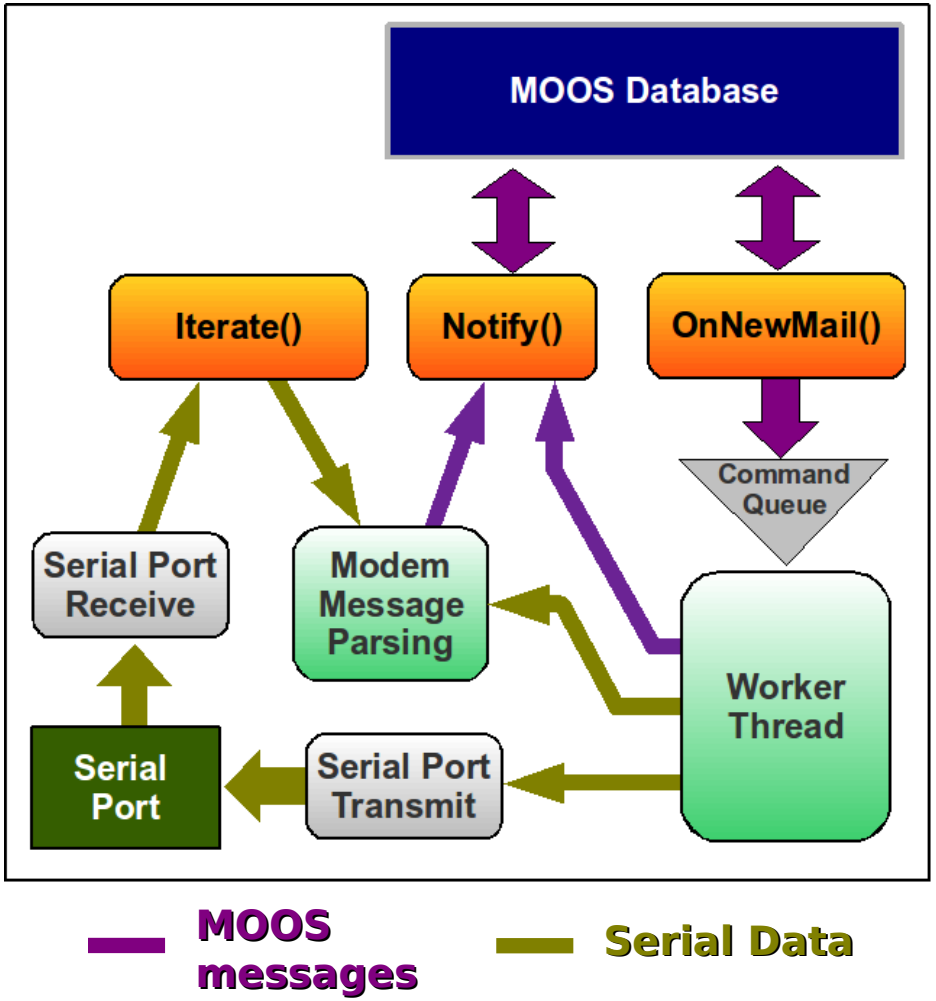
- iMicroModem
  - Matt Grund - WHOI
  - CCL data protocol
- Goby Underwater Autonomy Project
  - Toby Schneider (MIT, WHOI)
  - DCCL data protocol, media access control

Design Goals

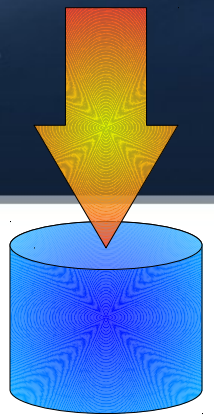
1. Expose all required modem functionality
2. Provide high-level API to modem functions via MOOSDB
3. Decouple data Rx, Tx from protocols
4. Publish modem statistics, diagnostic messages, and GPS pass-through

Design Approach

- Multiple threads
  - Rx: iterate()
  - Tx: worker thread
- Commands from MOOSDB are queued and prioritized
- Worker thread blocks on command or Rx via semaphore



Subscribed Variables



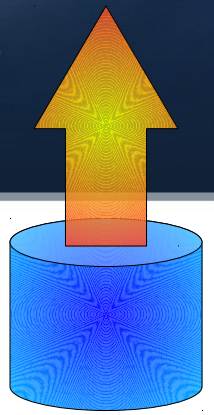
iWhoiMicroModem_CMD

- Single entry point for modem operations
- **String** of comma-separated 'param=value':
  - Command type
  - Comma-separated parameter list
- Optional 'Notify' parameter
  - Names MOOS variable to which command result(s) will be published

Modem Commands

- Data Write (ASCII/Binary)
- Data Read (ASCII/Binary)*
- Transmit (13-bit) user mini-packet
- Transmit PING (PSK, FM sweep, narrow-band)*
- Navigation PING (REMUS transponder)
- Modem hardware I/O line control*
- Auto-level receiver AGC*
- Measure noise level at receiver*
- Modem sleep*

Published Variables

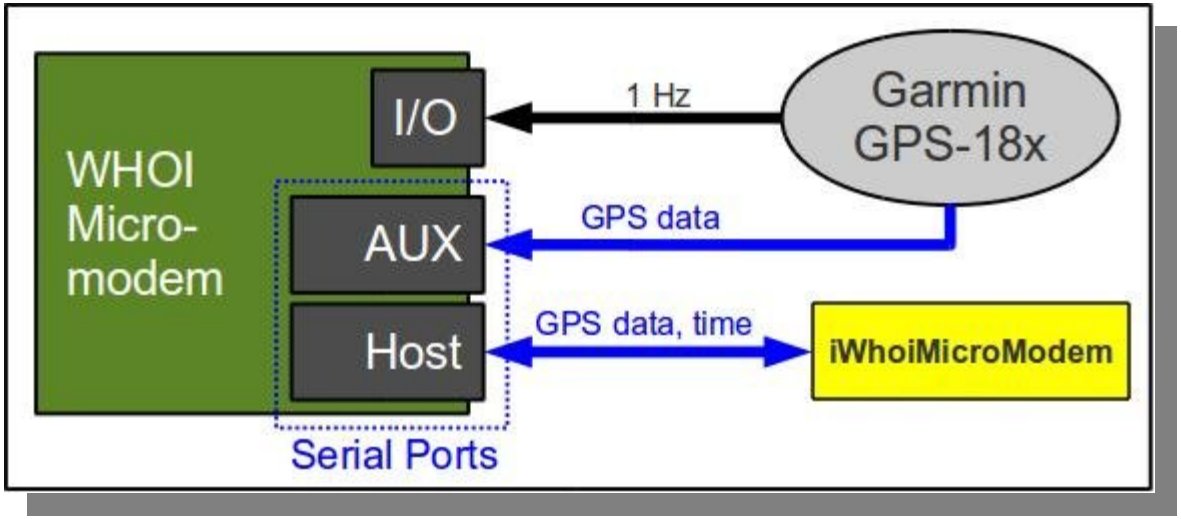


Published information includes:

- Communication cycle init
- Received ASCII, binary data
- Received (13-bit) User mini-packets
- Modem RTC time
- Optional diagnostic and info messages
- GPS NMEA sentence pass-through

GPS Synchronization

- Used with User Mini-packets for scalable multi-vehicle navigation
- Modem clock synchronizes to GPS
- Modem Tx triggers on 1 Hz PPS
- GPS reports published to MOOSDB



Mission File Parameters

Optional parameters:

- Modem NVRAM settings
- Modem command priorities
- “Promiscuous“ receive mode for:
  - ASCII, Binary data
  - (13-bit) User mini-packet
- Path to file containing vehicle ID (used as modem's acoustic ID)

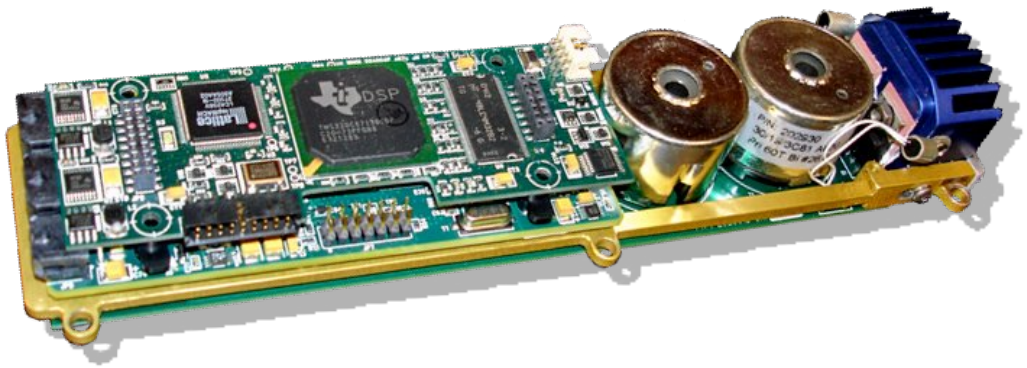
Results

Fully implemented and tested:

- Modem configuration and command queuing
- Binary data and User mini-packets
- Acoustic navigation PING and travel times
- GPS data pass-through
- Modem info and diagnostic messages

Roadmap

- Scheduled data Transmission
- Support high rate Tx using co-processor
- '3rd-party' transfer requests
- Multi-frame ASCII, binary data with sequencing



Conclusions

- Successful implementation of required modem functionality
- Extensible framework suitable for implementing remaining features
- Verified operation under Linux and Windows XP

Acknowledgements

Office of Naval Research

Magnetic Signature Assessment System Using Multiple Autonomous Underwater Vehicles (AUVs)

Phase I (N00014-08-1-0779)

Phase II (N00014-09-1-0711)

Phase III (N00014-10-1-0883)

iWhoiMicroModem