Autonomy and ODSS team plans for May/June 2012 CANON field experiment

April 18, 2012

1 Plan Summary

The autonomy team plan for May/June 2012 involves adding some communication between onboard and onshore processes and implementation of T-REX on shore to handle some of the shore-side decision making processes augmenting earlier work from 2011. In addition to the plans below, the team also plans to do some forward looking communication related engineering work during days allocated for engineering testing. The overall plan for mission control is illustrated in Fig. 1 and detailed below.

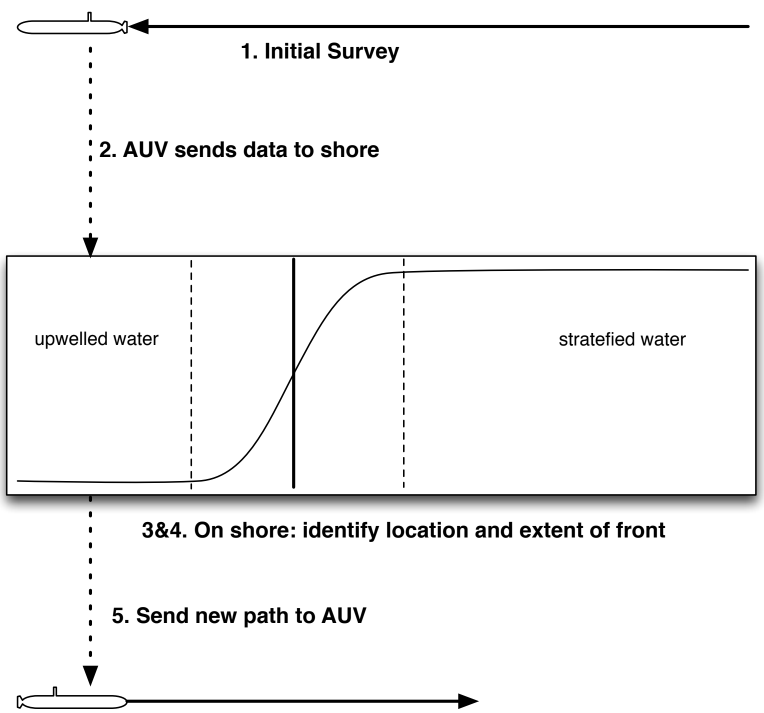

Figure 1: Mission control sequence. On shore part is handled by T-REX.

The plan is focused on observing frontal zones based on the interests of the Vrijenhoek lab.

1. The AUV is dropped in the relative vicinity of a front and performs an initial survey
   - We believe a straight line through front as an initial trajectory would be adequate

2. After every surfacing event the AUV sends in situ data
   - the in situ data will be a sub-sampled stream from one sensor, determined a priori (e.g. Temp)
   - Gulper triggering events will also be part of the in situ data sent to shore and visualized in the `ODSS`. The science user will then be getting a near real-time (albeit approximate) location (X,Y,Z) of triggered sample(s)
3. in situ data is processed on shore in order to find a potential frontal zone
   - we will use a version of the shore-side front detection algorithm, `MBFD` to capture the location and extent of the front
   - when the vehicle indicates that it is waiting for the new goal, deemed to be the center of the front, is produced along with a survey extent based on the estimated extent of the front
4. the mission (on shore) is then configured to follow a prespecified path centered on a point (or centroid)
   - the centroid might be the center of a front as calculated in 3 or it could be user specified or coming from other assets
   - the shape of the path is open to discussion, but we think a straight line through front would be adequate
   - the source of the centroid to follow is fixed for mission duration
5. the onshore `T-REX` communicates a new goal to the onboard `T-REX` and the vehicle executes the requested shape
6. go back to 2

2 What is new?

Our goals are to make progress in our algorithms and architectures using the `ODSS` as the central focus. Towards this end, our increasing emphasis will be on shore-side computation in this field experiment and for the rest of the year. This work will also be consistent with our NSF funded `COMECO` (http://robotics.usc.edu/comeco.html) project. So while the above plan looks very similar to what we've done before, there are a few critical differences:

- all the shore processing is handled by `T-REX`, which provides flexibility in real-time without needing to restart a process (for example if someone tells us that s/he would rather follow a centroid produced by the LRAUV than the one we compute on shore)
- the fact this computation occurs within `T-REX` sets up the infrastructure for more in-depth shore side planning
- the centroid sent by the shore-side `T-REX` to the Dorado to track is produced using data from the vehicle itself, which closes the loop and makes this real-time data useful independent of user input
- gulper trigger as a means to get better situational awareness along with sensor tracks in the `ODSS` will provide the shore-side user a better grasp of where such sample acquisition is taking place. Eventually we expect the shore-side user to command the vehicle with potentially different techniques using the `SmartSampler` providing substantially more flexibility in commanding the vehicle. As of now, there will be no impact on vehicle control as yet.

3 Work to be done

- `ODSS`

  The `ODSS` team is working hard in getting a new and better performing version of situational awareness and its interface to the backend in addition to new features noted below. Further, the team is evaluating what it would take to automate adjusting the depth envelop of the Scripps glider using shore-side autonomy and the communication backplane. While this is unlikely to be implemented in time for the experiment given the workload, evaluating and assessing the level of effort as a future option is being considered.

  - gulper visualization mechanism (Gomes)
  - ODSS GUI reimplemented in HTML and JavaScript to provide multiple browser support and improved user response time. (Gomes).
    - Firefox 11.0 supported
    - Chrome 18 supported
    - Internet Explorer 9 supported
    - Safari 5 supported
    - iPad supported via iPad Safari browser
  - Situational awareness perspective primary focus for May
    - Map display
    - Display platform tracks geo-referenced on map as transparent layer (Cline, Gomes)
      - Platform position in text (can be copied and pasted)
    - Display decision data displayed as transparent layer georeferenced on map (Cline, Gomes)
      - Satellite data
      - HF radar
      - etc.
  - Display sensor tracks geo-referenced on map as transparent layer (Cline, Gomes, McCann). Not yet scheduled.
  - ODSS Planning Perspective
    - Android app to be evaluated and demonstrated Thursday May 19th as part of an undergraduate CSUMB CAPSTONE project.
  - ODSS Observation Log
    - ODSS team (Gomes) built a log web service
    - CSUMB students have built mobile apps for entering log information.
      - iPhone and Android app to be evaluated in May
  - Data Analysis Perspective
    - High level Science User Requirements by April. Maughan.
      - Data Access (files, thredds, matlab libraries, etc.)
    - Data Archive Descriptions with pointers to data in filesystem by May. Maughan, Edgington, Godin.
    - Specify capabilities needed in STOQS to integrate MOQUA with STOQS. May.

- `T-REX` onshore

  - collect data from STOQS (completed)
  - reactor design for on-shore `T-REX` that can send new goals to the vehicle

- design a `T-REX` model that ties all entities together
- `MBFD` needs some work to fix problems and take advantage of mission details.
- encapsulate `MBFD` in the reactor
  * this involves Fred porting Jeremy's matlab code, including fixes above, to C++
  * some parts of the original `MBFD` (basically the momentum calculation and Kalman filter) are already ported to C++, but any new changes will need to be as well as the part which identifies the actual location and extent of the front

- `T-REX` onboard
  - send gulper updates along with sensor data when gulper state changes to triggered (coded, not fully tested)

- `SmartSampler`
  - The `SmartSampler` is planned to be used as a means for `T-REX` to gather information about the state of the gulpers and possibly statistics on sensor readings with no impact on gulper triggering as illustrated in Fig. 2.
  - minor code adjustments are required since other AUV code is expected to trigger samplers (coded but not fully tested)

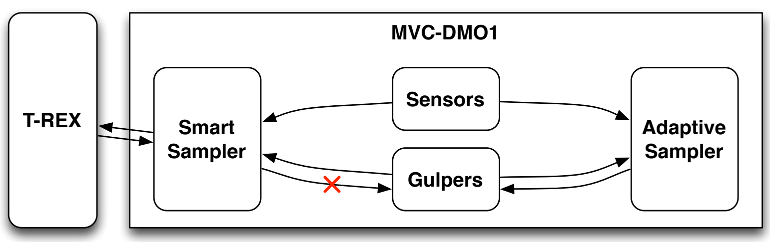

Figure 2: Information flow between sensors, gulper, Adaptive Sampler, SmartSampler, and `T-REX`. Note that SmartSampler will be treated as a listening device.