



STEVENS
INSTITUTE *of* TECHNOLOGY

THE INNOVATION UNIVERSITY

MOOS-DAWG

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Presentation #23:

Remote Control and Monitoring of MOOS Vehicles through Cellular Modems

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UNIVERSITY OF
CONNECTICUT
ROCKY HILL, CT

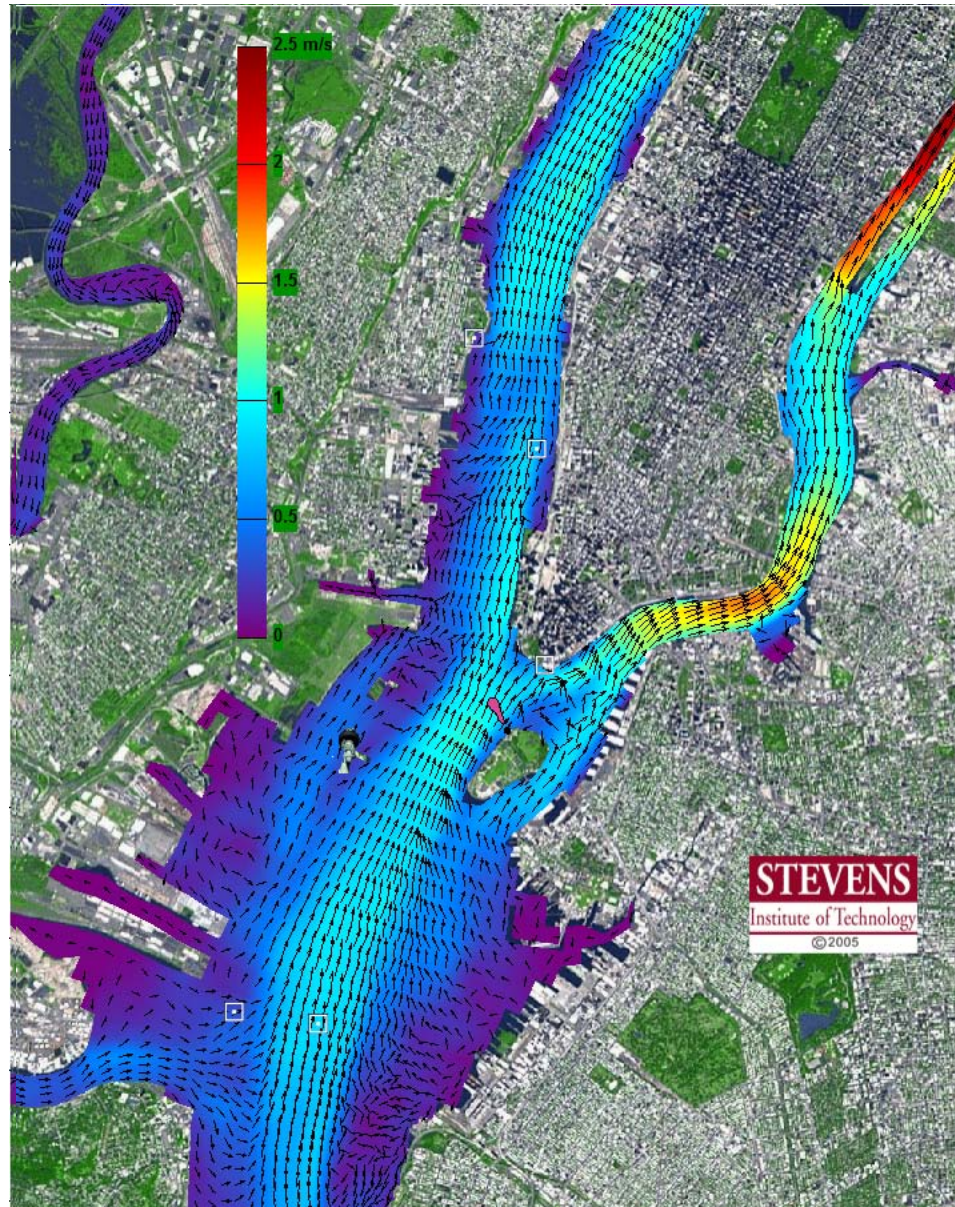






New York Harbor
Observing and
Prediction
System (NYHOPS)

+4 Hours

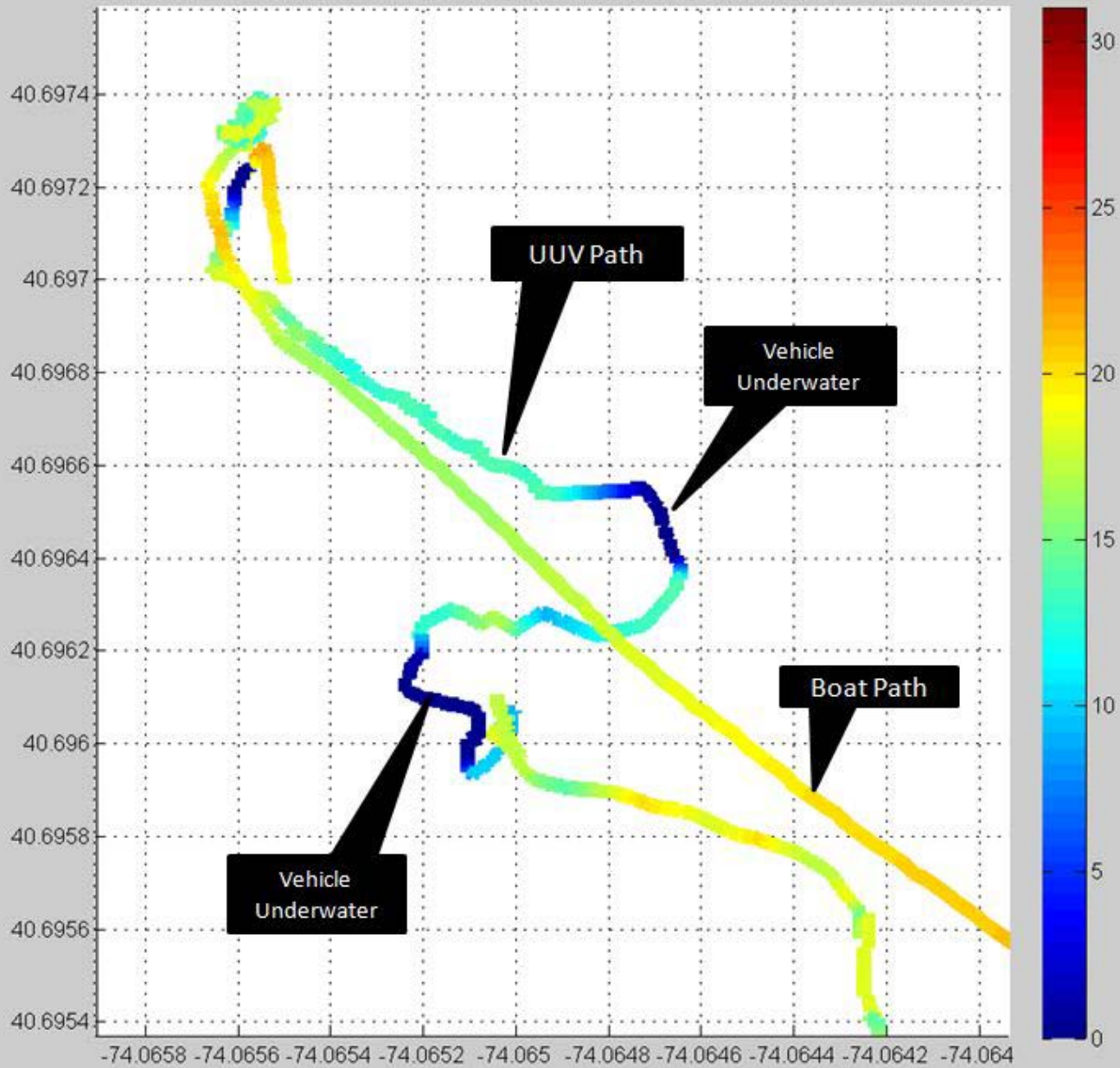


Means of vehicle communications

- Wifi
 - Short range, useless after vehicle is deployed
- Acomms
 - Limited range (best range we got was 300 meters)
 - Shallow water multi-path problems
 - Not a viable long-range form of communication
- Cellular Modem
 - Excellent coverage in the lower Hudson River Area
 - Good data-rate speeds for Internet connection
 - Viable option



Cellular Reception Signal logged on-board a UUV





Cellular Antenna

Unmanned Underwater Vehicle



MOOS Payload Processor
*only for non-native MOOS vehicles



GPRS Cell Modem

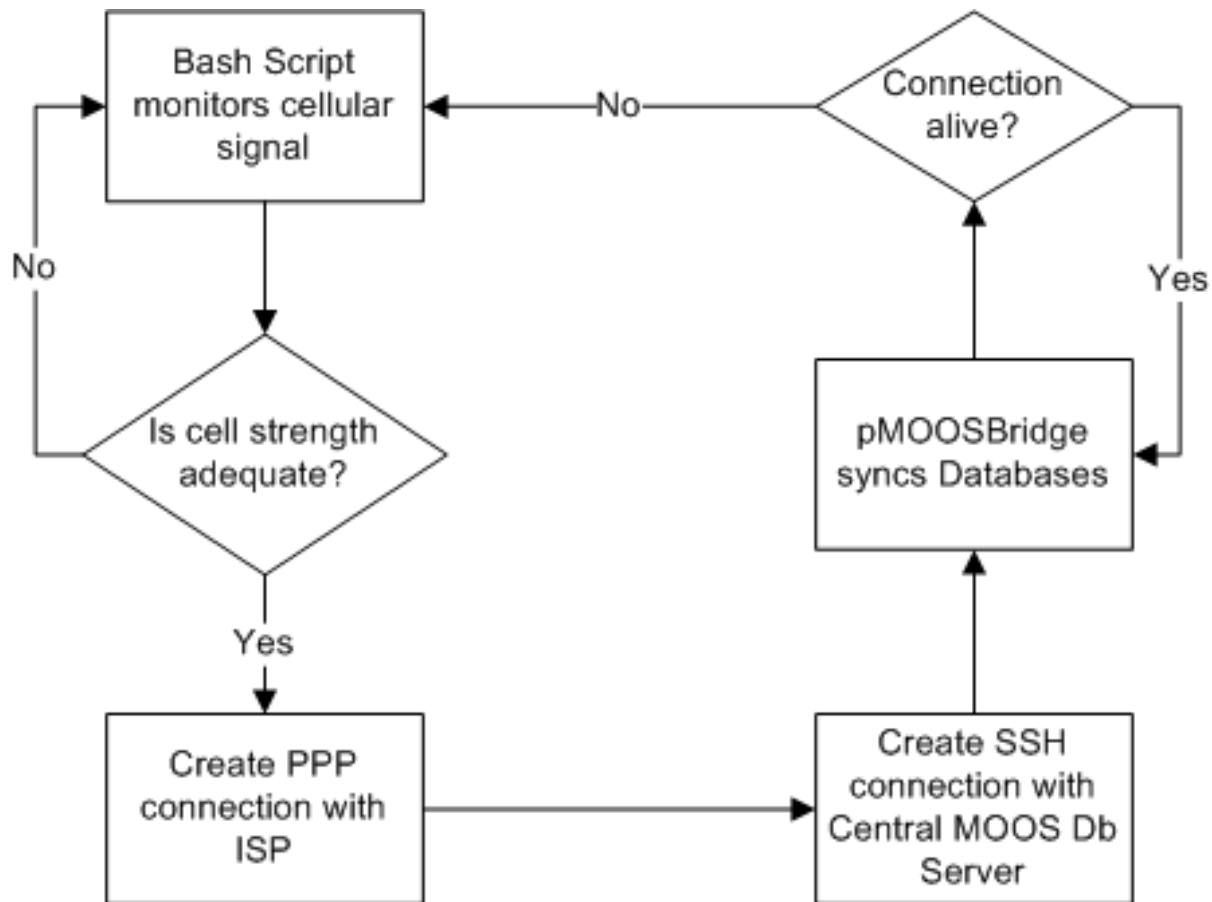
Remote Operator



Central Server Running a MOOS DB

A tan, vertical server rack unit representing the Central Server.

Cell Connection Process



Graphical interface capabilities

- Mapping
 - Geo-referenced nautical charts;
 - Zooming, moving;
- Mission planning
 - Graphically creating UUV mission on the map;
 - Adjusting all parameters of any step of a mission;
 - Saving and loading existing missions;
- Communicating with MOOS
 - Sending mission commands to MOOS DB;
 - Reading values of selected MOOS variables;
 - Plotting GPS coordinates of UUVs on the map.

Mapping and geo-referencing selected region

The screenshot displays the UUV_Viewer_12_0.vi software interface. The main window shows a map of Liberty State Park with a mission path overlaid. The path is marked with numbers 8 through 17, indicating a sequence of waypoints. A 'Ramp' is labeled on the map. The map is zoomed in, showing details of the park's layout, including a 'Marsh' area and a 'Ramp'. The interface includes a menu bar (File, Edit, Operate, Tools, Browse, Window, Help) and a toolbar with icons for navigation and mission control. On the right side, there is a control panel with the following sections:

- Full image** and **Step Back** buttons.
- Mission** section with **Map** and **Files** tabs.
- Zoom** and **Move** buttons.
- %zoom** field set to 81.68.
- MousePos** fields showing X: 1746.71 and Y: 13647.9.
- KeepMarkers** field set to 24:00:00.
- BlinkingMarkers**.
- Coordinates** section with X: -74.065097 and Y: 40.695767.
- Coordinates2** section with X: -74° 3' 54.35" and Y: 40° 41' 44.76".
- Loading** progress bar.

The map shows a blue area representing water or a marsh, with a yellow area representing land. A path of waypoints is marked with numbers 8 through 17. A 'Ramp' is labeled on the map. The map is zoomed in, showing details of the park's layout, including a 'Marsh' area and a 'Ramp'. The interface includes a menu bar (File, Edit, Operate, Tools, Browse, Window, Help) and a toolbar with icons for navigation and mission control. On the right side, there is a control panel with the following sections:

Creating or loading mission for UUV

The screenshot displays the UUV_Viewer_12_0.vi software interface. The main window shows a map with a mission path consisting of numbered waypoints (11, 13, 14, 15, 16, 17) and a 'Ramp' area. A red line indicates the mission path, starting at waypoint 11, moving to 13, then 14, and continuing towards 15. A red circle highlights waypoint 11. The interface includes a menu bar (File, Edit, Operate, Tools, Browse, Window, Help), a toolbar with navigation icons, and a status bar showing 'Time From Last Update' as 00:00:00. On the right side, there is a control panel with buttons for 'Full image', 'Step Back', 'Show Parameters', 'Start Mission', 'Load Mission', 'Save Mission', 'Step Back', and 'Clear Mission'. Below these buttons are input fields for 'Mission Name' (Mission_B_1), 'RangerName' (Ranger7), 'MissionEditor' (Move), and 'Range(m)' (30.00). At the bottom right, there are fields for 'Coordinates' (X: -74.061787, Y: 40.697014) and 'Coordinates2' (X: -74° 3' 42.43", Y: 40° 41' 49.25").

UUV_Viewer_12_0.vi

File Edit Operate Tools Browse Window Help

CurrentMap Mission FullMap uMS SingleFile Controls

Time From Last Update 00:00:00

Full image

Step Back

Map Files

Mission

RangerName Ranger7

MissionEditor Move

Range(m) 30.00

Show Parameters

Start Mission

Load Mission

Save Mission

Mission Name Mission_B_1

Step Back Clear Mission

Coordinates

X -74.061787

Y 40.697014

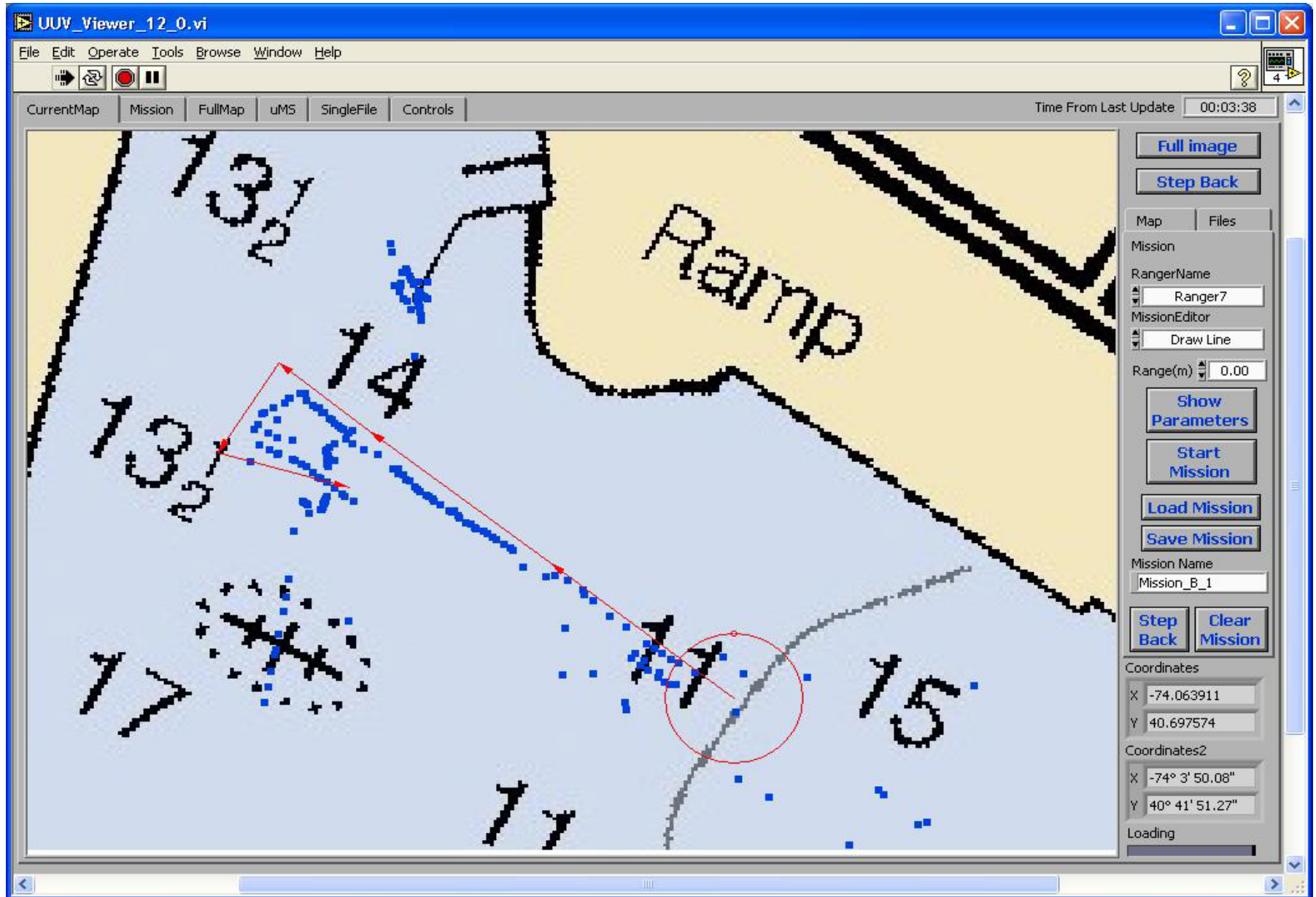
Coordinates2

X -74° 3' 42.43"

Y 40° 41' 49.25"

Loading

Plotting GPS tracks of UUV and comparing them against required mission



Current Capabilities

- MOOS has allowed for:
 - Simple communication to a vehicle and the ability to monitor/change all program variables
 - Portable platform allowing us to have many different types of vehicles with only one set of control software
- Remote Control through cellular internet connection with MOOS allowing:
 - Sending of a complete mission package to a vehicle that is currently underway
 - Receiving up-to-date scientific data

Acknowledgements

- This work would have been impossible without the efforts of Paul Newman and all the contributors to MOOS development.
- This work was supported by ONR project #N00014-05-1-0632: Navy Force Protection Technology Assessment Project.