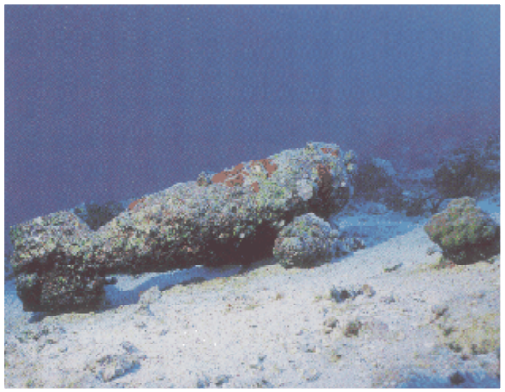
Task 3: Underwater UXO Casing Corrosion



Y0817 Pollution Abatement Ashore Program Program Reviews

3 June 2004

(NFESC Code 51)
(805) 982-1215

Problem Statement

- Submerged UXO will Eventually Cause Release of Munitions Constituents (MC) into the Marine Environment
- Predicting the Corrosion Behavior of UXO in the Marine Environment

Approach

-Assess Naval Capability (FY02)

-Develop U/W UXO Corrosion Prediction Model (FY03)

-Collect Corrosion Data for Model (FY03-05)

-Update Coefficients in Model (FY03-FY05)

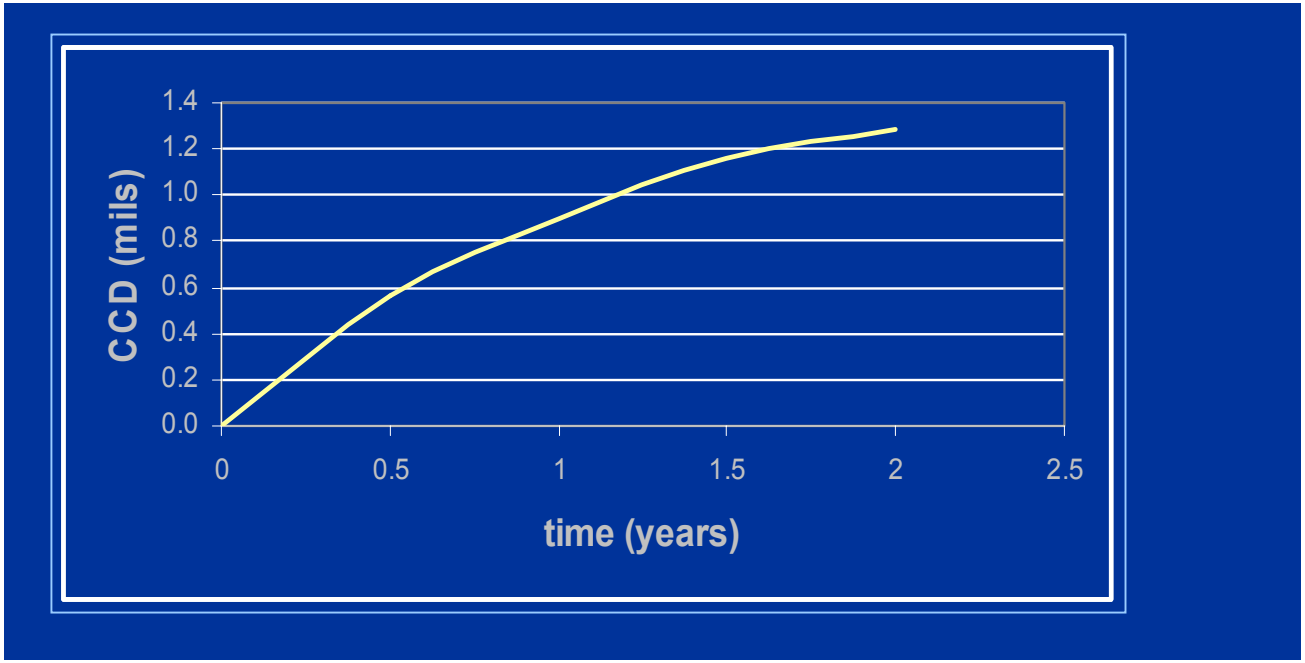
-Implement Model Software and User Guide (FY04-05)

Technology Description

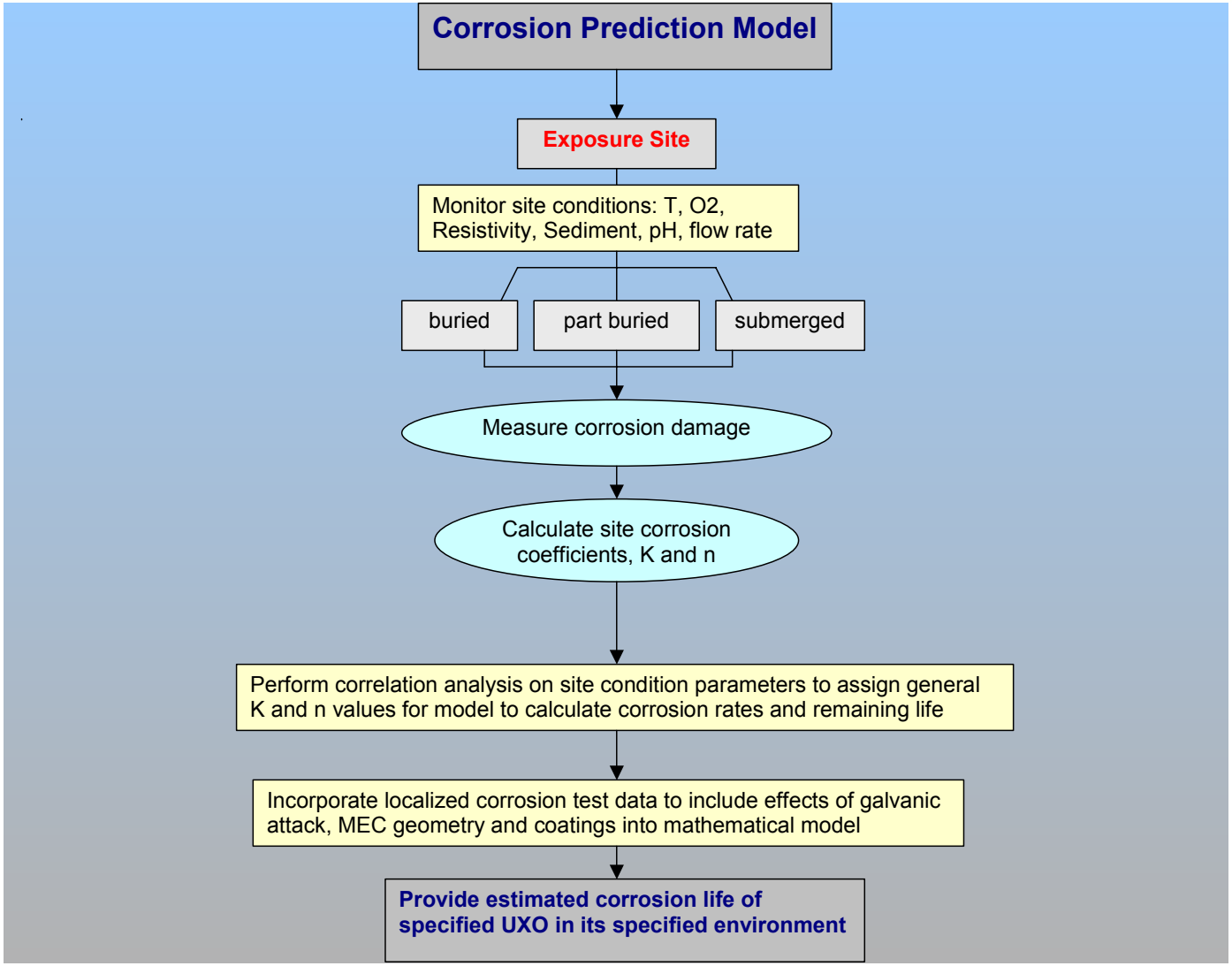
CORROSION PREDICTION MODEL

$$P = K T^{n}$$

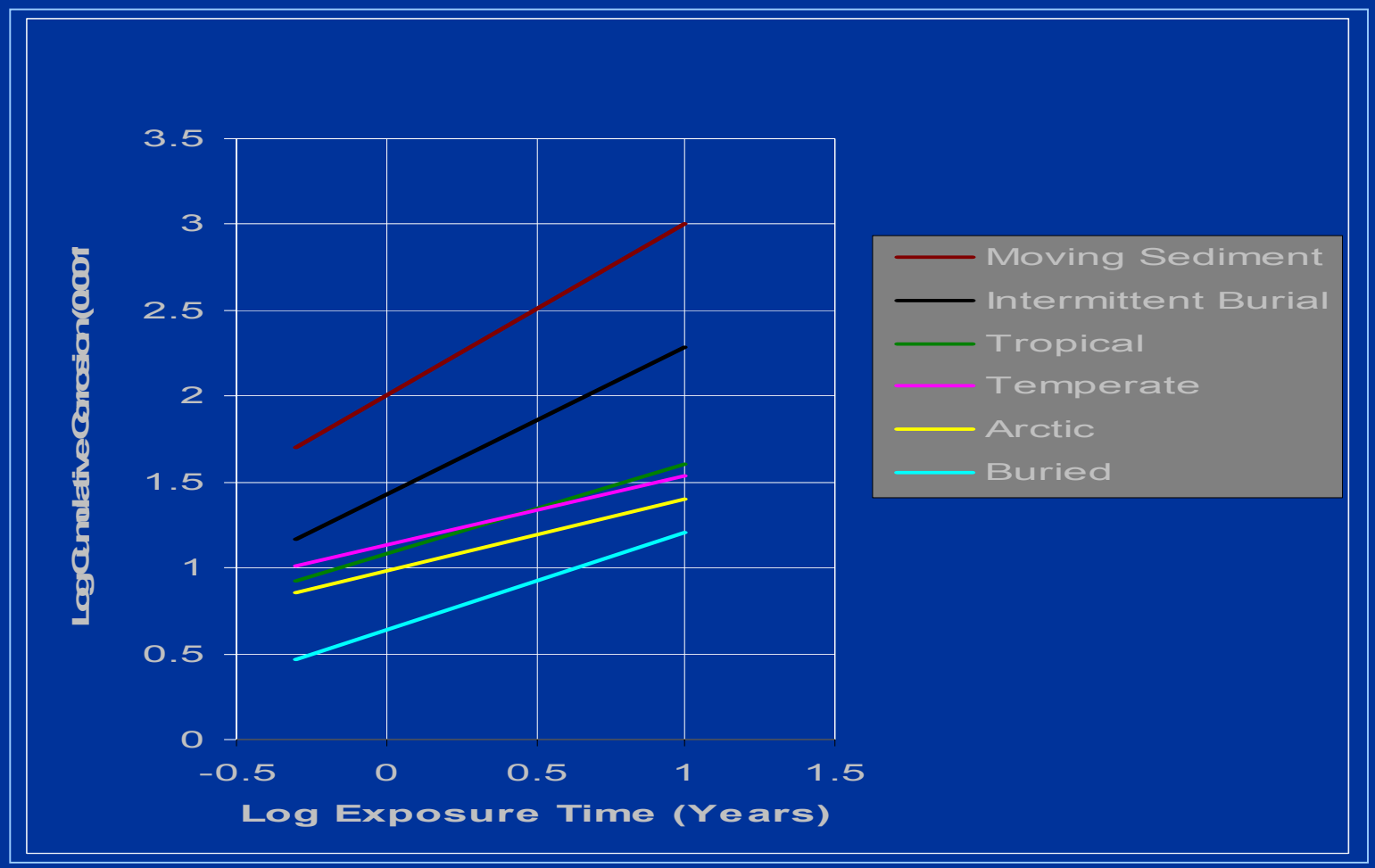
P = Casing Penetration (mils)
K = constant derived from corrosion data (mpy)
T = time (y)
n = constant derived from corrosion data



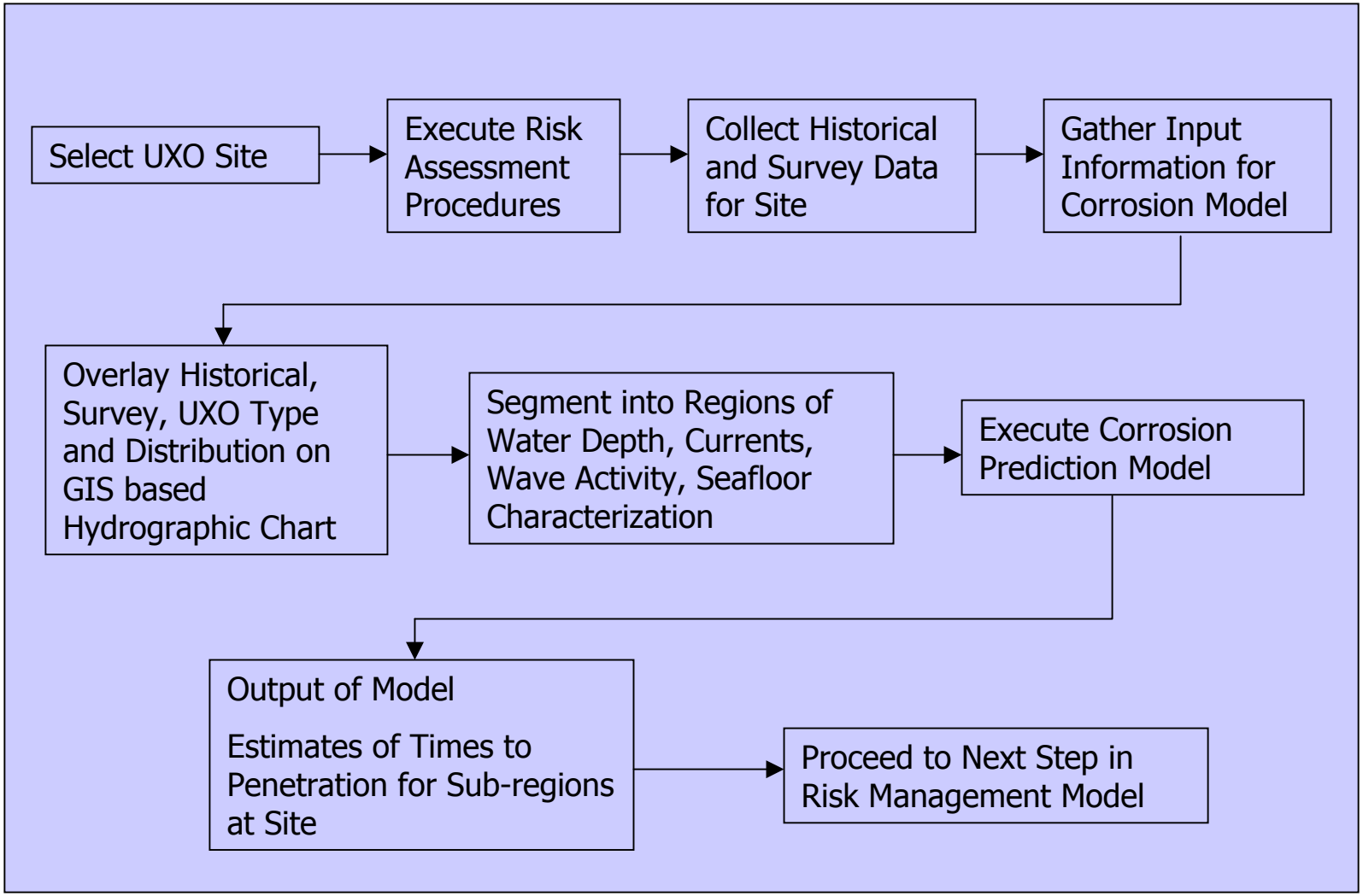
Corrosion Prediction Model



Corrosion Model to be Updated for Factors in Marine Environment



Flowchart of Model Application



Corrosion Tests

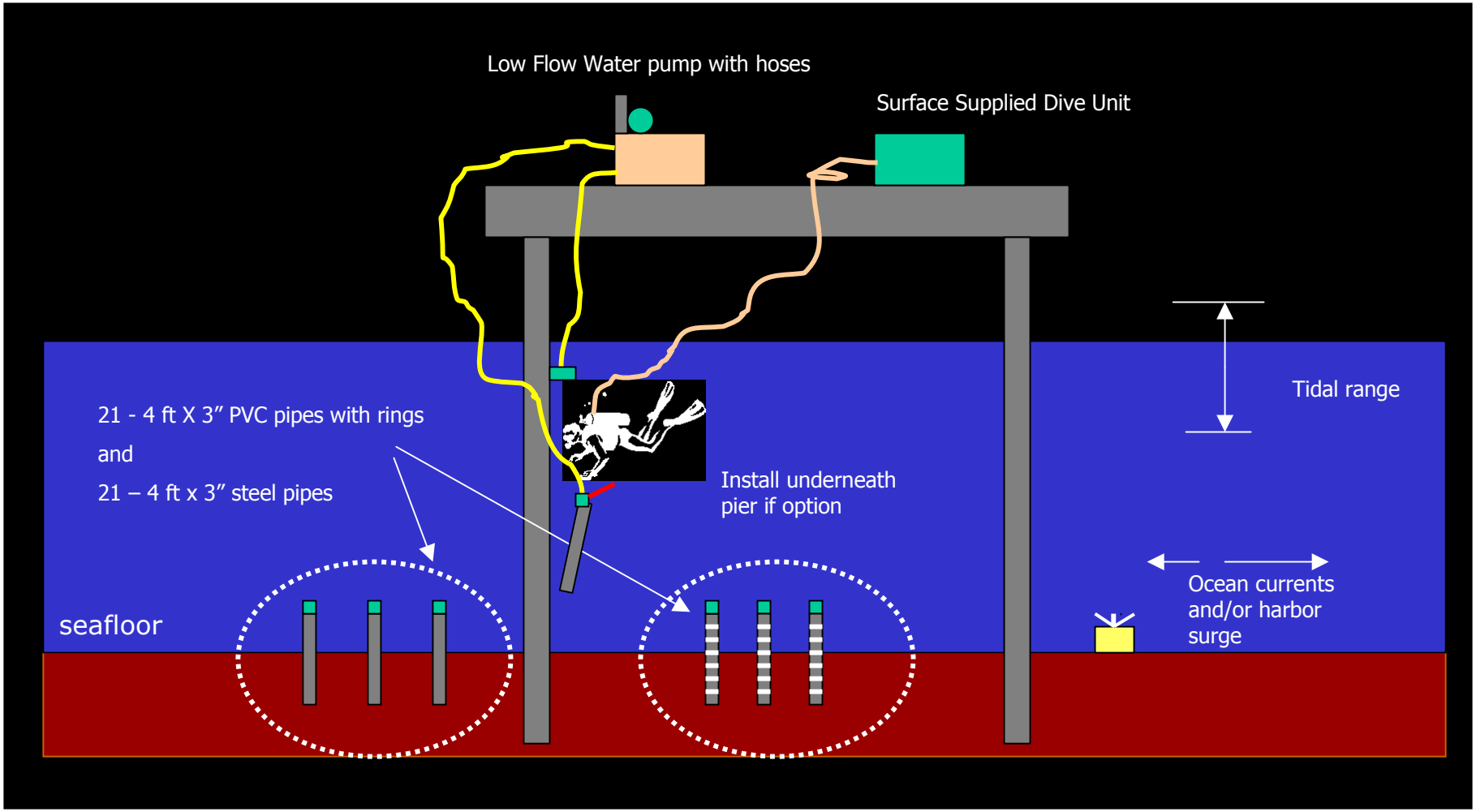
Goal: Obtain Data for Corrosion Prediction Model

- Generalized Corrosion (Field Tests)
  - Port Hueneme, CA
  - Indian Island, WA
- Localized Corrosions (Laboratory Tests)

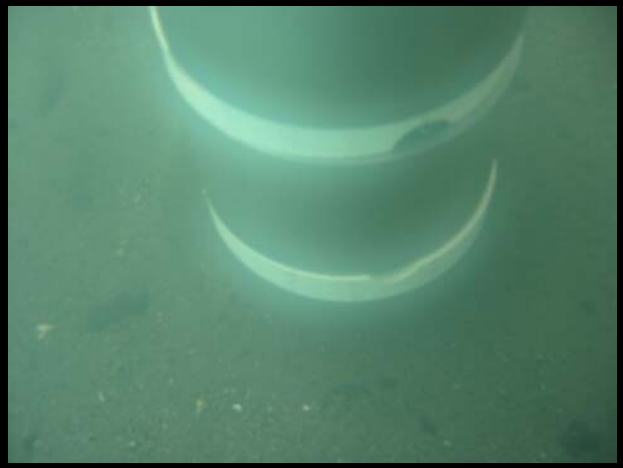
MK 82

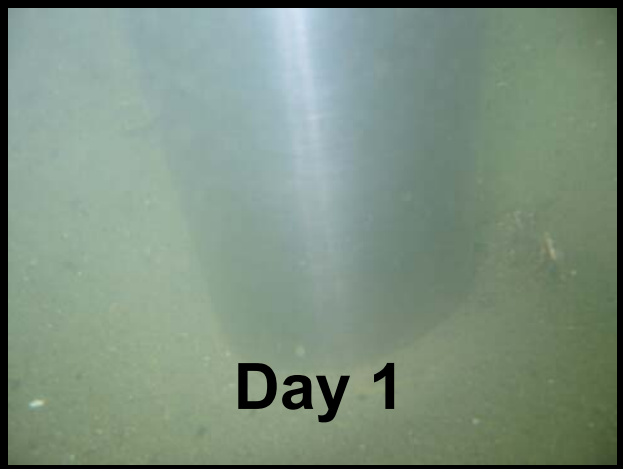
MK 38

Generalized Tests



Port Hueneme Tests – In Progress

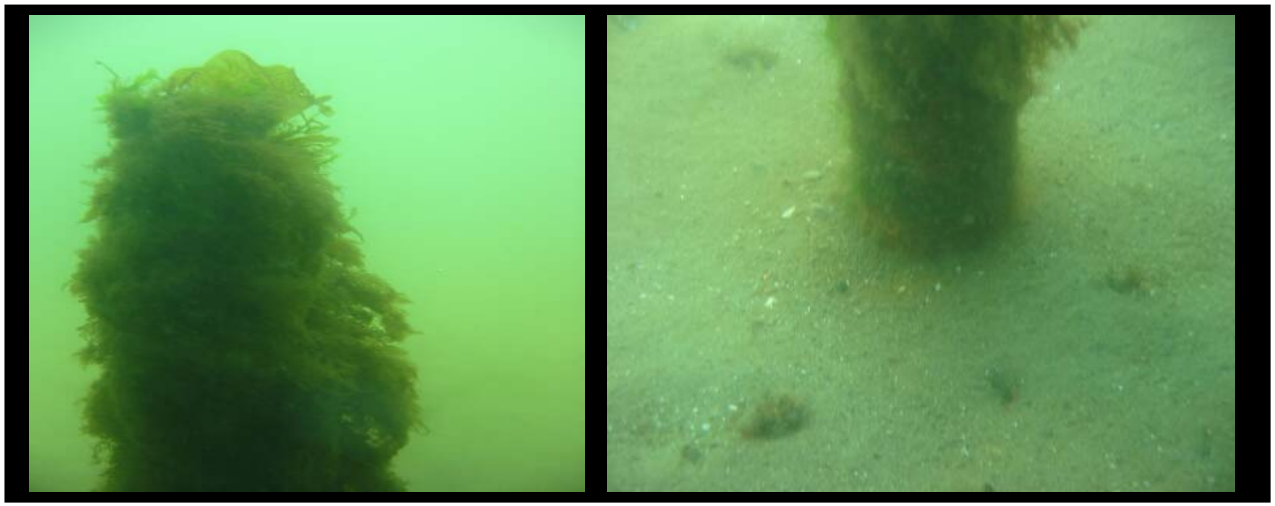




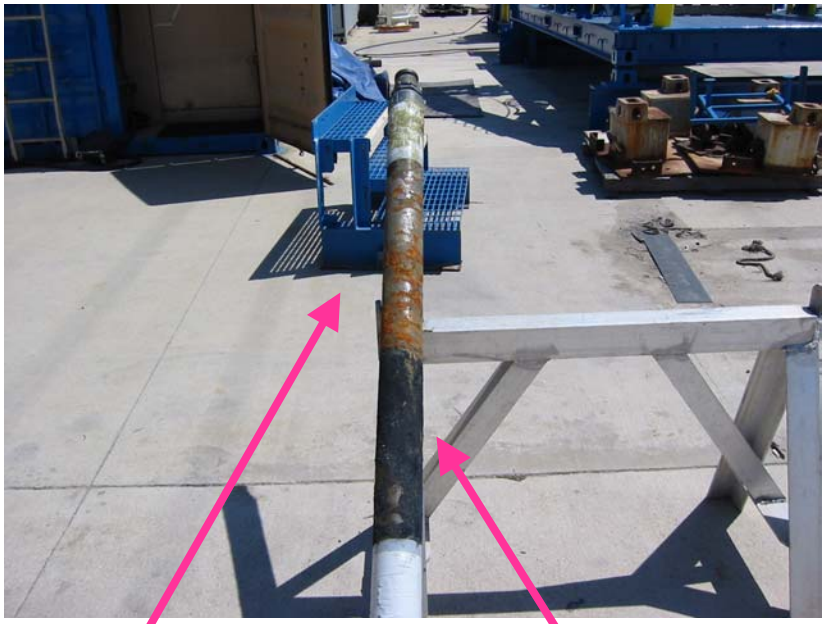
NAVMAG Indian Island, WA – Tests In Progress

1 Month

6 Months



Sample Preparation After 6 Months



Upper end (red rust)
Buried end (black encrustation)

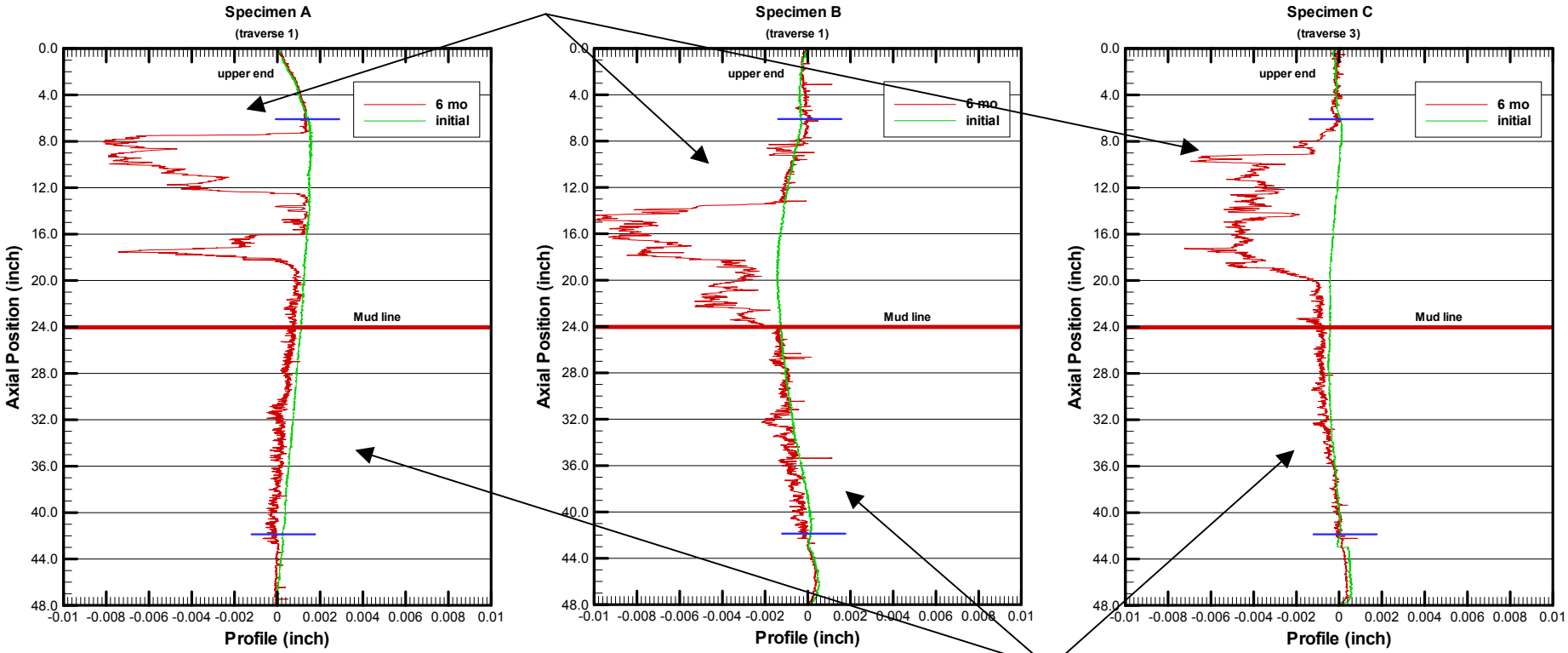
Cleaning for profilometer traverse

Test Articles - Before and After

Profilometer Measurements
(Four Orthogonal Traverses per Pipe)

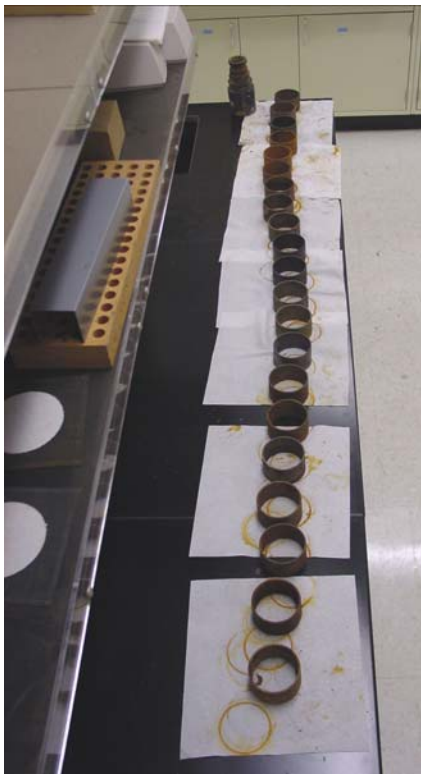
NAVMAG Indian Island, WA
6 Month Profile for 3 Samples

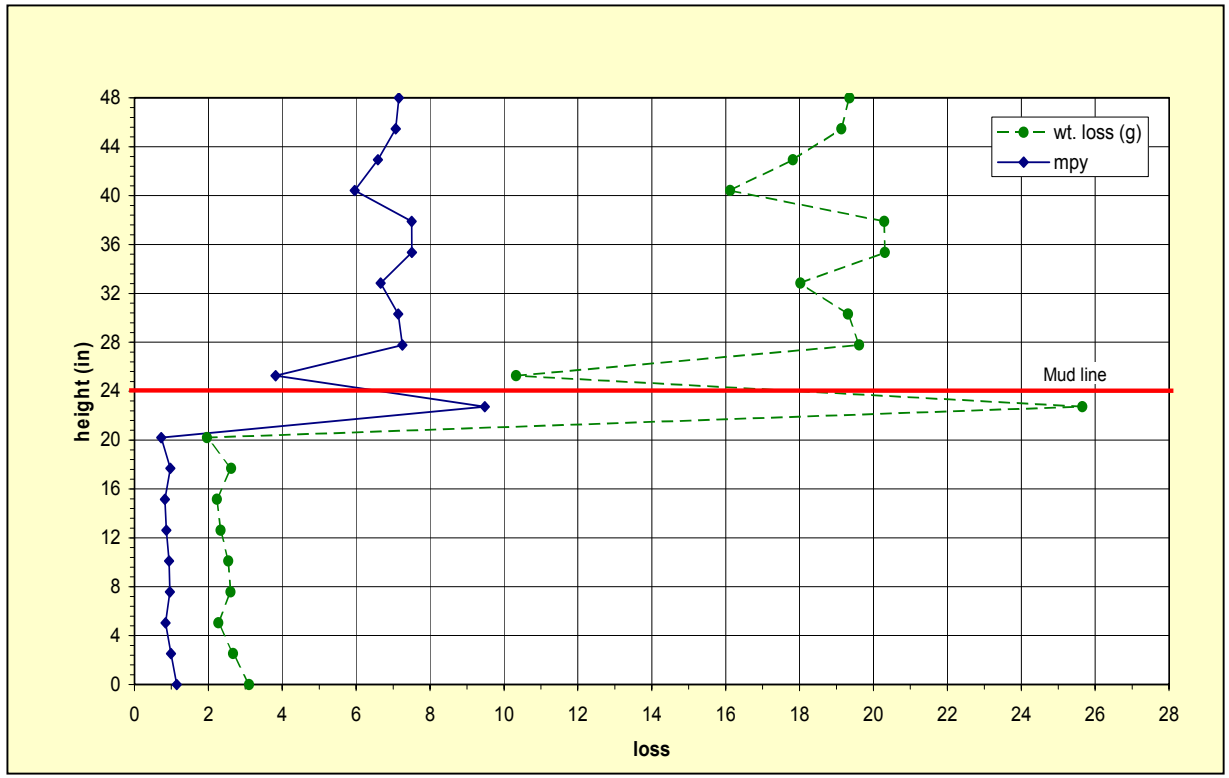
Unburied Section ~ 6-10 mpy



Buried Section ~ 1 mpy

NAVMAG Indian Island, WA
Ring Results for 6 Months





7 mpy unburied and 1 mpy buried

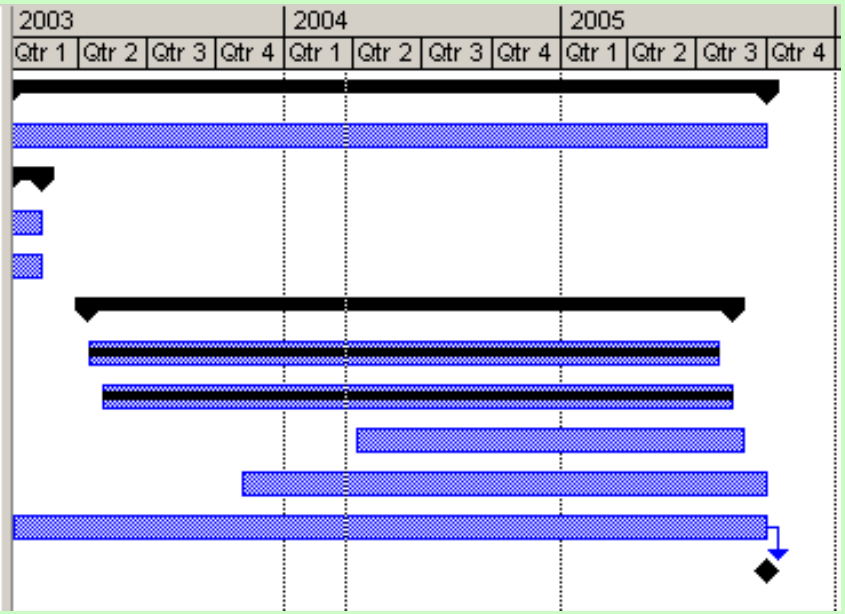
Benefits/Payback per Site

Task	W/O Model	With Model
1. Collect Historical Data for Underwater UXO site	$ 50 K	$ 50 K
2. Survey U/W Site for Item types and locations	$900 K	$ 500 K
3. Extract Representative Samples EOD Divers	$ 500 K	$0K
4. Render UXO Safe to Measure	$400 K	$0K
5. Assess Casing Condition	$100 K	$20K
6. Perform Statistical Analysis for Site	$200 K	$50K
Total	$2,150 K	$ 620 K
ROI	3.47 *	

* Assumes Corrosion Assessment of Sample Population and EOD Divers Allowed for Retrieval and Inspection

Schedule

	Task Name	Start	Finish
1	**U/W UXO Casing Corrosion**	**Wed 1/1/03**	**Fri 9/30/05**
2	Project Management	Wed 1/1/03	Fri 9/30/05
3	**Site Selection**	**Wed 1/1/03**	**Tue 2/11/03**
4	Port Hueneme, CA	Wed 1/1/03	Tue 2/11/03
5	Indian Island, WA	Wed 1/1/03	Tue 2/11/03
6	**Generalized Corrosion Tests**	**Mon 4/14/03**	**Tue 8/16/05**
7	Port Hueneme, CA	Mon 4/14/03	Fri 7/29/05
8	Indian Island, WA	Wed 4/30/03	Tue 8/16/05
9	**Localized Corrosion Tests**	Fri 4/2/04	Wed 8/31/05
10	**Collect/Assimilate Test Data**	Mon 11/3/03	Fri 9/30/05
11	**Model Planning and Development**	Thu 1/2/03	Fri 9/30/05
12	**Deliver Model and User Manual**	Fri 9/30/05	Fri 9/30/05



Milestones and Major Deliverables

Milestone	Estimated Completion Date	Status
Gather Existing Data	FY02	Complete
Identify Data Gaps	FY02	Complete
Develop Corrosion Model	FY02	Complete
Develop Test Plans	FY02	Complete
Conduct Prototype Tests	FY03	Complete
Conduct Generalized Corrosion Tests	FY03 ->	In-progress
Conduct Localized Corrosion Tests	FY04 ->	Summer 2004
Write Computer Model/Software Development	FY04	In-Progress
Summarize Corrosion Data and Corrosion Model	FY05	No started

Accomplishments to Date

- FY02
  - Base Form of U/W Corrosion Prediction model completed
  - Field Tests Planned
- FY03
  - Preliminary Localized Corrosion Measurements Taken on Related Specimen
  - Field Tests Started
- FY04
  - First 6 months data extracted
  - Additional Test UXO obtained for Localized Tests
  - Corrosion Model Design and Implementation Underway

Work to Completion

- Continue to Recover Test Specimens Periodically every 6 months initially and then 1-2 yrs later
- Localized Corrosion Tests
- Periodically Update Corrosion Model with Measured Data
- Prepare Corrosion Model User Manual
- Test Corrosion Model with Examples
- Deliver Model and User Manual

Options- Recommended New Tasks

	Proposed Task	ROM Cost
1	Leave Pipe/Ring Specimens for Longer Term:	$40 K/yr for 2 Sites
2	Test additional inert UXO samples in Laboratory setting and/or Protected Field Test Locations	$135K
3	Abrasive Tests	$125K
4A	Recover Actual Underwater UXO for Laboratory Corrosion Measurements to Gain Further Data	TBD
4B	Alternate, use EOD Divers to measure corrosion with underwater flux sensor in-situ at UXO site(s)	TBD

Summary

- Underwater UXO casings may eventually corrode and release MC into environment
- No Corrosion Assessment Capability Currently Exists for Marine Underwater UXO
- Develop Corrosion Prediction Model to Assist with Risk Assessment of Underwater Marine based UXO
- Collect Measured Data for Calibration of Model
- Update Model and Deliver with User Manual