MOTB Operations Considerations: Discussion Guide

5-21-10

Outline

A. Client Engagement
B. Operational Expenses

A. Client Engagement

The following is a high level look at how NREL engages prospective clients for our Blade Testing program. The steps NREL currently utilizes to develop a test plan with a prospective client are summarized below and applied, at a high level, to WEC testing:

1. **Initial Developer Contact**
    a. Update test inquiry sheet with initial hypothesized testing needs
    b. Provide Test Birth Specification Documentation to device company
    c. Provide general costing information to device company (blade test examples)
        i. 45m blade IEC test - $350-$400k (6-8 months)
        ii. 35m blade IEC test - $300k (5 months)
        iii. 25m blade IEC test - $250k (4 months)
        iv. 10m blade IEC test - $150k (3 months)
    d. General identification of potential large cost items (blade test examples)
        i. Test hardware
        ii. Blade instrumentation
        iii. Test requirements and sequence
        iv. Blade properties
    e. Discuss general testing schedule requirements

2. **If Preliminary Response is Positive:**
    a. Request information needed to specify a initial test paradigm rough draft, such as:
        i. Test sequence
        ii. Specifications of WEC device
        iii. Location specification
        iv. Mobilization and transport procedures
        v. Site preparation procedures

vi. Mooring procedures
vii. Operational procedures
viii. Recovery procedures
ix. Demobilization procedures

b. Non-disclosure agreement likely required
i. Start internal process to develop NDA

3. Develop Rough Draft Test Plan

a. Create baseline testing schedule
b. Determine appropriate test protocols
c. Determine cost estimates (service options A, B, C, etc.)
d. Review of schedule, cost, with testing team and management
e. Provide updated schedule, agreement drafts, and costs to WEC developer

4. Develop Detailed Test Plan

a. Detailed planning meeting with WEC developer
b. Detailed schedule formation
c. Detailed cost estimate
d. Refine agreement with WEC developer based on test specifics

The steps listed above demonstrate the iterative process needed to develop a detailed test plan and associated costs. The time required by the testing facility to develop this plan is significant. The table below summarizes the time commitment needed before any project can begin. These time estimates show the time required up front in rotor blade testing. Naturally, WEC device testing in the ocean is significantly more complex and a commensurate level of additional time will be required.

Task	Description	Estimated Staff Time Required (hrs)
1	Initial Contact	1
2	Update Blade Test Inquiry Sheet	.5
3	Send Testing Capability Package	.5
4	Earnest Client Interest	0
5	Evaluate staff and facility resources for WFO programs against DOE program support.	2
6	Discuss WFO potential and strategic aspects with management	1
7a	Discouraging Development Response to client – NREL unable to accommodate proposed work	.5
7b	Encouraging Development Response to client – have staff and facilities for performing the test	6
8	Conceptual Project Development Package	16
9	Final Project Development Package	32*

10	Start of Work	-

B. Operational Expenses

Naturally, there are numerous ways to price services. The cost to clients to have their rotor blades tested at NREL is determined on a per test basis as the specifics of each test vary. However, as a DOE National Laboratory, NREL has fixed overhead rates and work is priced based on time and materials with the appropriate overhead rates. A NNMREC test facility may not be constrained to this pricing paradigm.

This section only discusses costs only, not pricing, and is not intended to be a discussion guide, not to be comprehensive. A WEC device testing services organization/facility will have both fixed and variable (with each client engagement) operational costs. Examples of each of these types of costs are outlined below for further discussion:

1. **Fixed Cost Examples**
    a. Personnel
        i. MOTB center operator(s)
        ii. Program manager
        iii. Test engineer
        iv. Marine Operations (if not on staff but contracted, as needed per test, would be in variable cost section)

    b. Administrative (this may be captured in an overhead charge)
        i. Maintenance billing
        ii. Payroll

    c. Shore WEC test setup work space
        i. Cost to maintain a dedicated WEC test assembly space
            1. Inside and outside work spaces
            2. Facilities costs
            3. Model shop?
            4. Welding shop?

    d. Storage
        i. MOTB Wet or dry storage during idle period
        ii. MOTB support equipment storage (tools, moorings, rigging, etc)
        iii. MOTB electronics and mechanical shop space
        iv. Security

e. Maintenance
    i. MOTB
        1. Bottom anti-foul cleaning on a regular basis
            a. Clean “load” devices
            b. Clean around mooring points
            c. Clean any subsurface instrumentation
        2. Periodic surveys of mooring structure
            a. Survey anchor points
            b. Survey power cable and breakout box
        3. Replacement of mooring lines and hardware (~once a year)
        4. Regular inspection, servicing and repair of internal systems
        5. Regular inspection, servicing and repair of external devices
        6. Instrument calibration and repair
    ii. Telemetry infrastructure
        1. Periodic maintenance of local RF site
            a. Inspect cables and antenna
                i. Every couple of years check SWR of antenna and cable
            b. Look for newly installed devices from other sources
                i. Conduct RF survey if new gear on similar frequency or harmonics suspected.
    iii. Data storage
        1. System administration / upgrades for data storage machines

f. MOTB capital costs (depreciation)

g. Insurance
    i. MOTB hull and systems
        1. ABS requirements
    ii. Operations personnel
    iii. Dive operations
        1. Certification

h. Permitting
    i. Continuing permit fees
    ii. Environmental impact reports

2. Variable Cost Examples

Examples of expenses associated with an individual test deployment of a WEC are listed below. These are only examples and are not intended to be a comprehensive list. The WEC device test duration will be determined during the testing plan phase.

a. Mobilization and Transport
   i. Marine operations persons (if not full time staff)
   ii. transport to site of MOTB
   iii. transport to site of supporting systems

b. Marine operations (this could be broken down into events, such as deployment, operation, maintenance and recovery)
   i. Ship time (question: is OSU overseeing the whole test, including the installation and operation of the WEC or is the WEC developer using (renting) the MOTB? This needs to be considered in the cost model, or perhaps a different cost models for each case may be used. If OSU is responsible for the offshore operations, then ship cost and other activities must be considered. Ship time cost, for example, will depend on the size of WEC and the deployment needs of the MOTB. Daily operations vessels may be large or small depending on needs. Something along the lines of a UNOLS Class V vessel is probably the most likely deployment vessel. Deployment may be a multi-vessel operation depending on the deployment plan)Consumables (lines, fuel, etc)
   ii. Instrument and equipment rental
   iii. Communication costs
   iv. Emergency activities (this might be captured as an as needed charge for such things as power cable re-termination)
   v. Local accommodation and support of personnel if on land
   vi. Land rental for land based components
   vii. Travel to and from remote site (such as airfare)
   viii. WECs devices may require different support ships depending on testing needs
      1. Examples of ship time fees (<u>not costs</u>) are outlined below as a guideline of what these expenses may be (actual expenses, if these services are handled in-house, will, naturally, be some fraction of these costs).

Vessel cost	**Ship Daily Rate**	**Ship Standby Rate**
Class III Vessel	$20,000	$10,000
Class IV Vessel	$15,000	$7,500
Class V Vessel	$4,500	$2,300
R/V Elakah	$2,500	----
Skiff	$1000	----

ix. Marine operations personnel and divers (if not on staff)
    1. The table lists examples of contract service staff fees if brought on board as needed with each test deployment.

Labor cost	**Hourly**	**Daily (10hr)**
WEC Monitoring Technician	80	800
Engineering Support	100	1000
Diver	80	800
Marine Operations Technician	60	600

c. Potential variable capital costs (beyond what is typical)
    i. Any new equipment required for this specific test
    ii. Any maintenance cost that should be passed on to WEC developer
        1. Maintenance out of the scope of normal operations
    iii. New types of tests with more than "normal" reconfiguration
        1. Machine shop work
        2. Welding
        3. Materials/consumables
    iv. Test mobilization costs
        1. Overtime for Marine operations persons
        2. Special transport requirements
    v. Consumables used for specific test
        1. Hardware
        2. Tools / drill bits / etc