2005 SWOT Analysis
MBARI Platforms Engineering Group

DOCUMENT CONTROL SHEET

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1 Scope

This document comprises the strategic analysis for the MBARI Platforms Engineering Group.

2 SWOT Analysis

2.1 Strengths:

2.1.1 Skills:

- Many members have extensive experience in marine platform development.
- MBARI has an established record of platform design and deployment.
- There are many diverse disciplines in the Platforms Group, such as real-time/embedded software, electronics, power systems, control systems, mechanical design, hydrodynamics, mathematical modeling, and others.
- Both academic and industrial backgrounds are present.

2.1.2 Resources:

- Ready access to the deep sea.
- Good resources to execute projects, including ships, ROVs, AUVs, Moorings, shop resources, internal funding, computers, lab space, etc.
- Education and resources for professional development are available.

2.1.3 Mission:

- Not required to make a profit.
- Funding is relatively stable.
- Technology driven as well as science driven.
- Freedom to innovate with advanced technologies.
- Mandate - general and versatile (we have a lot of latitude in defining our direction).
- Mbari encourages teaming and large projects.
- Management support of platforms group.
- Emphasis on community thinking (we think in terms of developing ocean community , infrastructure, services and resources, addressing general needs). E.g. SAIL protocol, SIAM.

2.1.4 Organization:

- Matrixed work organization.
- Close association with science problems (access to scientists and science questions).
- Freedom to make use of proposal process (that we have a proposal process is good).
- Possible to have longer than 3 yr development cycles.

- Grouping platforms and platforms engineers together will encourage sharing designs and standards, and reduce redundancy.
- Have a systems level appreciation or view of issues when required.
- Grouping platforms engineers together could allow engineers to stay with project through I&T and initial operations. Encourages ownership and responsibility.

2.2 Weaknesses:

2.2.1 Human resources

- Insufficient tech support (1 tech: 9+ engineers)
- Inefficient execution of projects due to lack of key support staff (eg. Doc management)
- *Lack of sufficient project dedicated technical support to efficiently complete work planned. Several examples would be:1) the Platforms group has only one dedicated group technician and no EE technician for 6+ engineers. Department wide the ratio is 1:7+. 2) There is no support for engineering documentation development, control or archival. The responsibility for a large proportion of technical support is taken up by engineers themselves impacting their project efficiency and taking attention away from primary tasks.*

2.2.2 Technical facilities

- Inefficient project execution due to lack of project-dedicated lab space and lack of physical collocation of project members.
- *Engineering lab space is available for projects but usually as a temporary space that discourages installation of complete tool sets and testing facilities and is often far from the office space of the project members. Works against projects achieving and maintaining execution momentum.*

2.2.3 Resource management

- Too much multitasking among multiple projects for engineers, too many projects (proposal process inadequate?).
- *Multi-tasking across 3 or more projects creates major inefficiencies and scheduling difficulties. Works against projects achieving and maintaining execution momentum.*

2.2.4 Training and professional issues

- Insufficient awareness of ocean science problems, unfamiliarity with basic ocean science concepts and methods
- Lack of local educational resources in advanced technical fields, lack of emersion in current industrial state of the art technology (difficult to keep up with what's happening…constant exposure not there)

- inadequate technology information cross over (we don't get enough info about what is happening in other industries that might apply to oceanographic problems)
- *MBARI's geographical distance from higher education and technology centers makes it difficult to maintain professional currency. Engineers often do not take training opportunities when available due to perceived project workload and deadline pressure.*

2.2.5 Project Management

- Tendency to understate projects resource and/or budget estimates
- Feature creep, slowness in completing projects, project schedule milestone slippage
- Lack of tools needed to help management and engineers to accurately predict time requirements *(example?)*
- Insufficient awareness of requirements and connection to users *(example?)*
- differing/diverse project management styles between projects (different expectations and schedules)
- Over-reviewed projects (design review process, not enough prototyping) *(example?)*
- For on-ship systems, not enough time for engineering tasks (Support Issue) (hard to get access to operational resources once deployed)
- Tendency to over-engineer or future proof, tendency to over complicate projects *(example?)*
- Lack of strong system level leadership and architecture/design skills *(example?)*
- Lack of design focus on manufacturability and operational use *(example?)*
- *In summary, weakness in skilled project management that can accurately estimate budget and resources and effectively manage to budget and schedule. Lack of firm accountability reduces incentive to improve project management skills.*
- *Q. Is this a result of MBARI's fixed resource environment?*
- *Potential weakness in effectively interacting with users to set requirements and choosing technical solutions that are of appropriate technical level and scaled to project requirements. Ano~~u~~ther weakness is the difficulty in maintaining involvement with systems after they have become operational to fully evaluate results and foster further technical development.*

2.2.6 Program management

- Too much emphasis on project vs problem driven activities *(doesn't the problem come first and then the project is the technical implementation?)*
- Unclear mission statement (MBARI vs Engineering vs Platforms…), undefined platforms vs instruments, undefined group objectives, lack of long-term vision and objectives, lack of focus, lack of strategic vision in project thrust areas
- Too much emphasis on big science vs supporting our in-house science colleagues
- Resource caps (MOOS) make it difficult when project work has to stop (kills momentum)

- Not adequately exploiting opportunities that are infeasible for profit-driven organizations (we don't know what the opportunities are)
  Not enough (proposal) review before doing projects
- Lack of careful review of external projects – less freedom to change
- Too many approved projects, can't devote enough time and personnel
- Imbalance between large projects w/ high visibility and small margin for error and small, higher risk projects (*imbalance in which direction? Example?)*
- Insufficient collaboration between platforms projects (e.g. MOOS, MARS, Keck…)
- Difficult to balance short/long term projects and payoffs with existing staffing
- MBARI science different from external community (due to funding sources)
- Testing and continual development should be factored into proposal/planning process Still don't have systems that can operate without maintenance for extended periods
- *Overall weakness in setting firm organizational objectives, developing consistent vision to frame project directions and inadequate project proposal review (leading to too many projects?). Potential weakness that MBARI is reluctant to invest the resources into the infrastructure for supporting development projects in keeping with the scaling up of the size of the projects. Examples are systems engineering, project management, technician support, documentation management. Potential weakness that as MBARI continues to mature more time will be spent on bureaucratic overhead then on directly addressing engineering and science problems.*

2.2.7 Platform group and MBARI organization issues

- Interruption, loss of momentum due to reorganization
- Small size of organization
- Skills within platforms might not be accessible to rest of institute as with ME,SE,EE org
- Impotent schedule accountability (institution wide)
- Not enough opportunities to engage with scientists on their particular interests (comes from both sides)
- Current group lacks AUV systems engineering (we do have a lot of experience…)
- Better working relationships with science and operations groups
- (in our environment, high development cost, high)
- limited finances
- many types of platforms, not enough expertise across types
- *Weakness that broad range of platform types operated and under development at MBARI is too large for simultaneous specialization and technical advance in each type.*

2.3 Opportunities:

2.3.1 Observatories

- Opportunity to transfer observing system to national observing system seems to exist now.
- MBARI's role in ORION observatory efforts, MARS/MOOS/etc.
- Institutional focus on ocean observatories.
- Observatories open new platform options (eg. extended AUV deployments, hybrid ROV/AUV).
- Sharing of broad based observatory technology provides an opportunity to interact with and understand the science being done at other institutions.
- Existing connections to external science (IOOS, DESSC, ORION, NSF).
- Observatories becoming major initiative, community uncertain on how to proceed (systems engineering needed).

2.3.2 New/Evolving Technologies

- Real time data return from deep sea/long term presence.
- Design of distributed observing systems virgin territory, esp re transient processes.
- In situ power recovery for platforms and vehicles.
- Mars needs software solutions.
- Smart materials and structures for new class of platforms and vehicles.
- Rover comparatively unexploited, yet capable.
- There are many good challenges in AUV area (eg docking).
- Advances in communications. e.g. DSL
- Virtual operating environment for ROV may move ROV's ahead of HOV's for science utility.
- Coupling of heterogeneous observation systems to models beginning to be taken seriously.
- Progressive miniaturization of electronic components.

2.3.3 MBARI

- Enhanced ability to attract external funds due to MBARI contribution to projects.
- Oceanographic community recognition.
- Good resources and location for continued AUV development (strn).

2.3.4 General

- Opportunity to place MBARI personnel in community leadership roles.
- External institutional interest in MBARI technology (WHOI, NSF, etc).
- Use connections to instrument manufactures/vendor community to promote MBARI technology.

- Promote MBARI technology through conferences and peer review journals.

2.3.5 Structure/Organization

- Potential to define group wide standards for infrastructure functions (e.g. comms, power, OS).
- Refocus of personnel to platforms (providing a sense of project identity)

2.4 Threats

2.4.1 Funding/Resources

- Instability of external and MBARI funding
    - Failure to align with values of funding source (e.g. social relevance) could jeopardize funding
    - Decreased/level funding is a disadvantage
    - Increased use of external funds
        - Brings potential collaborative opportunities
        - Competitors with potential collaborators
        - MBARI not competitive with other large institutions (SIO, WHOI) in acquiring external funding
        - Use of external funding may also jeopardize our independence, makes us serve outside interests
- Resources spent supporting systems through full maturity reduces resources available for new development
- Resources required for supporting operational systems taxes resources
- Mitigated access to sanctuary resource due to increasing bureaucratic oversight

2.4.2 Competition

- WHOI
    - Direct competitors for OOI/ORION technology push
    - Technically very strong in platforms area (including areas in which we are weak: AUVs, acoustics, RF(?))
    - Established presence within science community (WHOI name associated with platforms)
    - WHOI strong in publishing peer-reviewed papers
    - Have lock on national facility (Alvin, Jason)
- Private sector
    - Domestic and international commercialization of ROVs and AUVs makes build vs buy a more difficult decision for us and for platform technology users
- Scripps/UCSD Supercomputing Center
    - Large, efficient soft-money machine
    - Strong positions in ORION, cyberinfrastructure collaborations

- Internal
    - MBARI science/ops are building their own platforms (are we really addressing their needs? Why not? Resources? Strategy?)
- Harbor Branch?

2.4.3 Core Competencies

- Competitors better able to identify and capitalize emerging technology opportunities in a timely way
- Competitors better able to choose right (science) problems AND solutions: must satisfy science and operational needs
    - Platforms are inherently high risk in terms of initial investment, length of design cycle What if we build it and they don't come?

2.4.4 MBARI Engineering Process/Execution

- Frequently changing requirements (may be a weakness - who changes requirements?)
- Not Invented Here
    - Internally, causes us to reinvent the wheel (weakness)
    - Externally, causes others not to adopt our technologies (threat)

2.4.5 Management of Intellectual Property

- Not enough peer reviewed publications relative to competitors
- IP protection mechanisms (patents, e.g.) may inhibit dissemination

2.4.6 Structure/Organization

- Product-centric structure may not optimally foster flow of knowledge across groups (how?)
- Internal and external science research directions may be divergent (which community to we serve?)
- Inability to distinguish platforms from instruments could lead to further diffusion of efforts
- Our structure may make it difficult to execute good Systems Engineering practices efficiently
- Inability to follow and respond nimbly to technological and scientific trends due to the way we are organized (how?)