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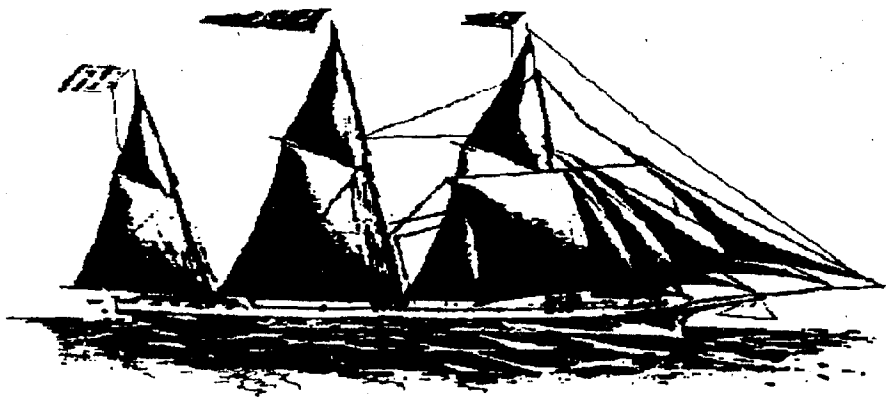
1992
Michigan Coastal Management Program
Final Report
8/1/93
Alva Bradley Shipwreck Site Documentation
and
Preliminary Cultural Resource Analysis

Submitted by
Glen Arbor Township
and
Manitou Underwater Preserve Committee
of the
Northwest Michigan Maritime Museum



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CONTENTS

Project background/rational pg.2

Grant application synopsis pg.5

Detailed description of work performed:

- National register nomination pg.7
- Video Mosaic Imaging pg.7
- Alva Bradley site mapping pg.11
- Photographic inventory of artifacts pg.11

Detailed project budget pg.12

Summary and recommendations pg.16

Acknowledgements pg.18

Attachments:

A. National register nomination
B. Video mosaic of port bow
C. Site map
D. Project safety manual
E. VMI training manual
F. Volunteer project evaluation
G. Project photographs

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PROJECT BACKGROUND / RATIONAL

The Northwest Michigan Maritime Museum was incorporated in 1981. At that time there was already expressed public interest and concern over shipwreck resources off the Benzie and Leelanau County coasts. In 1985 the Coastwatch program was initiated to facilitate public involvement in working to identify coastal shipwreck resources. 1986 saw the organization of the Manitou Underwater Preserve Committee (M.U.P.C.). This committee was charged with presenting the concept of a Manitou State Underwater Preserve to area communities and, with community approvals, pursuing state legislation to authorize the establishment of the preserve. In 1988 the Preserve was officially established and became the first State Underwater Preserve in Lake Michigan. The M.U.P.C. was reorganized as a permanent committee of the Maritime Museum and designated as the local management entity for the Preserve. A $53,000.00 project was initiated to establish a management and developmental program. $15,000.00 of this money was provided by the Michigan Coastal Zone Management Program.

An important component in the 1988 project period was the organization and training of a volunteer pool that would assist in recovery and organization of data from the field. In addition to being the only way to economically perpetuate field work after the termination of the funding period, there were many other benefits to this approach. The 1988 project period, though successful, illustrated many unforeseen and/or underestimated complexities of proposed plans. The overwhelming administrative needs of the volunteer program could not be met in 1989 by the museum or M.U.P.C. As such, a plan to continue the assessment work utilizing museum staff and local volunteers was implemented. The volume of data recovered by this effort was not satisfactory to meet proposed deadlines for assessment publication. Additionally, the "in house" work had few beneficial effects in promoting desired public recognition and involvement in Preserve development.

To continue to build public involvement and recognition, while at the same time acquiring essential assessment information, an Assistant Director position was created and filled at the museum to allow the director more time to deal with Preserve needs. A staff Field Assistant position was submitted to the Michigan Youth Corps Program, in addition to the regularly requested office assistant. A heightened effort to recruit volunteers, especially those who would be capable of leading documentation teams, was initiated. Boats and other equipment were sought out for loan or donation to assist during field operations. Finally, the museum assisted the M.U.P.C. in drafting a $5,000.00 budget that would meet minimum needs for fuel and cash expenses incurred during 1990 field operations.

As the 1990 field season approached, the volunteer pool had grown from 40 to 80. Boats and equipment were made available. An Assistant Director was hired at the Museum, and the Michigan Youth Corps approved the requested Field Assistant position. An irregularity in 1990 planning was the substantiated report of suspicious diving activity occurring on an apparent new find within the Preserve. Plans for a remote sensing orientation project were modified to address concerns. It was during this project in May 1990 that the ALVA BRADLEY was located. The State of Michigan Bureau of History provided funding assistance and support, as did the National Park Service. John Halsey of the Bureau of History was on board the search vessel at the time of its discovery. The ALVA BRADLEY had previously eluded M.U.P.C. divers. However, navigation charts indicating that it was resting in 30 ft of water provided little doubt that it had been stripped of relics and devastated by wave and ice. Much to everyone's surprise the ALVA BRADLEY presented itself as a likely undiscovered site with remarkable integrity.

The sensitivity of the ALVA BRADLEY situation prompted prioritization of work on that site, resulting in the majority of field time being directed there. A week-long project in August brought the National Park Services Submerged Cultural Resources Team, The N.P.S. National Maritime Historian, Michigan Sea Grant Program, Michigan Bureau of History, private consultants, Preserve supervisors, M.U.P.C. and volunteers together. Work centered on the ALVA BRADLEY magnetometer orientation. Field operations were terminated in mid-November with the investigation of the Maleski Pt. Fishery and the Annual recovery of the unified state marker/mooring buoys.

The ALVA BRADLEY site posed itself as a mixed blessing. It created a much desired, feature recreational dive site at Manitou. The tremendous artifact collection, association of structure and accessible depth, was unlike any other existing dive site in or around the Preserve. There was considerable pressure to make this site available to the public as soon as possible.

Responsible site management, however, dictated a methodical, time/labor intensive inventory of artifacts and site documentation. The M.U.P.C. chose not to publicize the site for recreational diving until site documentations are complete. Any conceived effort to maintain total secrecy was fruitless, however. The site's location is in a high boat traffic area and documentation efforts required public volunteers working the site during daylight hours.

Plans for a swift site documentation and inventory of artifacts were soon abandoned as the size and complexity of the ALVA BRADLEY site overwhelmed Preserve staff and volunteers. Both training and experience had been targeted to sites where simple baseline trilateration methods were appropriate. In light of the need for additional expertise, James Delgado, National Park Service Maritime Historian; Ken Vrana, Michigan Sea Grant Program; Irv Garrison,

N.O.A.A.; Larry Murphy, N.P.S.-S.C.R.U.; Ken Pott, Lake Michigan Maritime Museum; Phil Wright, S.O.S.; and others were brought to the site. Their generous assistance and advice created a methodology appropriate for documentation of the ALVA BRADLEY by M.U.P.C. staff and volunteers. Poor weather brought an early close to work at the site during the remainder of 1990.

By August of 1990, word of the ALVA BRADLEY site had worked its way into portions of sport diving circles. In that month the ALVA BRADLEY's brass dinner bell was stolen from the site. The bell was situated not 10 ft from an underwater plaque interpreting Preserve values and regulations and was removed with a survey clip attached. In October 1990 a Great Lakes sport diving journal published the location of the ALVA BRADLEY along with descriptions of artifacts and coins on the site. With the Sport Divers ethic and understanding of management concerns obviously not fully developed and the location divulged, the ALVA BRADLEY site had now become vulnerable.

Larry Murphy, expressing the opinions of all professionals exposed to the ALVA BRADLEY site, stated that "the ALVA BRADLEY site is very significant; every effort must be made to document and manage the site before negative impacts occur." Many persons, including then National Maritime Historian James Delgado, feel the ALVA BRADLEY would be clearly eligible for National Historic Register listing. With thorough site documentation in place prior to any human impact, local, state and federal managers will have an unparalleled opportunity to monitor user and environmental effects. This will allow management decisions to be made on actual site observations rather than conjecture.

Efforts directed to the management of the ALVA BRADLEY site in 1991 include the continuance of manual documentation efforts by Preserve volunteers. Additionally, a 1991 CZM grant, sponsored by Glen Arbor Township, had been awarded for the development of a Video Mosaic System and application of this system for documentation of the site. It was anticipated that this effort would greatly expedite documentation efforts at the ALVA BRADLEY and provide countless other benefits to submerged cultural resource management on the Great Lakes as a whole. Weather and other factors often inherent to research and development projects prevented the completion of a mosaic at the ALVA BRADLEY in 1991.

GRANT APPLICATION SYNOPSIS

The ALVA BRADLEY site is a case study for all states working to manage submerged resources. How do you prioritize, fund and administer archeological survey efforts? How do you balance the often conflicting interests of museums, archaeologists, sport divers, salvors, fishermen and the general public. What, if any, are considered acceptable compromises to the resource itself? To begin to answer some of these questions, the 1992 CZM project focused on the following objectives.

PROJECT OBJECTIVES

1. To nominate the ALVA BRADLEY as an archeological site on the National Register of Historic Places.

2. To develop the local resources to allow the completion of a video mosaic on the ALVA BRADLEY site in 1992, and to be able to cost effectively continue to apply this technology to other appropriate sites in the Preserve.

3. To finalize a scaled site map and photographic artifact inventory and to preliminarily evaluate the condition of the ALVA BRADLEY and its artifact assemblage.

4. To illustrate the results of these investigations in a report that will serve as a planning document for the local preserve committee and other managers in determining future strategies at the ALVA BRADLEY and other sites.

PROJECT DESCRIPTION

Since the discovery of the ALVA BRADLEY, every effort has been made to properly manage the site. Despite impedances, progress has been continually gained. Additionally,local heritage resource awareness and management expertise has been enhanced. The next logical step in the stewardship of this site is to complete a scaled site map and mosaic. 70% of the work necessary for the development of the scaled site map has been completed. Further work to complete the map will entail investigation of wreck structure and artifacts peripheral to the site and integration of structure detail. The development of the site map and video mosaic will be intertwined as each assists in the development of the other. Museum staff and Preserve volunteers will conduct the bulk of this work.

The four person Video Mosaic team (VMI) will work with a core group of four to six local Preserve volunteers and museum staff. The VMI team will contractually provide:

1. System design and development consultation.
2. System capabilities evaluation.
3. Grid and construction assistance.
4. On shore deployment and operational training.
5. On site deployment, operational training and assistance.
6. Editing training, operational assistance and extended editing consultation.
7. Consultation, on site assistance and evaluation of still photo documentation efforts.
8. Assistance with overall operations when possible or necessary.

The newly developed grid system will incorporate the knowledge gained from the 1991 research and development effort. It will become the property of the Manitou Underwater Preserve Committee (M.U.P.C.) on future site documentation efforts and made available to other preserves.

To document as much of the artifact assemblage as possible before additional impacts occur, a complete photographic inventory of the collection will conducted. Artifacts will be assigned identifiers correlating with numbered VMI image sectors. The data and imagery will be of great service in documenting the "as found" condition of the site, providing information for archaeologists and conservators analyses, support for N.H.R. nomination and public site interpretation.

National Register listing is important to Michigan's submerged Cultural Resource program as a whole. The process is an excellent means of defining categories and establishing priorities for significance. Listing provides an incentive for preservation by recognizing resources worthy of management and preservation efforts, affords a measure of protection from Federal undertakings and can be a source of, or enhance, funding efforts. Finally, it will bolster the National Park's efforts to heighten awareness of submerged cultural resources and increase National Register nominations.

Nomination of the ALVA BRADLEY to the National Register as an Underwater Archeological Site will be an important foundation for further work necessary at the site. Many management decisions surrounding the ALVA BRADLEY will be based on "values" associated with the site. The National Register nomination process will take uniform national standards for significance and integrity and apply them to the ALVA BRADLEY, an important step in assessing "value." If and when the nomination is accepted, the ALVA BRADLEY will be only the third site in Michigan waters to possess this designation. The majority of the nomination work will be conducted by qualified Maritime Museum staff, professionals and volunteers with consultation provided by the State of Michigan Historic Preservation Office, The National Maritime Initiative Staff in Washington D.C. and supervising archaeologists at Manitou.

DETAILED DESCRIPTION OF WORK PERFORMED

NATIONAL REGISTER NOMINATION

Work commenced in April 1992. Jed Jaworski, Director of the Northwest Michigan Maritime Museum, researched and drafted the nomination. Steve Harold of the Manitou Underwater Preserve Committee, Jay Martin of the Institute for Great lakes Research, and John Allen and Thomas Stoltmann of the Northwest Michigan Maritime Museum provided additional research and assistance.

During the lengthy research phase of the nomination, members of the Bradley family were located and interviewed. Mrs. Morris Alva Bradley provided a great deal of information. Mrs. Bradley related the existence of an original oil painting of the schooner as well. Like many "compelling" research projects it was difficult to terminate the research phase, knowing that potential untapped sources of information remain. Especially compelling is information and memorabilia relating to Thomas Alva Edison which is housed in museums and historic sites in other states. For instance an oil portrait of Captain Alva Bradley hangs at the foot of Thomas Alva Edison's bed in his Childhood home at Milan, Ohio. It would be interesting to know what influence Captain Alva Bradley had upon Edison's life.

Museum staff hours total in excess of 200 hours researching and assembling the nomination. As few shipwreck site nominations have been done on the Great Lakes, only three examples were available. The State Historic Preservation Office was very helpful and provided copies of existing nominations.

It is felt that the nomination submitted will support designation of the wreck site to the national register. When designation occurs, appropriate press releases will be made and a plaque placed on site. The Michigan Coastal Management Program will receive full recognition for its support of the nomination process.

VIDEO MOSAIC IMAGING

Efforts to implement the Video Mosaic Imaging (VMI) portion of this project can be divided into three major phases: 1. planning, 2. field implementation, 3. editing.

1. PLANNING

The 1992 Video Mosaic Imaging project benefitted from a CZM sponsored VMI development project implemented at Manitou in 1991. The 1991 project provided support for the belief that a Video Mosaic Imaging system could be effectively developed and utilized by non-professionals to document submerged sites. A contract was entered into with Great Lakes Visual/Research, the developers of

the Video Mosaic concept. The terms of this contract and the responsibilities of the parties involved with the proposed project consumed a great deal of time. Two factors may be responsible for this. One, GLV/R seemed to have a rather clouded development concept for VMI, Secondly, the M.U.P.C. could not "lock in" resources required in the contract. Preserve managers would like to have simply purchased goods and services to support VMI needs, ensuring their availability. However, depending on donated goods and services is the reality in which the M.U.P.C. must presently operate, for better or worse.

Concerns over safety and liability have also placed increasing demands on Preserve operations. Determining who is responsible is often viewed as who is "liable." Efforts to minimize potential liability have proven to be time consuming and costly. Fewer and fewer volunteers are willing to take responsibilities when there cannot be blanket coverage or guarantees protecting them from lawsuits. This reduces the pool from which qualified leaders can be recruited. Aside from these matters overall planing was well executed.

2. FIELD OPERATIONS

Field operations were considered a complete success by the Preserve Committee. For narrative of field operations see Attachment E.

1992 VMI CZM FIELD TRAINING DIVE SUMMARY

DATE	TANKS	DIVERS PARTICIPATING	TOTAL DIVE TIME
Mon. 8/3	10	7	8.8 hrs
Tue. 8/4	0	0 (weather cancellation)	0
Wed. 8/5	19	10	15.6
Thu. 8/6	18	12	14.8
Fri. 8/7	16	11	15.4
Sat. 8/8	3	3 (weather interruption)	2.2
Sun. 8/9	13	6	17.1
TOTAL:	79		73.9

3. EDITING

Defining editing needs for VMI is a difficult task. GLV/R was unable to easily define hardware and software requirements for the resources at our disposal which were primarily IBM related. Two professional computer consultants were brought in to assist. The Brauer Productions computer at our disposal is an IBM compatible, with an Intel 80386DX processor. It is equipped with a 14" multisync monitor and a standard VGA 640 x 480 resolution by 16 color video control card. This card is not capable of producing 64 gray scales on a black and white picture. To remedy this problem, a Boca Research super VGA card was purchased. This card is capable of producing the necessary resolution (640 x 480) and 16 gray scales necessary. In order to do this, the card must be able to handle 640 x 480 resolution and 256 colors.

It was decided originally by GLV/R that an existing paint program (Deluxe Paint II Enhanced) could be used to assemble the Photo Mosaic. This was not the case due to incompatibility with the video card. The reason is that there is no official standard for IBM compatible video systems having higher resolution (640 x 480) or more colors (16) than the VGA standard. There is a unofficial standard (VESA). The Boca video card will handle VESA, but the old version of Deluxe Paint II Enhanced will not. A later version of Deluxe Paint II Enhanced that will conform to VESA was purchased.

The Brauer system did not then possess enough Random Access Memory (RAM) to run the composite or "mosaic" image with Deluxe Paint II enhanced. For technical reasons the RAM could not be expanded. Steve Alexander of Graphics Wizards was called in as a consultant to determine whether the Brauer system could be made to meet requirements. It was finalized that the computer could not be expanded to accommodate VMI needs. With further experimentation a means of assembling a mosaic was identified and implemented with success. It involved the use of components of the Brauer System and computers located at the Graphics Wizards suite. The system successfully used is as follows:

The wreck imagery is captured and stored on super 8mm video tape. At Brauer Productions this is feed directly into a Fortell 525 time base corrector to "freeze" the image. It is then placed into a Vision "16" frame grabber/digitizer. The digitized image is then stored on a high density floppy disk as a TARGA file. Two images can be stored on one disk as each image is approximately 500 kilobytes. The disks are then transferred to the Graphics Wizards suite were they are loaded into a Macintosh II CI with 8 megabytes of RAM, a 120 megabyte disc and graphics accelerator card. An Apple file exchange program facilitates TARGA file being transferred from IBM to Macintosh systems. The Adobe Photo Shop software program facilitates the assembly of the mosaic. Experimentation also proved the mosaic could be assembled with equal ease on an IBM system possessing the same capabilities as the Macintosh. In this instance the Aldus Photo Styler program is utilized.

With this system twenty-five images can be assembled at a time. There were approximately 250 images secured during the project period encompassing about 1/4 the wreck site. As such, there would be ten "cut and paste" mosaic sections of twenty-five images assembled outside the computer. An average of twenty minutes is needed to integrate a single image file into the mosaic. This would place the total computer time needed to assemble the complete mosaic in excess of 330 hours. To arrive at a realistic figure for completion of the mosaic, figures for field acquisition bottom time can be applied. This would place the total diving/editing time in excess of 628 hours or 78.5 eight-hour working days. This figure does not take into account planning and travel time or any addition increases/deceases in efficiency that may developed.

To complete the mosaic of the ALVA BRADLEY wreck site additional funds must be acquired to either contract for computer services or purchase the hardware and software. A general outline of these costs are listed below for comparison purposes. These are non-negotiated flat rates/costs.

Contracted service:

Graphics Wizards computer editing suite (Includes operator)	
326.5 hrs @ 45.00	$14,692.50
Brauer Productions editing suite (includes operator)	
25 hrs. @ $80.00 hr	$2,000.00
Total	$16,692.50

Equipment purchase:

Macintosh computer	$4,500.00
Printer	$8,000.00
Software	$400.00
Frame grabber	$3,500.00
Total	$16,400.00

VMI SUMMARY

VMI provided a provocative alternative to time/labor intensive manual site documentation. Its potential has been clearly defined by the people who conceptualized it and embraced by many working in the field of submerged resource management. Developing a tool to easily acquire highly accurate site maps would fulfill a great need at the dawn of the zebra muscle invasion on the Great Lakes. The applicability of VMI to the shallow wrecks of the Manitou Preserve made it especially attractive. As such the Manitou Preserve has been involved closely with its development.

After the 1992 project period, however, the M.U.P.C. experienced reservations about the practicality of VMI at Manitou. It is now realized that the demands associated with implementing VMI at the ALVA BRADLEY site is in excess of previous expectations. These demands have exceeded the resources presently available at Manitou. Preserve volunteers, sub-contractors and M.U.P.C. members have all dealt with their share of frustration trying to carry out the 1992 project. It is unlikely that the Preserve will be able to raise the funds and organize the people and resources needed to continue the operation in the immediate future.

In addition to the information and experience gained in piloting the VMI concept, the 1992 effort produced many positive results. Available now is a functional grid and trained and experienced dive team to support VMI operations. The equipment and personnel will be available for needs at Manitou and elsewhere. The images of the port bilge section, while not yet completely assembled, will provide accurate and valuable information. With each passing day computer hardware and software is advancing in technology and declining in price. Since editing began on the 1992 VMI project, advances in paint software have already been realized. Especially attractive is the Adobe "Photo Shop" paint program which will run on both IBM and Macintosh systems.

ALVA BRADLEY SITE MAP

The ALVA BRADLEY site map is not fully developed at this time. This is a result of not being able to utilize VMI imagery as a drawing resource. It is anticipated that the map will be completed to the fullest extent presently possible by 9/15/93.

PHOTOGRAPHIC INVENTORY OF ARTIFACTS

Work in this area was aborted due to lack of sufficient resources. VMI imagery has recorded artifacts in the port bilge section surveyed during the project period. CZM funds allocated for this portion of the project are not being requested.

DETAILED PROJECT BUDGET

1992 ALVA BRADLEY CZM Expense Record

CZM funded expenses: **Last receipt # 58**

VMI

grid design, const. training, deployment, operations.

Rct.#	Date	Expenditure	Amount
34		Gas Crescent City, site prep.	$39.30
1	8/7	Gas, B. Steven's van, tank shuttle	$16.00
2	8/5	" "	$18.00
3	8/10	" "	$18.00
4	7/3	Gas, J. Jaworski, proj. adm.	$28.75
5	8/4	" "	$10.00
6	8/7	" "	$5.00
7	8/7	Gas, Chaos, tank shuttle	$39.42
8	8/10	" "	$10.40
9	8/3	Gas, 1 1/2" pump	$.65
10	8/3	Gas, Crescent City, operations	$22.00
11	8/8	" "	$15.00
12	8/9	" "	$15.80
13	8/6	Gas, Narcosis, operations	$30.00
14	8/7	Gas, Ruffian, operations	$40.00
20	8/21	" "	$40.00
21	8/5	" "	$30.00
22	8/6	" "	$20.00
23	8/21	Gas, Crescent City, site invst.	$12.50
51	8/13	Gas, Narcosis, operations	$217.25
55	2/4	GLV/R - grid, training etc.	$6,500.00
61	2/4	GLV/R - " "	$500.00
Total			$7,628.07

Photographic supplies, cameras, editing

15	8/12	two 8mm video tapes	$20.76
16	-	" "	$20.76
17	8/3	one 8mm video tape	$10.38
52	8/10	V-9 video camera rental	$200.00
56	10/2	Commercial editing facility	$750.00
60	2/4	Commercial editing facility	$250.00
57	1/13	Graphics wizard	$17.69
58	1/13	Graphics wizard	$250.00
59	2/4	photo duplication	$84.00
Total			$1,603.59

CZM expenses cont.

Administrative costs & misc.

18	8/6	Electric plug for hydrophone	$2.70
19	8/5	Fuses for hydrophone	$1.25
24	-	Paper	$7.80
25	-	Copies	$1.40
45	3/3	Daily ledger, log sheets	$11.96
46	3/11	File tabs	$1.85
47	3/16	Sheet lifters	$1.71
48	5/4	Daily ledger	$3.64
49	6/9	Printer ribbon	$3.84
50	3/18	Envelopes	$3.50
35	3/18	Copies	$1.35
26	6/16	Fax	$4.68
27	7/2	Fed X mail	$12.50
28	6/22	Postage	$8.70
29	6/24	" "	$1.04
30	6/22	" "	$3.23
31	8/26	" "	$.99
36	4/17	" "	$2.13
37	4/20	" "	$2.59
38	3/10	" "	$1.96
39	6/15	" "	.58
40	6/13	" "	.87
41	6/15	" "	.39
42	4/27	" "	$2.89
43	3/15	" "	$2.08
44	8/27	" "	$5.80
32	8/13	Telephone	$73.51
33	7/13	" "	$4.30
55	11/4	" "	$5.32
56	9/4	" "	$3.42
53		Project administrator 84 hrs @ $8.50	$714.00
54		Project Administrator 76 hrs @ $8.50	$646.00
59		National register nomination	$960.00

Total----------$2,497.98

TOTAL ALL CZM EXPENSES.....$11,729.64

MATCHING FUNDS/IN-KIND SERVICES
1992 ALVA BRADLEY CZM PROJECT

Establish moorings, site preparation:

Vessel Crescent City- 2 days @ $350.00 day	$700.00
Divers- 2 @ $25.00 hr. 4 hrs.	$100.00
Standby- 2 @ $10.00 hr. 7 hrs.	$140.00
Crew- 1 @ $10.00 hr. 9 hrs.	$90.00
Capt.- 1 @ $22.00 hr. 9 hrs.	$198.00
Total----------	$1,228.00

Vessels utilized for VMI field operations:

Crescent City- 2 days @ 350.00 day	$700.00
Narcosis- 4 days @ 350.00 day	$1,400.00
Ruffian- 8 days @ 350.00 day	$2,800.00
Good Harbor- 7 days @ 100.00 day	$700.00
Total----------	$5,600.00

Volunteer VMI divers:

8/2 VMI training- 10 @ $10.00 hr. 4 hrs.	$400.00
8/3 in water- $25.00 hr. 9 hrs.	$125.00
8/3 other- 5 @ $10.00 hr. 12 hrs.	$600.00
8/4 other- 7 @ $10.00 hr. 6 hrs.	$420.00
8/5 in water- $25.00 hr. 16 hrs.	$400.00
8/5 other- 6 @ $10.00 hr. 12 hrs.	$720.00
8/6 in water- $25.00 hr. 15 hrs.	$375.00
8/6 other- 8 @ $10.00 hr. 12 hrs.	$960.00
8/7 in water- $25.00 hr. 15 hrs.	$375.00
8/7 other- 10 @ $10.00 hr. 12 hrs.	$1,200.00
8/8 in water- $25.00 hr. 3 hrs.	$75.00
8/8 other- 5 @ $10.00 hr. 8 hrs.	$400.00
8/9 in water- $25.00 hr. 17 hrs.	$425.00
8/9 other- 4 @ 10.00 hr. 12 hrs.	$480.00
Total----------	$6,955.00

Matching cont.

Other:

Museum Staff- 120 hrs. @ $8.00 hr.	$960.00
Jay Martin, Steve Harold, Thomas Stoltmann Professional archival research and writing 50 hrs. @ $20.00 hr.	$1,000.00
Lodging- 20 occupant days @ $25.00 day	$500.00
Tank shuttle boat, van and operator 7 days @ $114.00 day	$798.00
Great Lakes Scuba Scuba tank fills- 79 @ $3.30 ea.	$276.50
Scuba North V-9 video camera rental	$200.00
Graphics Wizard computer consulting- 2 days @ $45.00 day	$90.00
Brauer Productions underwater video camera- 90 days	$2,000.00
N.W.M.M.M. VMI administrative- 32 hrs. @ $8.50 hr.	$ 272.00
Total----------	$6.096.00

TOTAL MATCHING FUNDS.....$19,879.50

TOTAL PROJECT COST:

CZM funds	**$11,729.64**
Match	**$19,879.50**

GRAND TOTAL.....$31,609.14

PROJECT SUMMARY AND RECOMMENDATIONS

The process of administering this CZM project and other submerged cultural resource programs at Manitou continue to provide useful information. In the case of this project it is apparent that strong organization is critical. Failure to fully achieve all of the project goals is largely due to the learning curve associated with VMI. However, the project was also hindered by the lack of a strong administrative entity with financial resources.

The staff of the Northwest Michigan Maritime Museum have always been at the disposal of the M.U.P.C. During this project period the museum was involved in a difficult transition. Aside from the field operations period, no museum staff have been available to assist with the project. The demands of work and family limit the amount of time available to M.U.P.C. members for hands on involvement. Volunteers organized by the committee also have limitations and require supervisory staff when utilizing VMI.

Keeping the projects momentum up became very difficult in the face of technical and financial demands that exceeded the museum and Preserve's present resources. The planning and organizational period offered its challenges. No National Park Service housing or boat dockage was available, contract negotiations with GLV/R were difficult, boats and dockage were hard to acquire. The amount of time and resources necessary to draft the National Register nomination could only be vaguely estimated.

The VMI field training and operations went well during the initial project period. Working on continued image acquisition and editing posed setbacks. The amount of time utilized in accessing the site and assembling and placing the grid makes a "weekend" approach to image acquisition impractical. The VMI grid would likely not withstand poor weather so it cannot left on site until weather or opportunity permits work to continue. The situation (on the ALVA BRADLEY) necessitates large project "periods" then to gather imagery. This demands high levels of organization and resources. This is problematic, given the volunteer nature and small budgets of most community-based preserve management entities.

The M.U.P.C. feels that VMI, as it is presently configured, does not meet the goals for which it was targeted. The time, expense, and high organizational demands negate its potential value. The VMI system does work in the sense that volunteers can be trained relatively easily to gather good imagery. With practice and technical support, this imagery can be assembled into an accurate mosaic. Although the system has not been utilized to document a complete site, it is easy to see that a final product could be of unequalled value. It appears that VMI would work best within a professionally administered program. This project, however, has illustrated volunteers can effectively and efficiently contribute to VMI. As such community-based volunteer groups could perform VMI with adequate funding and professional input and/or supervision.

As resources available to preserves increase and professionals become more accessible, the application of VMI will become more practical. These observations are based on two years of experience in helping to develop the system.

The M.U.P.C. is disappointed that the results of the project were not more encouraging. The work involved in administering a professional level of stewardship for sites like the ALVA BRADLEY has become overwhelming. The M.U.P.C. will continue to work to the best of its abilities to care for the site. We greatly appreciate the contributions of the Michigan Coastal Management Program. Their contributions provided valuable support to local submerged cultural resource management efforts.

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Humanities Collection Staff

Michigan State Archives

Michigan Bureau of History
Scott Peters

In addition to the aforementioned, many others contributed to this effort; we greatly thank them all.

Attachment "A"

NPS Form 10-900
(Oct. 1990)

OMB No. 10024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Schooner ALVA BRADLEY, Shipwreck Site

other names/site number U.S. Official No. 1910.

2. Location

street & number North Manitou Shoal, Lake Michigan ☒ not for publication

city or town North Manitou Island ☐ vicinity

state Michigan code MI county Leelanau code 089 zip code 49654

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this ☐ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. I recommend that this property be considered significant ☐ nationally ☐ statewide ☐ locally. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State of Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is: Signature of the Keeper Date of Action

☐ entered in the National Register.
☐ See continuation sheet.

☐ determined eligible for the National Register
☐ See continuation sheet.

☐ determined not eligible for the National Register.

☐ removed from the National Register.

☐ other, (explain:)

Schooner ALVA BRADLEY
Name of Property

Leelanau, MI
County and State

5. Classification

Ownership of Property
(Check as many boxes as apply)

- ☐ private
- ☐ public-local
- ☒ public-State
- ☐ public-Federal

Category of Property
(Check only one box)

- ☐ building(s)
- ☐ district
- ☒ site
- ☐ structure
- ☐ object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
		buildings
1		sites
		structures
		objects
1	0	Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing.)

_____

Number of contributing resources previously listed in the National Register

N/A

6. Function or Use

Historic Functions
(Enter categories from instructions)

Transportation/Water-related

Current Functions
(Enter categories from instructions)

Vacant/Not in Use

7. Description

Architectural Classification
(Enter categories from instructions)

N/A

Materials
(Enter categories from instructions)

foundation N/A
walls N/A
roof N/A
other N/A

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

Schooner ALVA BRADLEY
Name of Property

Leelanau, MI
County and State

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- [X] **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] **B** Property is associated with the lives of persons significant in our past.
- [X] **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [X] **D** Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark "x" in all the boxes that apply.)

Property is:

- [ ] **A** owned by a religious institution or used for religious purposes.
- [ ] **B** removed from its original location.
- [ ] **C** a birthplace or grave.
- [ ] **D** a cemetery.
- [ ] **E** a reconstructed building, object, or structure.
- [ ] **F** a commemorative property.
- [ ] **G** less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance
(Enter categories from instructions)

Maritime History
Transportation
Archaeology/Historic--Non-Aboriginal
Engineering
Invention

Period of Significance

1870-1894

Significant Dates

1871
April 1875
1888
1894

Significant Person
(Complete if Criterion B is marked above)

Cultural Affiliation

N/A

Architect/Builder

Quayle & Martin

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographical References

Bibliography
(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS):

- [ ] preliminary determination of individual listing (36 CFR 67) has been requested
- [ ] previously listed in the National Register
- [ ] previously determined eligible by the National Register
- [ ] designated a National Historic Landmark
- [ ] recorded by Historic American Buildings Survey # _____
- [ ] recorded by Historic American Engineering

Primary location of additional data:

- [ ] State Historic Preservation Office
- [ ] Other State agency
- [ ] Federal agency
- [ ] Local government
- [ ] University
- [X] Other

Name of repository:

Northwest Michigan Maritime Museum

Schooner ALVA BRADLEY
Name of Property

Leelanau, MI
County and State

10. Geographical Data

Acreage of Property 2 acres around site

UTM References
(Place additional UTM references on a continuation sheet.)

	Zone	Easting	Northing
1			
2			
3			
4			

☐ See continuation sheet

Verbal Boundary Description
(Describe the boundaries of the property on a continuation sheet.)

Boundary Justification
(Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title Jed K. Jaworski and John Allen

organization Northwest Michigan Maritime Museum date 8-12-93

street & number P.O. Box 388 telephone (616) 326-5152

city or town Empire state MI zip code 49630

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A **USGS map** (7.5 or 15 minute series) indicating the property's location.

A **Sketch map** for historic districts and properties having large acreage or numerous resources.

Photographs

Representative **black and white photographs** of the property.

Additional Items
(Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of SHPO or FPO.)

name _____

street & number _____ telephone _____

city or town _____ state _____ zip code _____

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C. 470 *et seq.*).

Estimated Burden Statement: Public reporting burden for this form is estimated to average 18.1 hours per response including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Chief, Administrative Services Division, National Park Service, P.O. Box 37127, Washington, DC 20013-7127; and the Office of Management and Budget, Paperwork Reductions Projects (1024-0018), Washington, DC 20503.

SUMMARY

The three-masted schooner ALVA BRADLEY, U.S. reg. #1910, was constructed at Cleveland, Ohio in 1870 at the renowned Quayle & Martin shipyard. Built of oak, the ALVA BRADLEY measured 694 gross tons, had a net tonnage of 616, a length of 189.5 feet, a beam of 32 feet, and a draught of 13.9 feet. The ALVA BRADLEY was one of the first vessels on the Great Lakes to use iron-wire rigging. During a gale on October 13, 1894, the vessel sprang a leak in northern Lake Michigan and sank in twenty-six feet of water on the North Manitou Island Shoal. Subsequent salvage efforts recovered most of the ALVA BRADLEY's deck machinery and cargo of steel billets.

Discovered in May of 1990, the ALVA BRADLEY today remains in nearly the same condition as described by salvors' accounts in the fall of 1894. The sides of the vessel have broken off at the bilge turns. The bilge and keelson remain intact and measure 182 feet in length with the stem still rising off the lake bottom. The centerboard, rudder, bows, cabinwork, shipboard appliances, and rigging are largely represented. A vast collection of artifacts lie scattered throughout the site. The wreck rests within the Manitou State Underwater Preserve and is the subject of an ongoing study by the Manitou Underwater Preserve Committee.

VESSEL HISTORY

The ALVA BRADLEY was built in 1870 by master shipbuilders Thomas Quayle and John Martin at their shipyard in Cleveland, Ohio. The vessel was touted as "...one of the best ever built by these well known shipbuilders. Nothing has been spared to make this vessel first-class in every particular, and the builders have succeeded in everything they undertook (Toledo Blade, July 12, 1870)."

When launched the new custom house measurements listed the ALVA BRADLEY's length at 190 feet; breadth of beam at 32 feet; depth of hold at 14 feet, with a registered gross tonnage of 649, and a net tonnage of 616. On July 16th, the vessel was enrolled at Cleveland, Ohio. Listed as owners are Quayle & Martin, Alva Bradley, and Captain George Stone, the latter of whom commanded her (Detroit Advertiser & Tribune, July 12 1870; ALVA BRADLEY Enrollment Document).

On the afternoon of July 10, 1870, the ALVA BRADLEY departed from Cleveland on its maiden voyage to load iron ore at Escanaba, Michigan (Toledo Blade, July 12, 1870). On the return voyage to Cleveland, the ALVA BRADLEY carried within its hold a record breaking 1387 net tons of ore (for the port of Cleveland) (Cleveland Herald, September 9, 1870). Often referred to as "Old Man Bradleys' Pet", the ALVA BRADLEY quickly became one of Quayle & Martin's most valuable

vessels (Miller 1989:4). In 1871 the ALVA BRADLEY was listed by Lake Underwriters in A-1 condition with a value of $45,000.00. In 1873 the vessel received an A-1 rating with a $40,000.00 value (Lake Underwriters 1888; Inland Lloyds 1888:10).

The owner's of the ALVA BRADLEY spared little expense on their favorite ship, and continually tried to improve the vessel. While laid up for the winter in 1871, the ALVA BRADLEY had its hemp standing rigging replaced with a new set of iron-wire rigging imported from Great Britain (Apparently the ALVA BRADLEY was the first vessel from Cleveland and possibly Ohio to use wire rope.)(Runge Card file; Door County Advocate, November 10 1894). A gang of riggers, specifically hired for the task, came to Cleveland from the East coast to work on the ALVA BRADLEY. The schooner's new iron-wire rope, "...was cut to lengths at an importing house on Broadway and cost a handsome price in gold (Runge Card File; Door County Advocate, November 10, 1894)." Skeptical of the ALVA BRADLEY's innovative new rigging, shipbuilders and sailors throughout the region predicted disaster for any ship that used wire rope. Wire rigging did not become fully accepted by shipbuilders on the Great Lakes until after 1874 (Martin 1990: 9). Hemp lanyards, which permitted more spring in the standing rigging, were still the preferred rig in 1871. Contemporary critics considered iron turnbuckles and wire rope too rigid and the "...worst thing[s] ever put on a vessel (Runge Card File; Door County Advocate November 10, 1894)." Nonetheless, the ALVA BRADLEY received its new rigging and sailed for over four years without a mishap--proving the skeptics wrong (Runge Card File, Door County Advocate, November 10 1894; Detroit Free Press, October 16, 1894).

In April of 1875 the ALVA BRADLEY's trouble free career came to an end when the schooner sank at Buffalo, New York for unknown reasons. On April 28 the large schooner was raised and placed in a dry dock at R. Mills & Co., where extensive repairs were made (Cleveland Herald, April 29, 1875). Following these repairs the ALVA BRADLEY's listing changed to an A-2 condition with a $30,000.00 value. Later in November of 1879 the schooner lost its sails during a gale on Lake Michigan. The ALVA BRADLEY's 1879 rating still remained A-2, but the vessels value dropped to $19,000.00. In 1882 the ALVA BRADLEY had its stern and deck replaced. Her Inland Lloyds listing for that year was A-2 with a $24,000.00 value. In the spring of 1883 the ALVA BRADLEY's ownership changed to the Bradley Transportation Co., of Cleveland, Ohio (Lake Underwriters 1888; Inland Lloyds 1888:10).

The ALVA BRADLEY over its career proved a very stout and hardy vessel. The large schooner endured numerous close calls with disaster, before finally meeting its demise. One such near disaster occurred on Lake Superior in late October of 1887. On Saturday, October 24, the ALVA BRADLEY, with nine crew members and Captain A.B. Parsons aboard, cleared the Soo Locks,

bound for Marquette, Michigan. The schooner carried within its hold 1,075 tons of coal for the locomotives of the Duluth, South Shore & Atlantic Line. Upon leaving the locks the ALVA BRADLEY's crew found themselves' sailing in the wake of the schooner GEORGE SHERMAN (#10218), which stayed in sight all that day (Miller 1989:1-2; Marquette Daily Mining Journal, October 24, 1887).

A storm struck early in the evening as both vessels rounded Whitefish Point. Gale-force winds rose from the east, driving tremendous seas before them. By Sunday morning the wind had swung to the north, bringing with it a blinding wall of snow. The ALVA BRADLEY made heavy weather of it all morning, locked in the grip of a terrible blizzard. That afternoon, as the ALVA BRADLEY came in sight of Shot Point, near Marquette, the vessel struck bottom and stranded. The thundering surf quickly swept away the schooners yawl boat. Captain Parsons and his men now had no means of escape from the helpless ship. Nearby, the GEORGE SHERMAN also lay stranded, her crew, however; safely made it ashore (Miller 1989:2-3; Marquette Daily Mining Journal, October 24-26, 1887).

The crew of the ALVA BRADLEY found themselves in an extremely perilous situation. Ice coated the entire vessel and the deck began to weaken. To keep from freezing the crew retreated to the cabins below, where they spent the night. As dawn broke the citizens of Marquette noticed people moving about on the still intact ALVA BRADLEY (Miller 1989:3; Marquette Daily Mining Journal, October 26, 1887).

Hearing of the ALVA BRADLEY's plight the captain of the fifty-six year old harbour tug A.C. ADAMS decided to attempt a rescue. The ADAMS, however, could not get in close enough to the grounded schooner. Also, twenty-foot seas prevented the crew of the tug from launching a boat. Dismayed, the towns people watching the failed attempt from the beach sent a telegram to the Portage Life-Saving Station, asking for help (Miller 1989:3; Marquette Daily Mining Journal, October 26, 1887).

Aboard the ALVA BRADLEY, Captain Parsons and his crew waited and watched. Shortly after noon the GEORGE SHERMAN began breaking up and the sailors concluded that their ship would do the same. Mercilessly the waves pounded the ALVA BRADLEY causing the schooner to work hard against the bottom. Yet, the vessel withstood the continuous beating from the twenty-foot seas throughout the day and into the night (Miller 1989:4, Marquette Daily Mining Journal, October 24-26, 1887).

Meanwhile, the life-saving crew at Portage, 130 miles away, loaded their surfboat onto the South

rescue attempt, up to that time, by the Life-Saving Service.). Arriving in Marquette at 10:00 p.m. the crew of eight under the command of Captain Ocha, immediately set about preparing their surfboat for the rough ride out to the ALVA BRADLEY. The captain of the A.C. ADAMS, volunteered to assist in the rescue, by towing the surfboat out to the wreck. At 1:00 a.m. on October 26, the tug with the surfboat in tow arrived off of Shot Point. Soon afterwards Captain Ocha and his crew made it safely onto the deck of the ALVA BRADLEY. After loading the crew of the helpless schooner into the surfboat Captain Ocha headed back to the A.C. ADAMS. The tug, however, had turned back for Marquette leaving Captain Ocha and his crew to fend for themselves in the open surfboat. The surfboat returned to the ALVA BRADLEY long enough for the crew to rest up before attempting to land on the beach. The ALVA BRADLEY's crew returned to Marquette by train to wait out the storm (Miller 1989:3; Marquette Daily Mining Journal, October 26-27, 1887).

On Wednesday, October 28, Captain Parsons and his crew boarded the ALVA BRADLEY to salvage their personal possessions. Finding the schooner in relatively good condition the captain ordered the crew to clear the ice off the vessel. Several days later J.H. Gillett of Marquette arrived with two steam pumps and eventually succeeded in dewatering the ALVA BRADLEY (Marquette Daily Mining Journal, October 29, 1887). On November 4, the refloated schooner finally made it to Marquette, where stevedores unloaded its cargo. Though the ALVA BRADLEY took a tremendous pounding from the heavy seas, the well-built schooner only needed minor repairs to its hull before being towed to Sault St. Marie, Michigan for winter lay up (Miller 1989:4; Marquette Daily Mining Journal, November 3-6, 1887).

During the 1887-1888 lay up, the ALVA BRADLEY underwent extensive repairs--somewhat altering the vessels appearance (This is also when the schooner was probably converted to a schooner barge.). The schooner had its deck raised (double decked), hull refastened, and a steam "donkey" boiler added to power the capstans, pumps, and windlass (Runge Card File; Inland Lloyds 1888:10). The raising of the deck increased the ALVA BRADLEY's depth of hold by 6.3 feet and its net tonnage by 283. In April of 1888 the schooner's new dimensions were listed as having a length of 192.2 feet, a beam of 32.0 feet, a depth of 20.2 feet, a gross tonnage of 934, and a net tonnage of 899. The ALVA BRADLEY had an A-2 rating and a listed value of $30,000.00. For the remainder of the ALVA BRADLEY's days the schooner would remain in tow behind a steamer, using its sails only to assist in favorable winds or in an emergency (Inland Lloyds 1888:10).

Not even a year after the ALVA BRADLEY's near loss, the newly converted schooner barge became imperiled again. While in tow of the steam barge E. B. HALE (#135012) the ore laden ALVA BRADLEY hit a submerged obstruction when passing Lime Kilns Crossing on Lake Huron.

The collision carried away the schooner barges steering gear and holed its hull. Then the tow line parted and the ALVA BRADLEY drifted downstream and sank in sixteen feet of water, about 100 feet west of Bois Blanc Island. The HALE proceeded on to Cleveland where her crew loaded two steam pumps on board and immediately headed back to the rescue of the ALVA BRADLEY (Detroit Free Press, July 13, 1888).

On July 20, the ALVA BRADLEY was afloat and in Malden. On July 22, additional pumps were put aboard and the crippled schooner was towed to Cleveland to discharge its cargo. The tug FOREST CITY, (#120255), then towed the ALVA BRADLEY to Amhurstburg on July 23, where a diver worked on the schooners bottom while five steam pumps kept the ship afloat. On the 25th the ALVA BRADLEY left Amhurstburg in tow of the FOREST CITY for Lorain, Ohio with two pumps steadily working. According to a Detroit Free Press writer, Captain John Quinn the manager of the salvage operation "...has completed a job he may well be proud of" (Detroit Free Press, July 24-25, 1888).

On August 7, 1888, Captain Wysoon of Cleveland took command of the ALVA BRADLEY. On May 5, 1889 the ALVA BRADLEY crashed into the Chicago, Milwaukee & St. Paul Bridge near Clybourn Avenue in Milwaukee, Wisconsin . The schooner caused $500.00 damage to the bridge and carried away its jib boom and foretopmast (Chicago Inter-Ocean, May 6, 1889). The 1889 Inland Lloyds listed M. A. Bradley as managing owner with the vessel rated A-2 and worth $28,000.00 (Inland Lloyds 1888:10).

The Wreck of the ALVA BRADLEY

On October 13, 1894 the ALVA BRADLEY and the schooner S.H. KIMBALL left the straits of Mackinac in tow of the JOSEPH S. FAY, (#75315), onto a storm swept Lake Michigan. The ALVA BRADLEY, now 24 years old, but recently refastened, was laden with steel billets bound from Fairport, Ohio to Milwaukee, Wisconsin. About twenty miles north of North Manitou Island, the ALVA BRADLEY sprang a leak and became helplessly adrift. It is not known whether the tow line parted or if the crew of either the FAY or KIMBALL cast off the line. Nonetheless, Captain Peter Olson, attempted to control the ALVA BRADLEY with the sails, but they were blown from the boltropes. The distressed schooner's steam pumps worked continuously, but the water continued to rise in the hold. As heavy winds ripped at the drifting schooner and enormous seas swept its decks, the ALVA BRADLEY's crew found themselves in a perilous situation (United States Life-Saving Service Annual Report 1896:114; Chicago Inter Ocean, October 16, 1894).

Meanwhile, on North Manitou Island a Life-Saving Service station lookout spotted a ship in distress ten miles south of the station. The vessel the lookout saw, lay broadside to the seas and nearly on its beam ends. At 11:00 a.m., station commander Peter Olson and a crew of six men launched the surfboat into the heavy seas and started to the distressed vessels assistance. By constantly bailing and dumping oil, the Life-Saving crew succeeded in reaching the vessel. Upon arrival Captain Olson found the schooner E. R. BLAKE, (#8982) under control and with both anchors down and holding. Captain Olson also observed that part of the schooner's deckload had gone overboard and its sails blown away. The captain of the BLAKE, however, refused all assistance. After four hours of hard and dangerous work, the life-saving crew succeeded in landing their boat on the south end of the island. Just then one of the surfboat's crew spotted the ALVA BRADLEY drifting onto the North Manitou Shoal (United States Life-Saving Service Annual Report 1896:114; Runge Card File).

Captain Olson observed the ALVA BRADLEY's crew struggling to anchor the vessel as heavy seas swept over the deck. The Life-Saving Service commander ordered his crew to pull for the distressed schooner, but apparently two of the crew refused. Undaunted, Captain Olson and the remaining four men set out for the rapidly sinking ALVA BRADLEY. By the time the life-savers came alongside the vessel, ten feet of water filled the ALVA BRADLEY's hold. After getting a line to the foundering schooner the benumbed crew of the ALVA BRADLEY (six men and one woman) skillfully took to the surfboat. As the surfboat pulled away, the ALVA BRADLEY sank, resting with her bulwarks awash and masts protruding from the raging lake. The entire compliment safely landed on the south end of North Manitou Island at 8:00 p.m.. The exhausted mariners remained on the south end of the island, returning to the Life-Saving Service station at noon the next day. The crew of the ALVA BRADLEY were taken to Traverse City, Michigan by the steamer DOUGLAS, (#157064) (Chicago Inter Ocean, October 16, 1894). Captain Petersen, deeply thankful to the life-savers, remarked, "...the Life-Saving crew was just in time...if not we would have all drowned" (Olsen 1894).

Captain Peterson telegraphed M. A. Bradley, owner of the ALVA BRADLEY, and advised him that the wreck rested on a sandy bottom with only two feet of water over the rail. He indicated that if further damage did not occur, two pumps would raise the schooner. Considering all that the ALVA BRADLEY had endured over twenty-four years of service, it is not surprising that Captain Peterson believed in the stout schooners ability to survive one more sinking. With the schooners reputation of survival in mind, M.A. Bradley called for the Swain wrecking tug FAVORITE (#9201), to proceed to the wreck scene and raise the ALVA BRADLEY. The weather, however, proved most unfavorable for any salvage attempt. On October 16 or 17 the FAVORITE, with a load of lumber to box the schooners hull, finally reached the wreck. There they found only fifty feet of the ALVA BRADLEY's bow intact and one mast standing. The rest of the vessel had broken up and the main

and mizzen masts had gone over. The unrelenting weather prevented the FAVORITE from salvaging any part of the ALVA BRADLEY's outfit (Detroit Free Press, October 16, 18 1894).

At the time of the schooners loss, the ALVA BRADLEY had an A-2 rating with a listed value of $20,000.00. M.A. Bradley did not carry insurance on the ALVA BRADLEY, but the cargo of steel billets was insured for $18,000.00. To recover the cargo and equipment, M.A. Bradley contracted the Parker & Millen Company of Detroit. Parker & Millen secured the contract by agreeing to perform the work on a sliding scale--receiving a higher percentage on what they salvaged from the wreck in the fall, than on what they recovered in the spring (They averaged about 40% of the salvage value.) (Detroit Free Press, October 19, November 3, 1894; Inland Lloyds 1888:10).

On November 2, the Parker & Millen salvage vessel T. W. SNOOK, arrived at the wreck site where they immediately set about the task of recovering the ALVA BRADLEY's cargo. Within two hours, however, foul weather forced the SNOOK to seek the shelter of Sleeping Bear Bay. In those two hours over the wreck, the crew of the SNOOK had salvaged over forty tons of steel billets and the ALVA BRADLEY's anchor chains and deck machinery before being blown off. After several days of waiting out the gale at Glen Haven the captain of the SNOOK decided to call off the salvage operation for that year. He later reported that the rest of the cargo was in easy reach if weather had permitted. Also, the captain of the SNOOK noted that the ALVA BRADLEY's stern had collapsed, and the schooners sides had broken at the bilge turns--only the bow and deck beams held the vessel together (Detroit Free Press, October 18, 19, November 3).

The last document issued to the ALVA BRADLEY was at Cleveland, Ohio, on April 20th, 1894. M.A. Bradley surrendered the ALVA BRADLEY's documentation at Cleveland on April 27, 1895; cause of surrender, "vessel lost" (Runge Card File).

Crew Members of the ALVA BRADLEY

Except for the ALVA BRADLEY's last captain, very little is known at this time about any other former crew members. Peter Petersen, the captain of the ALVA BRADLEY when the stout schooner met its demise, was born in Sandefjord, Norway, on July 27, 1865. Petersen grew up on a farm, but instead of following the family tradition he decided to pursue a career as a sailor. As a young man Petersen sailed for seven years "before the mast," traveling to the East Indies, Russia, Holland, Sweden, and South America. In the early 1880s Petersen emigrated to the United States and settled in Cleveland where he resumed his career as a sailor. Petersen first went "before the mast" on the SPEEDWELL, then he transferred to the FRANCIS POND and moved on again to the

ZACH CHANDLER. Next he shipped out on the HENRY A. KENT, eventually becoming the vessels first mate. In July of 1892, Petersen married Matilda Nelson, of Cleveland, and had one child, Frances Matilda Petersen. After four years on the KENT, Petersen transferred to the WILLIAM HOME for a short stay until he joined the Bradley line as mate of the ADRIATIC. Petersen then took command of the schooner barge ALVA BRADLEY until it wrecked in 1894. From the ALVA BRADLEY, Petersen became master of the MOPRAVIA, where he remained for one and a half years. Petersen's last command we know of was on the JOHN SCOTT RUSSELL, which he commanded in 1899 (Mansfield 1899:280).

ALVA BRADLEY Site Discovery

On May 6, 1990 at 6:30 p.m., members of the Manitou Underwater Preserve Committee(MUPC), a Michigan Sea Grant Preserve specialist, and State of Michigan Archaeologist, John Halsey discovered the wreck of the schooner barge ALVA BRADLEY. The MUPC discovered the site while returning to Leland from a side-scan sonar search at the northwest end of North Manitou Island--the possible location of the early steel steamer WILLIAM H. GILCHER (#81326). After the unsuccessful attempt to locate the GILCHER the survey vessel headed for the North Manitou Shoal in the hope of finding the ALVA BRADLEY. MUPC divers in the past had failed to locate the actual site of the ALVA BRADLEY--only finding fragments of the wreck scattered over the shoal. On the one and only pass the survey vessel intended on making before returning home a large ship-like image appeared on the screen. Subsequent ground truthing dives revealed a large wooden vessel over 150 feet in length, devoid of machinery, and carrying steel billets at the time of its stranding. The actual location of the wreck lies 1.5 miles due east from the ALVA BRADLEY's reported position. The observations made by MUPC divers and initial measurements indicated that the wreck was the ALVA BRADLEY.

ALVA BRADLEY WRECK SITE DESCRIPTION

The wreck of the ALVA BRADLEY today rests in 26 feet of water on the North Manitou Island Shoal. Glacial in origin, the shoal extends 3 miles out (southeast) from the south end of the island, and is comprised largely of glacial till, sand, gravel, rock, and boulders. The depth of the shoal averages about 20 feet with some offshore areas having a depth of less then 5 feet. At the time of the ALVA BRADLEY's loss a lightship marked the south end of the shoal, but today a lighthouse atop a crib structure marks the area. The shoal, today as in the past, is one of the greatest menaces

to vessels moving through the narrow Manitou passage. The ALVA BRADLEY lies nearly in the middle of the shoal, approximately 1.5 miles offshore from the south end of North Manitou Island, at the west end of an area known as "Millers Beach". The wreck rests on a nearly level bottom comprised of small and medium sized glacial rock with a light clay/sand overburden. Water visibility ranges from 3 feet to 25 feet, with a 14 foot average. The bow faces approximately 30 degrees north.

The ALVA BRADLEY is constructed almost entirely of white oak with iron fasteners. The vessels intact 182 foot long keelson rises approximately 6 feet off the lake bottom. Features on the keelson include the three mast steps, sacrificial capping below hatch areas, and the centerboard trunk, with the lower half of the broken centerboard enclosed within the trunk. The foot of the bow stem stands intact and rises approximately 6 feet above the keelson, representing the greatest relief on the site. Eighteen feet ahead of the bow foot lies the stem which rests flat on the bottom with the bobstay chains attached and leading towards the foot. The bilges are fully intact from bow to stern with ceiling and planking in place on most sections. A majority of the port side rests several feet from the port bilge where it broke off at the turn of the bilge. A small 36 foot section of the vessels port side lies just 3 feet away from the cant frames at the port bow.

The starboard side, also broken off at the bilge turn, lies in two sections. The aft one third is still attached at the cant frames and illustrates the shape of the stern. The structure flattens as it runs forward and separates from the bilge. Visible in this separation and partially pinned under the starboard side rests the rudder with its post running forward. Ahead of the rudder lies the forward two thirds of the starboard side. The after end of the forward section touches the break in the starboard bilge, but then runs away from the bilge on a 30 degree angle. Both port and starboard sides have a majority of their hanging knees attached. Lying flat on the bottom between the forward end of the starboard side and the starboard bilge rests the top half of the centerboard and a piece of structure may be associated with the bow.

Major debris fields consisting primarily of rigging components are found between the bow and stem and off the port bow.
These debris fields include blocks, deadeyes, cable, chain, eye bolts, jib hanks, chocks, and hawse pipes. Resting in the area of the port bow is a major assemblage of tools and materials that may have come from the "bosun's locker." Also, piping, rigging, stove parts, and fasteners lie scattered about the port bow. Featured in this area are sections of the ship's wheel, ornamental cast iron "stars" and scrolls associated with the ship's name board. The starboard bow contains similar material with the addition of a heavy gear which may be a part of the steam powered capstan. The majority of the remaining cargo of steel billets also rests in the bows.

Quantities of artifacts rest in between the frames throughout the site. Identified material includes coins in a leather purse, a pistol, a brass dinner bell, tools, steam pipes, valves, plumbing, rigging, and serving ware. A major concentration of galley/cabin associated material was located in and around the port bilge. Also, a cabin door lies wedged under debris in the port bilge. These "light wood" cabin components rarely exist at a shallow water site. Sampling indicates that quantities of artifacts exist at the site, hidden between structure, rocks, and beneath sand overburden.

Post Depositional Hypothesis

The present condition of the ALVA BRADLEY remains very similar to what the crew of the FAVORITE reported three days after the disaster occurred in 1894. The stern has disappeared without trace and the deck and deck beams are largely missing. Also, the vessel's sides are broken off at the bilge turn. By combining the historical wreck site descriptions with present data collected at the site, a hypothesis regarding the post depositional process may be made.

When the vessel sank it came to rest on small and medium glacial rock with a sand overburden approximately 26 feet in depth. The captain, upon leaving the vessel noted two hatches open with her bulwarks awash and masts standing. The severe weather that contributed to the ALVA BRADLEY's demise did not diminish for several weeks, making salvage work almost impossible. The cabin was likely smashed and carried off by the seas shortly after the sinking. The missing cabin works created a large opening on the after deck, allowing cabin (e.g. cabin door) and deck debris to spill into the bilge of the schooner. The door, for example, likely became pinned under, or entangled in a heavy object which dragged it into the bilge. This opening near the stern, combined with two or more open hatches allowed the sea to play upon the vessel's hull by creating a surging action.

The surging force eventually washed out the transom causing the rudder to fall outboard and under the starboard quarter. The starboard quarter is the only attached side on the site today and may have been the first section of hull to give away. The, then intact mizzen shrouds, probably, tempered the quarters collapse, thus, keeping it connected. The shrouds and mizzen mast then failed, destroying the overall integrity of the masts and rigging, which, until then, acted as a truss that supported the sides of the vessel as the deck deteriorated. With the strength provided by the masts gone, the deck beams rapidly failed as the sides of the vessel began to surge back and forth along with the mainmast. The stressed condition of the hanging knees makes it apparent that some type of surging action fractured the ALVA BRADLEY's sides at the bilge turns. The hull soon collapsed outward and rested splayed open on the bottom. Given the heavy load and fully submerged condition of the

ALVA BRADLEY at the time of its grounding the schooner probably did not work or pound on the bottom. Only about 50 feet of the schooner's bows remained intact after the sides of the hull collapsed. Owing to the powerful structural components incorporated in the bow and the remaining foremast and stays, the bow sections of the ALVA BRADLEY's hull failed last.

The crew of the SNOOK are known to have removed the majority of the cargo, anchors and chains. They also removed the windlass, capstan, spars and some rigging. Most of the billets found at the site remain in the bow. This indicates the bow remained intact when the salvers departed, as they were unable to clam the billets in the bow on account of the narrow space between the cant frames and keelson. By spring, the bow most likely deteriorated to point that it collapsed. Lake survey charts from the period indicate an obstruction rising 10 feet off the bottom. This obstruction was probably the stem, which at some point eventually gave way and now rests just forward of the wreck.

Historical Human Impacts

The original salvage efforts are probably the last human impact that effected the site prior to the ALVA BRADLEY's discovery in 1990. Owing to the abundance of artifacts present when first discovered, it is highly unlikely that any recreational divers had ever visited the wreck until recently. Items "missing" from the site are those that most likely drifted off, broke up, or had contemporary salvage value at the time of the ALVA BRADLEY's loss. It is difficult to gauge initial salvage impacts without further specific study. No obvious clam shell scars or signs of blasting and dredging are apparent.

Site Management History

The ALVA BRADLEY rests within the boundaries of the Manitou Underwater Preserve, established in 1988, it is one of nine state Underwater Preserves in Michigan. An underwater preserve is designed to protect areas of bottomland which encompass a concentration of sensitive and valuable resources.

In 1988 the Preserve was officially established and became the first State Underwater Preserve on Lake Michigan. The Manitou Underwater Preserve Committee (M.U.P.C.) reorganized as a permanent committee of the Northwest Michigan Maritime Museum and was designated as the local

management entity for the Preserve. A $53,000.00 project was initiated to establish a management and developmental program. It was within this preserve that the ALVA BRADLEY would be found.

Management of the ALVA BRADLEY site presented two major problems. The first being the documentation of the wreck and the artifacts within and around it. The second problem involves protecting and preserving the site for future generations to enjoy and learn from.

In an effort to address the problems of cataloging and documenting the site, one solution proved a great help. An important component of the management of the ALVA BRADLEY site involved the organization and training of a volunteer pool that would assist in recovery and organization of data from the field. These volunteers, many from the local community, have provided the man-hours and assistance needed to begin the development and research on the ALVA BRADLEY site. The volunteer pool has grown since it was introduced in 1988, its growth is one of the greatest assets to the management of this site.

The site of the ALVA BRADLEY presented itself as a mixed blessing. It created a much desired, future recreational dive site within the M.U.P.. Unlike any other existing dive site in or around the M.U.P., this shallow water site has a tremendous artifact collection combined with associated structure. Recreational diving interests applied considerable pressure to make this site available to the public as soon as possible. Responsible site management, however, dictated a methodical, time/labor intensive inventory of artifacts and site documentation. Until completion of the site documentation process the M.U.P.C. chose not to publicize the site for recreational divers. Any effort to maintain secrecy, however, proved fruitless. The site's location is in a high boat traffic area and documentation efforts required public volunteers working the site during daylight hours.

When discovered in May of 1990; the ALVA BRADLEY presented itself as a largely undisturbed site with remarkable integrity. The site was video taped during the first dive approximately two weeks after its initial discovery. The sensitivity of the ALVA BRADLEY situation prompted prioritization of work on that site, resulting in the majority of M.U.P.C. field time being directed there. In June, concrete blocks with sub-surface pendants attached were placed near the site to provide moorings for research vessels.

Next a week long project in August of 1990 brought Larry Murphy and the National Park Services Submerged Cultural Resources Unit, James Delgado, the N.P.S. National Maritime Historian, Ken Vrana of the Michigan Sea Grant Program, Ken Pott of the Lake Michigan Maritime Museum, Phill Wright of Save Ontario Ship Wrecks, and M.U.P.C. supervisors, committee members and

volunteers together. These groups worked together to assess and do an initial documentation of the wreck site. The generous assistance and advice given by these outside experts created a methodology appropriate for documentation of the ALVA BRADLEY wreck site by M.U.P.C. staff and volunteers.

At first traditional methods of underwater site documentation were employed. General dimensions were acquired by utilizing 100 and 200 foot fiberglass tapes on reels and recording measurements on mylar slates with pencils. First a tape was laid from bow to stern on the center keelson. All features of the keelson were noted and their positions recorded. Measurements were then taken from features on the keelson to the broken bilge turn and side sections to determine general size placement of structure. Measurements were taken at roughly right angles to the keelson; no square or level was used. Similar rough measurements were taken to determine the overall extent of the site.

With a general idea of structure and artifact concentrations, each piece or section of structure was given a letter designation. Certain artifact concentrations were also alphabetically labeled. Point pins and point clips were then strategically affixed to designated areas. With this done, a baseline was to be established. Because of strong currents and the total length of the site being 270 feet, traditional nylon baseline material was not considered. Lightweight stainless steel downrigger cable affixed to driven steel posts were placed for a baseline. As this cable was tightened with turnbuckles to remove sag the cable repeatedly snapped. The attempt was then later repeated using stainless aircraft cable. In this instance a come-along was needed in lieu of the turnbuckles inability to take up all the necessary slack. As all slack was removed a 200 ft. span of baseline clips snapped under the tension. Shortly thereafter the steel posts pulled. The steel posts were then doubled, but failed as before. At this time the 200 foot-plus baseline was abandoned as inappropriate for the site. Because of difficulties in documenting the site and the rapid loss and movement of artifacts by sport divers traditional documentation methods were put aside in favor of Video Mosaic Imaging for the 1991 season.

By August of 1990 word of the ALVA BRADLEY site had worked its way into portions of sport diving circles. In that month the ALVA BRADLEY's brass dinner bell disappeared from the site. The bell, not 10 feet from an underwater plaque interpreting State Underwater Preserve values and regulations was removed with a survey clip attached. In October of 1990 a Great Lakes sport diving newsletter published the location of the ALVA BRADLEY along with descriptions of artifacts and coins on the site. With the sport diver's ethic and understanding of management concerns obviously not fully developed and the location of the wreck divulged, the ALVA BRADLEY site had become vulnerable.

Efforts directed to the management of the ALVA BRADLEY site in 1991 included the continuance of manual documentation efforts by Preserve volunteers. Special low impact "Manta Ray" mooring systems were installed to safely moor vessels at the site. Because sport divers were now arriving in increasing numbers, state unified marker/mooring buoys were affixed to the Manta Ray anchors near the bow and stern. It was hoped that this would prevent divers from anchoring or grappling the wreck. Large numbers of divers visited the site and despite signs requesting cooperation, more and more artifacts were being relocated on the site or removed. To hasten site documentation efforts a 1991 CZM grant application was submitted by the M.U.P.C. and sponsored by Glen Arbor Township to develop a Video Mosaic Imaging System. With funding approved, the system would be applied at the ALVA BRADLEY site. It was anticipated that this effort would greatly expedite documentation efforts and provide countless other benefits to submerged cultural resource management on the Great Lakes as a whole. Weather and other factors often inherent to research and development projects prevented the completion of a mosaic at the site in 1991.

The Village of Glen Arbor and the Michigan Coastal Zone Management Program again sponsored grant monies, in August of 1992, that were matched by the M.U.P.C. to fully develop local resources to allow the completion of a video mosaic at the ALVA BRADLEY and other sites. A portion of these funds were also assigned to assist in the completion of a National Register Nomination for the site.

All professionals exposed to the ALVA BRADLEY site express opinions that, "The ALVA BRADLEY site is very significant; every effort must be made to document and manage the site before negative impacts occur." Many persons, including former National Maritime Historian James Delgado, feel the ALVA BRADLEY is eligible for a National Historic Register listing. With thorough site documentation in place prior to any human impact, local, state, and federal managers will have an unparalleled opportunity to monitor user and environmental effects. This would allow for management decisions to be made on actual site observations, rather than conjecture.

For the M.U.P.C. to make a sound management decision regarding the ALVA BRADLEY's artifact collection, additional information must be acquired. Options for the management of the site, including care and disposition of the artifact collection, must be fully understood. The ALVA BRADLEY site is a case study for all states working to manage submerged resources. How do you prioritize, fund, and administer archeological survey efforts? How do you balance the often conflicting interests of museums, archaeologists, sport divers, salvers, fisherman, and the general public. What, if any, are considered acceptable compromises to the resource itself?
If proposed management plans cannot be implemented at the ALVA BRADLEY site, there is little doubt that a deplorable loss of heritage resource will occur. Neither the Museum nor M.U.P.C.

have been able to generate sufficient local funding to address these concerns. It is not that local funds will not ultimately be available. Rather, a satisfactory level of local awareness must be gained and creative approaches to fund raising implemented before success can be realized. There are few who question the ability of the tri-county area to perpetuate the work that has been initiated at Manitou.

STATEMENT OF SIGNIFICANCE

SUMMARY

Under criterion "A" the ALVA BRADLEY shipwreck is being nominated as a classic representative of a 200 foot Great Lakes schooner. This vessel and the technological advances and adaptations associated with their development on the Great Lakes, have had far reaching impacts on the broad patterns of our history. The development and history of the Great Lakes region is directly related to that of the schooner.

Under criterion "C" the ALVA BRADLEY represents a distinct class of vessel; the full rigged, 200 foot Great Lakes Schooner. This type of vessel became the epitome of the Great Lakes schooner. The ALVA BRADLEY is also an example of a Great Lakes schooner converted for use as a schooner barge. The ALVA BRADLEY illustrates important adaptations in Great Lakes wooden sailing vessels. Reportedly the ALVA BRADLEY was the first Great Lakes ship fitted with metal shrouds, and also one of the first to use iron-wire rope for standing rigging. Also under the "C" criterion, the ALVA BRADLEY represents the work of renowned master shipbuilders Thomas Quayle and John Martin (Quayle & Martin) and builder/entrepreneurs Alva Bradley, Phillip Minch, and Issac Nicholas.

Under criterion "D" The ALVA BRADLEY wreck site, through underwater archaeological research, will provide information important to Great Lakes history on vessel construction, use and adaptation, and crew lifeways. The information capable of being extracted from this site is significant as the

site has not been pilfered and rests in only 26 feet of water. Although over 200 of the ALVA BRADLEY class of schooners were built, no examples remain except those resting on the bottomlands of the great lakes. Of these, few (if any) have the integrity and accessibility of the ALVA BRADLEY site.

HISTORICAL CONTEXT

Great Lakes Schooners

Great Lakes schooners and schooner barges evolved to meet the demands of the Lakes environment and the transportation needs of people and goods on the Great Lakes and connecting waters. Observations by naval experts as early as 1788 defined the fore-and-aft rig as the most suitable for lake vessels. At first square rigged vessels and than combination rigs, such as, barks, barkentines, brigantines, and hermaphrodite brigs sailed on the Lakes. The topsail schooner, however, came to dominate the lakes trade by the 1860s. In 1870, eighty percent of all sailing vessels on the Lakes employed the use of a schooner rig (Carrell 1985:12-14).

The typical schooner of the 1850s and 1860s had evolved to meet the demands of the Great Lakes environment. The vessels had to have a shallow draft and be highly maneuverable to navigate in the shoal infested and confined waters of the Great Lakes. Also, economically, schooners had the advantage over square rigged vessels due to the smaller size crews it took to operate a gaff rigged sailing ship. Typically less than 120 feet in length (the size of the largest lock in the canal system), Great Lakes schooners had square sterns, flat sides, long jib booms, and short mizzens. Most Lakes schooners had swing centerboards with boxy shallow draft hulls. The typical Lakes three-'n-after had its largest sail inboard, and a considerably smaller mizzen mast. The smaller mizzen did not blanket the other sails and in an emergency could be swung out, allowing the vessel to quickly turn. A well built schooner could do 13 knots in a good wind and still quickly jibe over (Carrell 1985:13; Palmer 1984:34-36).

As commerce increased and harbors, channels, and canal systems developed, evolution in vessel design and construction leaped forward to meet the demands of a growing region. With the opening of the Soo Canal in 1855, a dramatic increase in shipping on Lake Superior took place. During the ALVA BRADLEY's first year of operation Marquette, Michigan, located on Lake Superior's south shore had 390 vessel arrivals. Twenty years later that number had grown to 1,032. The

development of the iron and lumber trades in the region combined with navigational improvements (e.g., bigger locks, light houses, channel markers, and other aids to navigation), prompted the construction of larger vessels in excess of 200 feet. By the 1880s steamers soon began taking most of the passenger and package freight business from the schooners. The schooners, however, which had dominated the bulk trade following the civil war, still remained competitive until the 1890s (Labadie and Murphy 1987:30; Carrell 1985:13-15).

In the late 1860s and early 1870s ship owners began to adapt schooners for towing behind steamers. This arrangement called a "consort" system allowed the shipment of larger cargos in a more efficient and reliable manner. The schooners, adapted as towbarges, became known as "schooner barges". In 1868 there were 64 register schooner barges on the Great Lakes. By 1874, at least 216 schooner barges plied the Lakes behind small steamers (Carrell 1985:14-16; Labadie and Murphy 1987:46-50).

The peak of the sail era occurred in 1868 with 1,855 vessels with a total register tonnage of 294,000 tons. In the 1880s the decline of the schooner was precipitous. Because of the panic and world-wide depression in 1890, and success of the consort system, many sailing vessels were forced into retirement. Also, steam powered ships quickly began to dominate the Lakes trade. The advent of the bulk freighter brought about the final demise of the schooner and consort system. By 1890 only 54 schooner barges were register. In 1889, the last schooner slid off the ways of a shipyard, and by the early 1930s only three sailing vessels remained in service on the Great Lakes. No Great Lakes schooner has survived to the present excepting shipwreck remains and one quickly deteriorating raised relic (Labadie and Murphy 1987:46-50).

The Great Lakes schooners contributed significantly to the settlement and industrial growth of the Midwest. Between 1860 and 1875 the major means of transportation for people, raw materials, and manufactured goods on America's inland seas was conducted almost solely by the Great Lakes schooner. Additionally the Lakes schooner illustrates adaptations in design and operation reflective of the Great Lakes environment and the prevailing technology of the time.

The 200 Foot Schooners

The ALVA BRADLEY was built at a unique time in Great Lakes sail history. Confident in a strong post Civil War economic recovery, builders and shippers in the Great Lakes region rushed to invest in new shipping opportunities. The ravenous appetites of the iron mills in the east for iron ore lead to the discovery of vast ore deposits along Lake Superior's shore. Between 1854 and 1884 four

major iron ranges opened in Minnesota and the Upper Peninsula of Michigan. Also, the growing cities of the east needed the grain grown in the newly settled plains region of the country. The demand for transportation of these products exceeded the abilities of the existing Great Lakes fleet. When the deepening of the restrictive St. Clair channel became a reality, it touched off a wave of new ship construction targeted for the iron ore and grain trades (Labadie and Murphy 1987:45-50).

The deepening of the Soo canal to 16 feet in 1870, and the St. Clair River channel to 12 feet a year later, allowed Great Lakes shipyards to build larger ships to meet the increased freight demand. To capitalize on this new opportunity, a distinct class of schooner developed. Between 1871 and 1874 over 200 wooden schooners with lengths in the 200 foot range slid down the ways of shipyards around the Great Lakes. The increased carrying capacity of these vessels had investors feeling assured of high and consistent profits. Contemporary builders of 200 foot schooners did not consider them a distinct vessel class, however, historically they can be classified in such a manner. These ships were remarkably uniform in design and seldom varied in size by more than 50 tons. These large and impressive schooners had flat sides, clipper bows, draughts of close to 12 feet, and hulls framed and planked with white oak. Built over a four year period virtually all of these schooners entered the bulk cargo trade (e.g. grain, lumber, coal, and iron ore) on the upper Great Lakes (Labadie, personal communication, 1991).

With the era of sail quickly coming to a close, the increase in carrying capacity allowed the new schooners to compete with steamers for a short time longer. With the advent of this larger class of schooner, navigational improvements, and the development of the bulk freighter, freight movement through the Soo canal jumped from 1 million tons in 1860 to over 9 million tons in 1890. By 1911 cargo shipments had increased on the Great Lakes to over 80 million tons, a growth of over 1300 percent. While the bulk freighter contributed greatly to this increase, the initial surge in shipments began with vessels like the ALVA BRADLEY (Labadie and Murphy 1987:41; Labadie, personal communication, 1991).

The ALVA BRADLEY and other 200 foot schooners represented the height of nineteenth century wooden sail technology. Built at the zenith of the sail era, the ALVA BRADLEY reflected the culmination of almost one hundred years of innovation and adaption in Great Lakes schooner design. The vessel was designed to take advantage of the larger locks and deeper channels, which allowed the ALVA BRADLEY and others of her class to successfully compete with the smaller and more costly steamers (Labadie, personal communication, 1991).

The Alva Bradley as a Schooner Barge

Between 1871 and 1888 the ALVA BRADLEY operated as a full rigged schooner, relying only on the wind and an occasional harbor tug. The sight of a big three-'n-after pressed under full canvas has provided inspiration to many a painter and poet, and it is undoubtable the ALVA BRADLEY was an inspiring sight under sail. Economics more than aesthetics, however, dictated Great Lakes vessel design and in 1888 the ALVA BRADLEY was "reduced" to a schooner barge.

The schooner barge evolved, when it became apparent that towing several heavily laden vessels behind a steamer was more efficient and profitable than operating them individually. The early "consort" system developed when tugs began towing a series of vessels through channels. During the 1860s and early 1870s schooner barges were towed up and down the lakes from port to port. Eventually, cargo carrying steam barges replaced the tugs. Occasionally schooner barges hoisted sail to assist the steam barge or in the event of an emergency. Thus, the consort system allowed larger cargos to be moved at less expense. This concept was rapidly implemented and by the 1880s the success of the schooner barge/consort system had irrevocably changed Great Lakes shipping. (Toni Carrell 1985:14-15)

To successfully adapt to the changing economic conditions of the time many schooners underwent conversion to barges. The schooners, however, had to undergo a number of alterations and adoptions before they could fulfill their new role. The steam donkey engine, introduced in 1867, was important to the development of the schooner barge. Generally, the steam donkey engine was placed near the chain locker below deck. Its stack protruded up through the main deck aft of the windlass. The donkey engine provided steam power for the operation of the capstan, windlass, and pumps. Also, innovative captains employed the engines for cargo handling. Reduction of the masts or removal of topmasts and rigging were also common adaptations. The bowsprit was often cut off at the stem and tow bitts installed. These modifications allowed for a significant reduction in crew. Hatches were often enlarged and deckhouses modified. The result was a diminished, but economical vessel to operate. In time, new vessels were built specifically as schooner barges. The purposefully built barges had more refinements and special features that lowered operation costs and made them easier to handle (Carrell 1985:14-16).

The specifics of the ALVA BRADLEY's transition to a Schooner barge are not found in the historical record, making it necessary to acquire the information from the wreck site. In the future, the site should yield extensive information on the changes and special adoptions made to the ALVA BRADLEY in function and design.

Captain Alva Bradley

Alva Bradley, the son of Leonard and Roxanne Thrall Bradley, was born in Ellington, Connecticut, on November 27, 1814. In 1823, the family moved west to Ohio. The family traveled by wagon to Albany, New York, where they caught a canal boat to Buffalo. In Buffalo they booked passage on a schooner bound for Cleveland and from there traveled to Brownhelm, Lorain County, Ohio, where they settled on a farm two miles east of the Vermillion river and one mile west of town (Tassel and Grabowski 1987:119).

Young Bradley grew up in meager surroundings, his family always struggling to make a living. "He often suffered during winters for lack of sufficient clothes. He earned his first set of boots by chopping wood, and when his first pair of suspenders, knitted by his mother, were worn out, the next pair were paid for by chopping hoop-poles. Alva would walk over four miles to school, crossing the ice on the river and climbing the banks on the sides, never missing a day in class" (Cleveland Leader, November 30, 1885). Bradley worked on the family farm until he turned nineteen and left home looking for adventure on the Great Lakes (Cleveland Leader, November 30, 1885; Tassel and Grabowski 1987: 119).

Bradley first shipped out in 1835, serving before the mast on the schooner LIBERTY. After that he shipped on a number of sailing vessels; including the YOUNG LEOPOLD, EDWARD BANCROFT, and the EXPRESS. After two years of serving before the mast, Bradley made mate. In 1839 he became captain of the 15 ton sloop OLIVE BRANCH, which carried cargo between the southern ports of Lake Erie. Bradley than became master of the 45 ton COMMODORE LAWRENCE, owned by the Geauga Furnace Company (Cleveland Leader, November 30, 1885; Tassel and Grabowski 1987:119).

In 1841, Bradley and his new business partner Ahira Cobb, a merchant from Birmingham, Ohio, had the 104 ton schooner SOUTH AMERICA built for them at Vermillion, Ohio. Bradley sailed the SOUTH AMERICAN as master for three years between Milan, Ohio and Buffalo, New York and occasional across Lake Erie to Canada. In Canada, Bradley picked up lumber for the shipyards in Vermillion. In 1844 Bradley and Cobb had the 135 ton schooner Birmingham built, he commanded for three years. In 1848 Bradley and Cobb had the 185 ton schooner ELLINGTON built for them. The following year Bradley shifted his command to the 305 ton propeller INDIANA, which he and Cobb had built for the Buffalo and Chicago trade. The INDIANA was one of the first propellers built on the Great Lakes, and now its walking-beam-engine stands on display at the Smithsonian. The year 1852 saw the launching of the smart new 190 ton schooner OREGON, which Bradley commanded for its first season (Cleveland Leader, November 30, 1885; Tassel and Grabowski 1987:119; Cleveland Plain Dealer, December 3, 1885).

In 1853, Bradley and his partner formed Bradley & Cobb, shipbuilding Company. At this time he gave up his seafaring life and settled down with his wife Ellen Burgess Bradley in Vermilion. Bradley eventually had three daughters and one son. During his years of sailing Bradley never had a serious accident and "[i]t is said that he was enterprising, active, vigorous in mind and body, and a prudent business man..."(Cleveland Plain Dealer, December 3, 1885).

Bradley and Cobb continued their shipbuilding at Vermilion. In the spring of 1853 Bradley and Cobb launched the 238 ton CHALLENGE and in 1854 the 190 ton BAY CITY. In 1855 they built the 359 ton C.C. GRISWALD and a year later the 390 ton schooner, EXCHANGE. In 1859 Bradley moved his family to Cleveland. Not until 1861 did the Bradley & Cobb Shipbuilding Company launch another vessel, when the company built the 418 ton S.H. KIMBALL. In 1863 the company launched the 412 ton DAVID WAGSTAFF, and in 1864 the 370 ton J.F. CARD. In 1865 the two partners built and launched the 568 ton schooner ESCANABA. Two years later the 850 ton schooner NEGAUNEE was built at a cost of $52,000.00. The NEGAUNEE went into the lucrative Lake Superior iron ore trade (Cleveland Leader, November 30, 1885; Cleveland Plain Dealer, December 3, 1885; Tassel and Grabowski 1987:119).

Soon after launching the NEGAUNEE, Bradley and Cobb took on Philip Minch and Isaac Nicholas as partners. With more resources available to the company it grew and flourished, but the partners decided against building steamers. "They sighted fires, explosions and other steam related mishaps as an indication that steam technology had not yet sufficiently advanced for their interests"(Cleveland Plain Dealer, December 3, 1885). At this time it seems that Bradley sold his interests in the shipbuilding company to Cobb (Cleveland Plain Dealer, December 3, 1885; Tassel and Grabowski 1987:119).

In 1868 Bradley, Minch, and Nicholas, began to plan their future business dealings. They realized that steamers would eventually overtake sailing vessels on the Great Lakes. All concerned among the partners had substantial savings and could easily retire, but the future still looked bright--at least for the next ten years. The promise of navigational improvements combined with the post Civil War economic boom surely enticed the partners to stay in business. With the expansion of the Soo canal and deepening of the St. Clair River channel imminent Bradley, Minch, and Nicholas decided to get out of the shipbuilding business and move to Cleveland to operate a trading fleet. The Vermilion River could not handle the larger ships the partners planned on having built for them. Also, in Cleveland the steel furnaces, boiler and engine works, and skilled labor necessary to build the ships of the future were close at hand. In various Cleveland shipbuilding yards the partners commissioned the building of six wooden steamers, five steel propellers, the first iron bulk carrier on the Lakes, and several wooden tugboats (Tassel and Grabowski 1987:119; Cleveland Plain Dealer, December 3,

1885).

By 1870 the group established relations with the Quayle & Martin shipbuilding company, where the plans for the 200 foot schooner were conceptualized. At what point the two companies began working together and under what terms still remains unclear. Alva Bradley surely was attracted by Quayle & Martins reputation for the size and quality of the vessels their yard turned out. During the early part of the schooner ALVA BRADLEY's career Quayle & Martins name appears on the ships enrollment papers (Cleveland Plain Dealer, December 3, 1885; Cleveland Leader, November 30, 1885; Tassel and Grabowski 1987:119).

Ship Builders Quayle & Martin

Thomas Quayle was born in the parish of Kirk Michael, on the Isle of Man, May 9, 1811. At the age of sixteen Quayle and his family emigrated to the United States, settling on land in the townships of Newburgh and Warrensville, in Cayahoga County, Ohio. The Quayle family cleared the land, built a log cabin, and farmed the land (Cleveland Past and Present).

Before emigrating young Quayle had served as an apprentice to an english shipbuilder, and shortly after reaching the United States he sought employment in the shipyards of Cleveland. He apparently was an excellent worker and rapidly advanced through the ranks. In 1847 he formed a partnership with John Cody and for three years they concentrated on building large barks, brigs, and schooners. By 1849, the two partners split and Quayle then enter into a partnership with Luther Moss under the firm name of Moss & Quayle. Their company built the NILE, MILWAUKEE, FOREST QUEEN, DUNKIRK, and schooner CRESCENT. Quayle then established a partnership with John Martin (Cleveland Past and Present).

John Martin was born in Antrim County, Ireland, December 15, 1824. He emigrated to North America with his parents who settled in Montreal, Canada. There he learned the shipbuilding trade, attending school at night. After working at a Montreal shipyard for two years Quayle moved to French Creek, New York, from there to Detroit, Michigan and finally in 1843 to Cleveland. In Cleveland he established a partnership in the shipbuilding business with a Mr. DeGrote. A number of events transpired to allow John Martin to ultimately establish a partnership with Thomas Quayle. One of the shipbuilding firms of which John Martin was a member was deeply in debt, but owned the brig CORTLAND in which he had an interest. Martin took the brig and sailed her until the debt was reduced to $2,500.00, then he sold the vessel and dissolved the partnership. After jobbing and doing survey work for a couple of months Quayle built the brig JOHN G. DESHLER

for Handy, Warner & Co. The profits earned from building the brig allowed Martin to enter into a partnership with Quayle under the firm name of Quayle & Martin (Cleveland Past and Present).

Together, Quayle & Martin went on to build at Cleveland, some of the largest and finest vessels to ply the Lakes. In one year Quayle & Martin launched thirteen wooden sailing vessels. Quayle & Martin also became involved in trans Atlantic shipping--unusual for a Great Lakes firm at the time. Their first venture in overseas trade involved taking charge of the cargo of staves on the bark D.C. PIERCE and brig JOHN D. DESHLER bound for Liverpool. The venture proved successful, and the following year the pair took over two other cargos in the same vessels, selling one in Cork and the other in Glasgow. Thus began the exodus of Lakes vessels to the Ocean, and six vessels built by Quayle & Martin plied on salt water with good success (Cleveland Past Present).

One of these vessels, the bark C. F. KERSHAW had a number of innovative designs embodied in its construction and outfit. The vessel was described as, "...equal in all particulars to the best seagoing vessels, she is ahead of anything on the lakes." At 142 feet in length, the hold had no arch, with a five inch thick ceiling bolted edgewise. The vessel incorporated iron spikes sunk into the wood and covered with oak caulks to prevent rusting, as fasteners. The centerboard had iron sheathing around it and the vessel had extremely high bulwarks--much higher than on traditional Lakes craft. The vessel was the first on the lakes to be fitted with Cunningham patent topsails and had a Robinson patent steerer. Prior to the vessels departure from Cleveland to liverpool on July 19, 1857 an observer referred to the KERSHAW as "...the best vessel that ever sailed the inland waters. Her model is beautiful and symmetrical. She is the perfect picture of neatness and strength" (Cleveland Past and Present).

Another noteworthy vessel that Quayle & Martin built was the 201 foot bark WILLIAM T. GRAVES (1867)--the largest vessel of its day. The launching of the GRAVES gave Quayle & Martin a reputation for building vessels of unprecedented size and quality. In 1871 Quayle and Martin converted the Wm. T. GRAVES into a bulk freighter. Thus giving the GRAVES the status of being the first schooner to undergo conversion to a bulk freighter. (The wreck of the Wm. T. GRAVES rests on North Manitou Shoal just a half mile from the ALVA BRADLEY site). In 1870, the year the ALVA BRADLEY's construction began, Quayle & Martin launched the 1173 ton propeller B.W. BLANCHARD. This vessel had the reputation of being the "...finest and most luxurious passenger ship on the inland seas" (Cleveland Past and Present). These types of quotes seem most prevalent concerning the work of Quayle & Martin.

On May 1, 1860, Quayle and Martin played host to an engineer sent out by the Russian government to gather information and models of shoal water craft and tugs. The Russian government needed to

obtain information upon which they could base shipbuilding plans in their own country. This event, combined with Quayle & Martins saltwater ventures expanded the influence of this partnership well beyond the Great Lakes region (Cleveland Past and Present).

Both men established families in the Cleveland area. Quayle married Mrs. Ellenor Cannon, also of the Isle of Man and together they raised eleven children. Martin married and raised three children. Both men actively participated in the Cleveland community, were highly respected, and elected to several Municipal government offices. In 1873 Martin held the position of front runner in the Cleveland mayoral races, but the partnership and any mayoral opportunity ended On April 15, 1873, with the death of John Martin. At the time of his death the city flags and the bunting on the vessels in the harbor flew at half mast in his honor. The entire city council followed his remains during the funeral procession to the cemetery. The mayor of Cleveland did the eulogy at his funeral (Cleveland Past and Present).

Quayle then took his two sons, Thomas E. and George L. into the business under the name of Thomas Quayle & Sons. The renamed company continued to build the largest and sturdiest wooden vessels on fresh water, including the COMMODORE, then the largest vessel on the lake. Quayle retired from the business in 1879 after a continuous and active life as a shipbuilder for thirty-two years. His sons continued the business admitting a third son, William H.. The three sons perpetuated the firms reputation and in 1880, they launched the HENRY CHISHOLM. Built for Captain Alva Bradley, it held the record for a short time as the largest bulk freighter on the lakes at the time (Cleveland Past and Present).

Quayle & Martin constantly sought to create the largest wooden hulls possible with the technology available to them. At 270 feet the HENRY CHISHOLM represented the near maximum size a wooden vessel could achieve. The vessel incorporated in its hull 150 tons of iron to strengthen its wooden structure. Iron and steel vessels began making there appearances in the 1880s, but skepticism with these new and un-tested materials, combined with high costs kept the devout wooden shipbuilders at the firm busy. The prosperous future of iron and steel shipbuilding became apparent in the late 1880s however, and unlike some other shipyards, Quayle & Sons did not tool for the "new age" of ship building. In 1890 the firm of great "wooden" shipbuilders dissolved after thirty-seven years of continuous operation. In 1895 Thomas Quayle died at age eighty four (Cleveland Past and Present).

Fulfilling the role of innovators Quayle & Martin pushed the accepted limits of vessel size, construction, and operational capabilities. Their lifes' work contributed directly to the growth of the midwest, and establishment of cross Atlantic trade utilizing Great Lakes vessels. They have forever

influenced the course of history on the lakes.

The relationship between Captain Alva Bradley and Quayle & Martin will require more extensive research to understand.

Thomas Alva Edison

Thomas Alva Edison (1847 to 1931) is recognized as being one of the worlds most influential inventor/entrepreneurs. The name Edison is irrevocably linked with the electric light bulb, the telegraph, telephone, phonograph, and motion picture. Edison holds 1,093 patents, the greatest number held by one individual. Few, however, realize that the schooner ALVA BRADLEY shares the same name sake as Thomas Alva Edison (Tassel and Grabowski 1987: 119, 135).

Edison's father Samuel Ogden Edison Jr., established a home in Milan, Ohio in 1838. A native of Canada, Samuel Edison became involved in a political scandal and had to hastily depart for America, leaving his family behind. In the booming town of Milan, Samuel Edison planned on entering the lumber business, but he needed investors and capital. Captain Alva Bradley loaned Samuel Edison the money he needed to open up a lumber mill (Tassel and Grabowski 1987:119, 135).

Bradley became the Edison families major benefactor and good friend. In 1839, after the mill opened up, Bradley sent one of his vessels to Canada to pick up the Edison family members left behind. Bradley also, provided ships to Samuel Edison for picking up quality Canadian lumber for the mill. Alva Bradley became a close friend to the Edison family and often stayed in their home. When Samuel's wife Nancy gave birth to her seventh child, the proud parents christened him Thomas Alva Edison, his middle name given in honor of the man who had helped the family out so many times. Thomas was usually called Alva or "Al" by family members and close friends (Tassel and Grabowski 1987:119, 135).

It is not known at this time just what the relationship between Alva Bradley and Thomas Alva Edison became. Captain Bradley was 33 years old when Thomas Edison was born, giving the two ample opportunity to interact with one another. The Edison house in Milan still stands today, and hanging on the wall at the foot of Thomas Alva Edison's bed is a painted portrait of Captain Alva Bradley (Tassel and Grabowski 1987:119, 135).

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GEOGRAPHICAL DATA

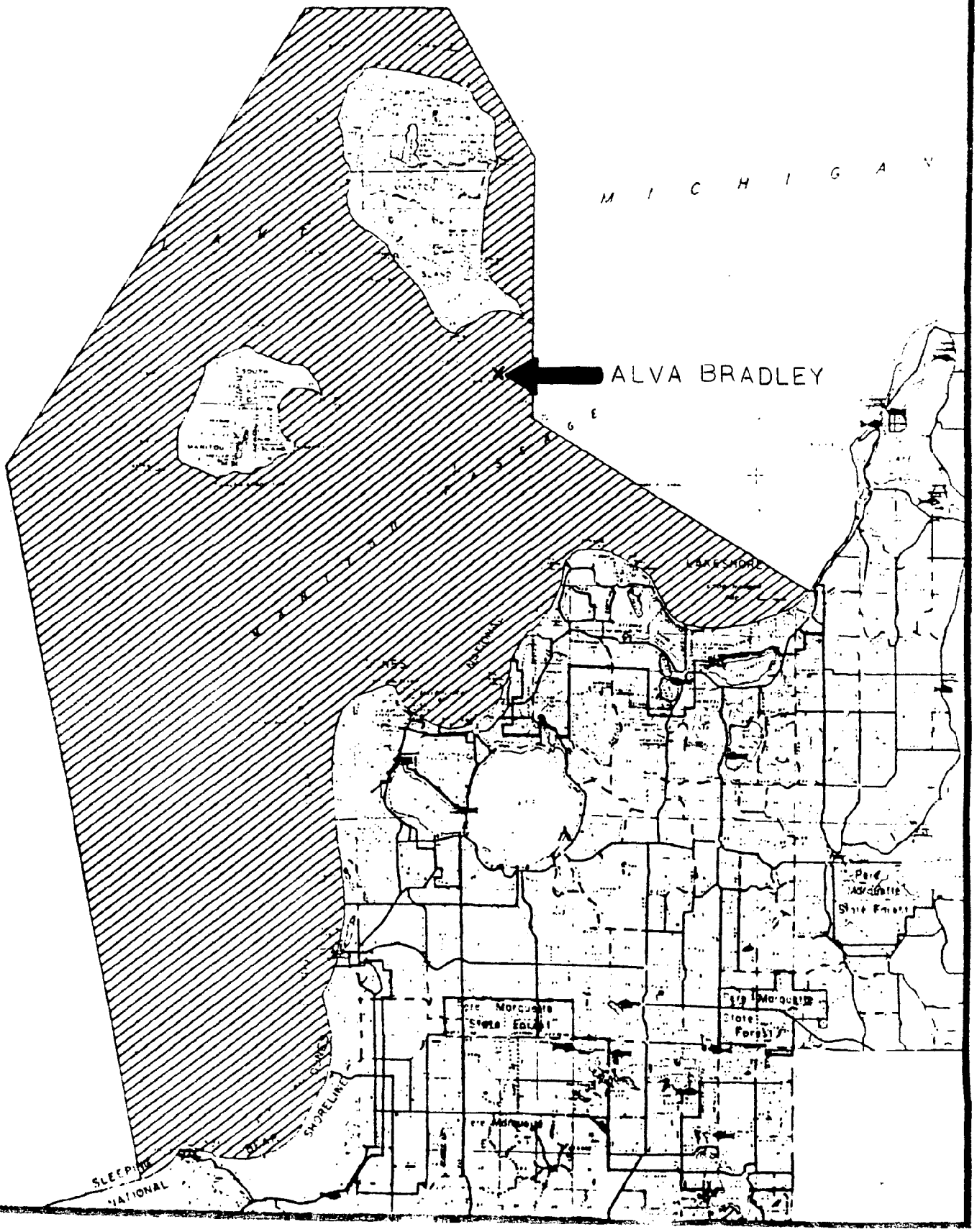
Verbal Boundary Description

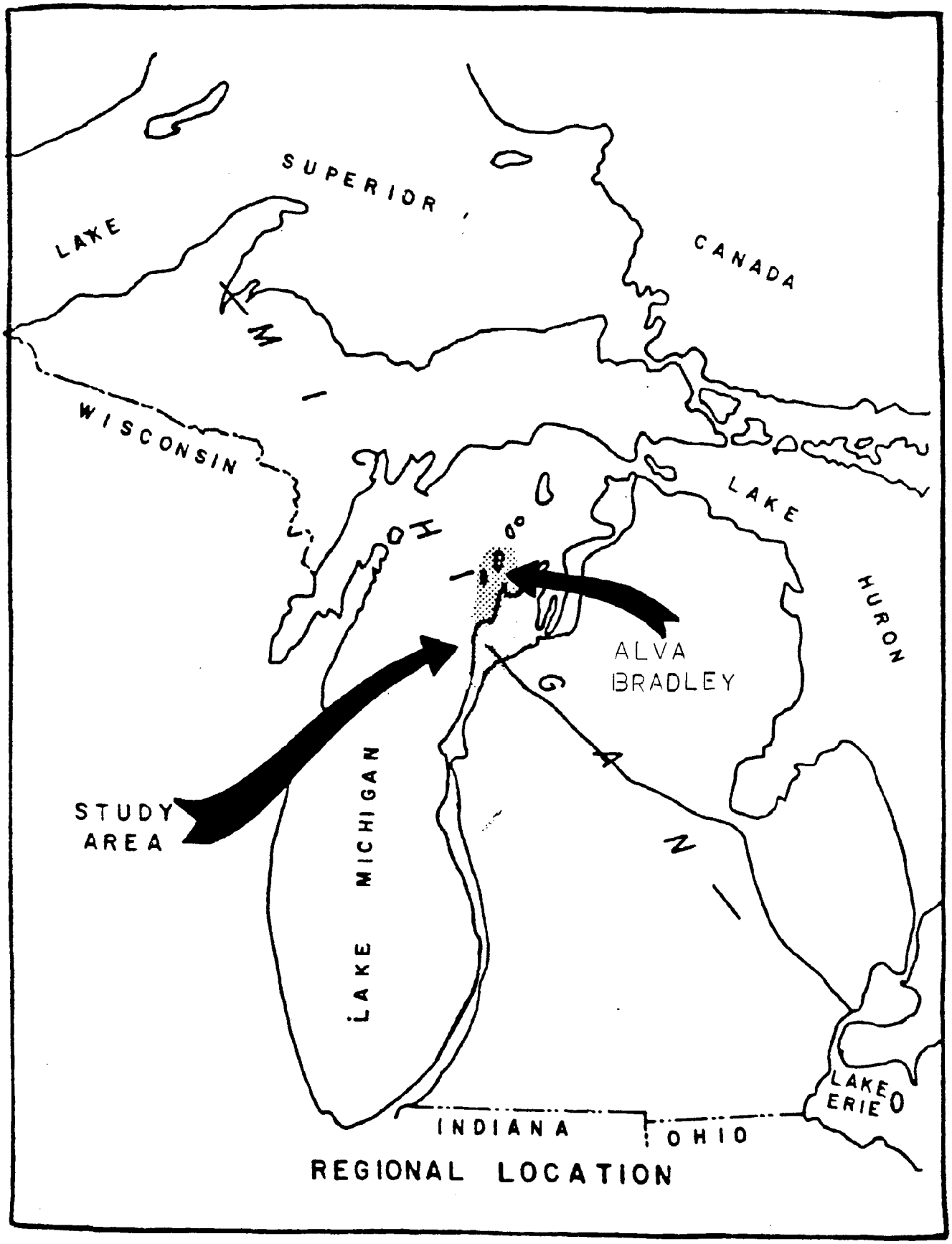
The ALVA BRADLEY rests in 26 feet of water on the North Manitou Shoal in Lake Michigan, within the boundries of the State of Michigan, Manitou Passage Underwater Preserve. The wreck lies approximately 1.5 miles offshore from the south end of North Manitou Island, Michigan. It is directly off of the west end of Millers Beach. The Loran C coordinates for the ALVA BRADLEY are 45°02.27 North and 85°59.26 West. The coordinates lie in the middle of the wreck site. The boundary for the site extends for 1 acre in all directions from the Loran C coordinates.

Boundary Justification

The ALVA BRADLEY's hull is broken up but largely represented along with a vast array of artifacts. The boundary is based on the probability of locating some structure, rigging, and other artifacts moved by waves and ice in the vicinity of the wreck site.

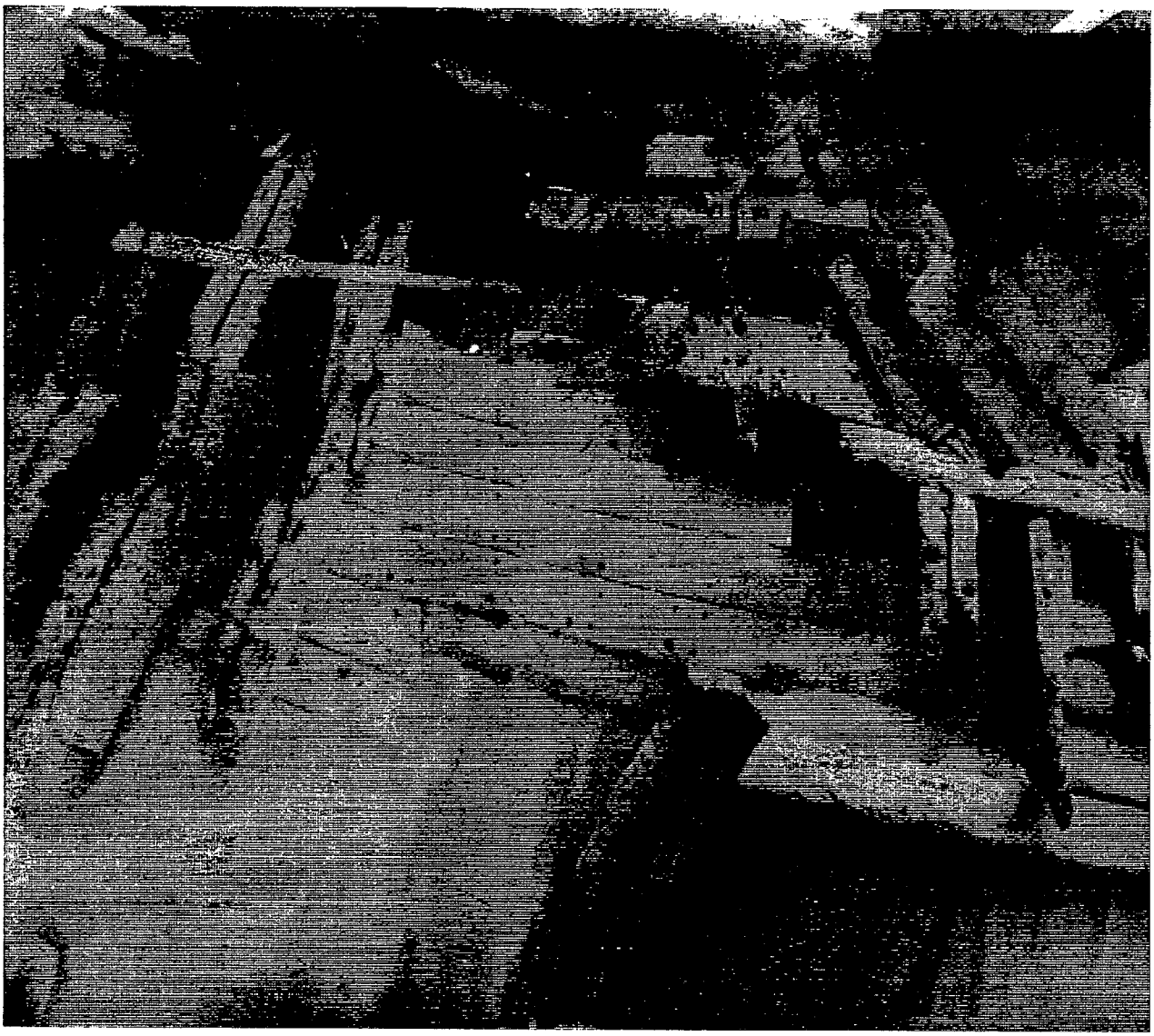
MANITOU PASSAGE
GREAT LAKES STATE BOTTOMLAND PRESERVE
282 SQUARE MILES





REGIONAL LOCATION

— Attachment "B" —



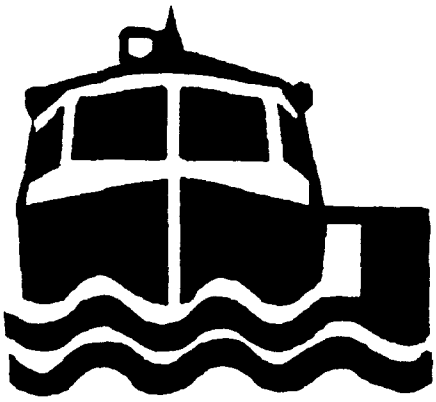
ALVA BRADLEY
Port side of Bow

— Attachment "D" —

Manitou Underwater Preserve Committee

of the Northwest Michigan Maritime Museum

SMALL CRAFTS



Emergency Operations Manual

Resource Inventory

EMERGENCY OPERATIONS PROCEDURES
MANITOU UNDERWATER PRESERVE FIELD OPERATIONS

Contents:

Guide to manual use pg.1

Emergency assistance available (who to call in an emergency) pg.2

Communications (how to call in an emergency).....pg.3

Emergencies (misc.) on site or underway (how to handle).....pg.4

Diving plan (emergency - how to handle, who to call).....pg.5,6

It is the responsibility of everyone associated with work conducted at the Manitou Underwater Preserve to become familiar with how to best handle emergency situations that may arise. All participants are required to read this manual and become thoroughly familiar with its contents. Additionally, you should take the time to note the locations of emergency equipment on boats and equipment used in support of site operations. Be sure to note the locations of important shore access sites. Many sites are in only semi-protected waters and many miles from the nearest harbor of refuge. Island sites must be considered as remote locations and all operations should reflect this.

Everyone's safety and well being (including your own) are dependant on the individuals that comprise the operations team. Think safely, work safely, and be prepared to respond appropriately should an emergency situation arise. Questions or suggestions regarding safety should be addressed to project safety officers.

U.S. Coast Guard: Station Frankfort is the nearest motor lifeboat station to the Preserve. Response time for the 44 ft lifeboat (depending on location) can be three hours. The 22 ft outboard up to one and one half hours. U.S. Coast Guard Station Charlevoix is the next nearest station with a motor lifeboat response time of no less than four hours. U.S.C.G. Air Station Traverse city provides the best response time via helicopter with a response time of aprox. twenty minutes. Evacuation of seriously injured personnel and/or persons forced to abandon a sinking vessel are best accomplished via C.G. helicopter. An A.L.S. flight surgeon accompanies all missions.

Leelanau Co. Sheriff Dept.: The Leelanau Co. Sheriff dept. maintains a marine patrol. Boats available are 22 ft. outboards with a response time generally no less than one half hour. They are available for emergency assistance only and are not well suited for towing. Sheriff patrol cars can be dispatched to shore access sites.

National Park Service: The National Park Service maintains a 27 ft. boat in Leland, a 21 ft. boat at South Manitou Island and a 16 ft. boat at North Manitou Island. Response time is variable as N.P.S. boats may often be underway in the area. N.P.S. boats are not well suited for towing. Most Park Rangers are certified E.M.T.s or advance first aid. E.M.T. Medical supplies are kept on North and South Manitou Islands at the Ranger Stations. N.P.S. patrols can be dispatched to shore access areas.

Michigan D.N.R.: The State D.N.R. conducts occasional marine patrols, however generally does not maintain adequate response times for emergency situations. They should be contacted for enforcement of Preserve regulations.

Grand Traverse Sheriff: The Sheriff Dept. in Grand Traverse Co. maintains an emergency dive team. Response time is variable but generally no less than one hour.

Munson Medical Center / North flight: Munson Medical Center in Traverse City maintains a fully staffed, 24 hr. facility. Advanced Life Support Intercept service is available via ambulance or North Flight helicopter dispatched from Munson in Traverse. North Flight will not conduct maneuvers over water, but can provide A.L.S. and evacuation from a shore access site. There is no recompression facility at Munson.

Empire F.D. Water Rescue Unit: E.M.T.'s trained in water rescue utilize a wave runner 3. and small utility boats. Fastest mainland response to most Preserve areas, limited off-shore capabilities.

Fire Dept. Ambulance, Glen Arbor / Leland: E.M.T. staffed Fire Dept. Ambulance service is available at shore access points.

COMMUNICATIONS:

Principal means of communication is via the VHF marine radio telephone. Only those persons rehearsed in radio operations should use these transmitters unless a situation warrants otherwise.

U.S. Coast Guard - ch. 16 hailing and distress
ch. 22 Coast Guard working frequency
ch. 21 Coast Guard Helicopter working frequency

Intership safety - ch. 16 hailing
ch. 6 working frequency

Leland Harbor Master - ch. 16 hailing
ch. 9 working frequency

Marine operator WLC Charlevoix - ch. 16 hailing
ch. 26 working frequency.

Leelanau Co. Marine Patrol - ch. 16 hailing and distress or request Leland Harbor Master contact land line.

National Park Service - all park vessels monitor ch. 16, for South Manitou hail the PIPING PLOVER, for North Island the EAGLE, for boats out of Leland the W.M. BURTON or BEAR.

Manitou Island Transit - ch. 16 hailing
ch. 9 working frequency
hail "Manitou Island Transit" for base station in Leland, or ferries MISHE - MOKOWA and MANITOU ISLE

Land line phone numbers:

U.S Coast Guard
Frankfort: 352-4242 or 352-9151
Charlevoix: 547-2995
Traverse City Air Station: 922-8210

Leelanau Co. Sheriff: 256-9829 outside 256 prefix -941-4111

National Park Service: 326-5134

Munson Medical Center / North flight: 922-9900

Empire F.D. Water Rescue Unit: 326-5151

Glen Arbor Fire Dept. ambulance: 334-9111
Leland Fire Dept. ambulance: 256-9311

Dept. of Natural Resources: 256-9374

EMERGENCY PROCEDURES ON SITE OR UNDERWAY:

Radio Distress:

1. Switch to channel 16 - Coast Guard.
2. Give Distress Signal, "Mayday," 3 times.
3. Give boat name, type, and color.
4. Give position.
5. Describe emergency.

Medical Emergency: Assess injury, provide first aid, give location and description of the injury to responding EMS units.

Man Overboard: Hail and pass the word "man overboard", post a lookout to do nothing but keep the overboard person in sight, throw a ring and toss buoys or other flotation material overboard, at night throw locator strobe attached to ring buoy.

Severe Weather/ Rough Seas: Don life jackets, Secure all loose objects in cabins and on deck. Close all windows, hatches and openings. No one should be permitted on deck without the knowledge of the Captain.

Fire:

1. If possible, use a fire extinguisher.
2. If practical, jettison burning materials.
3. Reduce the air supply
4. Assemble at opposite end of boat.
5. Make preparation to abandon ship:
   (a) Put on life jacket
   (b) Signal for help by radio or any means available

Vessel Taking on Water:

1. Put on life jackets.
2. Check bilge pump operation.
3. Pull up all decks and floor boards in search of leaks.
4. Slow or stop boat as needed. You may need to stay on plane to keep hole above water.
5. Stop engine, close sea-cock for engine cooling, disconnect hose and place end in bilge. Start engine to act as bilge pump.
6. Cover large hole from outside boat with mattress, etc.
7. Use radio to call for help. Channel 16 - Coast Guard.

Dense Fog: Reduce speed, post a lookout on deck and sound horn once every minute, turn on appropriate navigation lights. Hoist a radar deflector and establish radio contact with approaching vessels.

DIVING PLAN

Video-Mosaic Imaging Project
Manitou Passage Underwater Preserve - North Manitou Island Shoals
ALVA BRADLEY SITE (20 UM 30)

A) Site Conditions

1) Maximum Depth: 26 feet

2) Bottom Conditions: Mixed sand, gravel and rock. Fairly level, although actual slope is unknown.

3) Visibility: Can vary between 5 feet and 30 feet.

B) Safe Practices

1) Dive teams will receive diving assignments from one of the project research team prior to entering the water.

2) Dive teams will check in with the dive coordinator prior to entering the water. All dives will be logged on the diver entry-exit board and project diving record.

3) Dive teams will follow the dive plan, except for emergency situations or diver recall.

4) Divers have a **responsibility** to reject any diving assignment for reasons of fatigue, unsafe conditions, emotional condition, inadequate abilities, or other reasons. The project research team and dive coordinator will honor the diver's decision not to dive.

5) Solo diving will **not** be permitted under any circumstances.

6) Decompression diving is **not** allowed during the period of the project.

7) All divers will wear a buoyancy compensator or vest while in the water.

8) All divers will have an octopus regulator or second reguator that is available for his/her dive partner if needed.

9) Divers will immediately return to the boat if the diver recall signal is sounded.

10) Otherwise, divers will follow accepted safe diving practices as taught by their certifying agency.

C) Emergency Procedures

1) Project participants have a responsibility to report any unsafe conditions or emergency situations immediately to one of the project research team, or boat captains.

2) In the case of a medical emergency, start first aid as soon as possible, according to your skill level. All participants should know the location of project first aid equipment and supplies - ask one of the project research team or boat captains if you are unsure of these locations.

(A first aid guide for arterial gas embolism is attached).

3) Contact the U.S. **Coast Guard Group Sault Ste. Marie** in the case of a suspected emergency. Contact should be initiated on Marine FM radio channel 16. Follow the instructions of the U.S. Coast Guard for first aid, transport of the patient, or other emergency instructions. If U.S. Coast Guard Group Sault Ste. Marie does not respond, call for 1) "any Coast Guard Station," or 2) Grand Traverse County Central Dispatch.

4) Emergency Phone Numbers

Divers Alert Network (DAN):	(919) 684-8111
Benzie and Leelanau County EMS Dispatch:	Dial 0
Munson Hospital Emergency Room, Traverse City:	(616) 922-9333
U.S. Coast Guard Station Traverse City, Air Rescue:	(616) 922-8210
National Park Service Headquarters, Empire:	(616) 326-5134

* **NOTE:** All participants are expected to 1) behave in a safe and healthy manner, 2) share in the responsibilities of making project operations safe and successful, and 3) be familiar with the project diving plan, other project plans, and commonsense rules of safety. No horseplay or other inappropriate behavior will be tolerated.

Attachment "E"

Great Lakes Visual/Research
PO Box 27641
Lansing, Mi 48909-7641
(517) 482-9657
8/27/92

Department of Natural Resources
Land and Water Management Divisions
Coastal Management Program
Manitou Underwater Preserve Committee
Northwest Michigan Maritime Museum

Field activities report from Great Lakes Visual/Research, Inc.
on the VMI training session, August 1992

Description of Major tasks involved

1)grid design

Grid design is an ongoing procedure, the grid used for this project is a descendent of the grid used in 1991. Actual design procedures for this project began in May, 1992, the design was finalized in June, 1992.

By changing the construction materials of the grid we were able to overcome the serious weight problem the grid of 1991 suffered from. The material specified was a heavy wall PVC pipe material, available at any plumbing store. No major other problems occurred during this phase.

Task stands at 100% complete.

2)grid construction and testing

Grid construction began in mid June, 1992 and was on schedule for completion until it became clear that the project, as it stood at the time, could not occur for reasons of safety and inadequate preparation (as previously discussed). At this time, grid construction was halted until it was known whether or not it could be used.

At the time when the project was re-scheduled and all logistical needs seemed to be in place, construction of the grid began anew.

No problems occurred during this phase and the grid was completed fully in mid July, 1992.

At this time the main training team assembled at the Kellogg Biological Station, situated on Gull Lake near Hickory Corners, Mi., to begin testing procedures. These procedures included full grid construction underwater, leveling the grid on sloping surfaces, leg/sediment penetration measurements, leg angle measurements, weight and mass of the grid (subjective) - i.e. how easy is it to begin moving the grid, and how easy is it to continue moving the grid once in motion, and how easy to halt movement of the grid once moving. Additional tests of the prototype one of the camera mount (buoyancy, aspect tendency, stress on the grid, ease of movement along the grid), also tested was the affect of buoyancy devices

on various points along the grid.
These tests went without flaw, though some modifications were noted.

The only problem faced was with controlling excessive deflection from center due to the simple weight of the grid itself exerting pressure on the center joints. This was countered by using a system of buoyancy control points placed at the main center joint position. Additionally, ballast was required on the camera mount to counter the camera housing's aspect tendency to hang at about 220° and at the keel end of the grid to make that end more stable, though this modification was not implemented until actual on-site procedures began to verify this need.
This task stands at 100%.

3)video system assessment and integration

We first built a camera mount for the grid to accommodate our own system to act as a backup system and since the camera system designated for use by MUPC/NWMMM was "status unknown" for considerable time. Happily, we were able to obtain the camera housing in enough time to build a mount for it, but not enough time to test it.

Additionally, we were not able to secure the camera itself, therefore optical testing could not be done prior to arriving on-site. Optical testing determines how the grid is calibrated, and subsequently how the grid is to be used for on-site operations.

Camera testing occurred on the second day of the field operations (this being the first time the camera became available). At this time part of our team learned the camera's functions and how it assembled in the housing and then ran each MUPC/NWMMM team member through all the functions and drilled them on assembling the housing properly. The person who loaned the camera for this project neither trusted the people using the camera (meaning that he did not know all involved personally) nor was willing to show up on the project, and in addition required a $3000.00 deposit in case the camera housing flooded. A regrettable situation that no one could have foreseen. All personnel agreed that this situation was not acceptable and should be replaced immediately. Nevertheless, operations proceeded as planned and the camera was slated for deployment. This camera was deployed on the first day and used for a single image run in the port bow area. This image data was used to verify optical properties.

The next deployment day, Jack Spencer of Scuba North came through with a new camera/housing option with no strings attached. This camera proved to be considerably easier to use and with more logical camera control points. At this time our team re-trained all personnel to use this new camera system. The only drawback of this system was it use of a supplementary lens that increases the angle of view of the camera. This is good for basic video usage, but these lenses introduce a great deal of angular and optical distortions of the image on all edges. We compensated for this by increasing the image overlap areas so that most of the edge distortions will be eliminated by cropping.
If we can take it for granted that this camera will be used for the duration of the field season, then this task stands at 100% complete.

4)computer system assessment

Computer assessment began early this year by phone which produced no results. I visited Brauer Productions in Traverse City in June, 1992 to further assess the computer system capability. At this time it became clear, that either the personnel involved did not read the VMI tech manual or did not understand the specifications outlined. The system slated for use was not

acceptable in terms of software, RAM allocations and graphics display array. These items were discussed and agreed to and the meeting was closed.

One day during the field operations, specific personnel were dispatched to Brauer Productions to begin computer operations. It became immediately apparent that little progress had been made since our previous meeting. Additional RAM had been procured but had not been "mapped" to allow the computer to use it properly. The graphics array card was not compatible with the software designated and the new software upgrade had not been pursued with vigor to insure its arrival in time. Therefore, no computer construction operations were possible at all. The single bright spot in this aspect is that the computer acquisition of images from videotape is superb, and will produce images of good quality that will need minimal image processing after composite image construction.

At this time it is difficult to assess the percent completion, though our fulfillment of agreements stands as complete as could be accomplished and with phone consultation still to occur at any time, this task is considered to stand at 100% complete.

5)deployment training and Conclusion

Training on the grid operations is the first task, and this began at noon on the first day. Our strategy, as always, is to create teams of people who are all cross trained.

Training began with a general briefing of the VMI procedure and its rationale, the tasks and responsibilities each person will be required to fulfill, the team concept, dive procedures (non-impact, horizontal positioning, fin choice, hose tie-downs; dive cutoff point, no solo dives, underwater chain of command, and communications). Each person also filled out diver profile sheets. At this time all people were dismissed for about two hours in which to either have lunch or to obtain materials to secure their dive gear (loose hoses will catch and dislodge some grid apparatus). Also at this time our team evaluated the diver profiles to determine who could act as team leaders and to see if anyone was not qualified to participate.

The next phase of this day was to divide the personnel into teams and take them individually through grid construction and operations. Each team assembled and disassemble the grid completely at least once and run through leveling operations and to familiarize them with communication on the grid at all points. Each team also was drilled on the squaring operation, where the grid is moved so that it is perpendicular to the keel at all times. All operations were open to discussion at any time and questions at any level was encouraged.

The next day involved establishing a baseline along the keel and to lower the main grid components to the bottom, assemble the grid and then transport it to position one on-site. The only operation here that had any trouble was when the grid was transported on-site. At this time the dive team was composed of five divers, two stationed at either end and one in the middle. The grid was to move from the assembly point to the port side detached structure, move outboard of this structure then back inwards along this structure to a point parallel the main site rib line and as far forward as possible with the keel end of the grid astern. This plan was followed well and the grid moved easily in the water, unfortunately the team lost its bearings and had difficulty in finding the site at all. In the end the site was found and the grid was moved to a point just off the port side detached structure. At this time team members ended their dive due to air pressure cutoff. A second team was briefed and sent down to move the grid to position one on the site. This was accomplished with little difficulty. A third team of four assembled topside to move the grid to proper image run positioning and to accomplish at least one image run to use for camera

calibration verification. This team was briefed by team two after they had moved the grid on site and attempted rough grid positioning. Team three descended and found that the port side detached structure imposed a serious obstacle to positioning the grid perpendicular to the keel. The outboard legs were re-positioned so that the forward leg moved to a point about 12 feet on the grid while the aft leg moved to a point 19 feet along the grid. This allowed the grid to straddle the structure without impacting it. The camera run was now commenced, and as anticipated, only required about two minutes to complete. At this time, the team leader judged that the dive be ended.

The next day was cancelled due to weather. Though our team stayed all day in Leland to further brief divers and team leaders on camera operation and assembly and grid operations.

The next day was a full day were all teams were taken down in their pre-determined rotations. At this point the teams are comprised of four divers, two from MUPC/NWMMM personnel and two of our members. One of our trainers operates the camera position while the other runs oversight on all positions. The two MUPC/NWMMM members operate the ends of the grid and take all directions from the camera position operator.

The next day MUPC/NWMMM members increase to three per team and rotate through the camera position and one of our trainers continues overall oversight. At this time the trainers will intervene only if they see an omission of procedure. Two GLV/R personnel depart that night (thursday)

On the last day the MUPC/NWMMM personnel comprise the full team of either three or four, depending on the skill levels. GLV/R personnel assist as necessary and run briefings. On-site operations are observed by the trainers on a spot basis. At this time the port side, main site is over 90% complete.

It is believed at that time that the team concept had worked exceptionally well again. The more often people work together the more efficient they become. The grid and its movements are all highly designed and completely systematic. Once this system is understood, it is simply a matter of establishing good communication between the team members. We have found that it is best to allow each team to develop its own method of communication as each team will produce its own character and energy. A pre-determined, standard set of communications will work only as an early basis, it is certain that most divers will forget those communication standards in the beginning and by necessity develop their own as they are working. Each team will always find its own technique and this should never be discouraged.

By using the team leader concept, all new team members will look immediately to that person for guidance. Even if a new person with significant dive experience comes on to the project, carrying the attitude that they will perform like no other before, will quickly see that their experience will not apply to precise work such as the grid demands. There is always something that demands action and attention. The end positions of the grid are not exciting areas to be assigned to, but both ends are critical. It is the task of each end person to maintain a vigilant watch over those ends to check for many potential problems. It is their responsibility to note and correct any errors and to communicate to the camera position operator. If this does not happen, then the team breaks down. It is also the responsibility of the team leader to assess the skills of their teammates and to correct their errors. The team leader must assess the grid at all times. Essentially it is the team leader's task to ensure that their team members are up to speed.

Our team left with confidence that the team leaders we had designated would perform admirably. As in all projects there is always some people who are more suited for this type of

work than others. It is a difficult decision sometimes, but it is crucial to evaluate the divers and to use only the ones with the greatest skill, availability, energy and leadership qualities. In this project we felt that we spent too much time training people who failed this assessment according one or more of these criteria. It is a waste of precious time to do this.

On the other side, the participants who prove to be excellent must be trained and encouraged so that it is possible to put them right into the fire, so to speak. It is this person that a training project must target to be of the greatest effectiveness. These people can train the other less skilled or transitory participants and use them accordingly throughout the field season. While it is our goal to make the VMI process the most efficient site documentation system available, it is a mistake to think that any site can be fully documented in a week's time, particularly during a training session. The longer view must be taken.

Our end assessment is that of the MUPC/NWMMM personnel involved, five could easily be used as team leaders. Of these two are excellent, two are questionable, and one was not available to us for full training. Of the other participants only about 50% could be considered to be truly reliable for a full season of work. In total, three full, competent teams could be assembled at the end of the training project. *This was our target.*

However, leadership at the MUPC/NWMMM level must come forward and continue working and refining their own teams as well as allowing those teams to train new, qualified people as often as possible. Ideally, multiple teams can exist and develop and build their own documentation systems so that the VMI procedure can be deployed on multiple sites per year if needed. But as stated, this can only happen if the learning process continues.

At the time of this writing reports from MUPC/NWMMM indicates that progress is exceptional and that the training project was a success and that evaluations will continue.

This training project phase stands at 100% complete.

Financial report is attached.

Submitted, 8/28/92

Harley J Seeley, Sec/Treas, GLV/R, Inc.

Grid Construction

1)Lay out components as shown if Figure A.

2) Note numerical markings on each piece. Place items with matching marks next to eachother.

3) Item 1 and 1a will already be attached

4) Insert and bolt items 2 and 2a.

5) Items 6 and 6a will already be attached

6) Insert and bolt item 5 and 5a

7) Attach and bolt items 3 and 3a. And then items 4 and 4a.

8) Attach and bolt items 7 and 7a. Repeat for items 8 and 8a.

9) Insert item 9a through item 9. Insert item 9b through item 9a and bolt so that the elbow is horizontal. Repeat for items 10, 10a and 10b.

10) Elevate these legs so that the grid is about 1.5 feet off the ground.

11) Insert item 11a into item 11 and bolt. Repeat for items 14 and 14a.

12) Insert item 12a through item 12. Repeat for items 13 and 13a.

13) Elevate these legs to match height of the rest of the grid and insert through pins and lockdown.

14) Insert item 14b into item 14 and bolt. Repeat for items 11 and 11b.

Grid is now fully assembled.

Initial Grid Deployment

1) Assembled grid transported to Leland, all bolts checked.
2) Tie grid together internally to prevent excessive flexing.
3) Put grid on transport vessel.
4) Send diver team to establish sterile off-site area for grid and establish a bouy. Second dive team to check and/or establish baseline.
5) All divers out of the water
6) Lower grid to the bottom at the bouy location.
7) Outer legs bound together and lowered to bottom
8) Dive team follows surface line and movers legs to the grid and detaches line.
9) Flotation tubes bound together and lowered
10) Divers move tubes to grid and detaches line
11) Keel legs bound and lowered to bottom
12) Divers move keel legs to grid and detaches line.

Off-site grid assembly

1) Final check that bolts are secure.

2) Turn grid vertical and insert keel legs so that the 3" tees are on the bottom

3) Turn grid back to horizontal. Raise keel legs so that grid is approximately 2 feet high and insert and bolt the through pins

4) Insert outer legs into rear 4" vertical tees, elevate to about 2 feet and insert and bolt through pins.

5) Insert and bolt lower bouyancy tubes

6) Insert and bolt upper bouyancy tubes.

7)Attach 2 jugs at keelside, 2 at middle and 4 at Outer end of the grid.

8) Inflate jugs slightly.

1

Moving grid onto site

1) Diver team of three. One on each end and one in middle.

2) Keel end person controls all movement. Center diver assists where necessary and relays communication to Outer end diver.

3) Establish route from grid construction area to first deployment area on site.

4) Execute move to a position parallel to the keel, just off the ribs with the keel end most aft.

5) Adjust outer legs to a position 4-5 feet up.

6) Middle person moves toward the keel end of the grid to assist keel end operator.

7) Inflate lift jugs to neutral bouyancy

8) Keel end divers move grid 90° to rest on the keel.

8a) Outer end diver simply lifts and rotates grid to match movement of keel end operators.

9) Adjust keel leg elbows to the vertical position and bolt.

10) Dive team assesses outer leg position and adjusts legs to avoid structure impact at position one.

11) Adjust grid height to level target height and both ends

12) Outer end diver iniates the grid move to position one. Middle diver now assists the outer end diver.

13) Keel end diver matches movement of outer end.

14) When the grid is roughly in position, the keel end diver takes control and initiates the grid movement to actual position one on the baseline.

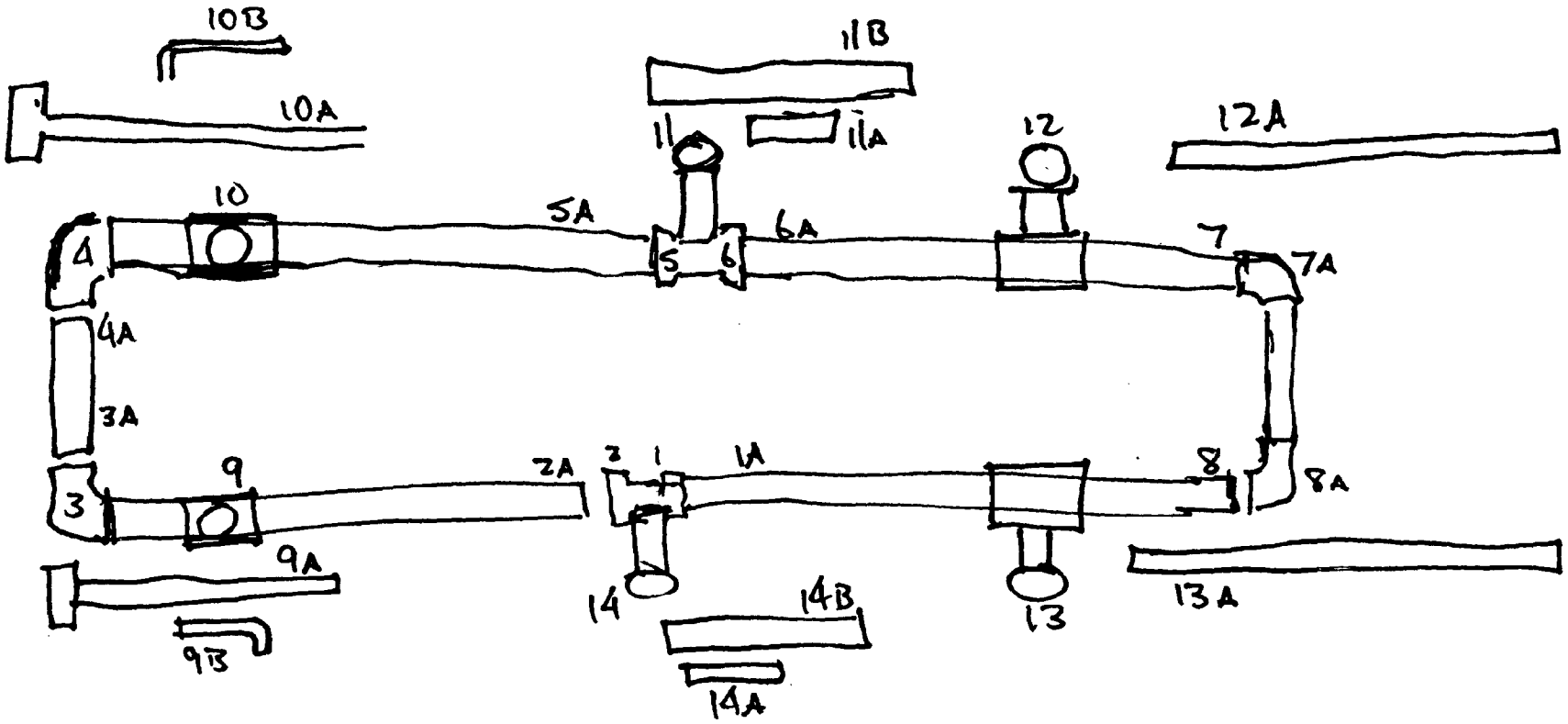
15) Outer end diver adjust position to match keel position.

Image run check list

Middle position is called operator one or Op1, keel end diver is operator 2 or Op2, outer end diver is called operator 3 or Op3.

1) Op1 moves camera carriage to the center of the grid
2) Op1 positions self in center of grid and perpendicular so that both ends can be observed.
3) Op2 initiates move of grid along baseline.
4) Op1 signals to Op3 to begin move
5) Op2 places aft leg at correct position on the baseline.
6) Op1 signals to O3 to stop.
7) Op1 moves to baseline and places template in position on baseline.
8) Op3 adjusts outer end of grid to match template distance.
9) Op2 keeps aft leg in position at the baseline.
10) Op2 records position of aft leg on the baseline on a slate.
10a) Op2 and 3 check grid to structure height at their positions and adjusts as necessary
11) Op2 and 3 deflate lift devices if necessary.
11a) Op1 powers up camera and starts recording
11b) Op2 and 3 off grid.
12) Op1 checks the camera mount.
13) Op1 makes sure camera carriage is at the correct markings on the grid
14) Op1 places stadia reference on site perpendicular to keel
15) Signals through the lens that position is ok
16) pause for 5 seconds.
17) Repeat steps 13 - 17
18) At end of image run, Op1 shuts down camera
19) Op2 and 3 back at stations.
20) repeat all steps until battery fails or any one diver reaches air cutoff level.

figure A


10B
10A
11B
11A
11
12
12A
10
5A
6A
4
5
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7A
4A
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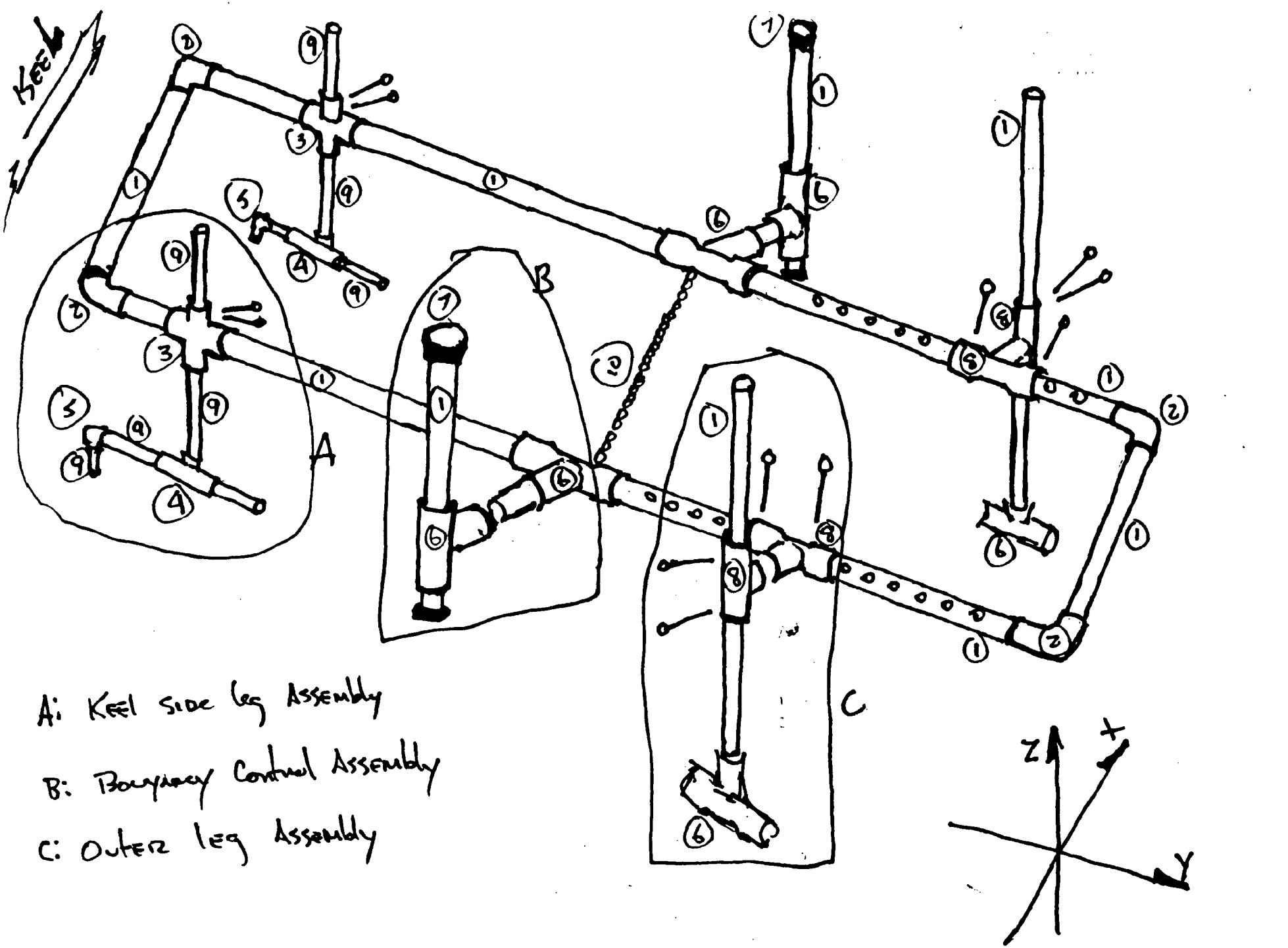
13A



A: Keel side leg Assembly

B: Boyancy Control Assembly

C: Outer leg Assembly

Attachment "F"

Manitou Underwater Preserve Committee

of the Northwest Michigan Maritime Museum

Box 388 • 11712 Lake Street • Empire, MI 49630 • 616-326-5533

Dear Video Mosaic Imaging (VMI) Project Participant,

At long last the computer hardware is in and we can now begin to assemble the images of the Alva Bradley gained during our first project period. Initial review of the images gathered give us reason to believe our first attempt at VMI will be a success.

Project teams worked successfully until Sunday, August 9th, when the entirety of the starboard bilge was recorded and the grid recovered. Although the weather was to take a turn for the worse, Sundays team worked in 20 ft water visibility with glass calm surface conditions. A far cry from Saturdays weather which also disabled the rudder on the regrettably indispensable RUFFIAN.

The commitment by volunteers such as yourself is unquestionably our greatest asset in attempting to conduct a project like VMI. As such we would like to know how you felt about your volunteer experience during this first project period.

Please take the time to answer the following questions, including your insights and recommendations. Remember to take into consideration the constraints/resources the Preserve must realistically work with. While an 80 ft live-aboard dive boat would be great...chances are slim.

After we are certain that data already recovered is adequate and any procedural or equipment corrections made, we will be scheduling further field work. We look forward to your continued involvement.

On behalf of Michigan Coastal Management Program and the Manitou Underwater Preserve Committee, we would like to thank you again for your time and commitment to this important project.

Sincerely,

Jed Jaworski
Project Administrator

1. Did you find the Video Mosaic Imaging procedure and equipment easy to understand and implement?

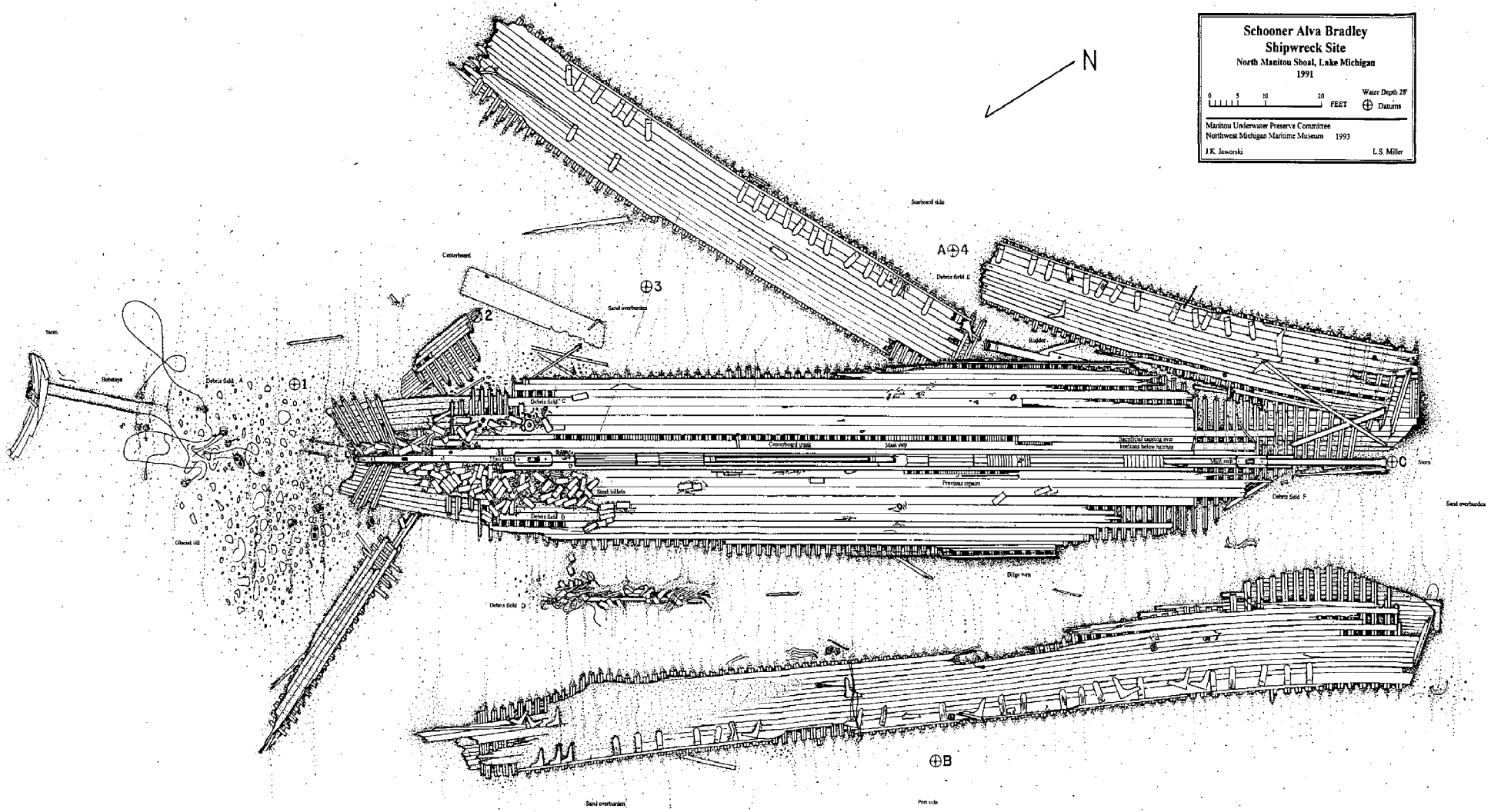
2. What do you feel the strengths and weaknesses of the Sunday orientation at the Leelanau school were?

3. What do you feel the strengths and weaknesses of the field operation were?

4. Do you feel that safety concerns were adequately addressed? ie. equipment, procedures, Project staff expertise.

5. What changes would you recommend regarding VMI procedures and/or equipment?

— Attachment "G" —


Schooner Alva Bradley
Shipwreck Site
North Manitou Shoal, Lake Michigan
1991
0 5 10 20 FEET
Water Depth 28'
Datums
Manitou Underwater Preserve Committee
Northwest Michigan Maritime Museum 1993
J.K. Jaworski
L.S. Miller
N
Starboard side
Centerboard
Stem
Bobstaye
Debris field A
Debris field C
Centerboard trunk
Mast step
Steel billets
Debris field B
Glacial till
Debris field D
Previous repairs
Debris field E
Rudder
Debris field F
Bilge turn
Sand overburden
Port side

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