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DEEP SUBMERGENCE RESEARCH CONDUCTED DURING
THE PERIOD 16 JUNE 1961 THROUGH
31 DECEMBER 1973

August 1974

TECHNICAL REPORT

*Prepared for the Office of Naval Research
under Contract N00014-71-C-0107; NR 265-107
(formerly Nonr-3484(00); NR 260-107).*

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Approved for Distribution Earl E. Hays

Earl E. Hays, Chairman
Department of Ocean Engineering

ABSTRACT

This report provides a brief overview of over twelve years of development and operations of the Deep Research Vehicle ALVIN and its support system. Conclusions regarding the usefulness of the work and recommendations regarding its continuance are made.

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I. Introduction

Contract Number N00014-71-C-0107 (initiated as Nonr 3484(00) was issued to Woods Hole Oceanographic Institution for the primary purpose of conducting Deep Ocean Research by means of a manned submersible. This included design, construction, operation and maintenance of the deep submersible and its support ship. The contract was effective on 16 June 1961 and expired 31 December 1973.

This report provides a brief summary of the work done but is not intended to be all-inclusive. Specific and detailed information is contained in the various technical reports, annual reports and technical memos which are referenced in Appendices B thru E.

II. Summary of Operations and Investigations

Work commenced on Contract Number N00014-71-C-0107 in October 1961 with the formation of a deep submergence research group. Accomplishments during the first year included monitoring of the Aluminaut Program, preparation of a specification, solicitation of bids and the award of a contract for a 6000 foot research vehicle. In addition, studies were begun for the outfitting of the vehicle and other associated engineering details.

The second year under this contract, beginning 1 November 1962 and running through 31 December 1963, was devoted primarily to monitoring the construction of the 6000 foot research vehicle through tests and inspections. The instrument system to be used was formulated and a final acceptance test was devised. Model tests, including a collapse test of a one-sixteenth scale model of the ALUMINAUT were performed and reported.

During the period 1 January 1964 through 31 December 1964 the 6000 foot research vehicle ALVIN was completed and delivered to the Woods Hole Oceanographic Institution and testing including 77 manned dives, was commenced. A catamaran support ship was constructed and tested. The last

three months of the year were used to begin an extensive inspection and refit period.

Calendar year 1965 saw the ALVIN reach full operational status. Upon the completion of the major refit started in 1964, ALVIN and the catamaran support ship proceeded to the Bahamas for testing, then to Bermuda for more dives and finally back to Woods Hole. A total of 31 dives were made including one unmanned to 7500 feet. All safety devices including the sphere release and battery dropping systems were thoroughly tested and two manned dives to full operational depth (6000 ft.) were successfully completed.

Calendar year 1966 probably justified, more than any other year, all of the time, effort and money expended under this contract. ALVIN played a key role in the successful recovery of an H-bomb lost in the sea off Palomares, Spain. Three other major programs carried out for the Navy included inspection of the ARTEMIS array off Bermuda, and the AUTEC range in the Tongue of the Ocean in the Bahamas as well as a dive series for the Naval Oceanographic Office. A total of 76 dives were made including 35 during the bomb search. Improvements in ALVIN and the catamaran support ship continued to improve the system capability.

In 1967, after an extensive refit of ALVIN and the catamaran support ship, a compressed diving schedule was carried out. This year saw the first extensive use of ALVIN for oceanographic research as opposed to engineering. Out of a total of fifty-five dives, forty-three were for specific oceanographic tasks broken down as follows:

Biology - 20

Geology - 17

Physical Oceanography - 3

Geophysics - 3

During 1968 the course of operations including 67 dives by ALVIN two important 'firsts' were accomplished. The first hard-rock sample was taken in deep water, and scientific observations were made, in situ, of a deep sea mount for the first time. Large numbers of more sophisticated tools to allow the scientist to sample, record and navigate were developed and tested.

The loss of ALVIN on 16 October 1968 while preparing to launch ended the diving program for the year. An attempt to salvage the submersible using the General Motors Deep Ocean Work Boat was unsuccessfully made on 3 November.

In 1969 this contract supported a wide variety of

activities, foremost among which was the search for and recovery of the research vehicle ALVIN through the use of the R/V MIZAR and the DSV ALUMINAUT supported by the M/V STACEY TIDE. Recovery devices were designed and constructed, navigation systems were modified and after recovery, cleaning and treatment techniques were devised for recovered equipment. In other areas Woods Hole participated in a dive on BEN FRANKLIN and carried out extensive alterations to the support catamaran LULU to enable it to handle the DRV SEA CLIFF. Monitoring of the construction of SEA CLIFF continued and work began in anticipation of the possibility of retro-fitting the TITANES sphere to ALVIN.

Primary efforts in 1970 were directed towards ALVIN's rebuild and preparation for receipt of SEA CLIFF. SEA CLIFF however was transferred from ONR to SUBDEVGRU ONE and emphasis was shifted completely to ALVIN. Other activities during the year included participation in the program for the construction of the titanium hulls under Project TITANES; assignment of the procurement of the electrical penetrators for TITANES; and participation in the Deep Ocean Technology (D.O.T.) program primarily with NSRDL, Annapolis, Maryland. By the end of the year a firm plan to bring ALVIN

back to a full 6000 foot operational capability was formulated and further plans were in work for an eventual increase of depth capability with the TITANES hull.

During 1971 the ALVIN rebuild was completed and in June, supported by the catamaran LULU, ALVIN began operations again. Out of a total of 82 dives, 22 were supported by this contract for test, training and certification. Major steps were made in planning for the ALVIN/TITANES refit and at the end of the year the submersible began an overhaul to make preliminary preparations for this refit.

The first four months of 1972 were spent completing the overhaul and in May diving operations commenced. Out of a total of 67 dives 21 were made under this contract for test, training and certification as well as supporting several scientific programs with separate funding of their own. In November ALVIN began the major tear-down to be ready for the arrival of the TITANES sphere.

During 1973 this contract, supplemented by a separate ONR contract for hull penetrators provided almost the sole support of ALVIN/LULU through the end of October. Work included the complete overhaul of the submarine, installation and outfitting of the TITANES sphere, testing of the assembled

vehicle at NSRDC Annapolis, Maryland, shallow sea trials and certification. By the end of the year nineteen dives were completed for test and certification of the new ALVIN including tank "dives" to 12,000 feet and open ocean dives to 3,800 feet.

III. List of Documents

Appendices B thru E have been prepared as a comprehensive list of pertinent reports, papers, etc. These documents are either directly related to or were prepared because of the program. It can be seen from the list that the deep submergence research contributed a significant amount to the technical and scientific literature.

IV. Conclusions

Over twelve years of work under this contract have culminated in a reliable and workable Deep Ocean Research capability. Providing scientists and engineers with the means to directly inspect and observe in the deep ocean has been demonstrably useful to both the scientific and engineering community during the period of this contract. In addition, and equally as important, the retrieval of an H-bomb has shown that a deep ocean capability is also a valuable political tool.

Other useful benefits have been derived from this work also. During the maturation of the ALVIN program, the continuity of trained personnel shows up as a valuable adjunct to this type of operation. The ALVIN program has had this continuity at the working level to a greater degree than any other deep submergence program under Navy sponsorship. Many developments in the deep submergence field have been tested, de-bugged and "babied" through the development stage by experienced personnel, where injection directly into the operating forces might easily have resulted in an evaluation by less experienced personnel of "not workable." The ALVIN system has provided a valuable operational test and evaluation platform for many developments including electrical components, jettison systems, ballasting systems and the titanium hull.

Advanced development work now going on under other sponsorship has its origin in early work done under this contract and is now providing the Navy with useful systems. Perhaps the best example of this is the Pulse Navigation System, three of which are now in operation in support of programs which will ultimately benefit the Navy. Discussions are presently underway which may result in providing the operating forces directly, with one or more of these systems.

Taken as a whole the Deep Ocean Research Program at Woods Hole Oceanographic Institution under the Office of Naval Research has made significant and lasting contributions to the Deep Submergence Field and to the Navy, and thereby to the overall posture of the country in this field.

V. Recommendations

Although minimal funding to continue pilot and vehicle certification has continued through 1974 under a separate contract, the imminent cessation of all direct funding of the program by ONR will have a serious impact on the maintenance of a deep vehicle capability for the Navy. In addition the loss of the use of the operational test and evaluation platform by the Navy will eventually affect the capabilities of the existing operating forces. Equally as serious will be the reduction in ability to provide services to the nation's scientific community. Without some form of base funding, continued advancement of the research capability will not be possible. It is therefore strongly recommended that a comprehensive effort be made to find a method of providing support for the ALVIN system that will provide for the retention of the working level expertise, continue to support the scientific community, maintain the deep ocean capability in a flexible manner and allow continued advancement of the state of the art.

APPENDIX A

Chronology of Operations

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	6/26/64	1	Off WHOI Dock	ONR Test	W. Rainnie M. McCamis H. Learnard	None			1-15	27'	1st Tethered Trim Dive
--	7/1/64	2	Bel Pond	ONR Test	M. McCamis W. Rainnie	None			1-00	12'	Submerged in- clining ex- periment
--	7/2/64	3	Off WHOI Dock	ONR Test	W. Rainnie M. McCamis	None			2-30	25'	1st free static dive
--	7/31/64	4	Off WHOI Dock	ONR Test	M. McCamis W. Rainnie	None			0-45	25'	System check out
--	8/4/64	5	W.H. Harbor	ONR Test	M. McCamis W. Rainnie	None			1-15	38'	1st free dive
--	8/5/64	6	"	ONR Training	M. McCamis W. Rainnie	None			0-30	70'	Training dive
--	8/7/64	7	"	ONR Training	M. McCamis W. Rainnie	None			2-25	40'	Training practice salvage
--	8/7/64	8	"	ONR Training	M. McCamis W. Rainnie	H. Froehlich			1-15	32'	Training 1st observer
--	8/12/64	9	Buzzards Bay	ONR Training	M. McCamis W. Rainnie	None			1-15	45'	Training
--	8/12/64	10	"	ONR Training	W. Rainnie M. McCamis	None			0-30	25'	Training
--	8/14/64	11	"	ONR Training	M. McCamis W. Rainnie	None			1-30	33'	Training

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	8/14/64	12	Buzzards Bay	ONR Speed trial	M. McCamis W. Rainnie	None			1-00	44'	Speed trials
--	8/17/64	13	"	ONR Speed trial	M. McCamis W. Rainnie	None			1-15	35'	Speed trials
--	8/17/64	14	"	ONR Training	W. Rainnie M. McCamis	A. Vine			1-00	25'	1st scientific observer
--	8/18/64	15	"	ONR Training	W. Rainnie P. Hamman	None			1-00	35'	
--	8/18/64	16	"	ONR Orientation	W. Rainnie	CAPT. C. Monsen			1-00	36'	Orientation
--	8/19/64	17	"	ONR Orientation	M. McCamis	LCDR. W. Lasley			0-45	36'	Orientation
--	8/19/64	18	"	ONR Trials	M. McCamis P. Hamman	None			2-00	38'	Training, speed trials
--	8/20/64	19	"	ONR Trials	M. McCamis W. Rainnie	None			0-45	45'	Speed trials
--	8/20/64	20	"	ONR Check out	P. Hamman W. Rainnie	W. Marquet			0-45	34'	Instrument check out
--	8/21/64	21	"	ONR Trials	M. McCamis W. Rainnie	None			1-15	43'	Trials
--	8/24/64	22	"	ONR Orientation	W. Rainnie	R. Backus			1-30	36'	Orientation
--	8/24/64	23	"	ONR Training	M. McCamis	W. Lane C. Rea			0-45	35'	Training

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	8/24/64	24	Buzzards Bay	ONR Training	P. Hamman M. McCamis	None			1-00	25'	Training
--	8/25/64	25	"	ONR Training	W. Rainnie	C. Bowin			1-45	42'	Orientation, gravity measure
--	8/25/64	26	"	ONR Orientation	P. Hamman W. Rainnie	A. Rechnitzer			0-45	33'	Orientation
--	8/25/64	27	"	ONR Orientation	P. Hamman M. McCamis	W. Scheville			1-15	36'	Orientation
--	8/26/64	28	"	ONR Training	M. McCamis	G. Kelly J. Wilska			1-00	36'	Training
--	8/26/64	29	"	ONR Orientation	W. Rainnie	P. Fye			1-15	41'	Orientation
--	8/26/64	30	"	ONR Orientation	P. Hamman M. McCamis	J. Knaus			1-00	44'	Orientation
--	8/26/64	31	"	ONR Orientation	P. Hamman M. McCamis	R. Chase			0-45	34'	Orientation
--	8/27/64	32	"	ONR Orientation	P. Hamman M. McCamis	W. Burt			1-00	30'	Orientation
--	8/27/64	33	"	ONR Orientation	P. Hamman W. Rainnie	J. Beckerle			1-00	40'	Orientation
--	8/27/64	34	"	ONR Training	P. Hamman M. McCamis	D. Bedding			0-45	35'	Training
--	8/27/64	35	"	ONR Orientation	P. Hamman M. McCamis	L. Baxter			1-15	41'	Orientation

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	8/27/64	36	Buzzards Bay	ONR Training	P. Hamman M. McCamis	A. Vine			0-45	40'	Training
--	9/1/64	37	W. H. Harbor	ONR Pilot Qual.	P. Hamman W. Rainnie	None			1-00	48'	Manipulator mounted
--	9/1/64	38	"	ONR Orientation	W. Rainnie	E. Link			1-15	28'	Orientation
--	9/2/64	39	"	ONR Orientation	M. McCamis	S. Johnson			1-00	28'	Orientation
--	9/2/64	40	"	ONR Orientation	P. Hamman	E. Hays			0-45	25'	Orientation
--	9/3/64	41	"	ONR Orientation	P. Hamman	J. Stanbrough			0-45	25'	Orientation
--	9/3/64	42	"	ONR Orientation Geology obs.	M. McCamis	J. Hulsemann			2-15	33'	Geological observations
--	9/3/64	43	"	"	W. Rainnie	R. Pratt R. Cordry			1-00	25'	"
--	9/4/64	44	"	"	P. Hamman	D. Stanley D. Owen			1-00	44'	"
--	9/8/64	45	"	ONR Orientation	P. Hamman	H. Sanders R. Hessler			0-45	32'	Orientation
--	9/8/64	46	"	ONR Photo mission	M. McCamis	J. Burke			1-00	40'	Photography

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	9/8/64	47	W. H. Harbor	ONR Orientation Geology obs.	P. Hamman	K. Emery			1-15	53'	Orientation Geological observations
--	9/9/64	48	"	ONR Training	P. Hamman	M. Fox R. Graham			1-00	31'	Training
--	9/9/64	49	"	ONR Training	M. McCamis	D. Mason G. Broderson			1-00	40'	Training
--	9/9/64	50	"	ONR Check out	P. Hamman	C. Tyndale C. Porembski			1-00	33'	Instrument check
--	9/10/64	51	"	ONR Orientation	P. Hamman	S. Mackay C. Menneken			0-45	34'	Orientation
--	9/10/64	52	"	ONR Orientation	M. McCamis	A. Bennett D. Mintzer			0-45	30'	Orientation
--	9/15/64	53	"	ONR Orientation	W. Rainnie	L. Cather H. Bernstein			0-45	39'	Orientation
--	9/15/64	54	"	ONR Orientation Current measurement	M. McCamis	D. Bumpus			2-00	30'	Orientation current measurement
--	9/15/64	55	"	ONR Geology obs.	W. Rainnie	R. Tagg			1-00	44'	Orientation Geology obs.
--	9/16/64	56	Vineyard Sound	ONR Training	P. Hamman M. McCamis	None			1-00	50'	Training in current
--	9/21/64	57	W. H. Harbor	ONR Orientation	M. McCamis	R. Dill A. Schlosser			1-15	40'	Orientation

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	9/21/64	58	W. H. Harbor	ONR Orientation	P. Hamman	A. Twitchell K. Mackenzie			1-00	30'	Orientation
--	9/22/64	59	"	ONR Orientation	W. Rainnie	J. Mavor			0-45	35'	Orientation
--	9/23/64	60	"	ONR Orientation	M. McCamis	J. Craven			1-00	34'	Orientation
--	9/23/64	61	"	ONR Orientation	P. Hamman	F. Weyl W. Whitmore			0-45	30'	Orientation
--	9/23/64	62	"	ONR Orientation	W. Rainnie	CAPT. J. Heg CDR. Jackson			1-00	40'	Orientation
--	9/23/64	63	"	ONR Orientation	M. McCamis	W. Avery D. Bleil			0-30	35'	Orientation
--	9/25/64	64	"	ONR Orientation	P. Hamman	CAPT. B. Byrnside			1-00	34'	Orientation
--	9/25/64	65	"	ONR Orientation	W. Rainnie	E. Bunce			1-00	45'	Orientation
--	9/25/64	66	"	ONR Orientation Geology	M. McCamis	R. Meade F. Manheim			1-15	45'	Orientation 1st core samples
--	9/28/64	67	Vineyard Sound	ONR Trials	M. McCamis P. Hamman	None			0-15	17'	Speed trials aborted be- cause of current
--	9/28/64	68	W. H. Harbor	ONR Trials	M. McCamis P. Hamman	None			1-15	62'	Submerged maneuvering trials

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	9/29/64	69	W. H. Harbor	ONR Trials	M. McCamis P. Hamman	A. Vine			2-15	65'	Speed trials
--	9/30/64	70	"	ONR Orientation	W. Rainnie	LCDR. L. Shumaker P. Ianuzzi			0-45	30'	Orientation
--	9/30/64	71	"	ONR Trials	P. Hamman	A. Vine C. Porembski			2-00	28'	Sub maneuver- ing charac- teristics and inst. check
--	9/30/64	72	"	ONR Geology	M. McCamis	C. Bowin			2-00	62'	Geology obs. & gravity measurement
--	9/30/64	73	"	ONR Trials	W. Rainnie P. Hamman	None			2-00	46'	Tethered - to cal. VB system sub- merged
--	10/1/64	74	Off WHOI Dock	ONR Trials	P. Hamman	H. Froehlich			1-15	20'	Tethered -to measure max. trim angle & run mach. at max. angles
--	10/1/64	75	"	ONR Trials	M. McCamis	W. Nesbitt			1-45	17'	Tethered -sub static thrust measurements
--	10/6/64	76	"	ONR Trials	M. McCamis P. Hamman	None			0-45	23'	Forebody re- lease test - aborted broken wrench

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
--	10/6/64	77	Off WHOI Dock	ONR Trials	P. Hamman M. McCamis	None			0-15	23'	Forebody re- lease test - successful
	5/17/65	78	Port Canaveral	ONR Trials	M. McCamis V. Wilson	None			1-00	25'	Tethered - est. neutral trim
	5/17/65	79	"	ONR Trials	M. McCamis V. Wilson	None			1-00	15'	Inclining experiment
	5/20/65	80	Off Cocoa Beach	ONR Training	W. Rainnie M. McCamis	None			1-15	203'	First dive open ocean - poor vis. surge problem
	5/21/65	81	Port Canaveral	ONR Training, Trials	M. McCamis V. Wilson	W. Marquet			1-30	37'	CTFM sonar alignment
	5/24/65	82	"	ONR Training, Trials	W. Rainnie V. Wilson	W. Marquet			2-00	39'	CTFM sonar adjustment
	5/25/65	83	"	ONR Training	M. McCamis V. Wilson	None			2-00	37'	Pilot training incl diver salvage of sub
	5/25/65	84	"	ONR Training	M. McCamis V. Wilson	None			2-00	37'	Pilot training emergency pro- cedures
	6/4/65	85	Coral Harbor	ONR Training	M. McCamis	C. Porembski R. Hakamaki			2-00	15'	Salvage training

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	6/5/65	86	Off Coral Harbour	ONR Training & photos	W. Rainnie V. Wilson	None			1-00	19'	1st clear water movies taken from sub
	6/5/65	87	"	ONR Training & photos	M. McCamis	W. Lasley			1-00	20'	Movies taken
	6/14/65	88	"	ONR Test, battery drop	M. McCamis V. Wilson	None			1-15	16'	Battery drop test one did not drop due to wave surge
	6/17/65	89	"	ONR Test, sphere release	W. Rainnie V. Wilson	None			1-15	16'	Successful sphere release
	6/21/65	90	"	ONR Test, battery drop	M. McCamis V. Wilson	F. Omohundro			1-15	19'	Successful drop
	6/24/65	91	3 mi SW C. Harbor	ONR Training & photos	W. Rainnie V. Wilson	None			3-15	70'	
	7/1/65	92	25-03N	ONR Deep test	Unmanned	None			9-30	7500'	Tethered, un- manned test. 1st night recovery

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	7/6/65	93	2 mi S. Clifton Pt.	ONR Training & photos	W. Rainnie M. McCamis	P. Fye			2-30	70'	
	7/7/65	94	3 mi S. Clifton Pt.	ONR Training & photos	M. McCamis W. Rainnie	None			2-30	180'	1st attempt deep dive
	7/8/65	95	4 mi S. Goulding Cay	ONR Deep test	W. Rainnie M. McCamis	None			4-45	1600'	1st deep dive
	7/13/65	96	5 mi S. Goulding Cay	ONR Deep test	M. McCamis W. Rainnie	None			4-30	1300'	
	7/15/65	97	"	ONR Deep test	W. Rainnie V. Wilson	None			5-15	2700'	
	7/16/65	98	"	ONR Deep test	W. Rainnie M. McCamis	None			4-30	3600'	1st propulsion failure
	7/19/65	99	Off Coral Harbour	ONR Sonar test	M. McCamis V. Wilson	K. Sharpe			1-15	25'	
	8/2/65	100	2 mi NW Goulding Cay	ONR Deep test	W. Rainnie M. McCamis	None			5-30	6000'	1st 6000' dive
	8/10/65	101	Port Canaveral Harbor	ONR Post-refit tests	V. Wilson	W. Marquet D. Hutchinson			1-45	32'	Main prop failed

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	8/22/65	102	2 mi SE Argus Is.	ONR Deep test	M. McCamis W. Rainnie	None			5-30	4500'	Main prop failed 4500'; conducted telemetry tests
	8/23/65	103	1 mi S Argus Is.	ONR Deep tests, topography observation	W. Rainnie M. McCamis	None			6-15	3000'	Main prop failed. Tele- metry tests.
	8/26/65	104	1 mi S. Argus Is.	ONR Photo, top- ography obs.	V. Wilson W. Rainnie	None			3-15	1900'	Lift props failed at depth; main prop on surface.
	9/24/65	105	Port Royal Bay Bermuda	ONR Post-refit tests	V. Wilson M. McCamis	None			1-45	40'	
	9/25/65	106	5 mi SE St. Davids Bermuda	ONR Deep test & photos	M. McCamis W. Rainnie	None			7-00	6000'	Successful
	10/19/65	107	Buzzards Bay	ONR Bottom ecology	V. Wilson	W. Marquet L. Bennett			0-48	38'	
	10/23/65	108	Cape Cod Bay Fish- ing Ledge	ONR Geology	V. Wilson	J. Trumbull			0-53	93'	Geology of ledge
	2/9/66	109	Harbor Rota Spain	ONR Test	M. McCamis V. Wilson	W. Marquet			1-20	40'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	2/14/66	110	Spain	ONR Bomb search	W. Rainnie M. McCamis	None	1427	1737	6-03	1800'	
	2/15/66	111	"	"	W. Rainnie V. Wilson	None	0945	1548	6-03	2100'	
	2/17/66	112	"	"	M. McCamis V. Wilson	E. Hays	0950	1650	7-00	2000'	
	2/19/66	113	"	"	M. McCamis V. Wilson	None	0934	1635	7-01	2300'	
	2/22/66	114	"	"	W. Rainnie M. McCamis	None	0835	1535	7-00	2250'	
	2/23/66	115	"	"	M. McCamis V. Wilson	None	1458	1830	3-32	1700'	
	2/24/66	116	"	"	W. Rainnie V. Wilson	W. Marquet	0910	1557	6-47	1550'	
	2/25/66	117	"	"	M. McCamis V. Wilson	E. Hays	0908	1628	7-20	2300'	
	2/26/66	118	"	"	W. Rainnie M. McCamis	R. Boykin	0848	1510	6-22	2300'	
	3/1/66	119	"	"	W. Rainnie V. Wilson	F. Andrews	0903	1608	7-05	2800'	Track found
	3/2/66	120	"	"	M. McCamis V. Wilson	E. Hays	1059	1815	7-16	3000'	
	3/3/66	121	"	"	W. Rainnie M. McCamis	D. Mason	1043	1730	6-47	3200'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	3/4/66	122	Spain	ONR Bomb search	W. Rainnie V. Wilson	R. Graham	0929	1355	3-26	2800'	
	3/7/66	123	"	"	M. McCamis V. Wilson	LT Helm, (DSP)	0907	1607	7-00	2700'	
	3/8/66	124	"	"	W. Rainnie M. McCamis	LCDR Henifin (DSP)	0830	1458	6-28	750'	
	3/9/66	125	"	"	W. Rainnie V. Wilson	C. Porembski	0936	1506	5-30	800'	Found air- craft wreckage
	3/12/66	126	"	"	M. McCamis V. Wilson	M. Fox	1512	1958	4-46	2600'	Track found second time
	3/13/66	127	"	"	W. Rainnie M. McCamis	None	0945	1703	7-18	2700'	
	3/15/66	128	"	"	M. McCamis V. Wilson	A. Bartlett	0920	1943	10-23	2550'	Found weapon ALVIN-ALUMINAUT rendevous sub- merged
	3/16/66	129	"	ONR Recovery assist	M. McCamis V. Wilson	None	1818	2315	4-57	2725'	
	3/18/66	130	"	"	M. McCamis V. Wilson	None	2203	0529	7-26	2775'	
	3/23/66	131	"	"	M. McCamis V. Wilson	None	0822	1651	8-29	2700'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth N/Ft.	Remarks
							Dive	Surf	Sub.		
	3/24/66	132	Spain	ONR Rec. assist	M. McCamis V. Wilson	None	1114	1841	7-27	2700'	
	3/25/66	133	"	"	M. McCamis V. Wilson	None	1816	0228	8-12	2900'	
	3/26/66	134	"	ONR Search	M. McCamis V. Wilson	None	1603	2304	7-01	2600'	
	3/27/66	135	"	"	M. McCamis V. Wilson	None	1432	2324	8-52	2500'	
	3/28/66	136	"	"	M. McCamis V. Wilson	None	1429	2123	6-54	2300'	
	3/30/66	137	"	"	M. McCamis V. Wilson	None	1030	1834	8-04	2950'	
	3/31/66	138	"	"	M. McCamis V. Wilson	L. Elliott (STRAZA)	0959	1616	6-17	2200'	
	4/1/66	139	"	"	M. McCamis V. Wilson	CDR Boykin (ONR)	0934	1651	7-17	2800'	
	4/2/66	140	"	"	W. Rainnie M. McCamis	LCDR Martin (BUWEPS)	0955	1913	9-18	2900'	Refound weapon ALVIN/ALUMINAUT rendezvous
	4/3/66	141	"	ONR Rec. assist	M. McCamis V. Wilson	None	1225	1936	7-11	2900'	
	4/5/66	142	"	"	M. McCamis V. Wilson	None	1624	2037	4-13	2900'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	4/7/66	143	Spain	ONR Recovery observation	M. McCamis V. Wilson	None	0636	0939	3-03	1925'	Weapon recovered
	6/22/66	144	W. H. Harbor	ONR Test dive	M. McCamis C. Porembski	W. Marquet	1532	1625	0-53	75'	
	7/1/66	145	Bermuda Bay	ONR Test	M. McCamis V. Wilson	W. Marquet	1434	1544	1-10	75'	
	7/3/66	146	31-55N 65-10W	USN/USL Photo Insp.	M. McCamis V. Wilson	None	1242	1745	5-03	3200'	Module inspection
	7/4/66	147	31-54N 65-11W	"	M. McCamis V. Wilson	D. Webb	1035	1540	5-05	5200'	" "
	7/5/66	148	31-54N 65-11W	"	M. McCamis V. Wilson	C. Porembski	1006	1528	5-22	6100'	" "
	7/10/66	149	31-54N 65-12W	"	M. McCamis V. Wilson	W. Mullarkey (USN/USL)	0942	1542	6-00	6100'	" "
	7/11/66	150	31-54N 65-12W	"	M. McCamis V. Wilson	G. Broderson	1120	1736	6-16	6000'	" "
	7/12/66	151	31-54N 65-12W	"	M. McCamis V. Wilson	W. Mullarkey (USN/USL)	1032	1610	5-38	5900'	" "
	7/17/66	152	32-15.4N 64-37.5W	ONR Biology	M. McCamis	R. Hessler	1352	1952	6-00	5850'	1st deep science dive
	7/18/66	153	31-54N 65-12W	USN/USL Photo Insp.	M. McCamis V. Wilson	D. Cobb (USN/USL)	1120	1647	5-27	5950'	Module in- spection

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	7/29/66	154	23-25.5N 77-34.5W	AUTEC Photo Insp.	M. McCamis V. Wilson	D. Owen	1202	1805	6-03	5200'	Cable inspection
	7/30/66	155	4 mi E Goulding Cay	"	M. McCamis V. Wilson	R. Austin (NUWS)	1037	1705	6-28	4350'	" "
	7/31/66	156	1 mi E Goulding Cay	"	W. Rainnie V. Wilson	R. Austin (NUWS)	1050	1457	4-07	2400'	" "
	8/4/66	157	24-25.5N 77-30.5W	"	M. McCamis V. Wilson	R. Austin (NUWS)	1322	1834	5-12	5450'	" "
	8/5/66	158	24-20.6N 77-29.5W	"	W. Rainnie M. McCamis	W. Murray (ITT)	1035	1736	7-01	5150'	Cable & Module inspection
	8/6/66	159	24-21.5N 77-38.6W	"	M. McCamis V. Wilson	F. Lamoureux (NUWS)	1052	1550	4-58	2625'	" "
	8/7/66	160	Off Andros Island	"	W. Rainnie V. Wilson	D. Fine (AUTEC)	1108	1537	4-29	5050'	" "
	8/12/66	161	TOTO 10 mi ESE site #1	"	M. McCamis V. Wilson	M. Merriam (DTMB)	1028	1628	6-00	5625'	" "
	8/15/66	162	25-00.7N 77-34W	ONR Movies	M. McCamis V. Wilson	None	1539	1650	1-11	shallow	Net Film
	8/17/66	163	25-03.4N 77-31.2W	ONR Movies	M. McCamis V. Wilson	None	1249	1507	2-18	200'	Net Film

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M./Ft.	Remarks
							Dive	Surf	Sub.		
	8/19/66	164	25-03.4N 77-31.2W	ONR Movies	M. McCamis V. Wilson	None	1104	1348	2-44	200'	Net Film
	8/22/66	165	TOTO	ONR Physical Oceanography	W. Rainnie	A. Vine	1039	1707	6-28	5850'	Rock Samples
	8/23/66	166	S.W. Goulding Cay	ONR Geology	V. Wilson	J. Schlee	1010	1605	5-55	5550'	" "
	8/24/66	167	4 1/2 mi S. of Goulding Cay	ONR Geology	M. McCamis	J. Schlee	1007	1531	5-24	3250'	" "
	8/26/66	168	1.1 mi off Clifton Point	ONR Visibility measurements	W. Rainnie	K. Olson	1129	1635	5-11	27500'	
	8/27/66	169	24-57N 77-38.1W	NAVOCEANO Geology	V. Wilson	F. Busby	1100	1545	4-45	4100'	Terminated because of approaching hurricane
	9/1/66	170	5 mi S. of Gould- ing Cay	NAVOCEANO Soil mechanics	M. McCamis	J. Rucker (NAVOCEANO)	1054	1606	5-12	3550'	
	9/6/66	171	24-56.8N 77-36.8W	NAVOCEANO Soil and gravity	W. Rainnie	R. Delort (NAVOCEANO)	1014	1655	6-41	4900'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	9/8/66	172	24-24.5N 77-34W	NAVOCEANO Activate module	V. Wilson	A. Davison	0925	1603	6-38	5350'	
	9/9/66	173	TOTO 3 1/2 mi E Site #1	NAVOCEANO Bottom recon.	W. Rainnie	D. Huddell (NAVOCEANO)	1012	1643	6-31	4500'	Bottom recon. at 700 fms.
	9/10/66	174	24-30.5N 77-35.0W	NAVOCEANO Mooring in- spection	M. McCamis V. Wilson	R. Merrifield (NAVOCEANO)	1203	1816	6-13	5550'	
	9/11/66	175	TOTO	NAVOCEANO Array insp.	M. McCamis E. Bland	B. Farquhar (NAVOCEANO)	0924	1554	6-28	5600'	
	9/14/66	176	24-57N 77-36.8W	NAVOCEANO Bottom pro- file	W. Rainnie C. Porembski	M. Klein (EG&G)	1032	1536	5-04	4900'	
	9/16/66	177	24-57N 77-36.8W	NAVOCEANO Bottom loss	V. Wilson	L. Breaker F. Taylor (NAVOCEANO)	1034	1550	5-16	4950'	
	9/18/66	178	24-57N 77-36.8W	"	W. Rainnie	L. Breaker F. Taylor (NAVOCEANO)	1003	1549	5-46	4550'	Bottom loss acoustic measurements
	9/19/66	179	24-57N 77-36.8W	NAVOCEANO Nav. tests	M. McCamis V. Wilson	W. Marquet	0908	1542	6-34	4950'	Tri-plane nav. experiments
	9/21/66	180	25-04.2N 77-36.8W	"	V. Wilson	R. Merrifield (NAVOCEANO)	1122	1339	2-17	150'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	9/22/66	181	25-04.2N 77-36.8W	NAVOCEANO Nav. tests	M. McCamis A. Davison	D. Webb	1200	1505	3-05	80'	
	9/23/66	182	25-04N 77-37W	NAVOCEANO Navigation	W. Rainnie	R. Merrifield R. Delort (NAVOCEANO)	0905	1039	1-32	50'	
	10/14/66	183	41-41N 69-17W	ONR Thermal grad	V. Wilson	C. Rooth	0837	1130	2-52	615'	Thermal structure examined
	10/15/66	184	40-15N 68-05W	ONR Geology	M. McCamis	J. Trumble	1420	1910	4-50	4800'	Geological survey, samples
	4/14/67	185	Eel Pond W. H.	ONR Post-over- haul tests and trim	M. McCamis	E. Bland A. Davison	1230	1326	0-56	14'	
	4/17/67	186	Eel Pond W. H.	ONR Tests	M. McCamis	None	1447	1555	1-08	12'	Inclining experiment
	5/12/67	187	25-04.1N 77-37.5W	ONR Testing	M. McCamis V. Wilson	E. Bland	1622	1807	1-45	1020'	
	6/15/67	188	24-04N 77-37.5W	ONR Testing	M. McCamis E. Bland	C. Porembski	1224	1251	0-27	75'	Aborted be- cause of port disconnect - flooded
	6/17/67	189	25-04N 77-35.5W	ONR Post-refit testing	M. McCamis E. Bland	C. Winget	1412	1752	3-40	2100'	Found & re- trieved lost battery cover

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	6/18/67	190	25-04.8N 77-33.5W	ONR Certifi- cation	M. McCamis V. Wilson	K. Tondreau	0944	1651	7-07	6000'	
	6/19/67	191	25-00N 77-35.2W	NAVOCEANO Geology	V. Wilson	F. Busby L. Dunn (NAVOCEANO)	1100	1624	5-24	6000'	Geological Recon.
	6/20/67	192	25-00N 77-38.8W	NAVOCEANO Geology	M. McCamis	R. Merrifield R. Young (NAVOCEANO)	1003	1834	8-31	6000'	"
	6/22/67	193	24-57N 77-37W	NAVOCEANO Navigation	V. Wilson W. Rainnie	A. Martin	1103	1858	7-55	4600'	Bottom marker tests
	6/23/67	194	24-57.5N 77-37W	NAVOCEANO Evaluation	M. McCamis E. Bland	R. Delort (NAVOCEANO)	1026	1705	6-39	4884'	
	6/25/67	195	24-58N 77-38.8W	ONR Water column observations	V. Wilson E. Bland	J. Ryther	1158	1816	6-11	5983'	Water column inspection & sampling
	6/26/67	196	24-58N 77-38.7W	"	M. McCamis E. Bland	D. Menzel	1003	1635	6-32	5862'	"
	6/30/67	197	W. Palm Harbor	ONR Training	W. Rainnie E. Bland	R. Williams	1046	1121	0-35	35'	
	6/30/67	198	"	"	E. Bland	R. Weaver K. Costa	1155	1225	0-30	36'	Bland's first solo
	6/30/67	199	"	"	E. Bland	R. Weaver L. Hunt	1241	1257	0-16	36'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	7/4/67	200	31-18.5N 78-53W	ONR Geology	M. McCamis V. Wilson	R. Pratt (VPI)	1355	1809	4-14	1805'	Manganese samples
	7/5/67	201	31-48N 79-12W	"	M. McCamis V. Wilson	F. Manheim	1207	1758	5-51	1832'	Rock Samples
	7/6/67	202	31-09N 79-13W	"	M. McCamis V. Wilson	R. Zarudski	1339	1508	1-29	2010'	Swordfish attack aborted dive
	7/7/67	203	31-48N 79-15W	"	M. McCamis V. Wilson	J. Milliman	1414	1818	4-04	1789'	
	7/13/67	204	35-36.7N 74-49.2W	"	M. McCamis	J. Milliman F. Manheim	1051	1401	3-10	2333'	Aborted early due to weather
	7/17/67	205	37-05N 74-53W	ONR Geology/ Biology	M. McCamis	K. Emery R. Edwards (BCF)	1018	1616	5-58	169'	
	7/18/67	206	37-13N 74-53.5W	"	W. Rainnie	K. Emery R. Edwards (BCF)	1153	1755	6-02	175'	
	8/4/67	207	40-16N 68-07W	ONR Geology	M. McCamis V. Wilson	J. Trumbull	0934	1710	7-36	5049'	Geological survey
	8/6/67	208	40-15N 68-06W	"	M. McCamis V. Wilson	D. Hathaway	0834	1605	7-31	4923'	Rock samples
	8/13/67	209	40-07N 68-16W	ONR Biology	M. McCamis E. Bland	B. Dale	0933	1757	8-24	5214'	Found F6F Aircraft

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	8/15/67	210	40-05N 68-18W	ONR Physical Ocean.	M. McCamis	C. Rooth S. Turner	1048	1640	5-52	2970'	Thermal structure measurements at thermo- clines
	8/16/67	211	40-09N 68-17W	ONR Biology	M. McCamis E. Bland	B. Dale	1003	1633	6-30	4010'	Biological samples
	8/21/67	212	39-44N 69-10W	ONR Geology	M. McCamis	E. Hays A. Vine	1407	1911	5-04	6000'	
	8/22/67	213	39-44N 69-09W	"	M. McCamis	E. Hays A. Vine	0954	1656	7-02	6000'	
	8/23/67	214	39-44N 69-09W	ONR Acoustics	W. Rainnie E. Bland	E. Hays	1135	1735	6-00	6000'	
	8/30/67	215	41-09N 68-43W	ONR Fisheries research	M. McCamis E. Bland	R. Wigley (BCF)	0950	1453	5-03	211'	Samples
	8/31/67	216	41-16N 66-01W	ONR Geology	M. McCamis E. Bland	D. Ross	1243	1835	5-52	5283'	Survey & samples
	9/8/67	217	41-15N 71-00W	ONR Public Rel.	W. Rainnie M. McCamis	L. Hutchinson	1454	1635	1-40	118'	
	9/9/67	218	39-45N 70-42W	ONR Thermal structure	M. McCamis	C. Rooth J. VanLeer	1013	1120	1-07	745'	Aborted pellet dis- penser prob.
A-23	9/10/67	219	39-45N 70-42W	"	M. McCamis	C. Rooth J. VanLeer	0953	1353	4-00	3135'	Scattering layer

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	9/19/67	220	39-45N 70-34W	ONR Biology	V. Wilson E. Bland	G. Hampson	0955	1730	7-35	6112'	Plankton net tows
	9/20/67	221	39-45N 70-35W	"	M. McCamis	R. Hessler H. Sanders	1000	1826	8-26	6200'	
	9/21/67	222	39-45N 70-34W	"	V. Wilson	R. Scheltema G. Hampson	0945	1757	8-12	6242'	
	9/23/67	223	39-48N 70-33W	"	M. McCamis	R. Hessler H. Sanders	1040	1600	5-40	4315'	Plankton net tows
	9/24/67	224	39-47N 70-33W	"	V. Wilson	R. Scheltema Barham (NUWC)	1148	1705	5-17	4365'	Rough re- covery (lost arm & basket)
	9/26/67	225	39-48N 70-33W	"	V. Wilson	R. Hessler G. Hampson	1030	1735	7-05	4235'	Arm search
	10/3/67	226	39-48N 70-33W	"	M. McCamis	R. Backus J. Craddock	0945	1323	2-41	2046'	Scattering layer obs.
	10/3/67	227	39-48N 70-33W	"	M. McCamis	D. Shores J. Teal	1347	1723	3-26	2828'	"
	10/4/67	228	39-48N 70-33W	"	W. Rainnie	G. Clarke R. Haedrich	1030	1355	3-25	2145'	"
	10/4/67	229	39-48N 70-33W	"	W. Rainnie	R. Backus G. Mead	1416	1738	3-22	2145'	"
	10/5/67	230	39-48N 70-33W	"	E. Bland	J. Craddock J. Teal	0950	1349	3-59	2425'	"

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	10/5/67	231	39-48N 70-33W	ONR Biology	M. McCamis	G. Mead D. Shores	1406	1722	3-16	1815'	Scattering layer obs.
	10/6/67	232	39-48N 70-33W	"	E. Bland	R. Haedrich G. Clarke	0947	1350	4-03	2425'	"
	10/6/67	233	39-48N 70-33W	"	W. Rainnie	R. Backus S. Poole	1405	1750	3-45	2440'	"
	10/13/67	234	39-47N 70-32W	ONR Geology/arm search	M. McCamis V. Wilson	D. Ross	0934	1620	6-46	1315m	Arm search
	10/14/67	235	39-47N 70-32W	"	M. McCamis V. Wilson	K. Emery	1104	1807	7-03	1323m	"
	10/15/67	236	39-47N 70-32W	ONR Geology	M. McCamis V. Wilson	K. Emery	0929	1252	3-23	1333m	Recovered arm
	10/15/67	237	39-47N 70-32W	"	M. McCamis V. Wilson	K. Emery	1314	1810	4-56	1333m	Recovered basket
	10/22/67	238	41-05N 71-20W	"	V. Wilson W. Webert	J. Sanders (HUDSON LAB)	1111	1529	4-18	51m	
	10/23/67	239	41-06N 71-40W	"	V. Wilson E. Bland	K. Emery	0827	1127	3-09	26m	Survey of side scan sonar track
	10/24/67	240	41-11N 71-35W	USN/USL ALVIN sound measurement	E. Bland	W. Marquet D. Potter (USN/USL)	1141	1519	3-38	8m	
	10/24/67	241	41-11N 71-35W	"	E. Bland	J. Rogers D. Potter	1544	1736	1-52	8m	Last dive for 1967

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	4/16/68	242	W. H. Harbor	ONR Post-refit checkout	V. Wilson E. Bland	None	1350	1420	0-30	5m	
	4/18/68	243	"	ONR Post-refit trials	V. Wilson E. Bland	C. Porembski	1202	1319	1-17	12m	Submerged trials
	4/23/68	244	42-04N 70-17W	Biology	M. McCamis V. Wilson	W. Schevill	1120	1304	1-44	61m	Whale Obs.
	4/26/68	245	42-02.3N 70-15.5W	"	M. McCamis V. Wilson	W. Schevill	1141	1526	3-45	54m	"
	4/27/68	246	42-02N 70-16W	"	V. Wilson E. Bland	W. Schevill	1105	1445	3-40	61m	"
	4/28/68	247	42-03N 70-16W	"	M. McCamis	W. Schevill Watkins	1215	1547	3-32	60m	"
	4/29/68	248	42-17N 70-03W	ONR Trials	M. McCamis W. Webert	J. Purcell	0910	1127	2-17	180m	Shallow cer- tification no problems
	5/7/68	249	42-01N 70-11W	ONR Orientation & training	M. McCamis E. Bland	LCDR Nyland	1100	1151	0-51	32m	
	5/7/68	250	42-01N 70-11W	ONR Orientation	E. Bland	D. Butler W. Page	1206	1233	0-27	35m	
	5/7/68	251	42-01N 70-11W	"	E. Bland	G. Gibson C. Hinton	1255	1335	0-40	33m	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	5/7/68	252	42-01N 70-11W	ONR Orientation	V. Wilson	R. Gordon T. Curtis	1345	1430	0-45	32m	
	5/7/68	253	42-01N 70-11W	"	V. Wilson	F. Medeiros J. Crocker	1442	1526	0-44	30m	
	5/8/68	254	42-03N 70-15W	"	M. McCamis V. Wilson	S. Raymond	0946	1043	0-57	57m	"Life" u/w photos of ALVIN
	5/8/68	255	42-03N 70-15W	"	E. Bland W. Webert	F. Omohundro	1152	1310	1-48	56m	"
	5/8/68	256	42-03N 70-15W	"	E. Bland W. Webert	LCDR Nyland	1429	1608	1-39	53m	
	5/9/68	257	P-Town Harbor	"	V. Wilson	A. Rutherford R. Weaver	0956	1155	2-00	19m	
	5/9/68	258	"	"	E. Bland	J. Parker R. Williams	1212	1343	1-31	18m	
	5/9/68	259	"	ONR Training	M. McCamis E. Bland	W. Webert	1359	1536	1-37	17m	Wreck pictures
	5/10/68	260	"	ONR Orientation	M. McCamis	S. Daubin G. Wagner	0938	1145	2-07	19m	
	5/10/68	261	"	"	V. Wilson	A. Sharp F. Mangels- dorf	1155	1333	1-38	20m	
	5/10/68	262	"	"	E. Bland	B. Korites J. Gruver	1350	1538	1-48	20m	Sonar contact on whale

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	5/11/68	263	42-01N 70-13W	ONR Biology	V. Wilson R. Weaver	J. Hughes	1137	1513	3-36	46m	Lobster obs. 4kHz pinger test
	5/13/68	264	42-03N 70-14W	ONR Orientation	V. Wilson W. Webert	CDR Walker (ONR)	1050	1257	2-07	54m	4kHz pinger test
	5/13/68	265	42-03N 70-14W	"	E. Bland	D. Butler LCDR Donnelly (ONR)	1316	1446	1-30	59m	
	5/14/68	266	42-02N 70-13W	"	V. Wilson	K. Tondreau (NAVSHIPS) LCDR Glass (USCG)	0950	1107	1-17	47m	
	5/14/68	267	42-01N 70-12W	"	V. Wilson	D. Clark R. Provencher	1120	1230	1-10	45m	
	5/22/68	268	43-08N 70-06W	ONR Geology	V. Wilson R. Weaver	J. Schlee	0903	1233	3-30	150m	Jefferies Ledge
	5/25/68	269	43-10N 69-32W	"	M. McCamis W. Webert	J. Hathaway	0905	1529	6-24	102m	Platts Bank
	5/26/68	270	43-10N 69-22W	"	V. Wilson R. Weaver	J. Schlee	0910	1115	2-05	197m	3 Dory Ridge Aborted - weather
	6/4/68	271	39-55N 68-59W	ONR Certifi- cation	M. McCamis	K. Tondreau J. Purcell (NAVSHIPS)	1220	1420	2-00	1000m	1000m certifi- cation, aborted weather bad

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	6/5/68	272	40-05N 68-15W	ONR Certifi- cation	M. McCamis	S. Daubin J. Purcell	1000	1625	6-25	1829m	6000 ft. certifi- cation
	6/12/68	273	40-22N 67-34W	ONR Release test	V. Wilson E. Bland	None	1710	1822	1-12	600m	Bounce dive
	6/16/68	274	40-17N 67-40W	Geology	V. Wilson E. Bland	D. Ross	0910	1612	7-02	1660m	Samples
	6/17/68	275	40-25N 67-40W	"	M. McCamis W. Webert	J. Hathaway	0843	1459	6-16	590m	
	6/20/68	276	W. H. Harbor	ONR Demon- stration	V. Wilson E. Bland	T. Horner	1027	1045	0-20	13m	Associates demonstration
	6/20/68	277	"	"	V. Wilson E. Bland	A. Bemis	1430	1454	0-25	13m	" "
	6/25/68	278	39-50N 70-33W	Biology	V. Wilson E. Bland	R. Hessler	1240	1817	5-37	860m	Fog recovery 100 yds. vis- ibility
	7/1/68	279	39-47N 70-32W	"	E. Bland	H. Sanders R. Cheshier	0948	1720	7-32	1360m	
	7/2/68	280	39-44N 70-34W	"	E. Bland	H. Sanders R. Hessler	0846	1745	8-59	1820m	
	7/9/68	281	39-46N 70-34W	"	M. McCamis	G. Grice J. Teal	0858	1539	6-41	1550m	Plankton tows

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
•	7/10/68	282	39-50N 70-35W	Biology	E. Bland	R. Scheltema Checkerly	0845	1505	6-20	1010 ^m	Plankton tows
	7/12/68	283	39-55N 70-34W	"	M. McCamis W. Weibert	K. Smith	1230	1822	5-52	500 ^m	"
	7/13/68	284	40-04N 70-34W	"	M. McCamis	J. Teal R. Scheltema	0825	1200	3-35	124 ^m	
	7/17/68	285	W. H. Harbor	ONR Training & Orientation	E. Bland W. Weibert	Thatcher	0952	0956	0-04	21 ^m	Shortest dive to date
	7/24/68	286	39-55N 67-24W	Geology	V. Wilson W. Weibert	K. Emery	1016	1700	6-44	1275 ^m	1st dive in a seamount
	7/25/68	287	39-56N 67-24W	"	M. McCamis	G. Gibson J. Milliman	0930	1645	7-15	1400 ^m	Bear seamount
	8/9/68	288	36-42N 25-42W	USNUSL Geological survey	M. McCamis V. Wilson	A. Ellin- thorpe (USNUSL)	1235	1837	6-02	688 ^m	Azores sea- mount survey
	8/10/68	289	36-58N 25-38W	"	V. Wilson E. Bland	A. Ellin- thorpe (USNUSL)	1043	1623	5-20	600 ^m	"
	8/11/68	290	36-58N 25-19W	"	M. McCamis E. Bland	A. Ellin- thorpe (USNUSL)	1119	1805	6-46	590 ^m	"
	8/12/68	291	36-58N 25-19W	"	M. McCamis V. Wilson	E. Scannell (USNUSL)	1130	1811	6-41	632 ^m	"

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	8/13/68	292	36-51N 25-41W	USNUSL Geological Survey	V. Wilson E. Bland	A. Ellin- thorpe (USNUSL)	1227	1710	4-43	875m	Seamount survey
	8/15/68	293	36-58N 25-19W	"	M. McCamis E. Bland	W. Bailey (USNUSL)	1010	1706	6-56	668m	"
	8/16/68	294	36-51N 25-41W	"	M. McCamis V. Wilson	A. Ellin- thorpe	0928	1622	6-56	921m	"
	8/17/68	295	36-58N 25-19W	"	M. McCamis V. Wilson	E. Scannell (USNUSL)	1008	1646	6-38	745m	"
	8/23/68	296	36-58N 25-20W	"	V. Wilson E. Bland	E. Scannell	1210	1732	5-22	630m	"
	8/25/68	297	36-58N 25-20W	"	M. McCamis V. Wilson	E. Zarudzki	1021	1752	7-31	660m	WHOI Geology observer
	9/2/68	298	37-08N 25-38W	"	V. Wilson E. Bland	R. Mallone (USNUSL)	1002	1538	5-36	273m	Seamount survey
	9/3/68	299	36-50N 25-41W	"	M. McCamis V. Wilson	R. Mallone	0710	1132	4-22	804m	"
	9/22/68	300	40-07N 68-16W	NAVOCEANO Nav system evaluation	E. Bland	W. Marquet R. Drever	1548	1827	2-39	600m	
	9/23/68	301	40-07N 68-16W	NAVOCEANO Nav system	M. McCamis	W. Marquet R. Drever	1410	1818	4-08	1651m	
	9/24/68	302	40-07N 68-16W	NAVOCEANO Nav system tests	E. Bland	R. Drever A. Eliason	0855	1702	8-07	1680m	Revisit F6F airplane

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	9/25/68	303	40-07N 68-16W	NAVOCEANO Nav system evaluation	M. McCamis	W. Marquet R. Drever	0924	1731	8-07	1680m	Revisit F6F
	10/3/68	304	39-45N 69-47W	Biology	M. McCamis	R. Backus P. Foxton	0903	1348	4-45	700m	Scattering layer samples
	10/6/68	305	39-45N 69-47W	"	V. Wilson	R. Haedrich M. Horn	1703	2040	3-37	200m	Night re- covery
	10/7/68	306	39-45N 69-47W	"	E. Bland	J. Teal D. Shores	0440	0717	2-37	222m	Night launch. Photos scattering layer.
	10/16/68	307	39-54N 69-16W	Buoy in- spection	E. Bland R. Weaver	P. Stimpson	1102	1116	0-14	22m	Aborted - camera probs.
	10/16/68	308	39-54N 69-16W	"	E. Bland R. Weaver	P. Stimpson	1220 16 Oct 1968	0807 1 Sep 1969	7674 ^h 47 min	1535m	ALVIN lost during launch
	5/17/71	309	Off WHOI Pier	ONR Tethered trim, elect check	V. Wilson E. Bland	W. Marquet	1602	1746	1-44	13'	First dive 1971 - Tethered
	5/18/71	310	"	ONR Trim and tests	V. Wilson E. Bland	A. Medeiros	1040	1510	4-30	13'	Tethered trim & inclining experiments
	5/20/71	311	41-31N 70-40W	ONR Tests	E. Bland V. Wilson	R. Weaver	1138	1335	1-57	13.7m	First free dive

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
	5/22/71	312	41-31N 70-40W	ONR Tests	V. Wilson E. Bland	G. Meier	1130	1211	0-41	14 ^m	Dummy battery drop, trim, inst. check
	5/25/71	313	41-31N 70-40W	ONR Trials	E. Bland V. Wilson	R. Picard	1517	1642	1-25	13 ^m	Sea trials
	5/26/71	314	"	ONR Orientation	V. Wilson E. Bland	J. Miller (NOAA)	1142	1225	0-43	13.7 ^m	Strong current
	5/26/71	315	"	"	V. Wilson E. Bland	J. Miller	1316	1339	0-23	15.2 ^m	Very low visibility
	5/26/71	316	"	"	V. Wilson M. McCamis	J. Donnelly (ONR)	1409	1452	0-43	15.2 ^m	
	5/26/71	317	"	"	V. Wilson	P. Wiebe J. Phillips	1521	1554	0-33	17.8 ^m	
	5/27/71	318	"	"	V. Wilson E. Bland	N. Brodeur (CDR Canadian Navy)	1021	1102	0-41	19 ^m	Visibility poor
40	6/2/71	319	41-09N 71-00W	ONR Pilot Cer- tification	W. Rainnie V. Wilson	W. Sutter (SUBDEVGRU I)	1640	1719	0-39	31.5 ^m	
"	6/2/71	320	"	"	M. McCamis E. Bland	R. Whitaker (SUBDEVGRU I)	1802	1901	0-59	31.5 ^m	
"	6/3/71	321	39-44.3N 70-58.7W	ONR NAVSHIPS certifi- cation	V. Wilson E. Bland	R. Gaite (NAVSHIP)	1141	1730	5-49	1840 ^m	First deep dive 6000' certification

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
40	6/11/71	322	41-31.3N 70-40.3W	ONR System check	V. Wilson M. McCamis	A. Medeiros	1105	1220	1-15	70 ^m	
41	6/17/71	323	39-46N 70-40W	Biology	V. Wilson	F. Grassle P. Smith	0929	1512	5-43	1805 ^m	Established bottom stations VB problems
"	6/18/71	324	39-47.7N 70-40W	"	V. Wilson E. Bland	T. Lawson	1346	1943	5-57	1450 ^m	Plankton tow propulsion problem
"	6/19/71	325	39-50N 70-40W	"	E. Bland	J. Craddock R. Beamis	1012	1639	6-27	1025 ^m	Plankton tow same pro- pulsion prob.
"	6/20/71	326	39-47N 70-40W	"	V. Wilson	F. Grassle P. Smith	1257	1949	6-52	1440 ^m	Propulsion problem
"	6/21/71	327	39-47N 70-40W	Physical Oceanog- raphy	E. Bland A. Medeiros	J. VanLeer (MIT)	1102	1812	7-10	420 ^m	Micro- structure studies
"	6/22/71	328	39-46N 70-40W	Biology	V. Wilson E. Bland	J. Craddock	1038	1940	9-02	1810 ^m	Bottom stations VB tests - same propulsion
42	7/2/71	329	42-38N 69-36.5W	Biology	V. Wilson M. McCamis	G. Rowe	1104	1842	7-38	275 ^m	
"	7/3/71	330	42-32.5N 69-32W	"	M. McCamis	G. Rowe D. Bumpus	1539	1951	4-12	267 ^m	Benthic survey

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
42	7/4/71	331	42-25N 69-45W	Biology	V. Wilson	G. Rowe G. Keller (NOAA)	0802	1155	3-36	245m	Search for lost hydro- phone
"	7/5/71	332	42-02N 70-11W	Instrumen- tation test	V. Wilson M. McCamis	T. Nixon (Lehigh)	1641	1743	1-02	18m	Penetrometer tests
"	7/7/71	333	42-25N 69-45W	Physical Oceanography	M. McCamis	A. Richards J. Van Siver (Lehigh)	1056	1758	7-02	248m	Search for lost hydro- phone
"	7/8/71	334	42-48.2N 69-46.5W	"	M. McCamis	M. Perlow T. Terry (Lehigh)	1138	1808	6-30	244m	Bottom sed- iment prop- erties
"	7/9/71	335	43-34N 69-31W	"	V. Wilson	J. Parks P. Dzwilew- ski	1114	1614	5-00	30.5m	Dive short because of weather
"	7/10/71	336	41-57N 70-18W	"	V. Wilson	A. Richards (Lehigh) W. Schneider (NSRDC)	0957	1026	0-29	30.5m	Aborted - leak indi- cation
43	7/16/71	337	42-25N 69-45W	ONR Array search and pilot train- ing	V. Wilson W. Rainnie	R. Weaver	1209	1630	4-21	242m	CTFM failure
"	7/18/71	338	42-51N 68-52W	Geology	V. Wilson E. Bland	R. Ballard	1036	1756	7-20	150m	Hard rock cores

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
43	7/19/71	339	43-01N 69-06W	Geology	E. Bland A. Medeiros	Lou King (Bedford Inst.)	1153	1250	0-57	82m	Aborted - gyro failure
"	7/20/71	340	43-01N 69-06W	"	V. Wilson A. Medeiros	Lou King (BEDFORD INST.)	1540	1958	4-18	40m	Hard rock drill failed
"	7/21/71	341	43-26.5N 68-37W	"	E. Bland	R. Ballard M. Kane (USC&GS)	1217	1828	6-11	128m	Survey & samples
"	7/22/71	342	43-04N 69-15W	"	V. Wilson J. Donnelly	Lou King	1132	1740	6-08	139m	150 lbs. rock samples
44	8/5/71	343	41-12.5N 66-04W	"	V. Wilson A. Medeiros	D. Ross	1153	1444	2-51	1604m	Aborted - ground #2 battery
NA	8/10/7	344	W. H. Harbor	ONR Test, trim	V. Wilson E. Bland	None	1355	1459	1-04	47'	
45	8/13/71	345	39-46N 70-40W	ARPA Biology	V. Wilson E. Bland	R. Turner	1038	1849	8-11	1810m	Female Scientist
46	8/25/71	346	39-46N 70-41W	ARPA Biology, Navigation	E. Bland R. Weaver	J. Teal	1140	1944	8-04	1825m	
NA	8/31/71	347	W.H. Harbor	ONR/ARPA Nav. system check out	V. Wilson J. Donnelly	W. Marquet	1103	1302	1-59	70'	

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
47	9/4/71	348	42-43.5N 58-50.6W	ONR Geology	E. Bland	R. Oldale R. Ballard	1157	1725	5-28	111m	Core samples
"	9/5/71	349	42-39.3N 58-50.5W	"	V. Wilson J. Donnelly	R. Ballard	1036	1443	4-07	115m	Rock samples
"	9/7/71	350	42-23N 70-00W	ONR/ARPA Geology, Navigation	E. Bland	W. Marguet R. Oldale	1355	1730	3-35	210m	Strong current low visibility
"	9/8/71	351	42-23N 70-00W	ARPA Navigation	V. Wilson J. Donnelly	W. Marguet	1017	1138	1-21	89m	
48	9/21/71	352	39-10N 70-00W	ONR Buoy line recovery	V. Wilson E. Bland	None	1132	1527	3-55	525m	Not recovered too much current en- route Fla.
"	10/10/71	353	23-53N 82-47W	NOAA/ONR Geology	V. Wilson J. Donnelly	G. Keller (NOAA)	1406	1417	0-11	70m	Aborted -CO2 blower failed
"	10/12/71	354	23-54.5N 82-47.5W	"	E. Bland	R. Ballard J. Kofoed (NOAA)	1109	1802	6-53	1230m	Survey and samples
"	10/13/71	355	24-05N 82-47W	"	V. Wilson J. Donnelly	G. Keller (NOAA)	1024	1710	6-46	873m	
"	10/14/71	356	24-16.5N 82-23W	"	E. Bland	G. Hershorn- hous G. Lapiene (NOAA)	1015	1305	2-50	461m	Straits of Fla. samples

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
48	10/14/71	357	24-16.5N 82-23W	NOAA/ONR Geology	E. Bland	D. Florwick D. Lambert (NOAA)	1317	1623	3-06	452m	Straits of Fla., samples
"	10/15/71	358	24-15N 81-50W	"	V. Wilson	G. Keller J. Kofoed (NOAA)	1015	1634	6-19	408m	1st dive in Sink Hole
"	10/21/71	359	25-35N 79-50W	"	E. Bland	J. Kofoed (NOAA) C. Neumann (U. Miami)	1233	1845	6-12	692m	Miami Terrace
"	10/22/71	360	25-00N 79-15W	"	V. Wilson	J. Kofoed G. Keller	1035	1648	6-13	658m	Straits of Fla. Bottom Recon.
"	10/23/71	361	24-54N 79-13W	"	E. Bland	G. Keller G. Hood (NOAA)	1130	1701	5-31	427m	" "
"	10/24/71	362	27-04N 79-22W	"	V. Wilson	J. Kofoed C. Neumann	1334	1816	4-42	666m	" "
"	10/25/71	363	27-09.5N 79-22.5W	"	V. Wilson	G. Keller C. Neumann	1131	1804	6-33	675m	" "
"	10/26/71	364	27-20N 79-25.2W	"	E. Bland	G. Keller J. Kofoed	1035	1758	7-23	668m	ALVIN attacked by marlin
"	10/27/71	365	Straits of Fla.	"	V. Wilson	G. Keller J. Kofoed	1005	1535	5-30	639m	observed porpoise to 195m
"	10/28/71	366	27-14N 79-13.5W	"	E. Bland	G. Keller D. Lambert	1113	1741	6-28	504m	Straits of Fla. Bottom Recon.

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
48	11/6/71	367	24-20N 77-31W	ONR/AUTEC Bottom recon.	V. Wilson E. Bland	None	0912	0947	0-35	260m	Surfaced to check hatch gasket
"	11/6/71	368	24-20N 77-31W	"	V. Wilson E. Bland	None	1001	1658	6-57	1536m	Recovered one sample
"	11/7/71	369	24-21N 77-29W	"	E. Bland V. Wilson	None	1050	1507	4-17	1562m	Photo survey
"	11/8/71	370	24-16N 77-30W	"	V. Wilson E. Bland	None	0930	1455	5-25	1525m	Large boulders with impact type scour all around.
"	11/12/71	371	24-56.9N 77-39.2W	ARPA Biology, Navigation	E. Bland J. Donnelly	W. Marquet	1136	1731	5-55	1770m	Search for location bottom bio station.
"	11/13/71	372	24-57N 77-39W	"	V. Wilson	T. Smith J. Houbbrick (SMITHSONIAN)	1003	1704	7-01	1799m	Unable find triplane
"	11/15/71	373	25-00N 77-35W	ARPA Biology, Geology	E. Bland	R. Ballard G. Rowe	1042	1718	6-36	1048m	Hard rock bottom steep hills
"	11/16/71	374	25-00.2N 77-35.5W	ARPA Geology	V. Wilson J. Donnelly	R. Ballard	1151	1536	3-35	650m	Climbed up cliff face 650 to 16 meters.
"	11/17/71	375	25-00N 77-35W	ARPA Biology	E. Bland	G. Rowe J. Teal	1251	1736	4-45	662m	Unable find xpndr; box cores

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
48	11/18/71	376	25-00N 77-34W	ARPA Biology Navigation	V. Wilson J. Donnelly	J. Teal	1115	1638	5-23	749m	Planted bell jar
"	11/19/71	377	25-00N 77-34W	"	E. Bland J. Donnelly	W. Marquet	1027	1523	4-56	687m	Captured 2 specimens of new genus of sea worm
"	11/24/71	378	25-00.2N 77-32.5W	ARPA Rock drill test	V. Wilson J. Donnelly	None	1532	1615	0-43	18'	Tested drill release while submerged
"	11/25/71	379	25-00.2N 77-32.5W	"	V. Wilson J. Donnelly	None	1025	1354	3-29	42'	Unable to back clear of drill
"	11/26/71	380	24-58.2N 77-34W	ARPA Gravity test VB tests	E. Bland J. Donnelly	T. Aldrich	1406	1712	3-06	309m	Gravity profiles
"	11/27/71	381	24-58.6N 77-59.6W	ARPA VB test; nav. test	V. Wilson J. Donnelly	None	1200	1633	4-33	1821m	Precision nav. test
"	11/28/71	382	24-58N 77-39W	ARPA Biology	E. Bland	P. Weibe R. Steer (FREQ. DEVICES INC.)	1210	1722	5-12	1830m	Test plankton net at deep depths
"	11/30/71	383	24-57.8N 77-37.7W	ARPA Magnetics, Navigation	V. Wilson	B. Luyendyk A. Eliason	1127	1140	0-13	15m	Aborted - ground in magnetometer

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
48	11/30/71	384	24-57.8N 77-37.7W	ARPA Magnetics, Navigation	V. Wilson	B. Luyendyk A. Eliason	1408	1622	2-14	373m	Magnetometer not func- tioning
"	12/1/71	385	25-00N 77-33W	ARPA Rock drill tests	V. Wilson	A. Barrs	1252	1708	4-16	53'	Successful test
"	12/2/71	386	25-00N 77-34W	ARPA Biology, Magnetics	E. Bland	R. Steer D. Williams	1351	1657	3-06	301m	Successful magnetometer test
"	12/5/71	387	25-10N 77-25W	ONR Biology	E. Bland	G. Grice M. Jhrde (NSF)	1019	1557	5-38	1733m	Plankton tows Female scient- ist
"	12/6/71	388	25-00N 77-34W	ONR Geology	V. Wilson J. Donnelly	R. Dill (NOAA)	1245	1516	2-31	740m	Ascended escarpment
"	12/8/71	389	24-21N 77-30W	ONR/NAVORD AUTC re- covery	V. Wilson E. Bland	R. James (LCDR, USN)	1349	1916	5-27	1583	Night recovery
"	12/9/71	390	24-20N 77-31W	"	V. Wilson J. Donnelly	P. Looney	1154	1706	4-12	1545m	Attached lift line
NA	5/5/72	391	W. H. Harbor	ONR Trim & test	V. Wilson E. Bland	None	1501	1608	1-07	10'	Tethered trim & checkout
NA	5/11/72	392	"	"	V. Wilson E. Bland	None	1505	1616	1-11	57'	Free trim dive

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
NA	5/11/72	393	W. H. Harbor	ONR Rock drill test	V. Wilson E. Bland	None	1201	1241	0-40	57'	Drill knocked off mounting
NA	5/12/72	394	"	"	V. Wilson E. Bland	None	1059	1310	2-11	60'	Difficulty reattaching drill
50	5/18/72	395	39-46N 70-41W	ONR Test	V. Wilson E. Bland	None	1023	1126	1-03	300m	Leak in- dication
"	5/18/72	396	39-46N 70-41W	"	V. Wilson E. Bland	None	1402	1407	0-05	40m	" "
"	5/19/72	397	39-46N 70-41W	"	V. Wilson E. Bland	None	0941	1443	5-02	1833m	Successful deep certi- fication
51	5/24/72	398	W. H. Harbor	ARPA Rock drill test	V. Wilson E. Bland	None	1445	1727	2-42	45'	Successful hook up
"	5/26/72	399	"	"	V. Wilson E. Bland	None	1101	1210	1-09	40'	Test sat- isfactory
"	5/27/72	400	42-31N 69-37W	"	V. Wilson	A. Barrs	1318	1330	0-12	300'	Aborted due to grounds
"	5/28/72	401	42-51N 68-52W	"	E. Bland	D. Williams	1037	1642	6-05	595'	Unable un- hook drill
"	5/29/72	402	42-51N 68-52W	"	V. Wilson	D. Williams	1010	1251	2-41	320'	Drill mal- functioned

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
51	5/31/72	403	42-38N 69-38W	ARPA Biology	E. Bland	G. Rowe R. Haedrich	1330	1431	1-01	920'	Trim problem
"	6/1/72	404	42-38N 69-38W	"	V. Wilson	G. Rowe R. Haedrich	1103	1502	3-59	925'	
52	6/8/72	405	39-46N 70-40W	NSF Biology	E. Bland	C. Wirsen T. McLellen	1027	1848	8-21	1746m	Female biologist. Unable locate station.
"	6/11/72	406	39-46N 70-40W	"	V. Wilson J. Donnelly	P. Wiebe	1434	1930	4-56	1811m	Unable locate station Hedgehogs
"	6/12/72	407	39-46N 70-40W	"	V. Wilson	K. Smith R. Turner	1006	1728	7-22	1828m	Female scien- tist. Found bottom sta.
"	6/14/72	408	39-46N 70-40W	"	E. Bland	F. Grassle T. McLellen	0900	1832	9-32	1828m	Female scien- tist. Visit towers 2 & 3
53	6/24/72	409	39-34N 72-25W	NOAA Geology & Biology	V. Wilson	G. Keller G. Rowe	1332	2006	6-34	530m	Planted string for later re- covery.
"	6/25/72	410	39-31.5N 72-21W	"	E. Bland	G. Keller R. Ballard	0927	1652	7-25	575m	Hudson Canyon
"	6/26/72	411	39-20N 72-03W	"	V. Wilson	G. Keller R. Ballard	0928	0948	0-20	200m	Aborted due ground #1 battery

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
53	6/26/72	412	39-19.6N 72-02.3W	NOAA Geology & Biology	V. Wilson	G. Keller R. Ballard	1228	1943	7-15	1827m	Hudson Canyon
"	6/27/72	413	39-34N 72-25W	"	E. Bland	G. Keller R. Ballard	0923	1634	7-11	477m	Planted current meter
"	6/28/72	414	39-27.7N 72-17.3W	"	V. Wilson	G. Keller T. Terry (LEHIGH)	0906	1326	4-20	853m	Sediment density probe
"	6/29/72	415	39-25N 72-09.5W	"	E. Bland	G. Keller R. Ballard	0900	1729	8-29	1438m	
"	6/30/72	416	39-39.5N 72-28W	"	V. Wilson	G. Keller G. Rowe	0852	1158	3-06	292m	Low visi- bility
54	7/7/72	417	42-31.5N 69-38.1W	ARPA Geology	E. Bland	A. Malahoff (ONR) R. Ballard	0901	1536	6-35	232m	Magnetometer runs. Rock hammer
"	7/8/72	418	43-09.5N 69-22.5W	ARPA Geology & Navigation	V. Wilson	J. Carlmark (ONR) W. Marquet	1348	1410	0-32	175m	UQC failed
"	7/9/72	419	43-09.5N 69-22.5W	"	V. Wilson	R. Ballard M. McCamis	0929	1605	6-36	130m	Rock hammer failed
"	7/10/72	420	43-10.5N 69-21.5W	ARPA Navigation	E. Bland J. Donnelly	W. Marquet	0957	1452	4-55	255m	Rough bottom

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
54	7/11/72	421	43-11N 69-21W	ARPA Geology	V. Wilson	R. Ballard D. Porter	1302	1830	5-28	159m	Rock hammer failed
"	7/12/72	422	43-10.5N 69-21.5W	ARPA Navigation	E. Bland J. Donnelly	D. Hosom	0835	1448	6-13	182m	Low vis- ibility rough bottom
"	7/13/72	423	43-13N 69-20W	ARPA Geology	V. Wilson	R. Ballard D. Porter	1132	1557	4-25	150m	
"	7/14/72	424	42-43.5N 69-47.8W	ARPA Navigation	E. Bland J. Donnelly	J. Porteous	1029	1454	4-25	375m	Bottom nav. experiments
55	7/20/72	425	42-27N 69-16W	NSF Geology	V. Wilson	W. Bryan L. King	1431	1840	4-09	264m	
"	7/21/72	426	42-50N 69-12W	"	E. Bland	R. Ballard R. McMasters	0945	1546	6-01	410'	
"	7/22/72	427	43-23N 69-10W	"	V. Wilson	R. Ballard W. Bryan	1010	1617	6-07	310'	
"	7/23/72	428	43-42.5N 68-48W	"	E. Bland J. Donnelly	L. King	1218	1826	6-08	318'	ALVIN's northern most dive
"	7/24/72	429	43-02N 68-54W	"	V. Wilson	R. Ballard B. Walden	1001	1408	4-07	411'	Rock samples
"	7/25/72	430	43-01N 68-59W	"	E. Bland	R. Ballard R. McMasters	0906	1513	6-07	390'	Rock samples strong current
" A-45	7/26/72	431	42-46N 68-54W	"	V. Wilson	R. Ballard W. Bryan	0946	1420	4-34	288'	Collected 108 lbs of rock

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
55	7/27/72	432	42-29N 68-40W	NSF Geology	V. Wilson	L. King J. Donnelly	0810	1230	4-20	639'	
NA	8/8/72	433	W. H. Harbor	ONR Post refit trials	E. Bland J. Donnelly	G. Hayward (BENTHOS)	1119	1230	1-20	50'	Test - cal. altimeter
NA	8/8/72	434	"	ONR Pilot dive	J. Donnelly	W. Marquet D. Foster	1257	1316	0-19	50'	1st solo for Donnelly
56	8/9/72	435	41-15N 71-00W	ONR Pilot cer- tification	J. Donnelly	W. Rainnie LCDR Whitaker (SUBDEVGRU I)	1450	1648	1-58	31m	
"	8/11/72	436	39-46N 70-40W	ONR Biology	E. Bland	G. Rowe D. Cohen	1137	2100	9-23	1827m	Visit tower #3 night recovery
"	8/13/72	437	39-46N 70-40W	"	V. Wilson	K. Smith J. MacIl- vaine	0836	1806	9-30	1815m	Dropped elevator with bell jars
"	8/14/72	438	39-46N 70-40W	"	E. Bland	P. Wiebe D. Cohen	0810	1540	7-30	1820m	Plankton tows planted garbage bale
"	8/15/72	439	39-46N 70-40W	"	V. Wilson	G. Rowe C. Clifford	1026	1847	8-21	1823m	Rough re- covery -visit garbage, lost camera
"	8/16/72	440	39-46N 70-40W	"	E. Bland	G. Rowe K. Smith	1123	1807	6-44	1822m	Recovered bell jars, search for cameras

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
56	8/17/72	441	39-46N 70-40W	ONR Biology	V. Wilson J. Donnelly	P. Wiebe	0751	1427	6-36	1800 ^m	Plankton tows
57	8/24/72	442	42-50N 68-55W	ARPA Geology Navigation	V. Wilson	W. Bryan J. Heirtzler	1412	1839	4-27	380'	
"	8/25/72	443	42-50N 68-55W	"	E. Bland	R. Ballard G. Bellaiche (CNEXO - France)	1129	1804	6-35	414'	Recovered xponder
"	8/26/72	444	42-50N 68-55W	"	V. Wilson	W. Bryan R. Ballard	1040	1637	5-57	390'	
"	8/27/72	445	42-50N 68-55W	"	V. Wilson	R. Ballard G. Bellaiche	0946	1515	5-29	400'	Navigation runs
"	8/29/72	446	42-50N 68-55W	ARPA Navigation	J. Donnelly	D. Foster A. Eliason	1028	1650	6-22	300'	Noise tests Nav. runs
"	8/30/72	447	42-50N 68-55W	ARPA Geology Navigation	J. Donnelly	W. Bryan G. Bellaiche	0958	1631	6-33	453'	
"	8/31/72	448	42-47.5N 68-52W	ARPA Navigation	E. Bland	D. Foster W. Page	0830	1315	4-47	501'	Nav. runs
58	9/7/72	449	39-34.5N 72-25W	NOAA Geology	E. Bland	G. Keller N. Staresinic (NOAA)	1012	1703	6-51	537 ^m	Hudson Canyon Visibility 2'
" A-47	9/11/72	450	39-34N 72-25W	"	V. Wilson J. Donnelly	G. Keller	0826	1026	2-00	460m	Recovered current meter

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
58	9/11/72	451	39-38.5N 72-26.4W	NOAA Geology	J. Donnelly	G. Keller W. VanSciver (LEHIGH)	1236	1807	5-31	368m	Samples & current measurement
"	9/12/72	452	39-32N 72-24.5W	"	E. Bland	G. Keller R. Swartz (LEHIGH)	0844	1210	3-26	582m	Density probe
"	9/12/72	453	39-38.5N 72-26.4W	"	J. Donnelly	G. Keller W. VanSciver	1507	1827	3-27	368m	"
"	9/13/72	454	39-27.5N 72-13.1W	"	E. Bland	G. Keller D. Lambert (NOAA)	0838	1553	7-15	1142m	Samples & current measurement
"	9/14/72	455	39-32.4N 72-24.5W	"	J. Donnelly D. Foster	G. Keller	0828	1231	4-03	570m	
59	9/24/72	456	39-46N 70-41W	NSF Biology	E. Bland D. Foster	G. Hampson	0846	0922	0-36	300m	Aborted due suspected life support problems
"	9/24/72	457	39-46N 70-41W	"	E. Bland D. Foster	G. Hampson	0943	1746	8-03	1790m	Relocated bottom station Set tower #5
"	9/25/72	458	39-46N 70-41W	"	J. Donnelly D. Foster	P. Holmes	0823	1715	8-52	1830m	Visit towers #1 and 2
"	9/26/72	459	39-46N 70-41W	"	J. Donnelly	H. Sanders T. McLellan	0820	1824	10-04	1830m	Longest dive this season

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
60	10/11/72	460	39-46N 70-41W	ARPA/NSF Navigation Biology	E. Bland	F. Grassle J. Drogou (CNEXO - France)	0926	1815	8-49	1830m	Nav. ex- periments cores
61	10/21/72	461	42-01N 70-11W	ONR Training	V. Wilson J. Donnelly	D. Foster	1339	1614	2-35	140'	
"	10/23/72	462	42-02.5N 70-10.5W	"	J. Donnelly D. Foster	A. Barrs	1043	1130	0-47	65'	
"	10/23/72	463	42-00N 70-11W	"	J. Donnelly D. Foster	K. Wagner	1136	1533	3-57	66'	
"	10/24/72	464	42-02.5N 70-14.1W	ONR Orientation	J. Donnelly	CAPT Darrell CDR O. Zipf (ONR)	1035	1313	2-38	160'	
"	10/25/72	465	42-02.5N 70-10.5W	"	E. Bland D. Foster	K. McDonald (WHOI/MIT)	1033	1224	1-51	48'	
"	10/25/72	466	42-02.5N 70-10.5W	ONR Training	J. Donnelly D. Foster	A. Barrs	1233	1507	2-34	63'	
"	10/26/72	467	42-09.8N 70-32.3W	ONR Rock drill test	V. Wilson	D. Williams	0940	1213	2-33	126'	
62	7/5/73	468	USNRDC Annapolis	ONR Tests	Unmanned	Unmanned	1415	1245	22-30	12000'	Unmanned power off test in tank - 2 cycles

LULU Cr. No.	Date	Dive No.	Location	Sponsor/ Purpose	PIC/CP	Obs.	Time			Depth M/Ft.	Remarks
							Dive	Surf	Sub.		
62	7/6/73	469	USNRDC Annapolis	ONR Tests	Unmanned	Unmanned	1720	0447	11-27	12000'	Unmanned power on test in tank 2 cycles
"	7/10/73	470	"	"	V. Wilson E. Bland	L. H. James (NAVSHIPS)	1040	2014	9-34	12000'	Manned cer- tification
NA	8/24/73	471	W. H. Dock	"	E. Bland J. Donnelly	None	1150	1235	0-45	10'	Tethered trim & check out
NA	8/24/73	472	"	"	V. Wilson	None	1312	1417	1-05	10'	Submerged inclining experiment
NA	8/30/73	473	"	"	V. Wilson J. Donnelly	D. Foster	1405	1528	1-23	10'	Inclining experiment
NA	9/4/73	474	"	"	V. Wilson J. Donnelly	L. Shumaker	1640	1716	0-36	10'	Trim dive
63	9/6/73	475	P'Town Harbor	ONR Tests & Training	V. Wilson E. Bland	L. Shumaker	1123	1353	2-30	65'	
"	9/7/73	476	42-01.5N 70-13.5W	"	J. Donnelly E. Bland	J. Moore	1432	1639	2-07	132'	
NA	10/9/73	477	W. H. Dock	"	V. Wilson J. Donnelly	D. Foster	1054	1150	0-54	15'	Tethered trim dive
"	10/9/73	478	W. H. Harbor	"	V. Wilson J. Donnelly	L. Shumaker	1424	1514	0-50	50'	Check out

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Technical Memorandums

Appendix B

<u>Tech</u> <u>Memo #</u>	<u>Name</u>	<u>Title</u>
DS-5	Walsh, J. B., Mavor, J.W., Jr.	Analysis of Details of ALUMINAUT Pressure Hull Joint (1962)
DS-7	Mavor, J. W., Jr.	Structural and Hydrodynamic Analysis Subjects for Research (1962)
DS-8	Mavor, J. W., Jr.	Structural Consideration in the Design of Instruments for Use with ALUMINAUT (1962)
DS-9	Mavor, J. W., Jr.	The Mechanical and Chemical Properties of the HY100 Pressure Hulls of the Submarine ALVIN (1973)
DS-11	Learnard, H. H., McCamis, M. J., Swinhart, O. L.	Electrical & Pressure Tests of ALVIN's Electrical Through Hull Penetrators. (1964)
DS-12	Learnard, H. H., Marquet, W. M., McCamis, M. J.	Twenty-Four (24) Man-Hour Test of ALVIN's Environmental System. (1964)
DS-13	Mavor, J. W., Jr.	Preliminary Memorandum on the Weight, Buoyancy and Stability, Speed, Power, Drag and Thrust of the Submarine (1964) (Final Report in preparation)
DS-14	Mavor, J. W., Jr.	Analysis of Proposed Titanium Buoyancy Spheres for ALVIN. (1964)
DS-15	Mavor, J. W., Jr.	Summary Report on Fabrication, Inspection and Test of ALVIN Fixed and Variable Buoyancy Spheres. (1965)
DS-17	Reviewed by Bureau of Ships	W H O I Comments on DSRV ALVIN Design (1965)
DS-18	Mavor, J. W., Jr.	Weight, Buoyancy and Stability Report on the ALVIN Vehicle as of May 17, 1965

<u>Tech</u> <u>Memo #</u>	<u>Name</u>	<u>Title</u>
DS-19	McCamis, M. J., Marquet, W. M., Broderson, G. D., Mason, D. H.	Fuse Testing in Oil for ALVIN Batteries (1965)
DS-20	Mavor, J. W., Jr. Sharp, A. G.	Design and Manufacture of New Emergency Hull Release for ALVIN (1965)
DS-20a		Comments of the WHOI DSRVG on the AUTEC I Specifications of May 27, 1965
DS-21	Shultz, W. S., Omohundro, F. P.	Long Term Exposures & Cycling Tests of Syntactic Foam Buoyancy Material Used in DSRV ALVIN (1966)
DS-22	Baxter, L., II	A Discussion of Various Means of Improving Visibility from the DSRV ALVIN or Similar Vehicles (1966)
DS-23	Morgan, H. A., Szczypinski, W. S.	Determination of Hull Efficiency Parameters for a Deep Submergence Hull Form (1967)
DS-24	Booth, R. J.	A Comparative Study of the Heave and Pitch Motions of the Deep Submersible, ALVIN and Her Support Catamaran During Surface Operations (1967)
DS-25	Sharp, A. G., Sullivan, J. R.	Tests of Propellers for ALVIN Side Propulsion Units (1967)
DS-26	Sharp, A. G.	Weight, Buoyancy & Stability of DSRV ALVIN (1968)
DS-27	Bland, E. L.	Criteria for the Selection Training & Qualifications of Pilots for Deep Sub-Engineering & Op. Section (1968)
14-68	Korites, B. J.	Deep-Ocean Observatory Research Program - A Prospectus (1968)
16-68	Korites, B. J.	Structure of Long Sediment Corers (1968)
8-69	Kenny, J. N.	A Modeling System for the Dynamics of an Underwater Launch and Recovery of a Deep Submersible (1969)

<u>Tech</u> <u>Memo #</u>	<u>Name</u>	<u>Title</u>
2-70	Berteaux, H. O., Morey, R. L.	Experimental Analysis of the Failed Wire Ropes of the Submersible ALVIN Hoist System
10-70	Porteous, J.	Evaluation of Movie Lights for Use on DSRV ALVIN (1970)
2-71	Walden, B. B.	Torpedo Recovery Device for DSRV TURTLE (1971)
6-71	Sharp, A. G., Winget, C. L., Eliason, A. H.	DSRV ALVIN Weight Report, 1971
5-72	Sharp, A. G., Eliason, A. H.	DSRV ALVIN Weight Report, 1972
6-73	Sharp, A. G., Doherty, K. W.	DSRV ALVIN Weight Report, 1973
		Management Plan DSRVG 1965
TM-4-69	Dunkle, W. M.	Summary Reports of Vessels, Aircrafts and Submarine Dives During 1967
TM-7-69	Dunkle, W. M.	Summary Reports of Vessels, Aircrafts and Submarine Dives During 1968
TM-3-70	Dunkle, W. M.	Summary Reports of Vessels, Aircrafts and Submarine Dives During 1969
TM-7-71	Dunkle, W. M.	Summary Reports of Vessels, Aircrafts and Submarine Dives During 1970
TM-1-72	Dunkle, W. M., Momm, A. O., Witzell, G. M.	Summary Reports of Vessels, Aircrafts and Submarine Dives During 1971
TM-4-73	Dunkle, W. M., Momm, A. O., Witzell, G. M.	Summary Reports of Vessels, Aircrafts and Submarine Dives During 1972
TM-7-74	Dunkle, W. M., Smart, C., Alexander, A. M.	Summary Reports of Vessels, Aircrafts and Submarine Dives During 1973

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Reference Manuals

Appendix C

<u>Ref #</u>	<u>Name</u>	<u>Title</u>
62-32	Walsh, J. B.	Strength of the "ALUMINAUT" Hull (1962)
62-41		Deep Submergence Research Conducted During the Period 1 November 1961 - 31 October 1962 (1962)
63-17	Walsh, J. B.	Preliminary Report on Pressure Test of One-Sixteenth Scale ALUMINAUT Model (1963)
64-1		Deep Submergence Research Conducted During the Period November 1, 1962 - December 31, 1963 (1964)
65-1	Mavor, J. W., Jr.	Mechanical and Chemical Properties of the HY 100 Pressure Hulls of the submarine ALVIN (1965)
65-6	Mavor, J. W., Jr.	Weight, Buoyancy and Stability of the Research Submarine ALVIN (1965)
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<p>Woods Hole Oceanographic Institution WHOI-74-60</p> <p>DEEP SUBMERGENCE RESEARCH CONDUCTED DURING THE PERIOD 16 JUNE 1961 THROUGH 31 DECEMBER 1973 by Lawrence A. Shumaker. 81 pages. August 1974. Contract N00014-71-C-0107; NR 265-107 (formerly Nonr-3484(00); NR 260-107).</p> <p>This report provides a brief overview of over twelve years of development and operations of the Deep Research Vehicle ALVIN and its support system. Conclusions regarding the usefulness of the work and recommendations regarding its continuance are made.</p>	<ol style="list-style-type: none"> 1. Deep Submergence Operations 2. Deep Ocean Research 3. Research Submersible ALVIN 4. Submersible <p>I. Shumaker, Lawrence A. II. N00014-71-C-0107; NR 265-107 (formerly Nonr-3484(00); NR 260-107)</p>	<p>Woods Hole Oceanographic Institution WHOI-74-60</p> <p>DEEP SUBMERGENCE RESEARCH CONDUCTED DURING THE PERIOD 16 JUNE 1961 THROUGH 31 DECEMBER 1973 by Lawrence A. Shumaker. 81 pages. August 1974. Contract N00014-71-C-0107; NR 265-107 (formerly Nonr-3484(00); NR 260-107).</p> <p>This report provides a brief overview of over twelve years of development and operations of the Deep Research Vehicle ALVIN and its support system. Conclusions regarding the usefulness of the work and recommendations regarding its continuance are made.</p>	<ol style="list-style-type: none"> 1. Deep Submergence Operations 2. Deep Ocean Research 3. Research Submersible ALVIN 4. Submersible <p>I. Shumaker, Lawrence A. II. N00014-71-C-0107; NR 265-107 (formerly Nonr-3484(00); NR 260-107)</p>
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