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March 18, 2005

UNOLS Council
Washington, DC

**Re: Application Requesting Designation of the *R/V Seward Johnson II*
as a UNOLS Vessel to replace the *R/V Weatherbird II*, presently operated
by the Bermuda Biological Station for Research**

Dear Council Members:

The Bermuda Biological Station for Research (BBSR), Inc., a Bermuda-based, United States-registered 501c not-for-profit research and education institution, is designated by the University National Oceanographic Laboratory System (UNOLS) as an Operating Institution. BBSR has operated the UNOLS-designated *R/V Weatherbird II* (WBII) since 1989.

With increased scientific focus on the waters off Bermuda over the past two decades, and projections for continued and increasing focus on the North Atlantic Ocean region near Bermuda over the next 10-15 years, it became evident to the trustees of the BBSR that a larger and more capable vessel is required to replace the WBII.

A committee of BBSR trustees and scientists has identified the UNOLS-designated *R/V Seward Johnson II* (SJII), currently owned by Harbor Branch Oceanic Institute (HBOI), as a suitable replacement vessel that will greatly enhance vessel support for science and educational activities. It will benefit UNOLS fleet operations in terms of enhanced science and educational capabilities and cost savings.

Please accept the attached document as BBSR's application to designate the SJII as a UNOLS vessel to replace the WBII, providing a suitable arrangement can be reached between HBOI and BBSR.

Sincerely,

Anthony Knap, Ph.D.
President and Director

Attachment: *Application Requesting Designation of the R/V Seward Johnson II as a UNOLS Vessel to Replace the R/V Weatherbird II, Operated by the Bermuda Biological Station for Research, a UNOLS Operating Institution*

Application Requesting Designation of the *R/V Seward Johnson II* as a UNOLS Vessel to Replace the *R/V Weatherbird II*, Operated by the Bermuda Biological Station for Research, a UNOLS Operating Institution

1. Background: Scientific and Operational Rationale for Replacing the *R/V Weatherbird II* with the *R/V Seward Johnson II*.

The Bermuda Biological Station for Research (BBSR), Inc., a Bermuda-based United States registered 501c not-for-profit research and education institution, is registered by the University National Oceanographic Laboratory System (UNOLS) as an Operating Institution. In 2004, the trustees of the BBSR commissioned a comprehensive external science review of BBSR's research and educational activities, as well as a review of operational and management structure. A major recommendation from the external science review report was the replacement of the *R/V Weatherbird II* (WBII) as soon as possible. Because of the vessel's size (115'), the deck, laboratory spaces and berth space (8-10 persons) are inadequate for multi-investigator cruises and specialized research needs.

To optimize research and education capabilities, a group of resident scientists at BBSR, ship users, and members of BBSR's Board of Trustees was tasked in late 2004 with providing options for replacing the WBII. The UNOLS designated *R/V Seward Johnson II* (SJII), currently owned but not in use at HBOI, was identified as a suitable replacement vessel. The size and capabilities of the SJII would alleviate the main operational deficiencies associated with the WBII.

The SJII is configured to conduct all current science operations performed on the WBII, although some modifications to the present ship layout (now optimized for submersible work) will be required to better support the types of science activities presently conducted off Bermuda. The most extensive modification suggested is fabrication of an integrated CTD garage and deployment/recovery station that is capable of handling the 24-place CTD rosette package used for the BATS time-series operations. We believe the reconfigured SJII will greatly enhance vessel support for the science and educational activities projected in the Bermuda region over the next 10-15 years.

Replacing the WBII with the SJII will benefit UNOLS fleet operations in terms of cost savings and enhanced scientific and educational capabilities as described hereafter.

2. Requirements for Becoming a UNOLS Vessel

a. Operation of the vessel for oceanographic research and education purposes:

The WBII is a general purpose research ship owned and operated by the BBSR, Inc. WBII has been a designated UNOLS vessel since 1989, and the mission of the ship is to support funded oceanographic research (primarily NSF) and education purposes.

b. Evidence of three or more years of continuous operation of shared use as a research and education facility:

BBSR has operated the WBII since 1989. The WBII supports four nationally and internationally important oceanographic time-series programs that have operated continuously for one to five decades. The WBII also supports other NSF funded research activities in the region. (See Table 1 for detailed listing of projects by principal investigator and institution, Table 2 for examples of ancillary studies supported by time-series programs, and Table 3 for the WBII 2005 schedule)

c. Projection of the vessel's use for the next year, including user charges:

The WBII is scheduled for 144 federally-funded days at sea in 2005 and BBSR expects that it would transfer those operations, plus additional days, to the SJII. The WBII primarily supports scientific research in the oligotrophic subtropical gyre of the North Atlantic Ocean. This region is an important modulator of the oceanic cycling of biogeochemical elements (C, N, P, Si, Fe), radiatively (e.g., CO₂, DMS) important gases, air-sea heat and salt transport, and climate. The ease of access to the deep waters off Bermuda has allowed WBII to contribute significantly to national efforts to improve our understanding of ocean processes. (see Table 4) Anticipating a schedule of 200 days, we expect the day rate for the SJII to be about \$10,500 and technical support to be \$1,500.

d. Successful completion of an appropriate safety inspection such as NSF Ship Inspection at the institution's expense:

The BBSR will schedule an NSF Ship Inspection of the SJII prior to starting operation out of Bermuda.

e. Capability of operating under the UNOLS Research Vessel Safety Standards:

The BBSR currently operates under the Research Vessel Safety Standards and will continue to do so with the SJII.

f. Regular availability to all federally funded users:

The WBII is available to all federally-funded users. By lead principal investigator (P.I) and institution, current projects, which will support a total of 144 ship days in 2005, are as follows:

- (1) Carlson, C.A. (UCSB); microbial studies;
- (2) Conte, M (BBSR/MBL); Ocean Flux Program (OFP) time series;
- (3) Dacey, J. (WHOI); oceanic DMS studies;
- (4) Dickey, T.D. (UCSB); Bermuda Testbed Mooring (BTM);
- (5) Fratantoni, D. (WHOI); Development of oceanographic sampling networks
- (6) Hansell, D.A. (RSMAS); DOC sampling;
- (7) Jenkins, W.J. (WHOI); tritium-helium tracer/ocean primary productivity;
- (8) Knap, A.H. (BBSR); Bermuda Atlantic Time Series (BATS) study;

- (9) Knap, A.H. (BBSR); The Panulirus (Hydrostation S) Stations;
(10) McGillicuddy, D.J. (WHOI); mesoscale eddy studies;

g. Maintenance to accommodate the needs of the academic oceanographic programs:

The BBSR will maintain the SJII to meet the needs of academic oceanographic programs.

h. Full participation in the UNOLS scheduling process. The operator shall receive, acknowledge, and structure requests for ship-time use in consultation with the UNOLS Office:

The BBSR will continue to participate in UNOLS ship scheduling and currently our marine superintendent is the vice-chairperson of the scheduling committee.

i. Submission of cruise reports and cruise assessments according to UNOLS uniform practices:

The BBSR will continue to submit cruise reports and cruise assessments.

j. Adherence to cost accounting and performance standards according to UNOLS uniform procedures:

The BBSR will continue to adhere to UNOLS cost accounting and performance standards.

k. Securing the necessary funds to support operation of their vessels:

The BBSR will secure necessary funds.

l. Statement addressing how the addition of this vessel to the UNOLS academic research vessel fleet will improve the mix of facilities available for oceanographic programs or address an identified need for specific capabilities:

Replacing the WBII with the SJII will benefit UNOLS fleet operations in the following significant ways (See Table 5):

Enhanced Science Capability:

- Expanded deck space would provide significantly greater flexibility in deck equipment configuration and ability to carry multiple winches, 20 ft vans and/or work boats simultaneously. The ability to launch larger buoys and instruments would also be enhanced.
- Larger wet and dry laboratory spaces and a more stable platform would better support multi-investigator cruises, would allow larger and/or more delicate lab instruments to be carried, and would provide the necessary space for semi-permanent installations in support of time-series research.
- Larger vessel size would improve ability to conduct science operations in higher sea state conditions.

- Greater science berthing capacity (22 scientists) would allow for larger science parties.
- Better vessel comfort and sea-kindliness on the larger SJII would greatly alleviate scientist and crew fatigue on longer cruises and at higher sea states.

Enhanced Educational Capability:

- Larger lab spaces and better sea-kindliness would provide a better environment for education.
- Greater science berthing capacity would allow multiple day cruises for science education and technical training.

Improved Cost Efficiency:

- Reducing the UNOLS fleet by retiring the WBII should proportionately reduce costs for oceanographic technical services, oceanographic instrumentation and shipboard scientific support equipment.
- The home port advantage of a suitable regional vessel in Bermuda would reduce overall fleet costs by reducing the number of transit and mobilization days.
- It would also reduce port costs that are now borne when East coast vessels must substitute for the WBII to support funded research activities in the Bermuda area.

3. Broader Impacts of Enhanced Vessel Capabilities at BBSR

Broader Impacts of Scientific Research:

The mission of the ship based at BBSR is to support funded science research in the oligotrophic subtropical gyre of the North Atlantic Ocean. This region is an important modulator of the oceanic cycling of biogeochemical (N, P) and radioactively (e.g., CO₂) important elements, air-sea heat and salt transport as well as climate. The ease of access to these deep waters has allowed the UNOLS vessel based at BBSR in Bermuda to contribute significantly to national efforts to improve our understanding of ocean processes and global issues such as: (1) climate change; (2) the complex interaction and feedback between climate phenomena, global warming, ocean biogeochemistry and ecosystem variability and health; and (3) the variability of greenhouse gases such as CO₂, the exchange of CO₂ between ocean and atmosphere, and variability of carbon sources and sinks. The Bermuda time-series activities are increasingly important for capturing unpredictable, larger-scale and lower-frequency climate variations associated with climate phenomena such as the North Atlantic Oscillation (NAO) and El Niño Southern Oscillation (ENSO). The UNOLS vessel based at BBSR also supports technology development that can be applied to studies of relevant environmental issues.

Broader Impacts of Technology Development Conducted on the WBII:

Accessibility to deep, oligotrophic waters within a few hours steam and the ability for regular shipboard calibration of new moored instrumentation will continue to make the time-series area an important site for instrument development. The expanded capabilities of the SJII will better

support the development and testing of these new technologies and thus will broadly improve the tools we have for understanding ocean and climate processes.

Broader Impacts of for Education, Training and Public Outreach:

The enhanced capabilities of the SJII for education and the greater berthing capacity will allow for development of courses specifically geared to training in shipboard methodology and technical training for the UNOLS fleet.

Table 1

Funded Projects on R/V *Weatherbird II* in 2005

NSF-funded research projects utilizing the *Weatherbird II* in 2005 will total 144 ship days in 2005. (Note: This is slightly less than the number of ship days funded in 2004, which was 159 because the WBII was not in service for six weeks in January-February 2005 due to required shipyard maintenance.)

The 2005 ship operating schedule is given in Table 3. All cruises except the BATS “Validation” transect to Puerto Rico will be conducted within 200 nm of Bermuda. This schedule is typical of operations over the past several years.

A. The Bermuda Time Series Programs

The primary users of the *R/V Weatherbird II* continue to be the four ongoing oceanographic time-series operations: the Bermuda Time Series Study (BATS), Hydrostation S (HYDRO), the Oceanic Flux Program (OFP) and the Bermuda Testbed Mooring (BTM). Together these four programs utilize 106 ship days, or 74% of the 2005 total. In addition to research directly supported by these grants, the time series programs together provide seagoing opportunities for sample collection and samples/data in support of a wide diversity of NSF-funded research. Examples these “ancillary” projects are listed in Table 2.

Knap, A. (BBSR) - OCE-0326885. The Bermuda Atlantic Time-series Study (BATS), begun in 1988, is one of the two U.S. Joint Global Ocean Flux Study (JGOFS) ocean time-series projects. The primary focus of BATS is upper ocean biogeochemical properties and their variability on monthly- to decadal time-scales. There are sixteen core cruises of 4 days each, during which there are 10 CTD casts, trap array deployment and recovery, production array deployment and recovery, in situ pumping for thorium and typically 10 bio-optical profiles a day. Sampling is done at 8 depths using a Kevlar line and GoFlo bottles once per cruise for BATS. There are numerous jobs associated with the ancillary science. These include *in situ* pumping, GoFlo casts, etc. Bloom cruises occur three times/yr. 5-Day Validation cruises are done twice per year. These cruises are single N-S transects (360 NM) from about 26°N to 33°N, inclusive of the BATS site. Other P.I.'s N.R. Bates, M.L. Lomas (BBSR).

Knap, A. (BBSR) – OCE-0138353. The Hydrostation S time-series, begun in 1954, is the

longest running open ocean time-series still ongoing. The primary focus of Hydrostation S sampling program has been conducted continuously at biweekly intervals for the past 46 years. This long-term record has proved to be immensely valuable. Hydrostation S conducts biweekly profiling of temperature, salinity and oxygen from 0-3500? m. There are two CTD casts during each visit along with two bio-optical profiles. The Hydrostation S time-series data has been a central part of the foundation of the U.S. effort to understand the role of the oceans in global change. Researchers studying global change, upper ocean geochemistry and, particularly, physical and chemical models of the time-course evolution of the upper ocean routinely rely on the Hydrostation S data to calibrate their models. The Hydrostation S time-series cruises have also provided ship time for many different NSF-funded projects over the years.

Conte, M. (WHOI) – OCE-0325627. The Oceanic Flux Program (OFP), begun in 1978, is the second longest running time-series off Bermuda. The OFP sediment trap time-series is unique in its focus on sedimentation patterns in the deep Sargasso Sea and on the processes controlling on flux variability on time scales of weeks to decades. OFP cruises to turn around the mooring are scheduled every four months. As well as mooring turnaround, CTD and Go-Flo casts are made. Additional sampling (e.g. in-situ pumps, surface sediment grabs, water sampling) is conducted on cruises for collaborative research projects when time and weather allow.

Dickey, T. (UCSB) – OCE-0099245. The Bermuda Testbed Mooring (BTM), begun in 1994, is a hydrographic and bio-optical mooring. Meteorological and spectral radiometric data are collected from a surface buoy tower. Subsurface instruments collect physical (T, S, currents), bio optical properties, nitrate and trace elements. CTD and bio-optical profiling casts before and after mooring recovery and redeployment. There are two mooring turnarounds per year. At monthly intervals, meteorological data is downloaded from the surface buoy array to the WBII via an acoustic modem and sent to the PIs for processing. Bathymetry survey data is supplied during the cruises. The BTM mooring provides a platform for testing of *in situ* chemical, biological and physical sensors, and understanding high frequency ocean variability. Other P.I.'s D. Frye (WHOI).

B. Other Research Projects

In 2005 the WBII will conduct cruises in support of other NSF and ONR-funded grants. The research topics are briefly described below under lead principal investigator. These projects are typical of the diversity of research at the time-series site and environs that is supported by the WBII.

Carlson (UCSB) - MCB-0237728: This project investigates the linkages between the microbial communities and their influence on biogeochemical processes in the subtropical gyre of the North Atlantic Ocean. A component of this project is the establishment of a Microbial Observatory focused on documenting the genomic diversity of the microbial community. Other P.I.'s S. Giovannoni (OSU).

Dacey (WHOI) - OCE-0241310: This project is focused on establishing a time-series of seawater dimethylsulfide (DMS) dynamics at BATS and process studies in the North Atlantic subtropical gyre. DMS and its precursor chemical dDMSP and pDMSP play an active role in the

cycling of sulphur in marine and atmospheric systems. Other P.I.'s N.R. Bates (BBSR), D. Toole (WHOI).

Fratantoni (WHOI) - N00014-00-1-0256: This project is studying submerged autonomous launch platforms for drifting instrumentation. (ONR funded).

Hansell (RSMAS) - OCE-0218646: This is a one-day cruise studying dissolved organic carbon (DOC) and certification of seawater DOC standards. CTD and associated water sampling.

Jenkins (WHOI) - OCE-0221247: This research is focused on understanding on the drivers of primary productivity in the North Atlantic subtropical gyre. Jenkins uses tritium-helium tracers to answer the question, "Is there an ocean primary production paradox?". Other P.I.'s M. Lomas (BBSR).

McGillicuddy (WHOI) - OCE-0241310: This project is studying the impacts of eddies and mixing on plankton community structure and biogeochemical cycling in the Sargasso Sea. Both the WBII and the Oceanus participate in two ship cruises. Other P.I.'s W. Jenkins, J. Ledwell, K. Buesseler (WHOI); N.R. Bates (BBSR); D. Hansell (RSMAS); D. Siegel (UCSB); P. Falkowski (Rutgers)

C. New Technologies, Instrumentation and In Situ Sensors

Ship operations at BBSR also support the development of new technologies, instrumentation and in situ sensors that continue to be tested, calibrated and groundtruthed, either from the ship or during deployments on the BTM. These studies have included:

1. Testing of the autosub (Millward, SOC);
2. New profiling technologies for CTD, XBT and ARGO floats (Frye, WHOI)
3. New pH sensors, (Byrne, USF)
4. $p\text{CO}_2$ buoys (Merlivat, LODYC) and sensors (DeGrandpre, Univ. Montana)
5. Testing of new ocean bottom seismometers (Sohn, WHOI) and vertical distribution of larval lobsters and other plankton: effects on along-shelf and shore-ward
6. Transport in a coastal current system (Incze, Bigelow Laboratory, and Dr G. Lough (NOAA/NEFC).

D. Technology Development

In 2005, ship operations will support technology development in programs such as the following, in addition to the installation of a new DMS system:

1. T.D. Dickey, UCSB; BTM mooring
2. D. Frye, WHOI; autonomous samplers
3. M. Silevitch; coral reef investigations with SUV, and
4. D. Fratantoni, ONR; in deployment and development of autonomous samplers. A new underway $p\text{CO}_2$ system will also be installed in 2005 (N. Bates, BBSR).

A number of other NSF-funded and international research studies are conducted in vicinity of the Bermuda time-series site. These projects are located here specifically because of the wealth of oceanographic information about the region that the time-series programs have produced. Many of these projects have utilized the WBII as a sampling platform and BBSR for logistics support. However others have utilized the east coast UNOLS vessels (RV's *Cape Hatteras*, *Oceanus*, *Endeavor*, *Cape Henlopen*), often because the deck, laboratory or berthing requirements of the funded research activities exceeds the capabilities of the WBII.

E. Educational, Training and Outreach Activities

Ship operations at BBSR are important contributors to education, training and public outreach. Many undergraduate, graduate and post-graduate students have received training or conducted their research using the WBII. Recent Ph.D. student researchers include: Kate Achilles (Univ. Delaware), Roberta Hamme (UW), Dede Toole (UCSB), and Jack Oliver (VIMS), P. Rossell (Univ. Concepcion, Chile) and C. Turich (Penn State). Ship operations have also contributed to improving the training and experience of young research scientists and technicians, through participation with oceanographic time-series programs such as BATS, Hydrostation S, OFP and BTM.

The WBII is used to give oceanographic and marine biological undergraduate and graduate students a taste of "real life" science as it addresses their particular disciplines. Each year, BBSR hosts undergraduates from the Duke University-BBSR in Beaufort to Bermuda program, University of Rhode Island, and a BBSR hosted NSF funded Research Experience for Undergraduates (REU). Many of these students participate in WBII scientific cruises, gaining valuable first-hand experience of science at sea. The scientific data for the BATS, Hydrostation S, BTM and OFP research programs also support education and training, being widely disseminated through easy online data access. This availability has led to a cascade of synthesis and modeling studies using data collected from the ship. These data have been some of the most important legacies of the JGOFS program, for example. National and international recognize the Bermuda time-series program as a central component of NSF programs and proposed ocean observing networks (e.g. OOI and ORION).

The ship's crew and scientists regularly contribute to public outreach efforts. The ship is part of the regular weekly BBSR educational tour to the general public. The vessel is also open for general inspection and informational tours on our annual Marine Science Day in September, when approximately 2000 visitors to the Station learn about marine research and the ongoing projects associated with it. The vessel has also played host to media and outreach organizations such as Discover Magazine, Discovery Channel and CNN. The public outreach efforts using BBSR's research vessel are critically important for improving public knowledge of science, the scientific method and societally relevant environmental issues, such as global warming, climate change, greenhouse gases such as carbon dioxide and ocean health and functioning.

Table 2

Examples of ancillary studies that have been supported by time-series programs (not exhaustive)

- *Prochlorococcus* and *Synechococcus* ecological functioning (Chisholm, MIT)
- iron and nitrogen fixation (Barbeau, WHOI/UCSB, Church, U. Delaware)
- microbial and viral ecology and dynamics (Carlson, UCSB, and Giovannoni, OSU)
- bio-optical oceanography studies (Nelson/Siegel, UCSB)
- CDOM cycling and variability (Nelson/Carlson, UCSB, and Steinberg, VIMS)
- dissolved organic carbon and nitrogen variability (Hansell, RSMAS)
- surface $p\text{CO}_2$ dynamics by continuous underway instrumentation (Bates, BBSR)
- zooplankton variability and physiology (Steinberg, VIMS, and Madin, WHOI)
- neutrally buoyant sediment trap development (Price/Buesseler/Valdes, WHOI)
- surface carbon cycle time-series (Bates, BBSR, and Keeling, SIO)
- dissolved oxygen cycling and primary production (Luz/Barkan, Hebrew University)
- trace metal cycling (Boyle, MIT)
- oxygen composition of dissolved organic phosphorus (Coleman, Yale)
- nitrogen fixation studies (Sigman, Harvard, and Lipschultz, BBSR)
- copepod reproduction studies (Ferrari, Smithsonian Institute)
- zooplankton dynamics using TAPS profiling instrumentation (Roman, UMD).

Table 3

R/V *Weatherbird II* schedule for 2005. Scheduled Jan and Feb cruises (9 ship days total) were conducted by R/V *Cape Hatteras* as WBII was in shipyard. The time-series programs are denoted in bold text.

DATE	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT	OCT	NOV	DEC	DATE
1				OFF		HYDRO		OFF	HYDRO		BATS		1
2				OFF	HYDRO						BATS		2
3											BATS		3
4				BATS						BTM	BATS		4
5				BATS					BATS	BTM		HYDRO	5
6				HYDRO		Jenkins	McGill		BATS	BTM			6
7			BATS			Jenkins	McGill		HYDRO		BATS		7
8			BATS			Jenkins	McGill	BATS	BATS		BATS		8
9			HYDRO			Jenkins	McGill	BATS	BATS		HYDRO		9
10							McGill	HYDRO		BATS	BATS		10
11				BTM			McGill	BATS		BATS	BATS		11
12				BTM			McGill	BATS		HYDRO		BATS	12
13				BTM		BATS	McGill		Fratantoni	BATS		BATS	13
14				Fratantoni		BATS	McGill		Fratantoni	BATS		HYDRO	14
15				Fratantoni		HYDRO	McGill	OFF	Carlson			BATS	15
16					BATS	BATS		OFF	Carlson		OFF	BATS	16
17					BATS	BATS		McGill		Dacey	OFF		17
18				BATS	HYDRO		BATS	McGill		Dacey	OFF		18
19				BATS	BATS		BATS	McGill		Dacey	OFF		19
20			BATS	HYDRO	BATS	Carlson	HYDRO	McGill		Dacey			20
21			BATS	BATS			BATS	McGill	HYDRO	Dacey			21
22			HYDRO	BATS			BATS	McGill					22
23	BATS	BATS						McGill			HYDRO		23
24	BATS	BATS	BTM			HYDRO		McGill					24
25	HYDRO		BTM					McGill		HYDRO			25
26	BATS		BTM	Hansell		HYDRO	McGill	BTM	BATS				26
27	BATS							McGill	BTM	BATS			27
28									BTM	BATS			28
29						Carlson	OFF	HYDRO		BATS			29
30			OFF				OFF		HYDRO	BATS			30
31			OFF				OFF			BATS			31
AYS	0	5	10	18	7	11	20	20	13	20	14	6	144

Table 4

Projected Future Research Activities in the Bermuda Region

Coordination of time-series activities and requests for TS cruises to support collaborative and ancillary NSF-funded research continue to grow. Time-series measurements are a major focus of the U.S. and international JGOFS science plans. In the future, ocean time-series will be important components of ocean biogeochemical programs and ocean observing networks supported by NSF (e.g., ORION, OOI, SOLAS, IMBER, CLIVAR, GOOS). The two NSF-funded stations (Bermuda and Hawaii) are central to national and international plans for a network of ocean time-series stations and are being used as models for time-series research efforts by other countries. In addition, these two sites are important training and testing grounds for both the national and international efforts to study biogeochemical cycles in the ocean.

Ship operations at BBSR will continue to be essential to support the development of new technologies, instrumentation and in situ sensors. BBSR is the only UNOLS vessel host institution that has accessibility to deep (>4000 m) waters within a few hours steam of the dock. As an example, M. Lomas (BBSR) is the lead PI on a research project of the type that would greatly benefit from a suitable vessel like the SJII operating at BBSR. His current grant (OCE-0241662; Enhanced New Production During Winter Mixing: A Missing Component of Current Estimates) utilizes the *R/V Oceanus* for an extended (30 days) process-oriented research cruise because the WBII cannot accommodate the science needs. This project is ending in early 2006, but a renewal proposal is planned to continue similar process-oriented research during the winter either near BATS or further north at the site of Sup-tropical Mode Water formation (STMW). These research activities would require a vessel that is large enough to stay at sea for extended voyages (>3weeks), accommodate multiple (>10) scientists, and be able to handle winter weather in the Sargasso Sea.)

Table 5**Comparison of R/V *Weatherbird II* and R/V *Seward Johnson II***

	WBII	SJII
BUILT/CONVERTED:	1982/1993	1982/1988
LENGTH:	115 '	168 '
BEAM:	28 '	38 '
DRAFT:	8.6'	11 '
GROSS TONNAGE: US	194	288
International	304	833
DISPLACEMENT TONNAGE:	360	781
COMPLEMENT:		
CREW	7	10-11
TECHNICIANS:	1-2	1-2
SCIENTIFIC PERSONNEL:	10	22
MAIN PROPULSION:	2x500 hp Luger	2x940 hp Detroit Diesel
BOW THRUSTER:	1x350 hp 360 deg	1x465 hp 360 deg.
SHIP'S SERVICE GENERATOR:	2x75 kw, GM6-71	3x190 kw, GM 8-71
PROPELLERS:	2 - 4 Blade Fixed Pitch	2-4 Blade Fixed Pitch
OWNERSHIP:	The Bermuda Biological Station for Research, Inc.	Harbor Branch Oceanographic Inst.
SPEED: (knots)		
CRUISING:	9.5	10.4
FULL:	9.5	11.1
MIMINUM:	1	1
ENDURANCE:	17 days	34 days
Limiting factor- Fuel		
RANGE:	4,000 nautical miles	7,000 nautical miles
Limiting factor - Fuel		
FUEL CAPACITY:	18,000 gallons	62,000 gallons
LABORATORIES: (sq.ft.)		
Total	580	1114
SEWAGE SYSTEM:		
MSD: Eltech Omnipure,	6MC	Orca2
HOLDING TANK:	2,000 gallons	4,929 gallons
MAIN DECK SQUARE FOOTAGE	780	1900

Acknowledgements

Many people have contributed material for this report including: Dr. N.R. Bates, Captain L. Black, Dr. M.H. Conte, Dr. R.J. Johnson, Dr. M. Lomas, Dr. A. Knap, D. Scheiner, Dr. P. Sedwick. Other people have provided comments, including Dr. T. Church, Dr. W. Jenkins, Prof. H.W. Ducklow, Dr. C. Lee, Dr. L. Madin, L. Glover, Prof. J. Farrington, Prof. J. Galloway, Dr. S. Seitzinger, Captain J. Moore, Mr. R. Ross, Mr. R. Long, Captain G. Gunther.