SPECIFICATIONS

The Naval Research Laboratory (NRL) has a requirement for a 500 MHz Wide Bore Nuclear Magnetic Resonance (NMR) spectrometer for advanced studies of solids and liquids.

The spectrometer purchase consists of a 500 MHz NMR system, with multinuclear, triple resonance, solids/liquids capabilities and a number of probes. Several options are included with the purchase.

The spectrometer is for use with an existing 11.7T widebore (89 mm) Magnex magnet. See attached magnet sheet. Aside from the magnet, it is not anticipated that any other existing NMR equipment (probes, etc.) will be used with the new instrument.

The contractor shall provide a 500 MHz Wide Bore NMR Spectrometer that, at a minimum meets the following specifications:

A. 500 MHz WIDE BORE NMR SYSTEM

The 500 MHz Wide Bore NMR system consists of a NMR console and probes. The NMR system must be capable of performing solids and liquids, multi-dimensional, single-, double-, and triple-resonance NMR experiments in a magnetic field of 11.7 T. The overall spectrometer stability over a 12 hour period, as measured experimentally by the reproducibility of the NMR signal amplitude, obtained with a 30° flip angle pulse, shall be ≤ 0.2%, acquisition to acquisition. The following NMR experiments will be used to characterize numerous types of materials including bulk semiconductors, polymers and polymer composites, nanoparticles (metals, metal compounds, diamond, etc.), biomolecules in solution and solid state, and ionic conductors: Satellite Transition Magic Angle Spinning (STMAS); Multiple Quantum Magic Angle Spinning (MQMAS); Combined Rotation and Multiple Pulse Spectroscopy (CRAMPS); Rotational Echo Double Resonance (REDOR); Two Pulse Phase Modulation (TPPM) / 64 step Small Phase Incremental Alternation (SPINAL64); Centerband Only Detection of Exchange (CODEX); Satellite Transition Population Transfer with Hyperbolic Secant Pulse; Fast 2D Acquisition; CBCANH = In proteins, the three-dimensional CBCANH experiment correlates the 1H and 15N amide chemical shifts with those of the intra-and interresidue 13C_alpha and 13C_beta chemical shifts through 1J(NH), 1,2J(N,C_alpha), and 1J(C_alpha, C_beta) coupling constants [1] and HNCA = In proteins, the three-dimensional HNCA experiment correlates the
1H and 15N chemical shifts with those of the intra- and interresidue

13C_alpha chemical shifts by means of the 1J(NH) and 1,2J(N, C_alpha) coupling constants. These experiments shall be demonstrated at the time of installation. The purpose of the demonstration is two-fold. First, we want a demonstration of how the hardware and software are set up to perform the listed experiments. Second, we want the experiment to be performed on a mutually agreed upon standard sample so that we can verify that the experiment is working properly. To that end, results for the particular experiment performed on the standard sample should be available in the open literature. We do not anticipate using the new instrument for imaging experiments.

1. Console

The NMR console specifications are divided into transmitter, receiver, gradient control, pulse programmer, and computer.

1.1 Transmitter

The transmitter must consist of three (3) independent and synchronizable *rf* channels, with the capability of expanding to four (4) channels. The frequency ranges of the three (3) *rf* channels cover 8 to 500 MHz (^{197}Au to ^{1}H). The amplitude, phase, and frequency of the *rf* channels must be under computer control for producing phase-shifted pulses, shaped pulses, and variable level cross polarization and decoupling. In addition, the amplitude, phase, and frequency (limited range) must have the capability to be set and changed within a pulse program. The required range, resolution, and settling times must be at least:

	range	resolution	switching time
fine amplitude	0 - 100%	0.1% linear	50 ns
coarse amplitude	60 dB	1 dB	50 ns
phase	360°	0.05°	50 ns
frequency	20 MHz	0.1 Hz	50 ns

The high power amplifiers must be driven by the console and provide linear operation. Three (3) amplifiers must be provided: one (1) to cover ^{1}H and ^{19}F with a minimum output of 500 W; one (1) in the frequency range of 8-205 MHz (^{197}Au to ^{31}P) with a minimum output of 500 W; one in the frequency range of 30-160 MHz (^{25}Mg to ^{11}B) with a minimum output of 500 W for triple resonance experiments. The high power amplifiers must provide power sufficient to produce the maximum RF fields specified for the probes in this document. The high power amplifiers must be capable of producing pulses, into a 50 Ω load, of up to

a maximum length of 100 ms with a duty cycle of at least 5% and amplitude droop of less than 10%.

1.2 Receiver

The receiver must be capable of detecting signals in the frequency range of 8-502 MHz (^{197}Au to ^{1}H). It must have a small signal bandwidth of ±2 MHz, a recovery time from end of blanked pulse to linear operation of the preamplifier <3 µs. The receiver must provide for quadrature detection. Signals must be digitized with at least 14 bit resolution at a rate of at least 4 MHz. The receiver must be capable of digitizing and storing ≥8 M complex data points. The digitization rate must be controllable with an internal clock or by external events.

The gain must be controllable over a range greater than 60 dB in ≤6 dB steps. Filtering of the input signals must be provided, with the filter cut-offs under console computer control, and cut-offs ranging from 1kHz to ½ the maximum digitizer bandwidth. Digital filters must be compatible with interleaved RF and acquisition events.

1.3 Gradient Control

The gradient controller must provide three (3) voltage / current outputs compatible with coil systems in the 3-axis gradient probe specified below. The outputs must provide the specified gradient strengths for the gradient probes. The gradient amplitudes must be under console computer control with resolution of ≥10 bit full scale. The minimum pulse length at full amplitude into a resistive load must be ≤10 µs.

1.4 Pulse Programmer

The pulse programmer must be capable of being used to perform the experiments listed under the general specifications for the 500 MHz NMR system. The pulse programmer must have at least 2 k words of memory for pulse programs and at least 64 k words of memory for amplitude, phase, and frequency shaping of *rf* pulses for each transmitter channel. The memory for pulse shaping must be configurable for simultaneous multiple waveforms. The minimum pulse program interval must be ≤50 ns, maximum pulse program interval ≥1000 s, and pulse program interval timing resolution ≤15 ns. The minimum repetition time of the pulse program must be ≤5 ms.

The pulse programmer must control the amplitude, phase, and frequency of *rf* pulses, the amplitude of magnetic field gradients, transmitter / receiver blanking / gates, and initiation of data acquisition, as well as provide at least eight (8) user-definable output lines. It must be synchronizable with the MAS rotor or

other external event, capable of controlling MAS rotor speed, and provide an external digitizer clock for synchronizing data acquisition with the pulse program.

The pulse program structure must allow for: loops and nested loops; branching; arrays, tables, or lists of any parameter values; calculation of dependent variables.

1.5 Host Computer

The host computer must be a commercially available workstation with at least two (2) GB of RAM, a hard disk drive with at least 250 GB capacity, DVDRW drive, 22" color monitor, keyboard, pointing device, and ethernet port supporting the Transmission Control Protocol/Internet Protocol (TCP/IP) for connection to the local network. Disks and manuals for the operating system and spectrometer control software must be provided in contractor format.

The computer must provide for acquisition and storage of NMR data, and control and storage of all spectrometer parameters including, but not limited to, shims, Magic Angle Spinning (MAS) rotor speed, and probe temperature. The computer must be capable of controlling the variable temperature unit such that an arbitrary list of temperatures can be entered and used in an automated sequence of experiments. The computer must include software for acquisition, processing, simulation, curve fitting, and display of 1-, 2-, and 3-dimensional data and for pulse program and macro editing / compiling.

The contractor shall, for the duration of the warranty period, provide at no additional cost the latest software upgrades of operating system, system software, simulation and curve fitting packages.

1.6 Pneumatic and Variable Temperature Units

PNEUMATIC UNIT: Microprocessor based MAS pneumatic unit capable of maintaining spinning accuracy to within ± 0.1% over entire temperature operation range for all probes purchased, including those listed as options. The pneumatic unit must also be controllable from the NMR console computer. Capability for spin rate logging to the computer shall be provided.

VARIABLE TEMPERATURE (VT) UNIT: Digital VT unit controllable from front panel, capable of maintaining accurate temperature regulation to within $\pm 0.5^{\circ}K$. Includes low and high temperature accessories for VT control of probe over specified temperature range for all probes, including those listed as options, purchased. The VT unit must also be controllable from the NMR console computer. Capability for temperature logging to the computer shall be provided.

1.7 Shims and Lock

Room temperature magnetic field shims must be provided that are compatible with the existing 11.7T widebore (89 mm) Magnex magnet at NRL and are capable of meeting the lineshape specifications for the probes listed below. Power supplies to drive the shims must be provided.

An NMR field lock must be provided with the system.

2. 500 MHz 3.2-4mm Triple Resonance H(F)/X/Y MAS Probe

This probe will be used for magic angle spinning (MAS) double resonance (H or F/X) and triple resonance (H or F/X/Y) NMR experiments. The probe must meet all specifications over the temperature range -150°C to +250°C. The sample rotor outer diameter must be either 4mm or 3.2mm, and the sample must be capable of MAS spin rates to at least 15kHz. The tuning range and RF field capability (during decoupling only and simultaneous irradiation) for each of the three channels under double and triple resonance conditions must, at a minimum meet the following requirements:

Rotor Diameter: 3.2-4mm
VT Range: -150° to +250°C
Spin Rate: ≥15kHz over VT range
Tuning Range: H/F: 470 - 502 MHz; X/Y(DR): 35 - 202 MHz (^{14}N to ^{31}P).

The probe must be able to perform triple resonance (TR) experiments on at least these nuclear combinations and any required inserts must be provided:
TR: ^{15}N/^{13}C/^{1}H; ^{2}H/^{13}C/^{1}H; ^{14}N/^{13}C/^{1}H; ^{69}Ga/^{71}Ga/^{1}H; ^{115}In/^{71}Ga/^{1}H; ^{2}H/^{29}Si/^{1}H; ^{29}Si/^{13}C/^{1}H; ^{195}Pt/^{31}P/^{1}H; ^{13}C/^{31}P/^{1}H.

The capability for additional triple resonance nuclear combinations be added to the probe at a later date (at additional cost to NRL) shall be provided.

Resolution: 0.2 ppm (^{13}C adamantane)

nucleus	γB_1 (double/triple resonance)
H/F (decoupling only)	110kHz
H/F (long pulse / simultaneous)	110kHz
H/F (short pulse)	160kHz
^{13}C (long pulse / simultaneous)	100kHz

^{13}C (short pulse)	120kHz
^{15}N (long pulse / simultaneous)	60kHz
^{15}N (short pulse)	80kHz

The probe must be provided with 20 sets of rotors with associated caps, spacers, drive tips, etc., and two sets of rotor packing tools.
The probe must meet all manufacturers published specifications not covered above.

3. 500 MHz 1.2-1.3mm Double Resonance H(F)/X High Speed MAS Probe

This probe will be used for magic angle spinning (MAS) double resonance (H or F/X) NMR experiments. The probe must meet all specifications over the temperature range 0°C to +50°C. The sample rotor outer diameter must be 1.2mm to 1.3mm, and the sample must be capable of MAS spin rates to at least 60kHz. The tuning range and RF field capability (during decoupling only and simultaneous irradiation) for each of the channels under double resonance conditions must, at a minimum meet the following requirements:

Rotor Diameter: 1.2mm to 1.3mm
VT Range: 0° to +50°C
Spin Rate: ≥60kHz over VT range
Tuning Range: H/F: 470 - 502 MHz; X: 35 - 202 MHz (^{14}N to ^{31}P).
Resolution: 0.1 ppm (^{13}C adamantane)

nucleus	γB_1
H/F	200 kHz
^{13}C	200 kHz
^{15}N	100 kHz

The probe must be provided with 20 sets of rotors with associated caps, spacers, drive tips, etc., and two sets of rotor packing tools.

The probe must meet all manufacturers published specifications not covered above.

4. 500 MHz ^{1}H/X Direct-Detection 5mm PFG Liquids Probe

This probe will be used for liquid state double resonance NMR experiments. The probe must meet all specifications over the temperature range -40° to +60°C . The probe must accommodate a standard 5mm NMR tube. The probe must be capable of spinning samples to at least 20 Hz. The probe must provide 1-axis

gradient at 10 G/cm and gradient rise/fall times of ≤ 50 µs. The tuning range and RF field capability must, at a minimum meet the following requirements:

VT Range: -40° to +60°C
Tuning Range: H/F: 470 - 502 MHz; X: 50 to 202 MHz (^{15}N to ^{31}P) with ^{1}H decoupling and observe capability
Resolution and Lineshape ($CHCl_3$): ≤6 Hz at height of ^{13}C satellites; ≤12 Hz at 1/5 of this height
γB_1: ≥20 kHz (^{13}C) and proportional to resonance frequency for other nuclei.
Sensitivity: ^{1}H on 0.1% ethylbenzene: S/N:390
Spinning sidebands: ≤1%
Magnetic field gradients along 1 axis, up to 10 Gauss/cm.
Magnetic field gradient rise time ≤ 50 µs.

The probe must meet all manufacturers published specifications not covered above.

5. 500 MHz ^{1}H/^{13}C/^{15}N Inverse-Detection 5mm XYZ PFG Liquids Probe

This probe will be used for liquid state triple resonance inverse detection NMR experiments. The probe must be optimized for ^{1}H observe. The probe must meet all specifications over the temperature range -40° to +60°C . The probe must accommodate a standard 5mm NMR tube. The probe must be capable of spinning samples to at least 20 Hz. The probe must provide 3-axis gradients with 10 G/cm gradients on each axis and gradient rise/fall times of ≤ 50 µs. The tuning range and RF field capability must, at a minimum meet the following requirements:

VT Range: -40° to +60°C
Tuning Range: H: 502 MHz; X: 50 to 202 MHz (^{15}N to ^{31}P) with ^{1}H decoupling and observe capability
Resolution and Lineshape ($CHCl_3$): ≤6 Hz at height of ^{13}C satellites; ≤12 Hz at 1/5 of this height
γB_1: ≥20 kHz (^{13}C) and proportional to resonance frequency for other nuclei.
Sensitivity: ^{1}H on 0.1% ethylbenzene: S/N:500
Spinning sidebands: ≤1%
Magnetic field gradients up to 10 Gauss/cm.
Magnetic field gradient rise time ≤ 50 µs.

The probe must meet all manufacturers published specifications not covered above.

B. OPTIONAL ITEMS

O1. High Power Amplifier for 285 - 500 MHz (^{203}Tl, ^{205}Tl, ^{3}He, ^{19}F, ^{1}H)

A high power amplifier, with output power of at least 300 W, for operation at 285 - 500 MHz (^{203}Tl, ^{205}Tl, ^{3}He, ^{19}F, ^{1}H) for use in the 500 MHz NMR spectrometer described in section 1. The high power amplifier must be driven by the console and provide linear operation. The high power amplifier must be capable of producing pulses up to a maximum length of 100 ms with a duty cycle of at least 5% and amplitude droop of less than 10% into a tuned load of 50 Ω. This amplifier will be used with the H/F/X probe (item 05 below) or with a probe for ^{203}Tl, ^{205}Tl, or ^{3}He to be purchased at a later date or built in our laboratory.

O2. Variable Temperature Precooling Unit

Cools nitrogen gas to -80°C with a sufficient flow rate to allow cryogen-free variable temperature experiments to -50°C with all probes in this solicitation, including MAS probes, such that all probe specs are met.

O3. 300 MHz 3.2-4 mm Double Resonance MAS Probe

This probe will be used for magic angle spinning (MAS) double resonance (H or F/X) NMR experiments with an existing 300 MHz NMR spectrometer. The probe must meet all specifications over the temperature range -150°C to +250°C. The sample rotor outer diameter must be 3.2-4 mm, and match the diameter of the probe described in item #2. The sample shall be capable of MAS spin rates to at least 15 kHz. This probe must be compatible with the existing 7T, wide bore Spectrospin magnet and shim system currently in use at NRL. The tuning range and RF field capability during simultaneous irradiation in both channels must, at a minimum meet the following requirements:

Rotor Diameter:	3.2-4 mm
VT Range:	-150° to +250°C
Spin Rate:	≥15kHz
Tuning Range:	H/F: 282 - 300 MHz
	X: 30 - 122 MHz (^{15}N to ^{31}P)
Resolution:	0.2 ppm (^{13}C adamantane)

nucleus	γB_1
H/F (simultaneous irradiation)	100 kHz
^{13}C (simultaneous irradiation)	60 kHz
^{15}N (simultaneous irradiation)	40 kHz

The probe must be compatible with the existing 7T WB Magnet and shim system currently at NRL. The 300 MHz MNR system uses a 7 T wide bore magnet. The console is a Bruker Avance DMX300, installed in 1996. The proton frequency is nucleus amplifier (6-243 MHz), and a 300 W X-nucleus amplifier (6-325 MHz). See attached magnet sheet.
The probe must be provided with 20 sets of rotors with associated caps, spacers, drive tips, etc., and two sets of rotor packing tools.

The probe must meet all manufacturers published specifications not covered above.

O4. 500 MHz Static High Power Multinuclear H(F)/X Double-Resonance Probe

This probe will be used for static double resonance NMR experiments in the 500 MHz MNR spectrometer described in section 1. The probe must meet all specifications over the temperature range -150° to +250°C. The sample coils must be interchangeable with sample diameters of 5mm and 10mm. In addition, 2 extra plug-in inserts (if available) without rf coil are to be provided for developmental use. The tuning range and RF field capability must, at a minimum meet the following requirements:

VT Range: -150° to +250°C

Tuning Range: 470 to 502 MHz (^{19}F and ^{1}H); 50 to 161 MHz (^{15}N to ^{11}B)
Optional tuning range extension from 35 MHz (^{14}N) to 203 MHz (^{31}P)

γB_1 (DR): ≥ 75 kHz (^{2}H 5mm); ≥ 75 kHz (^{11}B 5mm); ≥ 65 kHz (^{1}H 5mm);

The probe must meet all manufacturers published specifications not covered above.

O5. 500 MHz 3.2mm Triple Resonance H/F/X MAS Probe

This probe will be used for magic angle spinning (MAS) double resonance (H or F/X) and triple resonance (H/F/X) NMR experiments in the 500 MHz NMR spectrometer described in section1. The probe must meet all specifications over the temperature range -100°C to +100°C. The sample rotor outer diameter must be 3.2mm, and the sample must be capable of MAS spin rates to at least 25kHz. The tuning range and RF field capability (during decoupling only and simultaneous irradiation) for each of the three channels under double and triple resonance conditions must meet, at a minimum the following requirements:

Rotor Diameter: 3.2mm
VT Range: -100° to +100°C
Spin Rate: ≥25kHz
Tuning Range: H/F: 470 - 502 MHz; X(DR): 35 - 202 MHz (^{14}N to ^{31}P).
Resolution: 0.2 ppm (^{13}C adamantane)

nucleus	γB_1 (double resonance)
H or F (decoupling only)	120kHz
H and F (long pulse / simultaneous)	110kHz
H or F (short pulse)	150kHz
^{13}C (long pulse / simultaneous)	110kHz
^{13}C (short pulse)	120kHz
^{15}N (long pulse / simultaneous)	60kHz
^{15}N (short pulse)	80kHz

The probe must be provided with 20 sets of rotors with associated caps, spacers, drive tips, etc., and two sets of rotor packing tools.

The probe must meet all manufacturers published specifications not covered above.

O6. Caps and Rotors for MAS Probe Item #2

Five sets of rotors with associated caps, spacers, drive tips, etc. for MAS probe item #2.

O7. Caps and Rotors for MAS Probe Item #3

Five sets of rotors with associated caps, spacers, drive tips, etc. for MAS probe item #3.

O8. Caps and Rotors for MAS Probe Item #O5

Five sets of rotors with associated caps, spacers, drive tips, etc. for MAS probe item #O6.

Vertical Magnet Data Sheet

General Information/Magnet Dimensions

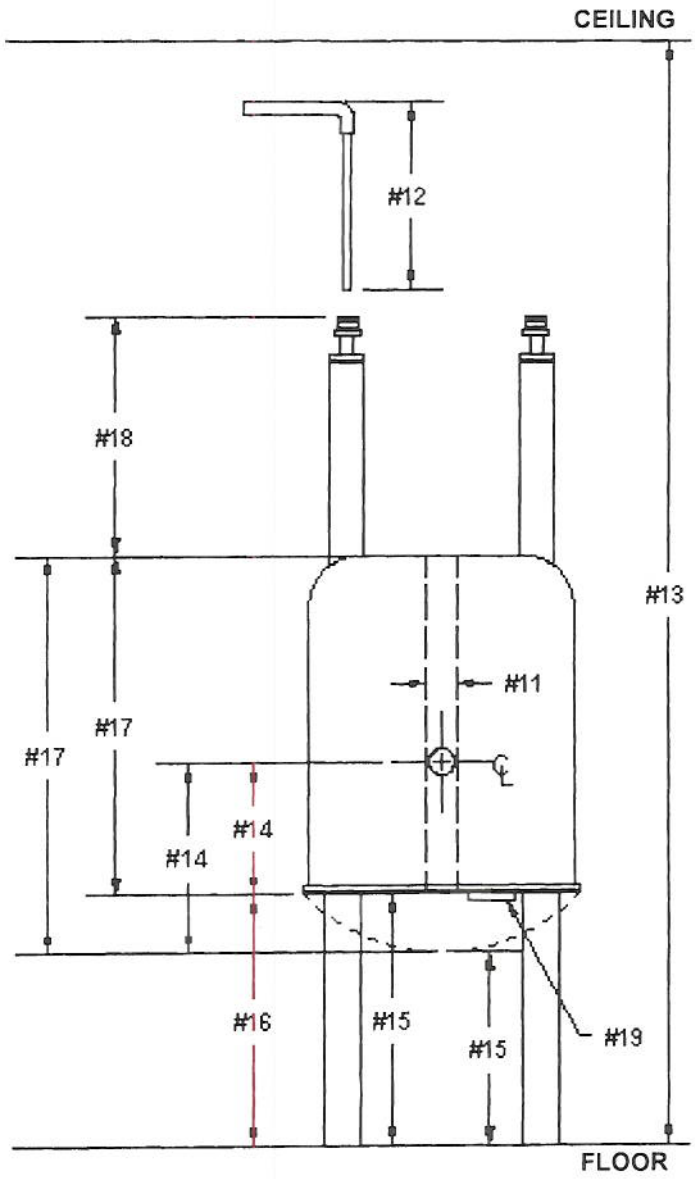
1. Customer_Naval Research Laboratory_____
2. Manufacturer of current console_Bruker_____
3. Model of current console_Avance DMX500 (1996)_____
   3a. If Varian, console serial #_____
4. Magnet manufacturer__Magnex_____
5. Magnet serial #___4143_____
6. Dewar/Cryostat #___500/89/AS_____
7. Project/Job #___C4143_____
8. Magnet age_____~10_____years
9. Exact H1 frequency (2 dec pl, xxx.yy*)___500.13_____MHz
10. Helium boil-off rate__~40l / 5weeks_____cc/hr
11. Room temp bore diameter_____89_____mm
12. Helium transfer tube length_____2000_____mm
13. Ceiling height_____4145_____mm
14. Centerline to bottom flange_____457_____mm
15. Floor to bottom flange_____831_____mm
16. Stand height_____831_____mm
17. Top flange to bottom flange_____1384_____mm
18. Top flange to top of He fill port_____550_____mm
19. Safety drop-off plate: YES_X_ NO__
20. Magnet bottom plate: FLAT_X_ ROUND___
21. Magnet stand bolt size: 8mm_X_ 10mm___
22. Does existing system have Solids? YES_X_ N0___

* #9 If microimaging, field may need to be moved – 250kHz
Liquids /solids may need to move –50kHz

A. Please provide a copy of the magnet dimensional drawing from the magnet manual if available.

B. Please provide a list of the superconducting shims and the most recent current settings or field plots.

C. Please provide a copy of the magnet's most recent H1 lineshape test spectra, including date, scale and parameter set.



#14 & 15 Note – Round or Flat bottom.

Anti-Vibration System

1. A/V system installed: YES_X__ NO___
2. If installed, what type: TIRE___ POST_X_ TABLE__ X one
3. Manufacturer___TMC60_____
4. Model #_____
5. Serial #_____

Please provide a copy of the A/V system dimensional drawing from the manual. If not available, please sketch the A/V system, including dimensions, on a separate piece of paper and attach.

Additional Information

1. Your name_____
2. Date_____17 January 2008_____
3. Telephone #_____
4. Additional information_____

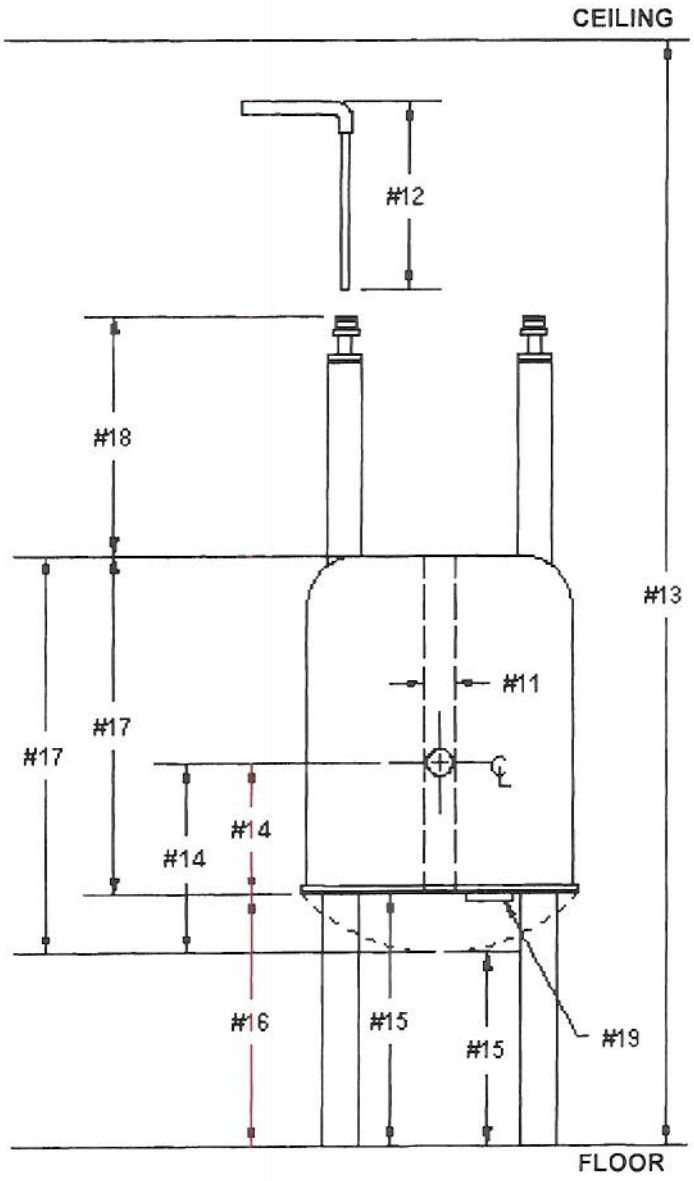
Vertical Magnet Data Sheet

General Information/Magnet Dimensions

1. Customer_Naval Research Laboratory_____
2. Manufacturer of current console_Bruker_____
3. Model of current console_Avance DMX300 (1996)_____
   3a. If Varian, console serial #_____
4. Magnet manufacturer__Bruker_____
5. Magnet serial #___BZH 52 30 120B_____
6. Dewar/Cryostat #___101/89/252_____
7. Project/Job #_____
8. Magnet age_____~22_____years
9. Exact H1 frequency (2 dec pl, xxx.yy*)___300.131___MHz
10. Helium boil-off rate____~40l / 18weeks_____cc/hr
11. Room temp bore diameter_____89_____mm
12. Helium transfer tube length_____686_____mm
13. Ceiling height_____3028_____mm
14. Centerline to bottom flange_____260_____mm
15. Floor to bottom flange_____708_____mm
16. Stand height_____708_____mm
17. Top flange to bottom flange_____1092_____mm
18. Top flange to top of He fill port_____483_____mm
19. Safety drop-off plate: YES___ NO_X_
20. Magnet bottom plate: FLAT_X_ ROUND___
21. Magnet stand bolt size: 8mm_X_ 10mm___
22. Does existing system have Solids? YES_X_ NO___

* #9 If microimaging, field may need to be moved – 250kHz
Liquids /solids may need to move –50kHz

A. *Please provide a copy of the magnet dimensional drawing from the magnet manual if available.*
B. *Please provide a list of the superconducting shims and the most recent current settings or field plots.*
C. *Please provide a copy of the magnet's most recent H1 lineshape test spectra, including date, scale and parameter set.*



#14 & 15 Note – Round or Flat bottom.

Anti-Vibration System

1. A/V system installed: YES___ NO_X_
2. If installed, what type: TIRE___ POST___ TABLE___ X one
3. Manufacturer_____
4. Model #_____
5. Serial #_____

Please provide a copy of the A/V system dimensional drawing from the manual. If not available, please sketch the A/V system, including dimensions, on a separate piece of paper and attach.

Additional Information

1. Your name_____
2. Date_____6 March 2008_____
3. Telephone #_____
4. Additional information_____

CONTRACT DATA REQUIREMENTS LIST

Form Approved
OMB No. 0704-0188

A. CONTRACT LINE ITEM NO.	B. EXHIBIT	C. CATEGORY:
0002	A	TDP _____ TM _____ OTHER _____

D. SYSTEM/ITEM	E. CONTRACT/PR NO.	F. CONTRACTOR
	61-0212-09	

Data Item 1

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE	17. PRICE GROUP
A001	Schematics and Operation Manuals		18. ESTIMATED TOTAL PRICE

4. AUTHORITY *(Data Acquisition Document No.)*	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
	Specifications	NRL Code 6122

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
LT	N/A	1TIME	EOC
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**
N/A		EOC	

16. REMARKS
The Contractor shall deliver schematics and operation manuals for all systems and subsystems, including probes upon delivery of system.

14. DISTRIBUTION	b. COPIES		
a. ADDRESSEE	Draft	Final Reg	Final Repro
COR		1	
15. TOTAL →	0	1	0

Data Item 2

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE	17. PRICE GROUP
A002	Test Results		18. ESTIMATED TOTAL PRICE

4. AUTHORITY *(Data Acquisition Document No.)*	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
		NRL Code 6122

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
LT	N/A	1TIME	EOC
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**
N/A		EOC	

16. REMARKS
The contractor shall provide test results for all systems and probes no later than two weeks prior to delivery of the system.

14. DISTRIBUTION	b. COPIES		
a. ADDRESSEE	Draft	Final Reg	Final Repro
COR		1	
15. TOTAL →	0	1	0

Data Item 3

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE	17. PRICE GROUP
A003	Disks and manuals		18. ESTIMATED TOTAL PRICE

4. AUTHORITY *(Data Acquisition Document No.)*	5. CONTRACT REFERENCE	6. REQUIRING OFFICE
		NRL Code 6122

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
LT	N/A		
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**
N/A			

16. REMARKS
The contractor shall provide disks and manuals for the operating system and spectrometer control software in standard format upon delivery of the system.

14. DISTRIBUTION	b. COPIES		
a. ADDRESSEE	Draft	Final Reg	Final Repro
COR		1	
15. TOTAL →	0	1	0

Data Item 4

1. DATA ITEM NO.	2. TITLE OF DATA ITEM	3. SUBTITLE	17. PRICE GROUP
			18. ESTIMATED TOTAL PRICE

4. AUTHORITY *(Data Acquisition Document No.)*	5. CONTRACT REFERENCE	6. REQUIRING OFFICE

7. DD 250 REQ	9. DIST STATEMENT REQUIRED	10. FREQUENCY	12. DATE OF FIRST SUBMISSION
8. APP CODE		**11. AS OF DATE**	**13. DATE OF SUBSEQUENT SUBMISSION**

16. REMARKS

14. DISTRIBUTION	b. COPIES		
a. ADDRESSEE	Draft	Final Reg	Final Repro
15. TOTAL →	0	0	0

G. PREPARED BY	H. DATE	I. APPROVED BY	J. DATE
COR Code 6122	2/11/2009		