BID SPECIFICATION FOR THE SUPPLY, COMMISSIONING AND TRAINING OF GAS CHROMATOGRAPH-MASS SPECTROMETER (GC-MS)–HEADSPACE INSTRUMENT INCLUDING SERVICE AND MAINTENANCE FOR A FIVE (05) YEAR PERIOD: AT THE FORENSIC SCIENCE LABORATORY SCIENTIFIC ANALYSIS SECTION: GAUTENG (PRETORIA)

2.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
2.16	All gas flows and pneumatics must be electronically regulated, e.g. By using Electronic Pneumatic Control (EPC). The EPC must be able to be controlled from the GC system and by the data system, allowing the gas flows and pressures in the gas-lines, including the column, to be programmable features. The electronic pneumatic control system must be able to operate in manners allowing for:	
2.16.1	Electronic vacuum compensation for GC/MS	
2.16.2	Electronic programmable pressure regulation	
2.16.3	Electronic programmable flow regulation	
2.16.4	Electronic constant pressure regulation	
2.16.5	Electronic constant flow regulation	
2.16.6	Electronic split ratio control	
2.16.7	Compensation for barometric pressure and ambient temperature changes is standard so that methods at sea level and high elevations give the same results.	
2.17	The gas piping, plumbing, sensor, valves and controllers for a second injector port must be pre-fitted.	
2.18	All the required high purity gas lines and gas manifolds for operation must be included and installed to enable GC operation, including servicing and leak checks on annual basis for contact period.	

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2.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
2.19	Suitable high purity gas regulators must be supplied and are subject to approval before installation	

3.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
3.	**The Injection Port**	
3.1	The installed injection ports must be a split/splitless injector for capillary operation able to supply up to at least 600 KPa constant pressure.	
3.2	The data system must control the capillary split/splitless valve and divert valve.	
3.3	The data system must control regulation and measurement of forward and back pressure on the capillary inlet.	
3.4	The injection port must be situated in its own heated zone and temperature must be programmable by the data system adjustable from ambient to 400°C in 1°C increments.	
3.5	All gas flows and pneumatics must be electronically regulated by (EPC). The EPC must be able to be controlled from the GC system and by the data system, allowing the following capabilities as programmable features:	
3.5.1	Vacuum compensation for GC-MS.	

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3.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
3.5.2	Electronic split ratio control, adaptable from 1:1 to 300:1	
3.5.2.1	Pre-injection switch to split/splitless status.	
3.5.2.2	Split flow at 3 different flow rates for 3 different start-times for 3 different durations.	
3.5.3	Constant and ramped column flow; 0 to 3 ml/minute in 0.05 ml/minute increments.	
3.5.4	Constant and ramped column Pressure; 0 to 700 KPa, in 1 KPa increments (must be able to maintain 600 KPa constant pressure on the column).	
3.6	The injector must allow for constant or pulsed injection, of which:	
3.6.1	The pressure will be specifiable in 1 KPa increments.	
3.6.2	The duration will be specifiable from 0 to 3 minutes, in at least 1s increments.	
3.7	The system must allow the use of any capillary columns with internal diameters from 0.10mm to 0.53mm ID (Internal Diameter).	

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3.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
3.8	The injector must be equipped with ultra-low bleed, ultra-high capacity (at least 2000 autosampler injections) seals, suitable for mass spectrometry, to eliminate the necessity of regularly replacing septa.	

4.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
4.	**The Oven**	
4.1	The GC oven door must allow easy access to the oven to ensure easy injector port maintenance and column installation.	
4.2	Oven temperature from 4°C to 450°C.	
4.3	Oven cooling time from 280°C to 30°C must be less than five (5) minutes at 21°C ambient temperature.	
4.4	The oven ramping rate must be adjustable between 0°C/min up to at least 60°C/min in minimum increments of 1°C/min. The oven ramp rate must be stable and well controlled over the complete temperature range from 40°C to 450°C.	
4.5	The oven must have a temperature programming capability with at least 20 temperature ramps and intermediate isothermal segments (negative ramps to be allowed).	

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4.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
4.6	The operator must be capable of calibrating the GC oven temperature to +/-0.1°C.	
4.7	The oven must be equipped with a facility that enables rapid cooling with liquid carbon dioxide. The bidder must provide and connect the relevant plumbing to the carbon dioxide source. A suitable filter must be installed in-line to prevent any solid material that may be in the cylinder from blocking the relevant lines.	

5.	The Bidder shall be responsible for supplying the following	COMPLY /DO NOT COMPLY
5.	**General GC**	
5.1	A complete maintenance manual set for the GC and injector, including complete gas flow diagrams, must be supplied during installation.	
5.2	Tools for maintenance and repair of each instrument must be included during installation.	
5.3	Gas line plumbing and gas regulators must be included in the bid as per site inspection.	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
6.	**Mass Spectrometer (MS)**	
6.1	**MS control:**	
6.1.1	All parameters of the MS, including transfer line, ionisation source, lenses and pre-filters, quadrupole rods, detector and vacuum system, must be under data system control	
6.1.2	Display temperature settings and readings.	
6.2	**Transfer Line**	
6.2.1	The GC must be interfaced to the mass selective detector via a short direct coupling interface between the GC and the mass selective detector.	
6.2.2	The interface must not be longer than 150 mm, measured from the GC oven to the ionisation chamber.	
6.2.3	Must allow fused silica capillary columns to enter the ionisation chamber and terminate close to the ionisation beam.	
6.2.4	The interface must have its own heater and be independently heated and controlled between 100°C to 350°C. The temperature control and display must be controlled by the workstation. Temperature control of the interface must thus be independent and under full data system as well as GC control from 100°C to 350°C.	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY / DO NOT COMPLY
6.2.5	Must be fully insulated to ensure stable and uniform temperature control across the length of the transfer line.	
6.3	**Ionization Source**	
6.3.1	The ion source must comply to the following:	
6.3.1.1	The ion source heater must be independently heatable with the temperature set points under full data system control ranging between 100°C and 250°C.	
6.3.2	The mass spectrometer must use an ion source where the metallic parts are constructed from inert material.	
6.3.3	An ion source suitable for Electron Impact type (EI) analysis must be supplied for the system.	
6.3.4	The ion source must be easily removable as an assembly for convenient cleaning.	
6.3.5	The filament emission current must be variable and must be able to be user-selectable from the data system via the data system software.	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
6.3.6	The emission energy should be user-selectable from the data system via the data system software.	
6.3.7	The ion source of the electron impact type must have 2 independently selectable filaments to allow continued operation in the event of the failure of one of the filaments.	
6.3.8	It must be possible to change electronically between the two filaments without breaking the vacuum.	
6.3.9	It must not be necessary to remove the column when removing the ion source.	
6.4	**Quadrupole Mass Analyzer**	
6.4.1	The mass analyzer must be of a monolithic quartz structure integrating hyperbolic shaped quadrupole rods.	
6.4.2	The quadrupole is to have its electrode surfaces covered by suitably inert material, e.g. titanium composite and gold thin and thick films.	
6.4.3	The system tunable lenses must separate the ion source and the mass analyzer to ensure high sensitivity for high mass ions and guard against mass analyzer contamination.	
6.4.4	If necessary to heat, the mass analyzer must be independently heatable at least over the range of 150°C to 300°C.	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
6.4.5	The instrument must have a mass axis stability of at least +/-0.1 amu over 12 hours.	
6.4.6	The analyzer must have a mass range of 1 to 1000 amu, adjustable in 0.1 amu steps.	
6.4.7	Scan rates of up to 12500 amu/sec with 0.1 amu mass resolution (at least 8000 amu/sec written to disk).	
6.4.8	Selectable scan ranges from 1 to 1000 amu, selectable for at least 3 specifiable time windows in GC-MS analysis.	
6.4.9	The mass spectrometer must have an automated SIM setup that can convert a full scan method to a SIM or SIM/Scan method.	
6.4.10	The software must automatically configure the number of SIM groups, SIM cycles across the peak, and the ions added to each group.	
6.4.11	In the SIM mode, the detector must be able to:	
6.4.11.1	Monitor up to 20 individually-selected masses, with selectable dwell times for each mass in the range 10 to100 ms.	
6.4.11.2	It must be possible to select at least 20 time windows of 20 ions in each GC-MS analysis.	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
6.4.12	Must be possible to easily view the mass scans in real-time (i.e. without entering diagnostics or tune menus).	
6.4.13	The mass analyzer design must allow for routine maintenance (e.g. cleaning the ion source) without the removal of the analytical column for easy and quick maintenance.	
6.5	**Detector**	
6.5.1	The detector must comply to the following specifications:	
6.5.1.1	The detector must be a Triple-Axis HED-Electron Multiplier or equivalent with extended lifetime	
6.5.1.2	The detector must be situated off-axis to minimize noise.	
6.5.1.3	The data system must allow adjustment of the multiplier gain measurement after it has been established automatically or by tuning manually. The option of normalizing the gain during automatic tune so as to get consistent sensitivity and ion counts between multiple GC-MS systems of different ages must be present.	
6.5.1.4	The detector voltage must be able to be prescribed by the GC-MS analysis method.	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
6.5.1.5	The mass spectrometer shall have an automatic interrupt system to provide protection against damage due to excess ion source pressure or electron multiplier output current, as well as filament or RFPA (Radio Frequency Power Amplifier) failure. Additionally, analyzer temperature zone and operating voltages shall be interlocked with vacuum pump speed to prevent instrument damage due to operation at excess pressure.	
6.5.1.6	The detector and the filament control must be able to be overridden manually during acquisition without termination of acquisition in order to protect the filament and detector.	
6.6	**Calibration**	
6.6.1	The system must have a mass calibration facility complying to the following specification:	
6.6.1.1	The reference compound glass reservoir must be connected to the instrument via a separate, independent inlet port.	
6.6.1.2	The reference compound solenoid valve must be under data system control.	
6.6.1.3	The reference compound solenoid valve must close instantly in the event of a power failure in order to protect the system.	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
6.6.1.4	Automatic tuning and mass calibration must be under data system control.	
6.6.1.4.1	It must be possible to specify the tuning file to be used, for GC-MS analysis.	
6.6.1.4.2	It must be possible to save tuning files under user-generated file directories and file names as well as to reload these parameters when necessary.	
6.6.1.5	The calibration liquid reservoir and vent valve must be easily accessible.	
6.6.1.6	The calibration compound e.g. PFTBA used by the system must comply with international standards in terms of traceability to National Measuring Institutes. Certificate of Analysis must be provided with installation stating the relevant measurement uncertainty and methods utilized in qualification of compound upon installation	
6.7	**Vacuum System**	
6.7.1	The vacuum system must exist of a rough pump and a diffusion pump.	
6.7.2	The status of vacuum system must be observable through the data system	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
6.7.2.1	A high-vacuum gauge must be installed to accurately read high-vacuum values.	
6.7.2.2	The data system must automatically warn users of poor vacuum status.	
6.7.2.3	The MS must not permit scanning if the vacuum is not sufficient.	
6.7.2.4	The vacuum value (e.g. mTorr) must be readable electronically for both vacuum pumps independently.	
6.7.3	The diffusion pump must have a capacity of at least 65 l/s capable of handling analytical flow rates of at least up to 1.5 ml/minute.	
6.7.4	An anti-pass back system to prevent back-flushing of pump oil must automatically activate in case of power or vacuum failure to protect the system.	
6.7.5	The instrument must allow pumping to be continued when electronics are serviced.	
6.7.6	An ion gauge must be included to enable the vacuum in the vicinity of the ion source to be determined.	
6.8	**General Mass Spectrometer**	

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6.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY*
6.8.1	A complete spare set of consumable items such as two additional seals, washers, insulators, calibration compound etc. must be included upon delivery.	
6.8.2	A complete set of service, operating, maintenance, training and software manuals must be supplied.	
6.8.3	The first cleaning of the mass analysis system (after the system has proven to run to specifications) must be included and serve as additional maintenance training.	

7.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
7.	**GC-MS System Performance**	
7.1	The sensitivity of the mass spectrometer must be tested on commissioning such that splitless injection of:	
7.1.1	1,0 ul injection of 1 pg/ul of Octafluoronaphthalene must yield a signal-to-noise ratio of at least 300:1 RMS of the extracted ion signal of the molecular ion 272 amu when continuously scanning EI from 50 to 300 amu with Helium and with Hydrogen 50:1 (with a Diffusion System) .	

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7.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
7.1.2	1,0 ul injection of a 20 fg of Octafluoronaphthalene must yield a signal-to-noise ratio of better than 10:1 RMS of 272 amu if scanning EI SIM.	
7.2	It must be the supplier's responsibility to supply the samples required for proving the compliance of the system to these specifications.	
7.3	The FSL quality management system includes a system suitability test which use Grob Test Mix as a criteria to evaluate and compare the chromatography and mass spectroscopy of a GC-MS instrument. It is routinely required for the instrument to be evaluated and to pass the relevant criteria in order to be utilized for operational work. It is essential that the purchased instrument is able to achieve the relevant criteria with minimal effort and analysis of relevant standards performed during commissioning.	
7.3.1	The instrument must produce mass spectra with relative ion intensity and isotope ratios for Decafluorotriphenylphosphine (DFTPP) .GC-MS instrument Suitability procedure (based on the criteria specified in the U.S.E.P.A. method 8270) without necessitating any user adjustment to the instrument or use of any procedure other than the standard automatic tuning and mass calibration routines. No artificial adjustment of the mass spectra must be required by the user.	

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7.	**The Bidder shall be responsible for supplying the following:**	**COMPLY /DO NOT COMPLY**
7.3.2	Full Operational Qualification and Performance Verification (OQ/PV) to be performed by the successful bidder upon commissioning of the systems. All measuring devices, calibrators and performance test materials must be fully traceable to an NMI and in line with ISO17025:2017.	
7.4	It is a requirement that the instrument must be proven to pass these criteria after installation and after every time a service technician has worked on the system, including service, source clean or repairs to the system.	

8.	**The Bidder shall be responsible for supplying the following:**	**COMPLY /DO NOT COMPLY**
8.	**Autosampler**	
8.1	An autosampler which integrates fully with the GC-MS and which is under full GC-MS software control must be included.	
8.2	The autosampler must be electrically operated with no pneumatics.	
8.3	The autosampler tray shall allow for fully integrated optional barcode reader to allow reading of vial barcode labels. Allows for programmable single vial heating (35°C to 80°C) and mixing prior to injection. Allows for bidirectional mixing up to 4000 RPM.	

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8.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
8.4	The autosampler tray must have the capacity for at least 100 to 150 vials (approximately 2ml each).	
8.5	The autosample tray must have removable tray racks e.g. 5 x 10 (50 vial) providing the ability to remove tray racks for adding additional samples without interrupting the sampler while running a sequence.	
8.6	The autosampler injector must be auto-aligning and able to be installed or removed without the use of tools.	
8.7	The autosampler syringes must be available in sizes to permit autosampler injections ranging from 0.2µl to 2ul in 0.2µl increments.	
8.8	Sample carry-over must not exceed 0,005 %.	
8.9	Sensors must provide warning in case of incorrect mounting or alignment of the autosampler to protect the syringe needle.	
8.10	The autosampler must have a quick disconnect mounting to be easily removed without disconnecting electrical- and gas connections thereby allowing for easy access for manual injections and injection port maintenance.	
8.11	All autosampler operating parameters must be controlled directly from the GC-MS data system as part of an analysis method:	

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8.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
8.11.1	All autosampler vials must be directly randomly accessible.	
8.11.2	On-column (temperature programmable) injection for standard capillary columns must be an on- site upgradeable option, for direct injection onto 250, 320 and 530um columns, without the need for a separate retention gap or mega bore column.	
8.11.3	Solvent syringe wash with a choice of at least six different solvent reservoirs, must be possible	
8.11.3.1	The washes must be specifiable from either, or both, solvent reservoirs.	
8.11.3.2	A number of pre-injection washes, specifiable from 0 - 15 per solvent reservoir, must be available.	
8.11.3.3	A number of post-injection washes, specifiable from 0 - 15 per solvent reservoir, must be available.	
8.11.4	The needle depths must be variable from 20 - 90 % of autosampler vial depth.	
8.12	User definable sandwich injections with up to 3 layers of additional liquid or an air gap for each layer.	
8.13	A solvent plug or air plug, specifiable in volume and solvent reservoir, must be possible.	

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8.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
8.14	The choice of different sample pull-up speeds must be available.	
8.15	Hot needle injection must be possible.	
8.16	Needle residence time must be specifiable.	
8.17	The choice of different injection speeds must be available, e.g. fast injection (100ms) and slow injection (500ms).	
8.18	It must be impossible for the auto-sampler to inject a sample from any sample tray position other than that specified in the analysis list for the specific analysis.	
8.19	The system, when equipped with optional extras (e.g. two towers, a tray, a heater/mixer/bar code reader) must be able to perform on-line liquid manipulation including solvent addition, standard addition, dilution, derivatization and quenching.	
8.20	One additional fully operational auto-injector system must be provided as spare component with the purchase of the system with in the contract time period.	
8.21	Headspace sampler: Analysis must be possible besides automatic liquid sampling and SPME injection techniques:	

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9.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
9.	Software Requirement	
9.1	Must utilize a multi-tasking software (foreground and background) allowing tasks such as data analysis, library searching, spectral analysis, quantification or the printing and editing of reports to be performed in the foreground with simultaneous data acquisition in the background mode.	
9.2	Must utilize a menu-driven user interface for total control of the entire GC-MS instrument (including auto-sampler).	
9.3	Must utilize a high-resolution, multiple-colour graphic package and a complete, enhanced set of chromatogram and spectrum display programs and quantification routines.	
9.4	Must utilize an interactive keyboard and pointer device (mouse).	
9.5	Must include an on-screen detailed help facility, which can be activated at any time to obtain more detailed information about all application software programs.	
9.6	Must permit instant switching between application program packages.	
9.7	Must include printer driver commands for all windows of the GC\Interface\MS software package.	

Brig SS Mawela | Col HJ Espach | LtCol PL Raliphada | LtCol AK Maleke | LtCol P Mabondo | Capt P Sixinti

BID SPECIFICATION FOR THE SUPPLY, COMMISSIONING AND TRAINING OF GAS CHROMATOGRAPH-MASS SPECTROMETER (GC-MS)–HEADSPACE INSTRUMENT INCLUDING SERVICE AND MAINTENANCE FOR A FIVE (05) YEAR PERIOD: AT THE FORENSIC SCIENCE LABORATORY SCIENTIFIC ANALYSIS SECTION: GAUTENG (PRETORIA)

9.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
9.8	Must include the facility of displaying from 0 up to at least five (5) separate extracted mass fragment chromatograms with or without the total ion chromatogram on a single easily printable screen normalized over the same scan range. This must be very simple to achieve and must be able to keep the last set parameters.	
9.9	Terminal operation must not be blocked while printing.	
9.10	Must permit user-programmable fully automated routines, including tuning, mass-calibration, qualitative and quantitative analysis of samples and printing of results and data through simple data system commands.	
9.11	Must include the automatic storing of all data acquisition (method) and tuning parameters for each data acquisition file. Above-mentioned parameters must be non-editable.	
9.12	The data processing software must provide post run treatment of data using the mouse and other Windows features.	
9.13	For data file security, data files must not be editable.	
9.14	While a data file is being acquired, it must be possible; on the file being acquired, to do manipulation and evaluation of the data as well as library searches on the mass spectra acquired without ever allowing changes to the raw collected data.	

Brig JS Mojwela | Col HJ Espach | LtCol PL Raliphada | LtCol AK Maleke | LtCol P [illegible]do | Capt P Sixinti

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9.	The Bidder shall be responsible for supplying the following:	COMPLY /DO NOT COMPLY
9.15	The software must include a retrieval system where all library entries may be searched by Chemical Abstract Number, Molecular Weight, Molecular Formula and Library Entry Number.	
9.16	The software must be able to perform the following on the sequence:	
9.16.1	It must be possible to edit (i.e. add on to) the analysis sequence in process and editing must be traceable in log files.	
9.16.2	It must be possible to queue analysis sequences to be analysed.	
9.16.3	It must be possible to import analysis sequences, for instance from a table in a spreadsheet, e.g. Excel.	
9.16.4	It must be possible to export sequences to spreadsheets, e.g. Excel.	
9.17	The software must provide a comprehensive diagnostics utility including system status, all tuning voltages, RF voltages, source pressure, filament status, etc.	
9.18	The software must have a comprehensive reporting system whereby custom reports may be generated using a Windows-based program such as Excel. The relevant reporting software program(s) must be supplied.	