THE BRITISH MASS SPECTROMETRY SOCIETY

# Delivering World-Class Science with British Mass Spectrometry!

## *A Community Vision for British Mass Spectrometry*

# Statement of Need

2021

*The Worlds First Mass Spectrometry Society!*

BMSS
BRITISH MASS SPECTROMETRY SOCIETY

# TABLE OF CONTENTS



*"Mass spectrometry is an axiomatic component of the national science portfolio and essential to sustain world-class research in the United Kingdom"*

*"The community highlight that UK R&D requires sustainability in instrumentation and people. including access to key. advanced instrumentation and laboratories that include subject-specific experts"*

*"Mass spectrometry is critical for British scientists in their delivery of world-class science"*

*"UK scientists have played and will continue to play a leading role in delivering mass spectrometry solutions to the world"*

*"Strategic. stable and long term investment is essential to realise sustainable access to world-class mass spectrometry in Britain"*

*Quotations extracted from the original BMSS DELPHI study 2019-2020*

# *A Community Vision for British Mass Spectrometry*

The British Mass Spectrometry Society's Executive Committee commissioned a pathway report in May 2019. Our objective was to produce a community-backed, evidence-based vision for the future of Mass Spectrometry in the UK to support EPSRC, UKRI, and HMG in the strategic planning, prioritization, and funding of the science of Mass Spectrometry in the foreseeable future.

As a follow-up to that pathway report, the BMSS, together with a community working group, was invited to submit a Statement of Need to EPSRC outlining the infrastructure that will enable our community to realise world-leading technology and expertise which is accessible to the entire scientific community and sustainable in terms of resource and personnel. Sustainable critical mass will be formed in key scientific areas for which mass spectrometry is a core technology, supported by investment in Research Technology Professionals, and developing expertise at all levels. The collaborative environment will nurture cross-fertilization of concepts and ideas; it will transform multidisciplinary training and cross-communication of best practice to ensure robust standards of data quality are met across the community.

This "Statement of Need" was submitted to UKRI on the 15th February 2021.

The next steps in this process involve working with EPSRC to refine this vision into a proposal to the UKRI Infrastructure Advisory Committee, meeting in the Autumn of 2021. Feedback and input from the community is encouraged.

**Dr Jackie Mosely**, Reader in Mass Spectrometry, National Horizon's Centre and Teesside University, **[BMSS Chair]**.

**Professor Peter O'Connor**, Professor of Analytical Chemistry and High-Resolution Mass Spectrometry, University of Warwick, UK **[BMSS Treasurer]**.

**Dr Anneke Lubben**, Head of Materials and Chemical Characterisation ($MC^2$), University of Bath, EPSRC Strategic Advisory Team for Capital Equipment.

**Dr Tony Bristow**, Principal Scientist for Measurement Science, Chemical Development, Pharmaceutical Technology and Development, Operations, AstraZeneca, Macclesfield, UK **[previous BMSS Chair]**.

**Dr Gavin O'Connor**, Head of Department, Biochemistry at Physikalisch-Technische Bundesanstalt (PTB) and Professor of Biochemical Metrology at TU Braunschweig, Germany. **[previous BMSS Chair]**.

**Dr Mark A. McDowall JP,** (former Marketing Director at Micromass UK Limited - WATERS Corporation) **[BMSS Meetings Secretary]**.

**Dr Ashley Sage,** Business Development Manager, Markes International Limited, UK (former Business Development Manager for SCIEX UK Limited) **[BMSS Advisory Board Chair & previous BMSS Chair]**.

# AMBITION & VISION

Mass spectrometry (MS) is a field of measurement science with an empowering analytical capability. As such a wide-reaching research discipline, MS has borne witness to an incredible growth in demand over the last 30 years, yet the funding schemes to support technological developments have not kept pace with the scale of adoption. In UK academia, MS is largely funded through responsive mode grant funding for individual research groups, or through strategic equipment funding and host institute capital funding to establish institutional facilities. As a consequence, in the UK, this field of science lacks centres with the critical mass in expertise and resource to support a step-change in scientific collaborations, instrument development, training, and development with cutting-edge MS technology, to deliver maximum impact from the use of this powerful technique.

In recognition of this need, the British Mass Spectrometry Society consulted widely across the UK and internationally, seeking input from leading mass spectrometrists as well as scientists who, as non-mass spectrometrists have world-class research that is reliant on MS. This consultation has resulted in an evidence-based community consensus about the future of UK mass spectrometry, leading to this ***statement of need*.**

## A UK Mass Spectrometry Framework:

This *statement of need* encapsulates key parts of that vision: the need for 6 nationally accessible MS focused research centres coordinated through a networking hub.

The investment required to deliver this framework (detailed below) involves:

1. Capital investment to provide top-level equipment to the centres.
2. Resource investment to provide personnel and operating funding for the centres and hub.
3. Research investment to support collaborative scientific research.
4. Training investment, at all skill levels, to sustainably populate and upskill the talent pipeline.

In combination, this framework will provide a universally accessible mass spectrometry framework for the UK industrial and academic scientific communities. Furthermore, by knowledge transfer among the centres and throughout the wider mass spectrometry community coordinated by the hub, by cross-fertilisation of ideas, and by establishment of new, diverse, multidisciplinary collaborations the UK MS framework will be greater than the sum of its parts and will provide the structural support to deliver on the wider scientific challenges which benefit from high quality, reliable, mass spectrometry data and expertise.

## Scientific Challenges Where Mass Spectrometry Research Will Play a Central Role:

### BIOSCIENCES & BIOTECHNOLOGY:

Mass spectrometry is the core technology, essential for the analysis of all (bio)molecules involved in 'life' and is largely responsible for the recent and rapid growth in the capabilities of the biotechnology industry.

Over the next decade and beyond, the big challenges of individualised, molecular treatments, understanding and adapting to new microbial and viral threats, engineering biological organisms to develop new materials and devices, trace analysis of potentially harmful entities, utilising engineered organisms to solve global problems will all require detailed molecular structural understanding of biomolecules. Such detailed biomolecular structure determination is dependent on mass spectrometry and will be delivered by emerging developments in MS leading to small transportable devices **and new clinical diagnostic tools** at one end of the scale, and high-performance instrumentation to characterise large biomolecular complexes and their interactions at the other end of the scale.

**CLIMATE CHANGE & ENVIRONMENT:**
Mass spectrometry is essential in food and water safety and sustainability and plays a central role in atmospheric monitoring and sustainable fuels. The remit is very broad, yet the analytical challenges align, and the impact of advanced mass spectrometry in this area will be felt across a huge community of researchers and society at large.

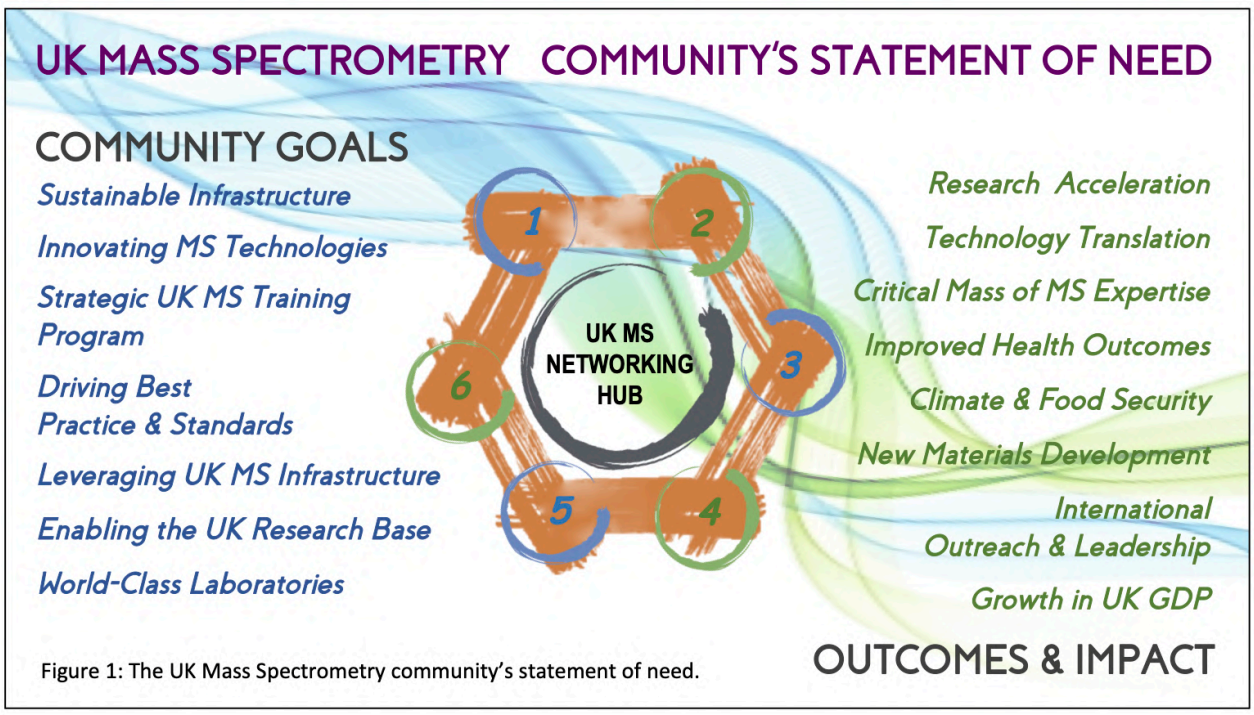



Figure 1: The UK Mass Spectrometry community's statement of need.

# AMBITION & VISION

Mass spectrometry will have significant impact on detection of agrochemicals and trace industrial effluents, detection of pharmaceuticals and drugs in municipal wastewater and drinking water, quality control and assurance of food and drink, improving government regulation of trace materials such as cannabinoids or heavy metals in food security, development of next-generation biofuels, and chemical analysis of airborne particulates and their impact on health.

**NEW MATERIALS (Structural Understanding):** Mass spectrometry is a critical technology in understanding new molecular entities such as antimicrobials, polymers and colloidal materials, and new surface energy materials needed for future batteries, organic solar cells, and organic circuitry. Detailed knowledge of the structure of these materials is key for learning how to control their synthesis and production. Over the next 5-10 years, rapid growth in newer mass spectrometry technologies like ion mobility spectrometry, tandem mass spectrometry, advanced high performance mass spectrometry, and smaller, portable instrumentation will provide determination of new higher-order structural information for a vast range of new materials. Combined simultaneous characterisation involving spatial location, shape, molecular structure, mass, and spectroscopy will achieve lasting impact in the development of new materials and biomaterials.

## The Step Change for UK MS.

The UK MS community is calling for a framework of centres with critical mass and excellence in key MS technology and application areas linked together and cooperating via a data, knowledge transfer, and training hub. This framework will provide a step change by bringing together scientists in areas of research where mass spectrometry is rapidly having profound impact, and provide the infrastructure and resource to ensure outputs (data and technology) are of a reliably high standard and in a format that can easily and reliably be used beyond our community.

UK MASS SPECTROMETRY
**Leveraging Bioscience & Biotechnology Research**

UK MASS SPECTROMETRY
**Innovating Spatially Resolved Molecular Research**

# STRATEGIC IMPORTANCE & CONTEXT

Realisation of the community vision will have immediate and lasting impact in the UK and beyond. Mass Spectrometry, as a major analytical measurement technology, is critical to any well-founded analytical laboratory and is of strategic importance in all aspects of molecular science in chemistry, physics, engineering and manufacturing, biochemistry, biology, medicine, clinical and pharmaceutical, agricultural and environmental, forensics and security, as well as being pivotal across academia, government/institutions and UK industry. The vast majority of high impact outputs from mass spectrometry come from collaborations between research mass spectrometrists and research groups from within this wider scientific community. To drive higher quality science, greater impact, and wider utilisation of advanced mass spectrometry capabilities and expertise, this proposal outlines a framework to bring together the full breadth of science from which to support, nurture and grow collaborations most productively, and will consequently have a significant positive impact on all the outlined areas of science and organisations.

In the UK, the density of world leading chemical and biotech industries such as AstraZeneca, Syngenta, GlaxoSmithKline, UCB, Lubrizol, LGC, Waters Corporation etcetera, and proximity to UK academia has facilitated an atmosphere of collaboration and cooperation, particularly with PhD studentships and similar scientific projects.

This proposal would provide stable, long-term investment that would enable those same scientists to undertake larger scale scientific and instrument development projects to deliver the next-generation tools that our community consultation identified (e.g. clinical diagnostics). MS is a diverse technology, and so technology developments made within the UK impact the full breadth of UK scientists expediently, maintaining the UK world-leading status.

The ubiquitous use of MS in all priority areas for research and development in the UK means that funding of mass spectrometry naturally falls across the remits of all the UKRI councils. This is an opportunity for cross-council investment in the infrastructure to support all of these research areas, with a coordinated approach to ensure maximum return on investment. The strategic goal of this infrastructure proposal is to embed collaborative science, pan-remit, between advanced mass spectrometry platforms and high-quality science projects, some of which currently involves experimental, blue-skies thinking. This constructive coordination is required now to leverage the full impact of high-quality mass spectrometry and data throughout the scientific community.

The proposed infrastructure will also increase availability, level of training, and facilitate data quality assurance and reliability which will enhance the impact of all mass

spectrometry investments, from individual research group equipment to departmental facility equipment to industry-based mass spectrometers.

## This Infrastructure Investment Will:

- Provide a sustainable basis for advanced scientific usage of critical infrastructure on a collaborative basis with scientists from all research disciplines around the UK from the outset.
- Sustainably increase the quality and quantity of utilisation and sharing of instruments throughout the mass spectrometry community from the outset.
- Generate a pool of trained scientists with the skill sets to deliver over the next 5 - 10 years and beyond.
- Provide a core from which to deliver outreach programmes to attract the next generation of students to sustain and grow our community beyond 10 plus years.
- Align with and deliver UKRI strategies.
- Develop next generation technologies.
- Enable and encourage commercialisation of next-generation technologies through intellectual property protection and knowledge transfer.
- Provide a framework for coordinating larger and internationally collaborative scientific endeavours.
- Deliver the impactful use of technology we have seen develop over the last 5 years and state that the MS vision investment will deliver the UK ready response to technology that will be discovered, designed and investigated in the coming decade.

Through consultation, the UK's MS community identified the availability of highly trained personnel is a critical limiting factor within the pharmaceutical and biotechnology industries, as well as within some academic departmental mass spectrometry facilities; a limitation which is well highlighted in the recent UKRI Research and Development Roadmap and the recently published Technician Commitment action plan.

The UK MS Framework proposed herein will have, at its heart, a mandate to train UG, MSc, PhD, PDRA, RTP, and industry and clinical personnel at all levels to increase the overall understanding of the more advanced methods, technologies, and data within the industry. The long-term impact of that training within the wider sciences will be substantial. In particular, the biotechnology industry will greatly benefit from the supply of highly trained personnel who can improve the quality and output of the science derived from the mass spectrometry tools on hand. While the industry already engages strongly with academics via CASE studentships, internships, and other programmes, the mass spectrometry hub and centres proposed herein will have a particular mandate to train within their area of specialisation and expertise enhancing the career prospects of those students and the competitiveness of the pharmaceutical and biotechnology industries within the UK.

## A Community Vision for British Mass Spectrometry:

The British Mass Spectrometry Society's Executive Committee commissioned a pathway report in May 2019 due to a community recognition of need for a coordinated vision for the field. The objective was to produce a community-backed, evidence-based description of the future of mass spectrometry in the UK to support EPSRC, UKRI, and the government in the strategic planning, prioritization, and funding of the science of mass spectrometry in the foreseeable future (5, 10, and 20 years). Consulting widely across the UK and internationally, seeking input from leading mass spectrometrists as well as scientists who, as non-mass spectrometrists have world-class research that is reliant on MS, the committee proceeded to engage with the community via an iterative editorial email questionnaire process, combined with outreach and engagement and dedicated discussion panels and poster sessions at several BMSS annual meetings and events. The outcome of this consultation process was the **UK Mass Spectrometry Vision document**, which is available at: https://www.bmss.org.uk/about-us/uk-mass-spectrometry-vision

There is clear community consensus that, over the next 5, 10 and 20 years , the MS community will need to develop robust and transportable technologies that will serve as game-changing in point-of-care diagnostics, forensics and security; will drive the fight against climate change; will provide the real-time analysis needed for the biotechnological future of today and tomorrow; will deliver real-time feedback for efficient manufacturing in chemical and food sciences, thereby unlocking future UK growth. At the other end of the scale, mass spectrometrists will push the boundaries of advanced mass spectrometry to provide molecular profiles for single cells and to study whole viruses, to understand and map disease progression, and to understand the molecular make-up of emerging energy solutions and smart materials. There is also a clear expectation from the community that greener, low environmental footprint versions of current MS technology will be key factors in all future strategic planning. To meet this expectation, the technology must be developed now.

The community highlighted that UK R&D requires sustainability in instrumentation and people, including access to key, advanced instrumentation and laboratories that include subject-specific experts. Thus, strategic, stable, and long-term coordinated investment is needed to harness the combined power of the technological assets (both existing and future) and research centre resources and personnel in combination with the direct engagement with and input from wider stakeholder communities including:

# USER & COMMUNITY ENGAGEMENT

- Industries such as biopharma, aggrotech, manufacturing, forensics and security, food and water processing and contract research organisations, whether large organisations or small and medium enterprises are strongly dependent on mass spectrometry. Furthermore, industry has cited a critical shortfall in mass spectrometry expertise, and although it funds a range of studentships, including CASE awards and industrial PDRAs, to increase the supply of these trained personnel, industry has indicated that the shortfall cannot be met through these routes alone and they would significantly benefit from more training, higher quality control and assurance, and collaborative science opportunities.
- British Mass Spectrometry Society (BMSS). The BMSS represents the main community of mass spectrometrists, in academia, government, and industry, within the UK. The BMSS also represents UK mass spectrometry on the global scale through its affiliation with the International Mass Spectrometry Foundation (IMSF).
- Community for Analytical Measurement Science (CAMS-UK): https://cams-uk.co.uk/about-cams-uk and the Centres for Doctoral Training. The hubs and centres discussed herein are completely aligned with the goals of CAMS-UK and several of the CDTs. CAMS-UK exists to advance measurement science and has ongoing projects in the areas of point-of-use sensors, separations and detection, data analytics, and novel instrumentation and methods.
- Royal Society of Chemistry (RSC). The analytical division of the RSC in particular, is dedicated to the progress and advancement of science and training in analytical methods and techniques. https://www.rsc.org/membership-and-community/connect-with-others/through-interests/divisions/analytical/about-us/
- The expected user base for the proposed Mass Spectrometry Framework will comprise the entire mass spectrometry community along with collaborating scientists who will draw on the resources (instrumentation and expertise) within the proposed centres and will include:
- Mass spectrometry research groups, for whom periodic access to next generation mass spectrometry technology, software and expert staff, will enable them able to deliver more ambitious and far-reaching research programmes.
- Institutional mass spectrometry facilities whose RTPs will benefit from continuing professional development and professional networking opportunities.
- Users of existing mass spectrometry infrastructure who will benefit from the data quality assurance and benchmarking activities that will ensure that existing instrumentation is working to the expected performance, thus leveraging the existing MS instrumentation and improving the return-on-investment across the entire UK MS community.
- Researchers in related fields whose work utilises mass spectrometry will be able to able to access advanced technology platforms and learn and develop new skill sets.

- ECRs establishing their careers and developing the next generation of researchers, providing a sustainable talent pipeline in the technological expertise needed to deliver top-quality results in mass spectrometry.

- Many challenges for mass spectrometry result from industry seeking solutions to their problems. The proposed UK MS Framework will have critical mass to coordinate multidisciplinary research programmes and transfer that knowledge and technology (with appropriate IP protection) back to the originating industrial partners.

UK MASS SPECTROMETRY
Leveraging Climate & Environment Research

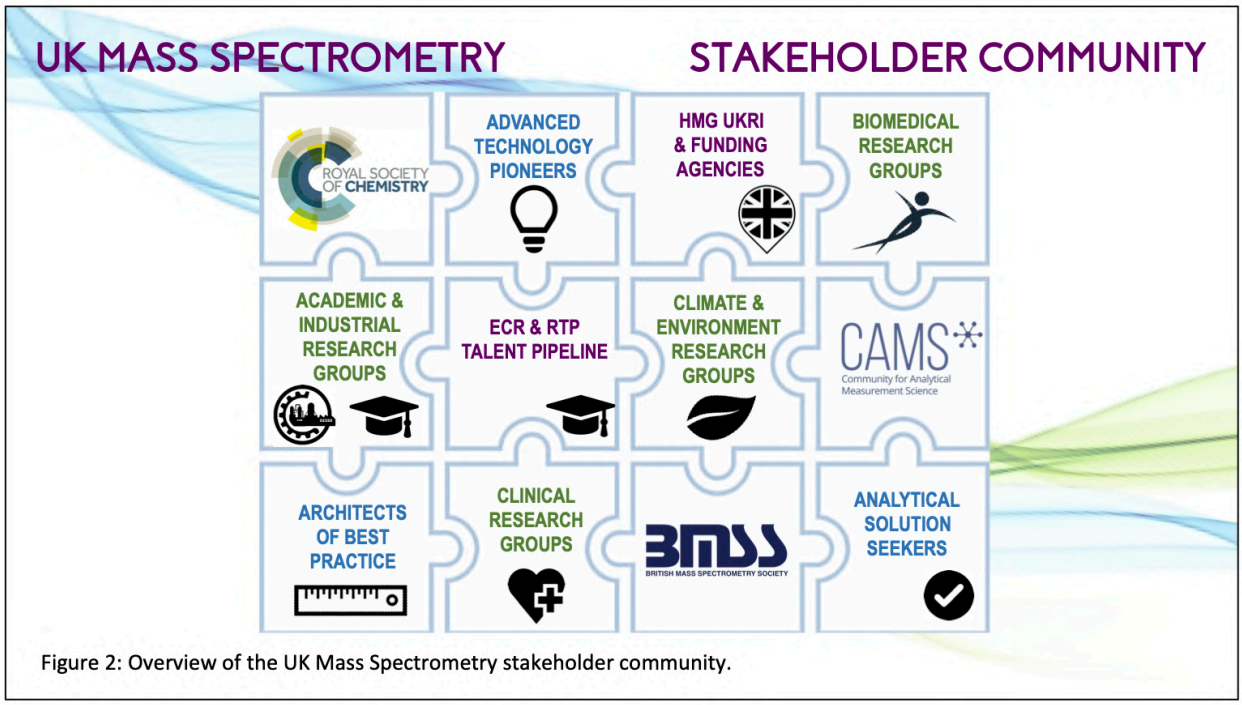



Figure 2: Overview of the UK Mass Spectrometry stakeholder community.

# THE INFRASTRUCTURE

## A UK Mass Spectrometry Framework:

Is needed which includes a networking hub linking a set of six MS centres, each focused on advanced research and collaboration in key areas of specialisation, community and society. The six MS centres will be focused on the following six areas of importance:

### 3 TECHNOLOGY CENTRES:

1. Advanced high performance mass spectrometry for molecular structural characterisation:
2. Next generation MS technology development, including robust, portable, instruments for clinical, environmental, and industrial use.
3. Spatially resolved mass spectrometry technologies for determination of the spatial distributions of molecules in a range of physical, chemical, biochemical, and clinical environments.

### 3 STRATEGIC MS APPLICATION CENTRES:

1. Advanced mass spectrometry for next generation biosciences, from cell and gene therapies, new antibiotics, viral vectors, host cell proteins, clinical analyses, and the gateway into medical and operating theatre devices.
2. Mass Spectrometry approaches to study climate change and environmental impacts, including trace analysis, isotope-ratio tracer studies, next generation fuels and biofuels, and food, air and water security.
3. Mass spectrometry for analysis of new materials, including polymeric materials, new pharmaceutical entities, understanding polymer degradation in plastics, biomolecule-polymer composite materials, and materials without a precise molecular formula (such as catalysts and surfaces),

## A UK Mass Spectrometry Networking Hub:

The networking hub will bring the community together and provide leadership, guidance and support. It will have oversight of training across all levels, data quality, knowledge sharing and research coordination, and will provide outreach to the wider scientific community and society. The centres will connect via knowledge transfer PDRA positions and provision of training resource. The centres will deliver and expand the state-of-the-art in their sub-field, provide the highest quality results to users and collaborators across the broader scientific community, and will expand training and understanding of their sub-field.

The networking hub will also coordinate an annual scientific meeting as well as the annual scientific advisory group meetings to maximise outreach and engagement with the wider scientific community and enhance the networking and training activities throughout the community.

## Delivery Approach:

The six centres and the networking hub should each be funded in response to a coordinated set of calls for proposals from UKRI, possibly coordinated and managed by EPSRC. These proposals should be reviewed for scientific excellence and vision with direct reference to this statement of need. As this UK MS Framework is likely to engage most of the mass spectrometry community in the UK, it will be necessary to look farther afield for reviewers, but the mass spectrometry community can suggest a large number of international experts with vision and expertise in delivery of large facilities and centres as well as a keen understanding of the mass spectrometry field as a whole.

## Options Analysis:

The community considered a range of options for provision of the key analytical infrastructure required in the UK, and a detailed SWOT analysis was done for each (available at www.bmss.org.uk/about-us/uk-mass-spectrometry-vision/). The six advanced mass spectrometry centres and a coordinating hub that would unite all infrastructure that currently makes up the UK landscape does not yet exist in the UK, and that missing component is proposed in this statement of need.

## Risks:

A key threat is lack of coordination, which could result in loss of connectivity and focus. This will be overcome by creation of the networking hub with shared staff and a trainee funding budget to engage with the UK MS Community

The risk of inadequate management of the networking hub and six MS centres will be mitigated by creation of advisory boards made up of representatives from key community stakeholders, including external representatives from UKRI, industry, academics from outside the mass spectrometry community, and international MS experts.

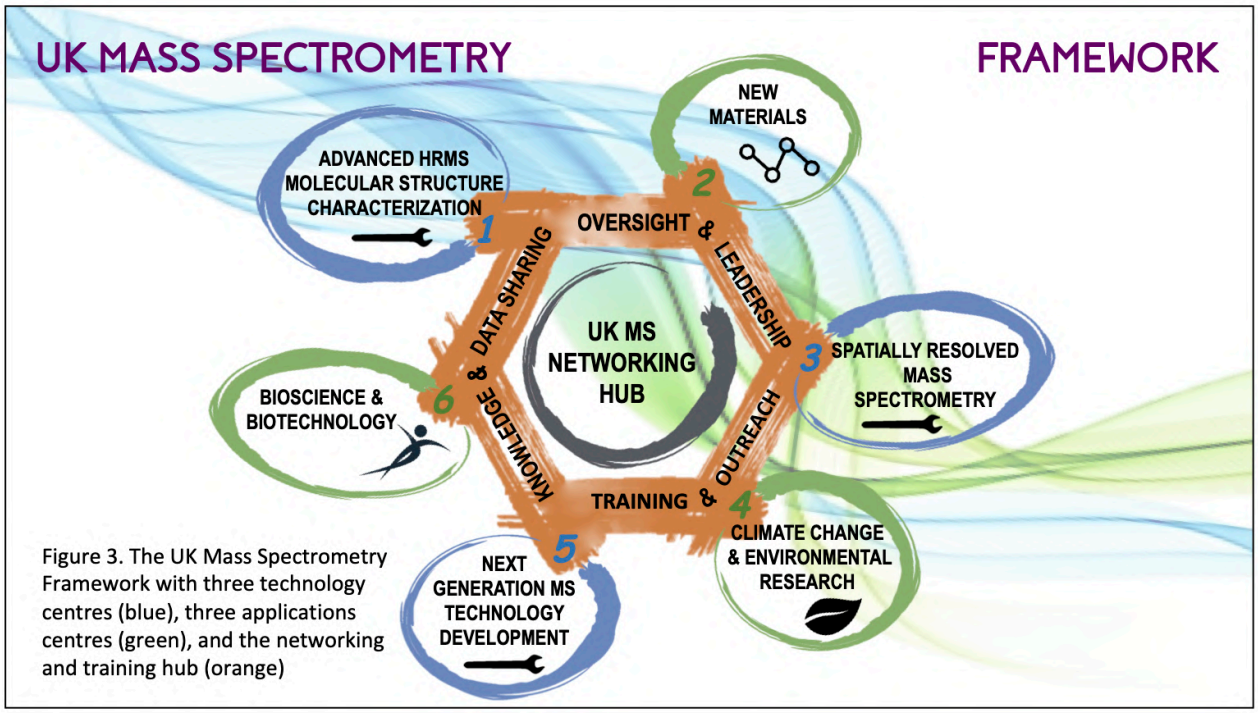



Figure 3. The UK Mass Spectrometry Framework with three technology centres (blue), three applications centres (green), and the networking and training hub (orange)

# THE INFRASTRUCTURE

Inadequate provision of resource for the MS centres and networking hub to cover staffing, maintenance, training, support, supplies, etc. will result in underutilisation of the infrastructure and curtail delivery at the high level expected. This would be mitigated via a robust and realistic long-term funding and cost recovery model.

Cost-recovery models must be carefully weighed against scientific excellence. A robust cost recovery model including accommodation for scientific excellence, ECR access, and pump-priming activities will mitigate this risk.

Loss of key staff (mitigated by use of longer-term contracts) may prevent some effective facility 'down time' while replacements are recruited and trained to the same level. This risk can be mitigated by funding and supporting career development of RTPs and other full-time research staff positions. As training and maintenance of the skills development pipeline for the wider scientific community is a major goal, staff turnover is expected and desirable, particularly for PDRAs, but there needs to be a balance to maintain expertise and ensure maintenance of high-quality outputs and results.

Loss of leadership in the field through aged equipment and stagnation of the staff. This will be mitigated by the energy and drive provided by the network hub, opportunities for career development, funding to maintain state-of-the-art capability, and the possibilities to disseminate results internationally. The rolling 5-year funding review cycle will also ward against stagnation.

UK MASS SPECTROMETRY
Innovating Molecular Structure Research

UK MASS SPECTROMETRY
Leveraging New Materials Research

The BMSS coordinated this 'Statement of Need' on the behalf of the entire UK mass spectrometry community. The BMSS membership currently stands at about 550 members who are primarily practicing mass spectrometrists within the British Isles, but with the outreach activities mentioned above this consultation reached >1100 scientists invested in mass spectrometry. The overall community engagement activities herein reached across the breadth of the field and included experts from the USA and Europe who had particular expertise with operation of large, advanced mass spectrometry facilities, advanced senior academics and industrial researchers, RTPs in technical research positions within departments and institutes, ECRs, PDRAs, and PhD students.

## Authors:

**Dr Jackie Mosely**, Reader in Mass Spectrometry, National Horizon's Centre and Teesside University, **[BMSS Chair]**.

**Professor Peter O'Connor**, Professor of Analytical Chemistry and High-Resolution Mass Spectrometry, University of Warwick, UK **[BMSS Treasurer]**.

**Dr. Anneke Lubben**, Head of Materials and Chemical Characterisation ($MC^2$), University of Bath, EPSRC Strategic Advisory Team for Capital Equipment.

**Dr Tony Bristow**, Principal Scientist for Measurement Science, Chemical Development, Pharmaceutical Technology and Development, Operations, AstraZeneca, Macclesfield, UK **[previous BMSS Chair]**.

**Dr Gavin O'Connor**, Head of Department, Biochemistry at Physikalisch-Technische Bundesanstalt (PTB) and Professor of Biochemical Metrology at TU Braunschweig, Germany. **[previous BMSS Chair]**.

**Dr Mark A. McDowall JP,** (former Marketing Director at Micromass UK Limited - WATERS Corporation) **[BMSS Meetings Secretary]**.

**Dr Ashley Sage,** Business Development Manager, Markes International Limited, UK (former Business Development Manager for SCIEX UK Limited) **[BMSS Advisory Board Chair & previous BMSS Chair]**.

Critically, the authors are grateful to the multiplicity of people around the UK, and beyond, who took the time to contribute to this study, to engage with us at various conferences and workshops to inform this document, and to the BMSS for its commitment to this project and for financial support.

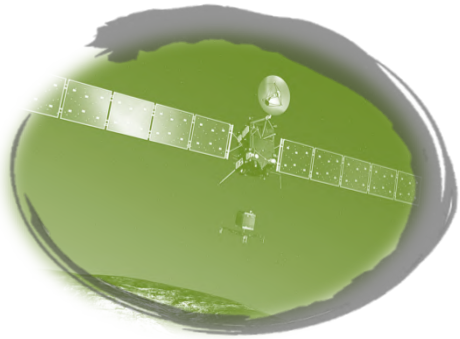
UK MASS SPECTROMETRY
Innovating NextGen MS Technology Research

*The Worlds First Mass Spectrometry Society !*

BMSS
BRITISH MASS SPECTROMETRY SOCIETY

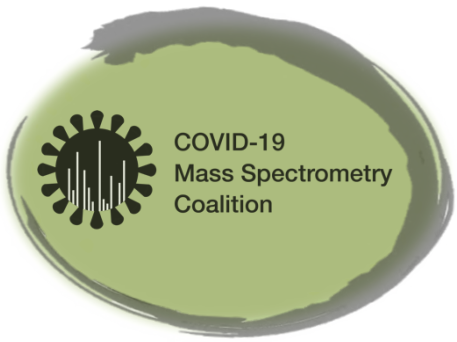
# AUTHORS & ENGAGEMENT

Furthermore, the mass spectrometry community has engaged extensively and collaboratively beyond the fundamental science of mass spectrometry and into the wider scientific community. Some recent evidence of such engagement includes the Rosetta mission: http://www.open.ac.uk/science/research/rosetta/mission/philae-lander/ptolemy which included a mass spectrometer to study the molecular structures of particles from the comet, - the development of tools for real-time diagnostic feedback in operating theatres: https://www.imperial.ac.uk/news/126106/intelligent-knife-tells-surgeon-tissue-cancerous/) to allow surgeons to determine cancerous tumour boundaries accurately using mass spectrometry detection of molecules specific to the cancer, and ongoing and rapidly developing research into detection and prognostic evaluation of the SARS-Cov-2 virus (and other viruses such as flu) in patients in hospital admissions, including detection of new variants as they arise (https://covid19-msc.org/ ). With future support from UKRI, the BMSS community will be able to continue to push the boundaries of science using mass spectrometry.



**UK MASS SPECTROMETRY**
**Enabling Molecular Cosmology Research**

**UK MASS SPECTROMETRY**
**Enabling Cancer Treatment Research**




**UK MASS SPECTROMETRY**
**Enabling Public Health Research**

# INDICATIVE RESOURCES

The UK Mass Spectrometry Framework includes the six centres (three technology-focused and three application-focused) listed above, linked together and coordinated by the network hub which focuses on data, training, technology sharing, and outreach. The centres are national research facilities and will require both capital and longer-term resource funding to go alongside cost-recovery measures in the three technology centres.

## Funding Requirements to Establish the Six Centres Include:

Capital funding for state-of-the-art instrumentation and software to establish the six centres. Due to specialism need variations this requirement will differ substantially among the sub-fields, with an anticipated median spend of ~£4.5M/centre (ranging from £2M-£5M).

On-going funding for instrument and software upgrades over initial 5-year period, ~ £250k - £500k per centre.

Funding for RTPs, median 5 at 1.0 FTE for 5 years per centre. It is expected that one or two full-time RTPs are needed per instrument or application area.

Funding for non-permanent staff. The centres should have a set of 5+ PDRA's or technicians funded for the full 5 years, but on rolling 2-3 year fixed-term contracts to increase training.

Thus, total funding for each of the six centres should have a median funding of approximately £10-15M each over 5 years, renewable based on productivity and vision.

## Funding Requirements to Establish the Networking Hub are as Follows:

Funding for research software engineers, bioinformaticians, and data scientists for the development of data standardisation, data analysis, data storage, and quality assurance methodologies. Funding for data repositories, protocol libraries, quality assurance methodology delivery.

Funding for outreach, administration, advisory board meetings, and other management costs.

Funding for knowledge transfer PDRAs (approximately 5-10 at 1.0 FTE on rolling 2-3 year fixed term contracts) with a remit to periodically move among the centres to transfer useful concepts and methodologies.

Funding for training 60-90 PhD students annually in MS. These studentships will primarily be hosted at academic institutions working with the hub or centres, on projects covering the entire range of mass spectrometry instrumentation and applications.

Thus, the networking hub would cost in the region of £10M - £15M over 5 years depending on the number of PhD students and PDRAs that can be supported.

# INDICATIVE RESOURCES

For both the hub and the centres, cost-recovery efforts can be used to supplement the training, maintenance, and supplies budget, provided the key criterion of providing scientific collaborations at the highest level of excellence is not compromised.

The hub and the centres will be expected to strongly support ECRs in order to expand the talent pipeline and develop long term collaborations and beneficiaries of the MS framework investment.

**The total UK Mass Spectrometry Framework is expected to cost in the region of £95M over 5 years.**

UK MASS SPECTROMETRY
Networking Research Infrastructure
Delivering ROI

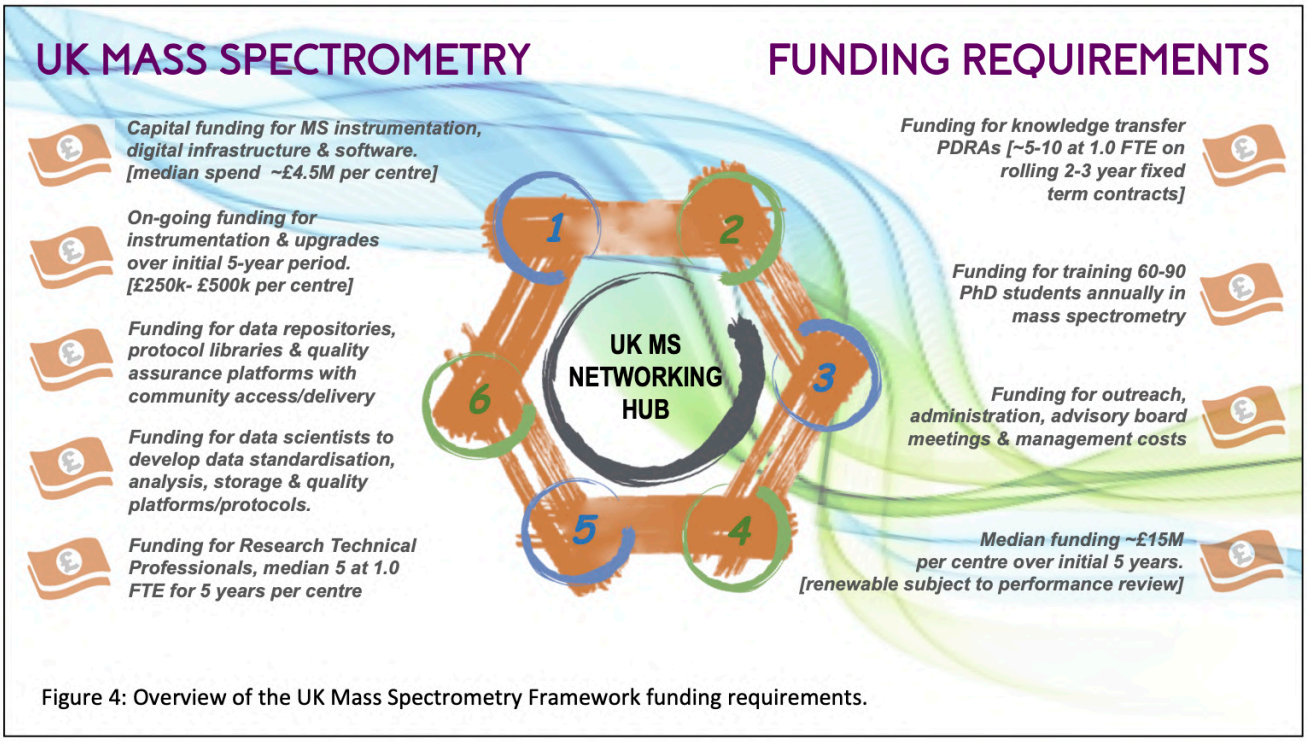



Figure 4: Overview of the UK Mass Spectrometry Framework funding requirements.

| Centres (6x) | 5-year costs |
|---|---|
| Capital Equipment | £4.5M |
| Upgrades | £0.5M |
| maintenance (8% of capital costs per annum) | £1.2M |
| RTPs (5x 1.0 FTE fEC) | £3M |
| PDRAs (5x 1.0 FTE fEC) | £2.5M |
| supplies and travel | £800k |
| ongoing costs (Director, Manager, Admin, SAB meetings, etc) | £1.6M |
| **Centre total** | **~£12-£15M** |
| **6x Centre total** | **~£80M** |
| **Hub (1x)** | |
| Computer Equipment | £250k |
| Upgrades | £50k |
| Maintenance (8% of equipment costs per annum) | £100k |
| Data scientist RTP costs (3x 1.0 FTE fEC) | £1.8M |
| Knowledge transfer PDRA costs (4x 1.0 FTE fEC) | £2.2M |
| PhD trainees (60x £25k/year for 4 years) | £6M |
| supplies and travel | £3.5M |
| ongoing costs (Director, Manager, Admin, SAB meetings, etc) | £1.6M |
| **Hub total** | **~£15M** |
| **UK MS Framework** | **~£95M** |

Table 1: Indicative estimate of the UK Mass Spectrometry Framework funding requirements.

THE BRITISH MASS SPECTROMETRY SOCIETY

**THE BMSS**

**The British Mass Spectrometry Society is a UK registered charity, founded in 1964. The BMSS strives to encourage participation in all aspects of mass spectrometry on the widest basis, to promote knowledge and advancement in the field and to provide a forum for the exchange of views and information. The BMSS is committed to ensuring equal opportunities and reflecting the diversity of British society as a whole.**

**UK CHARITY NUMBER 281330**

**BMSS ADMINISTRATOR**

**Mrs Lisa Sage:**
+44 (0) 1606 810 562
admin@BMSS.org.uk

**REGISTERED OFFICE**
British Mass Spectrometry Society,
25 Burwardsley Way, Northwich,
Cheshire, CW9 8WN, UK.

**CORRESPONDING AUTHORS**
**Professor Peter O'Connor:** p.oconnor@warwick.ac.uk
**Dr Jackie Mosely:** j.mosely@tees.ac.uk

# Statement of Need



2021

www • bmss • org • uk

*The Worlds First Mass Spectrometry Society !*

BMSS
BRITISH MASS SPECTROMETRY SOCIETY