**Submission to:**

**The House of Commons Science and Technology Committee Inquiry into "A new UK research funding agency"**

**Response to the call for written evidence**

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**From:**

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**AIRTO's response:**

AIRTO, the Association of Innovation, Research & Technology Organisations, on behalf of its members, welcomes the proposal to establish a national Advanced Research Projects Agency (ARPA), with the caveat that it does represent additional investment in research, development and innovation (as opposed to the redirection of existing funding). If established in this manner, it will be a powerful tool for helping the UK to implement the ambition stated in the Industrial Strategy to reach 2.4% of GDP for R&D by 2027, and will further bolster the UK's reputation as a 'Science *and Innovation* Superpower'. As things stand, time is running out to reach that goal, and in the wake of Covid-19, the government needs to take radical action to create attractive value propositions for industry to continue to invest in innovation. ARPA could be a successful mechanism for this.

AIRTO suggests that the mission of the new agency is to advance high-potential, high-impact technologies, that are too early for private sector investment, but have a clear end market in mind. Targets should be both individual products or essential underpinning technologies, and in both cases the output must be immediately exploitable once the ARPA project is completed. These technologies will be of national importance to government, society and the economy.

The UK's ARPA should combine long-term funding with rapid decision making and effective involved, proactive monitoring. Its work should be 'big picture' led while utilising the UK's existing, extensive infrastructure, and building comprehensive teams from all the different parts of the research, development, innovation, technology and industrial community – including both those that focus on cross-cutting technologies and those that support specific industrial sectors. These teams should comprise of the best organisations to undertake the work, irrespective of type, governance, ownership or location (see below regarding the specific question on location of the new agency). However, if there is no alternative, ARPA should have the ability to fund new facilities.

Information on the proposals for a UK ARPA is currently limited, with a stated government commitment to work with 'industry and academics' to finalise a proposal. There needs to be strong government engagement with industry; AIRTO believes it is crucially important that the Innovation, Research and Technology (IRT) sector is included in these discussions, as it provides an important component perspective of the UK innovation infrastructure, which is currently largely absent from policy discussions. This inclusive approach will enable cohesive programmes and projects with a clear, achievable, exploitable end-result to be successfully planned, undertaken and delivered. The IRT sector is a neutral convenor which interfaces with multiple parties: government, industry and academia. These institutions face into all sectors, and are a first port of call that can help engage existing industry sectors and supply chains and, where appropriate, assist entrepreneurial ventures with practical help on a whole range of their specialist needs. The sector helps both new and mature technology and innovation to reach into the marketplace, servicing the needs of its industrial client base. AIRTO is willing to represent the voice of the IRT sector in the ARPA discussions, and to play its role in the delivery of a national agency.

**Specific questions posed by the Inquiry:**

***What gaps in the current UK research and development system might be addressed by an ARPA style approach?***

The current UK research and development system is largely based on funding underpinning academic research, with more limited resources for exploiting this research. This approach is often driven by the technology rather than societal challenges or market demand, which leads to the UK being widely globally recognised for excellence in science, but relatively poor at its exploitation.

To secure the UK's reputation as a 'Science *and Innovation* Superpower', there are a number of current gaps that a UK ARPA should look to address:
I.      Programmes and projects that drive delivery of a strategic UK imperative (for example: projects contributing to achievement of the UK's targets for Net Zero carbon emissions).

II. Programmes and projects that have a real 'market' pull that will lead more easily to successful exploitation of the results and economic or societal benefits. Innovation is often assumed to be a linear process commencing in a laboratory; this is not the case. The 'technology push' approach of previous governments over the past couple of decades has not worked in lifting the level of R&D intensity beyond 1.7%. We are calling for something different, for change - for a 'market pull' approach in the government's strategy. More investment is needed in DEVELOPMENT infrastructure to gear in the private sector and pull technologies through to market.

III. Investment in later stage development to balance the investment in early stage research, thus ensuring technologies to become market ready. Too much focus on early stage research is not creating sufficient value: There is a need to rebalance public spending on R&D, the distribution of which stands at approximately 85% on early stage Research, and just 15% on mid and later stage Development activities. In this respect, the UK has been 'putting all its eggs in one basket'. The UK has an under-utilised IRT sector (much larger than Germany's Fraunhofers) which it could more purposefully deploy, with the industry knowledge, skillsets and infrastructure to assist with the translation of research to generate wealth, create jobs etc.

IV. The ability to develop and fund projects across different scientific and non-technical disciplines that are necessary for the development of products and services that can readily be introduced and adopted for use in public and private sectors.

V. Access to adequate levels of research and innovation funding for non-university organisations that offer varied and valuable expertise and experience. Government mechanisms such as UKRI can be restrictive or too complex, especially for SMEs. Procurement rules and state-aid concerns get in the way of businesses pursuing development funding.

VI. The scope to rapidly fund radical ideas that do not attract support from the conventional research community. Historically, the UK has not engendered an entrepreneurial or 'Freedom to fail' culture/leadership for innovation.

In summary, the gap is for funding that will allow comprehensive, mission driven, cross-sector project teams to be assembled that can address new, market driven, or radical ideas, and take them through to the point of exploitation. UK ARPA should be an agile organisation that funds mission driven projects which result in immediate deployment and exploitation. It should be driven by application led organisations seeking solutions to challenging problems.

### *What are the implications of the new funding agency for existing funding bodies and their approach?*

The UK ARPA must be complementary and additional to existing funding bodies and their approach. In particular, it will be crucial for the new agency's relationship with UKRI to be clearly defined and understood.

As the new agency will be addressing gaps in the current system, complementarity, distinctiveness and clarity should be achievable. UKRI has a main commitment to fund academic research, and a linear process from research through development to exploitation. The new agency will have a less structured route for its projects, funding integrated teams from whichever part of the infrastructure is appropriate. The two mechanisms are fundamentally different, but both valid. This means UKRI should continue with its current funding mechanisms and allow the UK ARPA to address the gaps discussed above with greater pace and focus.

However, there should still be co-ordination and cooperation between the UK ARPA and existing funding agencies (including UKRI) to ensure distinctions are maintained, benefits from collaboration are achieved, and unnecessary overlap is avoided.

### *What should be the focus on the new research funding agency and how should it be structured?*

The focus of a UK ARPA should be on challenging, multidisciplinary topics that, if necessary, span not only science and technology, but also the social, environmental and behavioural disciplines required to develop, deliver and implement solutions. It should be driven by the big strategic goals of the UK, with a strong focus on delivering implementable outcomes. Some of these have been identified as 'Grand Challenges' or topics pertaining to national risks, but should also include projects that address national opportunities.

Partnership between the IRT sector and industry is vital for delivering these projects, with support from the academic sector as necessary.

The portfolio of the agency should comprise individual but large projects, each being proactively supervised/monitored by a member of the agency's staff. A lesson from both DARPA and ARPA-E is the need for the agency's staff to be technically knowledgeable in the projects that they are monitoring, and to be able to provide technical advice and input. This can be achieved by these staff being seconded from the IRT community.

The UK ARPA will need a headquarters, but following the US model, will also require regional offices in order to make UK ARPA's technical staff constantly accessible to project teams. In the interests of efficiency, the head 'office' function should be limited, but not so much that it restricts the awarding and delivery of programmes and projects.

Complementing the technical expertise of the UK ARPA staff, will be the need for a dedicated commercialisation team to ensure the newly developed technology is rapidly and effectively exploited.

Oversight of UK ARPA will be important to ensure it is developed to meet the UK's needs and challenges, and delivers on these needs and challenges. A new entity may be necessary for this role.

### *What funding should ARPA receive, and how should it distribute this funding to maximise effectiveness?*

As an initial funding level for the first five years, £800 million is a modest starting point compared to US budgets, even allowing for the different sizes of population and economy. This initial funding should not be *pro-rata* over the five years, but gradually increased to avoid pressure for early spending of funding without the necessary infrastructure and developed projects in the early years.

However, AIRTO recommends that a larger level of initial funding is committed over a period of at least ten years to give the stability and enable the duration of projects that will ensure technical and marketable success.

The effectiveness of a UK ARPA will depend on a commitment to a broadly described portfolio of topics of importance to government, society and the economy, a thorough but rapid assessment process for proposals, building flexible project teams that comprise all the skills required, and strong project monitoring by experts fully involved in the work on a day to day basis.

### *What can be learned from ARPA equivalents in other countries?*

There are significant lessons to be learnt from ARPA equivalents in other countries, provided those lessons are then adapted to take account of the UK research, technology, innovation and industrial infrastructure. AIRTO and its members have some knowledge of ARPA equivalents, and this is summarised below. However, it is recommended that a more rigorous but rapid study is undertaken so that the UK's planning and structuring of its ARPA is evidence based.

The proposal to base the UK agency on the US models of DARPA and ARPA-E is sensible in view of their success, provided it is modified to address the differences in the research, development and innovation infrastructures between the US and UK. The differences mainly exist in that US universities often incorporate research institutes and national laboratories, whereas in the UK there is a separate IRT sector that includes Research and Technology Organisations (RTOs) including the subset of Catapult Centres, Public Sector Research Establishments (PSREs) some industry-focused university centres, and private sector research, development and innovation organisations.

The success of the US agencies as a model for other countries can be seen by similar organisations being set up or planned in a range of countries including Canada, China and Russia.

The lack of such an agency has been cited as the cause of Japan losing 'the innovation race'.

Both France and Germany have called for an EU agency of this type. The European Commission has declined to do this, stating that such an agency would be too 'top down' an approach, and that the European Innovation Council already fulfils this role. However, there is a view that the European Innovation Council does not have the scope and flexibility to provide the benefits of an ARPA type organisation.

There is relatively little publicly available feedback on the success of ARPA type initiatives outside of the US. However, probably because of their relatively long existence, more analysis has been undertaken of DARPA and ARPA-E. Tim Harford (Financial Times, 27 July 2018) cites five reasons for DARPA's success:
  I.   Speed and flexibility.
  II.  Run by scientists and not bureaucrats (with tight control over large budgets and a short tenure).
  III. Creating a vigorous marketplace for ideas – projects were widely distributed to a variety of universities and other institutions, practical prototypes were widely shared, and researchers brought together to learn from and pull apart each other's work.
  IV.  Filling the gap between blue skies research and a marketable end product.
  V.   Clarity of mission.
These five reasons provide a good starting point for discussing the basis and operating model for a UK ARPA.

Two other characteristics of DARPA and ARPA-E are widely cited:
  I.   There is a key role for a government department in each of the organisations, which provides focus to its activities.
  II.  Funding and objectives are long-term and stable, to ensure that sustainable progress is made, and benefit is achieved.


### What benefits might be gained from basing UK ARPA outside of the 'Golden Triangle' (London, Oxford and Cambridge)?

UK ARPA could comprise three key areas of activity:
  I.   Head 'office', which could be located anywhere in the UK, and its establishment outside of the 'Golden Triangle' could be a part of the Government's policy of supporting UK regions, and should reflect the 'levelling-up' agenda.
  II.  Regional 'offices'/hubs for project monitoring activity (DARPA has six such offices in the US). If the proposition discussed above, that ARPA project monitors must be actively involved in projects, is to be implemented, these monitors will need to be located in different regional facilities across the UK. There will be a requirement for critical mass to allow effective support for proactive project involvement and monitoring. The regional presence will be able to both build on and exploit local science and technical expertise, which has been identified by the Science and Innovation Audits.
  III. Organisations undertaking ARPA projects. It will be essential that UK ARPA projects are awarded to the best organisations to undertake the work, irrespective of geographical location. However, where the need for a new facility or organisation is identified, to address a technological gap, location outside of the 'Golden Triangle' should be a major consideration. Other considerations should be the availability of skilled people and resources and, for some projects, the suitability of the local environment to host demonstration and pilot projects. This latter consideration is particularly important for some industrial sectors, for example those involving offshore energy.


### Summary

The proposal for a national Advanced Projects Research Agency is welcomed by AIRTO as a complementary initiative to UKRI and its component parts, and could be a powerful tool for helping the UK to implement the ambitions stated in the Industrial Strategy for reaching 2.4% of GDP for R&D by 2027

The benefit of the new agency should be its focus on developing technologies (both underpinning and application specific) in response to key national missions and challenges, and marketable end-products. This defines the organisation as having a 'big picture' strategy, and strong links with industry.

There is significant work to be undertaken in identifying how the new agency will work and complement the existing infrastructure. Significant lessons can be learnt from DARPA and ARPA-E in the US, provided they are translated to take account of the UK's research, development and innovation infrastructure. AIRTO contends that much of the infrastructure for delivering projects funded by an ARPA style vehicle already exist in the form of the UK's extensive IRT sector. The recent Science Capability Review by the Government Office for Science recognised that there are organisations in this sector which fulfil an important national and/or public role but represent an under-utilised asset. AIRTO advocates that, where possible, such resources are fully deployed to deliver ARPA projects so that funding is used as efficiently as possible, leveraging existing world-class facilities/resources and expertise, rather than seeking to establish unnecessary new facilities from scratch. AIRTO is keen to play its part in establishing this new initiative, and to take a role in the operation of the new agency.

**About AIRTO**

AIRTO is the Association of Innovation, Research and Technology Organisations. Its membership comprises approximately sixty of the principal organisations operating in the UK's Innovation, Research and Technology (IRT) sector. The IRT sector has a combined turnover of £6.9Bn, employing over 57,000 scientific and technical staff (equivalent to the academic staffing of the Russell Group of universities) and, for comparison, it is significantly larger than the network of Fraunhofer Institutes in Germany both in size and its scope of activities. The sector contributes >£32Bn per annum to UK GDP. AIRTO's members work at the interface between academia and industry, for both private and public sector clients.

Members include independent Research and Technology Organisations, Catapult Centres, Public Sector Research Establishments, National Laboratories and some privately held innovation companies.

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