

**North East Advanced Material Electronics (NEAME) response to
BEIS Select Committee Inquiry into the UK semiconductor industry**

About NEAME

- 1.1 NEAME is a dynamic cluster working to revolutionise electronics beyond silicon in North East England. They are a group of leading-edge companies using advanced electronic materials technologies at the core of what they do. They embrace compound semiconductors, 2D materials such as graphene, diamond, metal oxide, polymer and organic materials, and even hybrids.
- 1.2 Next generation electronics, using advanced materials, are opening vast new horizons that impact on every facet of society. The North East region is at the vanguard of many of these and home to over 30 companies and organisations driving multiple revolutions. Collectively, these companies employ over 1800 people in this sector with combined growth forecasts expected to generate a further 2700 jobs by 2027.
- 1.3 NEAME is a business-led forum created in 2020, led by CEOs, C-Suite Executives and Directors with diverse interests but common challenges to driving world-leading growth and innovation needed to create successful companies that lead their fields. Some members design, develop, and make microchip-scale electronic devices. Others integrate them as a critical component of their products that are only possible by going beyond silicon.

About the sector in the region

- 2.1 18 companies in the North East have been identified as designing, manufacturing, or assembling compound semiconductors or compound semiconductor devices forming a core part of their business. Of these, 8 companies were either solely or primarily associated with the compound semiconductor industry, while 10 companies also identified as operating within the resilient communications industry. Some have UK sovereign capability.
- 2.2 These comprise a mix of micro- (22%), small- (28%), and medium-sized (44%) companies, in addition to one large company. These range from start-ups with turnover of £100,000 or less to more than £15 million for medium-sized companies and more than £50 million for large sized companies.
- 2.3 Average turnover per employee is calculated to be approximately £154,000. Importantly, there is significant growth potential for North East compound semiconductor companies with 46% of survey respondents projecting job growth of 100% or more over the next five years and 23% projecting growth in excess of 200%. Growth projections for turnover is even more bullish with 46% of survey respondents projecting turnover growth of 100% or more over the next five years and 31% projecting growth of more than 200% [*regional report in 2021*].
- 2.4 There is significant expertise and activity in the design of chips and devices and

component and sub-system level manufacturing and assembly in the North East, as well as compound semiconductor manufacturing capability, for example, Newton Aycliffe hosts a 310,000 ft² 6-inch wafer fab which includes a state of the art 100,000 ft² clean room designed for high volume manufacturing of compound semiconductor devices based on GaAs, SiC and InP materials.

- 2.5 Key semiconductor technologies being developed and used across the North East include RF, microwave, RADAR and communications, electronic devices using diamond, high temperature devices, RFID, radiation detection, lighting solutions, photonic healthcare, optical communication, advanced sensors, flexible displays and electronics.

Addressing the inquiry's questions relevant to NEAME

What is the UK's semiconductor supply chain and is this secure? If not, how can this be improved? What specific strengths does the UK have to contribute to regional or global semiconductor supply chains? How competitive is the UK within the global context of the semiconductor industry?

- 3.1 The UK, while having real strengths in systems integration (i.e. designing and using semiconductors in products), has historically been weak at consumer level semiconductor production.
- 3.2 The Siemens/Atmel story in North Tyneside in the late 1990s is a good example of how very large inward investment can be vulnerable to the UK's position especially in a post-Brexit environment. The UK supply chain environment will take years, if ever, to compete with other nations in this space.
- 3.3 There is, however, an opportunity for the UK to develop global leadership in next generation electronics utilising advanced materials, which embraces compound semiconductors such as SiC, GaN, GaAS and InP and 2D materials such as graphene, diamond, metal oxide, polymer and organic materials. There are significant emerging markets being driven by global automotive sector changes, advanced telecommunications and the Internet of Things meeting the needs of ageing society, climate change and better healthcare. In these areas and more, opportunities exist to create ultra-high value, knowledge intensive manufacturing centres capable of leading on a global stage.
- 3.4 In the North East, there are wafer fabrication capabilities such as the II-VI facility in Newton Aycliffe and INEX Microtechnology on the Newcastle University campus which is the only GaN facility for high frequency devices for UK defence and security.
- 3.5 Recent major investments in the region:**
- **PragmatIC:** £65m Series C funding in Q4 2021 employing 180 people to date and growing at more than 50 percent per annum.

- Their Sedgefield 200mm line is the **first semiconductor fab to be built on a new site in the UK since 1996** – that being the aforementioned Siemens plant in North Tyneside.
- Their new Durham 300mm line is the first 300mm wafer fab ever in the UK, bringing the UK semiconductor industry into the 21st Century.
- **II-VI:** multi-million pound investment creating additional 150 jobs between late 2021-2022; now totalling around 250 jobs
- **ORanGaN project - INEX Microtechnology and Viper RF:** £2.4m DCMS funding awarded in December 2021 to develop a sovereign UK supply chain, manufacturing processes, and packaging solutions, for RF-GaN devices which are critical to 5G communications systems electronics hardware

Are there opportunities for strengthening different parts of the current UK semiconductor industry? What are the potential weaknesses and strengths of the UK semiconductor industry to meet future requirements of electronic device manufacturing?

- 4.1 The UK punches above its weight in power electronics and high frequency at systems integration level but not at semiconductor level. All countries that benchmark higher than the UK in electronics all benefit from far stronger supply chains.
- 4.2 There is a nucleus of businesses in the UK that are next generation global leaders in their fields. Just within NEAME alone, there are a number of companies that use new materials such as diamond, graphene and other 2d materials, metal oxide, organic and polymer materials: all of which bring or require new processes and fabrication capability. PragmatIC in County Durham is a prime example of this. Other companies include Evince, Kromek, Smartkem and PowerRoll.
- 4.3 We are at an inflection point where the UK has a unique opportunity to establish a supply chain in order to ensure that current technological advantage gained by companies such as these is translated into commercial leadership. UK has historically been poor at turning technology leadership into commercial leadership. Multiple industrial white papers published over the last 20 years have evidenced that the UK has an unenviable track record of fostering major enabling innovation that is subsequently lost to the rest of world.
- 4.4 Better access to finance - both private and public funds - is critical, as this will in turn drive job creation and skills development. Policies and fiscal incentives to stimulate and grow the availability of capital (CAPEX and growth) to encourage levelling up would be very welcome.

Specific areas:

- i. Regional re-balance in attracting investors from the golden triangle. Deal flow for SMEs headquartered in the North East represents 3 percent of all deals and 1 percent of venture capital investment flow in the UK. Incumbent VCs are small and have

generally had to rely on public/private backed EIB loans ill-suited to patient capital needs. To be clear, NEAME is not advocating major investment in 'centres of excellence' but instead a policy of support that facilitates companies and organisations in the region collaborating through government leveraged enablement in much the same way that Regional Development Agencies and development corporations were able to. It is worth noting that the North East stood out as the most successful area in the country to benefit from this type of intervention.

- ii. Investing and nurturing innovation in a sovereign semiconductor supply chain is important. The economic multiplier effect that the technology can have on the supply chains is considerable. In our region, we can demonstrate how it can create jobs, drive innovation, and secure independence from Asian and US suppliers who might otherwise limit the development of vertical markets critical to the future prosperity of the UK.
- iii. Significant sources of private investment are generally not from within the North East, and not even from within the UK for a number of high growth disruptive technology businesses. There is very little support for early-stage industrialisation and scale-up which requires larger amounts to be meaningful. This is exacerbated in English regions by the lack of leveraged funding enjoyed by devolved nations. The National Security and Investment Act 2021 also adds to this challenge on two fronts:
 - a. ability to raise the scale of finance required that is already not forthcoming from within the UK,
 - b. constrain exit strategies for many businesses in the sectors covered by the Act and therefore the value of those businesses cannot be maximised.
- iv. Innovate UK continues to have a role to play, but is becoming more conservative and bureaucratic preferring to back perceived safer, closer to market, incremental innovation. While grant interventions for SMEs are typically 60–70 percent, actual out-turn levels are closer to 35-40 percent. Because this information is no longer captured, SMEs' contribution to innovation continues to be consistently undervalued. These levels are significantly below equivalent intervention mechanisms in most of the developed European nations.

**In which industries does the UK not have an end-to-end semiconductor supply chain?
Are there any opportunities for these supply chain gaps to be filled within the UK?**

- 5.1 Semiconductors facilitate and enable downstream businesses to deliver innovative applications and services using state of the art semiconductors. There is an opportunity to pull through technologies where the UK can be global leaders. Emphasis on investing downstream innovation that will pull through disruptive new semiconductors.
- 5.2 There are both industrial and consumer application markets that can be developed such as quantum sensors for biomedical monitoring. At present,

there are few 'top end' integrators in the UK supply chain, but the region is good at developing enabling components such as RF amplifier chips or circuits or low energy displays. The opportunity is there to develop verticals around these domains.

- 5.3 Automotive is a major economic contributor in the North East. The region has gained substantial investments in vehicle electrification businesses such as Turntide and Hitachi as elsewhere in the UK. This has the potential to be a significant market for SiC and GaN.
- 5.4 Defence, security, medtech, space, energy and telecommunications are also sectors that are growing within the region with the potential to collaborate on developing and utilising these new semiconductor technologies.
- 5.5 There is a role of government procurement and regulatory frameworks to accelerate adoption of innovation. This will help British innovations to have early adopters in the home market and enable scale up by being successful exporters. The issue of government procurement is also linked to developing and retaining sovereign capabilities which is particularly important in today's world where the fragility of supply chain is a major risk during scale up phase of businesses.

[How can the Government strengthen semiconductor research and innovation? Are there any current areas of weakness in the present Government strategy to semiconductor innovation? Is there effective communication between the various stakeholders within the UK's semiconductor ecosystem?](#)

- 6.1 There has been an improvement in the way Universities have tried to align with industry needs but the way their ranking works is still at odds to industry. There is still an overemphasis on publication of research versus impact.
- 6.2 Initiatives such as ARIA, currently in hiatus, offer the potential catalyst to an exciting stream of high risk and high reward innovative businesses in the semiconductor space. It is rumoured that UKRI is seeking to absorb the remit of ARIA. We see this as a retrograde step to driving innovation in the UK as the support must be step change innovation and not incremental change.
- 6.3 On average, there is a 15-20 year gestation period for hard-tech businesses, as is reflected by a number of the 'early stage' businesses in the NEAME community that were founded in the 2000s that are only now coming to fruition as the emerging next generation electronics businesses. UK venture capital investors typically look to have a 5-10 year horizon exit, and do not have the funds to drive companies into Series C and above rounds instead going for exits or passing over to foreign investment that sees technology going offshore.
- 6.4 Many 'deeptech' investment sectors have become highly commoditised in the deal process, such as fintech/AI where they have a model from which pitches are benchmarked against. Hard-tech does not sit comfortably with this requiring extensive expertise to undertake due diligence. In UK VC, only 20

percent of staff have direct start-up experience which contrasts greatly with 80 percent in the US. When these factors are combined, UK investment culture and environment does not support and enable hard-tech start-ups to flourish in this country.

[Does the UK have the required skills, talent and diversity to be able to boost its current semiconductor industry and to respond to future disruption?](#)

- 7.1 To sustain growth, we need to develop and train talent locally at a rate of hundreds per annum. Regional HE and FE colleges are not currently equipped to provide the intervention required in terms of both curriculums on offer and infrastructure to deliver some of the training required – in particular, practical hands-on semiconductor manufacturing and advanced programming skills. NEAME has been working with Business Durham and the Institute of Technology in Durham to develop a roadmap for how this could be addressed, and this is one area where direct government intervention would be beneficial.
- 7.2 For SMEs, training of graduates and apprentices is recognised but retention is a major issue driven by the scarcity of skilled people. The current six-month incentive does not go far enough in mitigating the risk that SMEs take when recruiting and equipping people with those initial skills valued in the wider job market. For defence and security applications, there are also associated issues if there is not sufficient UK talent available to provide the workforce.
- 7.3 Visa applications for talent has also been a challenge, particularly in relation to receiving responses and speed for processing applications. There is a considerable cost for SMEs recruiting through this route.

[What are the potential national security concerns or vulnerabilities in our semiconductor industry? How should the UK collaborate with the United States and European Union? What are the ramifications on other industries and the wider economy within the UK?](#)

- 8.1 For space and defence sectors, over 60 percent of electronics include semiconductor parts and are subject to ITAR restrictions. This is not a sustainable position for the UK to maintain but the solution is going to take one to two decades to resolve and needs a governmental level plan that is capable of extending to this horizon.

[Is the Government currently providing the clarity and direction required to enable growth and security in the semiconductor industry? Are the right governmental organisations involved with ensuring effective development of our current semiconductor industry to thrive in the future?](#)

- 9.1 Most NEAME businesses are unclear which department is leading. General consensus is that BEIS is the natural home to lead on the strategy.

