The Aerospace Cluster Strategy
2007 to 2017

Issue 1

This document is produced on behalf of the Northwest Development Agency to provide a structured approach to the development of the regional aerospace industry which has significant importance to the regional economy. Any issues relating to this document can be addressed to:

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1. The aerospace industry in the North West

1.1. The Vision

The development of a world competitive industry, capable of competing in a global market: An industry that has a highly skilled workforce with an innovative culture based on knowledge generation, supported by an educational framework to support skills development needs at all levels. To maintain and grow an industry, with visionary research and technology development capability, delivered through an integrated academic/industry partnership.

1.2. Statistics

The aerospace industry in the North West has a significant mass based on historical factors. It is predominantly airframe and aero engine system and component manufacture in support of three close coupled primes. Aero engine products support Rolls-Royce which produces the fan systems for its current range of engines. The influence of Airbus is based on airframe component manufacture. BAE Systems is the centre of military aircraft design and manufacture in the UK although, with Typhoon, we may have seen the last manned fast jet, assembled completely in the UK.

There is a small Maintenance, Repair and Overhaul capacity (MRO) in the region including engine overhaul and maintenance as well as MRO support. For the purpose of this document, it is included as part of the whole 'Supply Chain' of the regional aerospace industry.

BAE Systems, Airbus Industrie and Rolls-Royce are the main providers of work into the regional supply chain, with the others such as the Hyde Group, Aircelle and Assystem adding a significant element. Contractors to Rolls-Royce such as RLC Callender and Silcoms, carry out work for other engine manufacturers.

Key stakeholders in the regional aerospace industry:-

- North West Development Agency
- Sub Regional Partners (e.g. Lancashire Economic Partnership)
- Society of British Aerospace Companies
- Primary companies (e.g. Airbus Industrie, BAE Systems, RR)
- The aerospace supply chain
- Higher Education and Further Education Institutions (e.g. NWUA)
- Schools and colleges
- The Manufacturing Institute

- Learning Skills Council, Regional Skills Partnership, SEMTA
- North of England Excellence, Business Link
- UK Trade & Investment
- North West Community

The statistics quoted are based on a study contract issued to the University of Manchester, School of Business in July 2007.

The Airbus facility at Broughton is within three miles of the Cheshire border and therefore has a significant influence on the North West supply chain and employment and has an impact on education capacity and investment in the North West.

Aerospace is a priority sector within the Regional Economic Strategy.

Based on 2006 data

North West Aerospace GVA/employee	£73.5k
Average UK Aerospace GVA	£104.3k
UK Aerospace turnover 2006	£19.8 billion
North West Aerospace turnover	£6.3 billion
Airbus Turnover (Broughton)	£1 billion
North West aerospace employees total	48.5k
North West Aerospace GVA total	£3.56 billion (3.2% of regional GVA)
North West GVA total	£111 billion

Approximately 60% of Airbus employees live in the NW region which equates to circa 4200

Airbus Broughton GVA/employee	£129k
BAE North West GVA/employee	£116k

NB: Above figures taken from Aerospace Cluster Mapping Study 2007 produced by The University of Manchester Business School. The full study will be issued as an addendum to this report on completion.

1.3. Skills

The level of skills in the industry is high, typically level 3 (technician) and above. The average GVA in the regional industry is some £73,000 compared to the regional average of £15,500[1]. The changes in the industry, such as the use of lightweight non-metallic composite materials, the need for advanced skills such as systems and virtual engineering, environmental pressures and the need to move to a knowledge based supply chain to adapt to the challenge of unmanned systems, will put pressure on the need to improve skills to retain the industry in the region. High level GVA jobs are

[1] NWDA Regional Intelligence Unit

difficult to create and attract therefore the industry needs to maintain and develop a knowledge based industry. Inward investment is attracted to centres of knowledge, therefore the planning of the structure of the cluster through skills development, becomes the vital component in creating the appropriate conditions to develop the cluster.

The regional structures to manage skills development are based on:
- The North West Science Council aerospace sub group priorities.
- The Sector Skills and Productivity Alliance Process setting regional skills priorities based on the SEMTA Sector Skills Agreement, the national framework for skills definition in aerospace and engineering.

1.4. Infrastructure

The standard of infrastructure within OEM's is generally high but deteriorates further down the supply chain. East Lancashire has the most severe infrastructure issues. Many SMEs occupy old mills vacated in the decline of the cotton industry. Whilst providing relatively low cost accommodation, they are unsuited to the development of modern lean manufacturing methods, hinder growth and contribute to a negative image of the industry. The Samlesbury Regional Aerospace Park will provide high grade accommodation for a limited number of companies, but this will not fully address the issue of a lack of modern affordable infrastructure available to SME's in the supply chain.

An understanding of the demographics of skills population working within the region, and commuting outside the region, is required to effectively plan significant restructuring projects which will increasingly take into account transport and carbon footprint impacts.

1.5. IT Infrastructure

The technology of aerospace demands comparatively high levels of IT investment, but this varies through the layers of the supply chain. OEM's and Tier 1 companies require sophisticated integrated design through manufacture and through life support systems. The globalisation of the industry demands capabilities in virtual engineering with the ability to transfer data internationally. Lower down the tiers the level of capability decreases but all companies operating in the supply chain require the ability to accept digital data. Computer based production and business control systems are required at all levels.

Within the aerospace industry the management of data, both down and up the supply chain, is a significant problem. Aircraft are designed on different versions of software, paper drawings are still in use. The volume of data required to be cascaded within the supply chain is extremely high and complex.

The ultimate goal is to have a complete through life supply chain model for a specific system, for enhanced business control. The Boeing Corporation is known to be working on this highly complex problem which is a systems engineering/virtual engineering issue. This process supports the Boeing 787 variant development. (Reference 3.2 Innovation and Systems Development).

1.6. Processes

The industry demands detailed levels of process control throughout the supply chain due to the safety critical nature of the industry. Traceability from materials through to finished article use is a requirement throughout the life of a system. The industry has an approval process operated by the OEM's which is essential for companies to operate in the supply chain. The desire of OEM's to reduce direct supply chain interfaces is creating the need for sub tier approval processes. In civil aviation, the Civil Aviation Authority is responsible for defining processes relating to civil aircraft manufacture and operation.

The SBAC Supply Chains of the 21st Century, SC21, has as a key goal, in the streamlining of accreditation to reduce the number of quality audits and checks.

1.7. Innovation

The region's main expertise is in airframe design and manufacture and is based on build to print manufacture. Consequently innovation within the supply chain has been restricted. The move by the OEM's to restrict direct interfaces may have an impact, particularly on those companies moving towards design/manufacture capability, and is likely to generate more innovation at the higher sub tiers.
Whilst BAE Systems is the UK's lead in terms of advanced autonomous air vehicles (e.g. the Taranis is the largest UAV project in the UK), industry links with academia are limited, particularly within the SME community, and in fact innovation within SME's is limited. The reasons for this are varied but it is clear that the outputs required and measured by universities from research and technology carried out within universities, are different to the outputs required by industry. The answer lies in more industry led programmes and there are signs that this process is starting to develop. The North West Composites Centre at the University of Manchester is involved in the development of new composites manufacturing processes.

The NWCC is a key asset as part of a fully co-ordinated industry approach to developing innovative composite capability and needs to be at the heart of a regional composites strategy, given the accelerating demand for lightweight materials in aerospace and other sectors.

The Business Link organisation has been tasked with the sign posting of skills and innovation services, particularly to the SME's in the supply chain. This will need to be supported by robust innovation assessment and management tools.

1.8. The Supply Chain.

The aerospace supply chain, predominately based on airframe and component manufacture, is considered to have significant depth within the region. It has been organised in a traditional way with the main providers of work, the OEM's, having a significant number of direct interfaces at various tiers of the supply chain. The OEM's however wanted and needed a supply chain restructuring where the numbers of direct interfaces were drastically reduced, and the direct interfaces would be required to manage much larger packages of work. In fact the OEM's wanted a complete supply chain restructuring with fewer tiers, clearly defined tiers and companies who could strategically position themselves in the supply chain. The region has a real need to transform the supply chain to a close coupled, world competitive cluster with common language, values and understanding. The majority of the NWAA activity is centred on this goal through the NWAA Supply Chain Excellence Programme (described in detail at 3.1.2.).

The supply chain is largely based on metals and the transition to composites by the industry demands a specific regional strategy to ensure the retention of a substantive industry critical mass. *(Reference 3.2.5., Regional Composites Strategy).*

1.9. Marketing Strategy and International Trade.

The North West is recognised as the largest single Aerospace centre in the UK and one of the four largest centres internationally with an estimated one third of the UK total of combined turnover.

Globalisation of the aerospace industry has been moving forward at a significant pace with the development of worldwide partnerships by the primes, supply base contraction for integrated solutions, indigenous growth of low-labour cost markets and offset, all playing a part.

From the beginning of 2002 the NWAA developed a partnership with the UK Government's trade promotion network, UK Trade & Investment, through the secondment of a member of staff to the Alliance as an International Trade Manager. This has proved invaluable in enabling the Alliance to deliver a range of support activities including outward and inward missions, trade shows, seminars and workshops, provision of market intelligence and opportunities and one to one company support – all using the global and local expertise of the UK Trade & Investment network and tailored to meet the specific needs of the aerospace sector in the region.

Recent academic research has proven that engaging in overseas trade stimulates competitiveness and that those companies that are internationally active are generally more successful. Regional supply chain companies tend not to seek global business, but seek to win business from mainly regional sources of work. Few have international marketing strategies.

However within the aerospace sector specifically, there are a number of distinct reasons why it is becoming not only desirable but vital for companies' long term success to think and act internationally:

- Like the automotive industry, aerospace is becoming more global at an accelerating rate. Few aircraft (except the smaller business aircraft, trainers, air taxis etc) are made in one country.
- More countries are acquiring or developing a substantial aerospace capability e.g. China, India, Malaysia, Japan, Brazil.
- Drastic changes in prime procurement, on a global basis, are increasingly requiring integrated systems demanding an extension of supplier capabilities and a partnership approach to deliver integrated solutions at minimum cost, sharing development and risk responsibilities. The primes want to deal with fewer yet more 'knowledge based' suppliers who can meet the ever-demanding standards of excellence. To be able to meet such requirements in a global arena it is becoming increasingly necessary to engage in global partnerships not only to expand scope for capability extension but in some cases to satisfy preferences for indigenous input.

- The need to reduce manufacturing costs and to access new markets, is driving more primes and their 1st tier contractors to low labour cost sources of supply e.g. Malaysia, an issue which will become magnified by EU enlargement and the increasing sophistication of the developing markets. Suppliers further down the chain need to adjust to these shifting business patterns e.g. explore opportunities for trade with the new "customer" or consider some form of strategic alliance or technical collaboration.
- Growing overseas Offset commitments on the primes are also shifting manufacturing to developing markets. Again down stream suppliers need to address the "customer" move as above.
- Trading in dollars is increasing pressure on UK industry (ref. 1.10 Finance).

There is a need to formulate strategy in developing effective international partnerships to penetrate growth markets and expand international trade. To evolve this strategy, consideration should be given to:-
To strengthen the above the NWAA will have access via the UKTI network to include

- Market research and access to market advice.
- Information on opportunities and sales leads
- Financial support for in-house overseas research, missions (inward and outward) and overseas exhibitions/shows.
- Liaison with a wide global network of partners' e.g. SBAC/DMA, other regional cluster organisations, overseas posts.
- Increase access for companies to overseas buyers and suppliers
- NWDA liaison for cluster development, funding stream and inward investment interface.
- Access to companies, prime, 1st tier and SME and their experience/role in procurement, including Offset.

International support should not be seen as a stand-alone operation within the Cluster organisation, but one with constant interface with most other roles, notably supply chain, marketing and similarly it should be an essential part of the delivery of the Cluster's Strategy as a whole with operational interface with external partners to that Strategy whenever appropriate.

1.10. Finance.

The dollar is the normal dealing currency of the civil aerospace industry although currency issues also impact military programmes. The exchange rate of the US Dollar to Sterling and the Euro has a significant effect on profitability and the retention of and capacity to win business for the supply chain. This in turn impacts strategies of the higher levels of the supply chain in reviewing sources of manufacturing to leverage currency effect. The current weakness of the dollar is a significant issue and there are signs that dollar impact is being cascaded to lower levels of the supply chain to mitigate risk at the higher tiers. This in turn puts financial pressure on the lower and financial weakest elements of the supply chain.

Private Venture finance companies are showing positive signs of targeting aerospace as an investment opportunity. For the supply chain this may prove an attractive source of growth funding.

2. Cluster Strengths, Weaknesses, Opportunities and Threats.

2.1. Strengths

2.1.1. The presence of BAE Systems, Rolls-Royce, and the close proximity of Airbus, in the region. In particular BAE provide a centre of excellence and capability in military aircraft from concept through manufacture and support for military aircraft, and provide the main source of systems engineering capability.

2.1.2. An established manufacturing infrastructure with appropriate skills based on the core regional activities of airframe and aircraft engine component manufacture.

2.1.3. A high concentration of Universities in the region.

2.1.4. The number of major defence platforms manufactured in the region, giving the potential to exploit systems engineering as a core capability.

2.2. Weaknesses

2.2.1. The lack of world competitive companies, capable of supporting the primes in the management of large work packages based on risk share (e.g. GKN, Spirit).

2.2.2. The lack of major composite manufacturing capability among subcontractors. BAE Systems has a significant capability in composite manufacturing at Samlesbury for its military aircraft programmes and do support the civil market in composites manufacture and design.

2.2.3. The lack of major sub-system design and manufacturing capability. Examples such as radar systems, engine control systems, flight control systems etc are relevant. There is no presence from the main sub-systems suppliers such as Smiths Industries (now part of General Electric), Goodrich, Meggitt etc, except for component manufacture (Smiths Aerospace ((now Unison Engine Components)), and Goodrich).

2.2.4. The lack of a substantial electronics sub-contracting industry. Most electrical/electronic componentry is supplied from outside the region.

2.2.5. The lack of design capability outside of BAE Systems (Warton, Samlesbury and Woodford). Design companies have a presence in the region, namely Assystems and Morsons.

2.2.6. A limited level of aerospace research in the regional universities. Whilst the universities in the region have significant capability, the level of aerospace research is low.

2.2.7. There is limited hard metal machining capability in the region.

2.2.8. The low grade infrastructure occupied by some companies in the supply chain. This limits efficiency, growth and expansion.

2.3. Opportunities

2.3.1. The exploitation of BAE Systems, Warton, lead capability in autonomous vehicles.

2.3.2. Capitalising on the skills base in the region. The skills in the industry are predominately level 3 and above.

2.3.3. Developing focused inward investment opportunities based on the skills of the region. Promoting new infrastructure and associated inward investment through for example, the Samlesbury Regional Aerospace Park.

2.3.4. Developing enhanced skills and capability, particularly Virtual/Systems Engineering based on the number and variety of defence system platforms as well as civil aircraft systems and nuclear power facilities in the region.

2.3.5. Exploiting the University of Manchester/Bolton/Liverpool/Lancaster North West Composites Centre to develop new advanced flexible materials technologies for aerospace and advanced engineering.

2.3.6. Creating a 'super cluster' of world competitive aerospace companies through the NWAA Supply Chain Excellence programme with common language, shared vision etc.

2.3.7. Exploiting the development by a major regional company, of an advanced composites technology.

2.3.8. Developing a robust, cross sector composites strategy which attracts inward investment in creating 21st century composite component design and manufacturing capabilities.

2.3.9. The attraction and development of advanced technology companies to the region.

2.3.10. Exploiting the legacy business of BAE Systems military products.

2.4. Threats

2.4.1. One of more of the Primes/OEM's (Airbus, BAE Systems, and Rolls-Royce) exits the region.

2.4.2. The region fails to establish a viable composites industry based on technologies and capabilities at a time of increasing growth in use of the materials.

2.4.3. Environmental pressures increasingly impact the sustainability of current civil aircraft manufacture (i.e. reduced work).

2.4.4. Failure to plan the transition to a Virtual/Systems Engineering based industry and economy within the next two years. The nature of autonomous systems is such that their manufacture may be low technology.

2.4.5. Failure of the NWAA SCE programme to create world competitive companies in the next 4 years.

2.4.6. Emerging capabilities in China, India and Russia, increasingly take work share from the UK supply base.

2.4.7. The shortage of skilled workers in the region compared to the workload.

2.4.8. Poor infrastructure occupied by some companies in the supply chain.

2.4.9. The trading of aircraft in US dollars and the impact of a low value dollar on UK industry.

2.4.10. The lack of focussed investment availability to support opportunities with reasonable payback periods.

2.4.11. Doing nothing to realise to vision at 1.1.

2.1 Building on Strengths		
Strength	Action	Status
2.1.1 The presence of BAE Systems, Rolls-Royce, and the close proximity of Airbus, in the region. In particular BAE provide a centre of excellence and capability in military aircraft, and provide the main source of systems in engineering capability.	Using the NWAA SCE Programme, develop a 'super cluster' capable of meeting the needs of the primes. Facilitate collaboration among the primes on skill development and capacity planning in the supply chain.	The NWAA SCE Programme is active. Ten companies are currently participating. Managed through the steering committee supported by the primes. BAE & Airbus actively discussed regional capacity.
2.1.2 An established manufacturing infrastructure with appropriate skills based on the core regional activities on airframe and aircraft engine component manufacture.	Assess the skills capacity and need in the region and the capacity to deliver education. Review future product life cycle needs to adapt to changes in technology and market pressures.	SEMTA unable to furnish skills gap data. Reference actions at 4.1, competitiveness, actions 6 & 7.
2.1.3 An extensive university base.	Develop academia/industry groups to deliver Science Council strategy aligned to the needs of the industry. Encourage SME's to work with Universities and vice versa.	Active groups working on autonomous systems, virtual/systems engineering and composites via the NWCC.
2.1.4 The number of major defence platforms manufactured in the region giving the potential to exploit systems engineering/virtual engineering as a core capability.	Assess the SE/VE capability in the region. Assess the future need. Develop an action plan. Explore opportunities to develop complimentary expertise in support of the main players.	The systems engineering capability is currently dominated by the Primes. University of Liverpool bid for a VE/SE centre via NW Science Council planned for Oct. 07. Funding needed to carry out assessment.

2.2 Addressing Weakness

Weakness	Action	Status
2.2.1 The lack of world competitive tier 1 companies, capable of supporting the primes in the management of large work packages based on risk share. (GKN, Spirit, are examples of tier 1 companies).	Support inward investment activity and infrastructure investment to create the conditions for inward investment	Planning permission for the Samlesbury Regional Aerospace Park is not yet in place.
2.2.2 The lack of major composite manufacturing capability among subcontractors. BAE Systems has significant capability in composite manufacturing at Samlesbury for their military aircraft programmes and support the civil market in composites manufacture and design.	Develop a regional composites strategy through a working group of industry led stakeholders. To include academia.	NWDA support for the action to be started October 2007. Mapping current activity started.
4.2.3 The lack of a significant electronics sub-contracting industry related to aerospace needs. Most electrical/electronic components are supplied from outside the region.	Generate investment opportunities that differentiate the NW from other regions in what can be offered e.g. reduced time to market.	NWDA to lead as part of inward investment/RES strategy.
2.2.4 The lack of aerospace design capability outside of BAE Systems. Design companies have a presence in the region, namely Assystems and Morsons.	Understand and match the needs for military and civil aerospace design. Ensure adequate education provision for aerospace design skills.	The case for the VE/SE centre will be made in October. HLSP funding obtained for composites design course at level 4.
2.2.5 A limited level of aerospace research in the regional universities. Whilst the universities in the region have significant capability, the level of aerospace research is low.	Establish research capability to match industry needs through strategic and long term planning based on technology drivers.	Engagement with academia is mainly based on expertise and not locational bias.
2.2.6 The low grade infrastructure occupied by some companies in the supply chain limits growth and capability development.	Undertake a mapping exercise to determine demographic data for infrastructure investment needs.	Mapping study underway. Co-ordinate with specific sub-regional activity such as the former Michelin site in Burnley.
2.2.7 There is limited hard metal machining capability in the region.	Support existing capacity with investment to facilitate growth.	Explore Private Venture Capital opportunities.

2.3 Opportunities

Opportunities	Action	Status
2.3.1 The exploitation of BAE Systems Warton lead capability	Work in the Science Council Autonomous	AS sub group formed and operational.

in autonomous vehicles.	Systems sub group. Develop an autonomous systems stakeholder map.	
2.3.2 Capitalising on the skills base in the region. The skills in the industry are predominately level 3 and above.	Create a culture of skills development in the aerospace sector based on creating a knowledge based industry.	The NWAA Supply Chain Excellence programme recognises this need and includes skill development as a core process. The development of Systems/Virtual Engineering capability needs further effort.
2.3.3 Developing focused inward investment opportunities based on the skills of the region.	Carry out a detailed assessment of the current supply chain structure and capability (ref. 3.1.3). Evaluate skills, pinch points and gaps.	The supply chain model is in the process of being populated within the NWAA. Analysis will require NWDA input.
2.3.4 Developing enhanced skills and capability, particularly Virtual/Systems Engineering based on the number and variety of defence system platforms as well as civil aircraft systems and nuclear power facilities in the region.	Analyse the education capacity for V/S Engineering, estimate the future need and develop an implementation plan. Engage with the key companies to understand future requirements.	NWAA to initiate discussion with the NWUA and seek sources of skills funding. Evaluate the knowledge gained from the VIVACE programme funded through the European Framework programme. Submit a proposal to the NW Science Council for a VE centre based on the Daresbury site. Explore synergies on VE with Daresbury.
2.3.5 Exploiting the University of Manchester Advanced Composite Centre to develop new advanced flexible materials technologies for aerospace and advanced engineering.	NWAA to act in a managerial capacity advising the NWCC management on outputs, one day per month. Review extending project management role between industry and academia. Exploit emerging technologies. Establish a regional composites stakeholder group to develop a coherent industry led regional strategy for composites.	NWAA supporting NWCC one day per month. NWAA to recruit additional staff to work on academia/industry interface, by October 07. Develop an ‘industry lead’ approach.
2.3.6 Creating a ‘super cluster’ of world competitive aerospace companies through the NWAA	Identify the key industry players. Align with SC21	10 companies on the SCE Programme, a further 6 identified. Programme, fully

Supply Chain Excellence Programme.		supported by the Primes and stakeholders. Fully aligned with SC21
2.3.7 Attracting advanced technology companies to the region.	Identify with key stakeholders via the NWDA the potential and opportunities.	NWDA to lead.
2.3.8 Develop a robust cross sector regional composites strategy.	Establish an industry led group.	Reference 2.4.2

2.4 Addressing Threats		
Threat	Action	Status
2.4.1 One or more of the OEM's (Airbus, BAE Systems, Rolls Royce) exit the region.	Develop a supply chain that is capable of supporting the primes and one that can survive and compete in a global market.	The NWAA SCE programme is designed to deliver a world competitive supply chain capable of self-sustainment.
2.4.2 The region fails to establish viable composites technologies and capabilities at a time of increasing growth in use of the materials.	Establish a stakeholder group to devise a regional strategy.	Action to be initiated in October 2007.
2.4.3 Environmental pressures impact the sustainability of current civil aircraft manufacture.	Support the SBAC lobbying activity for aerospace. Support the technology strands related to reduction of environmental impact.	SBAC sustainable aviation group established. RR lead on the more environmentally friendly engine. Develop lightweight materials strategy within the region.
2.4.4 Failure to plan the transition to a Virtual/Systems Engineering based industry and economy within the next two years. The nature of autonomous systems is such that their manufacture may be low technology.	**Reference 2.3 above.**	
2.4.5 Failure of the NWAA SCE Programme to create world competitive companies in the next 4 years.	Apply continuous improvement to the SCE process. Maintain industry involvement. Celebrate successes.	Ongoing
2.4.6 Emerging capabilities in China, India and Russia, take work share from the UK Supply base.	Maintain pressure on skills development. Develop a plan of action to progress to a knowledge based	SCE programme is delivering the programme for change. Need to plan for advanced skills

	economy. Develop a 'future view' group.	development.
2.4.7 The shortage of skilled workforce in the region compared to the demand.	Develop a plan via STEMNET and the SSPA, to attract young people to the sector. Develop adult apprenticeships. Promote activity to develop level 3 skills.	Action within the Engineering and Aerospace SSPA.
2.4.8 The trading of aircraft in dollars and the adverse exchange rate.	Consider processes to support aggregation and hedging.	
2.4.9 Doing nothing to achieve the vision at 1.1	Doing nothing is not an option. Continue to develop a world competitive industry with clear plans to build on strengths, exploit opportunities, overcome weaknesses and neutralise threats.	Use this strategy and action plan as the baseline for developing action.
2.4.10 The lack of focussed investment available to support opportunities with realistic payback periods.	Seek alternative investment mechanisms.	Review prospects and opportunities for private financial investment.
2.4.11 Failure to provide adequate modern infrastructure for growth.	Develop a needs and demand map in conjunction with sub regional partners.	Develop relations with sub regional partners. Obtain buy in to this strategy.

3. Cluster Development. The Needs of the Aerospace Sector.

3.1. Competitiveness Development

3.1.1. Regional Aerospace Skills Development.

3.1.1.1. Regional Skills Structure. Aerospace skills have been defined in the SEMTA Sector Skills Agreement, action plan for England, May 2005. The regional mechanism for co-ordinating the key stakeholders in the Engineering and Aerospace SSA, is the regional Sector Skills and Productivity Alliance for Engineering and Aerospace, chaired by the NWAA. The structure is at Figure 1.

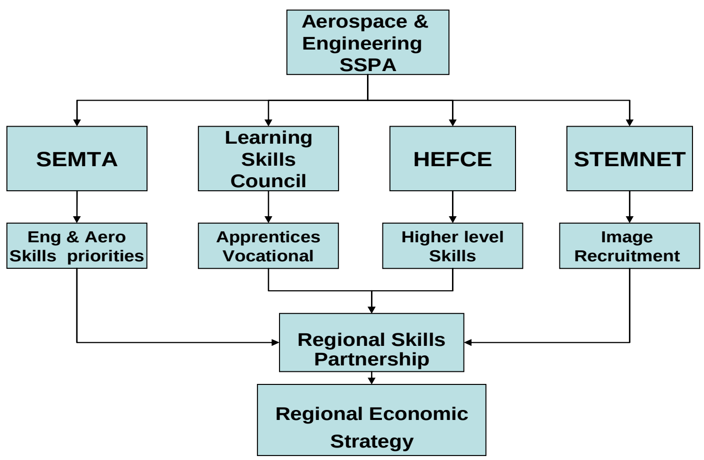


Figure 1

The E & A SSPA has been active for over two years but the process suffers from a lack of active resources to deliver the action plans. Other bodies are represented on the SSPA such as the National Skills Academy for Manufacturing (NSAM), Business Link, RDA etc. Whilst a process for ensuring the SSA is delivered, there have been achievements in identifying key skills priorities such as Systems Engineering and Composites training capacity.

The E & A SSPA is currently under review to establish a better process for managing the skills priorities, but a wider review of the SSPA process is now required.

Within the NWAA Aerospace Supply Chain Excellence Programme (ASCEP), the key SSA priorities have been further defined with Leadership heading a distinct prioritisation. *(Reference 3.1.2)*

There is a need to review apprenticeship schemes to confirm their fitness for the sector and to review the potential for adult apprenticeship schemes. These have received significant support from industry provided the schemes have longevity and are financially attractive to the target group. Given the lack of new entrants to the Advanced Engineering Sector, adult apprenticeships could be a valuable resource given a robust support scheme.

The introduction of the STEMNET organisation to co-ordinate activities relating to image and recruitment is vital. The plethora of schemes in this area is confusing to schools, the target audience and industry and STEMNET should bring much needed co-ordination and focus to a key area.

The Higher Education Funding Council for England operates the Higher Level Skills Partnership scheme, designed to fund industry led higher skills programmes, but not foundation degrees. Two bids from aerospace related to design of components in composite materials and manufacturing processes for composite materials, have been successful in receiving funding. The bids were a result of an industry led composites skills development group and the sector is keen to develop further, industry led processes of this type.

The OEM's are the predominant employers of graduates and should be the key link with universities on the fitness of higher education provision for industry, including reacting to new technologies with appropriate provision. Graduate recruitment by SME's is low.

The education provision in the region for Systems Engineering remains of concern and there is a requirement to assess current capability, the future need and a 'road map' to achieve the future need if we are to plan effectively for a transition to a knowledge based economy.

3.1.2. The NWAA Aerospace Supply Chain Excellence Programme

3.1.2.1. Rationale

For companies to survive and grow in today's aggressive business environment having world-competitive capability is not an option, it is a necessity. Companies need to develop strong and robust business processes and continue to improve these processes to remain competitive. It is also clear that loosely coordinated companies cannot compete with a well organised supply chain acting as a team. The North West supply chain must be integrated from the largest prime contractor to the smallest SME, with companies accepting responsibility for providing a total design, manufacture and support service that is 100% on time, 100% on quality and with all work taking place at the appropriate level (in terms of capability and cost) of the supply chain to ensure optimum cost with acceptable risk. In order for this to happen, key skills and processes within all companies will need to include; leadership, strategic business planning, project and risk management, manufacturing excellence (including LEAN), supply chain management and strategic "make versus buy" decision making, skills assessment and development, innovation, e-procurement and collaborative working.

Key aims of the NWAA ASCE Programme are to target accelerated GVA growth within the selected Companies and the creation of an integrated, structurally tiered Supply Chain capable of competing globally.

3.1.2.2. Building on the DNA of the NWAA Supply Chain Workshop Programme

The NWAA Aerospace Supply Chain Excellence (ASCE) Programme has been shaped by NW aerospace companies. It is built upon work with NW aerospace companies in 19 supply chain workshops delivered, in conjunction with AIRBUS UK, BAE SYSTEMS and Rolls-Royce, and with a passionate belief in the future prosperity of the aerospace industry in the North West of England.

In delivering a two and a half year supply chain workshop programme to some 150 companies in the region, the NWAA has understood the DNA that lies at the heart of the issues affecting the NW industry;

- In general, NW aerospace companies have not developed strong and rigorous business processes.
- NW companies are not collaborating to exploit synergies.
- NW aerospace companies have a huge potential to exploit productivity gains.
- Growth can be achieved in companies willing to drive towards business process excellence.
- There is a reluctance to change within the industry and this is the single biggest obstacle to improvement.
- There is a lack of understanding of the role of leadership and the need for strategic planning and change.
- Innovation is seen as high-risk and the processes for managing innovation, making better decisions and thereby mitigating risk, are not understood.
- NW aerospace companies are strongly dependent on the regional primes and there is limited understanding of global opportunities.
- The industry finds it difficult to set targets for Quality, Cost and Delivery and to benchmark itself against world-class.
- The industry is not exploiting the research and development capability in the North West HEI's.
- The industry would like a single point of contact for all business support services and a reduction in the variability of the quality of service provision.

3.1.2.3. Overview of the NWAA ASCE Programme

The ASCE Programme is a four year project and has been developed to provide coordination of existing business support in the region, to ensure quality of service provision and to minimize duplication. The ASCE Programme conforms to a Coordinating Model with existing suppliers integrated into a cohesive activity that will deliver business improvement and sustainability into the Regional aerospace supply chain (a "joined-up" approach).

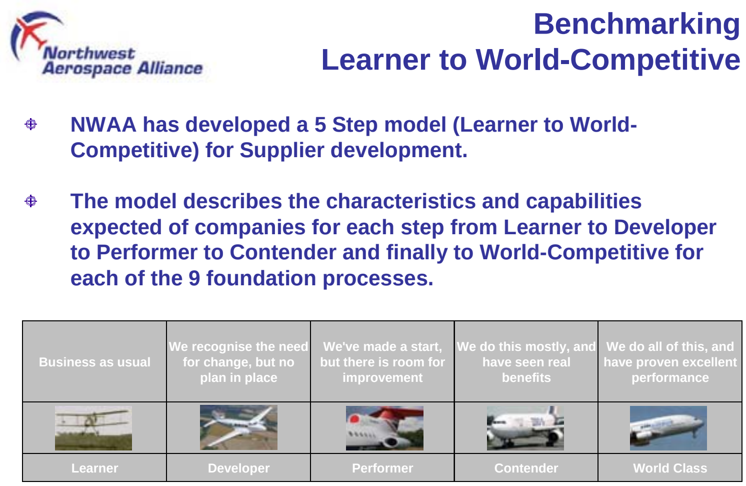
The NWAA's Aerospace Supply Chain Excellence (ASCE) Programme is the first coordinated approach to Supplier Development in the UK. A strong partnership of stakeholders has been developed to deliver the programme including NWAA, NWDA, three Aerospace OEM's (BAE SYSTEMS, AIRBUS UK and Rolls-Royce), the Society of British Aerospace Companies (SBAC) and business support organisations such as The Manufacturing Institute and North of England Excellence. The North West Regional Development Agency is providing new funding for the Programme, which currently totals £4.2 Million. In addition the OEM's are providing 24 Mentors, senior operational leaders, to work with participating Companies throughout their improvement journey. The companies on the programme are also committed to investing in their development. In total the NWAA ASCE Programme will invest over £8.4 Million in the development of a World-Competitive Supply Chain in the North West of England.

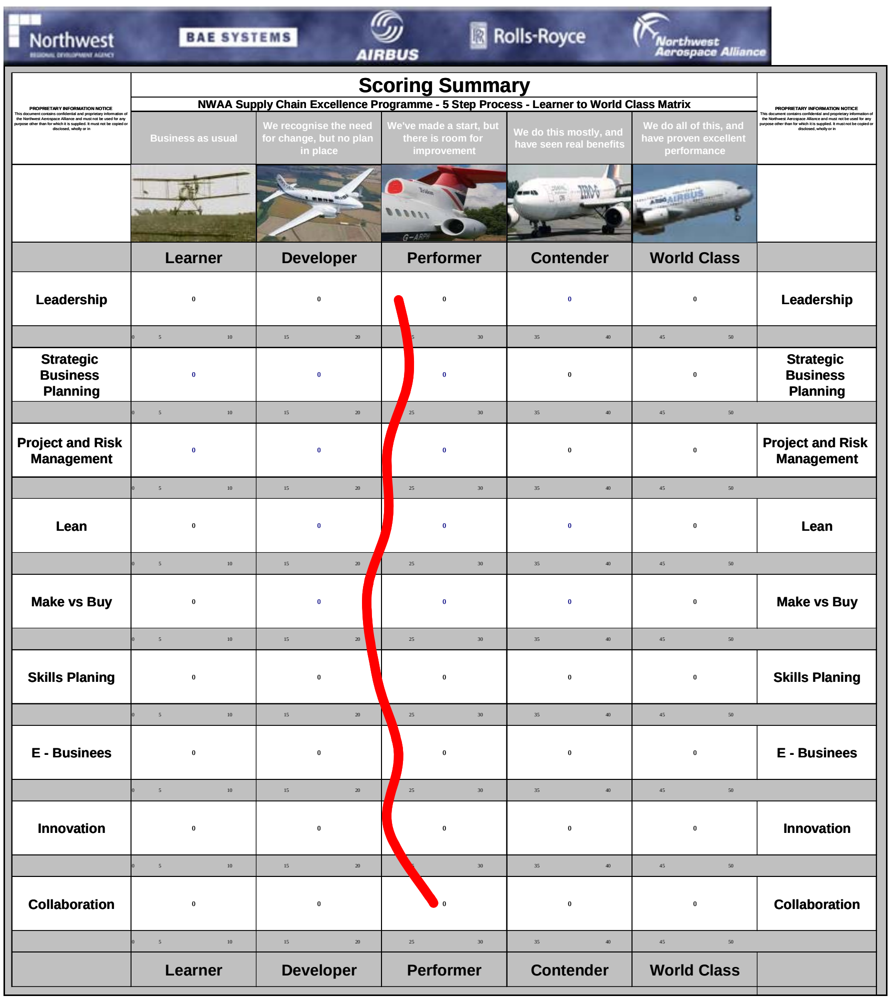
The NWAA ASCE Programme is closely linked to the Society of British Aerospace Companies' (SBAC) 21st Century Supply Chains (SC21) Programme.

The establishment of the National Skills Academy for Manufacturing (NSAM) will play a significant part in establishing a standards framework for manufacturing industry and the education/training provided through the ASCE is being established in collaboration with NSAM.

3.1.2.4. Results of the NWAA ASCE Programme

The NWAA ASCE Programme was formally launched in July 2006 at Farnborough International Air Show but did not receive Regional Development Agency funding until 1st November 2006. The first cohort of 5 companies (Hyde Group, RLC Group, Gardner Aerospace, John Huddleston Engineering, and PDS Engineering) formally joined the programme on 7th December 2006. The second cohort of 5 companies (APPH, Brookhouse Group, CML Group, Aerogistics Holdings and NW Engineering) formally joined the programme on 22nd March 2007. The third cohort of 6 companies (Senior Aerospace, Magellan, Apollo, Assystem, Hampson BHW and Silcoms have been invited to formally join the programme on 20th September 2007. The first 10 companies from Cohort 1 and Cohort 2 have now been benchmarked and the average result indicates performance in the Developer – Performer level. The objective of the ASCE Programme is to close the gap with World-Class levels of performance through a unique programme of Mentoring, Training and Coaching.





Scoring Summary

NWAA Supply Chain Excellence Programme - 5 Step Process - Learner to World Class Matrix

	Business as usual	We recognise the need for change, but no plan in place	We've made a start, but there is room for improvement	We do this mostly, and have seen real benefits	We do all of this, and have proven excellent performance	
	Learner	Developer	Performer	Contender	World Class	
Leadership	0	0	0	0	0	Leadership
	0 5 10	15 20	25 30	35 40	45 50	
Strategic Business Planning	0	0	0	0	0	Strategic Business Planning
	0 5 10	15 20	25 30	35 40	45 50	
Project and Risk Management	0	0	0	0	0	Project and Risk Management
	0 5 10	15 20	25 30	35 40	45 50	
Lean	0	0	0	0	0	Lean
	0 5 10	15 20	25 30	35 40	45 50	
Make vs Buy	0	0	0	0	0	Make vs Buy
	0 5 10	15 20	25 30	35 40	45 50	
Skills Planing	0	0	0	0	0	Skills Planing
	0 5 10	15 20	25 30	35 40	45 50	
E - Businees	0	0	0	0	0	E - Businees
	0 5 10	15 20	25 30	35 40	45 50	
Innovation	0	0	0	0	0	Innovation
	0 5 10	15 20	25 30	35 40	45 50	
Collaboration	0	0	0	0	0	Collaboration
	0 5 10	15 20	25 30	35 40	45 50	
	Learner	Developer	Performer	Contender	World Class	

The companies on the NWAA ASCE programme have themselves publicly stated why they feel the programme is unique;

- Common approach from the three main Primes, eliminating duplication of effort by both parties

- One Mentor as an interface with three customers, providing one clear message from the Primes.

- Subsidised, targeted training provision

- The Mentor provides a conscience and a conduit back to the customers creating a real two way problem solving environment

- Excellent benchmarking model based around sustained business improvement (through balanced scorecard) and not merely around Supply improvement

- Culture of objective targets and tangible results

3.1.2.5. Recommendations for the Future of the NWAA ASCE Programme

The NWAA ASCE Programme is a four year programme due to end on 31st October 2010. Any successor phase of the ASCE programme will be dependent on the achievements of phase 1 and the developing demands of the global industry. The NWAA will be working with the supply chain to develop any successor programme to build on the gains of phase 1 and the needs of the supply chain which will have been substantially reshaped (see 3.1.3) and will be continually adapted to meet the demands of new products emerging such as the Airbus A350, next generation single composite wing as well as the need to transition to a knowledge based economy.

3.1.3 The Aerospace Supply Chain tiering model

Supply Chain Tiering Evolution – The Aerospace Perspective

Studies of Toyota (especially in Japan) show hierarchal tiering structures with a select number or tier 1's working directly with Toyota, but also responsible for subsequently managing and developing their tier 1's (Toyota's tier 2's), who then manage tier 3's, a pattern repeated a further two or three tiers up-stream of Toyota as the OEM.

However, there are studies that show that supply chain structures are closely linked to product life cycles. For example, in white consumer/electrical goods where life cycles have lessened dramatically during the last 25 years, especially in the computer industry with the rapid introduction of new models, and even within the automotive industry with increased frequency of major derivatives and *'new'* products, it is becoming clearer that supply chains at new product introduction can be designed far easier than trying to re-shape an existing supply chain for a *'legacy'* product.

Within the Aerospace Industry, it is even harder to restructure the supply chain on certain products, mainly due to the proportionately higher length of product life cycles. For example, the Hawker programme is presently producing it's greatest ever delivery rates to customers in it's current 50+ year history; the A300 has been in production for 40 years; and the Single Aisle programme with over 3500 aircraft currently in the market will probably continue to sell in 10+ years time. With a high level of up front investment, both from the Supplier and from the OEM (in terms of aircraft assembly technology), as well as the service support requirements, results in many supply chains becoming somewhat *'rigid'*, subject only to longer-term, and smaller incremental changes, driven either by price or risk mitigation. This *'rigidity'* is further cemented if a supplier owns the technological IPR such as with ice protection, complex fly by wire avionics and fuel pumps: for once these have been fitted to the product it becomes practically difficult to remove/replace them from a live *'legacy'* programme.

Even when the IPR is with the OEM's, there are still a majority of components that become difficult to move because of the initial up front non-recurring cost investments (NCR's) such as new machines, launch-engineering and other infrastructural set up, that would have to be replicated, as well as re-financed, for any incremental mid-cycle supply chain re-design. Therefore, it is evident that the Aerospace Industry will always have to concurrently manage existing *'legacy'* products as well as *'new'* ones.

However, it is during the introduction process of new products where there is a possibility to major on supply chain reconstruction. Recent *'new'* programmes have seen heavier supplier investments through Risk Revenue Sharing Partnerships (RRSP), with a higher level of *'design-to-build'* requirements, whether from a systems or airframe perspective. This is best illustrated with the recent introduction of Boeing's 787, and with Airbus trying to emulate this philosophy with a differing supply chain construct on both the A380 and A400M; and with the A350, an even greater modular approach to Tier 1 packages.

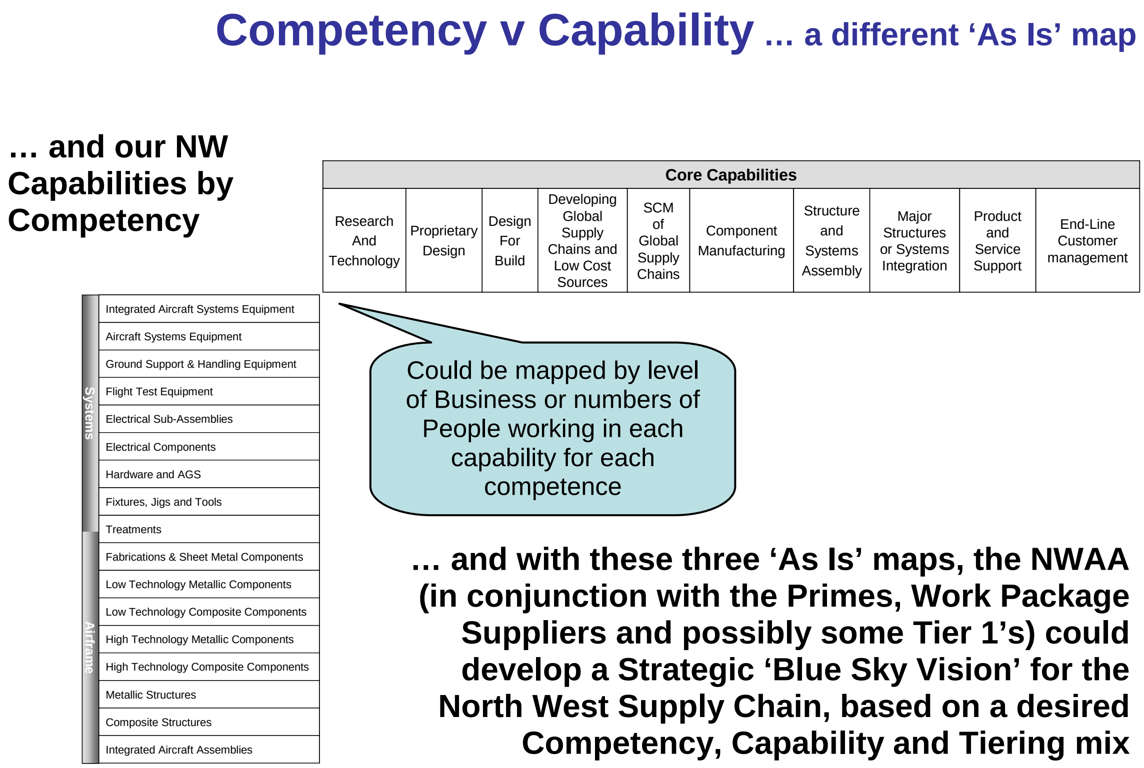
Hence, the aggregate effect of both concurrent *'new'* and *'legacy'* products sees the resultant evolution of a *'staggered tiering structure'*, where a hierarchal structure is still loosely evident, but where *'father-son'* as well as *'grandfather-son'* relationships become the norm. In other words, there are existing *'legacy'* tier 1's into Airbus, but on *'new'* products these tier 1's potentially become tier 2's and are integrated as tier 1 suppliers into an ever emerging breed of new *'Work Package'* suppliers.

Whether on *'new'* or *'legacy'* products, the industry will still see the support of these tiers by *'multi-tier'* suppliers (of goods or services) to one or more of these *'staggered tiers'*: for example Process Houses, Fastener suppliers, Raw Material stockists/suppliers and even Design Houses, could end up being direct suppliers to any tier of the resultant *'staggered teiring hierarchy'*.

Also, as the global environmental pressures continue to affect the industry, there will be other influences that will definitely start to affect the evolution of this *'industry tiering structure'*. For example, the current Airbus 'Power[8]' initiative will see sites being sold in conjunction with A350 sourcing decisions and ultimate investment requirements, and hence will be divested with the existing *'legacy'* supply chains 'in tow'. In addition, supply chains will be further influenced as a result of supporting offset/international-collaboration requirements, as well as the introduction of new low-cost sources.

Based on recent research in the Aerospace Industry that identifies that existing *'legacy'* tier 1's (of between 200 to 500 people) have procurement/supply chain organisations on average less than ten people. The research showed that 80% of what is currently supplied by these suppliers is 'made' rather than 'bought'; and there is now a realisation that current 'make v buy policies' will need to be readdressed to support the evolving model. Therefore, as with the Toyota model, there is a growing recognition that procurement and supply chain management of lower tiers is becoming more important and that the tiering would see existing *'legacy'* tier 1's not only losing their direct supply into OEM's on *'new'* products and dealing with new *'work package'* suppliers, but will also need to start to increase their influence on the next tier down as they develop their own core competencies.

In summary the Toyota model will (probably) never exist within the Aerospace and Defence Industry, purely based on the difficulty of redesigning supply chain structures during a mid-product life cycle, and that because these life cycles are very long in the industry, supply chain structures effectively become relatively *'rigid'* post the design stage of a *'new'* product.



3.1.4. Creation of a 'super cluster'

The region is influenced by three principle major companies, BAE Systems, Airbus Industrie and Rolls-Royce through its plant at Barnoldswick. Other significant influences are Aircelle and to a lesser extent Bombardier in Northern Ireland. These are work providers to the supply chain. Companies do not have to reside in the region to provide significant influence. Airbus at Broughton is within North Wales but its supply chain obviously does not recognise regional boundaries and around 60% of its workforce commute from English regions, mainly the North West.

All work providers, regardless of position in the tiering structure (ref 3.1.3) demand capacity in the supply chain and accordingly a set of behaviours that satisfy the increasing demands of the OEM's. The work providers have essentially common values and the SCE programme (3.1.2), which now is a main component of the national (SBAC) Supply Chains of the 21st Century (SC21) programme, is responding to the need to develop a new, close coupled, tiered supply chain with the capability to win work from any part of the global industry.

The commitment of BAE, Airbus and RR to the SCE programme and its principles is leading to significant changes in the supply chain. Capacity in the supply chain is critical to all work providers. That capacity needs to be planned and it is in the interests of the work providers to share information on capacity to avoid the 'pillaging' effect when demand is high. Skills in the region are finite and need planning to match current and future demand. An uncoordinated approach or 'self interest' approach, has been shown to create significant turbulence with the industry pillaging its own supply chain of core skills.

OEM's are now discussing supply chain capacity, particularly with respect to companies selected for the SCE programme. This is leading to the following transition from a random cluster (figure 2*)* to a focussed, close coupled cluster (*figure 3).*

SCE Cluster Development

Traditional Cluster

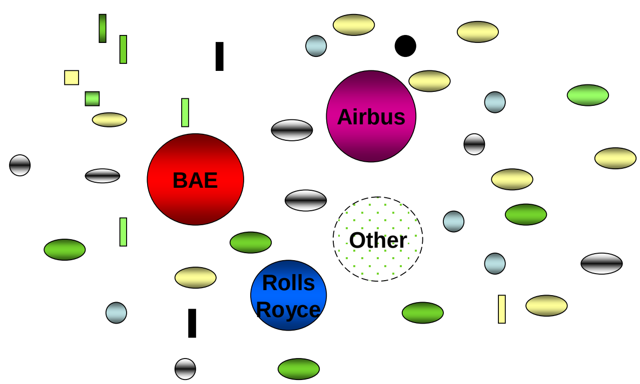


Figure 2

This is a random cluster with complex communication paths and little or no prospect of creating realistic models of skills requirements and capacity.

SCE Cluster Development

SCE Cluster

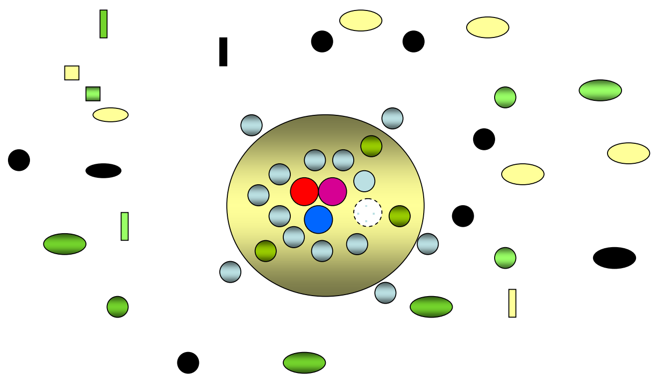


Figure 3

The centre group is the 'super cluster' of companies on the NWAA SCE programme, with the OEM's as the core group sharing information relating to the supply chain.

This grouping is sharing a common approach, common training, and common values and is starting to breakdown barriers preventing collaboration. It is also mapping into the tiering model described at 3.1.3. It will also provide the basis for cluster planning when it reaches a greater mass, specifically the planning of capacity and skills planning albeit on a Pareto basis, (3.1.5, 3.1.6).

Included in this 'super cluster' are HEI's and the required supporting infrastructure which would be the North West Composites Centre, Virtual Engineering Centre etc, and would include the composites strategy. It would also relate to any cross sector sub-cluster of companies involved with composites development. The key issue is to integrate HEI's and support structures into the cluster to achieve the integrated academic/industry focus.

Companies on the fringe of an aerospace 'super cluster' can follow the ASCE model and will be supported through the aerospace cluster and Business Link business support model. However, the need for culture change to 'world competitive' knowledge led is essential for any advanced engineering company.

3.1.5. The manufacturing capacity model.

It is vital to the industry that a realistic tiering model is understood and accepted by the industry. The model developed by Airbus and defined at 3.1.3 above, clearly defines a tiered structured industry from concept through to disposal, and allows us to populate the model with regional companies. Given basic knowledge from the OEM's of the work to be put into the supply chain, it is possible that a regional capacity at the various levels, technologies and tiers can be assessed. Based on this knowledge, industry investment in capacity would have more rationale but would need to take into account any capacity required for non regional and international business. A proposal for funding will be submitted for 3.1.5 & 3.1.6.

3.1.6. The regional skills needs model.

Aerospace as part of the Advanced Engineering capability in the region, relies on high level skills to sustain itself. Typically these skills are level 3 and above with little demand for level 2 in mature companies. The decline in apprenticeships and young people in general entering the industry, is leading to a higher aged workforce than is desirable and a shortage of skilled workers at a time when demand is at an unprecedented level. Given these factors it is vital to understand the skills gaps in the industry over the next five years say, in order to stimulate new entrant demand and to create appropriate training capacity in FE and HE establishments. The assessment of skills gaps is vital and this can only be achieved by understanding the workload and work content to be subcontracted into the region by the primes in detail, defining the capacity needs as at 3.1.6 above, and predicting the skills needs. If this can be achieved, the region may establish control levers on skills requirements and reduce risk to the industry by forward planning for major programmes.

Given the rate of technology development, Universities will need to consider their reaction time to the need for high level education that matches the needs of industry. Typically it takes five years to deliver a graduate to industry from design of a course to graduation. Adding three years to developing experience and we have timescales of around eight years. The design of Airbus A350 from concept to prototype is around four years.

3.2. Innovation & Systems Development

3.2.1. Science Council Strategy (Aerospace).

There needs to be activity in the region to enable the exploitation of emerging aerospace technology trends to ensure the sector’s growth in contribution to the region’s economy.

Priorities for the region from the North West Science Council, Aerospace sub group are to:

3.2.1.1. Remove the technology barriers preventing the industry from moving forward, for example with respect to autonomous air systems and development of an environmentally friendly engine.

This is being addressed through the National Aerospace Technology Strategy (NATS) and the region needs to engage with this process to derive maximum benefit. Engagement in the NATS programme for the region is led by the NWDA.

3.2.1.2. Confirm and exploit those emerging technologies which will have the greatest economic impact on the NW aerospace sector in the future. Areas identified by the sub-team are: Autonomous Air Systems, Systems Engineering *and Integration, Niche Composites for Civil aerospace* and *Virtual Engineering.*

A bid for funding for Systems Engineering under the Northern Way project, to assess current capability in the North of England, the future need and an action plan to reach that level, was rejected and actions will now be taken forward on a North West

Regional basis. The North of England has the majority of the major defence platforms integration and the transition through this process to a knowledge based economy is still a crucial issue, as identified in the Defence Industrial Strategy (December 2005). Consideration of a case for North West funding is under consideration. *Reference Action Plan A.*

A proposal for an embryonic Virtual Engineering Centre of excellence, encompassing common issues with respect to Autonomous Systems, is in preparation, led by the University of Liverpool with support from the NWAA, with input from all key stakeholders. It is planned to submit this case to the NW Science Council in October 2007. If funding is not available through this route, it will be submitted through the NWDA Strategic Investment Plan process.

The NWDA is funding Autonomous Systems development through the NATS programme and leads on this from a regional perspective into the national activity.

Composites are discussed under paragraph 3.2.5. Composites Strategy.

3.2.1.3. Increase the interaction of companies, both OEM's and the supply base, with the regions HEI's. We need to understand the emerging technology needs of the OEM's and position the research base to excel in this arena. Lower Tier companies need to be 'awoken' to the need for Innovation and supported to engage in R&D.

3.2.2. Industry led Research and Technology

Two broad trends are shaping the way that companies are undertaking research and technology development (RTD).

Companies are moving away from a system in which most of their research and technology development (RTD) was done in-house and they are actively seeking to collaborate.

Larger UK companies are locating their research centres globally where they sell their products and services. The UK is no longer the automatic first choice for their R&D investment.

In future, Universities will need to identify their areas of competitive strength in research and focus on them. In parallel, Industry needs to learn how to exploit innovation developed in the university sector. In support, Government needs to do more to support business-university collaboration.

3.2.2.2. Industry Funded Research and Technology Development (RTD)

The Lambert Review of Business – University Collaboration (December 2003) showed that "The main challenge for the UK is not about how to increase the supply of commercial ideas from the universities into business. Instead, the question is about how to raise the overall level of demand by business for research from all sources. Measured against other developed countries, the research intensity of British business is relatively low – and the position has been deteriorating in recent decades. This has had an adverse impact on the overall productivity of the UK economy. In 1981, the UK's total spending on R&D as a proportion of its gross domestic product was higher than that of any other member of the G7, with the exception of Germany. By 1999, it was lagging behind Germany, the US, France and Japan, and only just keeping pace with Canada. The business sector has been the biggest contributor to this relative decline.

The UK's R&D intensity is much higher than the international average in two broad areas – pharmaceuticals/biotechnology and aerospace/defence. It is below average in all other important sectors. The UK's business research base is both narrow and fragile, and is heavily dependent on the investment decisions of a dozen large companies mainly involved in pharmaceuticals and defence. "

3.2.2.5. RTD Management

The Lambert Review felt that Industry is often critical of what it sees as the slow-moving, bureaucratic and risk-averse style of university management. The University – Business relationship could be improved through sharing of business processes and best practice in;

- Leadership
- Project and risk management
- Technology management
- Strategic planning and resource allocation
- Skills development
- Collaboration / relationship processes

The Cox Review (2005) of surveys by the leading business organisations and wide discussions with businesses of all types revealed that the main obstacles to University – Business relationships:

- Lack of awareness and experience
- Lack of belief in the value of, or confidence in, the outcome
- Not knowing where to turn for specialised help
- Limited ambition or appetite for risk
- Too many other pressures on the business.

3.2.3. Virtual/Systems Engineering Development. Transition to a knowledge based economy.

3.2.3.1. Current Regional Capacity

The concept of virtual/systems Engineering is relatively immature as a practice in Industry and a taught subject in HEIs. However, the Regions' Industry base and HEI's have a highly regarded range of engineering systems expertise, including Advanced Design and Manufacturing. The appropriate integration of these engineering systems is critical to efficiency, optimisation and effectiveness of products/services supplied by NW companies. Establishing a virtual/systems engineering framework (Fig 4) would enable aerospace companies, throughout the supply chain, to fully understand, and contribute to, a product's performance prior to its development/manufacture, thus reducing risk and hence the final cost of the product and accelerating the response time to market.

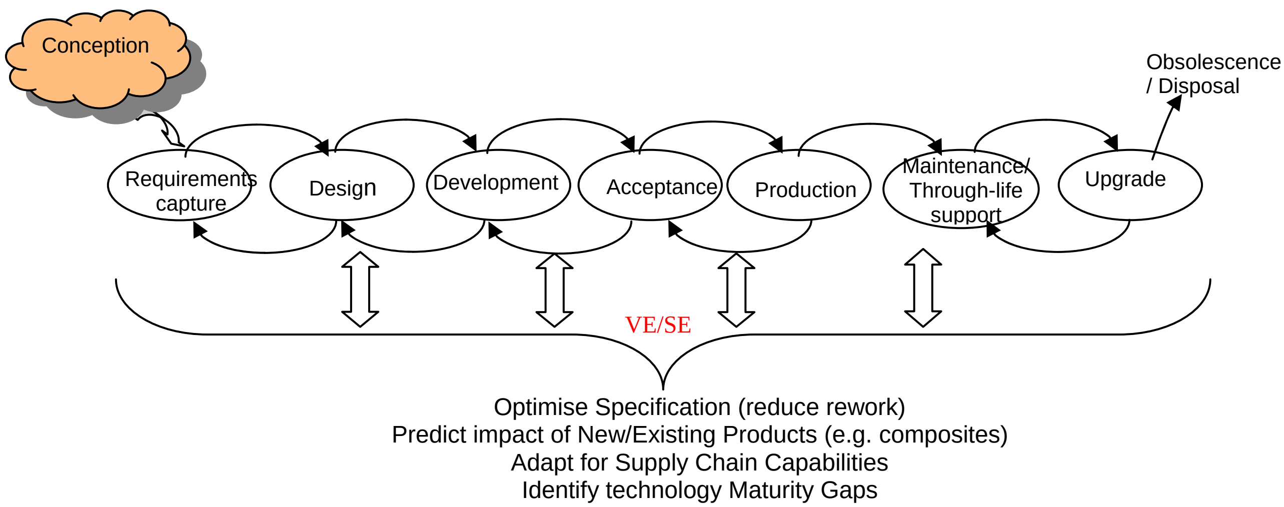


Figure 4 Schematic of VE approach integrating all aspects of product life cycle

There is currently no integrated Industry-HEI VE/SE capability in the North West, or for that matter, elsewhere in the UK. The establishment of this activity could have an instant impact on the performance of the aerospace sector acting as a powerhouse for skills, process development, project management and delivery, and problem solving.

3.2.3.2. Future capacity

The immediate impact of the proposed activities will be gained from developing and implementing the necessary VE/SE tools and techniques necessary for NW aerospace suppliers to adopt a structured and collaborative approach to future projects. This will be driven by established Primes, HEI's and Sector Support organisations within the Region. Ultimately the established VE/SE centre would increase competitiveness by enabling NW suppliers to;
- develop new concepts/products in response to initial capability requirements,
- implement existing product upgrades.

VE/SE models of existing components would demonstrate advanced design and manufacturing systems engineering and facilitate the engagement and development of the suppliers in the region to the mutual benefit of the suppliers and the major manufacturing companies.

The proposed centre would act as a hub for VE/SE activities within the region, achieving sustainability through both delivering strategic VE/SE projects to the region and researching/developing future VE/SE tools and techniques.

3.2.3.2.Proposed Activity

The ultimate objective is to create a purpose-built VE/SE Centre that will define and popularise a revolutionary vision for Engineering and provide the catalyst for UK Industry, and the NW Aerospace Industries in particular, to achieve a quantum leap in wealth creating Engineering capability.

This multifaceted centre would:

- As a VE/HE centre, provide the capabilities and facilities for Industrial organisations of all sizes to design and evaluate rapidly new products and their production facilities in virtual form, either in the centre or within their premises via links.

- As a research and technology centre, derive and execute joint research, technology and product development programmes across industry and between industry and academia.
- As an engineering computing and Information centre, house a (revenue generating) engineering data warehouse (storage and guaranteed retrieval) service, offering clients, for example, significantly more attractive value propositions for the support and maintenance of Engineering designs on long-life products.
- As an engineering design centre, house an engineering knowledge repository and network for access, evaluation and trading in product and component designs.
- As a leading edge engineering powerhouse, provide a vehicle for Engineering technology suppliers to demonstrate and market new technologies and techniques to the Engineering population.
- As an education centre it will specifically draw in and stimulate young people to consider engineering as a career choice, as well as providing a resource centre for schools and colleges. This fits well with current activities to ‘market’ engineering to a young audience.

3.2.3.4. Technical Approach

A staged approach to achieving the above goals has been developed to minimise risk. Phase 1 of the development, incorporates 5 key work packages. These activities will not only provide the tools and techniques necessary for the establishment of an effective VE centre but they will also address both the skills needs and market demand within the region. An overview of Phase 1 activities and how they underpin the success of the future centre is provided below;

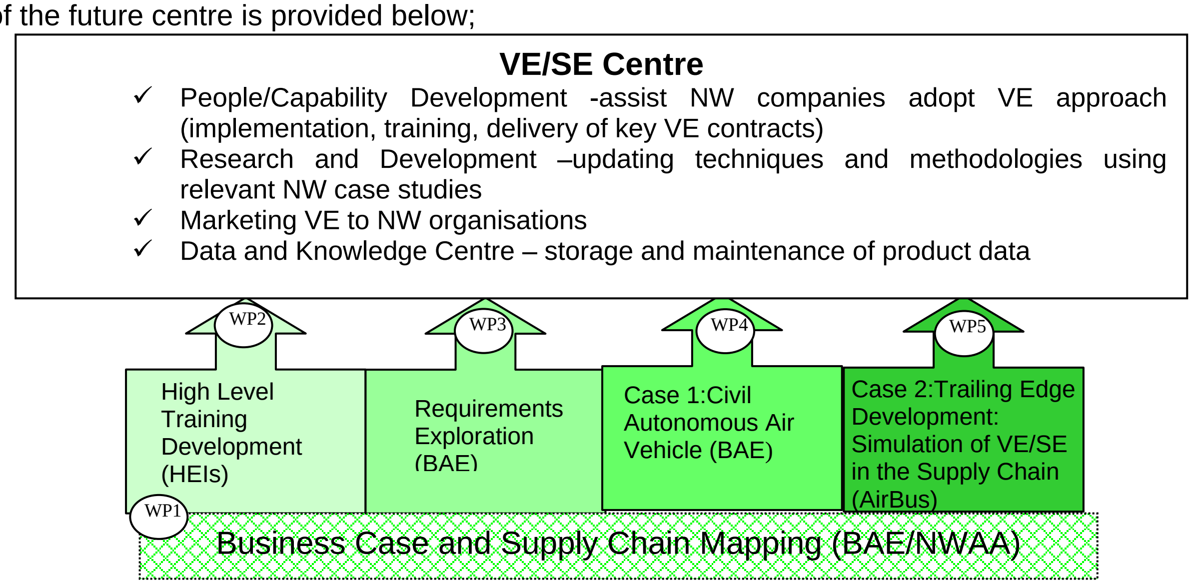


Figure 5 Summarising the main activities within the Phase 1, the foundations of the VE/SE centre

3.2.4. Autonomous Systems

3.2.4.1. Background

The non-military market for unmanned and autonomous air systems is potentially significant and diverse in both characteristics and application. This market is likely to include[2] the police, coastguards, mountain rescue services, utility companies, highways agencies, environmental agencies, national park authorities, agriculture, etc; all of which have a significant role in the North West. The autonomous systems technologies developed for the air sector also have potential application in both the land and sea sectors and civil and defence applications.

As an initial step in opening up this new market, the NWDA and regional industry have made significant investment in the ASTRAEA (Autonomous Systems Technology Related Airborne Evaluation and Assessment)[3] programme to overcome the regulatory hurdles to operating Unmanned Air Vehicles (UAVs) in unrestricted airspace. The next logical steps are to gain a clearer understanding of the initial user requirements for such systems and then to build on the regional academic and industrial strengths in this area to create a competitive capability in Autonomous Air Systems.

3.2.4.2. Proposed activity

The proposed approach is a three stage plan (attachment 2), commencing with data gathering, progressing through an interactive stage of requirement and capability development and culminating with a well positioned academic, industrial and user community to exploit the developing market.

The preparatory work will:

- Undertake a capability and gap analysis of the current regional academic and industrial players. An initial assessment of capability is summarised in attachment 3.
- Review best practice from other similar activities being undertaken elsewhere either to replicate or engage with.
- Assess the worldwide competition so as to identify realistic areas in which the NW could compete.

This will produce the first phase of the Strategy and the launch of the programme.

The first stage of the programme will:

- Establish a User Group to bring together, through workshops and other mechanisms, key regional players to shape the requirements for autonomous systems and to develop a community of potential operators to lead and stimulate the development of the market.
- Establish a Capability Provider Group to develop innovative solutions, both product and business to the requirements emerging from the User Group. These Groups will operate interactively.
- A plan to engage with other relevant parallel programmes (e.g. ASTRAEA, FLAVIIR, SEAS DTC, etc).

[2] An indication of the diversity of potential uses is shown in attachment 1.
[3] ASTRAEA is a £32M programme jointly funded by DTI, NWDA, SWRDA , SEEDA, WDA, Scottish Enterprise, BAE Systems, Agent Oriented Software, Flight Refuelling Ltd, QinetiQ, Thales, EADS, Rolls Royce.

3.2.4.3. Justification of the need

Unmanned vehicles will progressively replace manned vehicles in "dull, dirty and dangerous" operations and will open up new fields of use. By gaining an early understanding of the commercial application of UAVs, the NW based organisations (SMEs, major suppliers, primes, universities and research establishments) in the NW region could position themselves advantageously in an emerging market as producer, support service provider and operator. The total value of this market is difficult to estimate at this stage but is expected to grow rapidly over the next two decades[4]. The programme will also provide a vehicle to capitalise on the investment made in the ASTRAEA programme.

3.2.4.4. Lead organisation and project partners

The User Group would, ideally, comprise a broad range of potential users from the region, including police, coastguards, mountain rescue teams, environmental agencies, fire service, utility providers, national park authorities, etc. It may also need to include government and community representatives. The Capability Provider Group will comprise industry (BAE Systems, RR, AV-I, Morsons Projects, NWAA) and academia (Manchester, Liverpool, Lancaster, Salford, UCLAN).

Subsequent stages will be lead by organisations appropriate to the emerging requirements. Additional SME members will be introduced.

3.2.4.5. Exploitation for economic benefit

The ultimate outcome of the programme will be exploited through the market share of the global civil UAV business gained by the manufacturing and service industry in the region and also through improved effectiveness and efficiencies in the user community within the region. It has the potential for wealth creation, capability development and cost reduction within the region. In the short term, the initial study will place local industry and academia in a strong position to bid for and engage in research, development and training programmes in the autonomous systems field. Niche markets will be identified along the way and business opportunities will be exploited to the full.

The subject should stimulate interest in young people and could be used creatively to stimulate school children's interest in science subjects and engineering.

3.2.4.6. Anticipated outcomes

The initial study will provide the direction and justification for future work and investment. The ultimate outcome will be an industrial base equipped for the next major step in the evolution of aviation and an academic sector with a set of technologies and skills which can be exploited in the air, land and sea sectors internationally. It will also place the region at the forefront of the user community and potentially create a service provision market and training base for other users.

3.2.4.7. Fit with national / European aerospace strategy

The proposed programme aligns with AeIGT National Aerospace Technology Strategy (NATS) and the MoD's Defence Technology Strategy (DTS).

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[4] In 2005 the global civil UAV market was estimated at $2bn per annum by 2014.

3.2.5. Composites Strategy

The growth of use of composites in the aerospace is accelerating and the North West position is weak. The centre of excellence for military composites rests with BAE Systems at Samlesbury with support from smaller companies such as Brookhouse holdings. With respect to commercial aircraft composites capability, the capacity is even more restricted. Large section composites are generally manufactured out of the UK for Airbus but GKN and Airbus Filton have significant capability in the South West and South of England. There is however, significant activity in composites in the North West ranging from the development of new materials and processes, supply chain companies at the higher tiers reshaping strategies to transition into composite capability. Much of the significant activity is developing under the cover of non-disclosure agreements. It is proposed to establish a stakeholder group to evolve a regional strategy across the textile, aerospace and automotive sectors.

3.2.5.1. North West Composites Centre

The Northwest Composites Centre (NWCC) draws together and enhances the scientific expertise in the NW universities to create a Centre of international scientific reputation to the benefit of regional and national industry. It has a mission to undertake applied research leading to the development of new, cost effective, low energy, low cycle time composite processing routes for making real components and demonstrators to establish the effect of these production routes on composite structure and performance and thereby optimise their fitness for purpose to act as a regional Centre of expertise supporting, evaluating and introducing innovation in composite manufacture and design

The vision of the centre is to be a self-sustaining, world-class centre of excellence within 5 years of the start which was in February 2006. The scope covers polymer, metal and hybrid composites, although by far the most dominant activity is in polymer matrix composites. The focus is on rapid, low cost manufacturing techniques concentrating on technologies that are likely to give significant cost savings compared to traditional autoclave methods. The NWCC is a node of the National Composites Network with specific responsibilities for these activities. It has a range of facilities and expertise that encompasses technical textiles structures, composites manufacture and a wide range of characterisation facilities. The Composites Processing Facility is located on a single site at The University of Manchester with a comprehensive suite of processing and evaluation equipment. There are six project officers making the central equipment available to all members.

In order to achieve our mission our programme of research and development consists of two strands:

- Basic longer term research programmes aimed undertaking new science thereby extending our capability and establishing our research reputation
- Short responsive demonstrator or proof of concept, studies aimed at opening up new areas, trialling and optimising new processes, and identifying assessment procedures.
- The original three year NWDA funding is being complemented by additional long term project funding obtained through EPSRC, DTI and industry.

3.2.5.2 North West Composites Certification and Evaluation Centre

In contrast to metallics the NW has an immature composites supply base, yet the foundations for growth are there. NWDA, assisted by NWCC, has compiled a comprehensive list of over 600 regional companies/ organisations with a significant interest in composite materials. Access to testing and evaluation support has been identified as a bottleneck to the invention of new products and the winning of orders in "A Study of the NW Region's Capabilities and Opportunities in Composites", compiled by the North West Aerospace Alliance (NWAA) in March 2006. This problem is accentuated by a move by the primes from acceptance trials to a requirement for suppliers to provide supporting evidence. In the region, only BAE Systems has in-house test and development capability maintained on a project by project basis. There is no independent composites test facility in the UK.

The vision is to create a Composites Evaluation and Support Facility unrivalled in Europe. Integrating such a facility into the NW composites industry will provide the technology platform needed to increase the competitiveness of NW manufacturers in the global market and generate new jobs as the use of composites grows and traditional metallic airframe production slows. It will work with the Primes to ensure test conformity to support product acceptance for the NW supply chain. It would uniquely position the NW to innovate with high value composite products drawing in existing textiles manufacturing expertise. Further, the body of knowledge relating to the manufacture and maintenance of metallic airframes is not appropriate to composites, particularly with regard to failure prediction. Protocols are needed for inspection/qualification of these materials. It will provide expertise/equipment to support the production and maintenance of new aircraft.

The key technical deliverables of the CEF are specific, measurable, achievable, realistic and time-bound:

- A self-sustaining, cost-effective testing, evaluation and manufacturing support capability for the UK composites industry within 3 years with capability for assessment of mechanical properties of composite test coupons, elements, details and sub-components inclusive of environmental testing and conditioning.
- UK Accreditation Service (UKAS) and National Aerospace and Defence Contractors Accreditation Program (Nadcap) accredited (application in process within 18 months).
- Establishment of base-level design allowables and formation of an international shared design database – working with the National Centre for Advanced Materials Performance (in the USA), EASA and FAA.
- In-house/portable NDT inspection service (within 18 months) to verify materials and processes rework strategies and composite damage tolerance/resistance properties as well as support aircraft maintenance.
- Research on test and NDT methodologies aiming to reduce the reliance on large test matrices (on-going).

To establish the CEF the University of Manchester will provide support of £4.4M (£1M cash) with a further £4.6M required over a three-year period from the NWDA and £1M from industry. Within 18 months the Facility would be in place and accreditation being applied for. Within 3 years it would be self-financing with a 50/50 mixture of industry and research funding (= £900k per year) and a permanent staff of 8. There is an excellent fit with the National Aerospace Technology Strategy complementing existing National Composites Network capability. A delivery oriented structure will be put in place by an Industrial Facility Manager, appointing industry trained staff and reporting to the existing NWCC Industry-led Steering Committee. An assessment of whether it should be spun-out as independent Business will be assessed at the latest in year 3. The proposal has been approved by NW Science Council Aerospace sub-panel for submission to NW Science Council in October 2007 for consideration for funding, with a projected start date Oct 2008.

Key stakeholders would be the Advanced Engineering sector with particular focus on Aerospace sector, NWDA, NW Composites Centre, Univ. of Manchester, NWDA, and NWAA.

The centre as part of the NWCC forms a significant element of the regional composites strategy.

3.2.5.3. Composites Skills Training

Through the Aerospace and Advanced Engineering SSPA, the lack of composites skills training within the region has been identified as a significant issue. The outcome was an industry led composites group with the Universities of Bolton and Manchester (for the NWCC). Bolton and Manchester Universities prepared and submitted funding proposals to the Higher Level Skills Partnership (HLSP), for level 4 course funding for composite materials structure design and composites structure repair techniques, which were successful. These courses will be run in a collaborative way, between the two universities.

Level 2 and level 3 training capacity is an identified action.

3.3. Infrastructure & Inward Investment

The need for infrastructure regeneration needs to be quantified and action has been put in place to:

- Quantify the quality of manufacturing infrastructure of the cluster companies.
- Map the demographic movement of the workforce from place of residence to employment.
- Understand the regional skills map (skills and location).
- Correlate inward investment opportunity and need with the supply chain model (reference 3.1.3).

The quality of the infrastructure information should be relatively easy to obtain given it will be based on a five step grading with no sensitivity.

Demographic movement may be more difficult to obtain whilst still retaining data protection. The mapping study reference 3.2, is addressing these issues.

Inward investment is significant element in reshaping the cluster and in particular creating infrastructure improvements around the centres of skills population.

The proposed Samlesbury Aerospace Park is progressing whilst the Burnley regeneration plan has major references to the encouragement of advanced manufacturing.

The growing interest of Private Venture Capital companies may play a significant role in infrastructure and capacity/capability development based on the future supply chain model (reference 3.1.3).

The opportunities offered by European Regional Development funding will have an influence on infrastructure and capability development providing it can be correlated with skills availability. The attraction of high technology centres such as Daresbury will play a role in developing knowledge based technologies such as Virtual/Systems Engineering.

3.4. Sustainable Aviation.

The impact of civil aviation on climate change is now of significant global interest and can be seen as a threat to the industry, even though aviation contributes just 3% of carbon emissions. The accelerated growth of the aviation industry will increase this figure. However, under the Aerospace Innovation and Growth Team project, the Environmentally Friendly Engine development programme is along with other technology developments, designed to mitigate the aviation contribution to climate change, but improvements are likely to be out stripped by civil aviation growth.

The subject of sustainable aviation will be kept under review and actions added developed as appropriate.

3.5. Cross Sector Fusion.

The aerospace sector has valid links to the Automotive and Advanced Flexible materials sectors, all part of Advanced Engineering Materials as defined in the Regional Economic Strategy. All are considered in the RES to *be 'knowledge based, widely traded and have international growth potential'*.

Automotive offers significant knowledge with respect to supply chain management and skills development. The NWAA SCE programme is related to a Toyota programme of the late 1990's and the Lean Learning Academy was developed by ex Toyota personnel for Airbus, later adopted by BAE Systems and now part of the SCE programme under the Lean Leadership Academy.

Within the aerospace supply chain there are component manufacturing companies with automotive contracts but the crossover is limited. The Airbus wing and Typhoon flow lines do demonstrate the gravitation of advanced automotive based techniques to the aerospace industry. However, in the field of Advanced Flexible Materials there is a greater crossover with potential for real growth. Composite materials are widely used in aerospace, particularly the civil sector. Auto sport companies have experience and some are trying to break into the aerospace sector. Composites represent over 50% of new civil aircraft structures, the growth driven by the need to reduce weight for enhanced fuel efficiency. The trend is moving from auto sport to volume manufacture and this trend offers a significant opportunity for cross sector activity.

Advanced Flexible Materials, through the use of composite materials, will develop increasingly close activity with the aerospace sector. The need to combine the knowledge of weaving carbon fibre and designing aerospace components based on the particular characteristics of this technology is a significant challenge.

4. The Action Plan Proposals

4.1. Competitiveness

4.1.1. Develop a regional composites strategy via an industry led stakeholder group. October 07.

4.1.3. Create a skills development culture and a ‘road map’ to achieving a knowledge based economy.

4.1.4. Work with STEMNET through the NWDA SSPA process to develop plans to attract new entrants to the industry.

4.1.5. Review the future company development needs through a ‘future view group’. Assess the need for a successor to the SCE programme.

4.1.6. Continuously develop the SCE process.

4.1.7. Develop a manufacturing capacity model. (Reference CLUNET/ Cambridge University as possible collaborations).

4.1.8. Develop a skills capacity model. (Reference C5).

4.1.9. Develop provision for levels 2 & 3 composites skills.

4.1.10. Evaluate mechanisms to mitigate the dollar exchange rate effect.

4.2. Innovation.

4.2.1. Develop the key research and technology themes through regional university/industry programmes.

4.2.2. Establish the case for Virtual/Systems Engineering centre in the region, with Daresbury as the favoured site. Analyse the capacity for V/S engineering in the region, the future need and develop a plan for achieving the target. Initiate discussions with NWUA re sources of funding for needs and capacity assessment. Review the synergies and potential collaboration with Daresbury.

4.2.3. Build on the work done through the VIVACE project funded through the EC Framework programme.

4.2.4. Build on the BAE Systems Autonomous Systems knowledge particularly for the civil sector, through the NW Science Council Autonomous Systems Group. Submit a bid for funding for this activity to the NWSC.

4.2.5. Initiate discussions with the key players on requirements for future aerospace design. Understand and match the needs (skills, investment, infrastructure) for future military and civil aircraft design and manufacture.

4.2.6. Develop an industry/Academia project management interface to ensure more industry led management to academic programmes and outputs. Promote business/university collaboration particularly among SME's.

4.2.7. Integrate HEI's (NWCC etc, into the 'super cluster').

4.2.8. Promote the NWCC, Certification and Evaluation Centre.

4.3. Infrastructure development and Inward Investment.

4.3.1. Review inward investment opportunities including capacity restrictions, new areas such as electronics and key industry companies with significant differentiators. Develop and populate the Airbus Industrie supply chain model. Analyse a 'must have, could have, like to have' scenario for targeting inward investment.

4.3.2. Develop an inward investment plan, particularly around attracting knowledge based industries

4.3.3. Evaluate Private Venture Investment opportunities.

4.3.4. Assess the infrastructure requirements in conjunction with sub-regional partners.

4.4. Sustainable Aviation.

4.4.1. Support SBAC lobbying on sustainable aviation through dissemination of information.

4.4.2. Support the development of sustainable aviation technologies such as low weight/high strength materials.

4.5. Cross sector Fusion

4.5.1. Include Automotive and Advanced Flexible Materials in the composites strategy stakeholder group.

4.5.2. Consider a merger of the Engineering & Aerospace, and Automotive Sector Skills and Productivity groups for commonality and sharing best practice.

4.5.3. Share knowledge with Automotive and Advanced Flexible Materials.

4.6. International Trade Development.

4.6.1. Identifying those countries/continents along with partner organizations strategically important to target from a business development viewpoint. (Europe/USA/India /China etc) as well as identifying those projects with exploitation potential, including development, production and in-service programmes.

4.6.2. Identifying company support requirements and developing competitiveness i.e. with tailored support, (e.g. the NWAA Supply Chain Excellence Programme).

4.6.3. Identifying and capturing company capability shortfall and strategic strengths in the International arena.

4.6.4. To identify relevant support agencies/opportunities that the cluster organization can work in partnership with and providing effective, integrated international trade support for companies by acting as a focal point for partners both public and private.

4.6.5. Set up and maintain an international database to access the level and scope of NW aerospace activity e.g. where there are relevant projects.

4.6.6. To identify companies current market overseas activity and strategic strengths showing wish lists and gaps.

4.6.7. Promote and encourage participation at major international air shows e.g. Farnborough. Paris, MRO Europe

4.6.8. Promote and encourage participation of SME's at Business to Business events.
To identify and deliver partner, or in-house, programmes/activity to meet needs and facilitate /assist member exploitation of strategic markets.

4.6.9. To identify regions of importance for the aerospace industry e.g. Munich, Toulouse
Evaluate the key programmes, how to access them and promote inward and outward missions to relevant areas.

The Aerospace Cluster Strategy
2007 to 2017

Annex 1

The North West Aerospace Alliance

1. Mission Statement

To provide a fully integrated support structure for North West aerospace companies.

2. The NWAA - Regional Cluster organisation.

2.1. Background

Aerospace is the oldest cluster in the North West having been recognised some 10 years ago. In 2004, the emerging pressures on the industry, such as globalisation, the progression to autonomous systems and the emergence of composite materials technologies, has created an urgency to generate a culture change in the aerospace cluster to adapt to the evolving supply chain model and new skills demanded by the primes.

During the past three years the NWAA has been adapting its organisation to facilitate the required change in culture within the cluster, developing direct and pro-active communication processes with the primes and their supply chains.

The recognition that companies in the cluster have to be world competitive in order to survive is the core message of the NWAA and, after three years, it has succeeded in creating the culture of 'need to change', as well as laying the foundation culture to facilitate the approach to systems engineering and a knowledge based economy, the transition to new technologies and the adoption by the industry of new, non metallic materials and processes.

2.2. NWAA Current Higher level Activities

- Facilitate the development of a regional aerospace cluster strategy
- Provide technical & strategic support to the NWDA
- Facilitate strategic direction to sector
- Deliver sector development strategy
- Support inward investment policy
- Provide the framework to develop a Global/World Class Supply Chain
- Provide sector related events/publicity
- Provide the interface to the regional industry for national and international organisations
- Facilitate industrial opportunities
- Promote international trade
- Provide a forum for the industry voice
- Represent the membership to primes & national /local government interests

2.3. NWAA Staff Structure