

The runway to growth:

Using market understanding to drive efficient innovation in the aerospace, defence and security industry



Foreword



Guillaume Rochard

guillaume.rochard@fr.pwc.com

AD&S needs innovation to grow. But for many sector companies, innovation investments aren't delivering as much value as they could. Are yours?

In our work with aerospace, defence and security (AD&S) companies, we see the critical impact of innovation up close every day. Why is innovation so important?

- **It helps AD&S companies address their customers' challenges.** Airlines are looking to reduce fuel consumption, so aerospace companies are using innovation to develop advanced materials and other strategies to be more efficient. Airlines need to reduce maintenance cost and aerospace companies are responding with new sensor technologies that can help reduce maintenance time. Passengers want better in-flight entertainment and connectivity, which means new innovations around products and technology. Security companies are meeting increased concerns over hacking and data theft head-on. And as threats change, defence companies are developing new weapons systems to cope.
- **It creates competitive advantage.** By constantly improving products, technology and processes, AD&S companies can stay ahead of competition.

For most of our clients, innovation is already a core part of their internal culture and their company mission. And there's no denying that the sector has made some amazing advances over the past decade.

But while innovation is one of the top priorities for executives, our research suggests that innovation investments in the AD&S aren't always delivering long-term value. We think that's partly because of "value erosion" happening in large-scale, long-term projects. And when innovation happens at the programme level, it can be more difficult to get the most of investments across the whole business. But innovation can, and should, help improve the bottom line for the whole organisation.

This report takes a look at some of the ways how. We hope it provides food for thought and look forward to continuing the conversation.

A handwritten signature in black ink that reads "Guillaume Rochard". Below the signature is a short horizontal line.

Guillaume Rochard

Global Aerospace, Defence & Security leader

Contents

<i>About this report</i>	4
<i>Starting with a market-driven strategy</i>	5
<i>Improving your innovation performance</i>	9
<i>Using a strong innovation culture to win and keep talent</i>	14
<i>Developing a strong ecosystem</i>	19
<i>Commercialising innovation</i>	24
<i>Where next for your business?</i>	27
<i>Want to find out more?</i>	28

About this report

The runway to growth: using market understanding to drive efficient innovation in the aerospace, defence and security industry draws on data from PwC's comprehensive report, *Breakthrough innovation and growth* and on separate AD&S-sector specific research conducted in the US in parallel.

Breakthrough innovation and growth documents the impact that innovation has on growth and examines how leading companies are making innovation work for their organisations. The report explores three key questions:

1 How are companies using innovation to drive growth and what is the return on this investment?

2 How are approaches to innovation changing, particularly in light of a trend towards more disciplined innovation?

3 What are the leading practices and critical success factors that deliver tangible business results?

To answer these questions we drew on insights obtained from interviews with the 1,757 C-suite and executive-level respondents, across more than 25 countries and 30 sectors, who are responsible for overseeing innovation within their company. Our sample included 38 respondents from the AD&S sector from 10 countries.

For the parallel research project in the US, we analysed program, IRAD and customer funded RDT&E spend for the major aerospace & defence companies that participate in the US market. Companies spanned multiple technology categories from private aircraft to unmanned vehicles to personal armament.

We also interviewed 20 c-suite executives from a variety of AD&S firms; executives represented a cross-section of the industry:

- Commercial, defence, and space segments
- Aircraft, unmanned, and personal armament

58

Executives from the AD&S sector

10

 From 10 countries

Starting with a market-driven strategy



Innovation in the AD&S industry has had an enormous impact on modern life. Advances in aviation in the 20th century made air travel affordable; in the 21st century aircraft manufacturers are significantly improving its efficiency and reducing its environmental impact. Defence innovation is behind many of the technologies that are now taken for granted, such as GPS navigation and even the Internet itself.

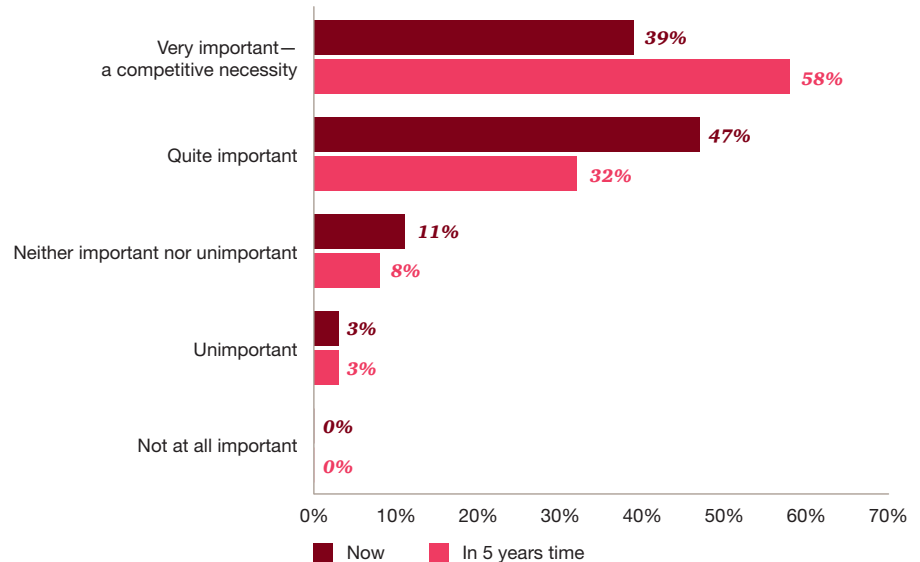
But what's more important for AD&S executives is the potential for innovation to drive revenues and help their companies differentiate from the competition.

Globally, nearly all of our AD&S respondents say innovation is important to their business. And for around three-fifths, it's a competitive necessity for future success (see Figure 1). Indeed, the only sectors more likely to see innovation as equally vital to future growth are pharmaceuticals and medical devices.

That's not a new trend. AD&S companies have long been focused on innovation—but it hasn't always gone smoothly. There have been high-profile delays, cost overruns and missteps on programmes in civil aerospace and defence over

Figure 1: AD&S executives view innovation as vital to future success

Q: How important is innovation to the success of your company now? In 5 year's time?



Source: PwC, Breakthrough innovation and growth. Base: AD&S: 38

the past decade. Executives recognise the industry's mixed track record, but believe innovation can drive long term value creation. They express a strong belief that innovation success may be the one thing that could prevent a revenue stall or long term decline and guarantees a strong competitive advantage.

Yet, globally less than two-thirds of AD&S companies say they have a well-defined strategy. That could lead to serious issues for those without a clear vision, because in our experience, execution starts with a sound strategy. Those companies that do have a clear strategy are already one step ahead—but they may still want to take another look.

63% vs. 79%

Less than 2/3 of A&D executives say they have a well-defined innovation strategy, compared to 79% of the top innovators across industries.

Understanding your market

For AD&S, we believe that innovation strategy should start with a sound understanding of the market. While it's one of the most important prerequisites for good innovation management, our research suggests it's also one of the most frequently overlooked. Some ways to help improve market awareness include:

- Working closely with your customers—and in some cases, their customers—to gain a deep understanding of airlines' needs for new aircraft or what threats governments are facing.
- Participating in a strong ecosystem with your supply base (or OEMs) including implementing co-creation/co-development
- Accessing sources of innovation and local talent that understand market needs.

All of these techniques can help when it comes to setting the right innovation priorities.

Looking beyond products and technology

R&D around products, services and processes is critical. But innovation should cross the entire enterprise. It's important to look for opportunities to grow revenue potential, for example by exploring new businesses in adjacent markets and supply chain innovation.

Whatever the strategy, strong processes to support commercialisation are critical. And so is good talent to implement them, along with a corporate culture that supports their creativity. This includes a willingness to take risks and allow failure—something that can be a struggle for AD&S companies.

Our research found that AD&S companies are generally following one of two distinct strategies, with some “traditional” innovators more focused on incremental improvements to products, while “disruptive” innovators look to shake up the marketplace (see *A tale of two innovators*).

Whichever strategy you choose, you'll need to make decisions about your goals and how you'll get there. There's no one-size-fits-all for innovation. We've identified some questions AD&S executives may want to ask themselves when taking a closer look at their company's innovation vision:

1. **Are we improving our innovation performance?** Do we listen to customers and get their feedback? To what extent will our innovation enhance the passenger and operator experience? Are we innovating around our own processes to increase engineering efficiency? Have we looked at how we can drive new business in adjacent markets?
2. **Can we attract, keep and motivate innovation talent?** Are we actively working to increase our candidate pool and position our company as a supportive environment for top innovative talent? Will we be able to adequately support increasing research needs in Asia?
3. **Have we developed a robust ecosystem?** How strong are our strategic partnerships? Are we co-creating products or product improvements and co-developing improvements to process and technology? Are we using open innovation and collaborative platforms effectively? Are we able to use social media channels to reach out?
4. **How efficiently can we commercialise good ideas?** Do we have good organisational structures and tools in place to implement innovation? Are we able to drive innovation across the entire business, not just within individual programmes? Do we have the right metrics to track and measure innovation success?

A tale of two innovators

We found that companies tended to fit into two distinct categories of innovators: traditional and disruptive.

Traditional innovators rely on their immediate customers for requirements: RFPs, customer leadership, customer engineers. They expressed greatest comfort and success when customers provided well documented sets of requirements at start of program

Disruptive innovators proactively collect inputs from stakeholders throughout the value chain, not just the immediate customer. They pay the most attention to the views of end users. And they analyse the value chain to find opportunities to disrupt competitors' and incumbents' current business models

While both approaches have had success, traditional innovators may do well to see if some disruptive approaches could open up their markets.



*Improving your
innovation performance*

91%

Ninety-one percent of AD&S executives say they're planning to collaborate with customers over the next three years.



Listening to customers

Innovations that customers don't value are essentially worthless—no matter how technically sophisticated they may be. So it is critical to understand what your customers need and work together with them as the first step to innovation success. AD&S executives already understand this—91% say they're planning to collaborate with customers over the next three years. And the sector has a strong focus on innovating around the customer experience.

But it's not always easy to balance customised innovation that meets customer needs with cost-effective, strategic innovation that helps the company move forward on its strategic agenda.

In our view, AD&S companies should isolate and modularise technologies that deliver the greatest customer value and focus development efforts on those technologies. That includes outreach efforts to customers. Safran's Jean-Pierre Cojan, Executive Vice President in charge of Strategy and Transformation, told us that "One of the key challenges is making sure that clients are ready to support new ideas in product innovation. We do this by using more collaboration and involvement between Safran, aircraft manufacturers and airlines."

For defence companies, understanding new, promising areas or government requirements are vital. That will probably mean building and deploying innovations in new areas and markets. In some cases, threats are evolving so quickly that AD&S companies may even need to educate some of their customers on how their innovations can help.

Bringing down engineering costs

Good technical solutions are no longer the only priority; increasingly, we're seeing a strong trend towards low-cost engineering. Customers are no longer willing to tolerate "price drift", so companies need to deliver more capability at lower cost. Often that means delivering radical and breakthrough innovation around their own systems and processes to increase efficiency. One example is Boeing, whose "moonshine shops" take a front-line approach to process improvement.

Another good way to bring down costs at the end of the programme is to pay close attention to the upfront design and make sure it's aligned to customer requirements right from the start.

AD&S companies can also pre-plan efficiencies across the programme lifecycle.

We've seen examples where that's already happening and companies are learning from issues in the past and potential commercial failures. Specific approaches could be:

- Front-load up-systems engineering and concept design
- Maximise design re-use and standardisation through product families and platforms
- Capitalise on return of experience from complex programmes

Developing new business models

Our research suggests that business model innovation is becoming a major area of focus for many AD&S companies. Nearly a third of AD&S executives (32%) are expecting to deliver radical or breakthrough innovations in this area over the next three years. And the same number expect to deliver radical or breakthrough innovation around services too. AD&S companies are seeing the importance of services as a way to differentiate product offerings and build lasting revenues. For example, BAE Systems now offers "through-life" support. The company partners with customers to make sure they can deliver key capabilities, including maintenance, repair and upgrades to systems.

Establishing market competitive solutions with high levels of design re-use

A global provider of transportation equipment identified a new market segment in one of its key regions. Competition was intense and the company recognised that it needed to be able to differentiate based on priority market requirements: whole life costs and time to market.

To address this challenge the company recognised that it needed to develop a new product platform based on existing designs to capitalise on previous reliability growth and minimise engineering hours. This represented a significant change in approach from “design every time” to “design re-use and standardisation” requiring significant changes to existing processes, governance structures and KPIs.

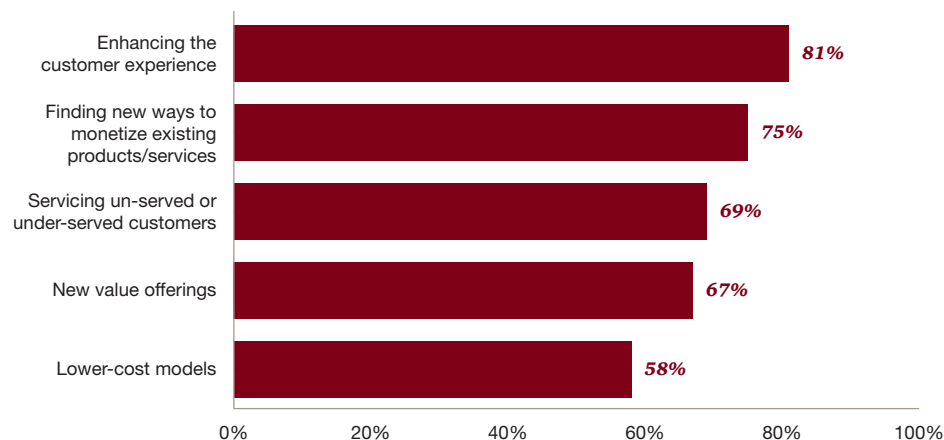
A robust market requirements and product planning process was established to define a full-set of requirements that captured input from key external (passengers, operators, regulators) and internal (sourcing, manufacturing & assembly, services) stakeholders. That provided a basis for understanding key trade-offs such as acquisition cost versus whole life cost.

Different platform options were evaluated against these requirements to strike the balance between the need for market distinctiveness with commonality. A KPI to measure design reuse and standardisation was introduced to support the decision making process and make sure that the platform concept would actually be used in bids and programmes.

—The result? A platform option that met priority market requirements whilst achieving 75% design re-use and standardisation was selected and developed as a basis for bids. That means significant reductions in non-recurring engineering costs, technical risk and time to market.

Figure 2: AD&S Business model innovation focusing on the customer, new markets for existing products

Q: Which of the following types of business model innovation will be you implementing over the next three years?



Source: PwC Breakthrough innovation and growth. Base: AD&S: 38

The customer experience tops the list when it comes to specific types of business model innovation. That suggests that AD&S companies are already very focused on improving their ability to co-create with customers. But nearly as many are looking for new ways to monetise existing products and services too. Many AD&S companies are moving into adjacent markets, like healthcare or environmental monitoring or smart grid operation. And some companies are licensing technology too. Lockheed Martin is working on a new material to filter seawater, as just one of many examples (see *Lockheed Martin's radical new solution to water scarcity*).

Moving into new markets means being closer to your new customer base and understanding their needs. This Customer intimacy strategy can be a long endeavour but it is a rewarding lever that leads companies to build smarter requirements but also to design better solutions collaboratively. Detlev Von Busch, Head of Business Development at Cassidian, describes

the situation, saying “We will shape our future through stringent and ongoing portfolio management and innovation. In addition we need to strengthen our global reach, competitiveness and customer proximity.”

Innovating around services is now also going well beyond standard MRO-style services. In the US, we found some companies are entering into managed service contracts in other related areas (e.g. communications service provider, air traffic management)—and in completely different industry settings too.

Lockheed Martin is using its expertise in processing streaming sensor data and engineering to provide support in medical settings.¹ The company says its data analytics techniques can help hospitals detect sepsis in large patient

sets, as just one example. And many AD&S companies are combining existing products with new types of services in innovative ways. At the Paris Air Show in 2013, Raytheon showcased environmental monitoring solutions that draw on its expertise in interpreting satellite data, while Finmeccanica, Saab and Thales are all developing a variety of solutions around smart cities and mobility.²

Sometimes competitors even cooperate to better meet customer needs. For example, research on aviation biofuels crosses company lines, with competitors Boeing and Airbus both participating in key research partnerships like the Commercial Aviation Alternative Fuels Initiative (CAAFI). It also expands across the supply chain. In the biofuels example, engine makers are working together with OEMs and airlines to develop universal standards.

¹ Lockheed Martin corporate website, <http://www.lockheedmartin.com/us/what-we-do/emerging/dataanalytics/medical-analytics.html>

² AIOnline, June 17, 2013. <http://www.ainonline.com/aviation-news/paris-air-show/2013-06-17/adjacent-markets-help-aerospace-and-defense-companies-hedge-against-defense-uncertainties>

Lockheed Martin's radical new solution to water scarcity

Access to clean water is becoming a major security issue. And defence contractor Lockheed Martin may have the answer. The company has patented a new material that can be used to filter seawater into freshwater. The Perforene membrane was developed by placing holes that are one nanometer or less in a graphene membrane.¹ At only one atom thick, graphene is both strong and durable, making it more effective at sea water desalination at a fraction of the cost of industry-standard reverse osmosis systems. Lockheed Martin is looking for commercialisation partners for the technology, which a Reuters article says could be on the market as early as 2014 or 2015.²

The company says the material can be tailored to other applications. That could lead to a wide range of uses, from cleaning the water used in the hydraulic fracturing or “fracking” process in the oil & gas industry to dialysis in healthcare.

It's not just a product innovation. Lockheed Martin has also been developing the processes that will allow the material to be produced at scale.

.....
1 Lockheed Martin corporate website, <http://lockheedmartin.com/content/dam/lockheed/data/ms2/documents/Perforene-datasheet.pdf>

2 Reuters, “Pentagon weapons-maker finds method for cheap, clean water”, March 13, 2013
<http://www.reuters.com/article/2013/03/13/us-usa-desalination-idUSBRE92C05720130313>

*Using a strong
innovation culture to
win and keep talent*



Finding innovative employees is a challenge for most industries, but the problem is even more acute in AD&S, where engineering talent is increasingly in short supply. Half of AD&S executives say finding and retaining the best talent to make innovation happen is a challenge for their organisation. That reflects a very real talent gap.

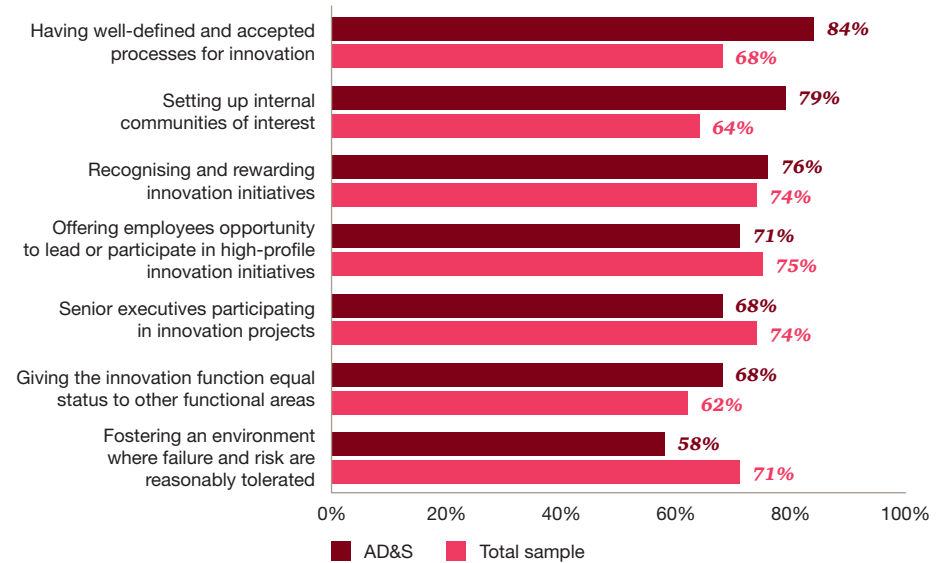
AD&S companies will need to make sure they're well-positioned to compete when it comes to attracting and retaining workers with the right skills. But what do innovative people want out of their employer? In our experience, the best breakthrough innovators want to be recognised as somebody who makes a difference—to their profession, to the company, and sometimes to the world. So companies with a strong innovative culture have an advantage when it comes to attracting, keeping and motivating key talent.

Developing a strong innovation culture

But even when the need is clear, creating an environment that supports innovation isn't easy. In fact 55% of AD&S respondents say that establishing an innovative culture internally is a challenge for their organisation. But they're meeting it head-on. Overall, at least two-thirds of AD&S respondents are using a wide variety of techniques to foster a positive culture, from developing a sound process, communities of interest and functional autonomy, to setting "tone from the top", recognising and rewarding innovators, and giving staff opportunities to participate in high-profile projects (see Figure 3).

Figure 3: When it comes to building an innovation culture, AD&S execs are focusing more on process, less on risk tolerance

Q: In your organisation, how important are each of the following to creating and fostering an innovative culture?



Source: PwC, Breakthrough innovation and growth. Base: AD&S: 38; Total sample: 1757.

When it comes to recognition and reward, we've found that the right employment package can be critical.³ And that doesn't just mean the highest salary. Broader aspects of remuneration such as opportunities to travel, flexible working and addressing the changing aspirations of different demographic groups will carry weight. Consider how attractive your total package is to future employees and have a balance of non-financial measures.

³ PwC, Talent management in Aerospace, Defence and Security: How to attract the people you need and hold on to them. <http://www.pwc.co.uk/aerospace-defence/publications/talent-management-in-aerospace-defence-and-security.jhtml>

We found some significant differences in how AD&S companies approach innovation culture compared to the rest of our sample. AD&S executives are heavily focused on structural areas. Far more say they have well-defined processes for innovation, and more are setting up communities of interest and giving the innovation function equal status too.

No risk, no reward?

But what about a healthy tolerance for risk? Only 58% of AD&S executives believe it's important to building their innovation culture. That puts it the lowest of any industry sector we tracked. There are some good reasons for this. Aerospace in particular is highly regulated and new materials, products etc. need to be rigorously tested and documented. If the sector's products don't work correctly, taking aircraft out of service for even a short period of time has an enormous impact on its airline customers. And in a worst case scenario, lives could be at risk. So companies can't afford to compromise on quality and accuracy—it's important for aircraft manufacturers to get innovations right the first time. Engineering-focused cultures also tend to be results-based, so they're less apt to allow for experimentation.

But the ability to tolerate failure and risk helps maintain what's sometimes called an “intrapreneurial” spirit—entrepreneurial zeal and speed coupled with the ability to leverage the assets of the large company. “Failures”—experiments that don't provide the expected results—are a natural part of the innovation process. Sometimes unexpected results can help show the way to bigger and better outcomes. Taking risks is especially important when it comes to ideas that may lead to breakthrough or radical change. Many innovators need creative freedom, something that can be difficult to find in a large organisation.

Medical technology is another sector where safety—in this case patient safety—comes first. But 85% of medical technology executives still say they are fostering an environment where failure and risk are reasonably tolerated. In fact, it's their #1 innovation culture priority. Why such a big difference? One reason may be the lack of a programme-oriented culture. Because medical technology innovation crosses the business, there may be more room to allow for exploring new ideas that may potentially benefit multiple products.



of AD&S executives believe tolerating risk and failure is important to building their innovation culture

Working across the group to spread risk

Our research suggests that AD&S companies are looking to reduce their exposure to risk. That's understandable, given the extremely high cost of new programme development. But AD&S companies need to find ways to mitigate risk without closing off research that could lead to the next breakthrough or radical innovation. One strategy is to finance some development projects at the group level; that lessens the pressure at the divisional level and can help foster innovation.

Finding tomorrow's talent, where it's needed

Looking ahead, the talent gap itself also poses risks to future growth. AD&S companies need a strategy to attract and retain their best employees. That includes understanding the existing skills base and how to keep strong innovators on board. And they need to transfer knowledge through a strong succession process too. Encouraging flexibility and mobility can help by increasing job satisfaction for your people.

There's already a shortage of talent in the US and Europe. And it's only going to get worse. In major markets like the US, there's a current generation of researchers and engineering getting ready to retire—and not enough new

graduates in math and sciences coming to take their places. Many top graduates are also taking jobs in the financial or consulting industries, instead of coming on board with AD&S.

Some companies are responding by investing in programmes that build the talent pipeline. And they're going one step further. For example, Safran has established a Corporate University, which partners with major universities and business schools to offer technical, management and leadership training for staff, to help foster talent in-house.

AD&S companies are growing in Asia, and so is the skills base there. AD&S companies will need to be able to tap into this talent base and also to bring local insight to bear on these markets (see *Booming Asia is likely to become a new center for AD&S innovation*).

Booming Asia is likely to become a new center for AD&S innovation

In the defence industry, budgets are shrinking in Europe and the Western hemisphere. But the situation is very different in Asia. China aims at becoming fully self-sufficient in terms of defence and has an impressive roadmap to do so. And India has emerged as the world's largest importer of major conventional weapons worldwide (12% of the global total). In Aerospace, too, Asia is growing fast.

What does this mean for AD&S companies?

- 1) OEMs are extending their footprint and capabilities into Asia markets.*
- 2) Asia governments are looking for technology transfer when negotiating large contracts.*
- 3) R&D spends are increasing quickly in Asia*

Over the long-term, Asia is likely to become an important location for AD&S innovation. And while engineering talent is still scarce, China and India are gaining fast when it comes to graduating engineers and PhDs. In 2011, China¹ enrolled over 170,000 masters' students in engineering. That's up from 132,000 in 2008. And in India, the number of spots for engineering and technology undergraduate students² grew by 125% in just five years.

.....
1 National Bureau of Statistics of China (<http://www.stats.gov.cn/english/statisticaldata/yearlydata/>)

2 <http://www.dreducation.com/2012/03/data-engineering-management.html>

Developing a strong ecosystem



Innovation doesn't just depend on how smart your people are. How well those smart people collaborate is just as important. We've found that across all sectors, the most innovative companies collaborate far more often than the least innovative.

In the AD&S sector, collaboration is especially important due to the high cost and long lead times associated with major programmes. Producing a new aircraft or submarine is a highly complex undertaking, where OEMs and increasingly also Tier One suppliers now need to manage a diverse ecosystem of suppliers.

Looking ahead over the next three years, respondents say they have plans to collaborate with a diverse range of partners from strategic partners and suppliers to academics and even competitors, although that's still a minority. Finding the right partner isn't always easy though especially in an increasingly globalised supply chain—nearly half of AD&S executives (45%) see it as a challenge.

We've seen that system suppliers are becoming increasingly important sources of innovation. Many are looking to differentiate themselves based on capabilities and performance; pursuing aggressive innovation agendas, and driving significant innovation, particularly within aircraft development programmes. OEMs are now sharing risk with suppliers, and collaboration is becoming an integral part of the development process—and even of initial research.

That's a profound shift from the traditional model, where most suppliers were “build to print”; e.g., expert at executing complicated plans and updating as needed—but not at developing the initial concept.

Taking the lead as the “Partner of Choice”

Innovation leaders in AD&S, as in many other sectors, are working to become the “Partner of Choice” in their innovation ecosystem. That helps them attract the best ideas from strategic partners, giving them access to faster, better, and cheaper innovations—a major competitive advantage.

It's not always easy to make collaborations work well, particularly when many players are involved. Falling short often leads to unforeseen risks and to delays. Indeed, programmes generally stand or fall on how well companies succeed in managing an inherently complex network of interlocking platforms and technologies from different suppliers. Unless you can get integration of this jigsaw right, don't make it even more complex by extending it further. If you can't get it right, then maybe a greater degree of vertical integration is what is needed.



of AD&S executives say their company will collaborate with strategic partners over the next 3 years

Opening up the innovation process

AD&S companies aren't just looking to their strategic partners to help drive innovation though. Some are also starting to embrace open innovation too. That's taking many forms, including research partnerships with government institutes and academia. More than one third of AD&S respondents believe that open innovation approaches offer the best possibilities for future growth.

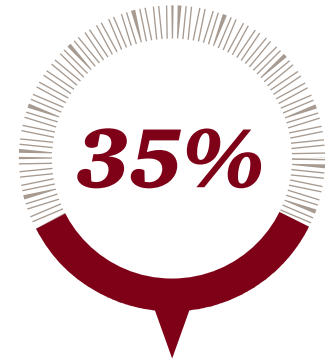
Research on composites is one good example of an area where open innovation is helping accelerate change. There are a whole range of projects within academia and sponsored or driven by government institutes. One example is a German-Canadian joint project, the Fraunhofer Project Centre for Composites Research at The University of Western Ontario in London Ontario.

In the UK, the Department of Business Innovation and Skills (BIS) released the country's composites strategy back in 2009. The UK sees composites as a vital high tech industry for future economic growth, so it has developed a coordinated approach bringing together Government, the regions, industry, research institutes and academia.⁴ A national centre dedicated to building the prototypes and the rapid manufacturing processes the UK requires is one facet; others include developing recycling strategies and training skilled personnel. AD&S companies are closely involved; for example, the GKN Aerospace Composites Research Center is located at the National Composites Centre.⁵

AD&S companies are also reaching out across industries to drive joint research. For example, in September 2012, the BMW Group and Boeing signed a collaboration agreement to participate in joint research for carbon fiber recycling as well as share manufacturing knowledge and explore automation opportunities.⁶

Some companies are developing their own centers for open innovation. The UK's BAE Systems has launched what it calls the "Sandbox" open innovation facility.⁷ It allows 3rd parties to use BAE Systems assets. In return, the company gets to evaluate new ideas and promote the development of products which can be integrated into BAE Systems products. Third parties get the ability to develop for BAE systems, an IP controlled environment, and access to expensive hardware and software.

Government research agencies have long been pioneers in open innovation. In the US, the Defense Advanced Research Projects Agency (DARPA), the agency many credit with inventing the internet, is one of the strongest proponents of open innovation. DARPA has crowd-sourced algorithms for its space station research programme, and is developing an open-source



of AD&S executives believe open innovation will lead to the most promising breakthroughs

4 Department for Business, Innovation & Skills, The UK Composites Strategy, November 2009.

5 <http://www.nccuk.com/collaborative-partnerships>

6 BMW corporate press release, "BMW Group and Boeing to collaborate on carbon fibre recycling", 12 September 2012. https://www.press.bmwgroup.com/global/pressDetail.html%3bjsessionid=hz9qSTFbLpLQ5G2KslxZG1GncFrFQM3Wl2tp0M212fP97B3WWgpTl-741441896?title=bmw-group-and-boeing-to-collaborate-on-carbon-fiber-recycling&outputChannelId=6&id=T0135185EN&left_menu_item=node__804

7 Phil Woods, "Innovation in Technology Acquisition in BAE Systems". http://www.defenceresearch.co.uk/pdf/dr10_philwoods.pdf

environment for developing systems like vehicles, aircraft and spacecraft. The agency has long used “challenges” around particular themes as a way to mobilise innovative ideas. The model allows small companies the chance to get a piece of the funding that might otherwise go only to major players. And it even reaches out to individuals too. One of DARPA’s latest challenges is “Crowd Sourced Formal Verification (CSFV).” It’s designed online games that test off the shelf software, helping to verify the absence of bugs or flaws in common open source software.⁸

Using social media

Social media channels like LinkedIn, Facebook, YouTube and Twitter are becoming an increasingly important part of the AD&S landscape. For example, the UK has a Defence Social Media Hub that lists a wide range of “official” and “sponsored” channels, and the Israeli Defence Forces have a “Spokesperson’s Unit” actively engaging with social media, while new conflicts are increasingly entering the global social space. There have already been tweets and foursquare check-ins from space. And when Airbus launched its new 350, the company used a whole range of social media channels, from Twitter and Facebook to Vine to promote the first flight.

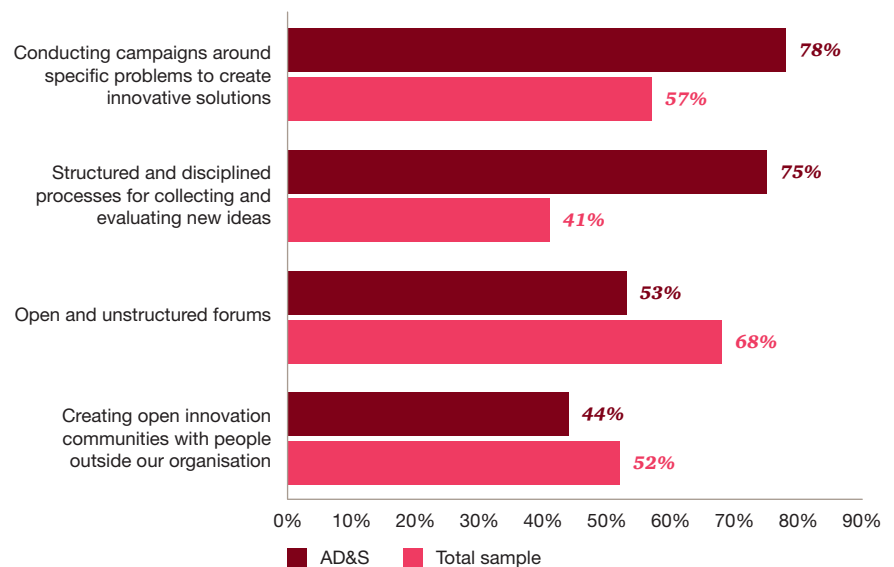
But do social media really have a role to play in innovation too? Our survey respondents gave an emphatic yes. More than three-quarters of them are already conducting campaigns around specific problems to create innovative solutions. That may reflect in part the prevalence of “challenge” competitions

like DARPA’s. And nearly as many AD&S respondents also say they’re using structured and disciplined processes for collecting and evaluating new ideas. That’s far more than across the overall sample (see Figure 4).

Social media can also be a powerful tool for raising awareness of innovation. Lockheed Martin’s website invites users to “Join the Innovation Conversation— Add us to your circles on Google+ for the latest news and updates about our innovations.” And many companies are using Twitter to increase coverage of technology breakthroughs in the media.

Figure 4: AD&S companies are already using social media far more than other sectors

Q: Does your company leverage social media to support innovation efforts in any of these ways?



Source: PwC, Breakthrough innovation and growth. Base: AD&S: 38; Total sample, 1757.

⁸ DARPA website, “Verigames Portal offers the chance to do serious IT security while playing online,” December 4, 2013. <http://www.darpa.mil/NewsEvents/Releases/2013/12/04.aspx>

Opening up a conversation with tomorrow's engineers

Airbus is using an open innovation strategy as a way to reach promising students. Its “Fly Your Ideas”¹ competition is held biennially. The first competition was launched in October 2008. Fly Your Ideas challenges teams of students to develop innovative ideas to shape the future of aviation. Since its launch, the challenge has already drawn together thousands of students from around the world.

“Fly Your Ideas” gives students the chance to develop teamwork, enhance their creativity and innovation skills, and improve their project management as well as presentation skills. Students have close interaction with Airbus staff and benefit from Airbus expertise and insight into the global aviation industry. Some past winners have resulted in long-term collaborations between Airbus and their sponsoring university.

The 2013 challenge focused on innovation and inspired over 6,000 students from 82 countries to register with 618 teams.² Students were asked to propose an idea addressing one or more of six themes: Energy, Efficiency, Affordable Growth, Traffic Growth, Passenger Experience, and Community Friendliness. Finalists were flown in to France to present their ideas to an Airbus jury. The winning team was from Brazil.

1 “Airbus - Fly Your ideas” website, <http://www.airbus-fyi.com/>

2 <http://www.airbus.com/presscentre/pressreleases/press-release-detail/detail/over-6000-students-worldwide-rise-to-the-airbus-fly-your-ideas-challenge/>

Commercialising innovation



Getting good ideas to your customers isn't easy. Two-thirds of AD&S executives say taking innovative ideas to market quickly and in a scalable way is a challenge for their company; that's significantly more than the average across industries (see Figure 5). That's what you'd expect in an industry where cycles are often very long. A new aircraft or weapons system is years, not months, in the making. And sometimes value starts to erode in long-range programmes.

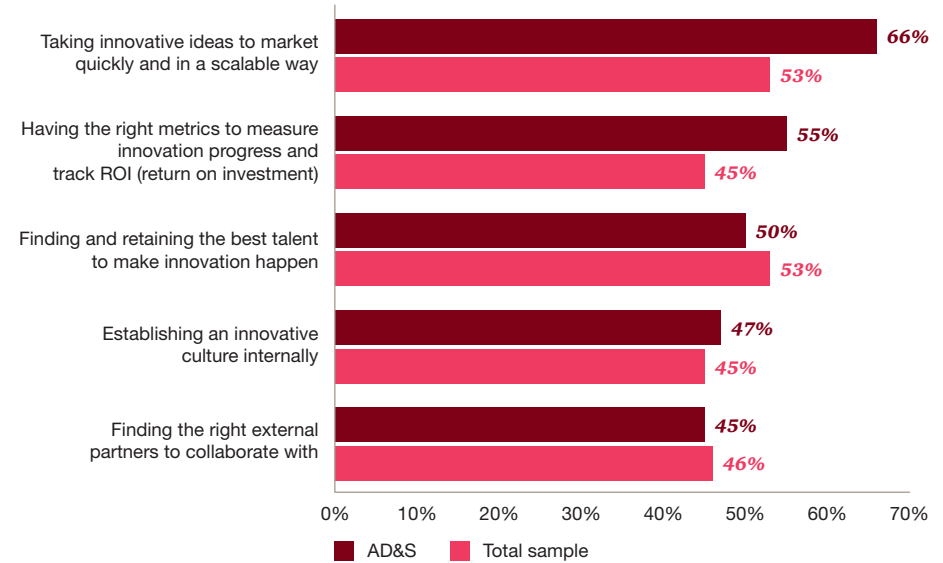
But there are ways that should be explored to get better. Having a well-defined organisational structure around innovation helps build alignment and higher performance through the sharing of best practices, resources and mental models for growth and innovation. These drive disciplined execution and lead to repeatable and scalable commercialisation of innovations.

So it's not surprising that the top innovators in our survey tend to have structured or formal innovation processes. Fewer AD&S companies are applying this type of discipline to innovation (see Figure 6). In fact, nearly a third of AD&S executives say that they organise innovation informally. And failing to coordinate across the business often means missing chances for growth or efficiency.

Historically the AD&S industry has been driven by programmes—specific aircraft of weapons systems developed over many years and sold over many years. These programmes often functioned autonomously—and that's created a legacy of spotty knowledge sharing in most AD&S companies. For example, we've found product planning is often confined within the boundaries of individual programmes. That can mean the innovations in one program aren't carried over to others, so opportunities to get more from a good idea are lost, or money is wasted on duplicate efforts.

Figure 5: Getting innovative ideas to market leads the list of innovation challenges for AD&S executives

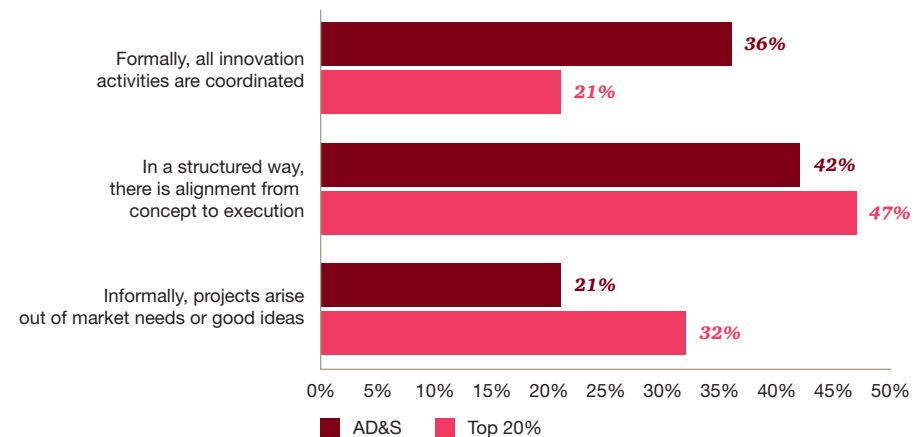
Q: How challenging do you find the following aspects of making innovation happen within your company?



Source: PwC, Breakthrough innovation and growth. Base: AD&S: 38; Total sample, 1757

Figure 6: AD&S executives are applying less discipline to their innovation processes

Q: Which of the following best describes the way that your company manages its innovation processes?



Source: PwC, Breakthrough innovation and growth. Base: AD&S: 38 Top 20%, 359.

Some companies aren't using the latest technology portfolio planning tools. That's because in organisations focused on programmes, it's difficult to consolidate common requirements to make the right trade-offs to develop technologies that serve multiple business needs.

Because many are so focused on operating at the programme level, AD&S companies often miss possible synergies happening across the business and don't make use of chances to leverage technology investment. A programme-focused structure can create cultural issues that hinder innovation too, like competition within a group that discourages cooperation and collaboration.

And yet—AD&S executives say they are convinced that well-defined and accepted innovation processes are important to establishing an innovative culture. In fact, with 85% rating it as important, it's number 1 on their list. That seems like a discrepancy, but it may just reflect different ideas of what a "well-defined" innovation process looks like. Informal processes may be accepted in the company—but we've found that applying structure and discipline can help move companies to the next level.

Strong innovation processes include room for fast failures

Effective innovation processes are iterative, beginning with the collection of ideas and progressing through stages of idea prioritisation, experimentation and decision-making about which ideas should be commercialised and ending with the delivery and monetisation of the innovation. When they work well,

these processes allows for the rapid development of successful ideas, and the fast failure of bad ones.

Fast failure is often particularly difficult for AD&S, but we believe it can give an important boost to innovation. Technologies like 3-d printing and enhanced computer simulations are making it possible to create real and virtual prototypes more quickly and at less cost. For example, Pratt & Whitney recently opened an Additive Manufacturing Innovation Center at the University of Connecticut using two different technologies to advance R&D. The company has already been using additive manufacturing for prototyping various engine parts.⁹ These kinds of advances should help companies make better decisions about which ideas should be commercialised, and speed up the development of winning concepts. Market leaders use agility and speed as valuable differentiators, enabling faster adaptation of new products, services and market.

Executives told us that innovation is the stepping stone to more profitable work and production program success; in some ways they believe it is necessary but not sufficient. Our research suggests that some companies have too many projects and past investments have not always contributed to enterprise value creation.

So tracking success is critical. But what aspects of innovation need to be measured? What are reasonable targets?

AD&S companies don't yet agree on the answers; indeed, 55% say that having the right metrics is a challenge for their companies. One standard metric used in other industries, the % of revenue delivered from new products, isn't as applicable for AD&S, given the long time scales of many of its products.

Targets around % of revenue from services or adjacent markets may be appropriate though. And it may be possible to track technology and process innovation better too, for example, by using a metric that quantifies savings on capital costs (capex) achieved by applying innovative technology instead of the best alternative technology available on the shelf.

In our view, the true measure of innovation success cannot only be seen through a financial lens. Leading companies define measurements that go well beyond the traditional ROI.

Some AD&S companies are already tracking patents and publications. In other industries, we've also seen companies documenting the transfer of know-how gained through innovation to other business units. For AD&S, this concept could be modified to reflect the transfer of know-how across programmes.

⁹ Design News, Aircraft Engine Maker Opens Additive Manufacturing Lab, April 29, 2013. http://www.designnews.com/author.asp?doc_id=262621&dfpParams=ind_183,industry_aero,bid_27,aid_262621&dfpLayout=blog&dfpParams=ind_183,industry_aero,bid_27,aid_262621&dfpLayout=blog



Where next for your business?

Companies with an innovation edge will have a strong competitive advantage. What can you do to make sure your company is a leader and not a laggard?

Know where you want to go and how you'll get there. Innovation requires careful planning and a clearly defined strategy. For AD&S, this needs to begin with a solid understanding of the market.

Listen. By getting feedback from customers upfront and throughout the life of a programme, you can improve the relevance of your innovation. Your own engineers and

your partners can tell you how to get more efficient. And moving into adjacent markets means learning about a whole new set of needs.

Focus on people. The executives we surveyed say it can be hard to get and keep the right people on board to make innovation happen. Developing and maintaining a strong innovation culture that supports top talent is critical. And so is finding good local talent in your growth markets.

Strengthen your innovation ecosystem. With suppliers moving from print-to-build providers to full-fledged innovators in their own right,

partnering is getting even more important. Getting co-creation right will make a competitive difference. And open innovation, collaborative platforms, and social media all offer tools that can help.

Make the most of good ideas. Applying more discipline and structure to innovation can help improve implementation. And we believe many AD&S companies also need to start looking beyond programmes and across their whole business when it comes to driving innovation.

Want to find out more?

For help and advice with your innovation strategy and process, please contact one of our Aerospace, Defence & Security leaders or one of our innovation leaders.

AD&S contacts

Global and France Aerospace, Defence and Security Leader

Guillaume Rochard
guillaume.rochard@fr.pwc.com

Brazil

Augusto Assuncao
augusto.assuncao@br.pwc.com

Canada

Mario Longpre
mario.longpre@ca.pwc.com

China

Huw Andrews
huw.andrews@cn.pwc.com

Germany

Martin Theben
martin.theben@de.pwc.com

India

Dhiraj Mathur
dhiraj.mathur@in.pwc.com

Italy

Corrado Testori
corrado.testori@it.pwc.com

Middle East

Masood Hassan
masood.hassan@ae.pwc.com

United Kingdom

Dean Gilmore
dean.gilmore@uk.pwc.com

United States

Scott Thompson
scott.thompson@us.pwc.com

Innovation contacts

Rob Shelton

Global Innovation Strategy Lead
rob.shelton@us.pwc.com

David Percival

Global Client Innovation Lead
david.percival@uk.pwc.com

Acknowledgements

We would like to express our appreciation for the expertise and support provided to the below listed individuals: Oliver Buccicone, John Chou, Elizabeth D'Antuono, Vincent Espie, Dean Gilmore, Jonathan Heasman, Bill Lay, Romain Lefrançois, Kurt Steltenpohl, Mark Thut and Peter Vickers

Thanks to Elizabeth Montgomery for her role in the production of this publication, to Michael Brilhault for project management and to Marina Waltz for design

PwC helps organisations and individuals create the value they're looking for. We're a network of firms in 158 countries with more than 180,000 people who are committed to delivering quality in assurance, tax and advisory services. Tell us what matters to you and find out more by visiting us at www.pwc.com.

This publication has been prepared for general guidance on matters of interest only, and does not constitute professional advice. You should not act upon the information contained in this publication without obtaining specific professional advice. No representation or warranty (express or implied) is given as to the accuracy or completeness of the information contained in this publication, and, to the extent permitted by law, PwC does not accept or assume any liability, responsibility or duty of care for any consequences of you or anyone else acting, or refraining to act, in reliance on the information contained in this publication or for any decision based on it.

PricewaterhouseCoopers has exercised reasonable care in the collecting, processing, and reporting of this information but has not independently verified, validated, or audited the data to verify the accuracy or completeness of the information. PricewaterhouseCoopers gives no express or implied warranties, including but not limited to any warranties of merchantability or fitness for a particular purpose or use and shall not be liable to any entity or person using this document, or have any liability with respect to this document.

Copyright © 2014 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details. AT-14-0184