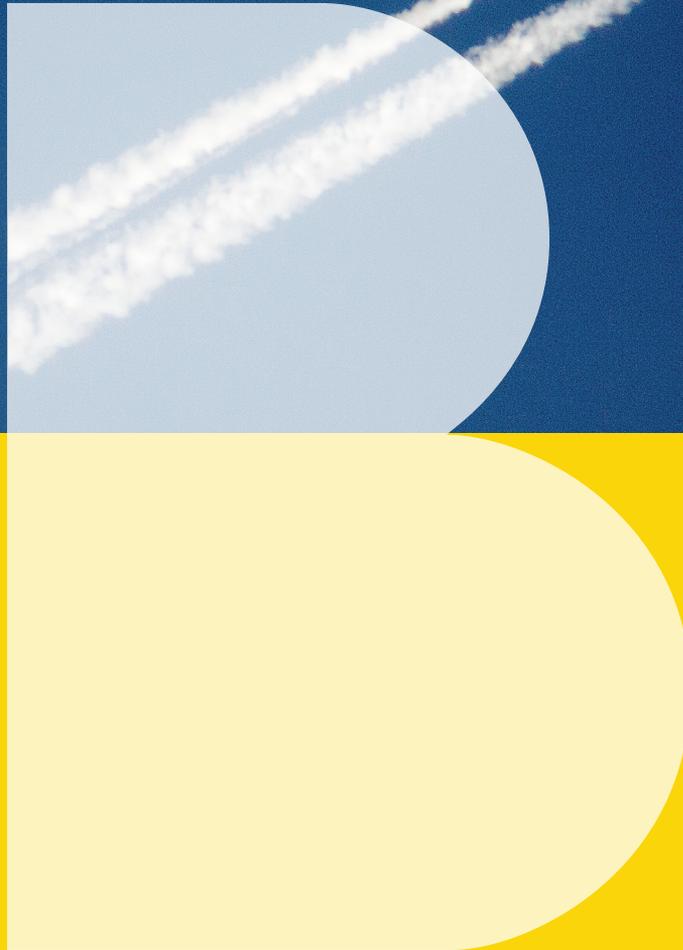


THINK ACT

BEYOND MAINSTREAM



June 2016

Aerospace industry: turning point ahead?

A&D Management Issues Radar 2016

THE BIG

3



87%

of our interviewees believe that the decline in European defense spending is over, while 31% expect a downturn in commercial aviation in the next three to five years.

Page 11

98%

of our respondents believe that digitization is the next big thing in the A&D industry. However, only 5% know what is really at stake.

Page 16

11%

only are positive about the long-term vision behind the management of their companies' engineering activities.

Page 22

In fulfillment mood. For 2016 and beyond market sentiment is more optimistic in the defense sector than in civil aerospace. Digitiza- tion? Underestimated.

Although most industry experts foresee further growth in the civil aerospace sector, the outlook is less positive than in 2015. The closer we looked at the various groups of companies, the more diverse the picture turned out to be. Two thirds of the participants in the civil sector expect growth to continue for the next five years or beyond. And yet, there is a slight feeling that the turning point is just down the road and that steady growth may soon be a thing of the past. As future growth could be uncertain, the consequence is that companies will have to be careful about their strategy and investment.

On the other hand, the mood in the defense sector is rather optimistic. Expectations vary by region, but the vast majority of industry leaders see defense spending returning to growth due to persisting geopolitical

tensions, not only in the Middle East but also in other regions. Generally speaking, this is good news for the industry. As A&D markets are volatile, and customer needs and behavior difficult to predict, it is surely beneficial for most companies to have a balanced portfolio across civil and defense. At the very least, market opportunities in defense should be carefully reassessed.

BE AWARE OF DIGITAL DISRUPTION

Apart from future changes in demand, digitization is expected to impact the industry heavily. Our survey reveals that managers are unsure when and how this will happen. In our view, top decision-makers are still underestimating the effects of digitization, especially the disruptive impact on their top line. Many are stuck with the belief that the impact will be mostly on bot-

tom line efficiency. Many companies just don't have the right skills and personnel to think of new business models and conduct the right analyses to determine what to do in this fast-changing environment.

REMARKABLE SHIFT IN R&D SPENDING

Overall, Research and Development (R&D) spending as a proportion of revenues is expected to be sustained at current levels for the next three years; given increasing production rates in both civil and defense sectors, this implies an increase in the absolute amount of R&D spending. From our perspective, this is one of the most remarkable results of the survey – given that the major new programs in the civil sector (A350 and 787) are well

past the peak of development spending, and that no major new defense programs have been launched, we would have expected to see a decline in R&D spending. Thus there appears to be a fundamental disconnect between the level of development program activity and the amount companies expect to spend on R&D.

Our survey also generates two further results:

- > A re-focus of engineering activities from new product development to product innovation, to process cost-focused industrial / manufacturing engineering, and to product cost-focused reduction projects.
- > A need to transform engineering in response to digitization in order to increase efficiency, shorten development cycles and lower costs.



30

CEOs/COOs/CFOs

200

senior industry executives

90

companies

20

countries

THE SURVEY'S SCOPE

Trends on market perspectives, digitization and engineering

This "A&D Management Issues Radar" is the 8th edition of our annual survey, since we first launched it in 2008 to support executive-level thinking across the Aerospace & Defense industry. For this year's issue we interviewed almost 30 CEOs, COOs or CFOs. In addition, we sent out a questionnaire, which was answered by almost 200 senior industry executives from nearly 90 companies in 20 countries. This year our survey captured prevailing trends on the following top management issues:

MARKET DYNAMICS

Will the current buoyant market conditions in the civil aerospace sector continue and will government spending on defense pick up again?

DIGITIZATION

Will digitization heavily impact the Aerospace & Defense industry and if so, which areas will be impacted the most?

MANAGEMENT OF ENGINEERING RESOURCES

How is the engineering function currently transforming and is the transformation managed with long-term vision?

The survey was conducted across a broad scope with participants coming not only from OEMs and Tier-1/2 Suppliers but also from Manufacturing Equipment Suppliers, Consulting, Automation, Technical Service Providers, Logistics Providers and Industry Associations. A broad range of industry players was included: Airbus, BAE Systems, Finmeccanica, Rockwell, Rolls-Royce, Safran, Thales and many others.

Priorities for 2016.

Manufacturing is the top operational concern within the A&D industry. The surprise: Product Strategy is more important than Supply Chain Management.

Every year we ask what senior executives see as their top 3 priorities for the next 12 months, and this year's top priority is no surprise – Manufacturing. → [A](#)

We can easily see why this should be the case when we consider the activities within the industry, which include:

- > two new large commercial aircraft programs, A350 and 787, having entered production and steeply ramping up production rates;
- > the introduction of two new engines, PW1000G and Leap-X, for re-engining single aisle aircraft with near vertical ramp-up curves;

> the long-awaited production ramp-up of the F-35 Joint Strike Fighter.

Supply Chain, clearly closely linked to Manufacturing, was the third-highest priority, and again this was no surprise. In fact, if we look at the trends in priorities in recent years, we can discern two clear phases.

During 2011 and earlier years, Program Management was the top priority, with considerable importance also attached to topics such as Product Strategy and R&D Efficiency; in this time period there were two large commercial aircraft programs in development, and companies were highly focused on managing the

A

TOP PRIORITY FOR THE MANAGEMENT

What are the main topics on your company's agenda in 2016?

[Four most frequent answers]



"The real surprise was that Product Strategy ranked as no. 2 this year, behind Manufacturing but ahead of Supply Chain."

AEROSPACE	DEFENSE
Manufacturing	Manufacturing #1
Supply Chain Management	Product Strategy #2
Product/Service Portfolio	Program Management #3
Geographic Expansion	Geographic Expansion #4

complex development processes associated with these aircraft. In more recent years as these programs have transitioned from development to production phases, Program Management slipped down the agenda, to be replaced by Manufacturing and Supply Chain.

The real surprise in this year's prioritization was that Product Strategy ranked as no. 2, behind Manufacturing but ahead of Supply Chain. Given the absence of new programs in the civil sector, this result is initially counter-intuitive. However, on closer inspection, the high ranking given to Product Strategy is largely due to the importance assigned to this topic in the defense sector. This finding ties in with the increases in defense budgets (noted on pages 11 ff. of this report), and the way in which defense companies are developing new products to capture a share of these increasing budgets.

If the defense industry follows the historical precedent set by the civil sector, we will see Program Management replace Product Strategy as new programs move from concept stage to development, only to be replaced in turn by Manufacturing or Supply Chain as new designs mature and require industrialization. Given the rapid pace of recent change in the civil sector, there is much that the defense industry could learn from the Program Management approaches developed in the civil sector in order to increase efficiency and ensure that commitments to customers are fully met.

Civil market: sentiment changing, despite the positive outlook? Optimism persists, but the number of skeptics is rising.

This year almost one third of our industry respondents (31%) believe that we are near the top of the current cycle, and that a downturn is coming in the next 3-5 years. This proportion, up from 27% last year, may indicate that sentiment in the industry is changing, since we also see the proportion of those believing that the industry is entering an endless "super cycle" down from 37% to 33%.

At a first glance it is hard to see why such skepticism is growing, since both Airbus and Boeing have around 9 years of backlog in their major programs, and both companies have announced production rate increases for their single aisle products. One concern sometimes expressed is over the number of orders in the hands of leasing companies. However, the proportion of orders by leasing companies in the current order backlog at Airbus has only increased from 16% to 20% from 2006 to 2016 – hardly a major influence in the growth in order books. In addition, if one looks at the total orders by region, there has been little change

over the last 10 years, with the proportion of orders in Asia little changed at 36-37%. → **B** If one searches for a reason to worry, a cause for concern may lie in the growth in "undisclosed" customers, up from 2% in 2006 to 14% in 2016. Assuming that this 14% is largely attributable to orders from Asia (perhaps not an unreasonable assumption given that named Chinese customers make up less than 1% of the order backlog at Airbus), this would mean that half of the backlog at Airbus (36% plus 14%) is in Asia – given the current concerns over the state of the economy in China, this could be a real cause for concern.

On the more positive side, 33% of our respondents expect that there will be gradual increases in production rates, and that these rate increases will be well-managed by the OEMs in response to changes in demand. These 33% believe that the industry is set for a long-term super cycle and will avoid the cyclical downturns that have historically plagued the civil aerospace industry roughly once every decade. Another

36% believe that the present cycle has some way further to run with volumes increasing by 10-20% from today, but that the industry will enter a downturn in around 5 years' time. Thus two thirds of the industry expect growth to continue for the next five years or beyond. However, uncertainty prevails, with increasing negativity, as if to prove that we live in VUCA times: volatile, uncertain, complex and ambiguous.

Aside from this general trend, we split up our findings to be more precise about expectations. Comparing companies by level in the value chain, we find that executives of tier-1 suppliers are more pessimistic with regard to a long-term super cycle with 40% expecting a downturn in the next 5 years. On the contrary, tier-2 suppliers' executives are much more optimistic than the overall average of the industry leaders – including OEMs – with 84% predicting a gradual rise for 5 or more years, or even a continuation of a long-term super cycle.

A MATTER OF TRUST AND TRANSPARENCY

Even with such a multifaceted picture, there is a slight feeling that the turning point is just down the road and that steady growth may soon be a phenomenon of the past. → **C** As future growth could be uncertain, the consequence is that companies will have to be careful about their investment and strategy. At this moment, the industry is cautious about the ramp-up in single aisle (i.e. Airbus A320 family and Boeing 737) production rates from a shade over 40 aircraft per month today to 60 aircraft per month by the end of the decade. The question is not whether OEMs can increase production rates in this way, but rather whether such a rate rise would be sustainable. Suppliers do not want to invest in additional capacity to reach rate 60, only to find that production rates are cut by the OEMs in a couple of years and the carefully added capacity stands idle. The two large commercial aircraft OEMs have good visibility over their own order books, and since they each control half of the market, the two OEMs have an exceptionally good perspective on the latest order patterns. It is up to the OEMs to communicate clearly and transparently, and the suppliers need to trust the OEMs.

"There are slight signs that the turning point is just down the road and steady growth may be a thing of the past."

B

A CAUSE FOR CONCERN?

Airbus order backlog by region

REGION	2006	2016	
Asia	37%	36%	↓
Europe	28%	22%	↓
Africa	1%	1%	→
Latin America	7%	8%	↑
Middle East	7%	8%	↑
North America	18%	12%	↓
Undisclosed	2%	14%	↑
Total	100%	100%	

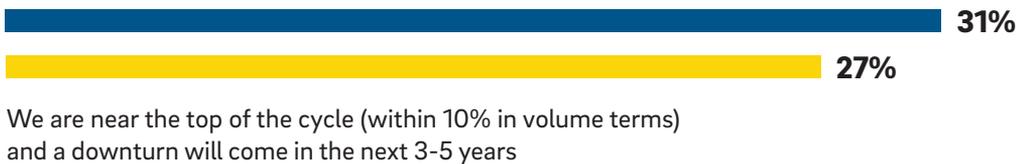
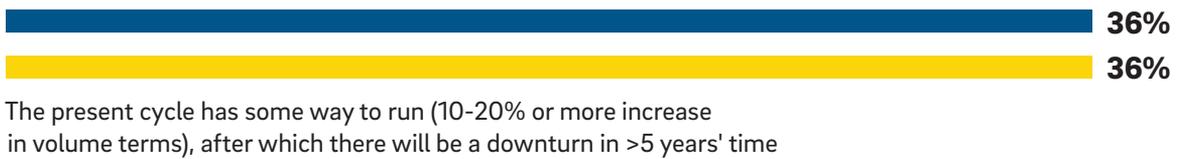
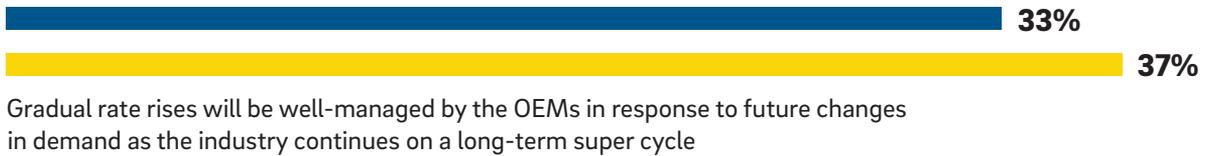
Source: Airbus

C

EXPECTED MARKET CONDITIONS IN THE CIVIL A&D SECTOR DOWNSTREAM

How long do you think that the current buoyant market conditions in the civil aerospace sector will continue?

● 2016 ● 2015



Defense market: Favorable conditions. Industry leaders agree that the European spending decline is over.

The defense market paints a clear picture. Almost 90% → **D** of the industry leaders in our survey expect a flat or growing budget for defense equipment in Europe. This positive outlook has increased since 2015, when two thirds predicted growth in the mid-term. It is a perfect match with other independent sources like SIPRI (Stockholm International Peace Research Institute). There is a lot of momentum in this segment, with bold signs of growing defense budgets: → **E**

Europe: Military budgets are expected to grow by an estimated average of 8.3% in 2016 after more than two decades of decline. This is due to the fear of terrorism and the tougher Russian posture. Europe is also hiking defense spending in response to the NATO request that all members spend 2 percent of their GDP on defense.

- > Military spending in Western and central Europe was down by 0.2% in 2015, but in Central Europe alone spending was up 13%, as per SIPRI data.
- > In France there is a strong concern over the situation in Africa and the Middle East as well as terrorist threats. The French defense budget is expected to total EUR 34 bn in 2019, up from EUR 31.4 bn in 2015. Part of this growth will be allocated to equipment purchase, maintenance, weapon replenishment as well as space and

cyberwarfare – positive messages for the likes of Thales, MBDA, Dassault Aviation and Safran.

- > Germany: Compared to earlier plans, the increases will see an additional EUR 10.2 bn pumped into the armed forces in the next four years. Under Federal budget proposals for 2017, the German armed forces will receive EUR 36.6 bn in 2017, compared with the current year's EUR 34.3 bn, and more than double the growth rate of 2.7 percent for the federal budget as a whole.

- > UK: The Strategic Defence and Security Review (SDSR) 2015 outlines a number of areas for increased investment, with an extra GBP 12 bn committed to the 10-year equipment plan, including F-35 fighter jets, A400M transport aircraft, "Protector" drones, Boeing's "P8" anti-submarine aircraft. The UK is about to create a Cyber-Security Operations Centre (CSOC). The GBP 40 m fund comes as part of an even larger GBP 1.9 bn to be invested in the UK's cyber-security over the next five years.

- USA: The Pentagon is to propose quadrupling its budget for European defense in 2017 to counter Russian foreign policy on the Ukrainian peninsula. The Pentagon will also propose a 50% increase in spending on the campaign against so-called Islamic State. According to

D

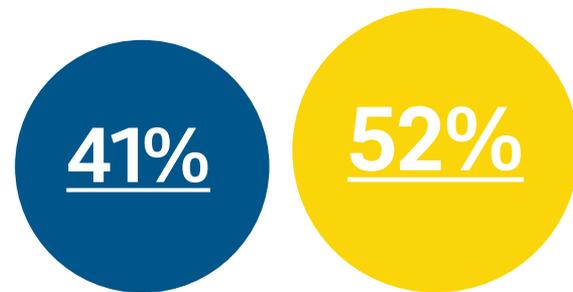
PERSPECTIVES ON DEFENSE EQUIPMENT IN EUROPE

Do you think that the decline in government spending on defense has reached an end?

● 2016 ● 2015



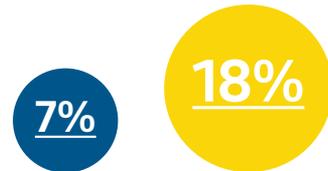
Yes, I expect defense spending to return to growth next year



Yes, I expect defense spending to remain flat



Yes 87%
(68%)¹



No, I expect additional cuts to defense spending for the next 1-2 years



No, I expect additional cuts to defense spending for >2 years



No 13%
(32%)¹

Defense Secretary Ashton Carter the US is investing USD 1.8 bn in 2017 to buy over 45,000 more laser-guided missiles and smart bombs.

Middle East: The threat from jihadist groups and the Saudi-led war in Yemen fuel a major rise in military spending. Saudi spending has led to the first upsurge in years. While Israeli expenditure is rising in absolute terms, it is sinking relative to GDP, and Iran is expected to be a major equipment purchaser with its sanctions lifted.

Asia: Tensions with China fuel spending in the region and push neighboring nations to launch programs with a naval focus. Japan is becoming a defense systems supplier, and India is striving to grow its capabilities versus China and Pakistan, but is slowed down by the lack of maturity of its industry and the weight of its bureaucracy. In Australia the mega-program for 12 submarines awarded to DCNS is another sign of this trend.

With regard to the general news about growing defense budgets in Eastern Europe, counter-intuitively our participants from those regions were more pessimistic about their perspectives. Admittedly, an uncertain geopolitical and security environment may reinforce the trend towards closed economies, with capital controls and trade restrictions. However, this may prove to be a short-term explanation. Western European experts are optimistic of improving market conditions in Eastern

Europe. 46% expect a return to growth next year, with only 13% afraid of a further decrease, e.g. in Russia. In early spring, some European companies spread good news: Finmeccanica announced that it had signed a contract to supply 28 Eurofighter jets to Kuwait, worth between EUR 7 bn and EUR 8 bn, with half of the contract value retained by BAE Systems, Airbus and its engine suppliers Rolls-Royce and MTU. For their part, French defense players enjoy continuous success, DCNS in Australia and Dassault in the Middle East and India, with very positive effects on their supply chain (mostly Thales and MBDA).

Other companies will benefit from the geopolitical situation, too. As A&D markets are volatile, and customer behavior is difficult to predict, it is beneficial to have two pillars to stand on: civil and defense business. Thales, a dual player, has performed strongly of late. There are exceptions to the balanced portfolio objective (MBDA, BAE Systems, DCNS). However, from a portfolio perspective companies ought to transform from being a mixed supplier with a defense background to an efficient supplier for the civil industry. In our view, the old belief holds true: OEMs need an aftermarket business, new and established programs, civil and defense products and services. To put it the other way round: aerospace suppliers should think of investing in defense. At the very least, they should stop divesting from defense.

E

UP IN ARMS

Growth of selected defense budgets until 2020 [in EUR bn]

	2015	2016	2017	2018	2019	2020	CAGR
Germany	28.7	29.8	31.8	32.1	32.9	34.1	3.5%
USA	487.3	509.0	475.9	483.8	490.8	495.7	0.3%
UK	47.7	48.3	48.9	49.4	50.0	50.5	1.1%
France	31.4	32.0	32.7	33.3	34.0	34.7	2.0%
Russia	46.9	45.2	49.1	53.3	57.8	62.8	6.0%
China	125.5	139.2	154.3	171.1	189.8	210.5	10.9%
India	35.1	37.4	40.0	42.7	45.7	48.5	6.8%
Saudi Arabia	49.3	55.0	59.6	64.6	70.0	75.8	9.0%

Digitization: The uncharted impact.

Although entry hurdles for a digital disruptor are high we foresee disruption attempts similar to automotive and space.

Among industry leaders there is hardly any doubt that the industry will be impacted by digitization in the mid-term. More than two thirds → **F** see this already happening, or arising within just 2 years. Hardly any of the respondents – a mere 2% – would deny that there will be a profound effect within the next 5 years.

However, 51% → **G** of the industry leaders questioned see the impact of digitization on bottom line efficiency only. 18% expect an impact on top-line in terms of new business models and/or new products or services, while 31% see an impact on both top- and bottom-line. From our perspective we'd say "only" half of them have disruption on their mind. This is surprising. A large share of industrial leaders seems to underestimate the risks that digitization poses for their value chains. Our experience from other industries suggests

that digitization affects customer needs, i.e. solutions become possible that were unheard of before. Therefore, we explicitly encourage leaders to scrutinize their whole value chain for disruption opportunities radically instead of focusing on pure efficiency improvement.

NO DISRUPTOR IN THE SKIES YET

Having said this, there is no digital disruptor in civil aircraft manufacturing in sight for now. Entry barriers remain extremely high. Certification costs and requirements cannot easily be overcome by new market entrants. The market concentration, be it in duopolies or oligopolies, is another hurdle.

Chinese and Russian OEMs are trying to enter the aircraft market – with systems and equipment from the incumbents in Europe or the US and, so far, with limit-

ed success. The new competitors did not strive for truly innovative and ambitious goals, instead they did what the incumbents did over previous decades. Hence they did not prove to be disruptors: They did not aim for instance to produce a large commercial aircraft for, let's say, EUR 20 m instead of EUR 50 m to really challenge the industry.

We observe a lack of imagination in some parts of the industry, especially in aircraft manufacturing. In our view many executives in the A&D industry do not jump far enough. They feel well protected by large order books and high hurdles to entry. Program management and engineering functions remain very powerful. We think the sector will be challenged by aggressive new players.

Take space as an opposing sub-sector: The barriers to entry are even higher, since many programs are government owned or heavily subsidized like the "Ariane" launcher or the European satellite program "Galileo". But still, US player SpaceX has enjoyed substantial suc-

cess in recent years. In our view SpaceX masters the fundamentals of digitization very well. It has "brought industrialization to a sector mostly run by agencies," as a top executive told us. Players like OneWeb challenge the satellite industry by setting cost and production rate targets that were considered impossible just a few years ago.

Although there is no disruptive player in the civil aerospace segment yet, the oligopoly with its persistent inefficiencies provides a promising environment for disruption. However, incumbents have begun to understand the need to change their approach and are developing their own start-ups and innovation entities. Airbus' "Bizlab" in Toulouse is an example. Incumbents do change: Airbus Defense and Space successfully secured a key production contract with OneWeb. We see the sector starting to change, and expect this change to gain significant momentum over the coming decade. "Any business in any segment can be disrupted," a top executive in aerospace told us anonymously.

What is digitization all about?

CHANGING THE GAME FROM SCRATCH

Digitization means rethinking business models from a customer perspective and deploying technology consistently. Yet it is also far more than just technological change: Digitization must be understood on a much more fundamental level. Getting it implemented is all about trial and error and – most of all – trying again and again and again until it works.

1 SMART DATA/BIG DATA
It's about knowing your customers inside out by capturing, processing and analyzing data from internal and external sources, harnessing the power of data to improve forecasts and decision capabilities.

2 AUTOMATION
It's about automating internal business processes and standardizing interfaces to business partners. But it's also about combining conventional technologies with artificial intelligence to create autonomous, self-organizing systems.

3 DIGITAL CUSTOMER INTERFACE
It's about occupying and controlling key positions and pivotal points of customer access, creating total transparency and delivering new services.

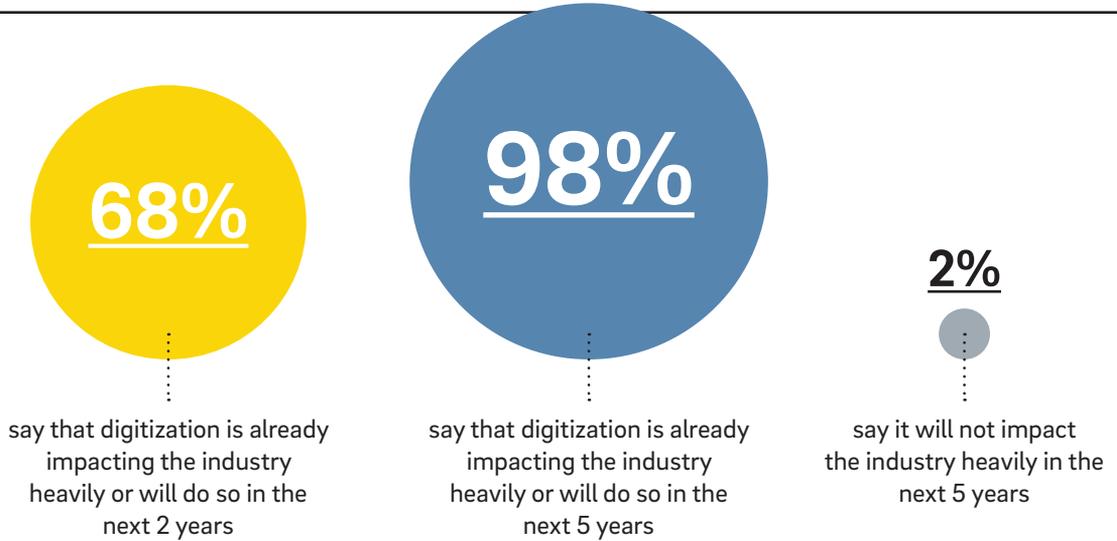
4 DIGITAL CONNECTIVITY
It's about leveraging high-bandwidth fixed and mobile telecommunications to interconnect the entire value chain, synchronize supply chains and thus shorten production lead times and innovation cycles.

5 CULTURE CHANGE
It's about thinking in terms of minimum viable products (MVPs) and spiral development instead of "getting it perfect first time". The technical or commercial failure of a concept or product is no longer seen as a negative, but as part of an inevitable and valuable learning journey. If you fail, fail fast and cheap. Do it better next time.

F

DIGITIZATION? YES, BUT...

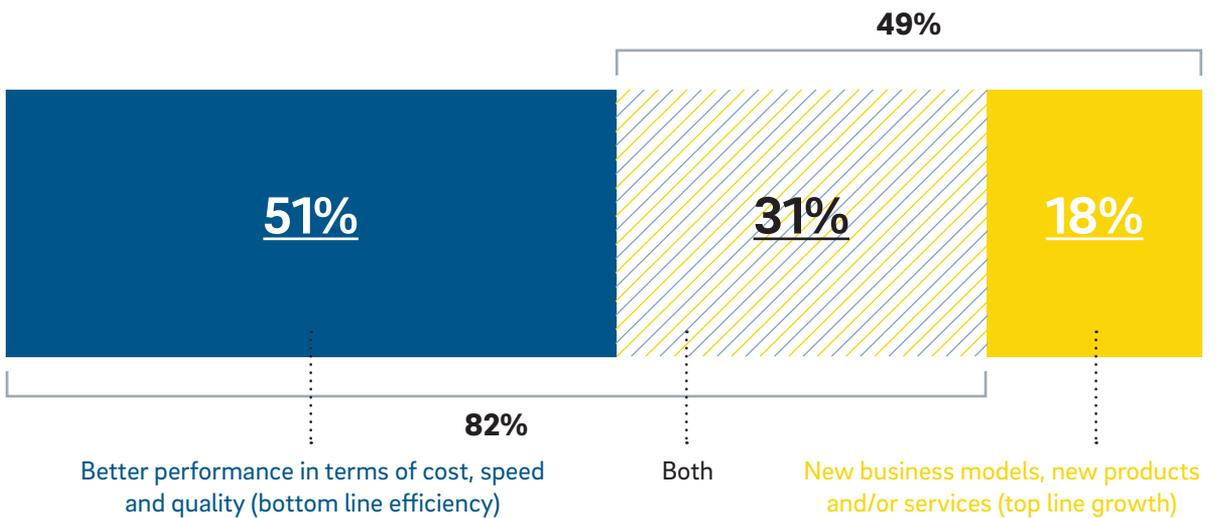
Will digitization heavily impact the Aerospace & Defense Industry?



G

BOTTOM LINE EFFICIENCY OR TOP LINE GROWTH?

How digitization will impact the Aerospace & Defense industry



Engineering reallocated. Overall R&D spending is increasing, although no major development programs ahead. Both OEMs and suppliers need to reassess their engineering strategies.

When talking to top managers, both at OEMs and suppliers, it becomes clear that there is a need and willingness to revisit the purpose of engineering and the way R&D is performed in the aerospace industry fundamentally. Ostensibly, engineering costs are a major cost block that is being challenged. But the issue runs deeper: while up to now the implied objective of any aerospace engineer has been to design for the highest possible performance, the paradigms are rapidly changing in the market. The SpaceX example shows that a reliable performance stemming from technology that is not state of the art is accepted if the cost of the

product can be reduced. Furthermore, the need to produce aircraft at ever faster rates points to a rapidly increasing necessity to be able to design for manufacturing. "It is the top management's responsibility to give the engineering community objectives they should work towards – we should be asking them to come up with ways to build an aircraft at 50% of today's cost," acknowledges a senior R&D executive at an OEM. In practice, however, the focus seems to lie on challenging engineering efforts and working incrementally on engineering efficiency. "We need to strengthen our program management to be able to better challenge engi-

"OEMs are preparing for yet unknown development programs, or they are not managing budgets properly."

neering and contain engineering cost," says the CEO of a tier-1 supplier.

Our survey reveals, however, that neither seems to be put into practice successfully. As a matter of fact, the survey results indicate that:

- > engineering costs tend to continue to increase, although the industry has reached the end of a development cycle and
- > there is little priority on disruptive thinking in the way the engineering function is being transformed.

STABLE FUTURE R&D SPEND

The feedback from the survey participants indicates that the significance of the engineering function has increased over the past three years even as development work on major programs (e.g. A350XWB, B787) has been completed. In particular, companies which used to spend only a small part of their revenues (i.e. below 2%) on R&D are investing more money today and will continue to do so in the coming three years → **H**: 17% of the companies in our survey spent very little three years ago, only 11% belong to this group today – and we can expect it to be down to 8% in three years' time. Simultaneously, companies with higher relative R&D spend have continued to increase it and will continue to do so, albeit at a slower pace than in the last 3 years and only within the lowest band of 2-4% of revenues. Taken altogether, a slight increase of R&D can be observed in the industry.

On a broad level this is a counter-intuitive result, given that the major development cycle has ended as both the 787 and A350 have entered service and are well past the peak of development spending, although there is some re-engineering activity (e.g. A320neo, A330neo, 737 MAX and 777X). Re-engineering comes at considerably less cost than an all-new aircraft, which is

why the OEMs are pursuing this strategy. Either the companies are preparing for some yet unknown new development programs, or they are not managing their budgets properly. It is indeed a pressing question: Do leadership teams control their engineering spend efficiently? It is well worth distinguishing between OEMs and tier-1 and tier-2 suppliers. Only with a closer look along the value chain does the data show how engineering resources are reallocated, with the focus shifting from OEMs to suppliers.

The results of our survey suggest that OEMs typically invest between 2% and 6%, with the highest number spending between 2% and 4%.

Tier-1 and tier-2 suppliers, on the other hand, seem to increase their relative R&D spending heavily. However, there is a difference between the two.

Tier-1s seem to be aiming towards an average spending of 2% to 4% (44% in the coming years against 38% today).

Tier-2s have already increased their spending drastically over the last three years (with only 16% remaining in the lowest spend cluster of the column today). Then, more than half of the questioned industry leaders claimed to spend less than 4% on R&D, now almost three quarters are spending more than 4%. → **I**

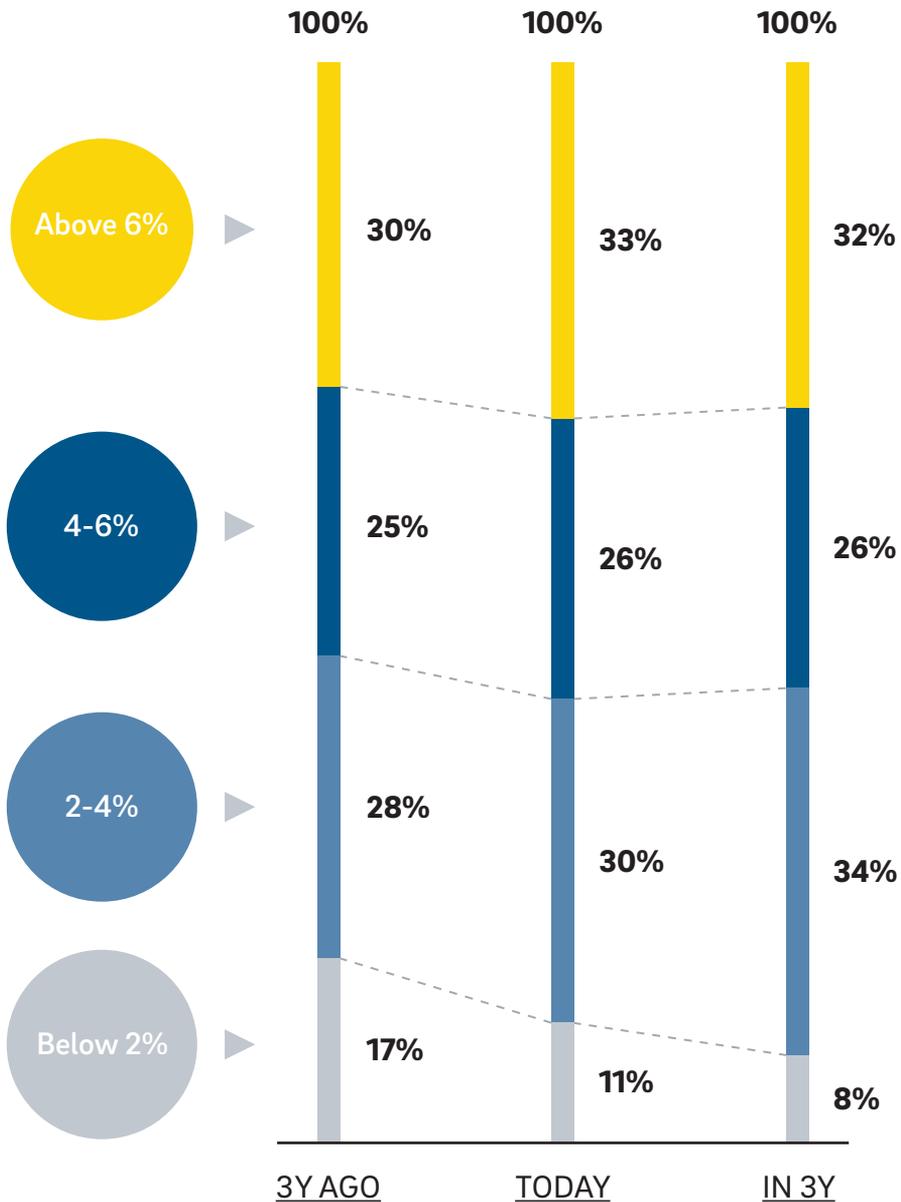
This underscores the different roles the suppliers adopt in the value chain. Tier-1 suppliers increasingly act as integrators, while tier-2 suppliers have taken over most of the innovation. The results illustrate how OEMs are pushing innovation down the value chain. However, from our experience this development is not without risk. The survey results also indicate that OEMs are not reducing their engineering spend correspondingly, which suggests a doubling of capacities along the value chain and corresponding inefficiencies. On the other hand, our experience shows that tier-2 suppliers often lack the program management capabilities and know-how to wisely spend the R&D money. Furthermore, there is a risk that tier-2 suppliers cannot sustain their R&D effort and capacities, given that they often do not have direct contacts with the OEM and that they have limited perspective of the OEM's overall needs and development roadmap.

All of the above points to the question of whether engineering efforts and resources are efficiently allocated along the supply chain or whether the industry's R&D model is not sustainable, i.e. heading towards an "engineering bubble" for lack of coordination.

H

MORE MONEY FOR R&D

Revenue spent on R&D activities

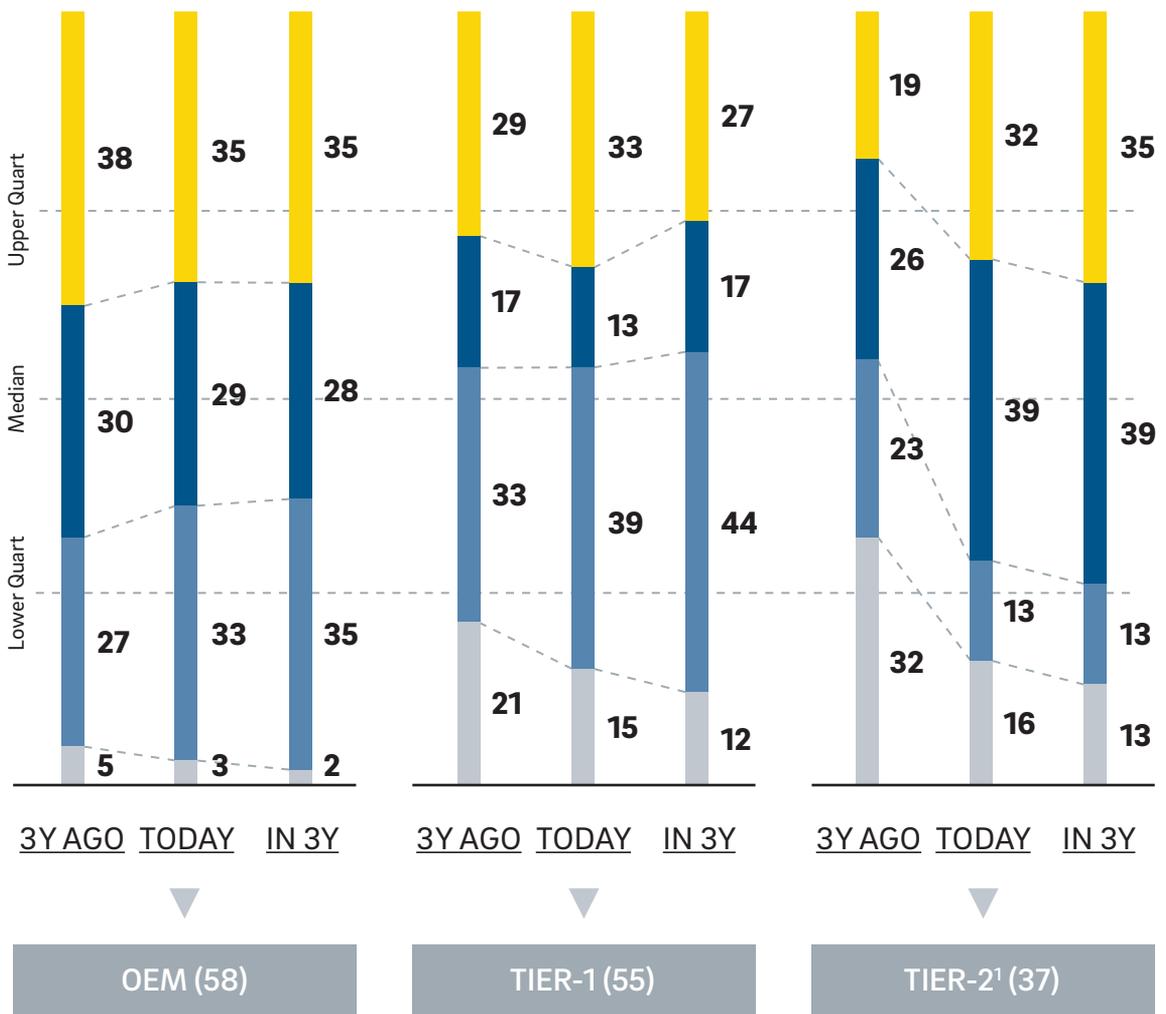


PUSHING THE PRESSURE DOWNSTREAM

OEMs pass it on: tier-2 suppliers are in charge of innovation.
Expenditures for R&D along the value chain

[% of answers]

● Above 6% ● 4-6% ● 2-4% ● Below 2%



Source: Roland Berger "Top Management Issues Radar 2016"

1) Includes Governmental Organizations and Institutions

"INCREMENTAL TRANSFORMATION"

Although spending seems to be increasing in the short term, the commencing of a new R&D cycle is expected only in the mid or long term. 91% of the industry leaders expect a new R&D cycle to commence within the next 10 years, with the vast majority being cautious, pointing to the time span 5 to 10 years from today. Hardly anyone among the industry experts anticipates a major new aircraft program before 2025. As it takes 3 to 4 years after the start of a development program for the R&D money to reach the tier-1 or tier-2 level, the next R&D cycle for suppliers will start even later.

Against this background, the industry leaders share the belief that the engineering function → J needs to be re-focused. Key axes for transformation are:

- > a clearer focus on the objectives of engineering enabling significantly lower product cost;
- > comprehensive leveraging of digital mindset and tools to increase agility;
- > the strengthening of the program function to allow for a better challenge of the engineering function.

In practice, however, the transformation of the engineering function in light of the downturn of the current R&D cycle mainly aims towards shifted resources, rather than capacity reduction or restructuring of the skills base or ways of working.

No clear tendency has evolved as to which areas within engineering are most affected by the transformation. Nonetheless, design, analysis & development seem to stand out, which is in line with the anticipated shift of focus towards incremental change. The "System of Interest" architecture & validation are considered to be least affected.

Similarly, the executives surveyed reveal no clear tendency regarding the impact of digitization and its potential to disrupt the function. The effects of digitization are seen more in terms of incremental improvement: "More efficient ways of working" rank highest, followed by "new features in products like connectivity", "shorter development cycles" and, to a much lesser extent, "reduced testing/prototyping cost" and the "integration of market intelligence data". The enhancement of products and product ranges using new features is seen as an important area, where digitization could be a future game-changer. In a way this applies to efficiency in terms of processes as well as product development, too. However, the overall disruptive potential of digitization on ways of working has not yet been

J

RESOURCES RESHIFTED

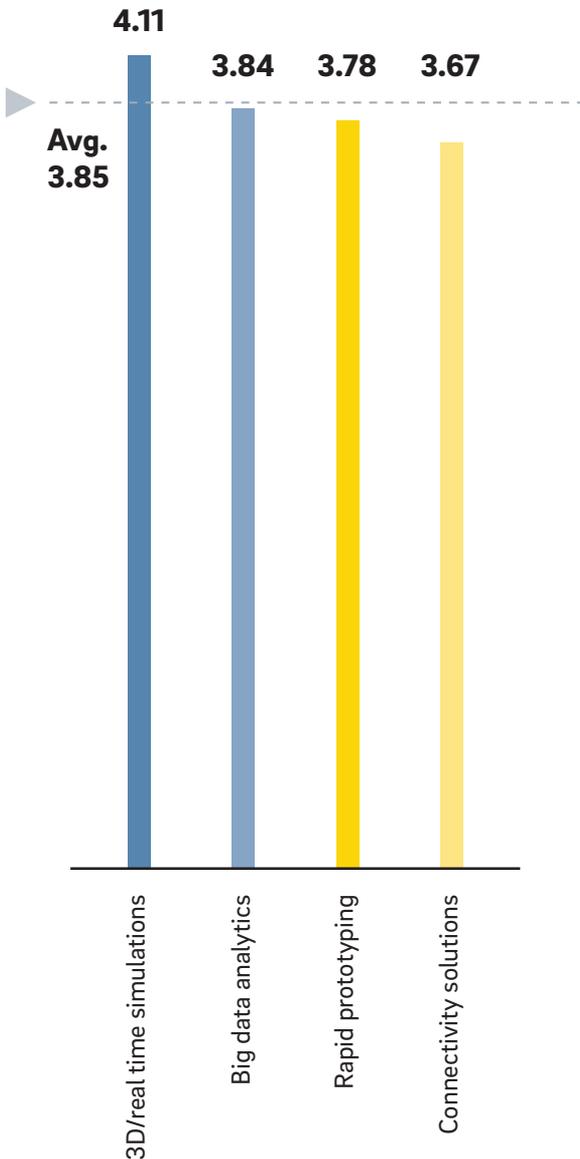
Incremental change in engineering: How the engineering function evolves [ranking 1 = low]



K

THE IMPACT OF DIGITIZATION ON THE ENGINEERING FUNCTION

Real time simulations and 3D applications matter most [ranking 1 = low]



fully captured or identified. Some respondents to our questionnaire and some of our interviewees mentioned that they were working on topics such as "model based development"; "flexible automation (robotized)"; "fast adaptability"; the "automation of conceptual design". However, "3D and real time simulations" clearly stand out from the other engineering issues, as far as the transformation of this function is concerned. → **K** There is a surprisingly large gap to the second item, "big data analysis"– which has been hyped for years now, but is slow to turn into practical applications. Rapid prototyping is not too high on the agenda either. We take an educated guess, fueled by our project experience: this is a result of the deep cultural heritage and mindset in the aerospace industry, aiming at "first time right".

WHAT ABOUT THE STRATEGIC VISION?

How, then, can companies successfully transform their engineering function? For instance shifting from development to manufacturing engineering: will they need the same number of people? Do they need the same people at all? They are reluctant to let too many people go in case another program does come up in the next few years.

All this leads to a fundamental question, namely whether the transformation of engineering follows a long-term strategic vision. Interestingly, almost half of the participants (47%) admit a misalignment between their corporate strategy and their engineering strategy. Asked whether the transformation of the engineering function in their company was managed "with long-term strategic vision" or whether there was "a risk regarding future capabilities in design of new products", only 11% are fully positive about the long-term vision. This is particularly striking given the overall increase in R&D spending. Resolving this mismatch ought to be right at the top of the management agenda. ♦

ABOUT US

Roland Berger, founded in 1967, is the only leading global consultancy of German heritage and European origin. With 2,400 employees working from 36 countries, we have successful operations in all major international markets. Our 50 offices are located in the key global business hubs. The consultancy is an independent partnership owned exclusively by 220 Partners.

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How the fourth industrial revolution is reshuffling the economic, social and industrial model

The fourth industrial revolution will transform the economic paradigm and the mechanisms for creating value that underpin it. Manufacturing has, in effect, switched from a mindset of mass production to one of mass customization. No longer is it based on scale and volume effects but on flexible and localized production situated close to centers of demand. In production planned by major players. It is more predictive and auto-corrective and it involves less trial and error.



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Companies are launching one digitization project after another at breathtaking speed. But are the countless projects embarked upon by Europe's market leaders actually getting them anywhere? Many of your future competitors and many of your future customers will not be the same ones as you have today. Break out of the traditional patterns of your industry. Come up with your own plan D for digital, custom-tailored to your business. Be radically digital!

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Publisher

ROLAND BERGER GMBH

Sederanger 1

80538 Munich

Germany

+49 89 9230-0

www.rolandberger.com

INTERNATIONAL A&D EXPERTS

Wilfried Aulbur (India)

Laurent Benarousse (Morocco)

Antonio Bernardo (Brazil)

Max Blanchet (France)

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Mathias De Dampierre (France)

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Jonothan Wright (United States)

Artem Zakomirnyi (Russia)

WE WELCOME YOUR QUESTIONS, COMMENTS AND SUGGESTIONS

MANFRED HADER

Partner

manfred.hader@rolandberger.com

Editor

THOMAS REINHOLD

thomas.reinhold@rolandberger.com

ROBERT THOMSON

Partner

robert.thomson@rolandberger.com

MASSI BEGOUS

Partner

massi.begous@rolandberger.com

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