



STOP THE MULTIBILLION DOLLAR DELAYS

PLANE AND TRAIN MANUFACTURERS
NEED TO RETHINK PRODUCT DEVELOPMENT

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Manufacturers of planes and trains are experiencing ongoing delivery delay problems that have set the industry back by more than \$20 billion over the past several years. On the aviation side, costs and delays have been the price for developing game-changing aircraft programs that will transform the economic profile of the airline industry. (See Exhibit 1.) On the rail side, rail integrators (which turn component assemblies into finished trains) are facing higher costs and penalties due to setbacks in high speed and regional passenger train projects across Europe.

Keeping the development and production planning of new products within budget and on schedule is a challenge for any manufacturer. But recently, the costs associated with setbacks have risen to new heights: Aviation and rolling stock development programs are experiencing delays of as much as four years, costing manufacturers significant additional engineering hours and hundreds of millions of dollars in cost overruns. At the same time, the contractual penalties that manufacturers must pay their customers, especially in the aviation industry, are soaring, reaching billions of dollars. (See Exhibit 2.)

SIMPLIFYING COMPLICATION THROUGH COLLABORATION

Rising demand for transport worldwide, coupled with an aging installed equipment base, will drive a large number of new projects. In the next 20 years, we estimate that there will be demand for 20 percent more aircraft globally – or approximately 36,800 units – compared with the orders received in the past decade. Orders for rail equipment, too, are expected to jump by 20 percent worldwide over the next two years, to \$213 billion, up from \$180 billion from 2007 through 2009, according to the Association of the European Rail Industry (UNIFE).

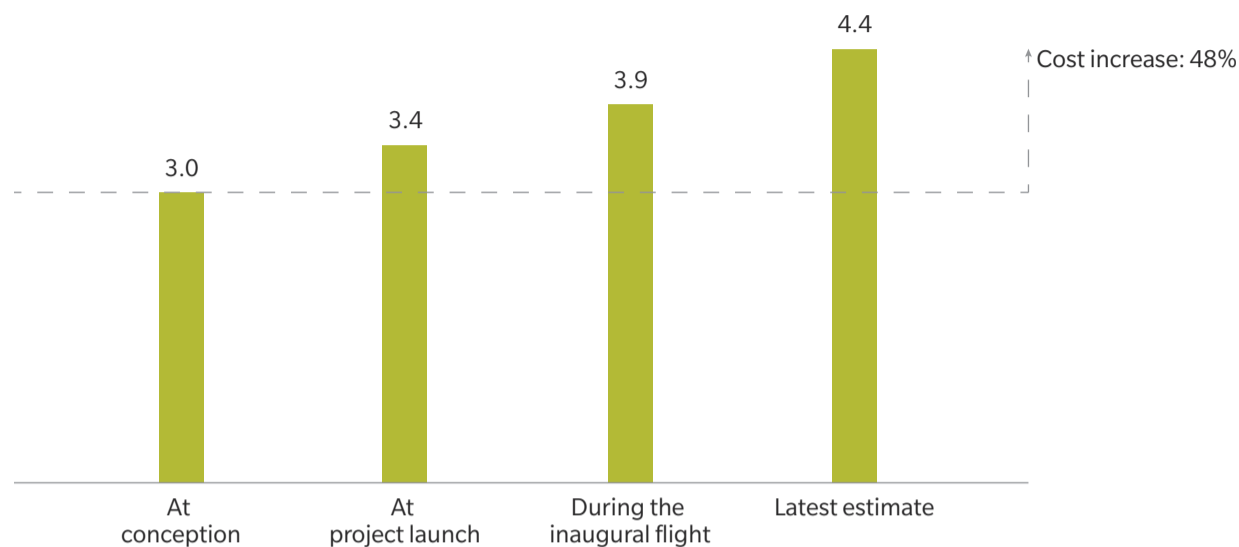
In addition, customers expect new equipment to reflect the latest available technologies, creating an even higher hurdle for manufacturers. The good news is that in our consulting, we are seeing a growing awareness on the part of manufacturers of the critical need for a more collaborative approach – one that can halt today's runaway costs.

In our view, the fundamental problem is that most manufacturers try to prevent product delays by improving their own product development and manufacturing processes in isolation. Instead, manufacturers must take a broader view to produce planes and trains that are becoming much more complicated and, thus, more difficult to deliver on time and on budget. Manufacturers must re-evaluate how they manage

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EXHIBIT 1: RECENT AIRCRAFT PROGRAM DEVELOPMENT COSTS, FROM PRELIMINARY DESIGN TO 2014

US\$ BILLIONS



Source: Company reports, Oliver Wyman analysis

everything – from product development and the supply chain to production ramp-up – in a comprehensive manner, involving their contractors, suppliers, and other third parties.

Tomorrow's industry leaders will be those companies that develop the capability to involve a wide group of stakeholders, ranging from startups and academics to their customers' and suppliers' engineering teams globally. Today, many manufacturers rely on siloed, opaque product development processes and incomplete assessment metrics. To end product development and delivery delays and improve quality, manufacturers must develop a more far-reaching and transparent approach, as this will allow them to tap into the expertise of a wider group of stakeholders. This approach will help manufacturers not only generate more innovative concepts, but also better estimate the maturity of these concepts before including them in the scope of new projects. Manufacturers will also be able to better anticipate major risks and assess the feasibility of new product planning and budget – from the point at which a plane or train is a concept to when it rolls off the assembly line.

EXHIBIT 2: EXAMPLES OF AIRCRAFT DEVELOPMENT AND PENALTIES

AIRCRAFT DEVELOPMENT PROJECT 1

Waiting clients > 50



Delay to date > 42 months



Penalties to date > \$4.5 billion



AIRCRAFT DEVELOPMENT PROJECT 2

Waiting clients > 20



Delay to date > 36 months



Penalties to date > \$4.0 billion



Source: Company reports, Oliver Wyman analysis

GREATER DEMANDS

Of course, the first step in solving a problem is properly defining it. Why are aviation and rolling stock manufacturers experiencing rising delays and costs? The primary reason: A more demanding environment. Remaining competitive requires developing ever more innovative planes and trains, at a faster pace, and at an equivalent, or lower, price.

Customers' expectations are rising, especially for those extras that increase comfort, infotainment, and connectivity for passengers. In addition, environmental and safety standards are becoming more restrictive. Approval processes for both aircraft and rolling stock are becoming stricter, with longer testing periods and more required documentation. At the same time, building planes and trains packed with new technological innovations requires more sophisticated engineering. Many new technologies require hundreds of thousands of engineering hours before they are sufficiently stabilized for the approval process.

Manufacturers are attempting to meet these mounting demands with a global and often fragile patchwork of component and assembly suppliers. Most rely on hundreds of small and financially stretched firms that offer limited visibility into their operations. Moreover, manufacturers often engage suppliers without a robust audit of their ramp-up capacity and quality and more often than not devote insufficient resources to follow up on action plans.

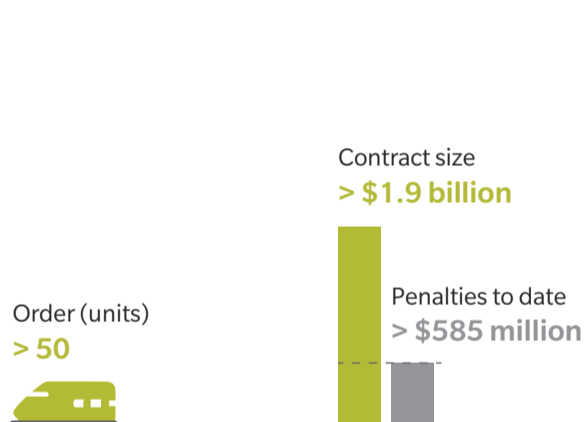
Some manufacturers even inadvertently introduce contractual risk into their supply chains by failing to include back-to-back terms and conditions in supplier agreements (which ensure a supplier passes on

its obligations and liabilities through to its subcontractors). As a result, these manufacturers may discover discrepancies between their needs and their suppliers' purchasing strategies much too late, requiring new initiatives on the part of the manufacturer to secure needed components and ensure product reliability. Such discrepancies increase the likelihood of a new product program running late and over budget.

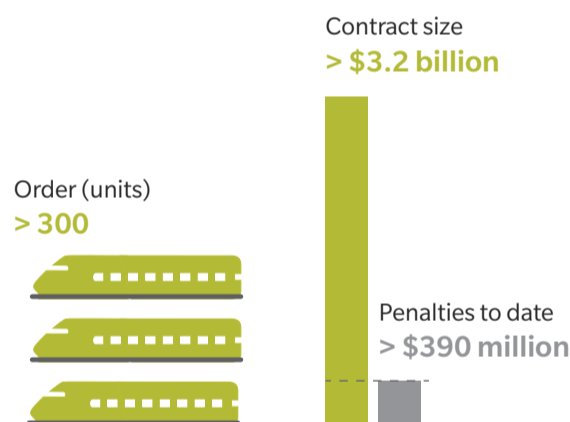
Making matters worse, customers are asking for more robust contracts, with more clauses to protect them from potential deviations. Customers are also enforcing penalty clauses more often than in the past and have equipped themselves with significant claims management departments. (See Exhibit 3.)

EXHIBIT 3: EXAMPLES OF TRAIN DEVELOPMENT AND PENALTIES

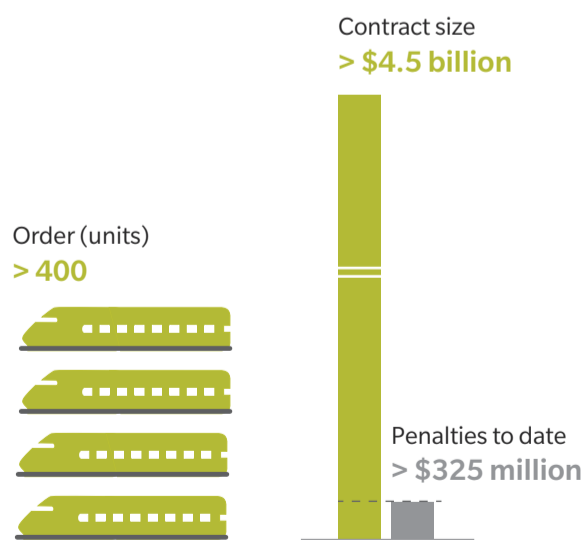
PROJECT 1: TRAIN DEVELOPMENT FOR A EUROPEAN RAILWAY



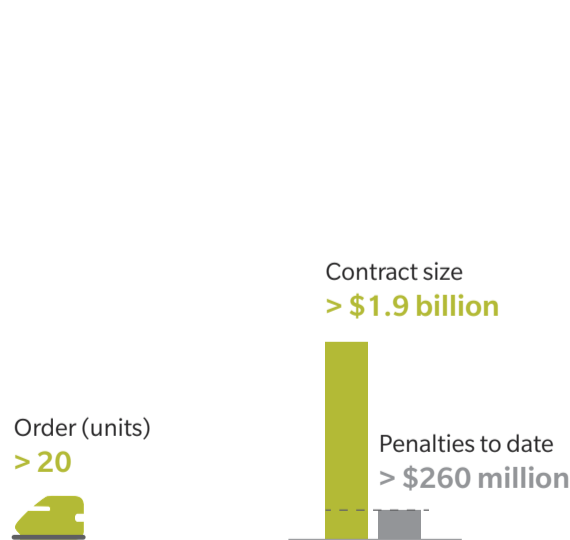
PROJECT 2: TRAIN DEVELOPMENT FOR TWO EUROPEAN RAILWAYS



PROJECT 3: TRAIN DEVELOPMENT FOR A EUROPEAN RAILWAY



PROJECT 4: TRAIN DEVELOPMENT FOR A HIGH-SPEED RAIL OPERATOR



Source: Company reports, Oliver Wyman analysis

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NINE BEST PRACTICE FLASH POINTS

In our experience, securing an on-time, on-budget product rollout involves best practices at nine “flash points” that occur throughout the product development cycle. Just as hitting the flash point of a fuel will cause a fire, each of these points can suddenly trigger a delay or significant cost overrun if mismanaged. Below, we examine each of these best practices, in turn.

FLASH POINT 1

CAST A WIDER NET FOR CONCEPTS

Before deciding on a new product concept, hold an “open innovation” competition to attract the best ideas. Open innovation initiatives that invite suppliers, customers, and even outsiders such as academics to participate can significantly improve the pool of choices for innovative concepts and accelerate the shift into development. In addition, collaborating with equipment operators (current or potential clients) during the drafting of specifications can help avoid overloads, anticipate operational costs, and test the feasibility of deadlines.

FLASH POINT 2

STANDARDIZE ENGINEERING

Reduce development costs by standardizing engineering processes, and then focus on the development of standardized and modularized components and assemblies. Such systems can be more easily and speedily adapted for customers and projects in different geographies.

FLASH POINT 3

ANTICIPATE AND MITIGATE RISKS

Establish an efficient alert process early on to gain more control over product quality. By tightening the management of so-called “maturity gates” associated with a “V-model” development life cycle, a manufacturer can better anticipate risks and launch mitigation initiatives more effectively. Establishing key milestones, or “maturity gates,” assist with validating each relevant step of a product’s design at each stage of its development.

FLASH POINT 4

IMPLEMENT A STRONG DESIGN AUTHORITY AND REINFORCE SYSTEM ENGINEERING

Build a functional architecture to manage interfaces, particularly as systems are becoming increasingly interlinked. To start, a company should improve its ability to track configuration evolutions by agreeing on a detailed description of objectives and expected performance at the various stages of development, using so-called “baselines.” Another critical, high-impact step is creating a “design authority” comprising senior experts to monitor engineering teams’ progress. Such an authority can ensure teams remain focused on quality, cost, and delivery requirements, and that the design is finalized at the appropriate juncture.

FLASH POINT 5

REVAMP TESTING STRATEGIES

A product’s development time can be significantly cut by increasing the number of upfront digital simulations and reducing the number of physical tests. Designs can be tested more rapidly with the use of simulation tools and of 3D-printed prototypes.

FLASH POINT 6

RAMP UP PROJECT GOVERNANCE

Project management processes and skills must be able to handle increasingly complex production runs. Ensure key performance indicators are focused on process control and are predictive, so risks can be better anticipated. Track progress weekly on design maturity, software development, test completion, and documentation. Project governance also must be flexible enough to evolve as product development progresses.

FLASH POINT 7

STRENGTHEN THE SUPPLY CHAIN

Innovation and collaboration can help strengthen what is often a fragmented and fragile supply chain. Facilitating faster maturation of the supply base and supplier consolidation can reduce the risk of small suppliers defaulting. At the same time, treating key suppliers as long-term partners in the process can improve the reliability and

performance of the product under development, with less likelihood of cost and time inflation. Back-to-back contracts can ensure that a supplier's obligations and liabilities to the manufacturer flow through the entire supply chain. Other ways that we have observed manufacturers assisting suppliers include helping them develop their engineering capabilities and expand their manufacturing capacity, locating subcontractors for them, and, at times, financing supplier initiatives.

FLASH POINT 8

ENSURE MANUFACTURING EXCELLENCE

To ensure an efficient process and a high quality product, embrace excellence. Practices such as lean manufacturing and Six Sigma are key to cost-effective assembly. Awareness must be raised as well, with regard to what constitutes operations excellence, so that standards are set along with a culture that encourages employees to send alerts at the first sign that something has gone amiss. In addition, reinforce external and internal quality control processes such as design reviews and First Article Inspection Reports that assess the effectiveness of the manufacturing process.

FLASH POINT 9

REGULARLY AUDIT THE ENTIRE PROGRAM

Program management teams often underestimate risks and overestimate their mitigation plans. Checkpoints often prove insufficient for large programs that involve a multitude of interrelated risks, including new technologies, technical issues, suppliers, partnerships, changing client requirements, ramp-up challenges, resource availability, and certifications. For these reasons, it is critical to perform an independent audit of the program at each key milestone, so as to challenge the program management's perspective on every potential risk.

BRING COSTS UNDER CONTROL, NOW

Some aviation and rolling stock manufacturers already have started implementing a wider range of best practices to reduce their project delays and cost overruns. But the startling rate at which the costs and penalties for producing planes and trains continues to climb shows that much more should – and can – be done.

In our view, the surest and quickest path to reigning in soaring costs is for manufacturers to cast a wider net and work collaboratively with clients, contractors, and suppliers. Companies that move quickly to address the pitfalls and complexities of these large development programs are the ones most likely to thrive in an increasingly hypercompetitive environment.



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