The McKinsey Quarterly

Chris Jennings
Fractured A Frame, 2007

Oil on canvas
60 × 36 in
Courtesy of the artist

Photography by:
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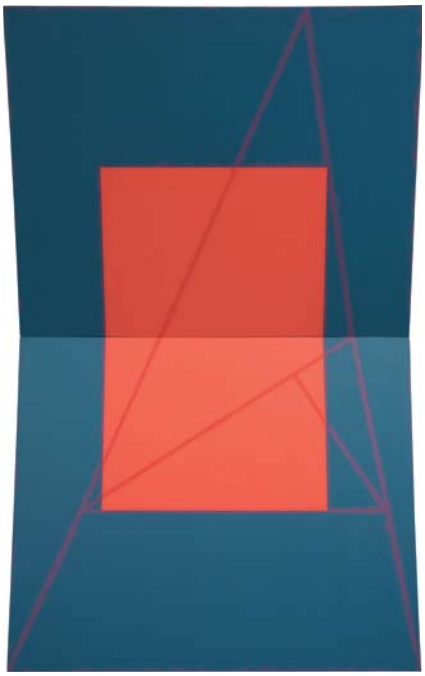

TRANSPORTATION

APRIL 2008

The growing role of emerging markets in **aerospace**

Manufacturers in developing markets are already helping incumbent original-equipment manufacturers in developed ones to cut costs. But that is just the beginning.

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Article at a glance

Emerging markets will represent a major source of demand for commercial aircraft over the next two decades. Yet these same markets currently meet only a small portion of the aerospace industry's sourcing needs—a portion that is much smaller, in fact, than it is in other manufacturing sectors, such as the automotive and consumer electronics industries.

But McKinsey research suggests that this will change in the years ahead. China and Russia are increasingly well positioned to supply Western aerospace OEMs. India has strong potential as well, though it too has further to go.

As new players emerge, Western incumbents will have to focus relentlessly on improving their value-added activities. Forming and managing global alliances and partnerships and coordinating global supply chains will also be essential.

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It would be easy—but wrong—to conclude from recent events in the aerospace industry that its globalization efforts have gone too far. To be sure, both Boeing and Airbus have discovered, in developing their new aircraft, that involving suppliers from around the world creates complex management, coordination, and design integration challenges. Nonetheless, McKinsey research indicates that the industry's globalization remains in its infancy. China, India, and Russia are likely to emerge as significant players over the next two decades, a development that will give Western companies major short-term cost-reduction opportunities that they must capture.

Over the longer term, however, these changes could promote the emergence of new players representing a novel form of competition for today's incumbents. In addition, further specialization in design, manufacturing, and assembly is likely among both suppliers and existing original-equipment manufacturers (OEMs)—such as Airbus, Boeing, and Bombardier—in areas where they have unique value to add or a compelling cost edge. Specialization will go hand in hand with more extensive collaboration, placing a premium on an organization's coordination and integration capabilities.

These conclusions are drawn from scenario-based modeling of the industry's future. The modeling was rooted in an analysis of the current capabilities of about 120 suppliers in China, India, and Russia—as well as from interviews with senior executives at OEMs and suppliers in developed countries and from a historical perspective on the circumstances in which nascent aerospace industries thrive or struggle. The result is a road map for aerospace OEMs and suppliers, in both developed and emerging markets, that seek to navigate the changes ahead.

Surging demand and compelling cost advantages . . .

Demand for aircraft in emerging markets is surging. China, India, and Russia are expected to purchase more than 3,500 planes (roughly 15 percent of global demand) over the next two decades, according to consensus industry estimates. Naturally, those countries also want a piece of the action as suppliers of higher-value components—and eventually as assemblers of aircraft.

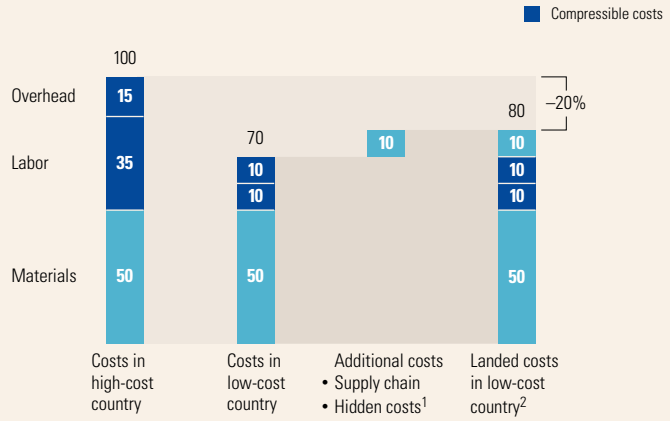
Currently, the chief attraction of these nations, especially China and India, as suppliers is lower labor costs. Our work with OEMs and suppliers indicates that even after accounting for transportation, the complexity associated with coordinating management and supply chains, and the expense of mitigating supply disruption risks, the cost of manufacturing typical aircraft structures (such as body panels or fuselage sections) can still be roughly 20 to 25 percent lower in these emerging markets than in more developed ones (Although Brazil also affords significant savings, this article doesn't focus on it, because it already has

a significant aerospace OEM—Embraer—in the regional-jet market.) The cost of labor, which on average is three to five times lower in these countries than it is in the developed world, also makes emerging markets attractive for labor-intensive maintenance and repair services (Exhibit 1).

Exhibit 1

Lowering costs

Aircraft structure manufacturing example; index: 100 = current costs in high-cost country



[1]Management complexity, risk, supply chain complexity.
[2]Landed costs include inbound transportation costs—eg, duties, taxes.

. . . but limited involvement to date

Despite these cost advantages, the aerospace industry's push into emerging markets has been relatively slow. In fact, only about 3 percent of its output originates in these areas. By contrast, in the consumer electronics, automotive, and large-scale-equipment sectors, roughly 85, 33, and 18 percent, respectively, of all manufacturing takes place in low-cost countries.

Several distinctive attributes of the aerospace industry have caused Western OEMs in this sector to limit their involvement in emerging markets—for starters, the complexity of the industry's technology; its extraordinarily high regulatory, quality, and safety requirements; the critical importance of protecting intellectual property in areas such as aircraft engine design or avionics; and the sometimes intimate relationship between military and civilian technology. Furthermore, aerospace manufacturing volumes are typically lower than those in other industries, and the level of design and production customization is higher than it is in many types of manufacturing.

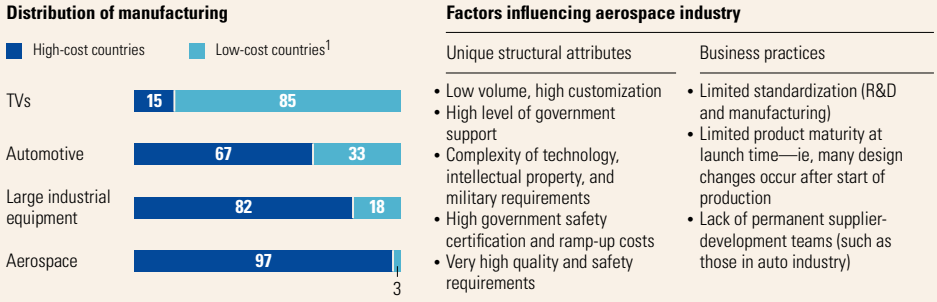
As significant as these barriers have been in slowing the growth of emerging aerospace-manufacturing markets, counterbalancing forces have recently begun to

[1] Offset requirements, which are government policies created to stimulate the growth of a country's supply base, typically require OEMs to source from that country a specific percentage of the parts used in all aircraft sold to domestic airlines.

turn the tide. These include offset requirements,[1] particularly in India; significant government investments in China and projected investments in Russia; and sourcing and engineering partnerships (with Western OEMs) that have begun to accelerate the development of the capabilities of emerging markets. Chinese suppliers, for instance, now manufacture structural components for Airbus and Boeing and fuselage sections for Bombardier. Soon, they also plan to begin handling the final assembly of the Airbus A320. Indian suppliers provide engineering services for many industry players and also produce wing exit doors for the Boeing 757, landing gear boxes for the Boeing 777, and passenger doors for the Airbus A320. Russian and other Eastern European suppliers, too, work with Airbus and Boeing. Honeywell, GE Aircraft Engines, and Pratt & Whitney have been building plants and engineering centers in these countries as well (Exhibit 2).

Exhibit 2

Slow to move



[1]Measured in number of units (for TV, automotive), number of people employed (for large industrial equipment), or sales (for aerospace).

Source: Global Insight; McKinsey analysis

Looking forward, looking back

To understand the potential of China, India, and Russia in the commercial aerospace industry, you must know the history of national attempts to break into it. The creation of Airbus by a British, French, and German consortium is the most widely known example, but Brazil's Embraer and Canada's Bombardier also provide useful lessons about the regional-jet market. So far, Japan has failed to develop a full-size, commercially viable aircraft, but its companies are strong partners in large portions of several major aircraft programs (notably the Boeing 767, 777, and 787), and Mitsubishi recently started moving toward the production of a small jet, the MRJ (Mitsubishi Regional Jet).

For emerging markets to create an indigenous manufacturing industry, they must possess a host of characteristics, starting with a government that makes the industry's development a significant national priority. It's also important for the domestic industry to be structured around a single integrated player that brings scale to development and manufacturing. A large pool of capital is another must. The ability to develop aircraft, manage the supply chain, coordinate manufacturing, and assemble a plane's structure (or at least to access such capabilities through

partnerships) is critical. And, of course, the resulting product must be globally competitive in both performance and cost. Demand from a state-controlled local market for the first 50-plus units is helpful but not a must (Embraer and Bombardier emerged successfully without this kind of help).

China seems closest to assembling this portfolio of capabilities and assets. It has already begun developing a regional jet (the ARJ21) through the Aviation Industry of China (AVIC I), its national aerospace company, and in early 2007 announced plans to build a 150-seat passenger jet. India—with a still-uncertain national vision, a small and relatively fragmented industry, little state funding, and limited design and manufacturing capabilities—now seems further from meeting the requirements. Russia, heir to the sophisticated Soviet aerospace industry, falls somewhere in between. The country has many strengths, but its industry structure, manufacturing capabilities, and aircraft-purchase levels are all significantly less advantageous than those of China (Exhibit 3).

Exhibit 3

Building blocks

Criteria for building full value chain of commercial-aerospace industry[1]

Meets given criterion

● Yes ● No ⛔ No, + key bottleneck

Criteria for success	Comments	Historical (over past 30 years)				Emerging challengers		
		EU	Brazil	Canada	Japan	China	Russia	India
Government stewardship of aerospace industry	Considered a national priority backed by credible plan	●	●	●	●	●	●	⛔
	Overarching governance of aerospace sector	●	●	●	●	●	⛔	⛔
Access to capital[2]	Government shares development risk	●	●	●	●	●	●	⛔
	Business partners share investment	●	●	●	●	●	●	⛔
	Private investment in local aerospace industry	●	●	●	●	●	●	⛔
Design capabilities	Fully developed program-management skills as evidenced by full-scale program involving global partners within last 10 years	●	●	●	●	●	⛔	●
	Proven core engineering	●	●	●	●	●	●	●
	Secondary engineering capabilities or access to them through partnerships	●	●	●	●	●	●	●
Manufacturing capabilities	Local aerospace-manufacturing base or access to global one	●	●	●	●	●	●	⛔
	Proven ability to integrate and undertake final assembly (1 significant jet aircraft assembled locally in past 5–10 years)	●	●	●	●	●	⛔	⛔
Product and demand	Local state-controlled market (orders coming from state-owned airlines) for first 50+ units (approximately covering development costs)	●	●	●	●	●	⛔	●
	Product with global appeal	●	●	●	●	⛔	●	⛔

[1]Based on analysis of aerospace development standards, EU: Airbus created by British, French, German consortium; Brazil: Embraer after 1994 (privatization, 2nd expansion phase); Canada: Bombardier after 1986 (privatization of Canadair, steady growth); Japan: prior to 2003 (and before launch of Mitsubishi Regional Jet project, which aims to sell first plane in 2012).
[2]Average development costs for regional jet = ~$1 billion; for single-aisle aircraft = ~$6 billion.

How high will the dragon fly?

Variables determining the pace of China's development in the aerospace industry will include the ability to understand global requirements; to design a compelling and reliable aircraft; and to develop program-management, supplier integration, and aftermarket-support capabilities. If China made rapid progress in these areas, by 2020 it could be a major supplier of advanced aerospace components (such as wings, landing gear, and composite structures), have a globally competitive second-generation regional-jet program, and be on the verge of delivering to airlines a large single-aisle jet that it had developed itself. Such an outcome is plausible thanks to the government's aggressive prioritization of the aerospace industry in the most recent five-year plan, along with the growing strength of the country's engineering base and the learning it will gain through alliances—with Bombardier on the ARJ21 (and potentially on the company's CSeries medium-sized aircraft program as well) and with Airbus on the final assembly of the A320. (Exhibit 4)

But progress could be slower. To be sure, the continuation of current trends would see China become a leading first-tier supplier of medium-complexity aluminum structures (such as fuselage sections) and achieve leadership in its domestic regional-jet market with the ARJ21, both by 2020. But the country's industry could struggle to achieve broad export success or to develop a larger Chinese aircraft. One key challenge is the ARJ21's relatively old design—with aluminum components and traditional aerodynamics—which slows down China's learning process.

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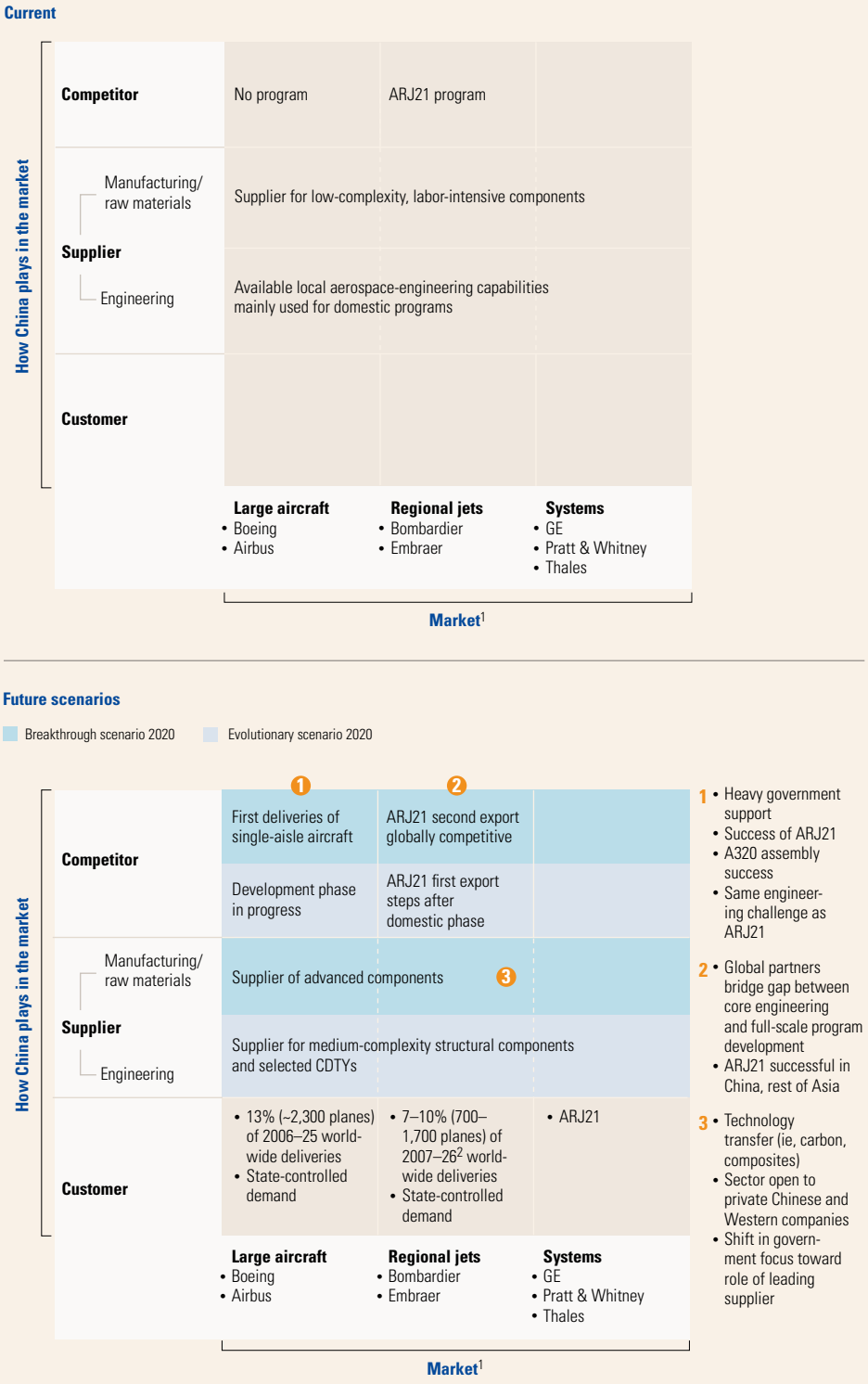
Exhibit 4

China's emerging aerospace industry



[1]Large aircraft = more than 90 seats; regional jet = fewer than 90 seats.
[2]Bombardier forecast = 2007–26; Embraer forecast = 2008–27.

Will the elephant get off the ground?

Currently, India has no significant supply base, limited scale in every segment of the industry's value chain, and no track record in the design and integration of commercial aircraft. Nonetheless, its aerospace industry will move forward, if only because the country's airline industry has been ordering new planes at a torrid pace (with demand growing by roughly 20 percent annually in recent years) and because the government requires Western OEMs to source some of the components from Indian suppliers. (Exhibit 5)

What's more, India could become a leading supplier of certain labor-intensive niche products (such as doors, interiors, and wiring harnesses) and the first-choice offshore location for nonstrategic aerospace research, development, and engineering (such as two- and three-dimensional drawings or simple simulations). There are several prerequisites for such a trajectory. One is government channeling of offset requirements toward the creation of focused aerospace-engineering and aerospace-manufacturing clusters. Two others are the aggressive entry into the industry of major private-sector players (such as Tata in manufacturing) and the continued development by engineering service providers (such as Wipro and Cades Digitech) of their aerospace-focused business. Finally, Western companies will need to improve their ability to integrate the offerings of external service providers.

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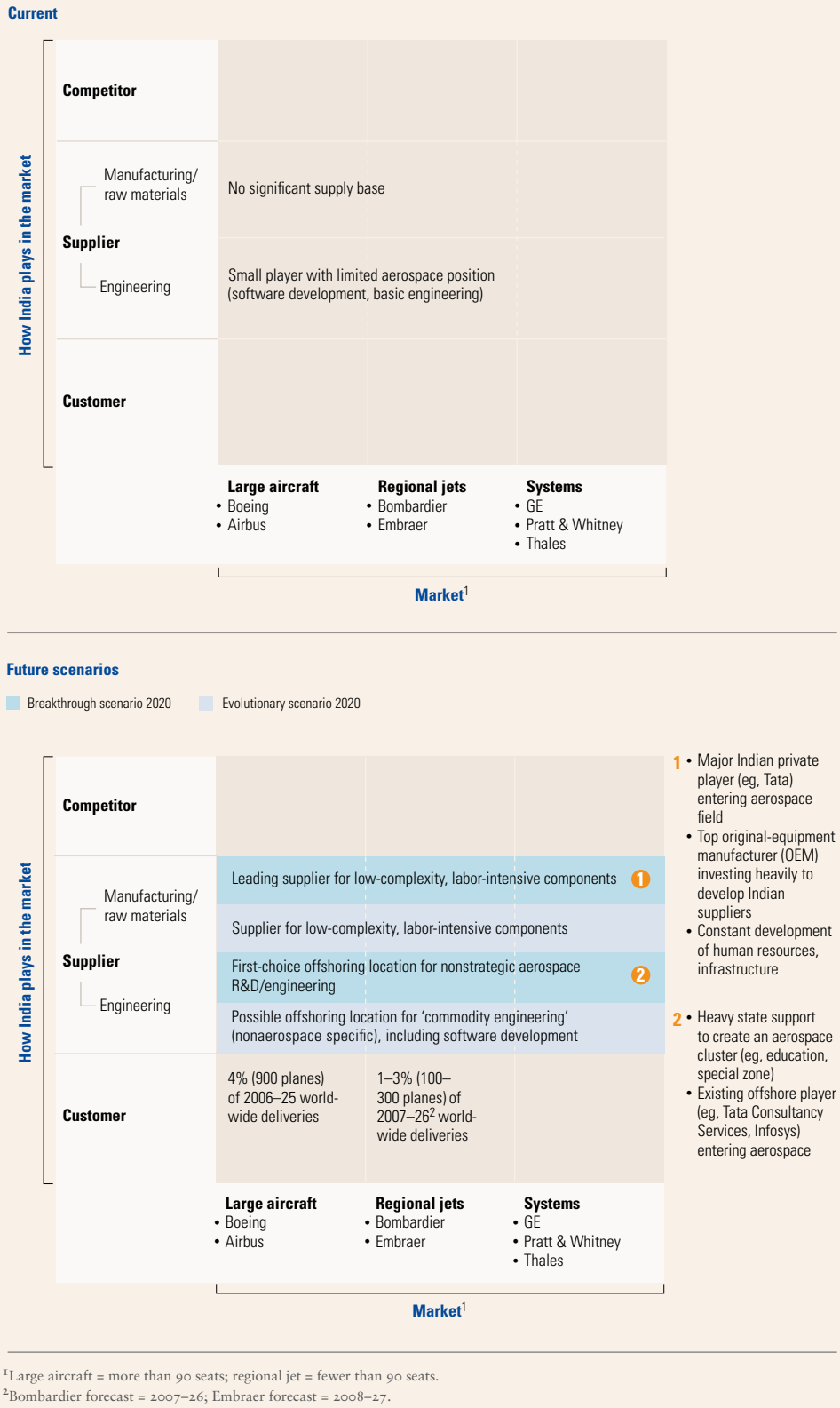
Exhibit 5

India, a niche player



[1]Large aircraft = more than 90 seats; regional jet = fewer than 90 seats.
[2]Bombardier forecast = 2007–26; Embraer forecast = 2008–27.

Will the phoenix rise from the ashes?

To some extent, Russia's trajectory is clear: the country's regional Sukhoi Superjet (SSJ) 100 program involves major Western partners (with Finmeccanica at the forefront) and already enjoys substantial interest from Russian and foreign airlines. Russia is also participating in a joint venture with France's SAFRAN to develop a regional-jet engine (the PowerJet SaM146). And the assets and skills of Russia's supply base suggest that it should, at the very least, become a leading supplier of titanium and aluminum parts, as well as a credible alternative to established players for advanced R&D. (Exhibit 6)

But the pace of Russia's development will depend on several factors. One is the extent to which industry consolidation supports economies of scale and ensures that the country focuses its talent and capital on the most critical projects. Another is the speed with which the industry can upgrade its design capabilities by collaborating with Western aerospace OEMs, which have already established design centers in Russia. Also critical are the development or acquisition of state-of-the-art integration and program-management skills and the emergence of a more customer-oriented and cost-performing industry culture. The absence of such a culture today is a legacy of the Soviet central planning of the past.

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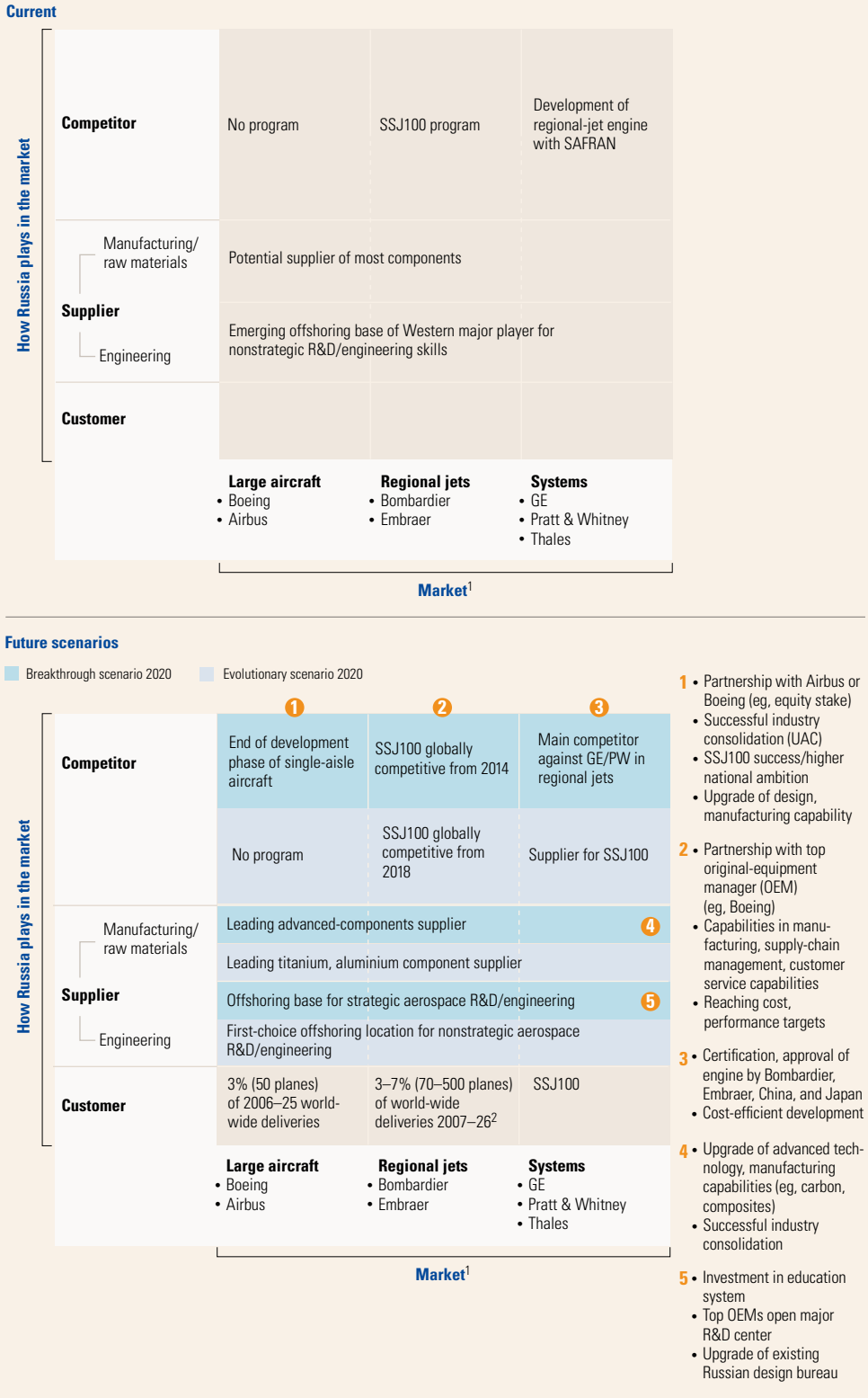
Exhibit 6

Resurrecting Russia



[1]Large aircraft = more than 90 seats; regional jet = fewer than 90 seats.
[2]Bombardier forecast = 2007–26; Embraer forecast = 2008–27.

A more global, more fragmented, more competitive industry

Global players studying the growth of these emerging markets can draw at least three clear lessons from all of this information.

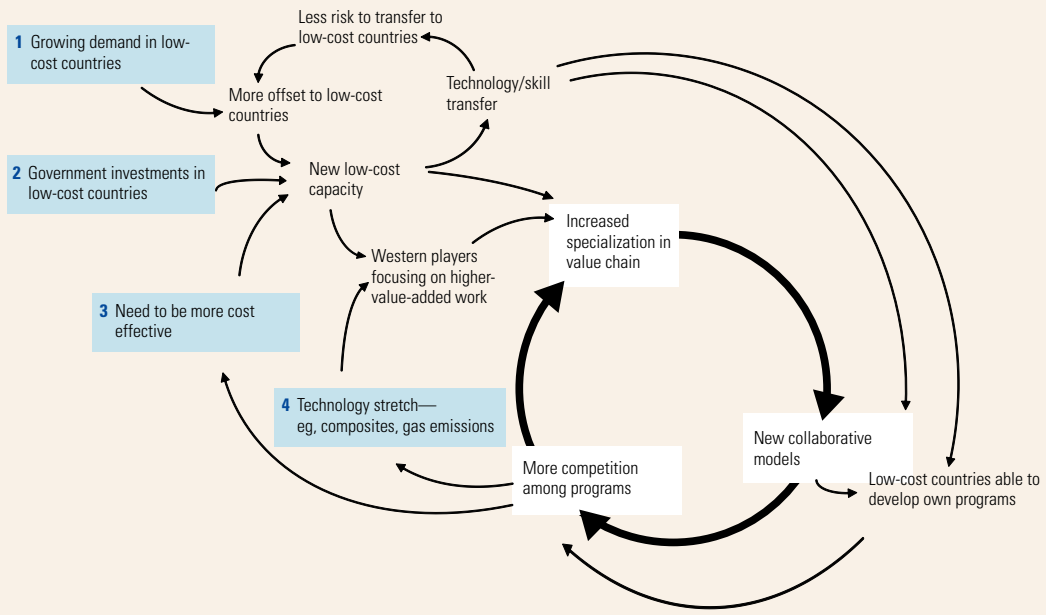
First, China, Russia, and to a lesser extent India will provide increasing amounts of low-cost manufacturing and engineering capacity for the aerospace industry. Players such as AVIC I, Sukhoi in Russia, and Hindustan Aeronautics (HAL) in India will leap forward in learning, gain economies of scale, and ultimately take their place as low-cost manufacturing and engineering platforms for the world. China, for instance, could become the preferred location for the manufacturing of simple airframes, Russia for the low-pressure modules of aircraft engines, and India for detailed engineering. These changes represent a major opportunity for Western players to improve their cost performance through global sourcing, manufacturing, and engineering.

Second, as Western companies leverage these new pockets of low-cost expertise, they will be able to refocus their resources and capabilities on higher-value activities, thereby contributing to the further specialization of the industry's value chain. Engineers in the Western world might, for instance, focus on developing the next clean-propulsion technology when the labor-intensive job of drawing detailed designs is undertaken elsewhere. Instead of producing simple aluminum structures, Western plants could aggressively develop composite assemblies.

Finally, incumbents will have to deal with a new breed of competitor benefiting from fresh private and public investments and low-cost local supply networks. Winning in the aerospace industry of the future will require incumbents to excel at integrating and managing global supply chains, transferring production flexibly to emerging markets, refocusing on higher-value-added activities, and forming and managing global alliances and partnerships (Exhibit 7).

Exhibit 7

Changing dynamics



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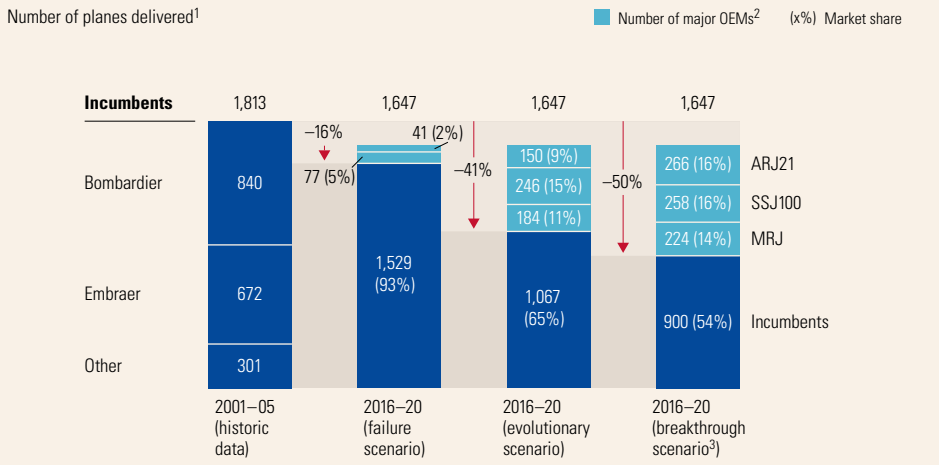
A glance at the future

These changes are already taking place in the regional-jet market. China (with its ARJ21), Japan (with Mitsubishi's MRJ), and Russia (with the SSJ100) all have credible programs that will challenge the market leadership of Bombardier and Embraer. Meanwhile, these two companies have been actively transferring some of their manufacturing activities to emerging markets. Finmeccanica has become a major partner of Sukhoi in the development of the SSJ100. SAFRAN and NPO Saturn have formed a joint venture to develop an alternative (the SaM146) to the GE regional-jet engine. And Bombardier recently struck an agreement with AVIC I to support the development of the ARJ21 in exchange for a share of the revenue from it and for a manufacturing alliance in the program to develop a medium-sized CSeries aircraft. Similar shifts—new competitors, new partners, and greater specialization—will surely occur in other segments of the industry in the decade ahead (Exhibit 8). Q

Exhibit 8

On the horizon



[1]Historic data from Teal Group; forecast of total volume based on average 20-year forecast for Bombardier and Embraer.
[2]OEMs = original-equipment manufacturers; major OEMs defined as having >5% market share.
[3]Figures do not sum to total, because of rounding.

Source: Teal Group; McKinsey analysis

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