1 ⋆ This Is Going to Be Big

The trip to the Four Seasons Club

On a freezing February evening in 2011, a little more than four years since my flight to Zhuhai, my wife and I tried to figure out how to get from our apartment in downtown Beijing to a recently opened restaurant on the far east side of town. Basic navigation in big Chinese cities can be more challenging than it sounds, and not simply for foreigners like us with incomplete language skills. I had been studying Chinese characters for many years, starting when we lived in Japan in the 1980s, and thus am comfortable enough reading Chinese maps and street signs; my wife, trained in linguistics and with a good ear in many languages, is much better at hearing and speaking. Together we are stronger than either of us separately; still the language can be a challenge.

And far from the main challenge in finding our way to an unfamiliar site in a big, fast-growing Chinese city. So many roads are constantly being repaved, redirected, renamed, or torn up. So many subway lines, bridges, tunnels, and flyovers are continually being opened, closed, or redone. Neighborhoods are razed in the course of a weekend—in Beijing both the traditional *hutong* courtyard houses from before the modern era and the squat, badly insulated, brutally ugly walk-up apartments built under Mao from the fifties through the seventies.

In their place, seemingly overnight and literally a few weeks or months later, appear a forty-story condo complex, a mall with car dealerships and Armani or Hermès outlets plus KFC and McDonald's, a government research center, a Carrefour or Walmart. Maps are often of little use. While living in Shanghai, I occasionally saw a taxi driver with a city map in his car, but never once in a cab in Beijing.

The Chinese man who would be our host that night had sent a link to the Web site for the venue he had chosen, the Four Seasons Club restaurant. This club has no connection to the familiar high-end Four Seasons international hotel chain, which has several locations in Beijing. Moreover, its name in Chinese—that is, its "real" name—was entirely different, its characters meaning Star River Club.

From the club's Web site, we found that it is located near the Qingnian Road Station on Line 6 of the Beijing Metro. Good news! We had each taken well over a thousand subway trips through our years of living in Shanghai and Beijing—several trips most days, nearly each day we were in town—and always preferred them as a way of avoiding chronically clogged roads. But how would we get onto Line 6, which we had never used before, from our apartment near the intersection of Lines 1 and 10? Unfortunately, it turned out that the only way there would be via a time machine, since Line 6 would still be under construction for the next year or two. No wonder we hadn't seen it on the subway-system maps inside the stations.

Buses were a possibility, and one we'd used for other sites off the subway grid. But at rush hour along Jianguo Road, one of Beijing's broadest and most heavily trafficked thoroughfares, the windows of each passing bus were dark with the overcoats of people jammed into every available cubic inch of its volume, with further huge crowds waiting expectantly on the sidewalk.

And anyway we would have had to change buses several times to get where we were headed. That left taxis. When we finally saw one with the bright red "empty car" (空车) sign illuminated, meaning that it would take passengers, I raced past a group of young Chinese women also looking for a taxi—forget chivalry, it was either that or stand around waiting all night—and got in, moving over to make room for my wife and an American friend visiting from California.

Over the next half hour, we inched and jolted the five-plus miles to the club, through the east-side congestion of Beijing's Fourth Ring Road and Chaoyang Road as the driver weaved in and out of construction zones. When we got within what we all reckoned to be a few blocks of the destination, he called the restaurant's number on a mobile phone for final turn-by-turn guidance through a particularly chewed-up, trench-ridden, girder-strewn building area.

The satellite map of the neighborhood, which we'd checked before leaving the apartment, was as out of date as any printed map. At the alleged site of the Star River hotel-restaurant-golf-course complex, it had shown only a low warren of Mao-era apartment buildings amid vegetable fields. I knew that at best the satellite view would be approximate. Chinese law requires that images of Chinese cities from Google Maps, Google Earth, and the like must be offset[1] from online street maps, so you can never exactly line up a street address with a satellite image. It's a feint at security, from a government that long viewed maps as highly sensitive information. This mentality reaches a delightful extreme in maps of the west side of Beijing: Satellite views and Google Earth show a huge airport sitting between the Fourth and Fifth Ring Roads, with a runway like the ones at O'Hare or JFK, alongside major malls and business centers. But that airport is used mainly for military and government purposes,

and its existence is acknowledged neither by highway exit signs nor on city maps, which show only a big blank spot in that area.

For our trip that evening, the mismatch was an offset in time more than in space, since there was nothing in either the satellite or the map images to suggest a business of any sort anywhere close to the destination. Yet as we neared the assigned address in the cab we saw something that in its neon lighting and its showy architecture would have fit in easily in Las Vegas.

The club's entrance had parapets modeled on a villa in Tuscany, or a castle from a fairy tale. A black Mercedes that appeared to have been washed and polished mere instants before sat gleaming in the driveway. Teams of attractive and spiffily uniformed young male and female attendants saluted us on entry with Chinese and English greetings. *Huanying guanglin!* Welcome, sir and madam! The building's back windows looked onto the recently opened fairways of the club's golf course.

For the next few hours inside, we enjoyed an unusually luxurious version of that staple of Chinese business interactions, the celebratory dinner. Many courses; many welcoming toasts; much gracious plucking with long serving chopsticks of the choicest morsel of fish or meat, for ceremonial placement by the host on the dish of the honored guest. The actual head of the roasted chicken, complete with beak and comb? For me? Why, thank you so much for this gesture of respect! Because the Chinese businesspeople at the dinner had all worked and studied outside China, we were spared the rounds of competitive bottoms-up toasting, toward the intended aim of all-hands drunkenness, that typifies many gatherings in the provinces. We were spared as well a TV set turned on and blaring soap operas, game shows, or karaoke songs inside the private dining room, a standard touch of provincial banquets. Instead we had sips of wine, cups of tea, mobile phones frequently ringing and

being answered, and animated discussion of Chinese-American business possibilities.

The main business to be done that night was between representatives of U.S. and Chinese coal and power companies, pooling their efforts for research in "cleaner" coal. American, European, and Japanese companies were all coming to China to see new carbon-control, coal-gasification, and other clean-up techniques tried and improved upon, since China is where so many of the world's plants were being built.

But, as often happens at such gatherings, other side deals were being discussed and dreamed about at the same time, and several Chinese guests went in and out of the room to take phone calls or drop in on other business dinners they had double-booked for that same night. For instance, late in the evening, an unassuming and modestly dressed man arrived from his previous dinner. He was less urbane-seeming than the others and unlike them spoke only Chinese, rather than being able to go back and forth between languages. Despite appearances, he turned out to be the wealthiest person present; as the CEO of one of the largest battery-making companies in the world, he was there to talk not about coal but about electric cars. A few weeks earlier he had been to Washington, where he met congressmen and told them about his dream of opening factories in the United States to produce batteries for a new electric car he was helping design. "This can change the future! If I can reassure those congressmen," he said, according to an interpreter at the table.

Confident, can't-wait talking and planning of this sort is familiar as both an exhausting and an exhilarating trait of modern China. I would hear the phrase "my dream is . . ." more

often in the course of a typical month in China than in a typical decade in the United States. The person who appeared to be most excited by his dream that evening was the dinner's host, a stocky man in his late fifties named Xu Changdong. Mr. Xu had a stake in the coal and energy discussion, to put it mildly; he personally controlled development rights to vast coal reserves in the Chinese autonomous region of Inner Mongolia, which the regional government had awarded him in exchange for his plans to open an advanced manufacturing plant there. But what really excited his passion was his newest venture, which he was sure was going to transform the country: a boom in aviation.

The morning after this dinner, one of his companies would announce a plan to sell helicopters inside China and start building them there—including at the plant in Inner Mongolia. Also that next day, the main Chinese newspapers would splash on their front pages the story of China's across-the-board push to become a major aerospace and air-travel power as part of the upcoming Twelfth Five-Year Plan.[2] In American and European discussion, the very term "Five-Year Plan" smacks of the Soviet era, suggesting clumsy central-government efforts that are out of touch with market realities and are therefore doomed before they start. Within China, businesspeople, government officials, and members of the public take very seriously the goals and spending targets laid out in the successive Five-Year Plans. They know that this is where a lot of public money and attention will be directed. The Twelfth Plan, counting from the First in the early 1950s under Chairman Mao, would run from mid-2011 through 2016 and include a big boost for aviation, which it listed as one of the "seven major strategic industries" for the next phase of the country's growth. Public investment in all phases of China's aerospace future over those years would come to 1.5 trillion Chinese yuan renminbi (RMB), or about

$230 billion. That was a 50 percent increase over comparable investment in the previous Five-Year Plan—and, depending on how you count, somewhere between five and ten times as much as the Federal Aviation Administration's budget for capital improvements and airport construction in the same period in the United States. Dozens of brand-new airports were coming, and thousands of new airliners for China's fleets, and many thousands of helicopters, business jets, and small aircraft of all varieties.

"You can't imagine how big this is going to be," Xu Changdong said in English to the guests at the dinner. "People have the money. They have the technology. The airspace is opening."

You can't imagine. By this time in China, I was beginning to.

Xu had grown up in Shanghai, gone to New York as a penniless thirty-year-old graduate student in 1983, and stayed there for nearly twenty years as he built an import-export empire. During the 1990s, after he had established himself, he went out one summer day on an open-ocean fishing expedition off Long Island. Anglers had ringed the boat's railings, with their backs to one another as they cast lines into the sea. Suddenly a hook that one person had flipped over his shoulder, on the backswing of a cast, caught the eyeball of someone on the other side of the boat. Xu, like the other passengers, was horrified and could hardly bear to look. But—as he remembered clearly, when retelling the story to me many years later—he was struck by the firm but low-key manner in which the boat's captain told him and everyone else to remain calm. The captain had radioed the Coast Guard and been assured that within eight minutes a rescue helicopter would arrive to take the victim in for emergency care.

"I looked at my watch, and even before eight minutes, the helicopter was coming," Xu said, when he told me the story in Beijing. The rescue crew lifted the victim from the boat's deck into the helicopter, and thence off to an emergency room.

"I heard later that the man's sight had been saved," Xu told me when reflecting on the role played by the rescue helicopter. "I realized that if he had been in China, absolutely there is no chance to save his eye. I said to myself, Someday I will bring this technology to China." At the current stage of China's growth it is common to hear that kind of "I will change the world / I will transform my country" declaration. Xu was certainly right about the unmet need in his homeland. A dramatic instance occurred after the Sichuan earthquake of 2008, when many thousands of Chinese people survived the initial landslides and building collapses, only to die of exposure or dehydration in the subsequent days. Chinese rescue forces had to trudge in by foot, since roads through the mountainous territory had been buried and the country had far too few helicopters with which to reach those who were still alive.

In the early 2000s, Xu came back to China, to expand his business and reenter the Chinese linguistic and cultural environment. He became a leader of the charmingly named Western Returned Scholars Association, composed of people who, like him, had graduated from American or other foreign universities and come back to China after successful business careers abroad. Xu had had $40 in cash in his pocket when he arrived at Kennedy Airport the first time, in 1983, and had been panicked at the discovery that the taxi to his student dormitory cost $30. Thus he had to find a part-time job immediately, which he did the very next day. By the time he returned to China two decades later, he had become rich by any country's standards. Hearing stories like Xu's, I often felt in China as if I were living through

a Horatio Alger novel, or a collection of them simultaneously. The rags-to-riches tales with their emphasis on early hardship, subsequent business success, and gratifying return to a prospering homeland, were so common that I had to remind myself to keep paying attention to them.

As he went on about his dream of what aviation would mean for China, Xu seemed tongue-tied for a moment. He turned to the translator and said, "I am forgetting my English! Let me speak in Chinese." One of the Americans at the dinner, who was making his first trip to China and spoke no Chinese, said with unthinking Blimpish patronization, "Oh, your English is not that bad!" Xu was in fact fully fluent in English, albeit with an accent, having done business in America for decades. He couldn't help himself: "Well, it *is* better than your Chinese." He softened that, somewhat, with a smile, and then switched to Chinese and relied on the interpreter: "It is as if we were talking twenty years ago, and I told you this was going to be the biggest market for cars in the world. You would look around and see the bicycles and the oxcarts, and you would think I was crazy. I would have been evicted from America if I had made that kind of claim!" Of course, by 2010, Chinese companies produced more cars, and Chinese customers bought more—including luxury models—than their counterparts in the United States. At that point General Motors was surviving not simply because of government help in the United States but also because of its strong position in China, where Buick remains a prestigious and best-selling brand.[3] "Or when those first very large Motorola 'mobile' phones came into China twenty years ago. And *The Wall Street Journal* said it would be ten years before China had regular desk phones and another ten before cell phones became popular." Of course, China was the world's largest mobile-phone market by the early 2000s.

"That is how it is going to be with flying. The next step will be the helicopter. Everything is about to take off."

Planning for "takeoff"

The Twelfth Five-Year Plan, the one that included aerospace as a strategic industry, wouldn't officially begin until later in the year, but at the start of 2011 the steps toward China's ambitious future in the skies kept coming. As Xu had said, they paralleled the leaps the country had previously made in electronics, automobiles, and many other fields, and the operative principle did seem to be "everything is about to take off," all at once.

A week after that dinner, the Beijing police force would announce its plans to buy a new fleet of helicopters for traffic and safety patrols over the town. Chinese cities have plenty of street-level noise, to put it mildly, but as soon as you think to notice it, you're struck by the lack of the overhead roar from airliners and helicopters that is the background soundscape in most of the world's other big cities. Later that same month, the head of China's central aviation agency—Li Jiaxiang, a former People's Liberation Army Air Force general who had then become head of China's national airline and who now ran CAAC, the Civil Aviation Administration of China—previewed some of the spending details that would accompany the next Five-Year Plan, including the 1.5 trillion RMB (at the time about $200 billion) for new airports, navigation systems, and airplanes. The story was run across the top of the front page of *China Daily,* the state-controlled English-language paper that is China's face to the outside world. "Aviation Sector Has High Hopes for Next 5 Years" was the headline.[4] In aerospace as in so many

areas, China was starting out far behind the United States and many other developed powers—but planned to catch up fast. The country's commercial airline fleet numbered only about 2,600 airplanes as of 2010, roughly half as many as America's for a population four times as large. The target in the next five years was 4,500 airplanes, a rate of purchase that would represent about half of the new aircraft sold anywhere in the world. Back in 2009, when airlines everywhere else in the world were canceling jet orders and stretching out delivery schedules as long as possible, a Boeing executive had pointed out that China was the only "dynamic aviation market" in the world and said that its "strong domestic air-travel growth" was the main indication "that the world aviation industry is beginning to recover."[5]

Total airline passenger volume had increased only modestly in the United States and Europe throughout the whole first decade of the twenty-first century—because of the 9/11 attacks, world financial crises, increased security hassles, and the overall neuralgia of flying. But in China passenger traffic had never stopped growing, and it was predicted to keep doubling every five years. It is tricky to compare market capitalizations of Chinese firms, especially large state-owned enterprises that can draw on government support, with those of outside corporations that usually must rely on normal equity markets. Still, the scale of Chinese carriers is impressive. The flagship carrier, Air China, is in capitalization terms the largest airline in the world, by far. As of 2011 its market capitalization was about $19 billion, or much more than that of the carriers United-Continental, American, US Airways, jetBlue, SkyWest, Hawaiian, and Republic, which, combined, were worth only about $15 billion.[6] The three largest Chinese carriers—Air China, followed by China Southern and China Eastern—are respectively numbers one, three, and

four in valuation among all airlines in the world. The three largest U.S. carriers are numbers nine, ten, and eleven, and the top three European lines are five, twelve, and thirteen.

Among passenger airports, Atlanta's is still the world's busiest, with about eighty-nine million passengers in 2010. But Beijing's Capital Airport is already second and gaining, with about seventy-four million passengers and traffic growing by well over 10 percent a year. In 2000, the three largest cargo airports, by tonnage carried, were Memphis (as the hub for FedEx), Hong Kong (for southern China's exports to the world), and Los Angeles (where many Asian imports arrive). In 2010, the three largest were Hong Kong, Memphis, and Shanghai. Traffic at both Hong Kong and Shanghai was up more than 20 percent from the preceding year, versus 6 percent for Memphis.[7] And none of this even counted the ambitions to open China's airspace for the kind of business-aviation boom that has been routine in the United States, Europe, Australia, and Latin America for decades. As of 2011, China still had relatively few airports compared with more developed countries—175 total, compared with nearly 1,000 in the United States capable of receiving commercial flights plus another 4,000 or so where propeller planes and small business jets could land. But the Chinese government was already at work on 150 new airports, mainly in parts of the country that had never previously had air service.

The Chinese ambitions extended to manufacturing too. Apart from the helicopters—and a planned jetliner that might someday take customers from Airbus and Boeing, and the regional jets—during the spring of 2011 a subsidiary of AVIC, China's main state-run aviation corporation, bought Cirrus Aviation, the pioneering company in Duluth, Minnesota, that made the world's most popular small propeller aircraft, including the one in which Peter Claeys and I had gone to Zhuhai.

Around the same time another AVIC subsidiary bought Teledyne Continental, the United States–based company that made the engines for Cirrus and a number of other small planes.

About ten days after that dinner with Mr. Xu, I was in Hong Kong, at the Asian Aerospace Expo, where organizations as large as Boeing and Airbus and as small as tour operators or three-pilot flight schools looked for customers. A Chinese man who had for some reason chosen the improbable English name Vicky—he and his business partner were known as Ricky and Vicky—had begun operations for an "FBO," or fixed-base operator, the aviation world's term for the kind of small-airport facility that would serve non-airline aviation.

"Now that they"—the government—"have got Cirrus, I think you will see very good support for general aviation in China," Vicky said. "Today we have only a few airplanes in all of China. In the United States, there are more than two hundred twenty thousand small airplanes![8] I can say, the market here will be enormous." Next to Vicky in the booth, I met a man named Chen, from the northeast zone of China still called Manchuria in the Western world and Dongbei, "East-North," in China. "I had always had a dream to fly, but when I tried to the military I did not pass the body exam," he told me, in English, referring to the military's physical screening tests. He looked perfectly hale, and I assumed that he had run afoul of the People's Liberation Army Air Force's notoriously strict eyesight standards for pilots.

Mr. Chen was a child during the Cultural Revolution and ended up in the metal-parts business. Thanks to China's infrastructure boom, he became very rich. His company had the contract to build metal structures at towers at the 2006 Interna-

tional Horticultural Exhibition in Shenyang, the northeastern city known as Mukden in the colonial days. The soaring symbols of the towers reawakened his interest in flight. He bought a small glider, went to the gigantic international AirVenture gathering in Oshkosh, Wisconsin, and decided he would make aviation part of his business. By the time I met him, he had also decided to buy several "wind-tunnel machines"—huge turbines that supported paying guests on cushions of air and gave them the feeling of skydiving—that he was going to install at the former site of the Shanghai World Exposition, and other places. "The aviation market in China is going to become very big!" he told me, reinforcing what Vicky had said. "Everyone knows this, all around the world!"

On the same day I spoke with him, I interviewed a salesman for a private jet company, who said that he had sold three new jets to Chinese customers within the past twenty-four hours. Each of the planes cost around $20 million; one of the sales was in cash, delivered in suitcases. In some parts of the world, bulk cash payments might come only from drug dealers or arms traffickers. In this instance the purchaser was a regional industrialist and real estate magnate, and the cash was a sign of the fast growth and rough-and-ready nature of Chinese capitalism at the moment.

A few days after that, a company in Shanghai announced the debut of *Wings and Water* magazine, a Robb Report–style publication about yachts and private jets for China's new wealthy class.[9] As a gauge of the potential, an official from Dassault, the French jet firm, pointed out that the United States already had more than eleven thousand business jets, versus two hundred to three hundred in China (only thirty of which were registered—the rest flying illegally). An aviation blogger outside China calculated that China had only 22 private jets per

trillion dollars of gross domestic product (GDP), versus 535 for the United States and 138 for Europe.[10] If it were to match the European level—on an income basis, not even adjusting for population—that meant its fleet could expand sixfold. To match the American level, a better comparison given its geography, it could expand by a factor of twenty-five. At the first-ever China Business and Private Jet Expo, held in Shanghai in 2010, the proudly nationalist paper *Global Times*—which chronicled the country's rise with such features as "Chinese vs. Foreign Stars: Who Has the Most Beautiful Legs?"—said China's leading role as an aircraft market, and eventually as a producer, would be another sign of its emergence as a modern power. "We are going to buy *two* business jets this time," the story quoted Li Nonghe, secretary general of the World Chinese Business Advancement Association, as saying. It added, "He showed his feelings of pride as Chinese are becoming richer to the point of owning jets."[11]

The next frontier in Chinese achievement

These plans were grand; some were grandiose. Some of them would succeed; some would become huge money losers and at best would be forgotten, with deluded investors or indifferent state agencies left to cover the eventual loss. Some would represent significant challenges to established businesses and whole industries in the rest of the world. Some would open opportunities for foreign participants. In these aspects and many others, the impending drive to make China a major player in the world's aerospace business resembles many other aspects of the country's rush to modernization since the beginning of its market reforms and opening to the world starting in 1979. The

more time I spent in China, the more I thought that this aspect of its industrial ambition, which has received far less attention than comparable pushes for clean-energy, info-tech, biotech, and other fields, was the next great arena and test case for Chinese modernization.

I am a lifelong aviation enthusiast, and for about fifteen years have been an active small-plane pilot. I had flown across the United States several times before arriving in China in 2006, and I imagined, or hoped, that I might be able to explore parts of the country in a small plane. Soon enough, I learned better. A few weeks after arriving in China, I had an unexpected interview with a senior official from the foreign ministry. I innocently explained my hope to see parts of China's western frontier from the air. He managed to keep a straight face while my comments were being translated. "That is interesting," he said in reply.

Ultimately I did manage to fly in a small plane more than once in and around mainland China, apart from the many dozens of trips I made on Chinese airlines. One year after my memorable trip from Changsha to Zhuhai with Peter Claeys in a Cirrus, I was copilot on another Cirrus flight with him. We started at a small airport outside Tokyo, down through Okinawa for a refueling stop on the eve of a typhoon, and after the storm passed to Taipei. From there Claeys took it on to Macau with an Italian pilot friend, Michele Travierso. Even though I had to give up—or, more optimistically, "postpone"—my own ambitions to fly throughout China, I sought out and met a large cast of Chinese and foreign figures who were preparing for the time when China's aviation dreams fully took off. These were the visionaries, hucksters, engineers, business promoters, regional power brokers, environmentalists, military pilots, air-

line entrepreneurs, and miscellaneous aviation enthusiasts who believe that China is about to enter its own aviation age.

I first looked into their world largely out of personal fascination, but over the years I became convinced that this was another crucially revealing subelement of Chinese life and prospects, with potentially important implications for the rest of the world. Life around the coal mines, life at the universities, life among the veterans of the Cultural Revolution who are trying to cope with (or suppress) memories of their individual and collective past—each of these says something about the country's overall possibilities. So it is with the people who are now negotiating with the military to open up China's skies, imagining a Chinese counterpart to Boeing, Airbus, and NASA, and reflecting on what the aviation boom in China, the world's biggest, will mean for the country's natural environment and that of the entire planet.

The people in this world include: The engineers hoping to build a Chinese counterpart to and competitor for Boeing and Airbus. The Boeing and Airbus officials—and smaller counterparts from Embraer and Dassault and Cessna and Diamond—trying to stay in the Chinese market and remain ahead of the competition. The provincial boosters and dreamers from the wilds of China who imagined that building a vast new airfield would be the secret to their area's prosperity. The foreign pilots who had been furloughed by airlines in the developed world and hired on for service as "freight dogs" (air-freight pilots) or instructors in China's burgeoning flight-academy business. The Chinese officials planning where to build the next dozen new airports, and the foreign architects and engineers and environmental consultants desperately competing to be cut in on those deals. The Chinese and international researchers

working to produce jet fuel from algae in hopes of offsetting the environmental effects of the aviation boom, on China and the world. The sales reps for American, European, and Brazilian airplanes and helicopters trying to sell their aircraft—who in some cases ended up selling their companies as a whole to Chinese bidders. And the people across China who, much as happened to Americans with the coming first of the "jet age" in the late 1950s and then of cheap deregulated air travel in the late 1970s, were changing their sense of the country and themselves through the idea of quick travel by air.

Almost any activity in China involves a lot of people, and so it is with Chinese aviation. The city of Xi'an alone has more than 250,000 aerospace engineers and assembly workers, about eight times as many as in the comparable U.S. aviation center, Seattle. That difference in volume says something about the gap in output and productivity levels too—with their much smaller workforce, the U.S. factories still produce most of the world's airplanes, from Boeings down to Cirruses and Cessnas. Still, the scale of the coming Chinese effort can seem fearsome and unstoppable. Late in 2011 a new company called the China Business Aviation Group played on that impression by announcing that "the giant had awakened" and predicting China's inevitable domination of the business-jet market worldwide.[12]

But the realities behind the scale and numbers, in aviation as in so many other aspects of China's development, are more complicated, sometimes less impressive, and always more interesting than they seem from afar. The comedy and infighting that coexist with grandiose national planning; the corruption and small-town parochialism that give policies such a different effect in the hinterland than was intended in the capital—these apply in aviation as they do in the "green tech" boom, the boom in higher education, and many other areas. The biggest differ-

ence between being a foreigner inside China and watching it as a foreigner from outside is how much more precarious and uneven the state of China's "success" seems from within, and the different view one gets as to how China's growth will affect the rest of the world.

The many stories that make "the China story"

There is no one China story or "complete" picture of China. That is the theme I stressed repeatedly in the *Atlantic* articles I wrote while I was living in China and that also guides this narrative. The first step toward reckoning with what is knowable about China's rise is remembering how diverse and contradictory conditions within the country can seem to be. Trends both good and bad in China's development can be identified, but every one of them has its exceptions and uncertainties.

Perhaps the strongest and most important of these general trends in China is the sense that *things are possible.* Many Americans and Europeans have that in their personal lives; it's very strong for those in the scientific, technological, and pop-culture businesses, but it has all but vanished from public life in many developed countries. The electorates in most of North America, Europe, and Japan know very well what their countries' main problems are. They just lack any belief that their governments will grapple with those problems or even that governments should try. China's problems are far worse and more obvious, starting with the rampant pollution and thoroughgoing environmental destruction that have become the nation's major public-health threat and challenge to its long-term development. But three decades into the modernization kicked off by Deng Xiaoping, most people seem to imagine that problems

will be solved, or at least that life will be better five years from now than it was five years ago.

The part of Chinese ambition that is channeled into aerospace parallels this larger trend, and its progress in this field is a close marker of its overall modernization. In the 1980s, China's airlines were antiquated and genuinely dangerous. Through most of the past ten years, they have been statistically among the safest in the world, and more comfortable than most in North America or Europe. Who remembers the last Economy Class seat on a U.S. airline that came with a meal as part of the price? I cannot remember being on a Chinese airline flight of any duration that did not include a hot meal—usually fish, chicken, or pork with either rice or noodles. The old airline system was a proxy for China's general backwardness, and the current one is an indicator of its progress and ambition, in surprisingly revealing ways.

Designing and building modern airplanes is even more complex than it seems, incorporating simultaneous advances on many separate technological fronts. Materials science (so the planes can be lighter and stronger), engine design (so they can fly more reliably on less fuel), electronics and avionics (as the plane's control systems and sensors become one enormous interconnected computer), large-scale coordination of supply chains and performance schedules, and more. Running a successful airline requires a combination of retail-level customer-handling skills, to keep the level of hatred and frustration felt by the flying public from driving them away from air travel altogether, and complex integration of route structure, fare changes, crew scheduling, the passenger-versus-cargo mix, and many other variables.

At the national level, keeping air travel safe enough to seem First World rather than Third World is the most complex

undertaking of all. It requires uniform maintenance and safety standards for airports in every remote corner of the country; a network of air-traffic controllers who know how to work within their own system and with the airlines' pilots and dispatchers; the ability to collect accurate weather reports from around the country, and get them to pilots and controllers in real time, while feeding the data into supercomputers to forecast hazardous patterns; a system for training pilots, mechanics, and inspectors and indoctrinating them into a safety-first culture; check-and-balance procedures that detect and correct those not fully indoctrinated and that keep any individual or organization from taking too many risks; and more. A modern air-travel system also requires a degree of integration across national borders—U.S. planes flying across the Caribbean routinely talk with controllers in Havana—and across organizational boundaries within each country, since military, commercial, and civilian authorities must coordinate their use of airspace. Therefore it is not just techno-chauvinism that leads rising nations to think that a functioning aerospace and air-travel system is a meaningful indication of full-fledged development.

Modern China is the world's great success story at the "hard" elements of this achievement: creating infrastructure, lowering production costs, doing any- and everything at a great scale. But it has yet to show comparable sophistication with the "soft" ingredients necessary for a fully functioning, world-leading aerospace establishment. These include standards that apply consistently across the country, rather than depending on the whim and favor of local potentates. Or smooth, quick coordination among civil, military, and commercial organizations. Or sustaining the conditions—intellectual-property protection, reliable contract enforcement and rule of law, freedom of inquiry and expression—that allow first-rate research-and-developments

institutions to thrive and to attract talent from around the world.

If China can succeed fully in aerospace, then in principle there is very little it cannot do. The combination of economic power and autocratic political control that has made the Chinese story so successful thus far seems, from a Western perspective, to be self-limiting, because it is a contradiction. The Chinese model has worked to bring a mainly peasant economy into the low-wage manufacturing era. But—the reasoning goes—it will be hard to sustain the controls as more Chinese people become rich, urbane, independent-minded. Or, if the government insists on maintaining the controls, it will be hard to move the economy beyond the stage of reliance on low-wage industries and copycat goods.

Aviation in all its aspects will be a test of these theories. For success, China will need the strengths it has already demonstrated, and ones it has yet to master.