

ENGINEERING A NEW SPACE:
CHINESE AMERICAN SCIENTISTS AND ENGINEERS IN
AEROSPACE IN SOUTHERN CALIFORNIA

When the Soviet Union launched *Sputnik 1*, the world's first satellite, on 4 October 1957, it not only took the world into the space age, but also marked a turning point in American science and technology policy. Within days, President Dwight Eisenhower radically changed how his administration solicited science advice and formed science policy. He appointed James Killian of MIT as his full-time science adviser and reassigned a group of science consultants as the President's Science Advisory Committee (PSAC). Although by no means blind believers in technological fixes for social and political problems, PSAC scientists nevertheless advocated in 1960 that American science and technology must "double and redouble in size and strength" in Sputnik's shadow.¹ In response, the federal government increased its support of science education to meet an expected technical manpower shortage, especially in the area of aerospace.

But how real was this manpower shortage? It turned out that whether the gap would materialize depended on what the federal government did or did not do, especially in aerospace. This became clear during the first months of John F. Kennedy's presidency. In April 1961, another Soviet feat in space, the orbiting of Yuri Gagarin, created renewed public pressure on the Kennedy administration. Just a month later, President Kennedy and his advisors deliberated over whether to launch a Moon-landing project; manpower became part of the calculation. When Kennedy was told that without a large space program there would be an oversupply of aerospace manpower, it "took away all the argument against the space program."²

The Apollo project absorbed all the existing manpower and generated a huge new demand of its own. In January 1962, Kennedy asked PSAC to study the problem of the technical manpower shortage. The

committee came back by the end of the year with a recommendation for increased federal support to universities and students in engineering, mathematics, and the physical sciences, which the National Science Foundation subsequently implemented.³ By 1963, according to Jerome Wiesner, Kennedy's science adviser and PSAC chairman, roughly every other science and engineering graduate would be expected to "go into NASA activities." When Kennedy asked again "what the new people would be doing if the NASA program did not exist," Wiesner answered, "one can only guess." It certainly made "the technical manpower problem today . . . tight," with serious shortages predicted for 1964–65, when the demand from Apollo would reach its peak. To meet this need would take not only the 70,000 new scientists and engineers produced in the United States each year, but also the four to five thousand immigrant scientists and engineers.⁴

It is not clear whether Wiesner included foreign students who were pursuing science or engineering degrees in the United States in the former or latter category. Either way, his memorandum indicates the crucial importance of attracting immigrant scientists and engineers to the United States to help meet the Apollo-driven demand for technical manpower. Of course, the need for foreign technical manpower did not originate with the Apollo project; there was much talk about the "Cold War of the Classrooms" in the 1950s, even before *Sputnik's* launch, and many policies had been enacted to attract foreign technical manpower to the United States. But due to its scale and technical nature, Apollo, more than any other single project, jacked up the demand for foreign technical manpower.

Chinese Americans in Science and Technology

Chinese Americans, perhaps more than any other group, benefited from the rising demand for technical manpower. In the late nineteenth century and the first half of the twentieth century, thousands of Chinese students came to the United States to study science and engineering. Most of these students returned home after finishing their studies, in part due to the Chinese Exclusion Acts that were first passed in 1882. But in 1949, with the Communist revolution in mainland China, a majority of the estimated 5,000 Chinese students then in the United States, many of them specializing in science and technology, decided to stay in the United States.⁵ By the mid-1950s, these so-called "stranded students" were joined by about 2,300 more Chinese intellectual refugees who had fled Communist China.⁶ By then the racist Chinese exclusion laws had

been repealed (during World War II), but the discriminatory immigration quota system, which limited new Chinese immigrants to 105 a year, was still in place. Both the stranded and the refugee Chinese were able to gain legal status in the United States only through a number of special congressional and executive decisions. Those decisions in turn were driven by dual Cold War concerns: denying talented workers to the Communists and attracting them to the United States. In 1953, for example, Congress passed and President Eisenhower signed the Refugee Relief Act that, among other measures, allowed stranded Chinese students to stay in the United States permanently and also permitted 2,000 Chinese refugees to enter the country over and above the 105-per-year quota.⁷

A third group of Chinese American scientists came from Taiwan (and to a lesser extent, Hong Kong) in the 1950s and 1960s. Many of these newcomers had been born and raised in mainland China, then fled with their families to Taiwan around the time of the Communist revolution in 1949. Most of them received undergraduate education in Taiwan but came to the United States for graduate training. The backward and often politically dangerous conditions at home provided the push, while the prospect of much better living and working conditions in the United States furnished the pull. In many ways, the migration of Taiwanese scientists and engineers to the United States fit into a pattern of "brain drain" that was common to many developing countries, such as India and South Korea, in this period.⁸

In the 1960s, the immigration of Chinese to the United States was further encouraged by both the continuing Cold War demand for manpower and the push for racial and ethnic equality amid the rising Civil Rights movement. By the end of the 1960s, about 2,000 students were leaving Taiwan for the United States each year.⁹ The landmark 1965 immigration reform act increased the annual allotment for Chinese immigrants from about 100 to 20,000 spaces, most of which went to Taiwanese Chinese, including those Taiwanese students in American universities who decided to stay in the United States following graduation. Finally, the reopening of United States–China relations in the early 1970s and the renormalization of diplomatic relations between the two countries in 1979 brought a fourth major wave of migration of Chinese to the United States, this time from mainland China, which was given a separate quota of 20,000 a year. These immigrants were once again led by students who came to the United States mainly to study science and technology, some of whom went into aerospace.¹⁰

Asian Americans in Aerospace

The exact numbers of Chinese Americans in aerospace are hard to come by, but some data on Asian Americans help piece together a picture of the scale and characteristics of this group. A 1989 report by the U.S. Government Accounting Office (GAO) on female and minority aerospace managers and professionals during the period from 1979 to 1986 provides some useful indicators. The industry employed altogether about 1.27 million workers in 1986, based on census data. The GAO examined closely about half of these employees (678,780 in 1986) because it focused on so-called EEO (Equal Employment Opportunity) data, which gathered more detailed information on the ethnicity and gender of workers at the larger companies.¹¹ Nationwide, Asian Americans comprised about 3.2 percent (about 38,100 if one uses the census data) of the aerospace workforce in 1986, almost doubling from 1.7 percent in 1979. This increase was slightly faster than the increase in Asian Americans as a percentage of the general population (from about 2 percent in 1979 to about 3 percent in 1986). In this period, total national aerospace employment increased by 58 percent, from 430,383 in 1979 to 678,780 in 1986.¹² The GAO data did not provide further detail on the proportions of various ethnicities in the Asian American category, but one assumes that the general pattern for the group held true for Chinese Americans, who make up the plurality of Asian Americans.

A striking finding of the GAO confirmed that the "glass ceiling" effect that blocked Asian American advancement in corporate America was especially serious in aerospace. Even though nationwide a greater proportion of Asian American aerospace employees had technical training and were in the category of "professionals" than whites, African Americans, or Hispanics, they had the smallest proportion of management jobs. For example, in 1980, according to the GAO's analysis of the EEO data maintained by the federal Joint Reporting Committee, while Asian Americans made up 1.5 percent of the employees in the industry, their share of professionals was 3.6 percent but their share of managers was only 1.0 percent. All minority groups and women were underrepresented in management in terms of their total numbers when compared with white males, but the case of Asian Americans seemed especially acute. Even as the number of Asian Americans in aerospace increased, the pattern seemed unchanged.¹³ As the sociologists Lucie Cheng and Philip Q. Yang argued, many Asian immigrant professionals discovered to their dismay that "America seemed to want them for their skills and work ethic as employees but not for their assertiveness and ambition as bosses."¹⁴

Nationwide

Table 1. Ethnic Distribution of Aerospace Jobs, 1980

Job Category	Percentage of Workforce			
	Whites	African Americans	Hispanic Americans	Asian Americans
All	81.0	11.6	5.4	1.5
Professionals	89.9	4.4	1.9	3.6
Managers	92.5	4.0	2.2	1.0

Source: GAO, Equal Employment Opportunity: Women and Minority Aerospace Managers and Professionals, 1979–1986 (Washington, D.C.: GAO, 1989), table II.1 on p. 23, <http://archive.gao.gov/d26t7/139889.pdf>.

There were some relatively bright spots in the statistics for Asian Americans: not only were they “over-represented” in the category of “professionals,” but also, as professionals and managers, they earned salaries about 95 percent of those of their white counterparts; in comparison, African and Hispanic Americans made only about 75 to 85 percent of whites’ salaries in 1987.¹⁵ Yet, even these numbers highlighted the narrow career paths that seemed open to Asian Americans in aerospace. Due to the nature of the industry, the option of escaping from the glass ceiling by going into self-employment was often not as readily available to Asian American scientists and engineers in aerospace as it was to those in other fields, such as computers or biomedicine. Furthermore, as the sociologist Joyce Tang pointed out, Asian Americans, like other minorities, again faced discrimination when attempting to go into self-employment, for example in the form of bias by consumers.¹⁶

Yet, despite persistent problems such as underrepresentation in management, there was no denying the dramatic increase of Asian Americans in aerospace. According to EEO data from the 1990 census, there were 143,434 aerospace engineers in the country that year, of whom 11,274, or about 8 percent, were Asian or Pacific Islanders (APIs).¹⁷ By the 2000 census, the number of aerospace engineers nationwide had fallen 23 percent to 110,475, but the number of APIs in the occupation held relatively steady: 10,440 who had two Asian parents, 540 who had one Asian and one non-Hispanic white parent, and 165 native Hawaiians and “other Pacific islanders,” totaling 11,145, or about 10 percent of the national total.¹⁸

Chinese Americans in Aerospace in Southern California

Nowhere was Asian American growth and concentration in aerospace more striking than in Southern California. The Los Angeles area had the largest number of aerospace employees in the country in the early 1980s. In 1979, there were 114,248 aerospace employees in the Los Angeles area, and about 4,570, or 4 percent, were Asian Americans, more than double their average representation in the industry nationwide. By 1986, the number of all aerospace employees in Los Angeles increased by 42 percent to 162,563, while Asian Americans more than doubled their numbers, to about 11,380 or 7 percent of the total regional aerospace employees.¹⁹ The trend continued in later decades. According to the U.S. Census of 1990, in the narrower category of aerospace engineers, the total number for Los Angeles County was 23,523, of which 3,610, or more than 15 percent, were API Americans.²⁰ Following the post-Cold War retrenchment in the 1990s, the total number of aerospace engineers in Los Angeles county fell to 12,135 by 2000, and the number of APIs (including native Hawaiians and other Pacific islanders) among them also decreased, to 2,780, but their proportion increased to about 23 percent.²¹

The pattern of Asian American employment in aerospace in Los Angeles followed that at the national level in some ways but also differed from it in others. As noted above, the percentage of Asian Americans in Los Angeles aerospace was about double that of the national average from 1979 to 1986.²² Asian Americans held professional and managerial positions in the Los Angeles area at triple the national rates; they made up about 10 percent of professionals and 5 percent of managers, according to the 1986 EEO data.²³ Such prominence in the industry undoubtedly reflected Asian Americans' higher concentration in the region. Indeed, if one compares their numbers in Los Angeles aerospace and in the regional labor market in general, one finds that all minorities were actually underrepresented in managerial positions and, somewhat surprisingly for Asian Americans, in professional positions as well.²⁴

Why was there such a high concentration of Asian Americans in aerospace in the Los Angeles area? There likely were several factors at work here. Rapid industrialization, including the rise of aerospace, and the accompanying economic expansion of Southern California in the post-World War II period created employment opportunities that attracted immigrants from all over the world, but especially from Asian-Pacific countries. While traditional immigration from many Asian countries was still severely restricted due to the discriminatory pre-1965 quota system, many students, especially those from Taiwan and Korea,

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were able to find ways to stay and work in the United States. In this regard, Southern California had advantages not only in its booming aerospace industry, but also in its many universities and colleges. The 1965 immigration reform further promoted Asian immigration because it vastly expanded quotas for the region and favored immigration of family members of those who were already in the United States. Other appeals of Southern California included the area's rich Asian and especially Chinese cultural traditions and resources, including Chinatown and many excellent Chinese restaurants, its position on the Pacific Rim, its status as a major port of entry for Asian Pacific immigrants, and perhaps most important of all, its pivotal role in trade linking the United States with the Asian Pacific region. All of these factors helped to make Los Angeles a favored place for Asian immigrants and Asian Americans to settle and find employment.²⁵

Among Asian American aerospace scientists and engineers, Chinese Americans not only formed one of the largest groups, but their story also provides an especially good illustration of how aerospace reshaped Southern California and vice versa. The presence of Chinese Americans in Southern Californian aerospace can be traced back to the 1930s, when a number of talented Chinese students, driven in part by their nationalist determination to build up China's nascent aviation industry and air force, came to study aeronautics at the California Institute of Technology (Caltech). Perhaps the most famous of them was Hsue-sen Tsien (Qian Xuesen in pinyin), who worked with Theodore von Kármán at Caltech first as a student and then as a colleague. Tsien helped establish Caltech's Jet Propulsion Laboratory (JPL) and consulted for the U.S. Air Force on secret military projects during and after World War II. The head of Caltech, Robert Millikan, had recruited von Kármán to Caltech to help convince aircraft companies to stay in the region by promising them a supply of good engineers. Tsien's return to Caltech as the Goddard Professor of Jet Propulsion in 1948 after a brief stint at MIT similarly reflected the institute's and the region's ambition to become a leader in the new aerospace field in the postwar period.²⁶

As detailed by Iris Chang, Tsien rose as an aerospace scientist in the 1940s but was persecuted as a suspected Communist during the early 1950s and, in 1955, was allowed to return to China, where he assumed leadership of the Chinese space-and-missile program.²⁷ In the wake of his departure, many Chinese Americans seemed to take two lessons from his experience: one, that Chinese Americans could indeed excel in American science and technology, and two, that in order to succeed in the United

States, they had to concentrate on their professional achievement and avoid politics at all costs.²⁸ This legacy, in addition to the effects of racial discrimination and language barriers, may also help account for the relative paucity of Chinese/Asian Americans in aerospace management.

The strategy, however, did seem to lead to success for a number of Chinese American scientists at academic institutions in Southern California, including those who studied aerospace. Yuan Cheng "Bert" Fung, for example, came from China in 1946 to pursue a PhD in aeronautics and mathematics at Caltech but decided to stay in the United States after he completed the degree in 1948. He became the second ethnic Chinese (after Tsien) to hold a professorship at Caltech, made major contributions to the field with his study of aeroelasticity, and pioneered the new field of biomechanics and bioengineering, first at Caltech and later at the University of California, San Diego.²⁹ Theodore Y. Wu, who followed Tsien and Fung as the third Chinese American professor at Caltech, also worked in fields related to aerospace engineering.³⁰ Another Chinese American aeronautical scientist, Tung-Hua Lin, came to the United States after designing China's first airplane (using a wood frame) in the 1940s during the war against Japan and stayed on to become an engineering professor at UCLA in 1955. Apparently the first Chinese American faculty member at the university, he made major contributions to the safety of building materials, including metals used in the construction of airplanes.³¹

Representing a younger generation of Chinese American aerospace scientists was Chih-Ming Ho. Coming from Taiwan in the 1960s, Ho received his PhD from Johns Hopkins in 1974 and rose to full professor of aerospace engineering at USC before moving to UCLA in 1991 to help found the new field of micro-electro-mechanical systems research with applications in aerospace. Elected a member of the U.S. National Academy of Engineering in 1997, Ho has been active in scientific and technological exchanges with institutions in Taiwan and mainland China.³² A 2009 review of UCLA's Department of Mechanical and Aerospace Engineering, for example, counted eight Chinese Americans (and about ten other Asian Americans) among its thirty-five active faculty members. The presence of these prominent Chinese American academics in turn helped attract other Chinese students from Taiwan and elsewhere to Southern California, often to study and work in aerospace. Following the 1965 immigration reform, they would help bring their own extended families to the Los Angeles area.

Following the establishment of diplomatic relations between the United States and China in 1979, an even larger wave of students and im-

migrants came from mainland China to the United States, where many of them studied science and technology. Most ended up working as scientists and engineers in the United States, some in aerospace in Southern California. The reopening of bilateral relations also led to increased trade in aerospace and opportunities for Chinese Americans in brokering such deals. In the early 1980s, for example, the Los Angeles-based aerospace company McDonnell Douglas entered into an agreement with China both to sell it aircraft and to help it set up facilities to produce its own. For this purpose the company created a subsidiary, McDonnell Douglas China, and appointed Gareth Chang, a Chinese American, its president.³³

The dynamic mutual reinforcement of the aerospace boom and Chinese immigration from both Taiwan and mainland China eventually helped reshape Southern California. The influx of the new Chinese immigrants led to the rise of new Chinatowns in metropolitan Los Angeles, especially Monterey Park ("Little Taipei"). The city elected the nation's first female Chinese American mayor, Lily Lee Chen, then a social-work manager for Los Angeles County, in 1983. In an interview with the *Los Angeles Times* at the time, Chen explained why she and her husband Paul, an aerospace engineer, decided to move from Seattle to Los Angeles: "The space industry was booming and so was the field of social work. . . . We were part of something important."³⁴ Aerospace jobs also brought Chinese immigrants to other parts of Southern California, including the Palos Verdes peninsula, beginning in the early 1980s.³⁵ According to a study by the sociologist Yen-Fen Tseng, the lure of Southern California continued into the 1990s, when "Taiwanese professionals and executives have . . . found Los Angeles more attractive because of its engineering jobs in high-tech and aerospace industries and its Asia-Pacific business environment."³⁶

As they have settled into Southern California, many Chinese American scientists and engineers in aerospace-related fields have become leaders of local Chinese American communities. Peter Yao, a child when he migrated to the United States with his refugee family in the mid-1950s, later became an engineer and mid-level manager at the aerospace firm Raytheon and in 2006 was elected the first Chinese American mayor of the city of Claremont.³⁷ Munson Kwok of Aerospace Corporation became president of the Chinese Historical Society of Southern California and one of the founders of the Chinese American Museum in Chinatown.³⁸ Regional organizations recognized Chinese Americans in aerospace. In 2007, for example, the Chinese American Engineers and Scientists Association of Southern California (CAESASC) honored Heidi

Shyu, vice president of corporate technology and research at Raytheon. Shyu, who had migrated with her family from Taiwan to the United States at the age of ten, became chair of the high-level U.S. Air Force Scientific Advisory Board in 2005 and thus rose to be one of the few women and Asian Americans in a leadership position in aerospace and military research and development.³⁹

The increasing importance of Chinese American scientists and engineers was also recognized within aerospace companies in Southern California. In the 1990s, for example, the Aerospace Corporation, a major local firm, joined with several Asian American organizations to establish the "Asian-Pacific Americans of the Year" awards. In 1998 the awards went to, among others, two Chinese American engineers, Dick Chang and James Chang. Dick Chang, an expert on material and structural problems, was originally from Taiwan, received his PhD from UCLA, and started working at Aerospace in 1973. He was active with the company's Aerospace Asian American Association, working on issues related to affirmative action, and in the CAESASC. James Chang, a specialist on damage tolerance and fracture control for aircraft and space vehicles, also came from Taiwan and joined Aerospace in 1983. He was equally active in the local Chinese American community, founding the Chinese Culture Association of Southern California and chairing, at one point, the Southern California Chinese School Council.⁴⁰

Not all Chinese Americans had the same political views, especially when it came to relations between Taiwan and mainland China. Many Taiwanese American aerospace scientists and engineers, especially those who were native-born Taiwanese (in contrast to those who fled to Taiwan in 1949 with the Nationalists) and who were sympathetic to the Taiwanese independence movement, organized the Taiwanese American Aeronautics and Space Association in 1993, a majority of whose members live in Southern California. This organization facilitated technology transfer to Taiwan after the native-born Lee Teng-hui became president in 1988 and especially following the election victory of the pro-independence Democratic Progressive Party (DPP) in 2000.⁴¹ Some of these DPP supporters gave up their U.S. positions to return to work in Taiwan full time. Ching Jyh Shieh, an aerospace engineer who had headed the Southern California Taiwanese Association, for example, moved to Taiwan in 1995 to serve in its space program.⁴² In contrast, the Society of Chinese American Aerospace Engineers, founded in 1999 and with many of its members originating from mainland China, declared in its bylaws that it was a non-political organization with the sole purpose of promoting the welfare of

Chinese American aerospace engineers, "following American laws and national regulations governing the restrictions of secrets." It maintained contacts with both sides of the Taiwan Strait.⁴³

Of all the aerospace institutions in Southern California, JPL had particular success in attracting Chinese American scientists and engineers, probably in part because its work was largely unclassified and so did not require security clearances that might be difficult for immigrants to obtain. A report in 2004 put the number of Chinese Americans at JPL at three hundred. In recent years the prominent roles they played in the Mars rover and Stardust projects have earned them publicity, both in mainstream American media and in Chinese-language media in the United States, mainland China, and Taiwan. But even in this supposed bastion of meritocracy, sometimes Chinese American scientists felt they suffered from conscious or unconscious discrimination. In 2006, Peter Tsou, for example, complained to Chinese-language media that, although he was the original designer of the Stardust project, which collected comet dust in space, he was relegated to the position of deputy principal scientist while others received most of the credit for its success. Tsou did not hide his disappointment and resentment: "This happened mainly because I am a Chinese."⁴⁴

While, for many Chinese American scientists and engineers, aerospace presented a technological escape from politics, for others, the boundary was far blurrier, especially after the end of the Cold War. In the early 1990s, although the Soviet and then Russian menace decreased, the perceived threat from a rising China increased. Ever since the Tsien case, Chinese Americans in aerospace often worked in the shadow of suspicion of disloyalty, as did their counterparts in nuclear science and other sensitive areas of technology. There have been a few cases of Chinese Americans convicted of violating the law in technology transfer to China in recent years. In 1997, Peter Lee, a Taiwanese-born Chinese American physicist who worked at the Los Alamos National Laboratory and later at TRW Space & Electronics Group in Manhattan Beach, was arrested by the FBI for transmitting secret technology on lasers and submarine detection to Chinese scientists. In a plea bargain, Lee admitted that he leaked classified information to Chinese scientists but insisted that it was unintentional—he was carried away by his enthusiasm for scientific exchange. In view of his cooperation and the fact that the information Lee leaked was soon declassified, Lee was given a very lenient sentence, one year in a halfway house. The event received scant media attention until the nationally publicized case of Wen Ho Lee, another Taiwanese-born Chinese American

scientist at Los Alamos who was accused of leaking vital nuclear secrets to China in 1999. That affair, which ended with only a minor conviction of mishandling classified information, ignited what to many Chinese Americans was a new witch-hunt resembling the McCarthy era.⁴⁵

In the 2000s, Chi Mak, a Chinese American engineer in the Los Angeles area, and several of his relatives were convicted of attempting to violate export-control laws, among other charges, by transmitting unclassified data related to submarines to people in China.⁴⁶ Once again, there was fear that this and similar cases would be used to cast doubt on all Chinese and Asian Americans. In court, the FBI revealed that it had put thousands of Chinese Americans, from both mainland China and Taiwan, under various forms of monitoring and surveillance for suspicion of military and commercial espionage. Influential Chinese American commentator Chen Shiyao warned in *Shijie Ribao* (*World Journal*), the largest Chinese-language newspaper in the United States by circulation, that such cases would probably limit the advancement of Chinese Americans in defense-related industries in the future, "with implications even for second, third, and subsequent generations of Chinese Americans":

In the shadow of the so-called Chinese menace, traps are everywhere in U.S.–China scientific exchange. Anyone not careful enough will likely be snared in legal troubles. Will Chinese Americans be sacrificed as pawns in superpower competition? Those Chinese Americans who are in sensitive occupations should learn to behave and protect themselves.⁴⁷

In all likelihood, such cases will make Chinese (and other Asian) Americans think twice before going into aerospace, just as the Wen Ho Lee case affected their attitudes toward working for the nuclear weapons and national labs (and hence increased the appeal of working at less-classified places like JPL). Yet, at a time when the GAO and other federal agencies are warning of a "major workforce crisis in the aerospace industry," the United States can ill afford to lose a major source of aerospace labor, and even less to again make an entire ethnic group suffer injustice due to international politics and the actions of a few individuals.⁴⁸

Conclusion

Like other American scientists and engineers, Chinese American aerospace scientists and engineers in Southern California were profoundly

shaped by broader social and political developments, in particular the Cold War arms and space races that created the huge demand for technical manpower in the post-World War II period. Along with other Southern Californians, they saw the fortunes of their industry and often the regional economy rise and fall (and rise again), following the contours of geopolitical developments. Like other minorities, especially other Asian Americans, they struggled against obstacles posed by racism and discrimination. Often their pursuit of professional excellence entailed forsaking political involvement or managerial advancement, whether by choice or necessity. Finally, like all Chinese Americans, they could not always control their own fates when international politics, especially U.S.–China relations, shaped how they were perceived by the rest of American society. The problem has proved an especially serious one for those dealing with sensitive, defense-related aerospace technologies.

In the second decade of this century, as the United States struggled to deal with a severe economic recession and other challenges, China and its scientific and technological progress, especially in space and clean energy, once again captured American national attention. In his state of the union address on 25 January 2011, for example, President Barack Obama characterized competition from China and India as “our generation’s Sputnik moment” and vowed that the United States would “out-innovate, out-educate, and out-build the rest of the world.”⁴⁹ President Obama was careful to call the Chinese achievements a constructive challenge to the United States, and his administration has continued the post-Nixon bipartisan tradition of pursuing scientific collaborations with China, but others took a more negative view of such endeavors. A U.S. congressman, for example, declared that China had stolen American space technology and succeeded in inserting a ban on all scientific and technological interactions with China involving NASA in the 2011 federal budget. Such measures recalled the days of United States–China Cold War rivalry, with potentially negative implications for Chinese American scientists and engineers.⁵⁰

Yet, despite all the obstacles, the attraction of doing cutting-edge science and technology, pursuing professional advancement, and contributing to American national security, coupled with the social, cultural, and environmental lure of a diverse Southern California, has proved irresistible for many Chinese American aerospace scientists and engineers in the past and will likely do so in the future. As they continue to fashion and refashion themselves in the shifting political and economic winds, the struggles of Chinese American scientists and engineers will provide a fascinating case study for historians to explore how science, technology, race, immigration, regional dynamics, and transnational politics interact.

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NOTES

- 1 President's Science Advisory Committee, *Scientific Progress, the Universities, and the Federal Government* (Washington, D.C.: U.S. Government Printing Office, 1960). For more on PSAC, see Zuoyue Wang, *In Sputnik's Shadow: The President's Science Advisory Committee and Cold War America* (New Brunswick, N.J.: Rutgers University Press, 2008).
- 2 Walter McDougall, *The Heavens and the Earth: A Political History of the Space Age* (New York: Basic Books, 1985), 322.
- 3 PSAC, *Meeting Manpower Needs in Science and Technology* (Washington, D.C.: U.S. Government Printing Office, 1963).
- 4 Wiesner to Kennedy, 8 May 1963, in Kennedy Library, President's Office File, Departments and Agencies File, box 85, folder "Office of Science and Technology 1963."
- 5 Zuoyue Wang, "Transnational Science during the Cold War: The Case of Chinese/American Scientists," *Isis* 101 (June 2010): 367-77.
- 6 Benjamin Zulueta, "Brains at a Bargain': Refugee Chinese Intellectuals, American Science, and the 'Cold War of the Classrooms'" (PhD diss., University of California, Santa Barbara, 2004).
- 7 Zulueta, "Brains," 56. Wang, "Transnational Science."
- 8 Iris Chang, *The Chinese in America: A Narrative History* (New York: Viking, 2003), 283-311. A shocked Donald Hornig, President Johnson's science adviser, found that almost the entire Korean engineering class that graduated in 1965 went to the United States and most stayed after finishing their graduate training; Wang, *In Sputnik's Shadow*, 256.
- 9 Chang, *Chinese in America*, 286.
- 10 *Ibid.*, 314-15.
- 11 U.S. Government Accounting Office [hereafter GAO], *Equal Employment Opportunity: Women and Minority Aerospace Managers and Professionals, 1979-86* (Washington, D.C.: GAO, 1989), <http://archive.gao.gov/d26t7/139889.pdf>. The census number is on p. 2, and the EEO number is on p. 25.
- 12 *Ibid.*, 25, 27.
- 13 For more on the lack of Asian Americans in aerospace management, see Deborah Woo, *Glass Ceilings and Asian Americans: The New Face of Workplace Barriers* (Walnut Creek, Calif.: AltaMira Press, 2000), esp. chap. 5, "The Glass Ceiling at 'XYZ Aerospace.'"
- 14 Lucie Cheng and Philip Q. Yang, "Asians: The 'Model Minority' Deconstructed," in *Ethnic Los Angeles*, ed. Roger Waldinger and Mehdi Borzogmehr (New York: Russell Sage Foundation, 1996), 305-34 at 328.

- 15 GAO, *Equal Employment Opportunity*, 36.
- 16 Joyce Tang, "Differences in the Process of Self-Employment among Whites, Blacks, and Asians: The Case of Scientists and Engineers," *Sociological Perspectives* 38 (1995): 273–309. Interestingly, she found that immigrant Asian Americans suffered less than native-born Asian Americans in the self-employment market.
- 17 Bureau of the Census, "Census '90: Detailed Occupation by Race, Hispanic Origin, and Sex," available from U.S. Census Bureau website, <http://censtats.census.gov/cgi-bin/eo/eeojobs.pl>.
- 18 Bureau of the Census, "Census 2000 EEO Data Tool," U.S. Census Bureau website, <http://www.census.gov/eo2000/index.html>.
- 19 GAO, *Equal Employment Opportunity*, 27 (table III.2), 71. The total growth in Los Angeles was slightly behind the national rate of 58 percent, partly because of the explosive increase (4,000 percent) of aerospace jobs in Seattle, the region with the second largest number of aerospace employees behind Los Angeles, from 1,599 in 1979 to 65,002 in 1986; *ibid.*, 71. The report referred to Los Angeles and Seattle "local areas," which in the case of Los Angeles probably meant Los Angeles County, not the city; *ibid.*, 26. On the rise of Los Angeles as an aerospace center, see the other essays in this book and Allen J. Scott, *Technopolis: High-Technology Industry and Regional Development in Southern California* (Berkeley and Los Angeles: University of California Press, 1993).
- 20 Bureau of the Census, "Census '90: Detailed Occupation."
- 21 Bureau of the Census, "Census 2000 EEO Data Tool."
- 22 GAO, *Equal Employment Opportunity*, 27 (table III.2).
- 23 *Ibid.*, 73.
- 24 *Ibid.*, 74–75. In contrast, in the Seattle area, the percentage of Asian Americans in managerial positions in aerospace was lower than their percentage in the regional workforce in general, but the percentage in professional positions was higher; *ibid.*, 76–78.
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- 37 "Full Biography for Peter S. Yao," League of Women Voters of California website, http://www.smartvoter.org/2003/03/04/ca/la/vote/yao_p/bio.html; Caroline An, "Peter Yao Elected Mayor of Claremont," *Inland Valley Daily Bulletin*, 30 March 2006.
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