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CHINA'S AIR DEFENSE RADAR INDUSTRIAL BASE

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ABBREVIATIONS

AESA	Active electronically scanned array
AEW&C	Airborne early warning & control
AI	Artificial intelligence
AVIC	Aviation Industry Corporation of China
AWACS	Airborne warning and control systems
CAS	Chinese Academy of Sciences
CASC	China Aerospace Science and Technology Corporation
CASIC	China Aerospace Science and Industry Corporation
CEC	China Electronics Corporation
CEIEC	China National Electronics Import & Export Corporation
CETC	China Electronics Technology Group Corporation
CIDEX	China Defense Electronics Exhibition
CIWS	Close-in weapon system
CSFC	China South Fire Control Center
CSSC	China State Shipbuilding Corporation
DoD	U.S. Department of Defense
ECRIEE	East China Research Institute of Electronic Engineering
ELINT	Electronic intelligence
EW	Electronic warfare
IADS	Integrated air defense system
ISAR	Inverse synthetic aperture radar
IT	Information technology
MANPADS	Man-portable air defense system
MIPAR	Multi-illuminator-based passive radar
MUCD	Military unit cover designator
NRIET	Nanjing Research Institute of Electronics Technology
NUDT	National University of Defense Technology
OTH	Over-the-horizon
OTH-B	Over-the-horizon backscatter
OTH-SW	Over-the-horizon surface wave
PLA	People's Liberation Army
PLAA	People's Liberation Army Army (ground forces)
PLAAF	People's Liberation Army Air Force
PLAN	People's Liberation Army Navy
PRC	People's Republic of China
RI	Research Institute
RMB	Renminbi
SAM	Surface-to-air missile
SAR	Synthetic aperture radar
SAST	Shanghai Academy of Spaceflight Technology
SASTIND	State Administration of Science, Technology, and Industry for National Defense
SEMIC	Sichuan Electronics Military-Industrial Group
SHORAD	Short-range air defense
SIAR	Synthetic impulse and aperture radar
SPAAG	Self-propelled anti-aircraft gun
SWAI	Southwest Automation Research Institute
SWIEE	Southwest Institute of Electronic Equipment
TEL	Transporter erector launcher
TELAR	Transporter erector launcher and radar
THD	Tianhe Defense
THz	Terahertz
UAV	Unmanned aerial vehicle
USAF	U.S. Air Force
USSF	U.S. Space Force

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EXECUTIVE SUMMARY

This report draws on open-source reporting, Chinese-language primary sources, satellite imagery, and multiple business databases to examine China's air defense radar capabilities and the industrial base that develops, produces, and deploys them. Key findings include:

- **China's large air defense radar industrial base produces comprehensive detection capabilities at all heights and ranges, and its newest systems appear to be on the international cutting edge of radar technology**. The bulk of air defense radar capabilities in the PLA are "third-generation" platforms that are solid-state, 3D radar systems with automated recording and networking capabilities, as well as limited anti-stealth capabilities. Modernization in this sector has been rapid, and the third-generation platforms are gradually being replaced with "fourth-generation" platforms that offer superior stealth-penetration capabilities, wider ranges of functions (combining fire control and surveillance, for instance), and expanded detection ranges. China's domestic market for military radars almost tripled in size over the last decade; in 2022, that market had grown to 42.5 billion RMD ($6 billion USD).

- **The PLA's air defense radar development in recent years has focused on fielding mobile systems and stealth-penetrating systems that can be networked with other radars to generate a more comprehensive sensing capability**. The PLA appears able to network air defense radar platforms of multiple types and capabilities at least at the brigade level, and can likely fuse information from air defense radars across the country into a centralized detection network. Given well-known problems with jointness and interoperability in the PLA, however, it is unclear exactly which systems can be incorporated into that network and how widely shared the fused data is.

- **China's air defense radar industrial base is large, robust, and still centered on large state-owned defense enterprises**. The China Electronics Technology Corporation (CETC) and several of its subsidiary companies and research institutes dominate this sector, but development and production capabilities are spread across at least 21 major corporate entities. One private company, Xi'an Tianhe Defense Technology Co., is also a major player.

- **China is pursuing a wide range of new radar technologies**. The companies involved in development and production are typically also involved in publicly available research on emerging radar technologies such as cognitive radar, quantum radar, intelligent radar, and microwave photon radar. This research is typically pursued in collaboration with academic researchers at a range of institutions, among which Beihang University and Tsinghua University are some of the most prominent civilian participants. PLA academic institutions

such as the National University of Defense Technology and the Air Force Early Warning Academy are also often involved in this work.

- **China's air defense radar systems are competing on the international market**. At least 23 countries were found to have received Chinese-made air defense radar systems, although occasional reports about problems with their capabilities and reliability may indicate PRC manufacturers are struggling to compete in this sector. Major recipients of these systems include Pakistan, Venezuela, and Egypt.

- **China's air defense radar capabilities limit U.S. freedom of action in the Indo-Pacific and, increasingly, in other countries**. The PRC's own air defense radar network offers comprehensive coverage of China's airspace, and domestically-produced long-range radar systems—many of which have been exported—provide layered detection capabilities outside China's borders, as well. The PRC's air defense radar network would be difficult for U.S. forces to penetrate except with the most advanced stealth, long-range, and hypersonic platforms. As the PLA's more advanced radar capabilities continue to proliferate, this may become true in other regions as well.

Scope and Methodology

This report characterizes the strength and trajectory of China's air defense radar industrial base by investigating four key research questions:

1) What air defense radar capabilities does the PRC have?
2) What does the industrial base responsible for developing and manufacturing those capabilities look like?
3) How are those capabilities likely to change in the future?
4) What implications do the capabilities and trajectory of China's air defense radar industrial base have for the United States and the US Air Force?

To answer these questions, this report first relied on a combination of Chinese-language reporting, U.S. government reports, and authoritative assessments of China's military equipment to identify all air defense radar systems known to be in service with the PLA. Given the likelihood that many of the PRC's air defense systems and their associated sensors appear able to be networked together to some degree, this report includes not just standalone surveillance air defense radar platforms, but also fire-control radars, surface-to-air missile systems (which can use their own built-in radars, rely on external sensors' guidance, or both), integrated shipborne radars used in the People's Liberation Army Navy's (PLAN) fleet, and airborne detectors such as reconnaissance helicopters and airborne early warning and control (AEW&C) / airborne warning and control systems (AWACS). While some anti-aircraft artillery systems in service with the PLA are likely to be radar-guided, given their short ranges and relatively limited detection capabilities, they were excluded from detailed consideration in this report. Some air-to-air missiles in the PLA's

arsenal also carry onboard radars, but they were excluded from this report because they are unlikely to contribute data to a larger air defense radar network.

That investigation resulted in the identification of 50 PLA systems that use air defense radars, some of which use multiple air defense radars. We then identified manufacturers for all of those platforms' radars and profiled them using a combination of PRC business databases, commercial databases, Chinese-language reporting, and other open sources. In some cases, that process identified additional air defense radar-producing subsidiaries that claimed to be important in the industrial base, so those were profiled as well. This process resulted in profiles of 21 companies that are likely to be responsible for the development and production of the bulk of the PRC's complete air defense radar systems. As a result of this focus on finished systems and in-service capabilities, this report does not consider companies involved in the midstream and upstream segments of the air defense radar supply chain.

In order to gain leverage on the question about the likely trajectory of the PRC's air defense radar industrial base, this report took three approaches. First, satellite imagery from Maxar's Global Enhanced GEOINT Delivery platform was examined at 436 radar sites in the PRC that were identified in open sources, in order to identify any visible enhancements or additional capabilities.[1] Second, emerging research in China's top radar journals was surveyed to identify upcoming air defense radar technologies and establish a sense of how close they are to maturity. Third, Chinese-language reporting on trade shows, company activities, military exercises, and technological developments was consulted in order to further explore the trajectory of the industrial base.

A few limitations of this approach are worth noting. A focus on radar systems designed specifically for air defense applications means this report does not consider the broad range of radars designed for civilian uses in, for instance, aviation, smart cities, oceanography, and meteorology. It also excludes from this investigation other military uses of radar, for instance ground-scanning synthetic aperture radars (SARs) and ocean-surface surveillance. However, some such systems appear to be able to detect aerial targets as well, in which case they were included in the scope of this report.

Finally, the limitations of open-source data on this topic are such that complete information was not always available on systems in service, their specifications, or their manufacturers' capabilities. While we are confident this report effectively characterizes China's air defense radar industrial base, it is possible, for instance, that other highly classified prototypes or platforms are in operation with the PLA. We have done our best to ensure accuracy by relying on authoritative sources and triangulation among multiple sources, and also highlight areas in which reliable sources disagree about empirical claims.

THE PRC'S AIR DEFENSE RADAR INDUSTRIAL BASE

As with many other military technologies in the PRC, China's air defense radar industrial base initially drew on imports and reverse engineering of foreign technology, primarily Soviet products. After the Sino-Soviet split, however, developing an indigenous capability to produce air defense radars became an urgent priority for Beijing. PRC analysts describe the progression of their air

defense radar in four generations. The first generation, in operation until the late 1950s, was generally non-coherent radar, highly susceptible to interference, and only offered detection in two dimensions. The second generation, from roughly the 1960s to the 1980s, was coherent radar that was able to detect targets in three dimensions. The third generation of air defense radars, from roughly the mid-1980s until the late 1990s, typically describes solid-state, 3D radars with automated recording and networking capabilities, as well as some degree of stealth penetration capability. Fourth-generation radars developed since the early 2000s integrate a wider range of functions, including surveillance, tracking, and fire control, in addition to expanding detection ranges and offering superior stealth penetration performance.[2]

PRC state media indicates that most air defense radars in service with the PLA today are of the third generation. PRC developers have produced several fourth-generation platforms that are reportedly at least as advanced as anything else on the international market, such as the SLC-7 (see p. 32), and many of them are already in service. However, it is not clear how many such cutting-edge systems have been deployed as of 2024. A common description in available media accounts is that the PLA uses "third-generation radar as the main body and fourth-generation radar as the backbone."[3] This likely indicates that third-generation systems make up the bulk of the PRC's air defense radars, with fourth-generation systems being incorporated as units' personnel become trained on them, information technology (IT) is updated to incorporate them, and more such fourth-generation platforms are produced.

In terms of production, China's air defense radar industrial base has seen robust growth and manufactures a wide variety of platforms for both domestic use and export. The "downstream" of the air defense radar sector, which produces the actual radar systems and platforms, remains dominated by state-owned corporations and research institutes. As discussed in the previous section, this component of the industrial base is the focus of this report. The primary manufacturers of complete air defense radar platforms are the 14th, 20th, 29th, and 38th Research Institutes of the China Electronics Technology Group Corporation (CETC) [中国电子科技集团公司], along with the 23rd Research Institute of the China Aerospace Science and Industry Corporation (CASIC) [中国航天科工集团有限公司] and one company that appears to be private, Xi'an Tianhe Defense Technology Company [西安天和防务技术股份有限公司].[4] A number of other entities compete in this field as well, all of which are described in the entity profiles section below.

The "midstream" component producers (*e.g.*, antennas and transmit/receive components) for military radars are evenly split among military research institutes and private organizations, while the "upsteam" semiconductor manufacturers are mostly private companies. Due to space constraints, these companies are not the focus of this report, but midstream standouts include Tianjian Technology [天箭科技] and Thunder Micropower [雷电微力], while prominent upstream entities include San'an Optoelectronics [三安光电] and Sichuan Electronics [四创电子].[5]

In terms of technological developments, advanced phased-array radars are now "mainstream" in China's military radar products, and PRC researchers are pursuing a range of even more advanced capabilities, such as cognitive radar (radar that can intelligently redesign itself in response to environmental conditions), quantum radar, and microwave photon radar (the transmit

and receive antennas for which could in theory be miniaturized to cover the skin of an aircraft and provide 360-degree visibility).[6] While much of the theoretical work related to air defense radars is conducted in universities and their affiliated state-supported laboratories, some units in the PLA, such as the Air Force Early Warning Academy [中国人民解放军空军预警学院], also produce publicly available research. Engineers at the research institutes mentioned above also regularly publish in top Chinese-language radar journals such as *Modern Radar* [现代雷达], *Radar Studies* [雷达学报], and *Radar Science and Technology* [雷达科学与技术].

While the sole private company that is known to have produced air defense radar products for the PLA, Xi'an Tianhe Defense, is consistently ranked as one of the PRC's top radar producers, it very much appears to be the exception in a market dominated by major state enterprises. Furthermore, its rise to prominence is relatively recent. The deployment of its "Smart Hunter" man-portable air defense system (MANPADS), for example, was heralded by contemporary observers as "the beginning of the shift of system production to companies outside of large industrial groups like CASC and CASIC…Before 2010, there were still very few members in the Chinese air defense system manufacturing club."[7]

Our analysis of the companies producing in-service radars for the PLA indicates a degree of consolidation in recent years, likely in search of greater efficiencies and possibly as a way to increase centralized control of research and production. For example, the China North Industries Group Pinance Co. [北方电子研究院有限公司] was established in 2010 as the result of a merger between multiple research institutes and holding companies within NORINCO that all focused on radar technologies (see pp. 139-142 below for more details).

China's domestic market for military radars has grown steadily, from an estimated 15 billion renminbi (RMB) ($2.1 billion USD) in 2013 to 42.5 billion RMB ($6 billion USD) in 2022.[8] Many of these air defense radar producers also export versions of their products abroad. Known recipients of Chinese air defense radar systems include Albania, Algeria, Bangladesh, Cambodia, Egypt, Indonesia, Iran, Laos, Malaysia, Mauritania, Morocco, Myanmar, Pakistan, Peru, Saudi Arabia, Serbia, Sri Lanka, Sudan, Thailand, Turkmenistan, Uzbekistan, Venezuela, and Zimbabwe. China has also recently removed some of its restrictions on exporting air defense radar equipment, so the PRC may be poised to export more such systems in coming years if foreign concerns about their accuracy and reliability can be addressed.[9]

Trends in Chinese Air Defense Radar Capabilities

Platforms in Service

As laid in in more detail in the "Air Defense Radar Systems in Service with the PLA" section below, which includes profiles of all known systems in service with the PLA that utilize air defense radars, the PLA operates a comprehensive suite of air defense radar capabilities. Mobile platforms offer detection and tracking at ranges up to 650km, and the PLA also operates several fixed-site over-the-horizon radars that can detect targets at ranges from 800-3,000km. Detection of low-altitude targets—previously a gap in many militaries' air defense networks—has reportedly been

addressed with the development of advanced systems like the YLC-18 "blind spot" mobile radar platform.[10]

Broadly speaking, the development trajectory of these capabilities has focused on increasing mobility, improved detection of stealth targets, and making detection and attack by anti-radiation munitions more difficult. Some of the older systems still in service, such as the CLC-3 and the JYL-1/1A (which entered service in 2008 and 2010, respectively) highlight the PLA's earlier shift to mobility and longer-range detection. More recently revealed advanced platforms such as the YLC-8B and JY-27A (both of which entered service in the mid-2010s) feature full mobility, detection ranges reaching 500km, the ability to network with each other and other radar platforms to form an integrated air defense radar detection network, and advanced stealth penetration capabilities. For example, some reports have claimed that the YLC-8B is "one of the few radars of its type in the world which can continuously detect and track a Western fifth-generation [stealth] aircraft at long range."[11] China's expanding suite of passive stealth-penetrating air defense radars—such as the relatively new synthetic impulse and aperture radar (SIAR) systems discussed below and the mobile SLR-66—aims to maintain all of these advantages while making it more difficult for opponents to target such systems.

OBSERVABLE BEHAVIOR

Satellite imagery and open sources also provide useful additional data on the development of China's air defense radar capabilities. Broadly speaking, the PLA's air defense radar capabilities are focused in three organizations: the PLA Army's (PLAA) air defense brigades, the PLA Air Force's (PLAAF) Radar Branch, and the PLA Navy's (PLAN) radar units. This section combines a brief overview of developments in these three organizations' capabilities with analysis of satellite imagery from 434 radar sites in China that were identified in open-source reporting. Using Maxar's unclassified imagery database, all of those sites were examined to track changes over time and, where possible, identify new or expanded capabilities.

PLA RADAR UNITS

PLAA Air Defense Brigades typically incorporate three sets of capabilities: surface-to-air missile (SAM) battalions equipped with systems like the medium-range HQ-16; short-range air defense (SHORAD) battalions combining truck-mounted short-range defense systems such as the HQ-17 and MANPADS systems such as the SmartHunter; and an electronic warfare (EW) battalion.[12] In general, PLAA air defense brigades have demonstrated major improvements in capability in recent years. For example, in addition to integrating EW capabilities into its air defense operations, at least one air defense brigade in the past few years was able to network the search, tracking, and targeting radars from all of its subordinate battalions. While the specific outcomes of this achievement have not been publicly reported, it should allow individual PLAA air defense brigades to more easily generate a common air picture for their subordinate battalions and update it in real time. It also likely lowers barriers to the PLAA sharing radar data with other services in a joint integrated air defense system (IADS).[13] State media, for instance, reported in 2021 that battalions under a certain PLAA air defense brigade "began to take turns entering the combat chain of a certain Air Force base in the Western Theater Command" with the goal of better

unifying information interfaces and developing joint operations standards.[14] (See pp. 17-19 below for more information on the PLA's progress in networking its air defense radar data.)

The PLA operates over 400 known radar sites, mostly under the command of the PLAAF Radar Branch [雷达兵]. Each Theater Command Air Force supervises subordinate radar brigades, which in turn have subordinate battalions, stations, and other elements. All radar brigades appear to be directly subordinate to one of at least 12 PLAAF bases, but some bases have directly subordinate radar stations that are not controlled by a radar brigade. (Each PLAAF base also directly controls SAM units in the PLAAF Ground-to-Air Missile Branch [地面防空兵], which often employ mobile radar platforms.) Radar units are divided into branches and specialty units; the former are responsible for long-range radar, including China's over-the-horizon radars, while the latter are responsible for short-range radar activities around airfields.[15] Broadly speaking, the PLAAF radar sites come in three types: air traffic control near airfields, strategically located medium- and long-range radars (often on mountaintops), and over-the-horizon radar used for early warning.[16] However, based on the platforms in service and under development that were analyzed in this report, China's indigenous radar development appears to be increasingly focusing on mobile platforms with long ranges that can be easily hidden, redeployed, or updated. State media in 2020 described China's early warning system as "relatively complete," relying mostly on third-generation equipment, but with an expanding proportion of the most advanced fourth-generation radars.[17]

Finally, the PLAN has also been steadily improving its radar units' capabilities. For instance, in 2020, state media reported that naval radar units from the Eastern Theater Command Navy had successfully practiced setting up "mobile radar networks" to increase survivability of their detection platform.[18] However, by mid-2023 most of the PLA Navy's air defense units – including that of the Easter Theater Command – had reportedly been transferred to PLAAF command. Still, the PLAN continues to operate at least some of its own radar sites, for instance on the PLA's South China Sea installations.[19] It also maintains advanced air defense radar systems on most of its surface fleet, as detailed below in the section on radars currently in service (pp. 25-96).

PLA Radar Installations

As noted above, this report examined satellite imagery of 434 PRC radar sites over time, starting from around 2019 until the most recent imagery available (image availability and frequency varied by location) in both Maxar and Google Earth imagery. This analysis resulted in three key findings. First, the PRC appears to be expanding its anti-stealth capabilities, with the installation of at least two new SIAR systems at preexisting radar sites visible in this imagery. Second, upgrades at existing sites—many of which appear likely to involve qualitative upgrades in detection capability—have been common. Third, a number of new sites have been established in the last five years, further expanding the PRC's already comprehensive air defense detection network.

While PRC developers have produced a range of stealth-penetrating radar systems, many of them mobile, other analysts have noted the PLA's repeated use of a new VHF meter-wave SIAR system (referred to in Chinese as "integrated pulse and aperture radars") that Chinese researchers assert is both undetectable by hostile forces because most radar detectors do not detect the wavelengths it uses and capable of detecting stealth aircraft and missiles. *Janes* reported in 2020

that this system was operational at a site near Shacheng Harbor [沙埕港] in Fujian Province, and that another was likely being tested and assembled near Li'anzhen [黎安镇] in Hainan Province. Another appeared to be operational on Subi Reef in the South China Sea as of 2020.[20] This report identified two others at which construction appeared to be complete in satellite imagery as of mid-2024: one on Dongfu Mountain [东福山], outside of Ningbo in Zhejiang Province; and one on Junshan Peak [君山顶], near Fuzhou (and directly across the Taiwan Strait from Taipei) in Fujian Province. Coordinates for these five likely SIAR radar systems are as follows:

- Dongfu Mountain: 30°08'03.9"N 122°45'59.1"E
- Junshan Peak: 25°35'31.5"N 119°49'03.9"E
- Li'anzhen: 18°25'52.6"N 110°04'02.3"E
- Shacheng Harbor: 27°10'39.3"N 120°25'21.6"E
- Subi Reef: 10°54'28.2"N 114°04'50.5"E

According to Google Earth's historical imagery, the Dongfu Mountain system began construction sometime around the beginning of 2019. It appeared complete by early 2022. No other updates have been visible at the site since in either Google Earth or Maxar imagery. It is not clear which PLA unit operates this site.

Figure 1: Likely SIAR site at Dongfu Mountain

Also according to Google Earth, the Junshan Peak site began construction sometime between February and April 2021. It appeared complete as of June 26, 2022. Prior to the transfer of most of the PLAN's radar assets to the PLAAF in 2023, this site was likely operated by the 61st Subunit of the PLAN's 1st Brigade (MUCD 92985), but its current designation is unknown.[21]

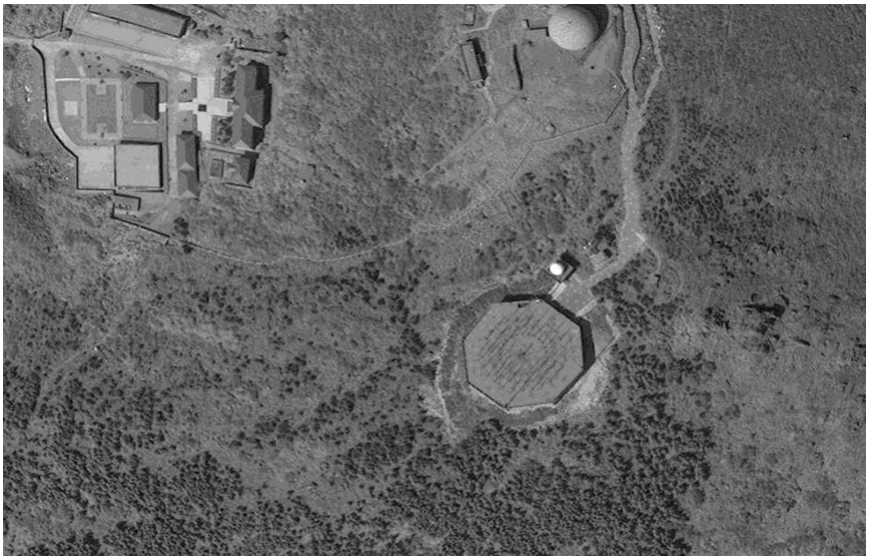

Figure 2: Likely SIAR site at Junshan Peak

These SIAR systems likely have a detection range of around 300km. On that basis, as the map below shows, they offer good coverage of Taiwan and the Taiwan Strait, as well as additional visibility in the South China Sea. *Janes* notes that meter-wave radars like these cannot be used effectively to direct air defense weapons and that, given the PRC operates a number of other stealth-penetrating platforms with similar or even longer ranges, the main advantage these SIARs would offer is allowing an incoming target to be tracked without detection until it got very close. At that point, a SAM system could handle final tracking and fire control. This would also explain why all known SIAR sites are located near other radars at larger air-defense sites.[22]

Figure 3 (produced using Google Earth Engine)

A number of less dramatic changes were evident in our analysis of satellite imagery, as well. Over the last five years, 40 percent of the sites examined – 173 sites – showed visible evidence of maintenance work and/or upgrades. Of those sites, 75 percent (30 percent of the total—130 sites) showed either additional radomes, dismantled and later replaced radomes (possibly indicating a replacement of the system inside), or likely additional capacity to host mobile radar systems and/or SAMs, such as new platforms or additional covered storage. The remainder were smaller changes with unclear implications, such as additional small support buildings, new roads, new recreational facilities, or new camouflage markings.

While space constraints preclude a comprehensive overview of all the changes observed, two examples are illustrative of these substantive air defense radar site upgrades. Some are relatively minor, such as the change observed at a site in Sanya [三亚市], Hainan Province.[i] In November 2019, three small camouflaged domes were visible at the site. In February of 2021, possible construction markings in yellow and black were visible throughout the site, and by February 2022, construction on an additional platform had begun at the southeast corner of the site. A likely radar system under a fourth camouflaged dome appeared to be complete by April 2024 (the imagery below in Figure 4 is from February 2022 [left] and May 14, 2024 [right]; the latter was chosen

[i] Coordinates: 18°10'15.8"N 109°34'09.7"E.

because it had the best visibility). No data was available about which unit operates this location, though it is likely to be a PLAAF Radar Branch site.

Figure 4: Upgrades at a Sanya radar site

Another, more dramatic site upgrade was visible just to the east of Fuzhou [福州市], Fujian Province, on a mountaintop in the Fuzhou Gushan Scenic Area [福州鼓山风景区] (coordinates: 26°03'55.7"N 119°23'52.9"E). For several years prior to 2020, the complex hosted five radomes of varying sizes. Starting in June 2020 and clearly visible by January 2021, extensive construction began. By July 9, 2022, seven radomes were visible (see Figure 5), and in undated imagery from Baidu Maps accessed on September 19, 2024, an eighth had been completed in the center of the site. It is likely operated by the 73rd Subunit of the PLAAF's 4th Radar Brigade (MUCD 94620).[23]

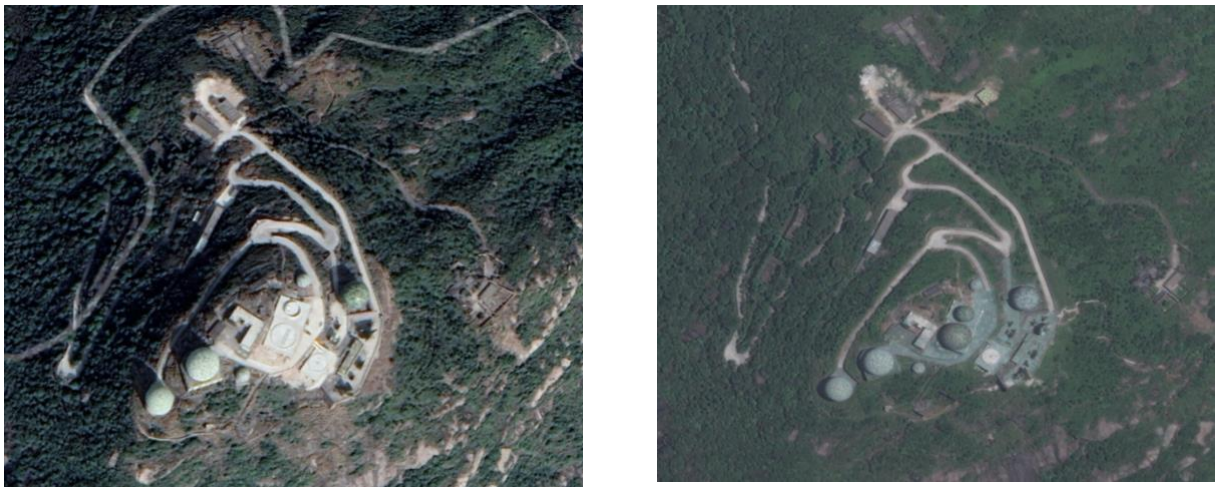

Figure 5: Upgrades at a Fuzhou radar site

EMERGING AIR DEFENSE RADAR CAPABILITIES

In addition to the range of platforms already in service with the PLA, PRC-based companies and researchers are in the process of developing an extensive range of other air defense radar systems and technologies. Some of these are known to be deployed with the PLA already, while others remain many years away from practical application. While time constraints and data limitations—in addition to the sheer size of the radar market in China—prevent a complete cataloguing of these systems, this section introduces some examples in an attempt to give readers a broad view of the PRC's air defense radar industrial base.

NEW PLATFORMS

Broadly speaking, the newest air defense radars that PRC manufacturers have exhibited fall into three categories. First, radar capabilities are being placed on new platforms, such as unmanned aerial vehicles and balloons, rather than the traditional fixed or vehicle-mounted styles. Second, radar technologies already in use are being used to target newly urgent threats such as drone attacks and low-flying missiles with small radar cross sections. Third, existing technology is being refined in order to enhance the platforms' capabilities to, for instance, detect stealth targets such as the F-22.

One prominent example of a widely reported new radar platform is the JY-400 tethered balloon reconnaissance and surveillance platform, developed by CETC's 38th Research Institute (the East China Research Institute of Electronic Engineering [华东电子工程研究所]) and publicly exhibited at the Zhuhai Air Show in 2021.[24] While relatively few details about the JY-400's capabilities are available, CETC describes it as capable of improving early warning and detection capabilities against low-altitude flying targets, in addition to serving as a ground observation platform and a communications relay. While it has not been publicly reported as in service with the PLA, similar platforms have been spotted above Mischief Reef in the South China Sea in November 2019.[25] Analysis of satellite imagery for this report also revealed another similar balloon platform tethered above an air defense radar site near Beijing, just outside of Ganying Village [甘营村], which is likely home to the 58th Subunit of the PLAAF's Second Radar Brigade [93534 部队 58 分队].[26] The aerostat platform has been tethered there on and off since at least 2020 (see Figure 6 below).[ii]

[ii] Coordinates: 40°09'07.1"N 117°12'48.2"E.

Figure 6: Possible JY-400

Another new PLA radar platform may be the "Shendiao" [神雕] drone – sometimes translated in English-language reports as "Divine Eagle" – developed by the Aviation Industry Corporation of China (AVIC) [中国航空工业集团公司] 601st Research Institute (also known as the Shenyang Aircraft Design Institute [沈阳飞机设计研究所]).[27] It is unclear who manufactured its radar systems, but it is described in Chinese-language reports as an early-warning unmanned aerial vehicle (UAV) developed to help detect stealth targets.[28] It is believed to carry five phased array radars for detection of airborne targets and possibly for provision of fire control data through the larger IADS.[29]

PRC developers have also displayed anti-drone systems such as the "Spiderweb" [蜘蛛网] YLC-48 "UAV terminator" [无人机终结者], manufactured by the CETC's 14th Research Institute (Nanjing Research Institute of Electronics Technology [南京电子技术研究所]), which is now part of the CETC's Glarun Group Co. [中电国睿集团有限公司]. It is a portable phased-array radar—reportedly China's first—with 360-degree coverage and the capability to track multiple targets. CETC markets it for both civilian and military customers.[30] It is not clear whether this radar system is widely used in the PLA, but state media reported that it was part of a rocket early warning system that PLA peacekeepers used in Mali in 2017.[31]

Advanced mobile stealth-penetrating radars also appear to have been a focus of China's air defense radar development efforts in recent years. The YLC-2E, for instance, is an upgraded version of the in-service YLC-2 that reportedly incorporates advanced artificial intelligence technology.[32] In the same series (and also developed by the CETC 14th Research Institute), the YLC-16 is another stealth-penetrating radar platform. While it may be an export-focused system, CETC describes it as a cutting-edge, dual-use system that is "the best three-dimensional, middle-range surveillance radar any buyer can now find on the market."[33] Notably, CETC advertises that it can be operated remotely, without human operators on-site, making it suitable for challenging terrain and remote locations.[34]

Finally, there are reports that a new AEW&C platform is in development. While its official designation is not clear, many observers refer to it as the KJ-3000 [空警-3000]. Unlike China's other AEW&C aircraft, this upcoming version's airframe is reported to be based on a domestically produced version of the Y-20. While some reports claim its radar will be integrated into the aircraft's skin, others claim it will maintain the KJ-2000's configuration, with a large

rotodome/radome mounted on the top of the fuselage. It may be the case that a design has not been finalized for this platform yet, but it is worth noting that there has been no firm confirmation such a platform exists at all. It is also not clear how soon the new plane, if it exists, might enter into production – rumors that it is about to be deployed have been persistent since at least 2014.[35]

UPCOMING TECHNOLOGIES

The PRC is also actively developing new radar capabilities on a variety of fronts. Broadly speaking, these research frontiers fall into two categories. The first involves supporting technologies that can both enhance in-use systems and contribute to more advanced systems. Radar networking and artificial intelligence (AI) are the two key approaches to achieving these goals. The second involves developing radar systems using new radio wavelengths or new underlying technologies. Terahertz radar, for instance, uses frequencies that have not been thoroughly explored technologically, while passive radars use signals emitted by other sources rather than generating their own and detecting reflections.[36]

In 2019, Li Gang [李刚], of the Information System Bureau of the PLAN's Equipment Department [海军装备部信息系统局], published a short article in the journal *Electronic Technology and Software Engineering* [电子技术与软件工程] titled, "New Radar Systems and Their Key Technologies."[37] His article is useful not only as a window into how one corner of the PLAN viewed China's radar capabilities, but also because he distinguishes between radar technologies that are relatively well understood (but may not yet be ready for real-world applications) and radar technologies that are still in a basic research stage, such as quantum radar, cognitive radar, and ultra-wideband radars. The remainder of this section first discusses networking and AI, then goes on to offer brief introductions of research into the technologies Li Gang identified as relatively well understood and likely to mature in the near term.

NETWORKED RADAR

Networking multiple radar systems is a central focus of research for air defense radars. As researchers at CETC and the University of Electronic Science and Technology of China [电子科技大学] noted in 2023 in the PRC's *Journal of Radars* [雷达学报], networking radars—ideally of varied frequencies, ranges, detection heights, and anti-interference capabilities—is "an effective technical approach to cope with new environments and new targets, and to significantly improve radar performance."[38] A number of China's air defense radar systems have been explicitly described as networkable (as noted in the section describing in-service systems below), and many more are likely able to be incorporated into air defense radar networks to some degree. It remains unclear, however, how comprehensive China's air defense radar network is and how it works.

As early as 2007, a senior PLAAF officer claimed that a "seamless network of all-weather air defense radars had been installed to cover all Chinese airspace."[39] Other Chinese reports from defense exhibitions echoed this claim, but they also lacked specifics.[40] This may have been true in a narrow sense, but it left a number of important questions open. Was this a network in the sense that their radars could collaborate and generate a unified picture of China's airspace? Which systems, specifically, were part of this "network"? Who had access to the information from this

network, at what levels? What capabilities did the radars included in this network offer? While information released since has offered additional clarity, many uncertainties about the PRC's ability to network its air defense radars remain.

That said, enough information has been released to confirm several aspects of the PLA's ability to network its air defense radars. It is clear that at least some PLA brigades have been able to construct a shared air defense radar intelligence network of some sort since at least 2013. Early that year, the *PLA Daily* reported on a radar brigade that was able to construct a "three-dimensional joint air defense network" made up of both ground-based and airborne platforms that "directly introduced the target information from the radar intelligence networking system into the target channel of the firepower unit, realizing a seamless link from 'sensor' to 'shooter.'"[41]

While some air defense radar systems could evidently be networked, ensuing reports indicate there was still work to be done in expanding the types of sensor systems that could contribute to a shared air defense intelligence picture. In 2016, state media reported that a team of researchers under Professor Xia Zhongwu [夏忠武] at the Shenyang Artillery Academy [沈阳炮兵学院] (now the Army Artillery and Air Defense Academy's NCO School [炮兵防空兵学院士官学校]) won an award for their project on networking artillery radars. That was reportedly the first such networking of artillery radar systems that had been achieved in the PLA.[42] Around the same time, researchers at the Dalian Naval Academy [海军大连舰艇学院] were focused on refining methods for networking maritime air defense radars, and CETC's 14th Research Institute was advertising a "networking center" [组网中心] that could connect air defense radars of multiple types, in multiple service branches, at the regional level.[43] China's AWACS platfoms, such as the KJ-2000, were also reported in 2015 to be able to exchange radar intelligence and other data in real time with command posts on the ground.[44]

Recent reports from experts at Xidian University [西安电子科技大学], the University of Electronic Science and Technology of China, and CETC's Information Science Academy [中国电子科技集团公司信息科学研究院] have explained that the PRC's current radar networking technology involves fusing information from radar systems that operate relatively independently, in a hub-and-spoke manner, whereby data fusion is conducted centrally. Resource coordination among systems is therefore relatively limited, and data fusion operates in a relatively centralized manner.[45] Research is ongoing on ways to more effectively distribute air defense radar data processing, improve resource scheduling, better integrate fire control and detection, and expand bandwidth for rapid data transfers.

In 2018, the director of CETC's 14th Research Institute noted that networks would be a key frontier of research into next-generation air defense radar systems.[46] Beihang University [北京航空航天大学], CETC, the National University of Defense Technology [国防科技大学], the Naval Aviation University of Engineering [海军航空工程大学], Tsinghua University [清华大学], and Xidian University are reportedly the PRC's leaders in radar networking research.[47] Research on radar networking currently focuses on improving network architectures, methods for information processing, capabilities to detect diverse target types, resource scheduling, and integration with new command and control concepts.[48]

There also appears to be some interest in expanding the scope of sensors included in such networks from dedicated air defense platforms to the rapidly developing suite of sensors involved in the PRC's "smart city" [智慧城市] initiatives. Very little information is available about how this would work, but civil air defense offices are reportedly interested in gathering data from such sensors to improve their operations. At least one such office, in Shandong, has also been explicit about its interest in "effectively interfacing with the military's integrated command platform."[49] Furthermore, a patent filed by an individual who appeared to be affiliated with the PLA Strategic Support Force's[iii] Information Engineering University [中国人民解放军战略支援部队信息工程大学] also notes that an integrated urban disaster management information platform for smart cities would have applications in air defense.[50]

INTELLIGENT RADAR

Similar to networking, AI in the context of air defense radars is best seen as a technology that enables a range of different improvements to radar systems. These are often collectively referred to as "intelligent radar" in Chinese [智能雷达]. One such intelligent radar type is cognitive radar [认知雷达], which uses intelligent algorithms to adjust transmission waveforms and receiving processing methods in response to changes in the environment that is being observed. Artificial intelligence tools such as deep learning are being applied in cognitive radar designs in an attempt to replace traditional algorithms for detection, tracking, and identification of targets, in addition to supporting the intelligent allocation of system resources.[51] The PLAAF is reportedly working on classified cognitive radar projects as of 2019, but available public reports indicate the technology is not yet ready for widespread application.[52]

Research on applications of AI to air defense radar systems in China's top radar journals focuses broadly on three topics. The bulk of research on AI applications in radar is focused on modeling and simulation of new algorithms for combating interference, improving image processing, or speeding up performance.[53] Some studies have also begun to explore the use of AI assistance in command and operational decision making, and others explore possible applications of AI in next-generation air defense radar networking techniques.[54] According to experts at CETC's 38th Research Institute, most of the theoretical research on intelligent radar is conducted at the Air Force Engineering University [中国人民解放军空军工程大学], the Beijing Institute of Technology [北京理工大学], the National University of Defense Technology, and Xidian University.[55]

The PRC is also working to incorporate AI into systems that support its air defense radar network. Early in 2024, for example, the Chinese Command and Control Society [中国指挥与控制学会] noted that China's "Integrated Air and Missile Defense" (IAMD) project aims to leverage AI to develop the capacity to integrate data from a variety of sensor types, presumably including

[iii] As of 2024, the Strategic Support Force no longer exists. This university may now be under the new Cyberspace Force. See Tian Qiang [田强] et al, "Interpretation of the 2024 Military Academy Enrollment Policy" [2024年军队院校招生政策解读], *PLA Daily* [解放军报], 17 June 2024, http://www.81.cn/szb_223187/szbxq/index.html?paperName=jfjb&paperDate=2024-06-17&paperNumber=05&articleid=933372.

air defense radars.[56] The 35th Research Institute of CASIC's Third Academy is also reportedly working on smart sensors that combine radar data from multiple missiles, and CETC has had its own "New Generation Artificial Intelligence Plan" since 2018.[57]

BISTATIC RADAR

Bistatic radar refers to a radar that uses two base stations for detection. Using two stations, similar to networking multiple radar systems as discussed below, enhances stealth penetration capabilities, reduces vulnerability to anti-radiation weapons, and can improve resolution in tracking radars.[58] Passive radars are typically bistatic, but bistatic systems can also include one active transmitter and one passive receiver. China has some such systems in use, including the YLC-29 passive system (see p. 43) and its over-the-horizon systems. Research on bistatic radar continues, however. For example, in 2022 researchers at the Maritime Target Detection Research Group of the PLA's Naval Aviation University [中国人民解放军海军航空大学] reported a successful test of a "hitchhiking" bistatic radar system that uses enemy ("non-cooperative") radar to detect targets; follow-on research is exploring the use of deep learning approaches to improve this system.[59]

PRC scientists appear to be developing a number of other bistatic systems, as well. In 2016, researchers at the Beijing Institute of Technology [北京理工大学] reported experimental verification of a bistatic forward scatter radar system, a poorly understood method which uses diffraction of signals by a target, rather than scattering of signals from the target, for detection.[60] In 2023, researchers at Xidian University's National Laboratory of Radar Signal Processing [雷达信号处理国家重点实验室], the China Academy of Electronics and Information Technology [电子科学研究院], and the AVIC Leihua Electronic Technology Institute [雷华电子技术研究所] verified the theoretical basis for a new integrated detection and tracking algorithm for bistatic radars.[61] Others at the National University of Defense Technology are working on airborne bistatic radars, and researchers at the Guilin University of Electronic Technology [桂林电子科技大学] are exploring the use of bistatic radars to detect UAVs.[62]

INVERSE SYNTHETIC APERTURE RADAR

Inverse synthetic aperture radar (ISAR) uses the movement of a target, rather than the movement of the searcher as in conventional synthetic aperture radar, to generate a high-resolution 2D image of a target. Although this radar technology is reportedly widely used in both civilian and military applications in the PRC, the only air defense radar system in the PRC known to use this technology is the SIAR stealth-penetrating system discussed on pages 10-14, although some of China's over-the-horizon systems may also use ISAR techniques.[63] Research on the use of this technology is, however, ongoing. National University of Defense Technology researchers, for instance, are working on developing interferometric ISAR, wideband ISAR, and multiple-input/multiple-output ISAR, while others there and at the CETC 20th Research Institute are attempting to apply quantum algorithms to speed up processing times for ISAR (slow processing is characteristic of this technological approach) and to improve imaging algorithms.[64]

OVER-THE-HORIZON RADAR

China has at least two fixed-site over-the-horizon (OTH) radars in operation, one using sky-wave technology and the other using surface-wave technology (see p. 44 and p. 46). It also operates at least two mobile over-the-horizon systems, the land-based SLR-66 and the naval Type 366 (see p. 86). The PLA has also likely deployed multiple microwave over-the-horizon radars on its outposts in the South China Sea.[65] Most of the continuing research on these systems is focused on clutter suppression and improving target detection, with Northwestern Polytechnical University, the University of Electronic Science and Technology of China, the Chinese Academy of Sciences (CAS) Institute of Electronics, and Xidian University as civilian leaders. On the military research side, the Air Force Early Warning University and the Naval University of Engineering are prominent producers of research on OTH radars. Recent scientific publications on the topic have focused on, for instance, improving methods for task planning, improving detection ranges, and developing filters for noise reduction.[66]

MICROWAVE PHOTON RADAR

Microwave photon radar is a detection technique that uses microwave photons rather than radio photons. Like many of the other frontier radar detection technologies discussed in this section, microwave photon radar excited analysts because of its potential for all-weather use, stealth penetration, and robustness against interference. Microwave photon radars can also be substantially smaller than traditional radar platforms, potentially allowing them to be embedded in the skin of aircraft or other platforms.[67] In the PRC, researchers at Tsinghua, the CAS Institute of Electronics, the Nanjing University of Aeronautics and Astronautics, and the Air Force Early Warning Academy all conducted laboratory experiments verifying the feasibility of microwave photon radar starting around 2017.[68] No microwave photon radars are known to be deployed in the PRC. Though some reports indicate working prototypes may have been developed, their widespread use appears to be a long-term prospect, given that microwave photon radar science requires integrating several fields of study that have so far remained relatively separate.[69]

PASSIVE RADAR

China's military has a number of passive radar systems already in service, such as the DWL002 and the older JY-50 (see pp. 39-40). In addition, the CETC 14th Research Institute recently displayed the 124E passive air defense radar system, and scientists from Wuhan University were reportedly able to detect a small drone using the echoes of Starlink satellite signals using an experimental passive radar array in the South China Sea.[70] Passive radars are advantageous to the PLA both because they can often detect stealth aircraft and also because they are difficult for anti-radiation munitions to find and target since they do not actively emit signals. They have also been a national research priority for the PRC, having been funded through a number of National Key Projects. Wuhan University's Radio Wave Propagation Laboratory [武汉大学电波传播实验室], for instance, has developed a multi-band, multi-array "multi-illuminator-based passive radar" (MIPAR) whose capabilities have been verified experimentally.[71]

However, the applications of passive radar remain relatively limited due to its dependence on unpredictable external signals, the limited range of frequencies it can reliably use, and the fact that

processing algorithms for it remain relatively unintelligent.[72] Chinese researchers in the field—many of them at the NUDT and Wuhan University[73]—have noted that much work remains to be done on, for instance: (1) environmental adaptability in the face of unpredictability in both external signal sources and countermeasures; (2) expanding the kinds of external signals that can be usefully relied upon for passive detection; and particularly (3) developing methods for coordination between active and passive radar systems, as well as among multiple passive systems.[74]

TERAHERTZ RADAR

Official PLA media has described terahertz (THz) frequency-based technologies as "unique and very attractive," and notes that THz radar has advantages in its exceptional spatial and temporal resolution and its ability to penetrate non-metallic materials.[75] While there are no known THz radars in use by the PLA as of the time of writing, development is ongoing. As early as 2011, the Chinese Academy of Engineering Physics [中国工程物理研究院] conducted a THz radar imaging test, and in 2012, NORINCO's 209th Research Institute reportedly used a THz device to detect a stealth target. By 2018, state media reported that CASIC's 23rd Research Institute had developed China's first THz synthetic aperture radar.[76] In 2019, state media reported that CETC had successfully developed a prototype THz radar and that a "second-generation prototype" was already in development.[77] NORINCO and the Chinese Academy of Engineering Physics reported around the same time that they had developed ground-based THz air defense radar prototypes that could detect targets with small radar cross sections such as the F-35.[78] Like many other emerging radar technologies in the PRC, researchers at NUDT appear to be at top of this field. They noted in 2018 that, while progress in THz radar had been rapid over the previous decade, "there are still many basic scientific and engineering problems to be overcome" before it can be put to widespread use.[79]

IMPLICATIONS FOR THE UNITED STATES

The PRC's air defense radar capabilities and industrial base have developed rapidly in recent years, and PRC-based commentators regularly argue not only that China's best air defense radars are as good or better than the American systems currently in service, they can also easily detect American stealth aircraft. As the U.S. Department of Defense noted in its 2023 report on Chinese military power, the PRC "has a robust and redundant IADS architecture…that relies on an extensive early warning radar network, fighter aircraft, and a variety of SAM systems."[80] The PRC has been able to produce advanced, mobile, fourth-generation radar systems that manufacturers claim can penetrate U.S. stealth technology since at least 2014 when it exhibited the JY-26 radar. While those most advanced radars reportedly do not make up the bulk of China's air defense radars yet, they are likely being deployed at strategic points along China's coast, and the PLA has ambitions to both expand usage of fourth-generation air defense radars and develop new, potentially revolutionary radar technologies.

Based on the number of systems identified in this report as in service with the PLA or in development, the PLA and the DoD likely have roughly the same number of radar systems in development, production, or sustainment.[81] Lacking additional detail on how many of each system are deployed, it is difficult to assess the balance in their air defense radar capabilities in any detail, but their suites of capabilities are likely broadly similar. While the PLA still operates several obsolete air defense radar systems, its combination of a comprehensive network of air defense detection sites, ongoing upgrades to radar capabilities, and the expanded use of new technologies like difficult-to-detect SIAR platforms would make penetrating its airspace a serious challenge, even for the United States. Advanced American stealth platforms and long-range missiles would ameliorate this challenge somewhat, but given the limited numbers of such platforms and munitions available, they would likely be insufficient to overcome China's distributed radar detection capabilities.[82]

In terms of the industrial base for developing and producing air defense radars, China's industrial base may have an edge in both size and diversity. According to a 2018 DoD report, 23 firms produce or have produced radars for the U.S. military, but the domestic market for military radar is dominated by only three firms.[83] In China, in contrast, this report identified 22 firms responsible for the air defense radars currently known to be in service with the PLA. If the examination had been expanded to include other types of military radar, the number would likely have been larger. Less intense competition resulting from a smaller domestic industrial base may hinder innovation and deployment of new radar platforms in the U.S. relative to China.

China may also be catching up in research into new and more advanced air defense radar technologies. While the reports that occasionally surface about China's breakthroughs in, for instance, stealth-penetrating radar and quantum radar are often overblown or entirely erroneous, China is producing a substantial amount of research on cutting-edge radar technologies. In the BlueScout database of global research publications, for example, the U.S. and China have published similar numbers of papers on quantum radar (U.S.: 67, PRC: 61) and cognitive radar (U.S.: 250, PRC: 212). China, however, has published substantially more on intelligent radar (U.S.:

16, PRC: 56), passive radar (U.S.: 333, PRC: 678), terahertz radar (U.S.: 12, PRC: 109) and microwave photonic radar (U.S.: 3, China: 56).[84]

The above numbers do not speak to the relative quality of the research done in the U.S. and the PRC, but they do indicate there may be more interest and attention being devoted to emerging air defense radar technologies by researchers in the PRC. While a comprehensive evaluation of the American air defense radar industrial base was beyond the scope of this study, policymakers and analysts in the U.S. continue to raise concerns about its robustness and its capacity to meet American national security needs. A report of the U.S. House Armed Services Committee on the FY 2024 National Defense Authorization Act, for instance, noted that the Committee "believes it is imperative for the Department [of Defense] to improve the reliability and resilience of the radar industrial base…The committee is concerned about potential lack of competition among sustainment providers and the risk this presents to the capability and speed of sustainment work."[85] DoD has also recently directed funds to semiconductor manufacturers making upstream components of radar systems.[86]

However, air defense radars do not appear to be among the highest priorities for the U.S. DoD. In 2022, for example, DoD's Office of the Undersecretary of Defense for Acquisition and Sustainment identified five priority industrial base sectors for the U.S., none of which included radars.[87] Given evident Chinese interest in such radar technologies, in the medium and longer term, that kind of sustained interest and funding may give the PRC an edge in developing new, more advanced air defense radars.

The PRC's air defense radar producers also have a strong interest in selling their systems abroad. While they do not so far appear to be popular beyond countries that have poor relations with the U.S. and its allies, Chinese air defense radar platforms have shipped to at least 23 countries. As the PRC's platforms become more reliable, more capable, and less expensive, their proliferation may hinder U.S. freedom of action in areas of the world where such platforms are put into service. In particular, if the PRC's air defense radar manufacturers' claims about their systems' stealth-penetrating capabilities prove to be true, many areas in which U.S. stealth platforms are accustomed to operating freely may prove more challenging in the future.

AIR DEFENSE RADAR SYSTEMS IN SERVICE WITH THE PLA

STANDALONE ACTIVE RADAR PLATFORMS

CLC-3 Target Indication Radar

Overview: This vehicle-mounted, high-mobility target indication radar [目标指示雷达] can reportedly be paired with multiple weapon systems.[88] A solid-state L-band radar that can track up to 10 targets at once,[89] it combines advanced phased array and pulse doppler technologies to detect low-altitude targets, and was reportedly designed to fill low-altitude gaps in larger air defense detection networks. While it is an older system, it reportedly remained in active service as of at least 2017.[90]

Figure 7: Mockup of a CLC-3 Radar

Entered into service: ~2008.
Manufacturer: Nanjing Research Institute of Electronics Technology / NRIET (now part of the CETC Glarun Group Co.,)
PLA Services: Likely the PLAA
Range: 25-100m depending on target height
Networkable: Yes
Mobile: Yes
Aliases: Possibly AS901
Exported to: Unknown

JYL-1/1A Air Surveillance Radar

Overview: The JYL-1 and JYL-1A are both mobile, long-range 3D S-band active electronically scanned array (AESA) surveillance radars.[91] As of 2014, the JYL-1A was reportedly "employed in large numbers in China" and described as being a "best-selling product on the international market.".[92] It uses solid-state, digital active phased array technology, and can track a large number of aerial targets in real time.[93] It has both military and civilian applications for air traffic control and airspace management tasks.[94] In 2009, an expert report described it as "typical of those assets that might be found in a modern air defense network."[95]

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Figure 8: JYL-1 Radar

Entered into service: 2010[96]
Manufacturer: East China Research Institute of Electronic Engineering (ECRIEE), also known as the CETC 38th Research Institute[97]
PLA Services: Unknown
Range: 320km[98]
Networkable: Unknown
Mobile: Yes
Aliases: N/A
Exported to: Venezuela[99]

JY-9 Search Radar

Overview: The JY-9 is a mobile, S-band low-altitude search radar that was developed beginning in the late 1980s, and first exhibited as a concept at the Cairo International Defense Exhibition in late 1987. It was exported to Egypt a few years later, after which Cairo reportedly used it in a joint military exercise with the United States.[100] There is no direct evidence available as to whether it remains in service with the PLA or not, though its inclusion in U.S. Army equipment databases indicates it may be.[101]

Figure 9: JY-9 Radar

Entered into service: Late 1980s/early 1990s[102]
Manufacturer: East China Research Institute of Electronic Engineering (ECRIEE), also know as the CETC 38th Research Institute[103]
PLA Services: Unknown
Range: 150km[104]
Networkable: Unknown
Mobile: No (transportable only)
Aliases: "Wall Eye"
Exported to: Egypt, Thailand, Zimbabwe[105]

JY-11B Surveillance Radar[106]

Overview: The JY-11 series of 3D surveillance radars includes both the initial JY-11 (first unveiled in 1998) and the substantially updated JY-11B radars (which likely remain in service). The JY-11 was transportable and dismountable, while the JY-11B is self-propelled and not dismountable. The JY-11 was an F-band radar designed to fill low- and medium-altitude gaps in air surveillance coverage. The JY-11B has a similar mission and likely operates in the E/F band.[107] It was displayed at the 2016 Zhuhai Air show, and is reportedly popular on the international market.[108]

Figure 10: JY-11B Radar

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Entered into service: Prior to 2016[109]
Manufacturer: CETC 14th Research Institute (now part of CETC Glarun Group Co.)[110]
PLA Services: PLAA,[111] PLAAF[112]
Range: 210-300km[113]
Networkable: Unknown
Mobile: Yes
Aliases: N/A
Exported to: Venezuela[114].

JY-26 Surveillance Radar

Overview: The JY-26 long-range surveillance radar is a mobile, 3D UHF-band radar that is reportedly stealth-penetrating and capable of tracking 500 targets.[115] First unveiled at the 2014 Zhuhai air show,[116] it was also reported widely after its appearance at the 2021 Zhuhai air show as part of a new tranche of China's advanced, stealth-penetrating radar capabilities.[117] Some prominent reports erroneously claimed it was China's military's first active phased array radar.[118] Its manufacturer, the 38th Research Institute of CETC, claims it was "developed in response to the needs of the international market" and that it was, as of 2016, a "backbone" of China's long-range early warning air defense network.[119] According to PRC state media, it has been deployed to Shandong Province.[120]

Figure 11: JY-26 Radar

Entered into service: Prior to 2016

Manufacturer: East China Research Institute of Electronic Engineering, also known as the CETC 38th Research Institute (possibly in cooperation with the CETC 14th Research Institute, now part of the CETC Glarun Group)[121]

PLA Branches: Unknown

Range: 500km+ (unverified)[122]

Networkable: Yes

Mobile: Yes

Aliases: "SkyWatch-U" [空中守望者-U][123]

Exported to: Unknown

JY-27A Surveillance Radar

Overview: Another of China's most advanced fourth-generation radars, the JY-27A is a long-range AESA meter-wave radar that was first revealed at the 2017 Paris Air Show.[124] In 2016, China's National Defense Science, Technology, and Industry Bureau [国防科技工业局] listed it as one of the "top ten star weapons of the defense science and technology industry" in the PRC.[125] It is reportedly relatively inexpensive, and as of 2019 at least seven of them had been deployed by the PLA.[126] State media reported that it had been put into mass production as of 2017.[127]

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Figure 12: JY-27A

Entered into Service: ~2013[128]

Manufacturer: East China Research Institute of Electronic Engineering, also known as the China CETC 38th Research Institute[129] (possibly in cooperation with the CETC 14th Research Institute, now part of the CETC Glarun Group)[130]

PLA Branches: Unknown

Range: 650km (unverified)[131]

Networkable: Yes

Mobile: Yes

Aliases: "SkyWatch-V" [空中守望者-V][132]

Exported to: Possibly Venezuela and Pakistan[133]

LLQ-305 Acquisition Radar

Overview: The LLQ-305 (which comes in A and B subtypes, the latter of which is shown below) is a mobile, digital phased array radar that has entered widespread usage in the PLA in conjunction with multiple platforms since it was introduced into service in 1997.[134] It was displayed prominently at, for instance, the 2015 PRC military parade, at which time Chinese-language reporting described it as having a fast response time, high reliability, strong anti-interference capabilities, and a detection range in the hundreds of kilometers.[135] Some Chinese-language reports indicate that it can support up to four HT-233 engagement radars (see pp. 78-79), which are used with a number of PRC SAM systems.[136] Unverified reports claim that this radar has been a mainstay of the PLAAF's mechanization.[137]

Figure 13: LLQ-305B Radar

Entered into service: 1997[138]

Manufacturer: East China Research Institute of Electronic Engineering, also known as the CETC 38th Research Institute, likely in cooperation with the CETC 14th Research Institute, now part of the CETC Glarun Group[139]

PLA Services: PLAAF, possibly others

Range: ~350km (for the LLQ-305A variant)[140]

Networkable: Yes

Mobile: Yes

Aliases: Type 305[141]

Exported to: Unknown

SLC-7 Surveillance Radar

Overview: The SLC-7 radar is a low-frequency 3D AESA radar that Chinese-language sources routinely describe as the "all-around champion" [全能雷达冠军]. It can reportedly detect stealth targets and may be part of a multi-radar network on the Paracel Islands that also includes the JY-27A and the YLC-8B.[142] According to the State Administration of Science, Technology, and Industry for National Defense (SASTIND), it operates in the L-band and has two "iconic characteristics:" an exceptional anti-interference capability and the ability to operate autonomously.[143]

Figure 14: SLC-7 Radar

Entered into Service: ~2013[144]
Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[145]
PLA Services: Unknown
Range: 450km[146]
Networkable: Yes
Mobile: Yes
Aliases: N/A
Exported to: Unknown

YLC-2 Surveillance Radar

Overview: The YLC-2 3D long-range active phased array radar operates in the L band. While reportedly targeted at surveillance tasks, it can also serve as an acquisition radar.[147] It has evolved through multiple variants: first the YLC-2, then an upgraded YLC-2A, then a self-propelled version of the YLC-2A that was designated the YLC-2V (pictured below).[148] As of 2017, the YLC-2V was thought to be the primary radar used by the PLAAF and PLAN for combat guidance and early warning, and was also thought to be suitable for supporting some components of the PLA Rocket Force (PLARF), as well.[149] An additional upgraded version that is reported to draw on artificial intelligence technologies, designated the YLC-2E, was first revealed at the 2023 World Radar Expo.[150]

Figure 15: YLC-2 Radar

Entered into service: Prior to 2008 (YLC-2)[151]

Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[152]

PLA Services: PLAAF, PLAN, possibly PLARF

Range: 200-330km[153]

Networkable: Yes

Mobile: Yes (either transportable or self-propelled, depending on variant)

Aliases: LLQ303, Type 385 (former)

Exported to: Pakistan[154].

YLC-4 Surveillance Radar

Overview: The YLC-4 is a solid-state UHF 2D radar designed for long-range surveillance.[155] It can also reportedly serve as a guidance radar when paired with an altitude radar,[156] and can be networked with up to four other radars.[157] It was intended for both civilian and military early warning and air traffic control.[158]

Figure 16: YLC-4 Radar

Entered into service: 1986[159]
Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[160]
PLA Services: Unknown
Range: ~400km[161]
Networkable: Yes
Mobile: No
Aliases: N/A
Exported to: Unknown

YLC-6 Surveillance Radar

Overview: The YLC-6 is a medium-range, low- and medium-altitude 2D self-propelled surveillance radar that likely functions in the E/F band. It was initially revealed at the 1996 Chinese International Conference on Radar and by 2005 was reportedly deployed in "considerable numbers" along the Chinese coastline opposite Taiwan.[162] It was also reported to be in service with the PLA in 2008 and specifically with a PLAAF mobile radar battalion in 2017; some are likely still in service.[163] It has been known to be developed in four models – M, MS, F, and H – all of which are self-propelled. Some of those models may be only intended for export.[164]

Figure 17: YLC-6 Radar

Entered into service: Prior to 2008
Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET) / CETC 14th Research Institute (now part of CETC Glarun Group)[165]
PLA Services: Unknown
Range: >150km[166]
Networkable: Unknown
Mobile: Yes
Aliases: STAR 2000 (possible)
Exported to: Egypt, Pakistan[167]

YLC-8B Surveillance Radar

Overview: First revealed in a pre-production iteration at the 2014 Airshow China exhibition, the YLC-8B is one of China's most advanced radar systems and perhaps the most prominent representative of China's fourth generation of long-range radars. It operates in the UHF band, is 3D and is a stealth-penetrating meter-wave AESA radar. One of China's most advanced indigenously produced radars, it targets medium and high altitudes.[168] The YLC-8B is designed to supplement fixed radar networks with additional capabilities such as stealth penetration and ballistic missile detection, and as of 2017 one source reported to *Janes* that it was "one of the few radars of its type in the world which can continuously detect and track a Western fifth-generation aircraft at long range." Its manufacturer claims it requires less than 30 minutes for a six-person crew to set up and take down.[169] Multiple reports indicate this system is currently in service with the PLA, possibly deployed on the Paracel Islands.[170]

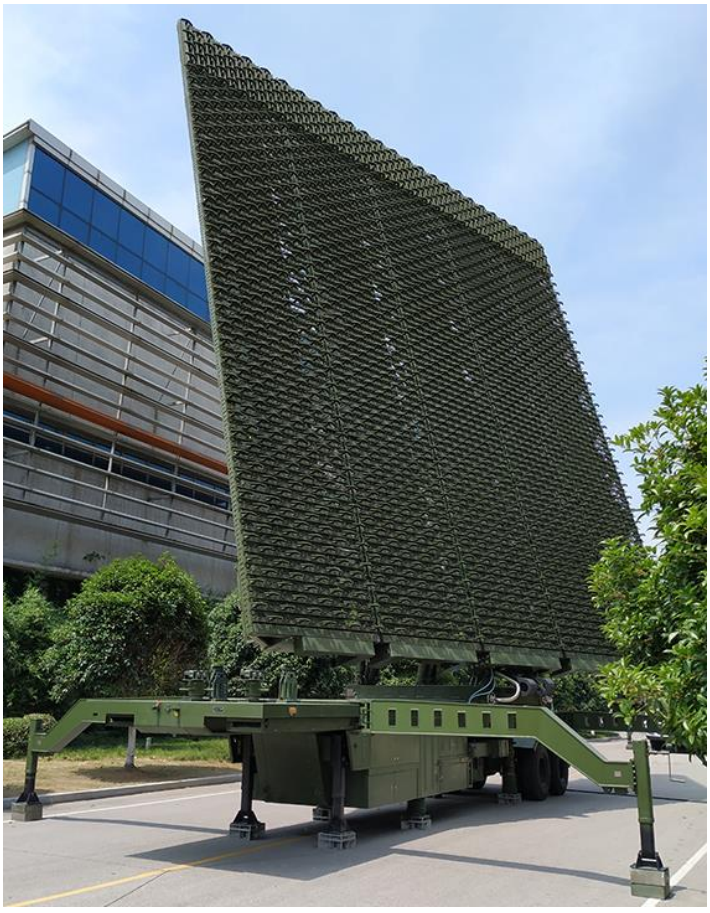

Figure 18: YLC-8B Radar

Entered into service: ~2013[171]

Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[172]

PLA Services: Unknown

Range: >500km (aircraft); >700km (missiles)[173]

Networkable: Yes

Mobile: Yes

Aliases: Type 609 "intelligence radar" [情报雷达],[174] "Big Guy" [大块头][175]

Exported to: Unknown

YLC-15 Targeting Radar

Overview: The YLC-15 is a self-propelled, coherent pulse-Doppler, short-range targeting radar operating in the S band.[176] While relatively little information about it is available, Chinese-language sources indicate it was in service with the PLA from 2008 until at least 2017. It is compact and can be installed on multiple kinds of vehicle platforms.[177]

Figure 19: YLC-15 Mockup

Entered into service: Prior to 2008

Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET) / CETC 14th Research Institute (now part of CETC Glarun Group)[178]

PLA Services: Unknown, likely PLAA

Range: >20km[179]

Networkable: Unknown

Mobile: Yes

Aliases: N/A

Exported to: Unknown

YLC-18 Surveillance and Tracking Radar

Overview: The YLC-18 is a medium-range, low-altitude 3D "blind spot" radar that was revealed in June 2007 and was reported as in service with the PLA shortly after.[180] Designed to fill low-altitude gaps in coverage from other radar systems, it is composed of a two-vehicle convoy and reportedly has strong performance against electronic countermeasures. In 2018, state media labeled it one of the most advanced early-warning radars in service with the PLA and the "flagship of China's stealth-penetrating radars."[181] State media reported that it remained in service at least as of 2021.[182]

Figure 20: YLC-18 Radar

Entered into service: Prior to 2008[183]

Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[184]

PLA Services: Unknown

Range: >250km[185]

Networkable: Yes[186]

Mobile: Yes

Alias: "Meerkat" [狐獴]

Exported to: Pakistan,[187] Sri Lanka[188].

STANDALONE PASSIVE RADAR PLATFORMS

DWL002 Air Defense Radar

Overview: The DWL002 passive detection system, made up of three reconnaissance stations (reportedly expandable to four), was a "modern and technically sophisticated" emitter locating system when it was disclosed in the early 2010s.[189] It was likely developed a year earlier, and its manufacturer claims that it has "excellent anti-stealth performance."[190] Multiple DWL002 units may be networkable to improve its capabilities.[191] At the 2021 World Radar Expo, CETC staff told reporters that as long as a stealth fighter had its radar or jamming equipment activated, the DWL002 would be able to detect it.[192] The degree to which this is true, however, remains unclear. It was tested against China's own "Dark Sword" [暗剑] UAV, which claims a radar cross-section similar to that of the U.S. F-22.[193] A 2018 study by Taiwan's Ministry of Defense assessed that its performance is superior to that of the YLC-20.[194]

Figure 21: DWL002 Radar

Entered into service: Between 2012-2016[195]

Manufacturer: Southwest Institute of Electronic Equipment, also known as the CETC 29th Research Institute[196]

PLA Services: Unknown

Range: ~500km (per manufacturer; unverified)[197]

Networkable: Unknown

Mobile: Yes

Alias: N/A

Exported to: Algeria,[198] Pakistan[199]

JY-50 Air Defense Radar

Overview: The JY-50 is a 2D "external radiation source radar" that uses signals transmitted by, for instance, civilian mobile phones, radio stations, and television broadcasts to detect and track airborne platforms. It relies on two base stations and multiple such pairs can be networked to improve detection capabilities.[200] Chinese-language reports claim it can track stealth aircraft.[201]

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Figure 22: JY-50 Radar

Entered into service: 2001[202]
Manufacturer: (Likely) Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[203]
PLA Services: PLAAF[204]
Range: 250km[205]
Networkable: Yes
Mobile: Yes
Alias: N/A
Exported to: Unknown

SM-02 Air Defense Radar

Overview: Very little has been made public about the SM-02 radar, but it is reportedly a passive stealth radar in service with the PLA as of at least 2016.[206]

[No image available]

Entered into service: Prior to 2016
Manufacturer: Unknown
PLA Services: Deployed with unspecified air defense units[207]
Range: Unknown
Networkable: Unknown
Mobile: Unknown
Alias: N/A
Exported to: Unknown

YLC-20 Air Defense Radar

Overview: The YLC-20 is a passive radar detection system that reportedly relies on detecting signals emitted directly from aircraft (as opposed to the JY-50, which relies on emissions from other sources).[208] They are typically paired with more advanced, active radar systems.[209]

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Figure 23: YLC-20 Radar

Entered into service: 2006[210]
Manufacturer: Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[211]
PLA Services: Unknown
Range: Unknown
Networkable: Unknown
Mobile: Yes
Alias: N/A
Exported to: Unknown

YLC-29 Air Defense Radar

Overview: The YLC-29 passive detection system was first revealed publicly at the 2017 Paris Air Show, with announcements that it could detect stealth targets.[212] The system uses two mobile base stations that the manufacturer claims rely on civilian FM radio signals to detect airborne targets, and at least one report claims it is likely to be an export model of equipment that was currently being used in the PLA.[213] It can track more than 200 targets over an area of roughly 40,000 square kilometers at once and can be set up in around 20 minutes.[214]

Figure 24: YLC-29 Radar

Entered into service: Prior to 2017

Manufacturer: Southwest Institute of Electronic Equipment, also known as the CETC 29th Research Institute[215]

PLA Services: PLAN[216]

Range: ~200km[217]

Networkable: Likely can use more than two base stations, otherwise unknown

Mobile: Yes

Aliases: N/A

Exported to: Unknown

Over-the-Horizon Backscatter (OTH-B) Radar

In addition to its mobile passive detection system, China has also fielded at least three backscatter over-the-horizon "sky wave" radars with unknown designations, usually referred to as OTH-B. These are bistatic systems, in which the transmitters and receivers are different kinds of antennas separated by long distances.[218] China's famous systems scientist, Qian Xuesen, began development of an indigenous OTH-B system in 1967, but its development stalled due to an inability to obtain needed foreign technology.[219] *Janes* reported that China was developing a new indigenous OTH-B system in 2001, and the first seems to have come into operation in the mid-2010s. While little detail is available, based on information made public about the prototype, it likely can detect targets at ranges between 800 and 3,000km.[220]

[No image available]

Entered into service: Mid-2010s
Manufacturer: Possibly Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[221]
PLA Services: PLAAF
Range: Minimum 800km, maximum 3,000km
Networkable: Unknown
Mobile: No
Aliases: N/A
Exported to: Unknown

SLR-66 Over-the-Horizon Radar

Overview: Very little information is available about the SLR-66 radar. The U.S. Army's Worldwide Equipment Guide identifies it as a fixed, bistatic system similar to the OTH-B system(s) described above,[222] but Chinese-language reports indicate it is a self-propelled coastal defense over-the-horizon radar that has both active and passive modes available.[223] It also has a naval variant; some reports say it is an alternate designation for the Type 366 / H/LJQ-366 naval radar.[224]

Figure 25: SLR-66 Radar

Entered into service: Unknown
Manufacturer: Unknown (exported by China National Electronics Import & Export Corporation / CEIEC)[225]
PLA Services: Unknown
Range: (Unverified) >300km (active mode); 250-400+km (passive mode)[226]
Networkable: Unknown
Mobile: Yes
Aliases: Unknown
Exported to: Possibly Indonesia

Over-the-Horizon Surface Wave (OTH-SW) Radar

Overview: China is reported to have several surface-wave over-the-horizon radars in operation, although very little information about their capabilities has been made public.[227] The one that has been identified in satellite imagery (pictured below) is a bistatic system with two sites separated by 2.65km.[228] Figure 26 depicts the transmitter site in Maxar imagery from July 30, 2022 (coordinates: 27°46'58.4"N 120°45'55.5"E), and Figure 27 depicts the rectangular receiver site in Maxar imagery from February 14, 2022 (coordinates: 27°45'27.4"N 120°45'05.6"E).

Figure 26: OTH-SW Transmitter

Figure 27: OTH-SW Receiver

Entered into service: Likely prior to 2008[229]
Manufacturer: Unknown
PLA Services: Unknown
Range: (Unverified) >300km[230]
Networkable: Unknown
Mobile: No
Aliases: Unknown
Exported to: Unknown

AIRBORNE SURVEILLANCE AND EARLY WARNING PLATFORMS

KJ-200 Surveillance Aircraft

Aircraft Overview: The KJ-200 [空警-200] airborne early warning and control (AEW&C) aircraft was long a mainstay of PLAAF and PLAN AEW&C capabilities, but it may be in the process of being phased out in favor of the third-generation KJ-500.[231] The "balance beam"-shaped housing above the aircraft's fuselage in the baseline version holds a JY-06 active electronically scanned array airborne early warning radar, and a KJ-500B variant in development may add a synthetic aperture radar for tracking targets on the ground.[232] Surplus KJ-200s were offered for sale to foreign customers at the 2019 International Defense Exhibition in Abu Dhabi.[233]

Figure 28: KJ-200

JY-06 Radar: This AESA radar operates in the E band and has 240-degree coverage. *Janes* describes it as similar to Sweden's Erickson Erieye.[234] It is designed in the "balance beam" configuration in order to reduce the need for aircraft modification in order to use it.[235]

Figure 29: JY-06 Radar

Entered into service: Late 2000s[236]

Radar Manufacturer: East China Research Institute of Electronic Engineering / CETC 38th Research Institute[237]

PLA Services: PLAAF, PLAN

Detection range: 300-470km[238]

Networkable: Unknown

Aircraft aliases: Shaanxi Y-8W, "Moth" (NATO designation), "Hunter Eagle" [猎鹰], ZDK-06 (export variant)

Radar exported to: Unknown

KJ-500 Surveillance Aircraft

Aircraft Overview: The KJ-500 [空警-500] AEW&C aircraft is a third-generation aerial surveillance platform that many reports say is slowly replacing the KJ-200 surveillance aircraft. Production of the KJ-200 reportedly stopped in 2018 after the KJ-500 reached full operational capacity.[239] It is the primary AEW&C aircraft for both the PLA Air Force and the PLA Navy. It hosts a distinctive dorsal-mounted radome that houses three AESA phased array radars, each with 120-degree coverage, allowing the full platform to achieve full 360-degree radar coverage. It also likely contains a surface search radar in its nose cone.[240] In 2021, the KJ-500H variant was revealed, which Chinese-language reporting described as the "core node of our military's air-based network information system."[241]

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Figure 30: KJ-500

Entered into Service: 2015 (for PLAAF)[242]

Radar Manufacturer: Reports differ; Nanjing Research Institute of Electronics Technology (NRIET), also known as the CETC 14th Research Institute (now part of CETC Glarun Group)[243] and/or the East China Research Institute of Electronic Engineering, also known as the CETC 38th Research Institute[244]

PLA Services: PLAAF, PLAN

Radar detection range: 200nm / 370km (surface targets), 388nm / 720km (high-altitude targets)[245]

Networkable: Yes[246]

Aircraft Aliases: Shaanxi Y-9W, Y-8GX-10, GX-10, Air Warning 500 [空警-500]

Exported to: Unknown

KJ-2000 Early Warning Aircraft

Aircraft overview: The KJ-2000 [空警-2000] is China's first-generation AEW&C aircraft, based on a modified Russian IL-76 airframe.[247] It uses a three-sided electronic scanning phased array (ESA) radar system, designated K/LLQF01, that can track 60 to 100 targets with 360 degrees of coverage.[248] The radar likely operates in the S or C band.[249] Analysis published by the Jamestown Foundation noted it employed more advanced antenna technology than the U.S. E-3C AWACS.[250] The radar's manufacturer claims that it is the largest airborne radar system in China; the KJ-500's three-sided AESA radar is a smaller, lighter variant of the K/LLQF01.[251] According to state media, it uses an "advanced network system" to exchange information with other units, platforms, and automated systems, including UAVs.[252]

Figure 31: KJ-2000

Entered into Service: 2004-2007[253]

Radar Manufacturer: East China Research Institute of Electronic Engineering / CETC 38th Research Institute[254]

PLA Services: PLAAF, possibly PLAN

Radar Detection Range: >400km[255] (likely similar to that of the KJ-500)

Networkable: Yes

Aircraft aliases: Mainring (NATO designation), Air Warning 2000 [空警-2000]

Exported to: Unknown

Tu-154 Electronic Intelligence Aircraft

Aircraft Overview: The Tu-154 [图-154] is a Russian-designed aircraft initially designed for commercial use. It is no longer in commercial use in China, but the PLA still operates four modified Tu-154M/D electronic intelligence (ELINT) aircraft.[256] In addition to a BM-KZ 800 ELINT collection system designed to collect data on surface-based radar transmitters, this modified version also has a synthetic aperture radar mounted underneath the fuselage that can likely track both surface and airborne targets.[257] The Tu-154 has been repeatedly spotted in Japanese and Taiwanese airspace, most recently in 2020.[258]

Figure 32: Tu-154 ELINT Aircraft

Entered into Service: 1992[259]
Radar Manufacturer: Unknown
PLA Services: PLAAF[260]
Radar Detection Range: Unknown
Networkable: Unknown
Aircraft Aliases: N/A
Exported to: N/A

Y-8J Early Warning Aircraft.

Aircraft Overview: The Y-8J was China's first operational early warning aircraft, and it is likely in the process of being phased out in favor of newer systems, particularly the KJ-500.[261] As of late 2023, four of them remain in service with the PLA Navy.[262] Uniquely among China's airborne early warning aircraft, it uses an imported radar system, the United Kingdom's Racal Skymaster surveillance radar.[263] There is also an ELINT-focused variant of this aircraft, which is designated the Y-8JB.[264]

Figure 33: Y-8J

Entered into Service: Late 1990s[265]
Radar Manufacturer: Racal (United Kingdom, now defunct)
PLA Services: PLAN
Radar Detection Range: 400km[266]
Networkable: Unknown
Aircraft Aliases: "Mask," Shaanxi Y-8J, Cloud-8 Warning [云-8 警]
Exported to: N/A

KA-31 Helicopter

Helicopter Overview: The KA-31 airborne early warning helicopter was originally developed for the Soviet Navy, but nine of them are currently in service with the PLAN in an AEW&C role.[267] This helicopter platform carries a Russian E-801E Oko (Eye) surveillance radar that operates in the L-band and can detect small targets at a range of 59-62nm (110-115km), although it cannot detect airborne targets above its own height.[268]

Figure 34: KA-31

Entry into Service: ~2010 (in China)[269]
Radar Manufacturer: Nizhny Novgorod Radio Engineering Institute (Russia)[270]
PLA Services: PLAN
Radar Detection Range: 110-115km for small targets
Networkable: Unknown
Helicopter Aliases: Helix (NATO designation)
Exported to: N/A

Z-18J Helicopter

Overview: The Z-18 series of helicopters were developed by Changhe Aircraft Industries Corporation (AVIC), and they have been modified into four variants: a utility variant for the PLAA (Z-18A), a ground-tracking variant for the PLAA with an additional terrain-following radar (Z-8G), an anti-submarine version with a surface radar and dipping sonar (Z-18F), and the airborne early warning variant, the Z-18J.[271] The Z-18J, pictured below, carries a long-range, multimode, active electronically scanned array radar of unknown designation.[272]

Figure 35: Z-18J AEW Variant

Entered into Service: Late 2010s[273]

Radar Manufacturer: East China Research Institute of Electronic Engineering, also known as the CETC 38th Research Institute[274]

PLA Services: PLAN[275]

Radar Detection Range: 200-270km[276]

Networkable: Unknown

Helicopter Aliases: "Bat," Changhe Z-18

9K331 Tor-M1 SHORAD System[277]

Overview: The 9K331 Tor-M1 is a Russian-designed and produced surface-to-air missile (SAM) platform sold to the PLA in the 1990s.[278] The platform incorporates a "Scrum Half" pair of radars.[279] Reports differ as to their specific characteristics, but a 2011 U.S. Army report about the Russian versions identifies the target acquisition radar as a G/H-band 3D pulse doppler radar, and the other radar as a dual acquisition and fire control J/K-band doppler phased array.[280] The International Institute for Strategic Studies estimates that 24 of them remain in service with the PLAA, though many more of the domestically reverse-engineered and produced version, the HQ-17, are in service as well.[281]

.

Figure 36: Tor-M1 SHORAD System

Entered into Service: (In China) 1990s

Radar Manufacturer: Unknown

PLA Services: PLAA[282]

Radar Detection Range: 25+km (detection and tracking); 25+km (acquisition and fire control). Detection range is between 9-15km for helicopters and UAVs.[283]

Networkable: Unknown

Platform Aliases: SA-15 Gauntlet (NATO)

FB-6 SHORAD System

Overview: The manufacturer of the FB-6 series (including both FB-6A and FB-6C variants) of "mobile light air defense missile system" notes that these systems typically combine three categories of equipment: a command vehicle (likely carrying a radar), a missile firing vehicle, and an FN-6 or FN-16 MANPAD missile.[284] Each command vehicle can command up to six launchers at one time.[285] At the 2012 China Defence Electronics Exhibition (CIDEX), the Sichuan Electronics Military-Industrial Group Co. (SEMIC, a previous name for the 081 Electronics Group Company profiled below) displayed two radars that were to be used in concert with each other: the Type 820 solid-state target acquisition radar, and the FB-6A Air Defence Missile Weapon Command fire control radar.[286]

The **Type 820** (pictured immediately below) was primarily designed to cover small, fast targets like Tomahawk cruise missiles. It is an S-band 3D pulse Doppler system that the manufacturer claims has good immunity to jamming.[287] State media in 2011 stated that it could track stealth aircraft, and that it can be deployed independently or as part of a larger networked system.[288]

Figure 37: Type 820 Radar

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The **FB-6A fire control radar** (pictured immediately below)[289] also works in the S-band and adopts a full coherent-pulse 3D phased array design. It can be set up in under five minutes and only requires a crew of two.[290] Based on the frequency of this radar's appearance in images of the FB-6A and its presence on the manufacturer's product page, it is likely the baseline radar pairing for this system.

Figure 38: FB-6A Radar

Entered into Service: 2006[291]

Radar Manufacturer: (For both radars) SEMIC, which is now 081 Electronics Group Company

PLA Services: PLAA[292]

Radar Detection Range: 65km (Type 820) / 30km for aircraft and 18km for cruise missiles (FB-6A fire control radar)

Networkable: Yes

Platform Aliases: N/A

FB-10A Combination SPAAG and SAM System

Overview: The FB-10A is a short-range, self-propelled air defense system that combines anti-aircraft artillery with SAM capabilities. It also combines optoelectronic sensors with radar guidance, but little has been made public about the radar's capabilities.[293] Scattered reports indicate it is a phased array radar.[294] A number of reports claim that FB-10 is actually a missile type used with the Type 625 self-propelled anti-aircraft gun (SPAAG)/SAM, but imagery from defense exhibitions (including of the FB-10A system, as shown below) indicates they are two distinct systems.[295] However, it remains possible that the missiles developed for the FB-10A system can be used in the Type 625.

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Figure 39: FB-10A SPAAG/SAM

Entered into Service: Possibly 2022[296]

Radar Manufacturer: Shanghai Academy of Spaceflight Technology (SAST), also known as the CASC 8th Academy manufactures the FB-10A; unclear whether it also manufactured the platform's radar system.[297]

PLA Services: Likely PLAA[298]

Radar Detection Range: Unknown; short-range platform

Networkable: Yes[299]

Platform Aliases: N/A; often confused with the Type 625

HQ-6 SAM

Overview: The HQ-6 [红旗-6] family of short-range SAM platforms has gone through a number of iterations since it was first developed in the 1980s. As of late 2023, the HQ-6A and HQ-6D variants remain in service with the PLA.[300] Both of these variants are based on the HQ-64, which entered service in 2001.[301] The HQ-6A (the missile launch vehicle for which is pictured below) combines an HQ-64 missile launcher with an early warning radar platform and the LD-2000 close-in artillery defense system, while the HQ-6D is an HQ-64 combined with a command vehicle that can control multiple HQ-64 batteries. The HQ-6D can also be integrated into the larger air defense network.[302]

A full HQ-64 system is equipped with one long-range search radar and three tracking/fire control radars, in addition to a number of support vehicles. Very little is known about these radars, but some information about two of those four radars was disclosed in 2008. At that time, the engagement radar was primarily designed as a continuous-wave X-band illuminator for the monopulse semi-active missile rounds.[303] The acquisition radar at the time—mounted on the command vehicle—appeared similar to the YLC-6M series (see p. 35 for a profile of the YLC-6), but there were enough differences that it was likely a new design.[304] Together, the surveillance and tracking/fire control radars can reportedly track 12 targets and engage three simultaneously.[305].

Figure 40: HQ-6A SAM

Entered into Service: 1989 (initial variant)[306]

Radar Manufacturer: (If the same as the platform manufacturer) Shanghai Academy of Spaceflight Technology (SAST) / CASC 8th Academy

PLA Services: PLAAF[307]

Radar Detection Range: 18km[308]

Networkable: Yes (at least the HQ-6D)

Aliases: Red Flag-6 / Hongqi-6 [红旗-6], LY-60 (export designation)

HQ-7 SAM

Overview: The HQ-7 [红旗-7] low-altitude SAM system is a reverse-engineered system based on the French Thales/Thomson CSF Crotale SAM. In China, it has been built in a high-mobility variant for the PLAA and a less mobile towed PLAAF version.[309] Four domestic variants are known to exist: the original HQ-7 (no longer in service), the HQ-7A (an upgraded version unveiled in 1998), the HQ-7B (a further upgraded version first seen in 2009), and the HHQ-7 (a naval version introduced in the 1990s, see pp. 73-75). The land-based variants in service are deployed on transporter erector launcher and radar (TELAR) vehicles paired with an acquisition radar vehicle.[310]

Few details are available about the radar systems used with the HQ-7A and HQ-7B, the two land-based variants currently in service. One recent unverified report indicates that while the HQ-7A had a parabolic antenna, the HQ-7B (pictured below) has a new, "flat" antenna, which may indicate an upgrade to a phased-array design.[311]

Figure 41: HQ-7

Entered into Service: 1988 (HQ-7),[312] 1998 (HQ-7A),[313] 2006 (HQ-7B)[314]

Radar Manufacturer: Unknown; platform manufacturer was CASIC's 2nd Academy.[315] While it is not confirmed that the 2nd Academy's 23rd Research Institute—which is focused on radar technology—produced the radar for the HQ-7, it is known to be involved in radar design and production for many of the other HQ-series SAMs.

PLA Services: PLAA, PLAAF

Radar Detection Range: ~12-15km[316]

Networkable: Unknown

Platform Aliases: "Chinese Rattlesnake" [中式响尾蛇], FM-80 (export designation), "Red Flag-7" [红旗-7]

Exported to: Pakistan,[317] Bangladesh, Turkmenistan[318]

HQ-9 SAM

Overview: The HQ-9 [红旗-9] SAM system has been described by state media as China's first domestically-produced, third-generation medium- and high-altitude long-range air defense system, which made its first public appearance at the 2009 military parade.[319] It is based on the highly capable Russian S-300PMU (SA-20).[320] An upgraded variant, the HQ-9B, was publicly revealed at the annual military parade a decade later in 2019.[321] Both versions remain in service as of late 2023.[322] There may also be a further upgraded version, possibly designated the HQ-9BE, was revealed at the 10th World Radar Expo in 2023.[323] It is not clear whether it is in service with the PLA yet, though nonspecific reports on the deployment of an upgraded derivative of the HQ-9B may indicate the HQ-9BE has entered into service.[324] A nearly identical version of this SAM, designated the HHQ-9/9B [海红旗-9/9B] is installed on many Chinese destroyers (see pp. 84-89).

The HQ-9B platform (pictured below)[325] is likely designed to be used with multiple radars, both for surveillance and for tracking. Most public reports, however, indicate that the primary fire control radar for the in-service variants is designated HT-233.[326] Older versions were reportedly paired with the SJ-212 phased array radar, which state media reported had a detection range of 300km,[327] and the upcoming HQ-9BE uses an LD-JPG600 3D S-band long-range early warning radar.[328]

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Figure 42: HQ-9B

Information about the HT-233 vehicle-mounted radar (pictured below) is limited.[329] It is likely a phased array system—reports differ as to whether it is passive or active—operating in the C or G band, and it is the Chinese derivative of the Russian 30N6E1 "Tomb Stone" radar.[330] At least one report indicates it may be a frequency-hopping radar.[331] Chinese media have described it as similar in capabilities to the U.S. Patriot system's AN/MPQ-53 radar.[332]

Figure 41: HT-233 Radar

. **Entered into Service**: 1995 (HQ-9; trial use),[333] 2023 (HQ-9BE)

Radar Manufacturer (HT-233): Unknown. Some sources claim it is manufactured by the China Precision Machinery Import-Export Corporation (CPMIEC), but that company focuses primarily on export versions of Chinese equipment and the claim could not be verified.

PLA Services: PLAAF[334]

Radar Detection Range (HT-233): 120-200km

Networkable: Likely; state media describes it as "effectively interfaced"[335]

Platform Aliases: FD-2000 (export designation), "Red Flag-9" [红旗-9]

Exported to: Morocco,[336] Pakistan,[337] Turkmenistan,[338] Uzbekistan[339]

HQ-12 SAM

Overview: The HQ-12 is a medium-range SAM air defense system that Chinese-language reports describe as focused on opposing fixed-wing aircraft and helicopters.[340] The basic model uses an SJ-202 "Gin Sling" phased array radar or its upgraded variant, the SJ-212,[341] but it can also be used with the H-200[342] or the SJ-231.[343]

Figure 43: HQ-12

Entry into Service: Possibly 1996[344]

Radar Manufacturers:

- SJ-202 / SJ-212: Unknown
- H-200: Unknown .
- SJ-231: CASIC[345]

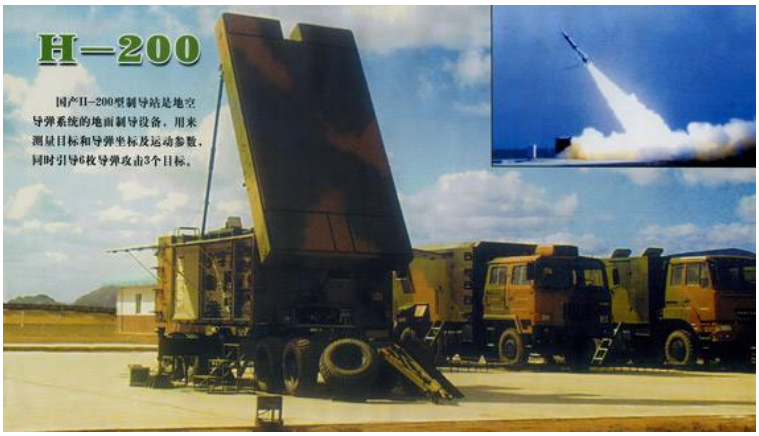

Figure 44: H-200 Radar

PLA Services: PLAAF[346]

Radar Detection Ranges:

- SJ-202 / SJ-212: ~115km[347]
- H-200: >120km[348]
- SJ-231: >120km[349]

Networkable: Unknown

Platform Aliases: Kaishan-1A / KS-1A [“凯山”-1A] (may be an export designation)

Exported to: Cambodia,[350] Myanmar[351]

Figure 45: SJ-202 Radar

Figure 46: Probable SJ-212 Radar.

Figure 47: SJ-231 Radar

HQ-16 SAM

Overview: The HQ-16 family of systems, like the HQ-12, is a medium-range SAM air defense system. It comes in two land-based variants, the HQ-16A and HQ-16B/C, as well as a naval variant, the HHQ-16. Unlike many of China's other SAM systems, the HQ-16 was developed as a naval system first, then adapted for the use of the PLAA.[352] In 2022, a newer variant designated HQ-16FE was exhibited at the Zhuhai Air Show. It reportedly offers longer range and better anti-jamming capabilities than its predecessor.[353]

Figure 48: HQ-16

While very little information about the details of the HQ-16 radar system(s) are available, SAST (see pp. 102-105) advertises on its website that it produced the 3D phased array radar used in an export variant of the HQ-16, the LY-80N (an image of this radar, designation unknown, is included below)[354] SAST also produced the HQ-16 itself.[355]

Entered into Service: 2011[356]

Radar Manufacturer: Likely the Shanghai Academy of Spaceflight Technology (SAST), also known as the CASC 8th Academy

PLA Services: PLAA

Radar Detection Range: 150km[357]

Networkable: Unknown

Platform Aliases: LY-80 (export variant), LY-80N (export variant)

Exported to: Pakistan[358]

.

Figure 49: Radar associated with LY-80N SAM

HQ-17 SAM

Overview: The HQ-17 [红旗-17] is a medium-range SAM system that was reverse-engineered from the Russian 9K331 Tor-M1 SAM system (see p. 55). It comes in at least three variants: a tracked system designated HQ-17, a wheeled system designated HQ-17A, and a new version tentatively designated the HQ-17AE that may not be in service yet. A full HQ-17 system typically consists of four launchers carrying eight missiles each, all paired with a medium-range radar system.[359] While the designation of the radars normally used with the HQ-17 are unknown, *Janes* reported in 2020 that the surveillance radar for the HQ-17A is a planar phased array, likely an upgrade over the Russian version the HQ-17 system was based on. While little is known about the changes in the HQ-17AE's radar system, one report claims it is a core component of CASIC's anti-UAV system.[360] The fire control radar appeared to be an active/passive electronically scanned array that also differs from the Russian version and is likely an upgrade.[361]

Figure 50: HQ-17

Entered into Service: ~2018[362]

Radar Manufacturer: Unknown; platform manufacturer (which also develops air defense radars) is the 23rd Research Institute of CASIC's 2nd Academy.

PLA Services: PLAA[363]

Radar Detection Range: >30km[364]

Networkable: Yes, at least with other HQ-17AEs[365]

Platform Aliases: "Red Flag-17" [红旗-17]. FM-2000 (export version), "low-altitude hunter" [低空猎手] (HQ-17AE), "Flying Mongoose" [飞獴]

Exported to: Saudi Arabia[366]

HQ-22 SAM

Overview: The HQ-22 [红旗-22] long-range SAM system is an upgraded version of the HQ-12 that was originally intended to be an more effective version of the HQ-2.[367] Manufactured by CASIC, it is often compared to the American Patriot.[368] While its performance is inferior to that of the HQ-9 and other newer SAM systems, it is much cheaper and often used to supplement more advanced systems.[369] The baseline HQ-22 battery consists of between three and six transporter-erector launchers (TELs) paired with an H-200 passive electronically scanned array target engagement radar and a JSG-100 target acquisition radar, along with various support vehicles.[370]

Figure 51: HQ-22

.The H-200 is also used with the HQ-12 SAM system, but relatively little is known about it. Scattered Chinese-language reports indicate the JSG-100 (pictured below; also referred to as the LD-2) is a 3D S-band early warning radar with a maximum detection distance of around 160km.[371]

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Figure 52: JSG-100 Radar

Entered into Service: ~2017[372]
Radar Manufacturer:

- H-200: Unknown
- JSG-100: Likely CASIC[373]

PLA Services: PLAAF, PLAN[374]
Radar Detection Range:

- H-200: >120km[375]
- JSG-100: 160-170km[376]

Networkable: Unknown
Platform Aliases: Red Flag-22 [红旗-22], FK-3 (export designation)
Exported to: Serbia, Thailand[377]

Smarthunter MANPADS Command and Control System

Overview: Designed by Xi'an Tianhe Defense Technology Co., the Smarthunter MANPADS command and control system is commonly deployed with PLAA combined arms brigade ground-based air defense operations.[378] It is designed to serve as both a short-range radar detection platform to guide MANPADS such as the FN-6 and possibly the QW-1/2, in addition to serving as a network backbone for distributed MANPADS operations. It can also guide anti-aircraft artillery such as the PGZ-09.[379] The system was first revealed at the 2010 Zhuhai air show, and was particularly notable because unlike most other indigenous Chinese air defense radar systems, it was developed by a private company. At that time, most such systems were developed by subsidiaries of the state-owned defense giants CASIC and CASC.[380] The Smarthunter radar's designation is likely JZ/QF-612 (pictured below), manufactured by Jezetech, which is also known as the Sichuan Jiuzhou Electric Group Company [四川九洲电器集团有限责任公司] (see profile on pp. 149-151).[381]

.

Figure 53: Smarthunter Radar

Entered into Service: 2013[382]

Radar Manufacturer: Sichuan Jiuzhou Electric Group Company

PLA Services: PLAA, PLAN[383]

Radar Detection Range: Possibly 50-100km[384]

Networkable: Yes

Mobile: Yes

Platform Alias: TH-S711A

Exported to: Cambodia, Malaysia, Pakistan[385]

Yitian Air Defense System

Overview: The Yitian [倚天] short-range air defense system was designed especially to deal with low-altitude targets, such as helicopters.[386] With a modular design, it can be (and has been) mounted on a variety of vehicles.[387] The system combines radar and photoelectronic detectors with both infrared and radar missile guidance, and it reportedly offers strong performance in complex electromagnetic environments.[388]

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Figure 54: Yitian System

Entered into Service: Possibly 2009[389]

Radar Manufacturer: Likely China North Industries Group Pinance Co.

PLA Services: PLAA[390]

Radar Detection Range: 12-18km[391]

Networkable: Unknown

Platform Aliases: TY-90 / "Sky Swallow-90" [天燕-90] (this actually refers to the missiles used by the Yitian system, but is sometimes used to describe the system itself), "Hunter" [猎手], possibly Type 92

Exported to: Laos,[392] Mauritania[393]

SHIP-BASED ANTI-AIRCRAFT SYSTEMS

HHQ-7 NAVAL SAM

Overview: The HHQ-7 [海红旗-7] SAM is the naval variant of the HQ-7 introduced into service in the 1990s, after which it was the standard PRC ship-based SAM for over a decade.[394] In recent years it has gradually been supplanted by more advanced systems such as the HHQ-9 and HHQ-10. According to the International Institute of Strategic Studies, it is currently deployed only on two Type 052 *Luhu* destroyers and two Type 053H3 *Jiangwei II* frigates.[395]

Figure 55: HHQ-7 SAM

While the launch systems and missiles are likely very close to identical to those of the land-based HQ-7, the radar system is distinct. Based on comprehensive modernization plans issued by the PLA Navy in 2006, the old radars for HHQ-7s—referred to as the "Sea Tiger" [海虎], which was likely the Type 345[396]—were "uniformly replaced" in 2009 with the Type 360A, which has better data processing and anti-interference capabilities.[397] The Type 360 is a surface/low-altitude search 2D E/F band radar that uses a parabolic antenna.[398]

Later reports indicate the Type 360 is being replaced by a newer radar system dubbed the "Sea Eagle" [海鹰] (also known as the Type 382).[399] The Sea Eagle is an S-band radar that uses a frequency-sweep dimensional phased array system.[400] A ground-based or ship-based "Sea Eagle" antiship missile system, including low-altitude radars, is also in operation in China, but it is unclear whether the two Sea Eagle systems are related. It is also unclear whether the Sea Eagle directly supports HHQ-7 operation.[401] Scattered reports indicate that the fire control radar for the HHQ-7

system may be the Type 345, which is thought to be a replica of the French-made Thomson-CSF Castor 2J/C.

Entered into Service: ~1996[402]
Radar Manufacturers:

- Type 360A: Yangzhou Marine Electronic Instrument Research Institute, also known as the China State Shipbuilding Corporation (CSSC) 723rd Research Institute (as of 2018, this is part of the CSSC 8th Academy)
- Sea Eagle / Type 382: Nanjing Marine Radar Research Institute, also known as the CSSC 724th Research Institute
- Type 345: Unknown

PLA Services: PLAN
Radar Detection Range:

- Type 360A: 250km[403]
- Sea Eagle / Type 382: >200km[404]
- Type 345 (tracking): ~30km for aircraft, ~15km for anti-ship missiles[405]

Networkable: Unknown
Radar Aliases:

- Type 360A: H/LJQ-360, "Seagull" [海鸥], SR60 (export variant), sometimes erroneously labeled the Type 362 [362 型]
- Sea Eagle / Type 382: H/LJQ-382
- Type 345: H/LJP-345, MR35 (export variant), Fog Lamp

Exported to: Unknown

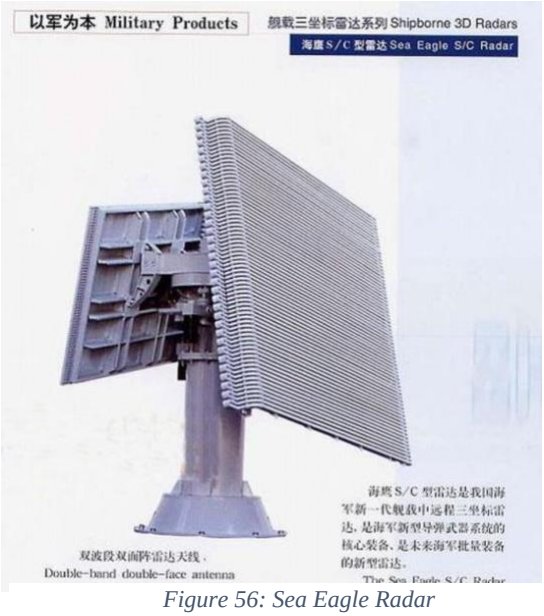

Figure 56: Sea Eagle Radar


Figure 57: Type 360 Radar

Figure 58: Type 345 Radar

HHQ-9 NAVAL SAM

Overview: The HHQ-9 [海红旗-9] family of SAM systems is the shipborne variant of the land-based HQ-9. Identical in design to the land-based version, the HHQ-9B was first installed on the Type 052C destroyer.[406] As of late 2023, it is a mainstay of China's sea-based air defense forces; it is deployed on eight Type 055 *Renhai* cruisers, six Type 052C *Luyang* II destroyers, and 13 Type 052D *Luyang* III destroyers.[407] The latter ships have been commonly referred to as the "Chinese Aegis," in part because the HHQ-9 is reportedly capable of anti-saturation defense at long range.[408]

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Figure 59: HHQ-9 SAM

The HHQ-9 is integrated with the Type 346 active phased-array radar, a widely used, indigenously produced Chinese radar that is thought to operate in the S- and C-bands. It reportedly comes in three variants: the Type 346, the Type 346A, and Type 346B.[409] The 346 is housed in a curved panel, while the 346A and the 346B are behind flat panels due to an upgraded liquid cooling system.[410]

Figure 60: Type 346

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Figure 61: Type 346A/B

Entered into Service: ~Mid-2010s[411]
Radar Manufacturer: CETC 14th Research Institute (now part of CETC Glarun Group Co.)[412]
PLA Services: PLAN
Radar Detection Range: ~450km[413]
Networkable: Unconfirmed, but likely
Radar Aliases: H/LJG-346 / 346A / 346B; "Star of the Sea" [海之星], Dragon Eye (NATO designation)
Exported to: Unknown

HHQ-10 NAVAL SAM

Overview: The HHQ-10 [海红旗-10], unlike the rest of the HQ series of SAMs, does not have a land-based equivalent. It was first revealed in 2008, and has been described in Chinese-language discussions as analogous to the Raytheon SeaRAM Ship Defense System or the Mistral short-range air defense missile.[414] The HQ-10 and HHQ-10 designations seem to be used interchangeably for it, and both refer to a shipborne SAM. State media in China report that this system is "mainly used to intercept anti-ship missiles coming from low and ultra-low altitudes."[415]

Very little detailed information is available about the HHQ-10's guidance. Open-source reports indicate it likely adopts passive radio frequency guidance to home in on incoming guided missiles, and that it uses infrared guidance as well.[416] It might be able to receive guidance from other radar systems in the larger IADS network; one report claims it may be "associated with" the HT-233 radar.[417]

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Figure 62

Entered into Service: 2012[418]

Radar Manufacturer: Unknown; SAM platform developed by the Shanghai Academy of Spaceflight Technology, also known as the CASC 8th Academy

PLA Services: PLAN[419]

Maximum Interception Distance: 9km[420]

Networkable: Unknown

Platform Aliases: FL-3000N (export variety)

Exported to: Bangladesh[421]

HHQ-16 NAVAL SAM

Overview: Like most of the other SAMs in the HQ family, the HHQ-16 [海红旗-16] is a ship-borne variant of the land-based HQ-16 that is largely identical in capabilities. Unusually for this family of systems, though, it was originally developed as a naval system, with assistance from Russia. It is based on the Russian Buk missile system.[422] As of the end of 2023, the system is deployed on two *Hangzhou* destroyers, one Type 051B *Luhai* destroyer, and an unknown number of the PLAN's 39 Type 054A *Jiangkai II* frigate. The missiles appear to be guided by integrated ship-based radar and fire-control systems, which are detailed for each type of ship in the next section.[423]

Figure 63: HHQ-16 SAM

Entered into Service: 2011[424]

Platform Manufacturer: Shanghai Academy of Spaceflight Technology

PLA Services: PLAN

Networkable: Unknown

Platform aliases: LY-80 (export designation)

Exported to: Pakistan[425]

AIRCRAFT CARRIERS

Overview: China currently operates two aircraft carriers, the *Liaoning* (also designated Type 001) and the *Shandong* (designated Type 002), with a third, the *Fujian* (Type 003), still undergoing sea trials as of late 2024. The two in-service carriers operate the HHQ-10 SAM system; while it is not yet certain which SAM system the *Fujian* will carry, commentators in China report the HHQ-10 systems may have already been installed on it.[426]

China's in-service aircraft carriers also operate the H/PJ-11 (Type 1130) close-in weapon system (CIWS), which reportedly utilizes a Type 364 2D search radar and a Type 349 targeting radar.[427] The Type 364 is a parabolic design operating in the H/I bands that detects surface and low-altitude targets, and it can reportedly be paired with not only the H/PJ-11 but also the Type 730 (H/PJ-12) and AK630 CIWS.[428] Multiple reports indicate it operates well under strong interference. The Type 349 is likely a dual X/J-band radar, and it is integrated on the gun mount of the CIWS it is paired with. It has at least three variants: Type 349, 349A, and the export version, LR66. The 349A incorporates an additional set of optoelectronic tracking equipment.[429]

China's aircraft carriers also carry a Type 346 S-band AESA surveillance radar, which is used on a number of the PRC's other naval platforms as well.[430] This radar is thought to operate in the S- and C-bands. It reportedly comes in three variants: the Type 346, the Type 346A, and Type 346B.[431] The 346 is housed in a curved panel, while the 346A and the 346B are behind flat panels due to an upgraded liquid cooling system.[432]

Radar Deployment:

- Type 364: Early 2000s
- Type 349: Possibly early 2000s
- Type 346: Early 2000s
- Type 366: Mid-2000s

Radar Manufacturers:

- Type 364: Yangzhou Marine Electronic Instrument Research Institute, also known as the CSSC 723rd Research Institute (part of the CSSC 8th Academy as of 2018)[433]
- Type 349: CETC 20th Research Institute[434]
- Type 346: CETC 14th Research Institute (now part of CETC Glarun Group Co.)
- Type 366: Unknown

Radar Detection Range:

- Type 364: >18km[435]
- Type 349: ~18km[436]
- Type 346: ~450km[437]
- Type 366: 250km (active) / 450km (passive)[438]

Networkable:

- Type 364: Unknown
- Type 349: Unknown, but unlikely
- Type 346: Likely
- Type 366: Yes

Radar Aliases:

- Type 364: H/LJQ-364, often confused with the SR64[439]
- Type 349: H/LJP-349, LR-66 (export designation)
- Type 346: H/LJG-346 / 346A / 346B; “Star of the Sea” [海之星], Dragon Eye (NATO designation)
- Type 366: H/LJQ-366, Band Stand (NATO designation)

Figure 64: Type 364 Radar

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Figure 65: Type 349 Radar

Figure 66: Type 346 Radar

Figure 67: Type 346A/B Radar

DESTROYERS

Overview: The PRC currently operates two broad types of destroyers: the Type 051B (*Luhai*-class) and the Type 052 family, which includes the baseline Type 052 (*Luhu*-class), the Type 052B (*Luyang*-I class), the Type 052C (*Luyang*-II class), and the Type 052D (*Luyang*-III class). All of these vessels incorporate SAM systems and CIWS of various types, with their associated radars:[440]

Type 051B: HHQ-16 SAM and H/PJ-11 CIWS

Type 052: HHQ-7 SAM and H/PJ-12 CIWS

Type 052B: (Russian) 9M317E Shtil-1 SAM and H/PJ-12 CIWS

Type 052C: HHQ-9 SAM and H/PJ-12 CIWS

Type 052D: HHQ-9B, HHQ-10 SAMs, and H/PJ-12 CIWS

In addition to these SAM and CIWS radars, the PRC's destroyer fleet operates several other surveillance and fire control radar types. Those that have been publicly identified are detailed below, categorized by type.

Type 360 Surveillance Radar

Equipped on the Type 051B destroyer, the Type 360S [360S 型] radar is a surface and low-altitude search radar that uses a parabolic antenna.[441] It can be paired with the older HHQ-7 SAM system, which is still deployed on the Type 052, possibly indicating this radar is used on that model of destroyer, as well. Most public reports treat the 360S as identical to the baseline Type 360 radar, which would mean it operates in the E/F band, but one unverified report indicates the "S" stands for S-band.[442] The details below are based on the Type 360.

Deployment Date: Early 2000s

Manufacturer: Yangzhou Marine Electronic Instrument Research Institute, also known as the China State Shipbuilding Corporation (CSSC) 723rd Research Institute (as of 2018, this is part of the CSSC 8th Academy)

Radar Detection Range: 250km[443]

Networkable: Unknown

Radar Aliases: H/LJQ-360, "Seagull" [海鸥], SR60 (export variant), sometimes erroneously labeled the Type 362 [362 型]

Type 346 Surveillance Radar

Equipped on the Type 052C and Type 052D destroyers, the Type 346 radar is an S-band AESA surveillance radar, which is used on a number of the PRC's other naval platforms as well (see pp. 85-86 and p. 95).[444] This radar is thought to operate in the S- and possibly C-bands. It reportedly comes in three variants: the Type 346, the Type 346A, and Type 346B, though the 346B is probably only deployed on Type 055 cruisers.[445] The 346 is housed in a curved panel, while the 346A and the 346B are behind flat panels due to an upgraded liquid cooling system.[446]

Deployment Date: Early 2000s

Manufacturer: CETC 14th Research Institute (now part of CETC Glarun Group Co.)

Radar Detection Range: ~450km[447]

Networkable: Likely

Radar Aliases: H/LJG-346 / 346A / 346B; “Star of the Sea” [海之星], Dragon Eye (NATO designation)

Type 366 Over-the-Horizon Radar

The Type 366 radar is an advanced “fourth generation” over-the-horizon radar that is equipped on most of the ships in the PLA’s surface fleet, including the Type 001 aircraft carrier; the Type 051C, Type 052B, Type 052C, and Type 052D destroyers, and the Type 054A frigates.[448] It is an indigenous Chinese design based on the Russian Mineral-ME over-the-horizon radar. It is also used on land-based installations, and multiple Type 366 radars can exchange information to triangulate and locate targets.[449] It has both active and passive modes and appears able to both identify targets in surveillance mode and provide targeting guidance.[450]

Deployment Date: Mid-2000s[451]

Manufacturer: Unknown

Detection Range: 250km (active) / 450km (passive)[452]

Networkable: Yes

Aliases: H/LJQ-366, Band Stand (NATO designation)

Figure 68: Type 366 Radar

Type 382 "Sea Eagle" Surveillance Radar

Equipped on the Type 051B, the Type 052, and the Type 052B destroyers, the Type 382 [382型], also known as the "Sea Eagle," is an S-band radar using a frequency-sweep dimensional phased array design.[453] It is deployed on a number of PLAN systems. A "Sea Eagle" shore-to-ship or ship-to-ship missile system, including low-altitude radars, is also in operation in China, but it is unclear whether the two Sea Eagle systems are related.

Deployment Date: Late 2010s[454]

Manufacturer: Nanjing Marine Radar Research Institute, also known as the CSSC 724th Research Institute

Radar Detection Range: >200km[455]

Networkable: Unknown

Radar Aliases: H/LJQ-382, "Sea Eagle" [海鷹]

Type 517 Surveillance Radar

The Type 517 is a meter-wave long-range surveillance radar dubbed the "Knife Rack" that may still be deployed on some destroyers, though scattered reports indicate it is either being removed from service or has already been removed.[456]

Deployment Date: Unknown

Manufacturer: Beijing Leiyin Electronic Technology Development Corporation[457]

Radar Detection Range: >300km[458]

Networkable: Unknown

Radar Aliases: H/LJQ-517, "Knife Rack" / "Knife Rest" [刀架]

Figure 69: Type 517 Radar

Type 518 Surveillance Radar

Equipped on at least the Type 052D destroyer and possibly other variants, the Type 518 [518 型] is a 2D L-band long-range search radar.[459] Chinese-language media describe it as an iconic feature of the Type 052 destroyer. It may be paired with an imported French "Sea Tiger" radar due to a relatively slow refresh rate and blind spots at medium and low altitudes.[460]

Deployment Date: Unknown
Radar Manufacturer: Nanjing Changjiang Electronic Information Industry Group Co.
Radar Detection Range: 360km[461]
Networkable: Unknown
Radar Aliases: "God's Eye" [神眼], REL-2 (export designation)[462]

Type 344 Fire Control Radar

The Type 344 [344 型] fire control radar is used on the Type 051B, the Type 052, the Type 052B, and the Type 052C destroyers, in addition to the Type 054 and Type 054A frigates. After around 1990, it became the standard fire control radar on China's destroyers. It operates in the I/J band and integrated an optoelectronic tracking system as well as a laser ranging system, and can track two targets simultaneously.[463]

Deployment Date: ~1990
Manufacturer: CETC 20th Research Institute
Detection Range: ~25km[464]

Networkable: Unknown
Aliases: H/LJP-344, MR34 (export variant)

Type 345 Fire Control Radar

Thought to be a replica of the French-made Thomson-CSF Castor 2J/C, the Type 345 fire control radar is also commonly used on PLAN ships, including the Type 052 destroyer.[465] It operates in the J-band and integrates infrared and optoelectronic supplementary trackers. It was often paired with the HHQ-7 SAM system and may have been designed specifically for that task.[466]

Deployment Date: Possibly late 1980s[467]
Manufacturer: Unknown
Detection Range: ~30km for aircraft, ~15km for anti-ship missiles[468]
Networkable: Unknown
Aliases: H/LJP-345, MR35 (export variant), Fog Lamp

Type 347 Fire Control Radar

The Type 347 [347 型] fire control radar is deployed on virtually all PLAN ships, including the Type 052, the Type 052C, and the Type 052D destroyers. Operating in the I-band, this radar is often thought to have both a search variant (Type 347S) and a fire control variant (Type 347G), but one recent Chinese report is skeptical of this and views it as only having fire control capabilities.[469]

Deployment Date: Late 1980s[470]
Manufacturer: CETC 20th Research Institute[471]
Detection Range: 30km (for aircraft) / 10-15km (for missiles)[472]
Networkable: Unknown
Aliases: H/LJP-347, Type 347G [347Gx 型], Type 347S [347S 型], "Rice Bowl" [米筛], "Rice Lamp" [谷灯], EFR-1 (export designation)

Figure 70: Type 347 Radar

FRIGATES

Overview: The PLAN currently operates two broad types of frigate: the Type 053H3 *Jiangwei* II and the Type 054 *Jiangkai*. The *Jiangwei* II frigates in operation include two of the baseline system and two of an upgraded version. Two of the baseline *Jiangkai* are in also operation, but the vast majority of China's frigates are the Type 054A *Jiangkai* II, of which 39 were in operation as of late 2023. All frigates operate SAM systems and some also carry CIWS:[473]

Type 053H3: HHQ-7 SAM, no CIWS

Type 053H3 (upgraded): HHQ-10 SAM, no CIWS

Type 054: HHQ-10 SAM and AK630 CIWS (Russian make)

Type 054A: HHQ-16 SAM and two of either the H/PJ-11 or the H/PJ-12 CIWS

In addition to the radars incorporated into those air defense systems, the PRC's frigates have been reported to operate a number of other air defense radars.

Type 354 Surveillance Radar

The Type 354 G/H-band radar was among China's first indigenously developed low-altitude air search radars, and was widely deployed in the PLAN in the 1980s and 1990s. Some reports indicate it was used on the Type 053H3 frigate at one time.[474] While Chinese observers occasionally claim that it may still be in service, most Chinese-language reports indicate that it has been replaced by the Type 360 or its successor, the Type 364.[475]

Deployment Date: ~1974[476]

Radar Manufacturer: Nanjing Marine Radar Research Institute, also known as the 724th Research Institute[477]

Radar Detection Range: ~100km[478]

Networkable: Unlikely

Radar Aliases: Eye Shield [眼罩], H/LJQ-354, MX902

Type 360 Surveillance Radar

Equipped on the Type 053H3 frigates, the Type 360 [360 型] radar is a 2D surface and low-altitude search radar that uses a parabolic antenna.[479] It operates in the E/F band and can reportedly be paired with the older HHQ-7 SAM system.

Deployment Date: Early 2000s

Manufacturer: Yangzhou Marine Electronic Instrument Research Institute, also known as the China State Shipbuilding Corporation (CSSC) 723rd Research Institute (as of 2018, this is part of the CSSC 8th Academy)

Radar Detection Range: 250km[480]

Networkable: Unknown

Radar Aliases: H/LJQ-360, "Seagull" [海鸥], SR60 (export variant), sometimes erroneously labeled the Type 362 [362 型]

Type 366 Over-the-Horizon Radar

The Type 366 radar is an advanced "fourth generation" over-the-horizon radar that is equipped on most of the ships in the PLA's surface fleet, including the Type 001 aircraft carrier; the Type 051C, Type 052B, Type 052C, and Type 052D destroyers, and the Type 054A frigates.[481] It is an indigenous Chinese design based on the Russian Mineral-ME over-the-horizon radar. It is also used on land-based installations, and multiple Type 366 radars can exchange information to triangulate and locate targets.[482] It has both active and passive modes and appears able to both identify targets in a surveillance mode and provide targeting guidance.[483]

Deployment Date: Mid-2000s[484]
Manufacturer: Unknown
Detection Range: 250km (active) / 450km (passive)[485]
Networkable: Yes
Aliases: H/LJQ-366, Band Stand (NATO designation)

Figure 71: Type 366 Radar

Type 382 "Sea Eagle" Surveillance Radar

Equipped on the Type 054 and Type 054A frigates, the Type 382, also known as the "Sea Eagle," is an S-band radar using a frequency-sweep dimensional phased array design.[486] It is deployed on a large number of PLAN systems. A "Sea Eagle" shore-to-ship or ship-to-ship missile system, including low-altitude radars, is also in operation in China, but it is unclear whether the two Sea Eagle systems are related.

Deployment Date: Late 2010s[487]

Manufacturer: Nanjing Marine Radar Research Institute, also known as the CSSC 724th Research Institute

Radar Detection Range: >200km[488]

Networkable: Unknown

Radar Aliases: H/LJQ-382, "Sea Eagle" [海鹰], "Top Plate" [顶板]

Type 517 Surveillance Radar

The Type 517 is a meter-wave long-range surveillance radar dubbed the "Knife Rack" that may still be deployed on the Type 053H3 frigate, though scattered reports indicate it is either being removed from service or has already been removed.[489]

Deployment Date: Unknown

Manufacturer: Beijing Leiyin Electronic Technology Development Corporation[490]

Radar Detection Range: >300km[491]

Networkable: Unknown

Radar Aliases: H/LJQ-517, "Knife Rack" / "Knife Rest" [刀架], Type 517H-1, SUR-17 (export variant)

Type 344 Fire Control Radar

The Type 344 fire control radar is used on the Type 051B, the Type 052, the Type 052B, and the Type 052C destroyers, in addition to the Type 054 and Type 054A frigates. After around 1990, it became the standard fire control radar on China's destroyers. It operates in the I/J band and integrated an optoelectronic tracking system as well as a laser ranging system, and can track two targets simultaneously.[492]

Deployment Date: ~1990

Manufacturer: CETC 20th Research Institute

Detection Range: ~25km[493]

Networkable: Unknown

Aliases: H/LJP-344, MR34 (export variant)

Figure 72: Type 344 Radar

Type 345 Fire Control Radar

Thought to be a replica of the French-made Thomson-CSF Castor 2J/C, the Type 345 fire control radar is also commonly used on PLAN ships, including the Type 054 and Type 054A frigates.[494] It operates in the J-band and integrates infrared and optoelectronic supplementary trackers. It was often paired with the HHQ-7 SAM system and may have been designed specifically for that task.[495]

Deployment Date: Possibly late 1980s[496]

Manufacturer: Unknown

Detection Range: ~30km for aircraft, ~15km for anti-ship missiles[497]

Networkable: Unknown

Aliases: H/LJP-345, MR35 (export variant), Fog Lamp

Type 347 Fire Control Radar

The Type 347 fire control radar is deployed on virtually all PLAN ships, including the Type 053H3 and Type 054A frigates. Operating in the I-band, this radar is often thought to have both a search variant (Type 347S) and a fire control variant (Type 347G), but one recent Chinese report is skeptical of this and views it as only having fire control capabilities.[498]

Deployment Date: Late 1980s[499]

Manufacturer: China Electronics Technology Group Corporation (CETC) 20th Research Institute[500]

Detection Range: 30km (for aircraft) / 10-15km (for missiles)[501]

Networkable: Unknown

Aliases: H/LJP-347, Type 347G, Type 347S, "Rice Bowl" [米筛], "Rice Lamp" [谷灯], EFR-1 (export designation)

CRUISERS

Overview: As of late 2023, the PRC operates eight Type 055 (*Renhai*) cruisers that carry both the HHQ-9 and HHQ-10 SAM systems, as well as the H/PJ-11 CIWS, all with their associated radars.[502] One analyst writing in the U.S. Naval Institute's *Proceedings* journal referred to these cruisers not just as China's own premier surface combatants, but also as "among the most formidable warships afloat." In addition to SAM systems, they carry ship-to-ship missiles and may be capable of carrying antisubmarine missiles.[503] They reportedly play a central role in carrier group air defense for the PLAN, and they have been likened to the U.S. Navy's *Ticonderoga*-class cruisers.[504] They reportedly carry the Type 346B surveillance radar system.

Type 346B Surveillance Radar

Equipped on the Type 055 cruisers, the Type 346B AESA radar is an upgraded variant of the Type 346 radar carried on the Type 052D destroyers and other PLAN ships. Likely also an S-band AESA surveillance radar, but possibly with dual-band capabilities, the 346B probably has a longer detection range given that its arrays are around 40 percent larger than those of the baseline Type 346. State media reported in 2020 that it could detect satellites in orbit.[505]

Deployment Date: ~2017[506]
Manufacturer: CETC 14th Research Institute (now part of CETC Glarun Group Co.)
Radar Detection Range: >450km[507]
Networkable: Likely
Radar Aliases: H/LJG-346B; "Star of the Sea" [海之星], Dragon Eye (NATO designation)

CORVETTES

Overview: As of late 2023, the PRC operates 50 Type 056A (*Jiangdao*) corvettes, which carry the HHQ-10 SAM system.[508] While their intended role is primarily coastal defense—they are reportedly in the process of being transferred from the PLAN to the China Coast Guard—they also carry the Type 360 surveillance radar and the Type 347 fire control radar.[509]

Type 360 Surveillance Radar

Also equipped on the Type 053H3 frigates, the Type 360 radar is a 2D surface and low-altitude search radar that uses a parabolic antenna.[510] It operates in the E/F band and can reportedly be paired with the older HHQ-7 SAM system.

Deployment Date: Early 2000s

Manufacturer: Yangzhou Marine Electronic Instrument Research Institute, also known as the China State Shipbuilding Corporation (CSSC) 723rd Research Institute (as of 2018, this is part of the CSSC 8th Academy)

Radar Detection Range: 250km[511]

Networkable: Unknown

Radar Aliases: H/LJQ-360, "Seagull" [海鸥], SR60 (export variant), sometimes erroneously labeled the Type 362

Type 347 Fire Control Radar

The Type 347 fire control radar is deployed on virtually all PLAN ships, including the Type 052, the Type 052C, and the Type 052D destroyers. Operating in the I-band, this radar is often thought to have both a search variant (Type 347S) and a fire control variant (Type 347G), but one recent Chinese report is skeptical of this and views it as only having fire control capabilities.[512]

Deployment Date: Late 1980s[513]

Manufacturer: CETC 20th Research Institute[514]

Detection Range: 30km (for aircraft) / 10-15km (for missiles)[515]

Networkable: Unknown

Aliases: H/LJP-347, Type 347G, Type 347S, "Rice Bowl" [米筛], "Rice Lamp" [谷灯], EFR-1 (export designation)

AIR DEFENSE RADAR MANUFACTURERS

081 ELECTRONICS GROUP COMPANY

Overview: With origins in the 1960s as part of the PRC's "Third Front" strategy to develop an industrial base in interior China to hedge against the possibility of attacks on the eastern coast, 081 Electronics Group Company [零八一电子集团有限公司] is today reportedly one of the "backbone" enterprises of China's short-range air defense capabilities.[516] As of 2023, its assets amount to 3.3 billion RMB (~$463 million USD),[517] and while reports vary, it may employ between 500-2,000 people.[518]

In addition to designing and producing military radars for both air defense and space surveillance operations, 081 Electronics Group Company's broader military electronics portfolio includes products serving the PLA's artillery, air defense forces, armored forces, air force, navy, ballistic missile force, and test bases.[519] It also offers a wide range of services that are not exclusive to the military: among other things, it produces household appliances, designs and manufactures integrated circuits, offers a range of manufacturing capabilities, and manages a portfolio of non-residential properties.[520] It should not be confused with a similarly named tractor/tank factory in Henan or with any similarly named PLA bases.

Year Established: 2006

Aliases:
- 081 Factory [081 厂 / 081 总厂] (previous incarnation)
- 081 Base [081 基地]
- Lingbaiyi Electronic Group Co., Ltd.

Websites:
- http://www.081.com.cn (defunct, 2002 version archived at https://web.archive.org/web/20020928233904/http://081.com.cn:80/)

Subordinate to:
- Since 2018: Sichuan Changhong Electronic Co., Ltd. (Changhong) [四川长虹电子控股集团有限公司]
- Prior to 2018: Sichuan Electronic Military Industry Group Co., Ltd. [四川电子军工集团有限公司], which is itself a Changhong subsidiary.

Notable Air Defense Radar Products:

- 3D multi-functional active phased array radar with electronic scanning and high measurement accuracy, unspecified designation[521]
- "Fire Eye" lightweight battlefield reconnaissance radar [火眼轻型战场侦察雷达][522]
- Radars for anti-aircraft guns, unspecified designations [军用高炮雷达][523]
- S-band coherent pulse 3D phased array radar for the FB-6 series of SHORAD platforms[524]
  - Some reports indicate this is a stealth-penetrating radar[525]
- "Sky Eye" X-band low-altitude surveillance radar [天眼 X 波段低空监视雷达][526]

- "Sky Dome" multifunctional search radar ["天穹"多功能搜索雷达][527]
  - Appears to have received 990,000 RMB (~$140,000 USD) in government subsidies[528]
- "Sky Screen" [天幕] counter-UAV system[529]
- "Sky Shield" counter-UAV weapon system ["天盾"反无人机武器系统][530]

Notable Relationships:

- Guangyuan Municipal Government: strategic reorganization agreement[531]
  - To allow Changhong to reorganize the 081 Group in 2022
- Chengdu University, School of Electronic Information and Electrical Engineering [成都大学电子信息和电气工程学院]: school-enterprise cooperation agreement[532]
  - Focused on both helping students get jobs with the company and on cooperation in scientific research and personnel training[533]
- Harbin Huade University Intelligent Manufacturing Engineering College [哈尔滨华德学院智能制造工程学院]: weeklong exchange visit in July 2023[534]

Known Subsidiaries:

- 081 Electronics Group Co. Beijing Branch [零八一电子集团有限公司北京分公司] (likely 100% ownership)[535]
- 081 Electronics Group Co. Chengdu Hi-Tech Branch [零八一电子集团有限公司成都高新分公司] (likely 100% ownership)[536]
- 081 Electronics Group Co., Ltd Equipment Manufacturing Branch [零八一电子集团有限公司装备制造分公司] (likely 100% ownership; now defunct)[537]
- 081 Electronics Group Co. Sci-Tech Branch [零八一电子集团有限公司科技分公司] (likely 100% ownership)[538]
- 081 Electronics Group Sichuan Honglun Machinery Co. [零八一电子集团四川红轮机械有限公司] (100% ownership)[539]
- 081 Electronics Group Sichuan Liyuan Electronics Co. [零八一电子集团四川力源电子有限公司] (100% ownership)[540]
- 081 Electronics Group Sichuan Tianyuan Machinery Co. [零八一电子集团四川天源机械有限公司] (100% ownership)[541]
- 081 Electronics Group Fire Control Technology (Chengdu) Co. [零八一电子集团火控科技（成都）有限公司] (49% ownership)[542]
- 081 Electronics Group Sichuan Tianhong Defense Technology Co. [零八一电子集团四川天弘防务科技有限公司] (100% ownership)[543]

Directly Subordinate Organizations

- Provincial-level Enterprise Technology Center [省级企业技术中心][544]
- Provincial-level Key Laboratory [省级重点试验室][545]

- Postdoctoral Research Workstation[546]

Key Personnel

- Yang Yanhui [杨艳辉]: chair[547]
- Zheng Jun [郑俊]: general manager, director, and legal representative
- Li Xiangang [李先刚]: director
- Suo Weicheng [索伟成]: director
- Yang Dan [阳丹]: director

Addresses:

- 081 Industrial Park, Tashan Bay, Xiaxiba Street, Lizhou District, Guangyuan, Sichuan [四川省广元市利州区下西坝街道塔山湾零八一工业园]
  - Likely also known as Tashan Bay Industrial Park, Xiaxi Street, Lizhou District, Guangyuan, Sichuan [四川省广元市利州区下西街道塔山湾工业园]
  - Mailbox (possibly at the same location): Box 122, Lizhou District, Guangyuan [广元市利州区 122 信箱]
- Nanling Village, Lizhou District, Guangyuan, Sichuan [四川省广元市利州区南陵村]
- Tashan Bay Area, Guangyuan, Sichuan [广元市塔山湾片区]
- No. 6, Dongda Street Section, Jinjiang District, Chengdu, Sichuan [四川省成都市锦江区东大街段 6 号]
- Pidu District, Chengdu, Sichuan [四川省成都市郫都区] (may just be subordinates)

BEIJING LEIYIN ELECTRONIC TECHNOLOGY DEVELOPMENT CORPORATION

Overview: The Beijing Leiyin Electronic Technology Development Corporation [北京雷音电子技术开发有限公司] is one of the primary suppliers of radar equipment to the PLAN.[548] A holding company for the China Shipbuilding Industry Systems Engineering Research Institute [中国船舶工业系统工程研究院], it is broadly focused on radar-related products, national defense and law enforcement, environmental sensing, and communications equipment.[549]

Beijing Leiyin is relatively small, with between 100-200 employees as of 2022 and total assets of 313 million RMB (~$44 million USD).[550] Ultimate ownership rests, through a number of intermediaries, with Suzhou City's Wuzhou District Government [苏州市吴中区人民政府] (74.36% since October 2023) and the Beijing municipal government [北京市人民政府国有资产监督管理委员会] (25.64% since October 2011).[551] It is active in research as well as production of radars.

Year Established: 1997

Aliases:
- Leiyin Company [雷音公司]
- Leiyin Electronics [雷音电子]
- Beijing Leiyin Electronics [北京雷音电子]
- (NOT the same as Leiyin Group [雷音集团])

Websites:
- https://www.leiyin.cn/
- https://web.archive.org/web/20121028183151/http://www.chinaleiyin.com:80/company.asp (defunct)

Subordinate to:
- China State Shipbuilding Corporation [中国船舶集团有限公司]

Notable Air Defense Radar Products:
- Type 517 meter-wave shipborne radar [H/LJQ-517 型警戒雷达][552]
  - Became a standard configuration on PLAN warships by 2020[553]
  - May be the air-search radar component of the "Chinese Aegis" platform[554]

Notable Relationships:
- Southwestern Air Traffic Management Bureau [西南空管局]: supported repair of weather radars after the 2008 Sichuan earthquake[555]
- Ocean University of China [中国海洋大学]: research into technology for detecting maritime targets and maintaining "national marine security" [国家海洋安全][556]

Known Subsidiaries:
- N/A

Directly Subordinate Organizations:
- N/A

Key Personnel:
- Huang Qiang [黄强]: Chairman of the Board (since August 2023)[557]

- Ma Donglin [马东林]: Manager, director, legal representative, and beneficial owner [受益所有人][558]
- Gu Zhangtao [顾章涛]: Director, financial manager[559]
- Yang Weilan [杨炜岚]: Director[560]
- Li Yingping [李英平]: Director[561]
- Yan Min [严敏]: Director[562]
- Gao Qianqian [高倩茜]: Director[563]
- Zou Jiawen [邹家文]: Chairman of the Supervisory Board [监事会主席][564]

Addresses:

- Building 4, No. 1, Haiying Road, Fengtai District, Beijing [北京市丰台区海鹰路 1 号院 4 号楼]
- Wuzhou District High-tech Zone, Suzhou, Jiangsu [苏州市吴中高新区] – new headquarters

CASC Shanghai Academy of Spaceflight Technology (SAST)

Overview: The Shanghai Academy of Spaceflight Technology [上海航天技术研究院] (SAST), also known as the CASC 8th Academy, subordinate to the major defense conglomerate China Aerospace Science and Technology Corporation (CASC), describes itself as one of the largest suppliers of advanced aerospace technology and air defense products in China. In addition to its core foci on air defense and military space technologies, its products have civilian applications in areas like lithium batteries, composite materials, and photovoltaics. The company is large and prestigious, boasting around 20,000 employees, 500 of which have Ph.D.s and 4,000 of which have master's degrees. Roughly half of its employees focus on research and development.[565]

SAST has been on the U.S. Department of Commerce's Entity List since 1999, though the list's entry has been modified several times with updated addresses, names, and aliases. SAST's missile systems such as the HQ-64 / LY-60, FN-6 / HY-6, and HQ-2 have been exported widely to countries including Albania, Cambodia, Iran, Malaysia, Pakistan, Peru, Sudan, and Thailand. It also designs and manufactures many parts for the Long March [长征] series of space launch rockets, which continue to be central to China's space launch operations.[566]

Notable Air Defense Radar Products:

- 3D radar for the HQ-16 / LY-80 SAM system[567]
    - Some versions of this system appear to use active phased array technology, but it is unclear whether SAST also manufactures them[568]

Year Established: 1961

Aliases:

- China Aerospace Science and Technology Corporation (CASC) Eighth Academy [中国航天科技集团有限公司第八研究院]
- Shanghai Academy of Space Technology [上海空间技术研究院]
- Shanghai Bureau of Astronautics [上海航天局]
- Eighth Academy [八院 / 航天八院]
- Shanghai Bureau of Space
- SHBOA
- Shanghai Astronautics Industry Bureau
- Shanghai Aerospace Technology Research Institute
- Shanghai Second Bureau of Electromechanical Industry [上海市第二机电工业局] (former)
- Eighth Research Institute of China Aerospace Science and Technology Corporation (erroneous)
- 8th Research Academy of China Aerospace (erroneous)

Websites:

- http://www.sast.spacechina.com/
- http://www.sast.cn/
- http://www.sast.net/ (English)

Subordinate to:

- China Aerospace Science and Technology Corporation (CASC)

- Dual-band solid-state active phased array radar for the A8-TG680 Guidance Vehicle [跟踪制导雷达车][569]
    - Can search for and track multiple targets, supports surface-to-air missile systems

Notable Relationships:

- N/A

Known Collaborations:

- N/A

Known Subsidiaries:

- 149 Factory [149 厂] / Shanghai Aerospace Equipment Manufacturer Co. (SAEM) [上海航天设备制造总厂有限公司][570]
- 509 Institute [509 所]; Shanghai Institute of Satellite Engineering (SISE) [上海卫星工程研究所][571]
- 800 Institute [800 所]; Shanghai Spaceflight Precision Machinery Institute [上海航天精密机械研究所][572]
- 802 Institute [802 所] / Shanghai of Radio Equipment Research Institute [上海无线电设备研究所][573]
- 803 Institute [803 所] / Shanghai Institute of Aerospace Control Technology (SACTI) [上海航天控制技术研究所][574]
- 804 Institute [804 所] / Shanghai Aerospace Electronics Technology Institute [上海航天电子技术研究所][575]
- 805 Institute [805 所] / Aerospace System Engineering Shanghai [上海宇航系统工程研究所][576]
- 806 Institute [806 所] / Shanghai Space Propulsion Technology Research Institute [上海航天动力技术研究所][577]
- 808 Institute [808 所] / Shanghai Institute of Aerospace Technology Foundation [上海航天技术基础研究所][578]
- 811 Institute [811 所] / Shanghai Institute of Space Power Sources (SISP) [上海空间电源研究所][579]
- 812 Institute [812 所] / Shanghai Institute of Spacecraft Equipment [上海卫星装备研究所][580]
- Aerospace Engineering Equipment (Suzhou) Co. [航天工程装备（苏州）有限公司][581]
- Aerospace Wuxi Health Management Center [航天无锡健康管理中心][582]
- Eighth Design Department [第八设计部/八部][583]
- SAST / Eighth Academy Beijing R&D Center [八院北京研发中心][584]

- Shanghai Aerospace Automobile Electromechanical Co., Ltd [上海航天汽车机电股份有限公司][585] (26.45% ownership as of January 11, 2024)[586]
- Shanghai Aerospace Industry (Holding) Co. [上海航天工业（集团）有限公司] / Shanghai Aerospace Energy Co. [上海航天能源股份有限公司][587] (44.21% ownership as of March 28, 2024)[588]
- Shanghai Aerospace Science & Innovation Development Co. [上海航天科创企业发展有限公司][589] (68.44% ownership as of March 29, 2024)[590]
- Shanghai Aerospace Industrial Co. [上海航天实业有限公司][591]
- Shanghai Aerospace Guohe Technology Development Co., Ltd 上海航天国合科技发展有限公司
- Shanghai Aerospace Technology Co. [上海航天空间技术有限公司][592] (44.98% ownership as of March 27, 2024)[593]
- Shanghai Astronautic Architectural Design Institute Co. [上海航天建筑设计院][594] (100% ownership as of November 21, 2023)[595]
- Shanghai Composite Material & Technology Co. Ltd [上海复合材料科技有限公司][596]
- Shanghai Shenhang Import & Export Co. [上海申航进出口有限公司][597]

Other Entities Invested In:

- Aerospace Investment Holdings Ltd. [航天投资控股有限公司] (ownership percentage unknown)[598]
- Aerospace Long March International Trade Co. [航天长征国际贸易有限公司] (20% ownership as of March 26, 2024)[599]
- Aerospace Science and Technology Finance Co. [航天科技财务有限责任公司] (10.01% ownership as of March 26, 2024)[600]
- Aerospace Science and Technology Rocket Technology (Shanghai) Co. [航天科技火箭技术（上海）有限公司] (1.17% ownership as of April 2, 2024)[601]
- Aerospace Times Real Estate Development Co. [航天时代置业发展有限公司] (6.67% ownership as of August 3, 3018)[602]
- Beijing Shenzhou Aerospace Software Technology Co. [北京神舟航天软件技术股份有限公司] (ownership percentage unknown)[603]
- Four-Dimensional Gaojing Satellite Remote Sensing Co. [四维高景卫星遥感有限公司] (7.17 ownership as of March 28, 2024)[604]
- Pinghu Shenjian Aerospace Technology Co. [平湖神箭航天科技有限公司] (100% ownership as of March 5, 2024)[605]
- Shanghai Aerospace Guohe Technology Development Co., Ltd 上海航天国合科技发展有限公司] (1.95% ownership as of March 26, 2024)[606]

- Shanghai Aerospace Logistics Co. [上海航天物流有限公司] (100% ownership as of August 1, 2018)[607]
- Shanghai Aerospace Real Estate Investment and Development Co. [上海航天房地产投资发展有限公司] (100% ownership as of November 27, 2023)[608]
- Shanghai Military-Civilian Integration Industry Investment Management Co. [上海军民融合产业投资管理有限公司] (20.2% ownership as of July 20, 2022)[609]
- Shanghai Tianyu Shihong Enterprise Development Co. [上海天宇实宏企业发展有限公司] (0.11% ownership as of March 5, 2024)[610]

Directly Subordinate Organizations:

- N/A

Key Personnel:

- Sun Gang [孙刚]: Director [院长] and Deputy Party Secretary (April 2023)[611]
- Wang Bolan [王波兰]: Deputy Director, Party Secretary (April 2023)[612]
- Ma Jia [马佳]: Deputy Party Secretary (April 2023)[613]
- Gao Bo [高波]: Deputy Director (April 2023)[614]
- Chen Yu [陈宇]: Discipline Commission Secretary (April 2023)[615]
- Zhang Chunming [张春明]: Deputy Director (April 2023)[616]
- Li Xin [李昕]: Deputy Director, Chairman of the Institute’s Labor Union, and Secretary of the Party Committee of Shanghai Aerospace Industry (Group) Co. [上海航天工业（集团）有限公司], (April 2023)[617]
- He Wensong [何文松]: Deputy Director (April 2023)[618]
- Wang Wei [王玮]: Deputy Director, Chief Accountant (April 2023)[619]
- Ji Feng [吉峰]: Deputy Director (April 2023)[620]

Address:

- No. 3888 Yuanjiang Road, Minhang District, Shanghai [中国上海市闵行区元江路3888 号]

CASIC Aerospace Nanhu Electronic Information Co.

Overview: Aerospace Nanhu Electronic Information Co. [航天南湖电子信息技术股份有限公司] is a particularly prominent subsidiary of the 23rd Research Institute of CASIC's 2nd Academy. It focuses on the development, production, sales, and services of air defense early warning radars. While little information has been made public about the specifics of the company's radar products, its website claims that its air defense early warning products have become central to China's air defense early warning capabilities and that they are deployed in multiple branches of the PLA.[621]

External reports on the company indicate that it has accumulated deep experience in radar engineering, with particular expertise in seven key technologies: phased array radars, software-based radar, adaptive anti-jamming radars, target classification and identification, design of highly mobile and highly integrated structures, and the design of components for phased array antennas and transceivers.[622] It has approximately 800 employees and its year-on-year revenue in 2024 decreased 23.85% to 725.69 million RMB (~$102 million USD).[623]

Year Established: 1989

Aliases:
- Aerospace Nanhu [航天南湖]
- Aerospace Nanhu Company [航天南湖公司]
- Jingzhou Nanhu Machinery Co., Ltd. [荆州南湖机械股份有限公司 / 荆州南湖]
- Jingzhou Nanhu Machinery Factory [荆州市南湖机械总厂] (former)
- Shashi Nanhu Machinery Factory [沙市市南湖机械总厂 / 南机厂] (former)

Websites:
- http://htnh.fyjs.casic.cn/
- http://23s.fyjs.casic.cn/n15279683/index.htm/
- http://www.jznanhu.com/

Subordinate to:
- CASIC, as of 2016

Notable Air Defense Radar Products:

While little information about the specifics of Aerospace Nanhu's products has been made public, financial reports label the company a leader in air defense early warning radar [防空预警雷达领军者] and indicate it produces several target indicating radars [目标指示雷达], at least one surveillance radar [警戒雷达], radar protective equipment [雷达防护装备], and radar training equipment [雷达训练装备].[624] Some reports indicate the company may have built a radar for the HQ-9 long-range SAM system deployed by the PLA.[625]

Notable Relationships:
- N/A

Known Subsidiaries:
- N/A

Directly Subordinate Organizations:

- Low Altitude Division [低空事业部][626]

Key Personnel:

- Ding Bo [丁柏]: General Manager [总经理][627]
- Luo Huihua [罗辉华]: Legal Representative [法人代表][628]

Addresses:

- No. 51 Jinlong Road, Shashi District, Jingzhou City, Hubei Province [湖北省荆州市沙市区金龙路 51 号]
- No. 9, Jiangjin East Road, Jingzhou Economic and Technological Development Zone, Jingzhou City, Hubei Province [湖北省荆州市荆州经济技术开发区江津东路 9 号]

CASIC 2ND ACADEMY, 23RD RESEARCH INSTITUTE

Overview: CASIC's 23rd Research Institute (RI) [中国航天科工集团第二研究院二十三所] is immediately subordinated to CASIC's Second Academy, which describes itself as "the cradle of China's missile industry"[629] and manufactures a number of SAM systems such as the widely deployed HQ-7 (also known as the FM-80S and the FM-90) and HQ-9 (export designation FD-2000) SAM platforms.[630] The 23rd RI itself is specifically focused on radar technology, including SAM guidance systems, space-based radars, early warning radars, weather radars, and wind profiler radars.[631]

The 23rd RI is a heavyweight in its field. As of 2019, its annual operating income amounted to 10 billion RMB (~$1.4 billion USD),[632] and one report claimed that between 2013 and 2018, the 23rd RI accounted for 60% of the total research and development in the field of measurement radar systems since 1995.[633] Along with its parent organization, the 2nd Academy, it is responsible for the production of key radar-enabled SAM systems such as the HQ-9 and the "low-altitude hunter" HQ-17AE.[634]

Year Established: 1958

Aliases:
- 23rd Institute [23 所]
- Beijing Institute of Radio Measurement [北京无线电测量研究所]
- CASIC 23rd Institute [航天科工 23 所]
- Second Professional Design Department of the Second Branch of the Fifth Academy of the Ministry of National Defense [国防部五院二分院第二专业设计部]

Websites:
- http://www.casic23.com.cn/index.html
- http://23s.fyjs.casic.cn/
- https://web.archive.org/web/20190520221402/http://www.birm-weather.com:80/ (English-language site for the meteorological component of the Institute's work)

Subordinate to:
CASIC 2nd Academy [中国航天科工集团第二研究院]

Notable Air Defense Radar Products:

- LD-JPG600 long-range three-dimensional radar [LD-JPG600 远程三坐标雷达]: highly mobile early-warning radar that can be networked with other air defense systems.[635]
- Guidance radar for the HQ-2 SAM system[636]
  - Reportedly has strong anti-jamming capabilities[637]
  - Played a role in China's efforts to counter U-2 surveillance aircraft[638]
- Also involved in many other HQ-series SAM systems. Though there is little information on those radars or who developed them, it is likely the 23rd RI was responsible for many of the radar systems involved.

Notable Relationships:

- Beijing Institute of Technology [北京理工大学]: jointly established the Radar Ergonomics Joint Innovation Laboratory [雷达人机工程联合创新实验室] in April of 2019.[639]
- Henan Handa Network Technology Co. [河南汉达网络科技有限公司]: signed a strategic agreement in May 2018 to develop a component research and development process information management module system [组件研发流程信息管理模块系统].[640]
- Surveying and Mapping Emergency Security Center of the Sichuan Bureau of Surveying, Mapping, and Geoinformation [四川省测绘地理信息局测绘应急保障中心]: jointly established an InSAR Remote Sensing Technology Application Research Center in 2020.[641]
- Chinese Academy of Sciences Institute of High Energy Physics [中国科学院高能物理研究所]: signed a contract for the development of two sets of 350kW plused high-frequency power sources for the straight-line segment radio-frequency quadropole (RFQ) accelerator of the national-level China Scattered Neutron Source Project [国家级大科学装置“中国散裂中子源项目” 直线段 RFQ 加速器].[642]

Known Subsidiaries:

- Aerospace Advanced Manufacturing and New Materials Innovation Institute [航天先进制造与新材料创新研究院][643]
- Aerospace Nanhu Electronic Information Technology Co.[航天南湖电子信息技术股份有限公司] [644] (43.31% ownership)[645]
    - This company is a major center for the development and production of air defense radars (see profile on pp. 106-107)[646]
- Aerospace New Meteorological Technology Co. [航天新气象科技有限公司][647]
    - Established to provide a wide range of services for meteorological and environmental monitoring, civil aviation, emergency disaster management, agricultural ecology, transportation, and smart cities.[648]
- Beijing Aerospace Guangtong Technology Co. [北京航天广通科技有限公司/航天广通][649]
- Beijing Aerospace Micro-electronics Technology Co. [北京航天微电科技有限公司][650]
- CASIC Intelligent Industry Development Co. [航天科工智慧产业发展有限公司]
- Pinghu Lab Company and five sub-companies [平湖实验室公司五家下属公司][651]

Other Entities Invested In:

- Beijing Aerospace Science and Industry Century Satellite Technology Co. [北京航天科工世纪卫星科技有限公司] (4.29% ownership as of April 12, 2023)[652]

- Beijing Jintianhai Aerospace Technology Development Co. [北京金天海航天科技发展有限责任公司] (unknown percentage)[653]
- CASIC Intelligence Industry Development Co. [航天科工智慧产业发展有限公司][654]
- CASIC Space Engineering Development Company [航天科工空间工程发展有限公司][655]
- Chengdu Aerospace Bomu Electronic Technology Co. [成都航天博目电子科技有限公司][656]

Directly Subordinate Organizations:

- 14 specialized radar research laboratories[657]
- Development center in Chengdu[658]
- Large-scale antenna test field [大型天线试验场][659]
- Radar industrial park in Yi County, Hebei Province [易县雷达产业园][660]
- Radar production base in the Beijing suburbs[661]
- Radar research and development center in Yongding Road District [永定路地区][662]
- Xi'an Research and Development Center [西安研发中心][663]
- Wuhan Early Warning Radar Research Institute [武汉预警雷达研究院][664]

Key Personnel (as of 2021):

- Hu Qingrong [胡庆荣]: Director [所长][665]
- Zhang Zhe [张哲]: Deputy Director [副所长][666]
- Wang Zhuo [王卓]: Deputy Director [副主任][667]
- Ma Ning [马宁]: Deputy Director of Industrial Development Department [产业发展处副处长][668]
- Dong Liang [董亮]: Director of Industrial Development Department [产业发展处主管][669]
- Kang Shaozheng [康绍峥]: Director of the Ninth Office [九室主任康绍峥][670]
- Zhang Jian [张剑] Director for the Tenth Office [十室主任][671]

Addresses:

- 32nd Floor, No.50 Yongding Road, Haidian District, Beijing [北京市海淀区永定路 50 号 32 楼]
- P.O. Box 142, Compartment 203, Human Resources Department, No. 26, Beijing [北京 142 信箱 203 分箱 26 号人力资源处]
- Additional development and production locations in Beijing's Fengtai and Changping Districts, Hebei's Yi County, Hubei's Jingzhou, Wuhan, Xi'an, Chengdu, Nanjing, Wuxi, and Zhejiang's Pinghu.

CETC 10TH RESEARCH INSTITUTE

Year Established: 1955

Aliases:

- CETC 10th Institute [中国电科十所 / 中电 10 所]
- CETC Spaceon Co., Ltd. / CLP Tianao Co., Ltd. [中电天奥有限公司]
- Tianao Co. [天奥公司]
- Tianao Group Co. [天奥集团公司]
- CETC Tianao [中电天奥]
- ZDSS (likely short for Zhong Dian Shi Suo / 中电十所)
- Southwest Institute of Electronic Technology / SWIET / Southwest Research Institute of Electronics Technology [中国西南电子技术研究所] (former)
- 1st, 2nd, and 3rd Ministry of Machine Building 10th Research Institute [第一 / 二 / 三机械工业部第十研究所] (former)
- Ministry of Machinery and Electronic Industry 10th Research Institute [机械电子工业部第十研究所] (former)
- Ministry of the Electronics Industry 10th Research Institute [电子工业部第十研究所] (former)
- Ministry of Information Industry 10th Research Institute [信息产业部第十研究所] (former)

Overview: CETC's 10th Research Institute (RI) [中国电子科技集团公司第十研究所] was established in Beijing in 1955, then moved to Chengdu two years later. Today, it is focused on design and manufacturing of avionics information systems, intelligent information systems, and aerospace information services. It claims to have received more than 500 technological achievement awards from the national government, provincial governments, and government ministries.[672] A prime supplier for the PLA, it has also been involved in networking of the Beidou satellites, early warning aircraft systems, and the Chang'e lunar exploration missions.[673]

While radars are not the central focus of the 10th RI's work, it nonetheless manufactures a number of radar products, at least one of which—the ST-312 ground surveillance radar (which likely has the ability to detect low-altitude aircraft such as helicopters)—is likely in service with the PLA.[674] At the 10th World Radar Expo in 2023, the 10th RI exhibited 11 radar products, including not only the ST-312, but also a coastal surveillance radar and anti-interference communications equipment.[675] It has been on the U.S. Department of Commerce Bureau of Industry and Security's Entity List since 2016.[676]

Notable Air Defense Radar Products:

- SPPR-0450-DUAV low-altitude surveillance radar [SPPR-0450-DUAV 低空监视雷达][677]
- SPPR-0x50-MN/MS Solid-State Amplifier Navigation/Surveillance Radar [SPPR-0x50-MN/MS 固态功放导航/监视雷达][678]
- ST-312 ground surveillance radar: capable of detecting low-altitude aircraft[679]

Notable Relationships:

- CASIC 4th Academy 17th Research Institute [航天科工四院十七所]: Long-term cooperation
- Institute of Aerospace Information Innovation, Chinese Academy of Sciences [中国科学院空天信息创新研究院][680]
- Institute of Remote Sensing and Digital Earth, Chinese Academy of Sciences [中国科学院遥感与数字地球研究所][681]
- National Astronomical Observatories, Chinese Academy of Sciences [中国科学院国家天文台][682]
- National Satellite Ocean Application Center [国家卫星海洋应用中心][683]
- Tibet Entry-Exit Border Inspection Station [西藏出入境边防检查总站][684]
- Wuhan University [武汉大学][685]

Websites:

- http://10.cetc.com.cn/
- https://en.18.cetc.com.cn/10/338199/index.html
- https://web.archive.org/web/20220630131449/https://baikeshot.cdn.bcebos.com/reference/10392945/ea12ee3331fe9519bc22c4b86132401c.png@!reference
- https://web.archive.org/web/20201101021320/http://10.cetc.com.cn/ (defunct)
- https://web.archive.org/web/20190215164341/http://hr.swiet.com.cn/ (defunct)
- https://web.archive.org/web/20141009104030/http://www.swiet.com.cn:8188/home.action (defunct)

Subordinate to:

- China Electronic Technology Group Corporation (CETC) [中国电子科技集团公司]

Known Subsidiaries:

Technically, CETC Tianao manages in trust the 10th RI, in addition to CETC Avionics Co. [中电科航空电子有限公] and possibly Chengdu Spaceon Electronics Co. [成都天奥电子股份有限公司].[686] It is unclear what this means in practice, but it may indicate the two are technically independent but function in a hierarchical relationship. Further complicating the picture, the 10th RI is reportedly the controlling sharedholder in CETC Tianao.[687]

- CETC Avionics Co [中电科航空电子有限公司][688] (40.03% ownership)[689]
- Chengdu Spaceon Electronics Co. [成都天奥电子股份有限公司][690]
- Chengdu Tianao Group Co. [成都天奥集团有限公司] (100% ownership)[691]
- Chengdu Tianao Hotel Co. [成都天奥宾馆有限责任公司] (60% ownership)[692]
- Chengdu Tianao Information Technology Co [成都天奥信息科技有限公司] (65% ownership)[693]
- Chengdu Tianao Measurement and Control Technology Co. [成都天奥技术发展有限公司] (66.94% ownership)[694]
- Chengdu Tianao Technology Development Co. [成都天奥技术发展有限公司] (100% ownership)[695]

- Chengdu Tianao Technology Development Co. [成都天奥科技开发有限公司][696]
    - Appears to work with Langchao/Inspur servers[697]
- Sichuan Tianao Aerospace Information Technology Co. [四川天奥空天信息技术有限公司] (100% ownership)[698]
- Sichuan Tianao Information System Co [四川天奥信息系统有限公司] (12.5% ownership) (12.5% ownership)[699]

Other Entities Invested In:

- CETC (Chengdu) Science and Technology Industrial Park Development Co. [中电科（成都）科技产业园发展有限公司][700]
- China Electronics Technology Finance Co., Ltd [中国电子科技财务有限公司][701]
- CLP Industrial Development & Investment (Tianjin) Partnership (Limited Partnership) [中电产业发展投资（天津）合伙企业（有限合伙）][702]

Directly Subordinate Organizations:

- N/A

Key Personnel:

- Zhao Xiaohu [赵晓虎]: Chairman of the Board [董事长] and legal representative[703]
- He Gang [何刚]: Manager [经理], Director [董事][704]
- Yue Feng [岳峰]: Director [董事][705]
- Zhang Hong [张红] : Director [董事] [706]
- Fang Yiguang [房屹光] : Director [董事][707]
- Jiang Yongqing [江永清]: Director [董事][708]
- Shen Hong [沈虹]: director [董事][709]

Addresses:

- No. 85, Yingkang West Road, Jinniu District, Chengdu City, Sichuan Province [四川省成都市金牛区营康西路 85 号]
- No. 48, Chadianzi East Street, Chengdu, Sichuan Province [四川省成都市茶店子东街 48 号]
- Inside the "concentrated area," Chengdu Core Valley Industrial Park, Shuangliu District, Chengdu, Sichuan [成都市双流区成都芯谷产业园区集中区内] (possibly a former location)

CETC 20TH RESEARCH INSTITUTE

Overview: The state-owned 20th Research Institute (20th RI) [中国电子科技集团公司第二十研究所] has been focused on military navigation technologies, including a range of air defense radars, for over half a century. It is currently subordinate to the state-owned defense conglomerate CETC, China's leading manufacturer of military electronics. In 2013, the 20th RI was subsumed into a new corporate entity (still subordinate to CETC) called the CETC Northwest Group Company [中电科西北集团有限公司], for which it is the core unit.[710] Between 2016 and 2024, the 20th RI grew from 2,641 employees to around 3,000 employees.[711]

In addition to radar equipment such as LR66 / Type 349 fire control radar used in the HHQ-7 naval surface-to-air missile system[712] and the Type 344 fire-control radar used on the PLAN's Type 052B destroyer,[713] the 20th RI reports that it studies and develops communications equipment, data links, satellite navigation tools, and radio navigation equipment.[714]

Year Established: 1961

Aliases:
- Xi'an Research Institute of Navigation Technology [西安导航技术研究所]
- China Electronics Northwest Group Co., Ltd [中电科西北集团有限公司]
- China Electronics Technology Group Corporation Northwest Group Corporation [中电科西北集团有限公司 / 中电西北 / 西北集团]
- China Electronics Technology Group Northwest Sub-Group 20th Institute [中国电科西北子集团 20 所]

Websites:
- https://www.cetc.com.cn/20/338808/index.html
- http://20.cetc.com.cn/
- http://www.cetc-20.com/ (possibly defunct)

Subordinate to:
- China Electronics Technology Group Corporation (CETC)

Notable Air Defense Radar Products:
- LR66 fire control radar
- Type 344 fire control radar
- Type 347G "Rice Lamp" fire control radar

Notable Relationships:
- Beijing University of Aeronautics and Astronautics [北京航空航天大学]
- Chengdu Tianao Electronics Company [成都天奥电子股份有限公司] - supplier[715]
- China Electronics Technology Group Corporation (Beijing) Company [中电科计量检测认证（北京）有限公司] - supplier[716]
- Chinese Academy of Sciences National Time Service Center [中国科学院国家授时中心]

- Defense S&T Key Laboratory of Antennas and Microwave Technology[iv] [西安电子科技大学天线与微波技术重点实验室][717]
- Sitron Electronics Company [四创电子股份有限公司] – supplier[718]

Known Subsidiaries:

- Beijing CETC Construction Investment Fund Management Partnership (Limited Partnership) [北京中电科建设投资基金管理合伙企业（有限合伙）][719]
- Beijing CETC Satellite Navigation System Co. [北京中电科卫星导航系统有限公司] (100% ownership as of 8 December 2023)[720]
- Beijing Trusted Network Communication Research Institute Co. [北京可信网络通信研究院有限公司] (10% ownership as of 3 April 2024)[721]
- CETC Aviation Electronics Co. [中电科航空电子有限公司] (4% ownership)[722]
- CETC Huijia Technology (Beijing) Co. [中电科汇嘉科技（北京）有限公司] (55% ownership)[723]
- CETC Galaxy Beidou Technology (Xi'an) Co. [中电科星河北斗技术（西安）有限公司] (100% ownership)[724]
- CETC Northwest Radar Branch [中电西北雷达分公司] / Radar Branch of China Electronics Technology Group Northwest Group Company [中电科西北集团有限公司雷达分所][725]
- CETC Ruice (Xi'an) Technology Service Co. [中电科瑞测（西安）科技服务有限公司] (100% ownership)[726]
- CETC Ruizhi Power Technology (Xi'an) Co. [中电科瑞志电源技术（西安）有限公司] (100% ownership)[727]
- CETC Xi'an Information Industry Park Development Co. [中电科西安信息产业园发展有限公司] (85.7% ownership)[728]
- CETC Xinghe Beidou Technology (Xi'an) Co. Ltd. [中电科星河北斗技术（西安）有限公司] (74.8% ownership)[729]
- China Electronics Technology Finance Co. [中国电子科技财务有限公司] (2% ownership as of 22 March 2023)[730]
- China Electronics Technology Tourism Industry Development Co. [中电科技旅游产业发展有限责任公司][731]
- China Power Industry Development Investment (Tianjin) Partnership (Limited Partnership) [中电产业发展投资（天津）合伙企业（有限合伙）] (2.7% ownership)[732]

[iv] Profiled in more detail in Ma Xiu, "The PRC State & Defense Laboratory System Part Two: Defense S&T Key Lab Directory," BluePath Labs for the China Aerospace Studies Institute, 20 March 2023, https://www.airuniversity.af.edu/CASI/Display/Article/3335234/prc-defense-st-key-lab-directory/.

- Defense Technology Branch [防务科技分公司][733]
- Industry Cultivation Platform (Xi'an Branch) of CETC Northwest Group Company [中电科西北集团有限公司产业培育平台（西安分公司）] (likely 100% ownership)[734]
- Xi'an CETC Xidian University Radar Technology Collaborative Innovation Institute [西安中电科西电科大雷达技术协同创新研究院] (12% ownership as of 1 April 2024)[735]
- Xi'an Hengfei Electronic Technology Co. [西安恒飞电子科技有限公司] (55.5% ownership)[736]
- Xi'an Navigation Hotel Management Co. [西安导航宾馆管理有限公司][737]
- Xi'an Ruite 3D Technology Co. [西安瑞特三维科技有限公司] (26% ownership)[738]

Directly Subordinate Organizations:

In 2016, the 20th RI claimed ownership of 10 functional management departments, seven research and development departments, four marketing departments, two manufacturing and production departments, and eight service and support departments.[739] In 2011, the RI only had one manufacturing and production department and eight functional departments.[740] Specific subordinate organizations include:

- Integrated Laboratory [综合试验室][741]
- CETC Northwest Radar Commissioning Site [中电西北雷达调试场][742]
- Computerized Numerically Controlled (CNC) Machining Center Corner[743]
- CNC Machining Center [数控机加中心] (~2011)[744]
- Electrical Production Line [电装生产线][745]
- Equipment Manufacturing Department 4 [装备制造部][746]
- Printed [Circuit] Board Production Line [印制板生产线][747]
- New Equipment Manufacturing Department [新建的装备制造部][748]
- Quality Inspection Center [质量检验中心][749]

Key Personnel

- Zhang Xiushe [张修社]: Institute Head (as of March 2024)[750]
- Sun Ting [孙亭]: Manager[751]
- Zhang Zhengrong [张峥嵘]: Director[752]
- Zhang Jianhua [张建华]: Director[753]
- Hou Huimin [侯惠民]: Director[754]
- Ding Xiancheng [丁贤澄]: Director[755]
- Liu Xiaoguo [刘小国]: Director[756]
- Zhao Ming [赵鸣]: Chairman of the Board of Supervisors[757]

Addresses:

- No. 1, Guanghua Road, Yanta District, Xi'an, Shaanxi [陕西省西安市雁塔区光华路 1 号二十所]
- No. 1, Baisha Road, Yanta District, Xi'an, Shaanxi [陕西省西安市雁塔区白沙路 1 号]
- Second Floor, Rear Building, Office Compound, Caotang Science and Technology Industry Base Management Office, Hi-Tech Zone, Xi'an, Shaanxi [西安市高新区草堂科技产业基地管理办公室办公院落办公楼后楼第二层]

CETC 29TH RESEARCH INSTITUTE

Overview: The CETC 29th Research Institute [中国电子科技集团公司第二十九研究所], also commonly known as the Southwest Institute of Electronic Equipment [西南电子设备研究所], describes itself as the first "backbone institute" in the PRC that specializes in all aspects of electronic information control technologies.[758] It has long been China's premier research organization focused on electronic warfare, for instance having built the KZ900 airborne electronic intelligence (ELINT) pod and a range of other ELINT receivers.[759] The Institute is also likely responsible, in part, for space-based electronic reconnaissance, having published detailed assessments of how best to track and target large naval surface combatants.[760] It reportedly supplies the PLA with 60 percent of its electronic reconnaissance and jamming equipment,[761] and it employs roughly 5,000 people.[762]

Notable Air Defense Radar Products:

- DWL002 passive detection radar system [DWL002 被动探测雷达系统][763]

Notable Collaborations:

- National Time Service Center of the Chinese Academy of Sciences [中国科学院国家授时中心][764]
- Chengdu Rongci Electronics Technology Co. [成都容瓷电子科技有限公司] / Ronci Electronics [容瓷电子] (supplier)[765]

Subsidiaries:

- Chengdu Siwi Electronic Co. [成都四威电子有限公司] (100% owned)[766]

Year Established: 1965

Aliases:

- Southwest Institute of Electronic Equipment [西南电子设备研究所]
- SWIEE [四威]
- Siwei Group / Siwei Company / Siwei Group Company [四威集团 / 四威公司 / 四威集团公司]
- CETC 29th Institute / 29th Institute [中国电科 29 所 / 29 所]
- 29 (Siwei Company) Institute (English only)
- Siwi Electronics Corporation (English only)
- Chengdu Siwi Electronics, Inc. (English only)
- Chengdu Siwei Electronics Co. (English only)
- Chengdu 29 Institute (English only)
- Siwi Group (English only)
- Southwest China Institute of Electronics (English only)

Websites:

- https://29.cetc.com.cn/
- http://29.cetc.com.cn/
- http://www.cetc.com.cn/29/335598/index.html
- http://www.swiee.com/
- http://www.cetc29hr.com/about.html

Subordinate to:

- China Electronics Technology Group Corporation (CETC)

- Siwi Group [四威集团] (aka Siwi Company [四威公司] / Siwi Group Company [四威集团公司]: may be a holding company, since many of its subsidiaries are owned by SWIEE itself of Chengdu Siwi (see above). These include:
    - Beijing Zhongxing Shitong Electronic Technology Co. [北京中星世通电子科技有限公司] (defunct, but previously 65% owned by Chengu Siwi)[767]
    - Chengdu Jiana Haiwei Technology Co. [成都嘉纳海威科技有限责任公司] (50%+ owned by Chengdu Siwi)[768]
    - Chengdu Rongwei Electronic Technology Development Company [成都蓉威电子技术开发公司] (100% owned by Chengdu Siwi [成都四威电子有限公司])[769]
    - Chengdu Siwi High-Tech Industrial Park Co. [成都四威高科技产业园有限公司] (100% owned by SWIEE)[770]
    - Chengdu Siwi Power Electronic Technology Co. [成都四威功率电子科技有限公司], formerly Chengdu Siwi Aviation Power Supply Co. [成都四威航空电源有限公司] (90% owned by SWIEE)[771]
    - Chengdu Xike Microwave Communication Co. [成都西科微波通讯有限公司] (100% owned by SWIEE)[772]

Other Entities Invested In:[773]

- AVIC (Chengdu) UAV Systems Co. [中航（成都）无人机系统股份有限公司] (2.14% ownership)
- China Electronics Technology Finance Co. [中国电子科技财务有限公司] (5% ownership)
- China Electronics Technology Group Corporation (Chengdu) Science and Technology Industrial Park Development Co. [中电科（成都）科技产业园发展有限公司] (15% ownership)
- China Electronics Technology Group Corporation (Tianjin) Venture Capital Partnership Limited Partnership [中电科国投（天津）创业投资合伙企业有限合伙]
- China Electronics Technology Tourism Industry Development Co. [中电科技旅游产业发展有限责任公司]
- Chengdu Hiway Huaxin Technology Co. [成都海威华芯科技有限公司] (4.85% ownership)
- Sichuan Jinqiao Information Communication Co. [四川金桥信息通信有限责任公司]

Directly Subordinate Organizations:

- Branches in Fujian, Guangzhou, Harbin, Xi'an[774]
- Chengdu Siwi Electronics Co. Communications and Navigation Branch [成都四威电子股份有限公司通信导航分公司][775]
- Dujiangyan Testing and Training Base [都江堰测试与培训基地][776]

- Defense Science and Technology Key Laboratory of Electronic Information Control [电子对抗国防科技重点实验室][777]
- Civilian Product Research and Development Center [民品研发中心][778]
- High-Tech Industrial Park Manufacturing Center and Testing and Training Base [高科技产业园生产制造中心和测试培训基地][779]
- Military Product Research and Development Center [军品研发中心][780]

Key Personnel:

- Gao Xianwei [高贤伟]: Director/head of institute [所长] (as of December 2023)[781]
- Yang Jianqiao [杨建桥]: Party Committee Secretary (as of April 2024)[782]

Address:

- No. 496, Kangxi Road, Chadianziying, Jinniu District, Chengdu City, Sichuan [四川省成都市金牛区茶店子营康西路 496 号]

CETC 38TH RESEARCH INSTITUTE

Overview: CETC's 38th Research Institute (RI) [中国电子科技集团公司第三十八研究所], also known as the East China Research Institute of Electronic Engineering (ECRIEE) [华东电子工程研究所], is one of the PRC's best-known air defense radar-focused organizations. It integrates research, development, manufacturing, and testing in seven major development areas, in its own telling: early warning detection, earth observation, information countermeasures, measurement and control communications, floating platforms, public security, and integrated circuits.[783] Its radar products are deployed on China's airborne early warning and control (AEW&C) aircraft, including the KJ-200, KJ-500, and KJ-2000, and it is also likely working on an even more advanced AEW&C aircraft dubbed the KJ-3000.[784] It probably employs around 4,000 people,[785] though some reports claim it may have employed up to 8,000 at one point.[786] Recently, it was merged with a number of other research institutes into CETC Microelectronics Technology Co. [中电博微电子科技有限公司]. though it may still exist as an independent entity.[787] It has been on the U.S. Department of Commerce Bureau of Industry and Security Entity List since 2018.[788]

Year Established: 1965

Aliases:
- East China Research Institute of Electronic Engineering (ECRIEE) [华东电子工程研究所]
- East China (Anhui) Institute of Electronic Engineering [华东(安徽)电子工程研究所]
- East China Institute [华东所]
- 38th Institute [三十八所 / 38 所]
- Southwest China Research Institute of Radar Technology [西南雷达技术研究所] (former)
- Hefei Institute of Electronic Engineering (erroneous)

Website:
- http://www.cetc38.com.cn/

Subordinate to:
- CETC

Notable Air Defense Radar Products:
- AUICS-3000 integrated anti-UAV system[789]
- JH-18 low-altitude surveillance radar[790]
- JY-26 "Skywatch-U" long-range 3D air warning radar[791]
  - CETC described this radar in 2021 as the "backbone equipment of long-range early warning in the air defense network."[792]
- JY-27A "Skywatch-V" meter-wave counter-stealth radar[793]
  - CETC's chief engineer revealed in 2018 that the PLA operates at least seven of these radars[794]
- JY-400 balloon early warning radar platform[795]

- JYL-1/1A long-range air defense and air management integrated air surveillance active phased array radar[796]
- KJ-200 AEW&C radar [空警 200 预警机雷达][797]
- KJ-500 AEW&C radar [空警 500 预警机雷达][798]
    - NRIET, also known as the CETC 14th Research Institute, was likely also involved
- KJ-2000 three-sided AESA radar[799]
- LLQ-305A/B (Type 305 A/B) self-propelled 3D acquisition radar[800]
- SLC-2C long-range multifunctional gun positioning radar[801]
- Undesignated electronic reconnaissance aircraft electronic mission system [电子侦察机电子任务系统][802]
- Undesignated new generation highly maneuverable multifunctional radar [新一代高机动多功能雷达][803]
- Undesignated portable X-band phased array radar [便携式 X 波段相控阵雷达][804]
    - Reportedly designed for weather monitoring, but has been used in support of military needs.
- Z-18J "Bat" helicopter long-range active electronically scanned array radar[805]

Notable Relationships:

- Chinese Institute of Electronics Radar Branch: CETC 38th RI hosts this organization; the director of the 38th RI's science and technology committee, Wu Jianqi [吴剑旗], also directs the Radar Branch[806]

Subsidiaries:

- Anhui Bowei Chang An Electronics [安徽博微长安电子有限公司][807]
- Anhui Bowei Guangcheng Information Technology [安徽博微广成信息科技有限公司][808]
- Anhui Bowei Ruida Electronics Technology [芜湖博微瑞达电子科技有限公司][809]
- Anhui Sun-Create Electronics Co. [安徽四创电子股份有限公司][810]
    - CETC describes this as "the number one Chinese radar stock" [中国雷达第一股]
- Brainware Terahertz Information Co. [博微太赫兹信息科技有限公司][811]
- CETC ECRIEEPower (Anhui) Co. [安徽博微智能电气有限公司][812]
- ECRIEE International Co. [中电科技（合肥）博微信息发展有限责任公司][813]
- ECU Electronics Industrial Co. [合肥华耀电子工业有限公司][814]
    - 90.8% ownership by Anhui Sun-Create Electronics Co.[815]
- Hefei ECRIEE-TAMURA Electric Co. [合肥博微田村电气有限公司][816]

Directly Subordinate Organizations:

- Anhui Automotive Electronics Engineering Research Center [安徽省汽车电子工程研究中心][817]
- Anhui Beidou Satellite Navigation Key Laboratory [安徽省北斗卫星导航重点实验室][818]

- Anhui Provincial Public Security Information Technology Key Laboratory [安徽省公共安全信息技术重点实验室][819]
- CETC Floating Platform R&D Center [中国电科浮空平台研发中心][820]
- DAM Flexible Production Line [DAM 柔性生产线][821]
- Digital Prototyping Laboratory [数字样机实验室][822]
- Engineering Technology Department [工程技术部][823]
- Hefei Public Security Technology Research Institute [合肥公共安全技术研究院][824]
- Microassembly Laboratory [微组装实验室][825]
- National Integrated Circuit Design Center [国家级集成电路设计中心][826]
- Precision Welding Laboratory [精密焊接实验室][827]
- Russia New Technology R&D Center [俄罗斯新技术研发中心][828]
- Structural Mechanics Laboratory [结构力学实验室][829]

Key Personnel:

- Chen Xinping [陈信平]: legal representative[830]
- Zhang Chengwei [张成伟]: Party Committee Secretary, Director [党委书记、所长][831]
- Yao Zhehui [姚哲晖]: Deputy Secretary of the Party Committee and Secretary of the Discipline Inspection Commission [党委副书记、纪委书记][832]
- Wu Jianqi [吴剑旗] - Director of the Science and Technology Committee [科学技术委员会][833]
    - Radar expert specializing in meter wave anti-stealth radar[834]

Addresses:

- 199 Xiangzhang Ave, Hi-Tech Zone, Hefei, Anhui, [安徽合肥市高新技术开发区香樟大道 199 号]
- North Gate, 38th RI, 19 Hehuan Road, High-Tech Zone, Hefei, Anhui [安徽省合肥市高新区合欢路 38 所北门]

CETC GLARUN GROUP CO.

Overview: The CETC Glarun Group Company [中电国睿集团有限公司] was created in June 2019 through a complex merger of several companies and research institutes. Perhaps the best known is the 14th Research Institute of CETC, which has long been one of the most prominent producers of military radar technology in the PRC. That institute is also known as the Nanjing Research Institute of Electronics Technology (NRIET) and has published widely on radar technology under this name.[835] The creation of CETC Glarun also incorporated the 23rd Research Institute of CETC, also known as the Shanghai Transmission Line Institute [上海传输线研究所], which focuses on information transmission lines and fiber-optic sensing technology.[836] The Glarun Group also existed as a separate entity since 2007.[837] Its primary subsidiary, the Glarun Group [国睿集团] was part of the CETC 14th Research Institute since at least 2013,[838] focused on civilian applications of the 14th Research Institute's work.

Year Established: 2019 (NRIET was founded in 1946)

Aliases:
- CETC 14th Research Institute [中国电子科技集团公司第十四研究所] (now a component of Glarun)
- CETC 14th Institute [中国电科 14 所 / 中电 14 所]
- CETC 23rd Research Institute [中国电子科技集团公司第二十三研究所] (now a component of Glarun)
- Nanjing Research Institute of Electronics Technology (NRIET) [南京电子技术研究所] – alternate name for the CETC 14th Research Institute
- Nanjing Insitute No. 1
- Nanjing Institute of Electronic Technology [南京电子技术研究所]
- Guorui [国睿]
- CETC Guorui [中电国睿]

Websites:
- https://www.cetc.com.cn/14/338547/index.html
- https://14.cetc.com.cn/
- http://www.nriet.com
- http://hr.nriet.com/ (hiring site)

Subordinate to:
- CETC

Notable Air Defense Radar Products:
- CLC-3 vehicle-mounted, low-altitude radar[839]
- H/LJG-346A/B / Type 346 [346 型] / "Star of the Sea" [海之星] / "Dragon Eye" radar[840]
- JY-50 passive direction-finding and positioning radar[841]
- KLC-7 "Silk Road Eye" [丝路眼] radar for the next-generation AEW&C aircraft, possibly designated KJ-600 or KJ-3000[842]
- KLJ-7A / "Eye of the War Eagle" [战鹰之眼][843] fighter-based active phased array fire control radar (possibly)[844]
- YLC-2E S-band multi-function, stealth-penetrating radar[845]

    - First revealed at the 2023 World Radar Expo; reportedly is highly intelligent, able to automatically schedule target detection and select anti-interference strategies[846]
- YLC-4 solid-state long-range early warning radar[847]
    - In 2008 was reportedly a "backbone" of China's air defense network[848]
- YLC-6 truck-mounted 3D medium-range surveillance radar[849]
- YLC-8A/B / Type 609[850] anti-stealth surveillance radar[851]
- YLC-18 "Meerkat" [狐獴][852] medium-range, low-altitude 3D radar[853]
- YLC-20 passive radar[854]
- YLC-48 portable phased array radar[855]
- SLC-7 fourth-generation stealth-penetrating vehicle-mounted radar[856]
    - The CETC 38th Research Institute may also have been involved in designing this platform[857]
- SLC-12 vehicle-mounted stealth-penetrating radar[858]
- SLC-18 space surveillance active phased array radar[859]
- Three fixed AESA phased-array radars deployed on the KJ-500 (possibly)[860]
    - CETC 38th Research Institute was likely also involved.

Notable Collaborations:

- Beijing Institute of Technology [北京理工大学][861]
- Chinese Academy of Sciences (CAS) Institute of Geology and Geophysics [中国科学院地质与地球物理研究所][862]
- Civil Aviation Administration of China Air Traffic Control Bureau Technical Center [民航局空管局技术中心][863]
- Xidian University: joint investment in the Xi'an CETC Xidian University Radar Technology Collaborative Innovation Research Institute Co. [西安中电科西电科大雷达技术协同创新研究院有限公司][864]

Subsidiaries:

- (primary) Glarun Group [国睿集团][865]
    - Focused on civilian products and services[866]
    - Sometimes referred to in English as the Guorui Group[867]
- (primary) Glarun Technology Co. [国睿科技/国睿科技股份有限公司][868]
    - One of the company's primary subsidiaries; some foreign reports indicate it may also work on air defense radars[869]
    - Notable additional subsidiary: Nanjing Glarun Defense System Co. [南京国睿防务系统有限公司/国睿防务] (100% ownership)[870]
        - Research and development, design, manufacture, testing, sales, and service for military radars, possibly primarily for export models[871]

- Beijing Glarun Zhongshu Technology Co. [北京国睿中数科技股份有限公司] (holding company / member company [控股公司/成员企业])[872]
- China Electronics Technology (Nanjing) Electronic Information Development Co. [中电科技（南京）电子信息发展有限公司] (holding company / member company [控股公司/成员企业])[873]
- China Electronics Technology Yangzhou Baojun Electronics Co. [中电科技扬州宝军电子有限公司] (holding company / member company [控股公司/成员企业])[874]
- Guorui Technology Co [国睿科技股份有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[875]
- Jiangsu Glarun Hotel Co. [江苏国睿酒店有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[876]
- Nanjing Dazhi Communication Technology Co. [南京达智通信技术有限责任公司] (holding company / member company [控股公司/成员企业] as of 2018)[877]
- Nanjing Glarun Antaixin Technology Co. [南京国睿安泰信科技股份有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[878]
- Nanjing Glarun Bolabel Environmental Energy Co. [南京国睿博拉贝尔环境能源有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[879]
- Nanjing Glarun New Energy Electronics Co. [南京国睿新能电子有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[880]
- Nanjing Glarun Xinwei Software Co. [南京国睿信维软件有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[881]
- Nanjing Internet of Things Application Research Institute Co. [南京物联网应用研究院有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[882]
- Nanjing Lopu Co. [南京洛普股份有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[883] (1.84% ownership)[884]
- Nanjing Rail Transit System Engineering Co. [南京轨道交通系统工程有限公司] (holding company / member company [控股公司/成员企业] as of 2018)[885]
- Zhangjiagang Free Trade Zone Guoxin Communication Co. [张家港保税区国信通信有限公司] (holding company / member company [控股公司/成员企业])[886]

Other Entities Invested In:

- CETC Industry Development Investment (Tianjin) Partnership (Limited Partnership) [中电产业发展投资（天津）合伙企业（有限合伙）] (5.45% ownership)[887]
- China Electronics Technology Finance Co. [中国电子科技财务有限公司] (2.99% ownership)[888]

- CETC 14th Research Institute Intelligent Technology (Beijing) Co. [中电科十四所智能科技（北京）有限公司] (100% ownership)[889]
- CETC (Tianjin) Venture Capital Partnership (Limited Partnership) [中电科国投（天津）创业投资合伙企业（有限合伙）] (2.48% ownership)[890]
- CETC Aviation Electronics Co. [中电科航空电子有限公司] (0.4% ownership)[891]
- CETC Aviation Investment and Development (Sichuan) Co. [中电科航空投资发展（四川）有限公司] (25.53% ownership)[892]
- CETC Wuhu Diamond Aircraft Manufacturing Co. [中电科芜湖钻石飞机制造有限公司] (15.22% ownership)[893]
- CETC Harbin Rail Transit Co. [中电科哈尔滨轨道交通有限公司] (19.54% ownership)[894]
- Fuzhou CETC Ltd. [福州中电科轨道交通有限公司] (37.52% ownership)[895]
- Jiangsu Gaochun Ceramics Co. [江苏高淳陶瓷股份有限公司] (52.6% ownership) (52.6% ownership)[896]
- Jiangsu Huachuang Microsystem Co. [江苏华创微系统有限公司] (58.65% ownership)[897]
- Nanjing Lopu Industrial Co. [南京洛普实业有限公司] (75% ownership)[898]
- Qingdao Glarun Marine Electronic Technology Development Co. {青岛国睿海洋电子科技发展有限公司} (100% ownership)[899]
- Shenzhen Yuanwang Electronic Equipment Manufacturing Co. [深圳市远望电子设备制造有限公司][900]
- Xi'an CETC Xidian University Radar Technology Collaborative Innovation Research Institute Co. [西安中电科西电科大雷达技术协同创新研究院有限公司] (12% ownership)[901]

Directly Subordinate Organizations:

- Defense Science and Technology Key Laboratory of Antennas and Microwave Technology [天线与微波技术国防科技重点实验室] (full profile available in cited report)[902]

Key Personnel for CETC Glarun Group Co.:[903]

- Wang Jianming [王建明]: Legal representative [法定代表人]
- Li Langping [李浪平]: Director and general manager [董事兼总经理]
- Zhao Shuancheng [赵栓成]: Director [董事]
- Xu Jin [徐进]: Supervisor [监事]

Key Personnel for Glarun Technology Co.:[904]

- Li Langping [李浪平]: Chairman [董事长], legal representative [法定代表人], director [董事]
- Wan Haidong [万海东]: Director [董事]
- Liu Zhenghua [刘正华]: Employee Supervisor [职工监事]
- Wu Bing [吴冰]: Employee Supervisor [职工监事]
- Wu Yi [吴迤]: General manager [总经理], director [董事]
- Zhou Hongliang [周鸿亮]: Deputy general manager [副总经理]
- Liao Rongchao [廖荣超]: Supervisor [监事]
- Peng Wei [彭为]: Director [董事]
- Xu Zhijian [徐志坚]: Independent director [独立董事]

Xu Bin [徐斌]: Chairman of the Supervisory Board [监事会主席], Supervisor [监事]

Addresses:

- No. 8 Guorui Road, Yuhuatai District, Nanjing, Jiangsu [江苏省南京市雨花台区国睿路 8 号] / No. 8, Guorui Road, Yuhua Economic Development Zone, Nanjing [南京雨花经济开发区国睿路 8 号]
- Floor 27, Building 3, Bowang Garden, No. 5 Yangfangdian East Road, Beijing [北京羊坊店东路 5 号博望园 3 号楼 27 层] (as of 2016)
- No. 1, Dinghuaimen, Gulou District, Nanjing, Jiangsu [江苏省南京市鼓楼区定淮门 1 号] (as of 2016)

China Electronics Corporation Nanjing Changjiang Electronic Information Industry Group Co.

Overview: Nanjing Changjiang Electronic Information Industry Group [南京长江电子信息产业集团有限公司] has its origins in China's first complete machine manufacturing enterprise to design, manufacture, and export large-scale electronic equipment.[905] Described as the "cradle of China's radar industry" [中国雷达工业的摇篮], it remains heavily involved in the ongoing development of China's early warning technologies.[906] It employs around 700 people.[907]

Year Established: 1946

Aliases:
- NJCJEC
- Nanjing Changjiang Electronic Information Industry Group Co., Ltd.
- Changjiang Electronics [长江电子]
- Nanjing Changjiang Machinery Group Corporation / NJCJMG [南京长江机器集团有限公司] (former)
- State-Run Factory 720 [国营 720 厂] (former)
- State-Owned Yangtze River Machinery Manufacturing Plant [国营长江机器制造厂] (former)

Websites:
- https://njcjec.com/
- http://www.bianfu.com/

Subordinate to:
- China Electronics Corporation (CEC) [中国电子信息产业集团] (through several layers)
- Directly owned by Nanjing Panda Information Industry Group Co., Ltd. [南京中电熊猫信息产业集团有限公司]

Notable Air Defense Radar Products:
- REC-1 radar: high-performance, multi-purpose air and sea warning radar [多用途对空对海警戒雷达] / C-band shipborne air and sea warning radar [C 波段舰载对空对海警戒雷达][908]
- Type 518 / REL-2 radar: L-band shipborne air warning radar [L 波段舰载对空警戒雷达][909]
- REL-6B radar: air warning and guidance radar [空中警戒和引导雷达][910]
- RES-1 radar: multipurpose medium- and low-altitude air defense warning radar [多用途中低空防空警戒雷达][911]
- Type 518 L-band long-range air surveillance radar[912]
    - Reportedly deployed on the Type 052D destroyer

Notable Relationships:
- Nanjing University of Aeronautics and Astronautics [南京航空航天大学]: with Nanjing Changjiang, runs the NUAA-NHCJEC National Engineering Practice Education Center [南京航空航天大学—南京长江电子信息产业集团有限公司国家级工程实践教育中心][913]

Subsidiaries:

- Nanjing Changjiang Science Park [南京长江科技园有限公司] (100% ownership)[914]
- Shenzhen Jiayu Industrial Co. [深圳市佳宇实业有限公司/深圳佳宇实业有限公司][915]
- Xuzhou Zhongdian Panda Microelectronics Co. [徐州中电熊猫微电子有限公司][916]

Directly Subordinate Organizations:[917]

- Bidding Information Office [标档情报处]
- Communications Equipment Manufacturing Departemtn [通信设备制造部]
- Electrical Equipment Company [电器设备公司]
- Electronic Equipment Manufacturing Division [电子装备制造部]
- Home Appliances Manufacturing Division [家电产品制造部]
- Household Electronics Company [家电公司]
- Logistics Center [物流中心]
- Measurement Test Center [计量例试中心]
- Mechanical Equipment Manufacturing Department [机械装备制造部]
- Mechanical Non-Ferrous Casting Department [机械有色铸造部]
- Microelectronics Corporation [为电子公司]
- Mold Company [模具公司]
- Quality Supervision Branch [质量监督处]
- Research Institute [研究所]
- Science Park Corporation [科技园公司]
- Staff Hospital [职工医院]
- Technology Institute [工艺所]
- Transformer Manufacturing Department [变压器制造部]
- Transportation Management Department [运输管理部]

Key Personnel:

- Yang Yuanjiang [阳元江]: chairman (of the board) [董事长], legal representative[918]
- Gui Guohua [桂国华]: general manager [总经理], director [董事][919]
- Li Weiping [李卫平]: director [董事][920]
- Fan Laiying [樊来盈]: director [董事][921]
- Lin Peng [林鹏]: director [董事][922]

Addresses

- No. 9, Hengyi Road, Economic and Technological Development Zone, Nanjing, Jiangsu [南京经济技术开发区恒谊路 9 号]
- Luxiying No. 97, Nanjing [京芦席营 97 号]

CHINA SOUTH 081 ELECTRONICS GROUP FIRE CONTROL TECHNOLOGY (CHENGDU) CO.

Overview: 081 Electronics Group Fire Control Technology (Chengdu) [零八一电子集团火控科技（成都）有限公司] today broadly focuses on research and development of high-tech military equipment combining optics, mechanics, and electronics. While relatively little information about it is available publicly today, its 2002 website indicated it was a research and development company focused on the large-scale production of fire-control radars.[923] It continues to publish widely on radar and related technologies.[924] China South Industries Group (see pp. 131-134) owns 51% of it and 081 Electronics Group (see pp. 97-99) owns 49%.

Notable Air Defense Radar Products:

Unknown

Notable Relationships:

- N/A

Known Subsidiaries:

- N/A

Directly Subordinate Organizations:

- N/A

Key Personnel:

- N/A

Year Established: 2002

Aliases:

- China South Fire Control Center (CSFCC)
- Fire Control Center [火控中心]
- China North Industries Group Fire Control Technology Center [中国兵器装备集团火控技术中心] (former)
- China North Industries Group Corporation (Chengdu) Fire Control Center [中国兵器装备集团（成都）火控中心]
- China North Industries Group Corporation (Chengdu) Fire Control Technology Center [中国兵器装备集团（成都）火控技术中心] (former)
- State-Owned 081 General Factory [国营零八一总厂] (former)
- Southern Group Fire Control Technology Center [南方集团火控技术中心] (former)

Website:

- http://www.081.com.cn (defunct)

Subordinate to:

- China South Industries Group

Addresses:

- No. 277, Tianqin Road, Chengdu Hi-Tech Zone [成都高新区天勤路 277 号]
- Fire Control Center Pilot Base, No. 139 Shuangbai Road, Chengdu Hi-tech Zone, Sichuan Province [四川省成都高新区双柏路 139 号火控中心中试基地]

CHINA SOUTH INDUSTRIES GROUP CORPORATION

Overview: China South Industries Group [中国南方工业集团公司], also commonly known in Chinese as the China Ordnance Equipment Group Corporation [中国兵器装备集团公司], has existed in some form—including, at times, as a PRC government ministry—since the early 1980s, but was incorporated in its current form in 1999. Broadly speaking, it is known for its twin foci on defense and automotive products. China's State Council describes it as a "core force of the national defense science and technology industry…and one of the most dynamic military-civilian combinations having a large military industrial group in China." [925] It also has substantial product lines focused on oil and energy.[926]

China South Industries Group is a large state-owned enterprise, reporting between 170,000 and 209,000 employees between 2017 and 2019.[927] It also has a global presence, exporting to more than 170 countries and regions. [928] The U.S. Department of Defense lists it as a Chinese military company operating in the United States.[929]

Notable Air Defense Radar Products:

- LD-3000 land-based short-range air and missile defense system (equipped with a 3D active phased-array radar)[930]
  - Likely in service with the PLA[931]
  - Likely developed in cooperation with NORINCO[932]
- LD-76 anti-aircraft gun: incorporates a phased-array search radar[933]

Notable Relationships:

- Ford (no details available)[934]
- Mazda (no details available)[935]
- Peugot Citroen (no details available)[936]

Year Established: 1999
Aliases:

- China Ordnance Equipment Group Corporation [中国兵器装备集团公司]
- CSGC
- Ordnance Equipment Group [兵器装备集团]
- Ordnance Group [兵装集团]
- Southern Industries [南方工业]
- China Ordnance [中国兵装]
- China Ordnance Group [中国兵装集团]
- China Weapon Equipment Group Co., Ltd. (rare)
- CSG (rare)
- China Ordnance Group Corporation (sometimes used by English-language media)
- China North Industries Group Corporation [中国北方工业公司] (erroneous)
- People's Republic of China Ministry of Ordnance Industry [中华人民共和国兵器工业部] (former)
- China North Industries (Group) Corporation [中国北方工业（集团）总公司]
- China National Arms Industry Corporation [中国兵器工业总公司] (former)
- China National Armaments and Equipment Corporation [中国兵器装备集团公司]

- CMA CGM French container transport and shipping company (no details available)[937]

Subsidiaries:

- 208th Research Institute [中国兵器装备集团兵器装备研究所 / 中国兵器工业第二 0 八研究所][938]
- Baoding Tianwei Baobian Electric Co. [保定天威保变电气股份有限公司][939]
- Baoding Tianwei Group Co. [保定天威集团有限公司][940]
- Baoding Tongwei Electrical Equipment Co. [保定同为电气设备有限公司][941]
- Beijing Beiji Electromechanical Industry Co. [北京北机机电工业有限责任公司][942]
- Changan Automobile Finance Co. [长安汽车金融有限公司][943]
- Chengdu Guangming Optoelectronics Co. [成都光明光电股份有限公司][944]
- Chengdu Lingchuan Special Industry Co. [成都陵川特种工业有限责任公司]
- China Chang'an Automobile Group Company [中国长安汽车集团股份有限公司][945]
- China Jialing Industrial Co. (Group) [中国嘉陵工业股份有限公司（集团）][946]
- China North Industries Group Corporation Ordnance Equipment Research Institute [中国兵器装备集团兵器装备研究所][947]
- China North Industries Group Finance Co. [兵器装备集团财务有限责任公司][948]
- China Ordnance Equipment Research Institute [中国兵器装备研究院][949]
- China South Fire Control Center (CSFCC) [中国兵器装备集团（成都）火控技术中心 / 中国兵器装备集团火控技术中心][950]
    - Has developed a complete industrial chain for low-altitude target defense radars [低空目标防御雷达], which it reportedly sells to the PLARF, PLAAF, and PLAN.[951]
- Chongqing Changan Automobile Co. [重庆长安汽车股份有限公司][952]
- Chonggqing Changan Industry (Group) Co. [重庆长安工业（集团）有限责任公司][953]
- Chongqing Changjiang Electric Industry Group Co. [重庆长江电工工业集团有限公司][954]
- Chongqing Dajiang Industry Co. [重庆大江工业有限责任公司][955]
- Chongqing Hongyu Precision Industry Co. [重庆红宇精密工业有限责任公司][956]
- Chongqing Huxi Motor Industry Co. [重庆虎溪电机工业有限责任公司][957]
- Chongqing Jialing Quanyu Motor Vehicle Co. [重庆嘉陵全域机动车辆有限公司][958]
- Chongqing Jialing Special Equipment Co. [重庆嘉陵特种装备有限公司][959]
- Chongqing Jianshe Automotive Systems Co. [重庆建设汽车系统股份有限公司][960]
- Chongqing Jianshe Industry (Group) Co. [重庆建设工业（集团）有限责任公司][961]
- Chongqing Nanfang Motorcylce Co. [重庆南方摩托车有限责任公司][962]
- Chongqing Wanjiang Industrial Co. [重庆望江工业有限公司]

- Chongqing Wanjiang Industry Co. [重庆望江工业有限公司/重庆长安望江工业集团有限公司][963]
    - Works on search and tracking radars [搜跟雷达],[964] radar system design [雷达系统总体设计],[965] and radar signal processing [雷达信号处理][966]
- Guizhou Gaofeng Petroleum Machinery Co. [贵州高峰石油机械股份有限公司][967]
- Heilongjiang North Tools Co. [黑龙江北方工具有限公司][968]
- Huazhong Pharmaceutical Co. [华中药业股份有限公司][969]
- Hubei Huaqiang Technology Co. [湖北华强科技有限责任公司][970]
- Hubei Huazhong Optoelectronics Co. [湖北华中光电科技有限公司][971]
- Hunan South China Optoelectronics (Group) Co. [湖南华南光电（集团）有限责任公司][972]
- Hunan Yunjian Group Co. [湖南云箭集团有限公司][973]
- Jiangxi Changjiang Chemical Co. [江西长江化工有限责任公司][974]
- Jinan Qingqi Motorcycle Co. [济南轻骑摩托车有限公司][975]
- Jinan Qingqi Suzuki Motorcycle Co. [济南轻骑铃木摩托车有限公司]
- Luoyang North Enterprise Group Co. [洛阳北方企业集团有限公司][976]
- Shanghai Electronic Control Institute [上海电控研究所][977] / 218th Research Institute[978]
    - Focuses on tanks, armored vehicles, rocket artillery and other electronic control components and systems[979]
- Southern Industrial Asset Management Co. [南方工业资产管理有限责任公司][980]
- Southern Industrial Technology and Trade Co. [南方工业科技贸易有限公司][981]
- Southwest Automation Institute (SWAI) [西南自动化研究所][982] / China North Industries Group Automation Research Institute Co. [中国兵器装备集团自动化研究所有限公司][983] / 58th Research Institute of China Ordnance Industry [中国兵器工业第五八研究所][984]
    - Works in part on air defense fire control systems[985]
- Southwest Technology and Engineering Institute [西南技术工程研究所][986]
- Wuhan Binhu Electronic Limited Liability Company [武汉滨湖电子有限责任公司][987]
    - Specializes in the research, development, and production of radar and communication products.[988]
- Wuhan Changjiang Optoelectronics Co. [武汉长江光电有限公司][989]
- Xi'an Kunlun Industry (Group) Co. [西安昆仑工业（集团）有限责任公司][990]
- Zhongyuan Special Steel Co. [中原特钢股份有限公司][991]
- Zhongzhuang Group Co. [中光学集团股份有限公司][992]

Directly Subordinate Organizations:

- 10 production bases[993]
- 31 complete vehicle and engine factories[994]

Key Personnel:

- Cheng Fubo [程福波]: Chair and Party Group Secretary (appointed April 2024)[995]

Websites:

- http://10.cetc.com.cn/
- https://en.18.cetc.com.cn/10/338199/index.html
- https://web.archive.org/web/20220630131449/https://baikeshot.cdn.bcebos.com/reference/10392945/ea12ee3331fe9519bc22c4b86132401c.png@!reference
- https://web.archive.org/web/20201101021320/http://10.cetc.com.cn/ (defunct)
- https://web.archive.org/web/20190215164341/http://hr.swiet.com.cn/ (defunct)
- https://web.archive.org/web/20141009104030/http://www.swiet.com.cn:8188/home.action (defunct)

Subordinate to:

- China Electronic Technology Group Corporation (CETC) [中国电子科技集团公司]

Addresses:

- No. 10, Chedaogou, Haidian District, Beijing, China [中国北京海淀区车道沟十号] (sometimes listed as a "working address" [办公地址]
- No. 46, Sanlihe Road, Xicheng District, Beijing [北京市西城区三里河路 46 号] (sometimes listed as the "registered address" [注册地址])
    - This is the same address as NORINCO

CHINA SOUTH INDUSTRIES GROUP AUTOMATION RESEARCH INSTITUTE

Overview: The China South Industries Group Automation Research Institute [中国兵器装备集团自动化研究所有限公司] focuses on design, system integration, simulation, and testing of a range of fire control systems, with applications in tanks and other assault vehicles, artillery suppression weapons, and integration of air defense weapons that combine guns and shells.[996]

Notable Air Defense Radar Products:

- Unknown, though the company does work on radars generally, for example on radar tracking systems[997] and radars to guide robots in radiation-heavy environments.[998]

Notable Relationships:

- N/A

Subsidiaries:

- N/A

Directly Subordinate Organizations:

- N/A

Key Personnel:

- Zhou Yong [周勇]: Legal representative[999]
- Chen Changjin []: General manager, Chengdu branch[1000]

Year Established: 1977 (incorporated 2020)

Aliases:

- Southwest Automation Research Institute (SWAI) [西南自动化研究所]
- China National Armaments and Equipment Group Automation Research Institute [中国兵器装备集团自动化研究所]
- China National Instrument Industry Corporation [中国兵器工业第五八研究所]
- 58th Institute [58 所]
- Institute of Military Automation [兵装自动化所]
- Sichuan Mianyang Southwest Automation Research Institute [四川省绵阳西南自动化研究所] (may be a separate but related entity, existed from 1994-2020)

Websites:

- http://www.58suo.com/
- https://www.58suo.csgc.com.cn/

Subordinate to:

- China South Industries Group Co., Ltd.

Addresses:

- No. 7, Section 2, Xianren Road, Youxian District, Mianyang City, Sichuan Province [四川省绵阳市游仙区仙人路二段七号]
- Building 31, No. 7, Section 2, Xianren Road, Youxian District, Mianyang City, Sichuan Province [四川省绵阳市游仙区仙人路二段 7 号 31 栋]

CHINA SOUTH INDUSTRIES GROUP CHONGQING CHANGAN WANGJIANG INDUSTRY GROUP CO.

Overview: Chongqing Changan Wangjiang Industry Group [重庆长安望江工业集团有限公司] was formed in 2020 from the merger of Chongqing Wangjiang Industry and Chongqing Changan Industry Group. The new group offers comprehensive mechanical processing and manufacturing capabilities,[1001] and among other sectors, it works on search and tracking radars, radar system design, and radar signal processing.[1002]

Notable Air Defense Radar Products:

- CWR-37 3D trajectory-measurement radar [三坐标弹道测量雷达][1003]
    - Little is known about this radar, but it may have air defense applications
- CS/SA-1 anti-aircraft gun system [高炮系统], with search radar and dual-band tracker radar incorporated[1004]

Notable Relationships:

- CETC 39th Research Institute[1005]

Known Collaborations:

- N/A

Subsidiaries:

- N/A

Directly Subordinate Organizations:

- N/A

Key Personnel:

- N/A

Year Established: 2020

Aliases:

- Chang'an Wanjiang [长安望江]
- Chongqing Changan Wangjiang Industrial group Co., Ltd.
- China North Industries Group Corporation Special Equipment Research Institute [中国兵器装备集团特种装备研究院]

Websites:

- https://cqwjgy.csgc.com.cn/
- http://www.cqwjgy.com/

Subordinate to:

- China South Industries Group Corporation

Addresses:

- Room 608, 6th Floor, No. 39, Yonghe Road, Yuzui Town, Jiangbei District, Chongqing [重庆市江北区鱼嘴镇永和路 39 号 6 层 608 室]
- Guojiatuo, Jiangbei District, Chongqing [重庆市江北区郭家沱] (Wanjiang)
- No. 599, Konggang Avenue, Yubei District, Chongqing [重庆市渝北区空港大道 599 号] (possibly Changan)

CSSC 724TH RESEARCH INSTITUTE

Overview: The 724th Research Institute (RI) [中国船舶集团有限公司第七二四研究所], also known as the Nanjing Marine Radar Research Institute [南京船舶雷达研究所], produces a number of important naval air defense radars currently in use by the PLAN (see below), but more broadly it has made major contributions to the shipbuilding, oceanic engineering, automobile, and home appliance industries.[1006]

In 2018, however, the 724th RI merged with the China Shipbuilding Industry Corporation's 723rd RI to form the CSIC 8th RI. Reportedly, this was intended to achieve better resource coordination and greater efficiencies of scale. On the military side, the new institute will continue to focus on systems for radar detection, electronic countermeasures, and information countermeasures. On the civilian side, it will focus on high-end intelligent equipment engineering, new materials and food packaging engineering, environmental protection engineering, medical equipment, and smart electronic information engineering.[1007] The 724th RI appears to retain some organizational independence, at least for now, since it placed job advertisements under the 724 name in 2024.[1008] The 724th RI itself employs roughly 2,000 specialists.[1009]

Year Established: 1970

Aliases:
- Nanjing Marine Radar Research Institute [南京船舶雷达研究所]
- 724 Institute [七二四所 / 724 所]
- CSSC 724 Institute [中船 724 所]
- CSIC 724 Institute [中船重工 724 所]

Websites:
- http://www.724.cn/
- http://www.china724.com/ (defunct)
- http://wmdw.jswmw.com/home/?lid=1177

Subordinate to:
- CSSC [中国船舶集团有限公司]

The 724th RI publishes the academic journal *Radar and Countermeasures* [雷达与对抗].[1010]

Notable Air Defense Radar Products:

- Type 382 "Sea Eagle" air search radar[1011]
  - Deployed on the Type 051B, Type 052 and Type 052B PLAN destroyers;[1012] the Type 054 and Type 054A frigates;[1013] and the Type 075 landing helicopter dock.[1014]
- Possibly the Type 354 / H/LJQ-354 radar[1015]
  - Likely being phased out; reportedly still deployed on the 053H2 missile frigate as of 2023[1016]

Notable Relationships:

- Anqing Maritime Safety Administration of the People's Republic of China [中华人民共和国安庆海事局][1017]
- Guangdong Maritime Safety Administration of the People's Republic of China [中华人民共和国广东海事局][1018]
- Shenzhen Maritime Safety Administration of the People's Republic of China [中华人民共和国深圳海事局][1019]

Subsidiaries:

- Pengli Technology [中船鹏力（南京）科技集团有限公司/南京鹏力科技集团有限公司][1020] (100% ownership)
    - Founded by the 724th RI, and accordingly now part of the 8th RI[1021]

Entities Invested In:

- Chongqing Shipbuilding Industry Co. [中国船舶集团重庆船舶工业有限公司/中船重工（重庆）西南装备研究院有限公司] (2.17% ownership)[1022]
- CSIC (Chongqing) Southwest Equipment Research Institute Co. [中船重工（重庆）西南装备研究院有限公司][1023]
- Jiangsu Haizhiyuan Catering Management Co. [江苏海之源餐饮管理有限公司][1024] (no longer in operation)
- Nanjing Shenghai Electronic System Engineering Co. [南京盛海电子系统工程有限公司][1025]

Directly Subordinate Organizations:

- Shengdali Engineering Technology Development Department, Nanjing Ship Radar Research Institute [南京船舶雷达研究所盛达利工程技术开发部][1026] (appears inactive)

Key Personnel:

- Yang Yinhua [杨吟华]: President [院长] of the 8th RI (as of June 2024)[1027]
- Yu Hongming [余宏明] – Party Committee Secretary [党委书记] of the 8th RI (as of June 2024)[1028]

Address:

- No. 346, Zhongshan North Road, Nanjing [南京市中山北路 346 号]
- No. 30, Changqing Street, Jiangning District, Nanjing City, Jiangsu Province [江苏省南京市江宁区长青街 30 号]

CHINA NORTH INDUSTRIES GROUP CORPORATION (NORINCO)

Overview: NORINCO [中国兵器工业集团有限公司] is one of the world's largest defense contractors, with an enormous footprint inside China—it employs almost a quarter million people as of 2022[1029]—as well as a wide range of international customers such as Russia, Saudi Arabia, Pakistan, Venezuela, and Myanmar.[1030] It maintains hundreds of subsidiaries,[1031] as well as more than 50 sub-groups and directly managed work units across the PRC.[1032]

NORINCO produces a wide range of defense-related products, including amphibious assault ships, air defense systems, small arms, and precision strike missiles.[1033] It also operates in a range of other sectors, including petroleum and mineral resource development, optoelectronics, sports equipment, mining, logistical service, smart city technology, railroads, and investment and asset management.[1034]

At the end of 2022, the company's total assets amounted to 519.7 billion RMB (~72.9 billion USD)[1035] and its total operating income was 556.2 billion RMB, with a 24.1 billion RMB profit.[1036] For comparison, its profit in 2010 was only about 6.759 billion RMB (~$948 million USD).[1037] However, cash flow has been trending down since 2020, raising some concerns among investors.[1038]

Notable Air Defense Radar Products:

- IBIS80 3D target designation radar [IBIS80 型三坐标目标指示雷达][1039]
- IBIS150 3d target indication radar [IBIS150 型三坐标目标指示雷达][1040]
- IBIS200 3D target indication radar [IBIS200 型三坐标目标指示雷达][1041]
- LD-2000 "land shield" short-range air defense and anti-missile weapon system [陆盾 2000 近程防空反导武器系统][1042]

Year Established: 1980
Aliases:

- China North Industries Corporation [中国北方工业有限公司 / 中国北方工业公司] (technically this is the main subsidiary of the group, not the group itself)
- NORINCO Group [中国兵器]
- CNGC
- China Ordnance Industries Group Corporation / China Ordnance Industries Group [中国兵器工业集团有限公司]
- "Arms Industry" [兵器工业]
- PRC Ministry of Machinery Industry No. 5 [中华人民共和国第五机械工业部] (former)
- PRC Ministry of Armaments Industry [中华人民共和国兵器工业部] (former)
- China North Industries (Group) Corporation [中国北方工业（集团）总公司] (former)
- China National Arms Industry Corporation [中国兵器工业总公司] (former)
- China National Weapon Industry Corporation [中国兵器工业集团公司] (former)

Subordinate to:

- State-Owned Assets Supervision and Administration Commission of the State Council (SASAC) [国务院国有资产监督管理委员会]

    - In service with the PLA,[1043] incorporates a J-band tracking radar, possibly the LR66[1044] or the EFR-1 "Gudeng" [谷灯] radar[1045]
- LD-3000 "land shield" short-range air defense and anti-missile weapon system [陆基近程防空反导武器系统][1046]
- RA-60 emplacement reconnaissance radar [RA-60 型炮位侦校雷达][1047]
- SWS2 mobile self-propelled anti-aircraft gun/surface-to-air (SPAAG/SAM) system:[1048] radar package includes a C-band search radar and Ku-band tracking radar[1049]
    - Appears to be intended for export
- Type 905A shore defense radar [905A 型岸防雷达] (possible air defense applications)[1050]
- Yitian [倚天] short-range air defense system (incorporates an active phased-array 3D target designation radar)[1051]
- Yitian II air-defense missile weapon system [倚天 II 防空导弹武器系统][1052]

Websites:
- http://www.norincogroup.com.cn/ (the broad group itself)
- http://www.norinco.com/ (primary subsidiary)
- http://en.norinco.cn/
- http://cngc.com.cn (defunct)

Selected Subsidiaries:
- China North Chemical Research Academy Group Co. [中国北方化学研究院集团有限公司][1053]
- China North Industries Group Pinance Company LTD [北方电子研究院有限公司][1054]
    - Also involved in work on air defense radars; see profile on pp. 143-144 for details
- Inner Mongolia First Machinery Group [内蒙古第一机械集团有限公司][1055]
- Jinxi Industry Group Co. [晋西工业集团有限责任公司][1056]
- NORINCO [中国北方工业有限公司][1057]
- NORINCO International [北方国际是中国北方工业公司][1058]
- North Huajin Chemical Industrial Group [北方华锦化学工业集团有限公司][1059]
- North Industries Group Finance Co. [兵工财务有限责任公司][1060]
- Norinco 206th Research Institute / Xi'an Institute of Electronic Engineering [中国兵器工业集团第二〇六研究所/西安电子工程研究所][1061]
    - Also involved in work on air defense radars, including air defense fire control radars, helicopter-borne radars, and artillery reconnaissance radars[1062]
- North General Electronics Group Co. Ltd. (NGEG) [北方通用电子集团有限公司][1063]

- Currently works on civilian radar systems[1064]

Key Personnel:

- Cheng Fubo [程福波]: Chairman [董事长] and Party group secretary [党组书记][1065] (as of June 2024)
- Liu Dashan [刘大山]: President [总经理], board member [董事], Party group deputy secretary [党组副书记][1066] (as of June 2024)
- Jiang Liangping [蒋亮平]: board member [董事], Party group deputy secretary [党组副书记][1067] (as of June 2024)
- Zhang Hua [张华]: Chief Accountant [总会计师], Party group member [党组成员][1068] (as of June 2024)
- Chen Xuechuan [陈学钏]: chief inspector of the Discipline Inspection and Supervision Office [纪检监察组组长], Party group member [党组成员][1069] (as of June 2024)
- Li Chunjian [李春建]: Vice President [副总经理], Party group member [党组成员][1070] (as of June 2024)
- Zhi Yulin [植玉林]: Vice President [副总经理], Party group member [党组成员][1071] (as of June 2024)
- Yan Zhe [闫哲]: Vice President [副总经理], Party group member [党组成员][1072] (as of June 2024)
- Zhang Liqun [张立群]: Vice President [副总经理], Party group member [党组成员][1073] (as of June 2024)
- Lu Chun [卢纯]: External board member [外部董事][1074] (as of June 2024)
- Tian Min [田民]: External board member [外部董事][1075] (as of June 2024)
- Su Wensheng [苏文生]: External board member [外部董事][1076] (as of June 2024)
- Fu Zhimin [符志民]: External board member [外部董事][1077] (as of June 2024)
- Peng Xinguo [彭心国]: Worker board member [职工董事][1078] (as of June 2024) and Party-Masses Work Department Leader [党群工作部部长] (as of March 2024)[1079]
- Jiang Liangping [蒋亮平]: NORINCO Group Deputy Party Secretary [集团公司党组副书记] (as of March 2024)[1080]
- Wu Zhuang [吴莊]: Director of the International Affairs Department at NORINCO [集团公司国际事务部部长] (as of March 2024)[1081]
- Gao Xi [高希]: Deputy Director of Human Resources Department [人力资源部副部长] (as of March 2024)[1082]
- Hu Yisheng [胡诣升]: Special Agent in Charge of the Ministry of Civil Affairs and Development [民品发展部专务] (as of March 2024)[1083]

Addresses:

- No. 12, Guang'anmen South Street, Xuanwu District, Beijing, PRC [北京宣武区广安门南街甲 12 号] (note: Xuanyu District no longer exists)
    - Also known as No.12 Guang'anmen South Street, Beijing, China [中国北京广安门南街甲 12 号]
- No. 44, Sanlihe Road, Xicheng District, Beijing [北京市西城区三里河路 44 号]
    - English website lists it at No.46 Sanlihe Road, Xicheng District, Beijing

CHINA NORTH INDUSTRIES GROUP PINANCE CO.

Overview: A relatively new subsidiary of NORINCO, Pinance [北方电子研究院有限公司] was the result of a merger of multiple offices within NORINCO that focused on radar technology, including the 214th Research Institute, the 206th Research Institute, and a group of holding companies including Xi'an Leitong Technology Co. [西安雷通科技有限责任公司] and Xi'an Changyuan Electronic Engineering Co. [西安长远电子工程有限责任公司].[1084] Recruitment introductions to the company describe it as the "most important supplier of land-based tactical radar in China" [国内最主要的陆基战术雷达供应商].[1085] It is the only professional radar technology research institute subsidiary to NORINCO.[1086]

Year Established: 2010

Aliases:
- Northern Electronics Institute [北方电子院]
- Electronics Institute [电子院]
- Possibly NORINCO 206th Research Institute [中国兵器工业第二〇六研究所 / 兵器二〇六所 / 206 所], which is also known as the Xi'an Institute of Electronic Engineering [西安电子工程研究所]
- China North Industries Group Corporation North General Electronics Group Co., Ltd. [中国兵器工业集团北方通用电子集团有限公司] (former)
- Northern Radar Electronic Technology Group Co., Ltd. [北方雷达电子科技集团有限公司] (former)

Websites:
- http://dzjt.norincogroup.com.cn/

Subordinate to:
- NORINCO and, by extension, the State-Owned Assets Supervision and Administration Commission of the State Council (SASAC) [国务院国有资产监督管理委员会]

Notable Air Defense Radar Products:
- SD-10A active radar-guided medium range surface-to-air missile [SD-10A 主动雷达导引中距导弹][1087]
- Tianlong-50 air defense missile system [天龙 50 防空导弹][1088]
  - Reportedly designed as an inexpensive option for export markets
- Tianlong-100 long-range surface-to-air missile system [天龙 100 远程防空导弹][1089]
- Likely responsible for some components of the Yitian [倚天] SHORAD system[1090]

Key Personnel:
- Liu Zhifeng [刘智峰]: Legal representative, Party Secretary, and Chairman (as of March 2024)[1091]
- Bao Yongjie [包永洁]: General Manager and Deputy Party Committee Secretary (as of March 2024)[1092]

Address:

- 2nd and 3rd floors, Building 101, Xi'an Institute of Electronic Engineering, Fengqi East Road, Xi'an Aerospace Base [西安市航天基地凤栖东路西安电子工程研究所 101 号大楼 2 层、3 层]

CSSC 723RD RESEARCH INSTITUTE

Overview: The 723rd Research Institute (RI) of the China State Shipbuilding Corporation (CSSC) [中国船舶集团有限公司第七二三研究所], also known as the Yangzhou Marine Electronic Instrument Research Institute [扬州船用电子仪器研究所], has been a part of the new CSSC 8th Academy [中国船舶第八研究院] since a reorganization that merged the 723rd RI with the CSSC 724th RI (also known as the Nanjing Ship Radar Institute [南京船舶雷达研究所]) in 2018. While the new academy and both RIs have a broad portfolio including new energy, medical equipment, and food packaging, they have historically focused on maritime radar and electronic warfare capabilities. The 8th Academy's products are, however, reportedly used widely across the PLA, including in the PLAA, PLAN, PLAAF, PLARF, and the former PLASSF.[1094]

The new 8th Academy, with campuses in both Yangzhou and Nanjing, employs about 4,000 people, of which 60% are reportedly research personnel. The Yangzhou Marine Electronic Instrument Research Institute accounts for around 1,500 of those.[1095] The 8th Academy currently claims seven research departments, unspecified key national defense laboratories, and multiple testing sites. It also publishes the technical journal *Ship Electronic Countermeasures* [舰船电子对抗].[1096]

Year Established: 1968 (merged to become the CSSC 8th Academy in 2018)

Aliases:
- 723rd Research Institute [七二三研究所]
- 723rd Institute [723 所]
- Yangzhou 723rd Institute [扬州 723 所]
- CSSC 723rd Institute [中船 723 所]
- China State Shipbuilding Corporation 8th Research Institute (Electronic Information and Countermeasures Research Institute) Yangzhou Campus [中国船舶集团有限公司第八研究院（电子信息与对抗研究院）扬州院区]
- 723rd Research Institute of China Shipbuilding Industry Corporation [中国船舶重工集团公司第七二三研究所] (former)
- PLA 723rd Research Institute [中国人民解放军第七二三研究所] (former)

Websites:
- http://www.yz723.com.cn/

Subordinate to:
- China State Shipbuilding Corporation (CSSC)

Notable Air Defense Radar Products:
- (724th RI) H/LJQ-354 / Type 354 radar: likely equipped on some Type 053H3 frigates[1097]
- H/LJQ-364 / Type 364 radar: equipped on Type 052D destroyers[1098]
- (723rd RI) Type 360/360A radar: equipped on the naval SAM system HHQ-7[1099]
- Low- and medium-altitude surveillance radar (unspecified designation)[1100]
  - Reportedly based on the civil air defense system's low-altitude early warning system

Notable Relationships:

- Shanghai Senci Power Technology Co. [上海盛驰电源科技有限公司][1101]
    - Has supplied various types of power supplies to the 723rd RI

Subsidiaries:

- SSC Haibowei (Jiangsu) Technology Development Co. [中船海博威（江苏）科技发展有限公司][1102] (100% owned by the 723rd RI)[1103]
    - Appears to be heavily focused on air defense radar technology; its radar products have been used on bombs, aircraft, naval ships, and land-based trucks.[1104] It also reportedly serves as the science and technology investment management platform for the 8th Academy.[1105]
    - Founded in either 2010 or 2012[1106]
    - Address: No. 43, Taizhou Road, Yangzhou [扬州市泰州路 43 号]
    - Website: (defunct) https://web.archive.org/web/20160112180120/http://www.haibowei.com.cn/
    - Notable relationships:
        - Dongfang Wind Power's New Energy Division [东方风电 - 新能源板]: Haibowei won a bid to supply the "Dongfang Wind Power Cooling System and Wind Power Slip Ring Series Product Project" [东方风电冷却系统与风电滑环系列产品项目][1107]
        - Tangshan Civil Air Defense Office [唐山市人民防空办公室]: cooperated on the Tangshan Civil Air Defense Low-Altitude Early Warning System [唐山市人防低空预警系统][1108]
        - Xiantao Civil Air Defense Emergency Command Center [仙桃市人防应急指挥中心]: Haibowei made a bid to for Xiantao's "Civil Air Defense Emergency Command Center Information System Integration Project" [仙桃市人防应急指挥中心信息系统集成工程], though it was apparently unsuccessful[1109]
    - Subsidiaries:
        - Jiangsu Haiming Medical Equipment Co. [江苏海明医疗器械有限公司] (12% ownership)[1110]
        - Yangzhou Haijiang Technology Co. [扬州海江科技有限公司] (100% ownership):[1111] Manufactures radars and associated supporting equipment[1112]
        - Yangzhou Haike Electronic Technology Co. [扬州海科电子科技有限公司][1113] (100% ownership):[1114] Specializes in research, development, and production of equipment related to radars and electronic countermeasures, as well as microwave components[1115]

        - Yangzhou Haitong Electronic Technology Co. [扬州海通电子科技有限公司][1116] (100% ownership):[1117] works on military equipment, but unclear whether that includes radars[1118]
        - Yangzhou Haixing Intelligent Technology Co. [扬州海星智能科技有限公司] (100% ownership)[1119]
    - Key personnel:[1120]
        - Yang Yinhua [杨吟华]: Chairman
        - Li Wei [李伟]: General Manager and Director
        - Yu Hongming [余宏明]: Director
        - Zhang Youyi [张友益]: Director
        - Li Guohua [李国华]: Director
        - Cai Qiwen [蔡其文]: Director
        - Lu Zhihong [陆志宏]: Director
        - Yang Yu [杨宇]: Supervisor
- Jiangsu Haiming Electronic Medical Equipment Co. [江苏海明医疗器械有限公司] (as of ~2007)[1121]
- Yangzhou Haijiang Marine Electrical Instrument Technology Development Company [扬州海江船用电器仪表科技开发公司] (as of ~2007)[1122]
- Yangzhou Haike Electronic Technology Co. [扬州海科电子科技有限公司] (as of ~2007)[1123]
- Yangzhou Hailing Telecommunications Technology Industry Company [扬州海菱电讯科技实业公司] (as of ~2007)[1124]
- Yangzhou Haixing Technology and Trade Company [扬州海星技贸公司] (as of ~2007)[1125]
- Jiangsu Runyang Project Management Co. [江苏润扬项目管理有限公司][1126]
- Yangzhou Xinhai Electrical Automation Co. [扬州新海电气自动化有限公司] (as of ~2007)[1127]

Directly Subordinate Organizations:
- 723 Electronic Science and Technology Park / Yangzhou High-Tech Industrial Development Park[1128]
- Equipment Engineering Department [装备工程部][1129]
- Gaoyou Lake Test Base[1130]
- Medium- and Low-Altitude Detection and Navigation Division [中低空探测与导航事业部][1131]
- Qidong Test Base[1132]
- Radar Engineering General Technology Laboratory [雷达工程总体技术研究室][1133]

- Radar General Professional Group of the CSSC Yangzhou 723rd Research Institute [中船总扬州 723 所雷达总体专业组][1134]

Key Personnel:

- Fan Guoping [范国平]: Legal representative[1135]
- Yang Yinhua [杨吟华]: Legal representative,[1136] Deputy Party Secretary of the 8th Academy[1137]
- Yu Hongming [余宏明]: Party Secretary and Vice President of the 8th Academy[1138]

Addresses:

- No. 26, Nanhexia, Yangzhou City, Jiangsu Province [江苏省扬州市南河下 26 号]
- No. 168, Wuzhou East Road, Yangzhou City, Jiangsu Province (South Gate, New Light Source Industrial Park, Yangzhou Development Zone) [江苏省扬州市吴洲东路 168 号（南大门，扬州市开发区新光源产业园内）]
- No. 166, Linjiang Road, Yangzhou City, Jiangsu Province (East Gate 1, New Light Source Industrial Park, Yangzhou Development Zone) [江苏省扬州市临江路 166 号（东 1 门，扬州市开发区新光源产业园内）]
- No. 168, Linjiang Road, Yangzhou City, Jiangsu Province (East Gate 2, in the New Light Source Industrial Park, Yangzhou Development Zone) [江苏省扬州市临江路]168 号（东 2 门，扬州市开发区新光源产业园内）
- No. 43, Taizhou Road, Yangzhou City, Jiangsu Province [江苏省扬州市泰洲路 43 号]
- In the New Guangyuan Industrial Park of the Development Zone (north side of Wuzhou East Road) [开发区新光源产业园内（吴州东路北侧）]
- No.1, Wenhui Nanlu, Yangzhou, Jiangsu, China, 225001

SICHUAN JIUZHOU ELECTRIC GROUP COMPANY

Overview: Sichuan Jiuzhou Electric Group Company [四川九洲电器集团有限责任公司] describes the scope of its business as ranging from real estate development and industrial molds to radar, communications equipment, and building electric engineering.[1139] While little is publicly known about the Group's products, it reportedly focuses on secondary radar systems and equipment. Prior to receiving the "Sichuan Jiuzhou" appellation, it operated as the state-owned Fujiang Machinery Factory [涪江机器厂], which was founded in 1958. In 1995, it was restructured into a limited liability company, and reportedly standardized as a Wholly State-Owned Corporation [国有独资公司] (WSO) in 1999.[1140]

Sichuan Jiuzhou Electric Group Company still exists,[1141] but it was subsumed into the Sichuan Jiuzhou Investments Holding Group Co. [四川九洲投资控股集团有限公司] in 2020.[1142] That group furthermore has a controlling stake in Sichuan Jiuzhou Electric Co. [四川九洲电器股份有限公司],[1143] a publicly listed company in which the Sichuan Jiuzhou Electric Group Company itself also has a controlling stake.[1144] The new group's size is unclear, but Jiuzhou Group employed 6,500 people in 2021.[1145]

Year Established:
- 1958 (original founding)
- 1994 (incorporated)

Aliases:
- Jiuzhou [九洲]
- Jezetek
- Sichuan Jiuzhou Electric Appliance Group Co., Ltd. [四川九洲电器集团有限责任公司]
- Jiuzhou Electric [九洲电器]
- Factory 783 [七八三厂]
- State-Owned No. 783 Factory [国营第七八三厂] (former)
- State-Owned Fujiang Machinery Factory [国营涪江机器厂] (former

Websites:
- https://en.jezetek.cc/
- http://jezetek-intl.cc/
- http://www.jiuzhou.com.cn/

Subordinate to:
- Mianyang State-Owned Assets Supervision and Administration Commission [绵阳市国有资产监督管理委员会] and Sichuan Provinicial Department of Finance [四川省财政厅]

Notable Air Defense Radar Products:
- (Possibly):[1146] JZ/QF-612 radar used in the Smarthunter portable air defense missile command and control system [便携式防空导弹指挥控制系统][1147]
- (By a subsidiary): JZ/RFEW-8721M radar used for low-altitude target detection and tracking[1148]

Notable Collaborations:
- Chongqing Municipal Public Security Bureau [重庆市公安局][1149]

- Xiamen Haican District Civil Air Defense Command Post Management Station [厦门市海沧区人民防空指挥所管理站][1150]

Subsidiaries:

- Mianyang Jiuzhou Real Estate Development Co. [绵阳九洲房地产开发有限责任公司] (100% ownership)[1151]
- Mianyang Smart City Operation Service Co. [绵阳市智慧城市运营服务有限责任公司][1152]
- National Air Traffic Control Surveillance and Communication System Engineering Technology Research Center [国家空管监视与通信系统工程技术研究中心][1153]
- Shenzhen Jiuzhou Investment Development Co. [深圳市九洲投资发展有限公司][1154]
- Sichuan Jiuzhou Electric Co. [四川九洲电器股份有限公司/四川九洲][1155]
    - Listed company with stock code 000801
- Sichuan Jiuzhou Electronic Technology Co. [四川九洲电子科技股份有限公司][1156]
- Sichuan Jiuzhou Prevention and Control Technology Co. [四川九洲防控科技有限责任公司] (63.25% ownership)[1157]
    - Works on air defense radars: it is "mainly engaged in research and product development focused on low-altitude and ultra-low-altitude target detection and proximity defense systems" [主要从事低空超低空目标探测和低空近程防御系统技术研究及产品研发][1158]
    - Reportedly responsible for developing the JZ/QF-612 radar (see "Notable Air Defense Radar Products" above)

Directly Subordinate Branches:[1159]

- Jiuzhou Group Holdings
- Jiuzhou Jena Co.
- Sichiuan Jiuzhou Electric Group Co. Baotou Branch [四川九洲电器集团有限责任公司包头分公司]
- Sichuan Jiuzhou Electric Group Co. Beijing Branch [四川九洲电器集团有限责任公司北京分公司]
- Sichuan Jiuzhou Electric Group Co. Nanjing Branch [四川九洲电器集团有限责任公司南京分公司]
- Sichuan Jiuzhou Electric Group Co. Research Institute [四川九洲电器集团有限责任公司研究院]
- Sichuan Jiuzhou Electric Group Co., Urumqi Branch [四川九洲电器集团有限责任公司乌鲁木齐分公司]
- Sichuan Jiuzhou Electric Group Co. Weihai Branch [四川九洲电器集团有限责任公司威海分公司]

- Sichuan Jiuzhou Electric Group Co. Xi'an Branch [四川九洲电器集团有限责任公司西安分公司]

Key Personnel:

- Cheng Qi [程旗]: Legal representative[1160]

Address:

- No. 6 Jiuhua Road, Mianyang, Sichuan [四川省绵阳市九华路 6 号]
  - AKA No.6 Jiuhua Road, Pioneer Park, Mianyang, Sichuan, China 621000
  - AKA No.6 Jiuhua Road, Science and Technology Business Park, Mianyang, Sichuan, China 621000
  - AKA No.6 Jiuhua Road, Kechuang Park [科创园], Mianyang, Sichuan
- Beijing Branch: 7th Floor, Block E, Jinyu Jiahua Building, Shangdi 3rd Street, Haidian District, Beijing
- Chengdu Branch: No. 765, Middle Section of Tianfu Avenue, High-Tech Zone, Chengdu City, Sichuan Province
- Chongqing Branch: 17th Floor, Building No. 2, Tian'an Digital City, No 101 Cuibai Road, Dadukou District, Chongqing, China
- Shenzhen Branch: Jiuzhou Electric Appliance Building, No. 12 Road, Keji South, High-Tech Zone, Yuahai Street, Nanshan District, Shenzhen City, Guangdong Province

SUN-CREATE ELECTRONICS CO.

Overview: Sun-Create Electronics [四创电子股份有限公司], formerly Anhui Sun-Create Electronics, primarily produces radar and radar accessories, public safety products, power supply products, mobile support equipment, and information systems engineering designs.[1161] CETC's 38th Research Institute describes Sun-Create as the "number-one Chinese radar stock" [中国雷达第一股].[1162] It is China's first publicly listed radar company, and it has seen strong growth in recent years.[1163]

Year Established: 2000

Aliases:
- Sun-Create Electronics [四创电子]
- Anhui Sun-Create Electronics Co., Ltd. [安徽四创电子股份有限公司] (former)

Websites:
- http://www.sun-create.com/

Subordinate to:
- China Electronics Technology Group Corporation (CETC)

Notable Air Defense Radar Products:
- "3G Mesh" low-altitude surveillance radar ["网眼 3G" 低空监视雷达][1164]
  - Designed for UAV defense and regional cloud monitoring
- DBF system 3D surveillance radar [DBF体制三坐标监视雷达][1165]
  - Reportedly designed for emergency response, civil aviation, and defense against unmanned aerial systems
- SCR-23 long-range air traffic control radar [远程空管一次监视雷达][1166]

Notable Relationships:
- Unknown

Known Collaborations:
- Unknown

Subsidiaries:
- Anhui Bowei Changan Electronics Co. [安徽博微长安电子有限公司][1167]
- Hefei Huayao Electronics Industrial Co. [合肥华耀电子工业有限公司][1168]
- Xuancheng Chuangyuan Information Technology Co. [宣城创元信息科技有限公司][1169]

Directly Subordinate Organizations:
- Unknown

Key Personnel:
- Zhang Chengwei [张成伟]: Legal representative and chairman of the board[1170]
- Ren Xiaowei [任小伟]: Director and general manager[1171]

- Sun Wenhua [孙文华]: Supervisor[1172]

Address:

- No. 3366, Xiyou Road, Hefei High-tech Industrial Development Zone [合肥高新技术产业开发区习友路 3366 号]

XI'AN TIANHE DEFENSE TECHNOLOGY COMPANY

Year Established: 2001 (incorporated 2004)

Aliases:
- Tianhe Defense [天和防务]
- THD
- Xi'an Xianfeng Electronics Co., Ltd. [西安信风电子有限公司] (former)
- Xi'an Tianhe Investment Holding Co., Ltd. [西安天和投资控股有限公司] (former)
- Xi'an Tianhe Investment Holding Group Co., Ltd. [西安天和投资控股集团有限公司] (former)
- Shaanxi Tianhe Industrial Group [陕西天和实业集团] (former)
- Tianhe Industrial Group [天和实业集团] (former)

Websites:
- http://www.thtw.com.cn/
- https://www.en.thtw.com.cn/ (English)

Subordinate to:
- N/A (privately held)

Overview: Founded in 2001, Xi'an Tianhe Defense Technology Company [西安天和防务技术股份有限公司] describes itself as the first listed private military enterprise in China. The company identifies five areas that are core to its business: 1) military equipment; 2) intelligent security; 3) integrated electronics; 4) communication electronics; and 5) intelligent coastal defense.[1173] In an interview in 2019, the director of the company's Applied Technology Research Institute [应用技术研究院], Liu Bo [刘博], noted that while Tianhe Defense was still working to promote development in traditional areas, it was also expanding into emerging fields such as metamaterials and millimeter-wave radar chips [超材料、毫米波雷达芯片].[1174]

Areas Tianhe Defense works in range widely, from marine environmental monitoring equipment and navigation equipment to artificial intelligence applications and terahertz detection technologies. Unusually for most of the entities profiled in this report, it appears to remain quite small, employing around 300 people as of July 2024.[1175] Like most other components of the air defense radar industrial base, however, it has gone through a complicated process of growth involving multiple restructurings since it was founded.[1176] Several of its air defense radar-related subsidiaries are explored in more detail in this profile, as well. Its products have been both exported and used by the PLAA, PLAN, PLAAF, PLARF, PLASSF, and PAP.

Notable Air Defense Radar Products (some are likely dual-use):
- "Falcon" air defense system with integrated radar [“猎影”防空系统][1177]
- "Falcon" 2.0 air defense system ["猎鹰"2.0][1178]
- Low-Altitude Guardian [低空卫士][1179]
- TH-R315A DBF border defense radar [TH-R315A DBF 边防侦察雷达] (intended for ground surveillance, but likely can detect flow-flying aircraft)[1180]

- TH-R316 DBF 3D target indication radar [TH-R316 DBF 三坐标目标指示雷达][1181]
- TH-S317 photo-radar integrated low-altitude monitoring system [TH-S317 光雷一体低空监视系统][1182]

Notable Relationships:

- Chengmai County Industrial Information and Science and Technology Bureau [澄迈县工业信息化和科学技术局][1183]
- Longjuzhai Subdistrict Office of Danfeng County People's Governmnent [丹凤县人民政府龙驹寨街道办事处][1184]
- Office of the Military-Civilian Integration Development Committee of the CPC Xi'an Municipal Committee [中共西安市委军民融合发展委员会办公室][1185]
- Shaanxi Academy of Sciences [陕西省科学院机关][1186]
- Xi'an Hengda Microwave Technology Development Co. [西安恒达微波技术开发有限公司]: likely produced the microwave antennae for Tianhe Defense's TH-R313 low-altitude radar[1187]

Subsidiaries:

- *Tianhe Defense Technology (Beijing) Co. [天和防务技术（北京）有限公司] (100% ownership)[1188]
    - Works on continuous-wave radar systems[1189]
- *Xi'an Tianwei Electronic System Engineering Co., Ltd [西安天伟电子系统工程有限公司] (100% ownership)[1190]—Tianhe's military products appear to largely be this subsidiary's responsibility[1191]
    - Also known as Tianwei Electronics [天伟电子][1192]
    - Website: http://twdzxt.cn/
    - Addresses:
        - One is the same as the parent company (see above)[1193]
        - Additional address: No. 9, Keji 5th Road, High-tech Development Zone, Xi'an, Shaanxi Province [陕西省西安市高新开发区科技五路 9 号][1194]
    - Subsidiary:
        - Quanzhou Guijia Electronic Technology Co. [泉州归嘉电子科技有限公司] (100% ownership) – works on radars as well[1195]
    - Directly Subordinate Organizations:
        - Xi'an Tianwei Electronic System Engineering Co. Marine Information Technology Branch [西安天伟电子系统工程有限公司海洋信息技术分公司][1196]
        - (Possibly) Xi'an Tianwei Electronic System Engineering Co. Technology Center [西安天伟电子系统工程有限公司技术中心][1197]

    - Key Personnel:
        - He Zenglin [贺增林]: Executive Director, General Manager, and legal representative (he also leads Tianhe Defense)[1198]
        - Zhang Xiaohu [张小虎]: General Manager[1199]
        - Ning Chen [宁宸]: Supervisor[1200]
        - Wei Yufen [魏玉芬]: Financial Director[1201]
- Baoji Tianhe Defense Technology Co. [宝鸡天和防务技术有限公司][1202]
- Beijing Zhengqihe Health Technology Co. [北京正气和健康科技有限公司] (12.7% ownership)[1203]
- Chengdu Tongliang Technology Co. [成都通量科技有限公司][1204]
- Hanzhong Tianhe Defense Technology Co. [汉中天和防务技术有限公司] (100% ownership)[1205]
- Nanjing Pio Electronic Technology Co. [南京彼奥电子科技有限公司] (100% ownership)[1206]
- Shaanxi Guantian Aviation Industry Investment Fund Partnership (Limited Partnership) [陕西关天航空产业投资基金合伙企业（有限合伙）][1207]
- Shangluo Tianhe Defense Technology Co. [商洛天和防务技术有限公司] (100% ownership)[1208]
- Shenzhen Huayang Communication Technology Co. [深圳市华扬通信技术有限公司] (100% ownership)[1209]
- Tianhe Defense Technology (Hainan) Co. [天和防务技术（海南）有限公司] (100% ownership)[1210]
- Xi'an Dingsheng Electronic Technology Co. [西安鼎晟电子科技有限公司][1211]
- Xi'an Great Wall Digital Software Co. [西安长城数字软件有限公司][1212]
- Xi'an Tianhe Coastal Defense Intelligent Technology Co. [西安天和海防智能科技有限公司] (65% ownership)[1213]
- Xi'an Tianhe Jiamo Industrial Materials Co. [西安天和嘉膜工业材料有限责任公司] (70% ownership)[1214]
- Xi'an Tianhe Life Science Co. [西安天和生命科技有限公司][1215]
- Xi'an Tianhe Military-Civilian Integration Innovation Technology Research Co. [西安天和军民融合创新技术研究有限公司][1216]
- Xi'an Tianhe Security Innovation Technology Co. [西安天和安防创新技术研究有限公司][1217]
- Xi'an Tianhe Tengfei Communications Industrial Park Co. [西安天和腾飞通讯产业园有限公司] (100% ownership)[1218]
- Xi'an Tianhe Yunmai Data Technology Co. [西安天和云脉数据科技有限公司][1219]
- Xi'an Tianjiao Zhihai Technology Co. [西安天蛟智海科技有限公司][1220]

- Xi'an Tianyi Information Technology Co. [西安天译信息科技有限责任公司] (51% ownership)[1221]
- Xinjiang Tianhe Defense Technology Co. [新疆天和防务技术有限公司] (100% ownership)[1222]

Key Personnel:

- He Zenglin [贺增林]: Founder, Chairman, General Manager, Company Leader, and legal representative[1223]
- Wan Cheng [万程]: Director
- Gong Yaqiao [龚亚樵]: Managing Director and Deputy General Manager
- Di Kai [狄凯]: Deputy General Manager
- Zhang Guanrang [张关让]: Deputy General Manager
- Zhang Faqun [张发群]: Deputy General Manager and Director
- Duan Yong [段永]: Deputy General Manager
- Wang Shuanzhu [王栓柱]: Deputy General Manager
- Liu Guofa [刘国法]: Deputy General Manager
- Zhang Lei [张雷]: Chairman of the Supervisory Board

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- No. 158, Western Avenue, High-tech Zone, Xi'an City, Shaanxi Province [陕西省西安市高新区西部大道 158 号]
- No. 9, Keji 5th Road, High-tech Zone, Xi'an [西安市高新区科技五路 9 号]
- No. 68, Keji 2nd Road, Yanta District, Xi'an City, Shaanxi Province [陕西省西安市雁塔区科技二路 68 号]

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