

Survivable and Adaptable Aerial Intelligence, Surveillance, and Reconnaissance in Peer Conflict

By

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Abstract

The People's Republic of China is developing tactics and technology to counter United States aerial ISR platforms and methods through their greatly expanded their aerial and naval capabilities. The PRC's stealth technology creates contested skies for ISR collection. Their Navy has commissioned many warships and are now developing aircraft carriers which will give them the ability to better project power across the globe. In a conflict with the PRC, our current ISR aircraft will not survive the conflict. New technologies such as the Skyborg program may ameliorate this problem by presenting so many ISR aircraft that any aggressor will fail to shoot down them all without unsustainable losses. Artificial Intelligence can also help by assisting with rapid analysis. Finally, and most importantly, there is the realization that there will have to be a cultural change in the conduct and methodology of ISR. With these new developments of UAVs, artificial intelligence, and changes in culture and methodology of ISR the United States can prevail in peer conflict.

“Everyone has a plan 'till they get punched in the mouth.” – Mike Tyson¹

In World War II, Britain’s Bomber Command was suffering heavy losses in their strategic bombing campaign against Germany. Bomber Command’s raids on German cities resulted in massive losses to the bomber force with minimal damage to the Nazi war machine. The German radars operators tracked the bombers and the anti-aircraft defenses, along with night fighters, were directed to shoot down many of the bombers. Eventually, the British deployed a device they named, “Window,” also known as, “Chaff,” in the United States.² Immediately the results were apparent, the Bomber forces went from losses in the hundreds to just twelve bombers lost and no more major losses of aircraft seemed possible, but the Germans developed a countermeasure within a week.³ The Germans adapted their tactics and surveillance capabilities to the new threat. The British’s punch was quickly met with a counterpunch.

In the 21st Century, the United States and its allies engaged in low-intensity conflicts concentrated in the Middle East and Central Asia. The U.S. and its allies achieved air superiority within weeks of invasion. Nearly all aircraft, except for low flying helicopters, could operate with impunity in these combat zones. ISR aircraft flew without any threats aside from aerial malfunctions providing a constant state of observation over a relatively unsophisticated enemy. With the winding down of combat operations in that part of the world, the eyes of ISR have begun to look elsewhere. Aerial ISR must not remain stagnant and be prepared to undergo

¹ “Mike Tyson Quotes (Author of Undisputed Truth).” Goodreads.

² Cynthia Kelly. “Freeman Dyson's Interview.” Freeman Dyson's Interview | Manhattan Project Voices. Atomic Heritage Foundation, February 18, 2015.

³ Cynthia Kelly. “Freeman Dyson's Interview.”

radical changes such as distribution of capability, artificial intelligence, and cultural flexibility to remain effective or it will lose.

While the United States fought to subdue an unconventional enemy, the rest of the world developed methods of combating the United States' ISR advantage. The PRC, like a boxer studying an opponent, has devised counters to the aerial ISR aircraft of the United States.⁴ Given the PRC's current population, resources, and economic strength they represent the most significant challenge to the United States in over a generation. The most likely area of conflict with the PRC will be in the western Pacific so their navy and air force will be the most probable opponent. The conflict will be on a scale that the United States military has not faced in decades or perhaps ever.

Before getting too far into the counters that the PRC is creating, we must explain how the military in the PRC is organized. Mao Zedong said, "Political power grows out of the barrel of a gun."⁵ The Chinese Communist Party (CCP) is in control of the military and the military is the armed wing of the CCP. The People's Republic of China does not have an apolitical military in the American sense. The overall military is called the People's Liberation Army. As such the formal name of the air force is the People's Liberation Army Air Force (PLAAF) for example and the navy is called the People's Liberation Army Navy (PLAN).

The PLAAF has been rapidly advancing in technology and tactics over the past 20 years. They have introduced many new aircraft and are rapidly updating their training. For instance,

⁴ "Military and Security Developments Involving the People's Republic of China." Office of the Secretary of Defense, 2021.

⁵ "Quotations from Chairman Mao Tsetung: Mao, Zedong, 1893-1976." Internet Archive.

they are the first nation outside of the United States to field a stealth fighter.⁶ They have made great strides in updating their aircraft fleet to that that is comparable to Western air forces.

The future of the PLAAF is likely to continue these trends. There will be improved variants for the J-20 stealth fighter such as a two-seat version.⁷ Another aircraft that will become a threat in the future will be the stealth bomber that they are developing.^{8,9} In addition to new aircraft, the PLAAF is updating their training to provide a realistic environment and improve independent action for aircrew.¹⁰ For instance, they have begun implementing large-scale exercises with the goal of simulating realistic combat scenarios.¹¹ By moving away from the old model of training the aircrews will be a much more adaptable opponent than in the past.

The PLAN has also made rapid advances as well. In terms of number of warships, they are now the largest navy in the world.¹² The ultimate goal of the PLAN is to become a blue-water navy and be able to operate anywhere in the world's waters. A wide variety of ships and submarines are under development. Most visible of all these advances is the aircraft carrier program that the PRC is pursuing. They currently only have a few carriers, but are building

⁶ Minnie Chan. "China's J-20 Stealth Fighter Joins the PLA Air Force." South China Morning Post, July 20, 2018.

⁷ John Tirpak. "China's New Two-Seat J-20: Trainer or Manned-Unmanned Teaming Platform?" Air Force Magazine. Air Force Association, October 28, 2021.

⁸ "Military and Security Developments Involving the People's Republic of China." Office of the Secretary of Defense, 2021.

⁹ Kristin Huang. "China's Mysterious New Bomber 'Will Be Able to Strike Long-Distance Targets'." South China Morning Post, May 25, 2021.

¹⁰ Derek Solen. "Initial Fighter Pilot Training in the PLA Air Force." China Aerospace Studies Institute. Air University, February 2021.

¹¹ Mingzhi Chen. "China's Air Force Wraps up Large Force Exercise- Likely 'Red Sword 2020.'" China Aerospace Studies Institute, Air University, August 28, 2020.

¹² "Military... Developments Involving... China." Office of the Secretary of Defense.

more.¹³ In addition to the carriers, they are developing stealth aircraft for carrier operations such as the J-31.¹⁴ With this new navy, the PRC will be able to project power far beyond its borders.

In light of the PRC's developments, American aerial ISR is at a decision point. What has worked in the past will not work in a conflict with a peer. For example, in war games over a hypothetical PRC invasion of Taiwan, the USAF was only able to win a pyrrhic victory in 2030 with an air force it does not even have in 2021.¹⁵ Previous war games with present inventory resulted in defeat with massive losses for the USAF.¹⁶ These wargames presented a plausible scenario in which air superiority is no longer a given for the USAF. Something that USAF has not had to consider for decades. We still have an opportunity to reorient our efforts and focus on building an Air Force that will win in a war in the Pacific.

A numerous, distributed, and Artificial Intelligence enabled force would be the counter punch to stumble the PRC in its current strategy. That way in the event of a conflict the loss of a single ISR aircraft will not significantly degrade the ISR picture. Concepts such as the Skyborg program would increase the number of sensors for ISR.¹⁷ The Skyborg program is a program to develop autonomous unmanned wingmen that can act in support of manned aircraft.¹⁸ Having many of these aircraft flying around in support of manned aircraft or on their own will increase

¹³ Jake Wilson. "China's Domestic Aircraft Carrier Program: Modernization and Challenges." Air University, November 12, 2021.

¹⁴ David Axe. "Coming Soon-a New Stealth Fighter for China's New Aircraft Carrier." *Forbes*. Forbes Magazine, September 30, 2021.

¹⁵ Valerie Insinna. "A US Air Force War Game Shows What the Service Needs to Hold off - or Win against - China in 2030." Defense News, April 12, 2021.

¹⁶ James Kitfield. "'We're Going to Lose Fast': U.S. Air Force Held a War Game That Started with a Chinese Biological Attack." Yahoo!, March 10, 2021.

¹⁷ "Skyborg: OPEN...RESILIENT...AUTONOMOUS." Air Force Research Laboratory. Accessed December 6, 2021.

¹⁸ "Skyborg." Air Force Research Laboratory. Air Force Research Laboratory, September 20, 2021.

survivability of the capability and possibly increase the sensor range as well. The sheer number that would be flying at any one time would make it difficult to completely destroy all the sensors. Aerial ISR, in this case, would be like a spider web able to spot anything from multiple angles at the first sign of detection.¹⁹

Another counterpunch that should be considered is how ISR is essentially organized. The goal would be to reduce the number of steps data would have to go through from sensor to shooter. Intel should be integrated into the sensor shooter plan. To help with this artificial intelligence and machine learning should be researched with the goal in mind of reducing the time needed for analysis.²⁰ A recent example of this being tested was with the U.S. Army's Scarlet Dragon exercise. In the exercise AI was used, "to help identify targets," and, "shortened the decision-making process... to just one hour."²¹ In addition to the increased speed, the accuracy of identification improved as well. For instance, "When we took the AI and tipped the human where to look, we were exceeding 95 percent in our capabilities to identify what to look for which is better than either 44 percent with AI alone or 85 percent with humans alone."²² Given the historical precedent of rapidly changing tactics and technologies in wartime, it will be vital for analysts, whether human or an artificial intelligence, to be able to quickly adapt to whatever the enemy may try.

In this new way of doing ISR it may have to lead to some changes to how ISR is organized within the Air Force. It may require a greater level of ISR assets and personnel

¹⁹ Robert Stiegel. "Is the Air Force Serious about Intelligence, Surveillance, and Reconnaissance?" War on the Rocks, June 26, 2019.

²⁰ "ISR Flight Plan Unclassified Summary - AF." Accessed December 5, 2021.

²¹ Amanda Miller. "In DOD Experiments, Target Identification Gets Faster, More Accurate with Ai." Air Force Magazine. Air Force Association, October 31, 2021.

²² Miller. "... Target Identification... More Accurate..." *Air Force Magazine*.

integration the likes of which we have never done before. If we are going to spread ISR capabilities to many different platforms then it may be necessary to do the same for its personnel. Like the assets being decentralized the personnel will be decentralized too. This may involve putting ISR personnel and equipment within other kinds of operations rather than exclusively ISR operations. With this spreading of assets and personnel, this new way of doing ISR must be able to process hundreds if not thousands of kill chains quickly. In addition to decentralization, ISR personnel must be prepared to face an enemy with similar technological capabilities and will use those capabilities for deception and concealment.

The Air Force recognizes the methods and platforms of peacetime surveillance and reconnaissance are ill-suited in peer conflicts. The PRC in particular, has made great strides on improving its capabilities and the world in general are, in terms of airpower, are moving away from the precedent of the post-Cold War era into something new. The PRC are not like the Germans mentioned earlier in that the Germans came up with a countermeasure within a week. The PRC are likely to be much faster. The same old bag of tricks will not work since the enemy has thoroughly familiarized themselves with it. We cannot be trying to fight the last war in the next one. We must plan for a fight against someone that can give equal blows. No plan survives first contact with the enemy or as Mike Tyson would put it, “get punched in the mouth.”²³ However, we can develop ISR systems and methods that can take a punch and respond with an effective counterpunch.

²³ “Mike Tyson Quotes.” Goodreads.

Bibliography

Axe, David. "Coming Soon-a New Stealth Fighter for China's New Aircraft Carrier."

Forbes. Forbes Magazine, September 30, 2021.

<https://www.forbes.com/sites/davidaxe/2021/09/30/coming-soon-a-new-stealth-fighter-for-chinas-new-aircraft-carrier/?sh=1e1a2c151ea9>.

Chan, Minnie. "China's J-20 Stealth Fighter Joins the PLA Air Force." *South China*

Morning Post, July 20, 2018.

<https://www.scmp.com/news/china/article/2077732/chinas-j-20-stealth-fighter-flies-fighting-forces-says-state-media>.

Chen, Mingzhi. "China's Air Force Wraps up Large Force Exercise- Likely 'Red Sword 2020.'" China Aerospace Studies Institute. *Air University*, August 28, 2020.

<https://www.airuniversity.af.edu/CASI/Display/Article/2328631/chinas-air-force-wraps-up-large-force-exercise-likely-red-sword-2020/>.

Huang, Kristin. "China's Mysterious New Bomber 'Will Be Able to Strike Long-Distance Targets'." *South China Morning Post*, May 25, 2021.

<https://www.scmp.com/news/china/military/article/3134609/chinas-mysterious-h-20-strategic-bomber-may-be-able-strike>.

Insinna, Valerie. "A US Air Force War Game Shows What the Service Needs to Hold off - or Win against - China in 2030." *Defense News*, April 12, 2021.

<https://www.defensenews.com/training-sim/2021/04/12/a-us-air-force-war-game-shows-what-the-service-needs-to-hold-off-or-win-against-china-in-2030/>.

“ISR Flight Plan Unclassified Summary - AF.” Accessed December 5, 2021.

<https://www.af.mil/Portals/1/documents/5/isrflightplan.pdf>.

Kelly, Cynthia. “Freeman Dyson's Interview.” Freeman Dyson's Interview | Manhattan Project Voices. Atomic Heritage Foundation, February 18, 2015.

<https://www.manhattanprojectvoices.org/oral-histories/freeman-dysons-interview>.

Kitfield, James. “‘We're Going to Lose Fast': U.S. Air Force Held a War Game That Started with a Chinese Biological Attack.” Yahoo!, March 10, 2021.

<https://www.yahoo.com/lifestyle/were-going-to-lose-fast-us-air-force-held-a-war-game-that-started-with-a-chinese-biological-attack-170003936.html>.

“Mike Tyson Quotes (Author of Undisputed Truth).” Goodreads. Accessed December 6, 2021. https://www.goodreads.com/author/quotes/6583167.Mike_Tyson.

“Military and Security Developments Involving the People's Republic of China.” Office of the Secretary of Defense, 2021.

<https://media.defense.gov/2021/Nov/03/2002885874/-1/-1/0/2021-CMPR-FINAL.PDF?source=GovDelivery>.

Miller, Amanda. “In DOD Experiments, Target Identification Gets Faster, More Accurate with Ai.” *Air Force Magazine*. Air Force Association, October 31, 2021.

<https://www.airforcemag.com/dod-experiment-artificial-intelligence-target-identification/>.

“Quotations from Chairman Mao Tsetung : Mao, Zedong, 1893-1976.” Internet Archive.

San Francisco, CA: China Books, January 1, 1990.

https://archive.org/details/isbn_9780835123884/page/61/mode/2up.

“Skyborg.” Air Force Research Laboratory, September 20, 2021.

<https://afresearchlab.com/technology/vanguards/successstories/skyborg>.

“Skyborg: OPEN...RESILIENT...AUTONOMOUS.” Air Force Research Laboratory.

Accessed December 6, 2021. [https://cdn.afresearchlab.com/wp-](https://cdn.afresearchlab.com/wp-content/uploads/2020/02/20155247/AFRL_Skyborg_FS_0921.pdf)

[content/uploads/2020/02/20155247/AFRL_Skyborg_FS_0921.pdf](https://cdn.afresearchlab.com/wp-content/uploads/2020/02/20155247/AFRL_Skyborg_FS_0921.pdf).

Solen, Derek. “Initial Fighter Pilot Training in the PLA Air Force.” China Aerospace

Studies Institute. Air University, February 2021.

[https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/PLAAF/202](https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/PLAAF/20210216%20Initial%20Fighter%20Pilot%20Training.pdf?ver=CWRhXQPS7sgn1voT)

[10216%20Initial%20Fighter%20Pilot%20Training.pdf?ver=CWRhXQPS7sgn1voT](https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/PLAAF/20210216%20Initial%20Fighter%20Pilot%20Training.pdf?ver=CWRhXQPS7sgn1voT)

[IxrDow%3d%3d](https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/PLAAF/20210216%20Initial%20Fighter%20Pilot%20Training.pdf?ver=CWRhXQPS7sgn1voT).

Stiegel, Robert. “Is the Air Force Serious about Intelligence, Surveillance, and

Reconnaissance?” *War on the Rocks*, June 26, 2019.

[https://warontherocks.com/2019/06/is-the-air-force-serious-about-intelligence-](https://warontherocks.com/2019/06/is-the-air-force-serious-about-intelligence-surveillance-and-reconnaissance/)

[surveillance-and-reconnaissance/](https://warontherocks.com/2019/06/is-the-air-force-serious-about-intelligence-surveillance-and-reconnaissance/).

Tirpak, John. “China's New Two-Seat J-20: Trainer or Manned-Unmanned Teaming

Platform?” *Air Force Magazine*. Air Force Association, October 28, 2021.

<https://www.airforcemag.com/new-two-seat-chinese-j-20/>.

Wilson, Jake. "China's Domestic Aircraft Carrier Program: Modernization and Challenges." *Wild Blue Yonder Digital Journal*. Air University, November 12, 2021. <https://www.airuniversity.af.edu/Wild-Blue-Yonder/Article-Display/Article/2842336/chinas-domestic-aircraft-carrier-program-modernization-and-challenges/>.