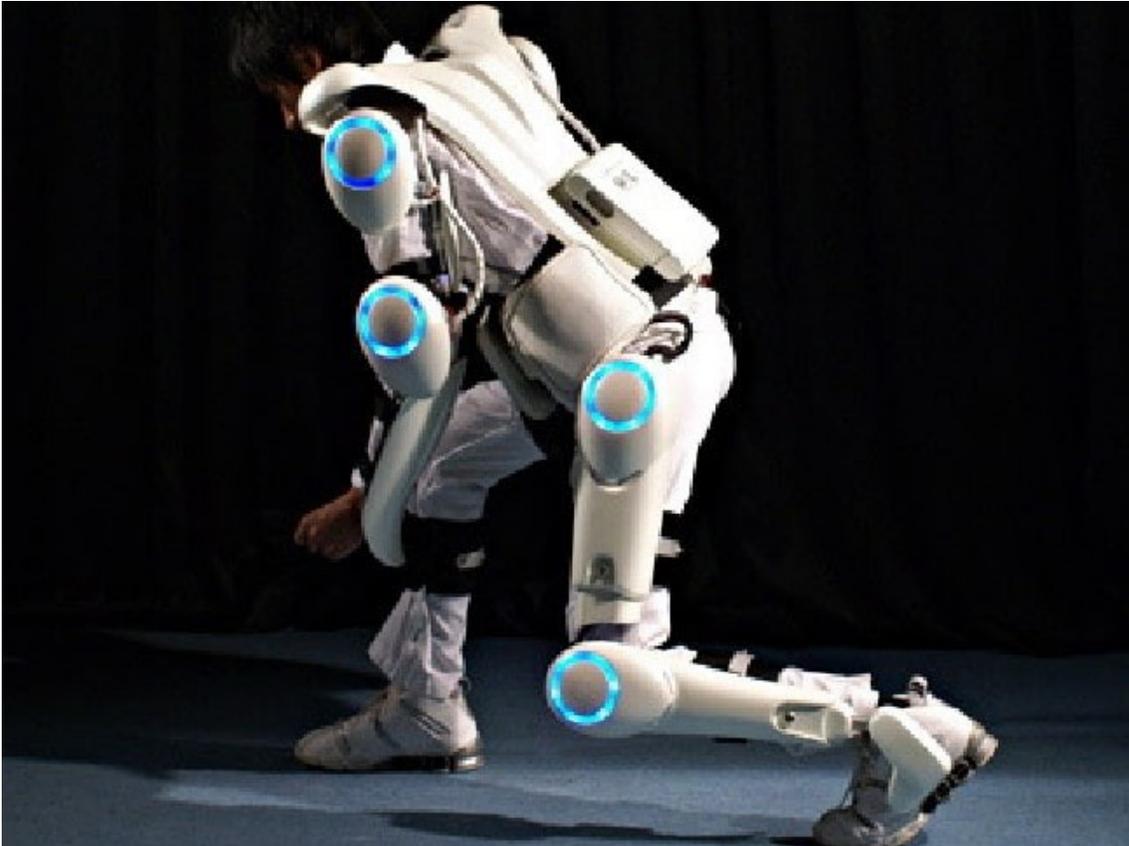


TECHNOLOGY SCAN : CHINA

13 MAR 2019

Brig Rajeev Kumar Bhutani (Retd)

China's Working on the Second Generation of Military Exoskeleton Evolving Exoskeletons.



Norinco, China's state-owned manufacturer of armored vehicles and heavy ground munitions, has debuted its second-generation military exoskeleton, a battery-powered body brace designed to help infantry members carry some 100 pounds (45 kgs) of weapons, supplies, and ammunition.

Compared to a previous Norinco exoskeleton, which came out in 2015, this second generation has a better battery, more robust hydraulic and pneumatic actuators, and a streamlined harness. The new exoskeleton will include physiological and biological sensors, and actuators that serve as the muscles to power the suit. The suit's helmet has also been built to include a thin, transparent glass with ballistic protection and a heads-up

display. Powered knee joints will also allow exoskeleton wearers to climb 100 flights, while still engage in combat.

The new version is also lighter, which will likely reduce strain felt by the exoskeleton's wearer, making it a better choice for troops in mountainous terrain. These refinements in weight, ergonomics, and power supply could also boost the second-generation exoskeleton's co-efficiency ratio. Basically: the higher the ratio, the less physical effort is needed to wear it. A ratio of 5:1 means that the wearer's body only needs to exert the effort it takes to carry 10 pounds in order to carry 50 pounds. Norinco's first-generation exoskeleton had a top speed of 2.8 miles per hour, for 12 miles. This new version improves on that and with enough charge it can walk 20km at a speed of 4.5 km/h (Lockheed Martin's HULC also has similar speed and endurance figures). The exoskeleton demonstrated enough flexibility to allow lateral ground movement: crawling in the mud while under enemy fire, for example.

Norinco isn't the only Chinese exoskeleton builder. In January 2018, the China Shipbuilding Industry Corporation's (CSIC) 707th Institute showed off its own powered exoskeleton to senior Chinese military officers. CSIC is marketing theirs as ideal for the shipyard, where people are expected to carry huge loads. In addition, Chinese military engineers at EEAE have developed the L-70 exoskeleton, which was first revealed by the 202 Institute of China Ordnance Industry Group in 2014 at the Zhuhai Airshow, and then in June 2015. Before that, the Nanjing Military Region's General Hospital built an exoskeleton that helped its wearer lift up to 80 pounds.

China's push to develop powered exoskeletons has implications for almost every area of combat operations. If the plans prove successful, Chinese infantry and special operators could not only carry heavier equipment for longer distances, but also attach body armor to individuals. Also, the exoskeletons would look like the Americans concepts that include the Tactical Assault Light Operator Suit.

Practically, exoskeletons are designed to assist soldiers in a wide array of support tasks, including loading supplies and ammunition, getting heavy missiles onto airplanes, and repairing ships. So far, such exoskeletons, whether in the U.S., China or Europe, are generally intended for logistical and engineering purposes with time limitations due to their short range and battery life.

Comparison with the United States' Exoskeleton. The U.S. Army is investing millions of dollars in experimental exoskeleton technology to make soldiers stronger and more resilient, what is being called as advanced gear to equip a new generation of "super-soldiers." The technology is being developed by Lockheed Martin Corp (LMT.N) with a license from Canada-based B-TEMIA, which first developed the exoskeletons to help people with mobility difficulties stemming from medical ailments like multiple sclerosis and severe osteoarthritis.

Worn over a pair of pants, the battery-operated exoskeleton uses a suite of sensors, artificial intelligence and other technology to aid natural movements.

For the U.S. military, the appeal of such technology is clear: Soldiers now deploy into war zones bogged down by heavy but critical gear like body armor, night-vision goggles and advanced radios. Altogether, that can weigh anywhere from 90 to 140 pounds (40-64 kg), when the recommended limit is just 50 pounds (23 kg).

Exoskeletons shown by the USA appear to be more advanced. [US Special Forces are building the TALOS \(tactical assault light operator suit\) exoskeleton.](#) It will provide protection against shrapnel and small arms fire, but could be targeted by an electromagnetic pulse weapon.

The United States is not the only country looking at exoskeleton technology. Russia, in particular, was working on several versions of exoskeletons, including one that it tested recently in Syria.

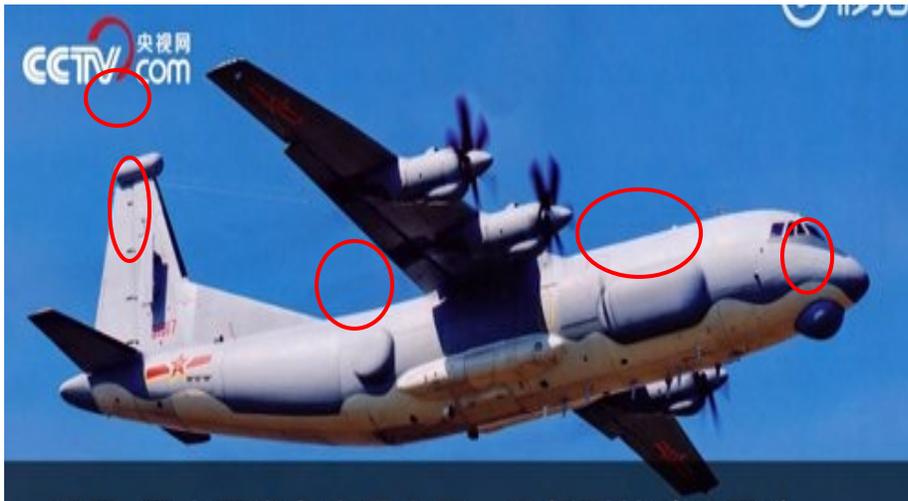
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Capt (IN) KK Agnihotri

New Chinese Intelligence Gathering and EW Aircraft. China has reportedly developed a new type of electronic warfare aircraft with extra antennas installed on board. It would be in a position to gather intelligence on all kinds of platforms, especially in the maritime domain, to gain tactical advantage in case of a conflict. A photo of the aircraft, featured in China Central Television (CCTV) is shown below.



It appears to have been developed from Y-9 transport aircraft, and the CCTV report termed it as 'a new type of special mission aircraft,' without further elaboration. It seems to be equipped with a hemispheric radar dome under its chin, two large antennae on each side of the fuselage, an antenna on each side of the tailfin and an EW pod on top of the tailfin (As marked). Such devices indicate that the aircraft can effectively gather broad spectrum of adversary's COMINT and ELINT. The CCTV report said that It can also carry out suppression of enemy's electronic signals, thus supporting China's aerial strike missions, by jamming and rendering the hostile air defense systems, ineffective.

Comments: The Y-9 medium-sized tactical transport aircraft with a maximum range of about 4,000 km, is known to have been modified as required, for early warning, reconnaissance and anti-submarine roles. But the new variations seen in the photo are much different from the others. One important role the new aircraft could play is to gather intelligence and electronic data in the South and East China Seas. The new aircraft could replace the Gaoxin-4 (GX-4); an older electronic warfare aircraft based on the Y-8 transport airframe, because the Y-9 being larger and heavier can fly longer and carry more devices. This is an important development which will have serious ramifications in maritime operational domain. Hence, more technical details of its sensor package and EW suites must be sought.

Source: http://english.chinamil.com.cn/view/2019-03/07/content_9444106.htm

Brig Navjot Singh Bedi

China-US Huawei 5G Standoff during Mobile Tech Summit. Robots, cars, drones and virtual-reality gaming sets connected by cutting-edge 5G networks were among the thousands of futuristic gadgets on display at this year's Mobile World Congress in Barcelona, Spain in March 19. While there is much excitement over how 5G will transform our everyday lives, the conference was overshadowed by the standoff between the United States and Beijing over the Chinese telecom giant Huawei, which the U.S. says could be used by the Chinese government for espionage. The U.S. State Department's Deputy Secretary for Cyber Policy Robert L. Strayer said: "We will continue to engage with these governments and the regulators in these countries to educate them about what we know and keep sharing the best practices for how we can all successfully move to next generation of technology. I'll just say there are plenty of options in the West." He also urged allies to do the same.

Comments. Washington has banned Huawei from 5G rollout in the United States, citing Chinese legislation requiring companies to cooperate with the state — raising fears Huawei 5G networks overseas could be used as a 'Trojan horse' to spy on rivals. Australia, New Zealand and Japan have followed Washington's lead and restricted Huawei's involvement in 5G. Europe remains undecided — but the industry needs clarity on the same. The really key aspects of 5G are the low latency communications, massive sensor and massive machine-to-machine communications, which are about industry and industrial uses. And as that gets into things like critical infrastructure, so there is a lot more non-personal or industrial data being used which really has people concerned. For example, military forces in countries like the U.S. will also leverage large parts of the commercial network.

Chinese firm Huawei is a big player in 5G network technology and also had a big presence at the Mobile World Congress. Huawei's management has said the company would never use 'back doors' for espionage — and the Chinese government has dismissed the accusations. The European community in particular and also the U.S. have to clarify what these policies mean, what a ban would mean or what some kind of a partial ban would mean, if there's really a middle ground that can be found there because banning Huawei could possibly set Europe's 5G rollout back another two years.

(<https://www.voanews.com/a/mobile-world-congress-overshadowed-by-huawei-5g-spying-standoff-/4804788.html>)

5G Modem Balong 5000 Chipset. Richard Yu, CEO of Huawei Consumer Business Group, unveiled the 5G modem Balong 5000 chipset in Beijing in Jan 2019. Chinese tech giant Huawei has announced plans to release a next-generation smartphone based on its own technology instead of U.S. components, stepping up efforts to compete with global industry leaders.



Thailand Launches Huawei 5G Test Bed. Thailand launched a Huawei Technologies 5G test bed, even as the United States urged its allies to bar the Chinese telecoms giant from building next-generation mobile networks. The 5G test bed in Thailand, the United States' oldest ally in Asia, will be Huawei's first in Southeast Asia. Mr Pichet, Thailand's minister clarified that it's cooperation with Huawei on the test bed does not mean Thailand is not concerned about security issues. This 5G test bed project is a testing period for Thailand, during which the nation can make observations which will be useful to either confirm or disconfirm the allegations.

The 5G test site is in Chonburi, the heart of the Thai military government's \$45 billion economic project - the Eastern Economic Corridor (EEC) - about 90 km southeast of Bangkok. Vendors like Nokia, Ericsson and Thai telecoms operators have also set up 5G labs at the site. U.S. embassy spokesperson in Bangkok said the US advocates for secure telecoms networks and supply chains that are free from suppliers subject to foreign government control or undue influence that poses risks of unauthorized access and malicious cyber activity.

Comments. Huawei has previously set up a cloud data centre worth \$22.5 million in Thailand's EEC, a centre piece of the government's policy to boost growth in the country that has struggled to attract foreign investors besides the Chinese. Ties between the United States and Thailand have cooled since the Thai military took power in a 2014 coup. Relations between Bangkok and Beijing, on the other hand have, warmed in recent years as evident from a pickup in defense trade and Chinese investment. Huawei, the world's top producer of telecoms equipment and second-biggest maker of smartphones, has been facing mounting international scrutiny amid fears that China could use its equipment for espionage, a concern the company says is unfounded. Huawei, which gets nearly half of its revenue from outside China, says it has secured more than 30 commercial 5G contracts globally. But it has not yet signed a 5G contract in Thailand. Huawei is in talks with telecoms operators, to secure local partnerships ahead of a national rollout scheduled for December 2020. Possibly for Thailand, security concerns over Huawei's equipment would have been analysed in context to its competitive pricing versus that by U.S. firms

(<https://telecom.economictimes.indiatimes.com/news/thailand-launches-huawei-5g-test-bed-even-as-us-urges-allies-to-bar-chinese-gear/67897174>)

Overall Comments. In addition to security & espionage related concerns, the issue of IPR over 5G high end cutting technology is at the heart of standoff between USA and China.

Gp Capt GD Sharma, VSM (Retd)

Chinese Space Surveillance: Yaogan Satellites Constellation. Satellites play a vital role in Chinese pursuit of Anti access and Anti denial strategy by providing surveillance capability on 24 hour basis of the chosen area. The Yaogan series of satellites were launched by China from 2006 onwards, are a constellation of operational ISR satellites that provide China a global Intelligence Surveillance and Reconnaissance (ISR) capability. These satellites are positioned in Low Earth Orbit (LEO) in the space at the height of 600km. A 2018 report from National Institute of Advance Studies suggest that satellites have been launched three at a time from the Xi Chang Launch complex using the CZ 2C launcher. The three orbital planes occupied by the twelve satellites are also spaced equally around the earth separated by 120 degrees.

The architecture of this 12 satellite constellation suggests that the purpose is to achieve a near continuous ELINT surveillance of the regions between 35 degrees North and 35 degrees South Latitude.

It is likely that two other triplets will soon be launched so that the three equally spaced orbital planes will each have six satellites apiece spaced 60 degrees apart. This will create an operational constellation of 18 satellites.

Chinese Yaogan satellite constellation comprising ELINT, SAR and EO satellites provide large area surveillance capabilities especially over the Pacific region. This constellation has been in operation since 2010 and provides China with the ISR capabilities to detect adversaries at distances far away from its coastline.

The constellation uses three kinds of satellites:-

- (a) Electronic Intelligence (ELINT) satellites that pick up the electronic emissions and locate the object of interest in the Ocean with a relatively coarser spatial resolution;
- (b) Synthetic Aperture Radar carrying satellites that are cued by the ELINT satellites or by other satellites in the constellation that have located the object of interest;
- (c) Electro-optical satellites that are cued by the ELINT satellites or by other satellites in the constellation that had located the aircraft carrier earlier.

Till the end of April 2018, China had launched 31 Yaogan satellites. Apart from catering to specific missions such as the Anti Satellite Ballistic Missile (ASBM), this constellation provides the needed large area surveillance capability for its Anti Access and Anti denial (A2AD strategy). It is expected that all operational areas would be covered by ELINT satellites.

Air Cmde T Chand (Retd)

Aviation – PRC. For ease of analysis, Aviation Technology is often categorised into Flight Control Systems (FCS), Aero-engine, Airframe, Avionics systems, General systems, Weapon systems, Safety Systems, Electronic Warfare Systems, Tools, Test Equipment, Ground handling Equipment (TTGE) and Flight Testing. Chinese aviation industry is believed to have made noticeable progress in the development of all these systems except aero-engine which is believed to be in advance stage of development.

The Aviation Industry Corporation of China, Ltd. (AVIC) is the main organization dealing with all aspects of the aviation and provides complete services to customers in many sectors - from research and development to operation, manufacturing and financing.¹ Its business units cover defence aircraft, transport aircraft, helicopters, avionics and systems, general aviation, research and development, flight testing, trade and logistics, assets management, finance services, engineering and construction, automobiles and more. AVIC has over 100 subsidiaries, nearly 27 listed companies and more than 450,000 employees.

AVIC main products are: Fighter aircraft J-10, J-11, [J-15](#), J-16, [JF-17](#), [J-20](#) and [J-31](#); Fighter bomber aircraft, JH-7; Trainer aircraft, JL-8, JL-9 and L-15; Bomber aircraft H-6 and H-20; three types of AEW&C aircraft; six types of Transport aircraft; ten types of helicopters and a large number of UAVs.²

AVIC offers export of five types of military aircraft.³ The FBC-1 is a two-seat, twin-engine supersonic fighter-bomber, designed for performing air interception and air-to-surface attack mission. Powered by two turbofan engines, it is equipped with advanced integrated avionics system. It can carry air-to-air missiles, anti-ship missiles, air-to-ground missiles and guided bombers. The FC-31 is a fourth generation multi role fighter developed for the international market. With excellent combined operation effectiveness and independent intellectual property rights, it adopts a normal configuration - single seat, twin engine, outward tilted twin vertical tail and all movable horizontal tail, with big S inlet on its both sides and a built-in weapon pod. FC-20/FC-20A is a third generation fighter aircraft with high performance capabilities and multi-functioning abilities. The FC-1/JF-7 is a new-generation light multi-role fighter, jointly developed by China and Pakistan. Equipped with state-of-the-art systems and weapons, the FC-1/JF-17 has BVR air combat capability as well as powerful air-to-surface attack capability. The fifth product F-8T is a multi-purpose, supersonic, all-weather fighter aircraft. AVIC also exports Trainer aircraft, UAVs, Transport aircraft, Avionics systems and Aircraft simulators.

A test bed J-10B powered by a WS-10 with thrust vectoring (TVC) was demonstrated at the 2018 China International Aviation & Aerospace Exhibition. The TVC nozzle uses actuator-assisted moving petals, similar in concept to General Electric's Axisymmetric Vectoring Exhaust Nozzle (AVEN) and Pratt & Whitney's Pitch-Yaw Balance Beam Nozzle

1 <http://www.avic.com/en/>

2 https://en.wikipedia.org/wiki/Aviation_Industry_Corporation_of_China

3 *Ibid*

(PYBBN).⁴ The Shenyang WS-10 codename Taihang is a turbofan engine designed and built by the AVIC. The WS-10A reportedly powers the J-11, the J-16, and the Shenyang J-15. Chinese media claims that 300 aero engines were manufactured from 2010 to 2015.

Successful development of the thrust vectoring system is a major achievement and it will enhance capability of the Chinese aircraft to the level of best modern highly maneuverable fighter aircraft.

⁴ https://en.wikipedia.org/wiki/Shenyang_WS-10

