Preliminary Assessment of China's J-35A Stealth Aircraft Debut at Zhuhai Airshow

Introduction

China declassified its latest fifth-generation aircraft, the J-35A at the recently held Zhuhai airshow. This aircraft took part in a five-minute aerial display showing its maneuverability with a series of steep dives and climbs.[1] According to People's Liberation Army Air Force (PLAAF) officials, the Shenyang Aircraft Corporation (SAC) and the Aviation Industry Corporation of China (AVIC) manufactured J-35A is a midsize land based stealth fighter jet which is expected to perform operations like air-combat and precision strikes against land and sea based targets. Another expert added that the J-35A has a smaller size, lower air drag and an outstanding stealth capability. The important feature of the J-35A, as reported, is its low production cost as compared to the heavyweight J-20.[2] This debut will make China only the second nation after the US to have two stealth aircrafts, but PLAAF has not confirmed whether the J-35A has entered active military service as of now.[3]

Design comparison of J-35A with American F-35

The PLAAF's need for J-35A may stem from its larger goal of undermining or matching the air-power capabilities of the US. J-35A's naval variant the J-35, likely to debut in the future, will operate from aircraft carriers to assist PLAAF deter adversaries like the United States (US) and North Atlantic Treaty Organization (NATO) allies operating near China's areas of interest like Taiwan straits or the South China Sea.[4] Many western experts have pointed out that the J-35A is copied from the American F-35, but still visual differences in design exists. Barring exterior design, the engine, air-inlet design and the fuselage wing configuration are the important factors for any fighter aircraft's performance.

The engine exhaust of F-35 has a polygonal design, whereas, the J-35A has a rounder exhaust. The air-intake of F-35 features larger, straight-sided intakes positioned near to the fuselage whereas the J-35A's narrower intakes are angled slightly outward. In terms of wing shape, the F-35 has trapezoidal wings integrated to the main fuselage, while the J-35A has larger trapezoidal wings with a different placement, probably meant for aircraft carrier-based operations.[5] The main differentiating feature is the engine configuration, where the J-35A is a twin engine fighter and the F-35 being a single engine jet with short take-off and vertical landing feature which is absent in J-35A.

J-35A's technical features speculations

As per Global Times, the Chinese Communist Party's (CCP)-funded national daily, the key features of J-35A include enhanced stealth, informatisation, network integration, and intelligence capabilities. It emphasises on information warfare, collaborative operations, and multi-domain combat and operates within stealth and counter-stealth combat frameworks which signal towards its priority to evade detection as well as to accurately detect its enemy counterparts. When pitted against a fourth-generation fighter, it is said to operate beyond adversary's detection range. Against a similar fifth-generation fighter, it is reported to achieve a strong lethality and survivability, to establish a rapid and stable closed-loop kill chain.[6]

The CCP's statements somehow seem exaggerated at the moment because any fighter aircraft requires years of flight trials and validation before initially being inducted with the end users. The American F-35 had to undergo more than a decade's flight trial before being successfully inducted into the American and its allied air-forces. Even if one goes by the CCP reports, if the J-35A is indeed operating with the features described at a lesser production cost, then it means that the J-35A is better than the costly J-20 and it should replace the J-20 which is not the case as of now. The CCP stresses on the long range detection of J-35A, which should imply that it should have powerful radars, missile approaching radars, Electronic Warfare (EW) suites etc. But in the absence of any credible specifications from the manufactures, it is hard to validate most of the CCP claims. This fact is also observed by the recent statement of Wang Yongqing, chief expert at the SAC and Research Institute of AVIC who quoted that the J-35A is in its development phase, which is still underway.[7]

Although the technical specifications of the J-35A is still not available in public domain, the initial prototype of J-35A, the FC-31, had Russian made RD-93 engines having a thrust of 80 kilonewtons (kN).[8] But as per China's Ministry of National Defence, the J-35A is equipped with a homegrown engine. As per PLAAF officials, the test pilots found the J-35A highly maneuverable having excellent control and user-friendly human-machine interaction.[9] There are also reports of China working on an improved variant of the domestically developed WS-13 engine, which can generate 22,000 pounds of thrust equivalent to 98 kN of force. The J-35A is expected to carry 18,000 pounds of internal and external munitions.[10]

No information is available regarding the stealth features of this jet, but western experts acknowledge that Chinese scientific community have spent decades to research on fighter jet stealth technology. The shape of airframe, similar to F-35 is designed to minimise the radar signature. But currently it's not publicly known if the J-35A utilizes special radar-

absorbent coatings, communications or radar systems similar to F-35 to avoid detection. The J-35A is reported to use the advanced domestically developed WS-19 engines having 10 per cent more thrust than its predecessor.[11] Therefore, it has to be seen whether the Chinese design will be able to minimise the heat signature coming from the engine because engine infrared signature has been an issue with the F-35 also.[12]

Visual assessment from Zhuhai airshow

The short display of the J-35A from the Zhuhai airshow throws some hints about its preliminary capabilities, mainly its engine capacity and maneuverability. In a less than one minute video footage obtained from the local media, the J-35A is seen cruising horizontally at a comfortable angle.[13] In another footage, the J-35A is seen performing a partial/incomplete vertical Charlie and a side roll followed by an inverted turn.[14] The accurate radius of turn with that manoeuvre can't be estimated because of absence of further clear footage. Also, the super cruise speed is not identified in the footage.

The twin engines are clearly seen to be throttling with afterburners which indicates that the J-35A had to power up two engines at wet-thrust configuration to perform a steep climb which in normal conditions can be performed with dry thrust conditions only if the aircraft is not loaded with payloads at similar altitude. In case of a normal vertical charlie, any aircraft attains a higher maximum suitable altitude for a longer duration of time which is beyond the human visual range. Since in the video footage, the J-35A is stabilsing without achieving much altitude and within normal human visual range, the engine seems to deliver wet-thrust at lower altitude, thereby, implying that the requirement of thrust and fuel at a higher altitude will be more even with payloads.

In terms of J-35A's maneuverability, even though the Chinese media and PLAAF experts are suggesting that it's a highly maneuverable aircraft, we must deeply revisit the concepts of maneuverability. The performance of an aircraft is the measure of the steady state or the point performance. Maneuverability is a measure of the time derivative of the performance. Agility is a measure of the time derivative of the maneuverability which are rapid, controlled angular rotations and heading changes. So, it's not just maneuverability but the overall agility which makes any aircraft better than another. The agility is again measured in terms of axial, longitudinal and lateral metrics. Likewise, functional agility of any fighter jet can be measured using models like combat cycle time, roll reversal parameter, pointing margin metric and thrust vectoring. Overall, it has been observed that post stall maneuverability and thrust vectoring improves the functional agility.[15] The J-35A didn't

display all the above metrics in the Zhuhai airshow, and it's not confirmed whether it has any thrust vectoring feature at the moment. So, it will be premature to categorize the J-35A as highly maneuverable.

Impact on regional geopolitics

The arrival of the J-35A is not going to cause any significant shift in the balance of air-power as China's technology still has a long way to go. The other challenges include lack of real-world combat experience of PLAAF pilots, getting more pilots trained for transition from third-generation fighter jets to the highly digital systems of fifth-generation jets. The only likely impact could be political in nature with regards to the Taiwan issue as these jets could increase the survivability of Chinese naval aviation.[16] While it has been confirmed that the J-35 (naval) is more suited for carrier based operations, there is no news of the J-35A being optimized for usage with the land force of PLA or the PLAAF.[17]

As far as the export potential of J-35A is concerned, China could be looking to export J-35A to Pakistan to reap the benefits of investments into its technology. China even has indicated its willingness to mass produce J-35 in large numbers in a short period of time.[18] The other potential buyers could be Egypt, UAE and Azerbaijan who's fighter fleet upgrades have been stopped by the US. This will also help China to find buyers which may otherwise opt for Russian jets.[19] The only issue with this vision is that none of these three countries are major naval powers and none of them possess any aircraft carrier. So, exporting to these countries may be a tricky issue.

Conclusion

The overall intention of China to manufacture the J-35A is to show the US and NATO members that it can also develop and possess two stealth fighters. The other objective is to export these to friendly nations and expand its export market. Rather than improving on the initial shortcomings of the J-20 with respect to stealth and engine, the Chinese here are trying to match up in terms of numbers. The stealth profile, engine capacity and maneuverability of J-35A will be a mystery and won't be validated in the near future if PLAAF keeps its data classified. As far as its operational status is concerned, it is expected to follow the same timeline as that of the J-20. But what the Chinese didn't realize is that the world will soon shift to sixth-generation fighter jets and it would have been a smart move for the Chinese to showcase a sixth-generation fighter rather than a fifth-generation fighter to surprise the US and the world.

Endnotes:

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