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## DESIGN IMPROVEMENTS IN DF-21 (CONVENTIONAL) VARIANT: SIGNALLING DETERRENCE AT THE CONVENTIONAL LEVEL

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After becoming an independent and separate wing of the armed forces recently, the PLA's Rocket Force has conducted a couple of manoeuvres and testing of a new and improved variant of an IRBM. In recent years, China's missile force has become more proficient at "signalling" which it does by releasing test and operation manoeuvre videos of its missile forces.

Taiwanese news websites and Chinese language media have revealed that a new improvement has been done on the DF-21 Intermediate Range Ballistic Missile (IRBM). The PLA Rocket Force had carried out an exercise in late February 2016 where manoeuvres had taken place along with the winter test firing of a variant of the DF-21 IRBM.<sup>1</sup> During the latest testing of the missile, in February new aerodynamic control surfaces were observed in the warhead

section.<sup>2</sup> The missile is believed to be either the DF-21C (A/B) or the DF-21D.

Rarely does the world get to see the actual missiles like the DF-21 as otherwise only the canister is visible during parades and manoeuvres. Only a few times was the actual JL-1 SLBM (similar to the DF-21 design) without the canister shown in the parades, that too during the eighties. Towards the end of February, the Chinese Rocket Force released a test video which showed a test launch of an improved DF-21 variant. The images of the actual missile popping out of the launch tube and the ignition were observed. In this rare visual, new control surfaces (fins) were observed in the payload section of the missile indicating that it is a terminally guided variant and that it is an effort to further improve the accuracy of the missile.



The DF-21 is an IRBM which comes in several variants with varying accuracy. The design of 'this' primarily land attack variant (DF-21 A/C) comes from China's first solid fuelled missile and its first SLBM that was to arm the Xia class SSBNs. There is some ambiguity in the designation (A,B, C), but the best guess based on the available information on the missile is that there are three to four variants. The first variant, DF-21, is primarily a nuclear missile going by its very low accuracy. The accuracy of the missile has been improved in the later variants like the DF-21 A/B and DF-21C.

The DF-21C is believed to be for conventional precision strikes as it has very high accuracy. Jane's Strategic Weapon Systems claim the CEP to be 30 meters which makes it conventionally very effective. The latest variant, though not a land attack variant, is the much hyped DF-21D Anti Ship Ballistic Missile (ASBM) which is believed to have an additional internal strapped-on terminal guidance system for improved terminal accuracy.

In addition to the control surfaces, another structural change was also noticed at the end of the canister. The cushions at the end of the canister matched with the ones in the DF-21D missile canister displayed during the recent parade.<sup>3</sup> Though initial Chinese media reports suggested it to be a conventional land attack missile, later reports claim the missile to be the DF-21D – the anti-ship variant of the DF-21

series.<sup>4</sup> However, these are just speculations as the possibility of the new cushion structure of DF-21 D canister being adopted for the land attack variant cannot be discounted.

The Jane's Defence Weekly website opines that the new missile might not use the same bi-conic warhead design of the DF-15B.<sup>5</sup> However, it can be observed from line diagrams and parade displays that the DF-21 warhead designs significantly differ from the DF-15 warhead design, though both are bi-conic.<sup>6</sup> The DF-21/JL-1 series warhead design has only varied slightly over time but has retained the bi-conic shape.<sup>7</sup> Experiments and studies have shown that bi-conic design gives a good balance between improving accuracy and velocity unlike the tri-conic design.

Moreover, unless there is a need to increase the payload capacity or the missile is given MIRV capability, the bi-conic design might not change. Hence, with no access to the recent test imagery of the DF-21 it would be impossible to comment on any variation in the re-entry vehicle design. However, the variations, if any, cannot be too drastic so as to alter the aerodynamic characteristics of the missile. Doing so would require some post production testing.

The Chinese media reports do mention that the recent DF-21 test involved a bi-conic warhead design.<sup>8</sup> Hence, the only speculation, if altered, is the degree of change in the angle of air flow break points which determine the ratio

between the velocity and accuracy. If the design goes for a lower ratio of velocity compared to previous DF-21 designs, then, theoretically speaking, it could be the DF-21D. Nevertheless, it could also be the same land attack variant with higher accuracy.

The deliberate display of the design changes, indicating an improvement in the accuracy or better manoeuvring capability to defeat missile defence systems as speculated by some online Chinese language media,<sup>9</sup> appears to be an attempt by the Chinese armed forces to signal deterrence at the conventional level. Nevertheless, the improvements in the missile systems are a continuous phenomenon as has been observed from several such events in the past few years. It is to be noted that every design improvement to the DF-21 conventional series in terms of accuracy, lowering of velocity and in the terminal guidance and control features are going to take China closer towards realising reliable ASBM capability.

*(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])*

#### Notes

<sup>1</sup> "Recently revealed: DF-21 ground attack missile", [http://news.ifeng.com/a/20160226/47595938\\_0.shtml](http://news.ifeng.com/a/20160226/47595938_0.shtml) , 26 February 2016

<sup>2</sup> "The upgraded DF-21 comes with a bi-conic warhead meant for underground targets", <http://mil.news.sina.com.cn/china/2016-02-26/doc-ifxpvyx1671490.shtml>, 26 February 2016.

<sup>3</sup> "China reveals DF-21 MRBM manoeuvrable warheads", <http://www.janes.com/article/58013/china-reveals-df-21-mrbm-manoevrable-warhead#> , 14 February 2016.

<sup>4</sup> "东风 21D 新弹头引西方关注 遏制好战势力冲动(图)", <http://www.chinanews.com/mil/2016/02-16/7759014.shtml>, 16 February 2016

<sup>5</sup> No.3

<sup>6</sup> Observed from parade photographs and line diagrams of the DF-21 variants, JL-1 and DF-15 series given in Janes Strategic Weapon Systems (2013-2014).

<sup>7</sup> Ibid

<sup>8</sup> "台媒：东风 21 最新型可打地下目标 敌更难拦截(图)" <http://www.chinanews.com/mil/2016/02-26/7773910.shtml>, 26 February 2016

<sup>9</sup> No.2