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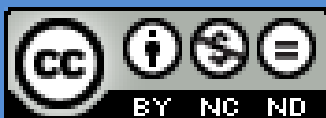
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From Ad Hoc Evaluation to Institutional Capability: The Emergence of Flight-Testing in the Indian Air Force

Mr Ashutosh Kumar

Research Scholar, Unni Kartha Chair of Excellence



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Introduction

Established on October 08, 1932, the Indian Air Force (IAF) has evolved from a small auxiliary air arm into one of the most technologically sophisticated components of the Indian defence establishment.¹ On April 01, 1933, the IAF's first operational flight took to the skies with six Royal Air Force (RAF)-trained officers and 19 Havai Sepoys in four *Westland Wapiti IIA* biplanes.² Post-independence, the IAF underwent rapid expansion as India sought to strengthen its airpower capabilities in response to emerging strategic challenges in the neighbourhood. The IAF inducted its first single-engine powered jet, named *de Havilland Vampire*, in 1948, which was of British origin.³ The increasing complexity of aviation technology significantly expanded the technical demands associated with aircraft induction, maintenance and operational deployment within the IAF.⁴

Despite the technological evolution in the country, much of the existing scholarship on the IAF has primarily focused on operational history, aircraft acquisitions and broader defence policy developments. While these studies provide valuable insights into the growth of air power, there has been little attention paid to the institutional mechanisms that enabled the testing and evaluation of newly inducted aircraft and the modification of aircraft with advanced avionics or weapon systems to enhance their operational capabilities. Hence, the safe and effective integration of increasingly complex aviation systems required systematic procedures for performance evaluation and operational certification. The reliance on foreign testing arrangements or informal evaluation processes often proved insufficient, in the absence of such institutional frameworks.⁵

This article examines the way the IAF gradually addressed this challenge in the early decades after India's independence in 1947. It argues that the technological expansion (after the induction of the first jet aircraft, *Vampire*) exposed the limitations of ad hoc testing arrangements and led the IAF to develop an indigenous institutional framework for flight-testing, beginning with the establishment of the Aircraft Testing Unit (ATU) in 1948 and evolving into more structured establishments in subsequent years.⁶

The Technological Transformation of the Indian Air Force

Technological transformation within the IAF was witnessed post-independence. Initially established with a limited fleet and operational responsibilities, it gradually expanded its role in response to emerging strategic challenges and the growing importance of airpower in modern warfare.⁷ As India started strengthening its defence capacity after 1947, the air force also began acquiring a wide range of aircraft to enhance its operational effectiveness and technological capacity in the region.

By 1950, the IAF had six fighter squadrons equipped with aircraft like *Spitfires*, *Vampires* and *Tempests*, which were being operated from Kanpur, Poona, Ambala, and Palam, alongside one *B-24 bomber* squadron, one *C-47 Dakota* transport squadron and a communications squadron at Palam.⁸ However, the acquisition of jet aircraft increased the complexity in aircraft operations and evaluation. These systems required rigorous assessment of performance characteristics, system reliability and operational suitability before they could be integrated into the service safely.

At the same time, the institutional framework of India's defence establishment was still evolving. In the early years after independence, India sought to strengthen its defence capabilities by acquiring modern military technologies. The problem here, however, was that the institutional systems required to evaluate and support these technologies were still evolving.⁹

Within this context, the modernisation of the IAF needed to meet new demands for systematic evaluation mechanisms which should be capable of assessing aircraft performance under Indian conditions.

The Institutional Gap in Aircraft Testing

While the technological transformation of the IAF enhanced its operational capabilities, it also exposed a significant institutional challenge. There was no structured framework for the systematic testing and evaluation of newly inducted aircraft in the country. In the early decades after India's independence, aircraft acquired by the IAF were tested and certified largely by manufacturers or foreign air forces before delivery. Although such external evaluations provided only a baseline assessment of aircraft performance, they did not always account for the specific operational conditions under which these aircraft would be flown. Differences in climate, infrastructure, operational doctrine and logistical systems meant that aircraft would require additional evaluation to determine their suitability for service in India.

This challenge was deepened by the broader institutional context of India's defence establishment during the early post-independence period. Defence procurement frequently proceeded in response to immediate operational needs of that time, while the institutional mechanisms which were required to support advanced military technologies were still in their developing stage. As scholars have noted, the early defence policy environment often reflected a pattern where technological acquisitions went ahead of the organisational capacity required to sustain them effectively.¹⁰ Within the aviation domain, this imbalance clearly meant that the IAF had to operate those jet aircraft without a fully developed domestic system for testing and technical evaluation.

The evolution of maintenance frameworks within the IAF during the early decades after independence reflected the need for structured technical oversight and systematic evaluation procedures.¹¹ As aviation technology became more complex, these limitations highlighted the importance of developing an indigenous institutional capability for flight-testing within the IAF.

The Emergence of Indigenous Flight-Testing Capability

The increasing technological complexity and the limitations of foreign dependent testing of aircraft gradually pushed the IAF toward developing an indigenous institution. The first step in this direction came with the creation of the ATU under the command of Wing Commander H Moolgavkar, established to test the newly inducted fighter jet, the *de Havilland Vampire*, which was acquired from the United Kingdom.¹² The ATU was tasked with conducting flight- testing and evaluation of the aircraft within the IAF's operational context. The establishment of this unit represented the first formal attempt by the IAF to move beyond ad hoc testing practices and develop an indigenous mechanism for assessing aircraft performance.

The establishment of ATU marked an important institutional shift in India. Instead of relying completely on foreign certification, the Air Force created a domestic capability to test foreign-procured aircraft under local environmental and operational conditions. Such testing was critical for identifying technical limitations, evaluating operational suitability, and ensuring safety during induction into service.

As the IAF continued to modernise during the 1950s, the scope of flight-testing expanded significantly. The introduction of newer aircraft, such as the *Dassault Ouragan (Toofani)* and *Hawker Hunter*, created additional demands for systematic evaluation. Recognising these new requirements, the Aircraft and Armament Testing Unit (A&ATU) was established in 1957 in Kanpur, Uttar Pradesh, under the command of Squadron Leader Bhopinder Singh.¹³ It increased the scope of testing activities to include aircraft systems, armament integration, and operational trials. Over time, this expansion of testing responsibilities reflected that flight-testing was both a technical task and a critical component of managing technological risk in modern aviation. The gradual development of this capability laid the foundation for the further institutionalisation of flight-testing within the Indian Air Force.

Institutionalisation of Flight-Testing in the Indian Air Force

The increase in flight-testing activities in the 1950s and 1960s eventually transformed flight- testing into a more structured institutional capability. As aviation technology advanced, the evaluation of aircraft required specialised technical experts who could analyse the performance of the aircraft and

the systems' behaviour alongside skilled pilots. This growing difficulty again highlighted the need for a more comprehensive approach to flight-testing that combined operational flying experience with systematic technical analysis.

In response to these new requirements, the A&ATU was transformed into the Aircraft and Systems Testing Establishment (ASTE) in 1972 and shifted to Bengaluru in the state of Karnataka.¹⁴ The reorganisation reflected the indigenous scope of flight-testing because aircraft systems and weapons integration became central aspects of aviation capability. ASTE was tasked with conducting a wide range of testing activities, such as performance evaluation, systems trials, and operational assessments of newly introduced aircraft and equipment.

Simultaneously, the increasing complexity of testing activities required specialised professionals within the testing ecosystem. Apart from test pilots, flight test engineers also began to play an important role in analysing aircraft systems. They combined their engineering expertise with operational knowledge and ensured that aircraft were evaluated rigorously before entering service.¹⁵ The emergence of such professionals indicates that flight-testing had gradually evolved into a structured institutional process. Through ASTE, the IAF gradually developed the organisational capability required to manage the technological challenges of the complex modern military aviation.

Conclusion

The early decades of the IAF reveal the increasing technological complexity in airpower and how it created new institutional challenges that could not be addressed by relying on informal or foreign testing of aircraft. As the IAF procured advanced aircraft, the limitations of the ad hoc testing system became outdated. The need to test aircraft performance, system reliability, and operational suitability under Indian conditions pushed the Air Force to develop its own flight-testing capability. The establishment of the ATU in 1948 marked the first institutional response to this challenge, followed by the expansion into the A&ATU in 1957 and then the ASTE in 1972. It reflected a mature effort to create a structured framework for evaluating complex aviation technologies. The evolution of flight-testing within the IAF shows how technological change can drive towards the development of new institutional capabilities, which are essential for the effective functioning of the air force.

Notes:

¹ Press Information Bureau, Government of India, "The Story of the Indian Air Force: A Journey Through Time," October 07, 2024, <https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=153257&ModuleId=3>. Accessed on March 05, 2026.

² Ibid

³ Indian Air Force Historical and Warrior Studies Cell, *Aircraft and Systems Testing Establishment* (Secunderabad: College of Air Warfare, 2006), p. 3.

⁴ Arjun Subramaniam, *India's Wars: A Military History 1947–1971* (Gurugram: HarperCollins, 2026), pp. 86-101.

⁵ Chris Smith, *India's Ad Hoc Arsenal: Direction or Drift in Defence Policy?* (Oxford: Oxford University Press, 1994), p. 57.

⁶ Indian Air Force Historical and Warrior Studies Cell n. 3, p. 3

⁷ Press Information Bureau, n. 1.

⁸ Ibid

⁹ Smith, n. 5,

¹⁰ Ibid., pp. 62-66.

¹¹ Anchit Gupta, "Invisible Architecture: How the IAF Lost and Found Its Maintainance Logic," Indian Air Force History, January 12, 2026, <https://iafhistory.in/2026/01/12/iaf-maintenance-framework-1947-1966/>. Accessed on March 05, 2026.

¹² Indian Air Force Historical and Warrior Studies Cell, n. 3 p. 5

¹³ Ibid. p. 5

¹⁴ Ibid., p. 11.

¹⁵ Malteesh Prabhu, "Evolution of the Flight Test Engineer," Society of Flight Test Engineers, April 16, 2021, <https://www.sfte-india.in/evolution-of-the-flight-test-engineer/>. Accessed on March 04, 2026.