



# CENTRE FOR AIR POWER STUDIES

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## A Review of The Status of Single Pilot Cockpit Operations

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Source: [Flight Nerd Air Force: Aviation Training](#)



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*"The engine is the heart of an airplane, but the pilot is its soul."*

- Walter Raleigh

When Sir Walter Raleigh said these profound words, he must not have had any idea of the concept of Unmanned Aviation. Though unmanned aviation is still some decades away, civil aviation experts are already actively discussing the possibility of Single-Pilot Cockpit Operations (SPOs) by the end of this decade. Some are calling it the reduced crew operations concept, which is essentially a reduction in the traditional two-pilot operations, and it has been gaining traction in recent years. This path-breaking thought is driven by the potential for significant cost savings for airlines and is being pushed by the aircraft operators. However, the aero safety concerns of the passengers, which would ultimately determine the acceptance of the proposal, along with the technological limitations, remain the main hurdles.

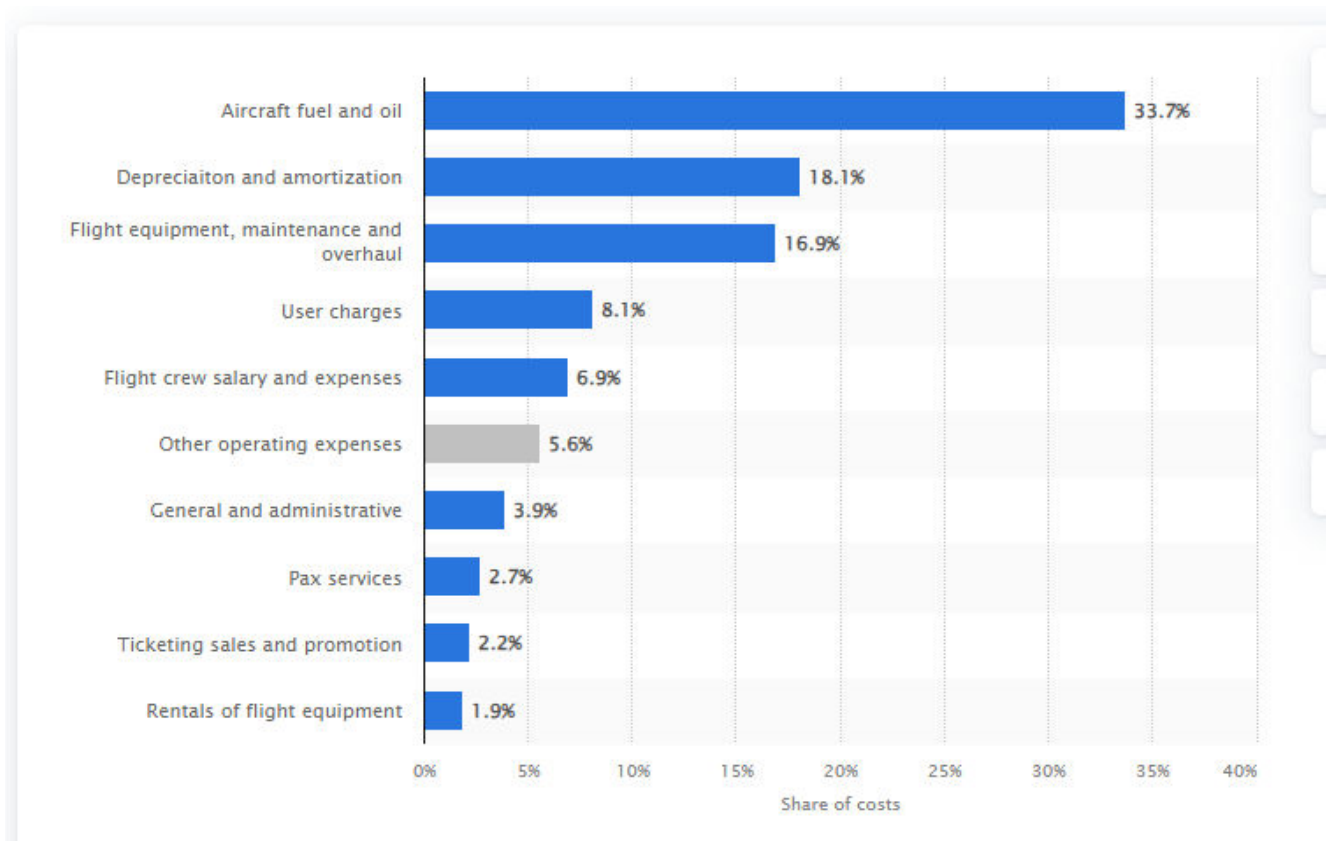
### **Single-Pilot Cockpit**

The reduction of pilots and aircrew in the cockpit is not new. We used to have five pilots in the cockpit who took on the task of manually handling the controls, monitoring the engines as well as navigating the airplane. Once the technology improved and sturdy autopilots and satellite navigation came onto the scene, ensuring reasonable reliability, the crew reduced to three— Pilot in Command, First Officer and Flight Engineer. This set-up gave way to the two-pilot system of today after the arrival of Multi-Function Displays (MFDs). The reduction in the crew has always been a difficult task, but the aircraft manufacturers have ensured that the enhanced technologies can handle the workload of the removed aircrew. SPOs involve flying commercial aircraft with just one pilot in the cockpit, relying on advanced and error-proof automation and potentially ground-based support personnel. Proponents argue that during routine cruise phases, automation would handle most tasks, freeing up the pilot for monitoring and decision-making. This could translate to significantly reduced crew costs, a major expense for the airlines.

## Pros and Cons of Single-Pilot Cockpit

### Pros:

(a) *Reduced operational costs for airlines:* The expenditure towards Aviation Turbine Fuel (ATF) is the major part of the expenditure incurred by the airlines. The salary paid to the pilots is approximately 7 per cent, and it can come down to 4-5 per cent with the implementation of SPOs. In today's competitive pricing, a drop of 2 per cent in ticket prices may give an edge to the airliner.



### Distribution of cost structure in the Indian aviation industry in financial year 2022

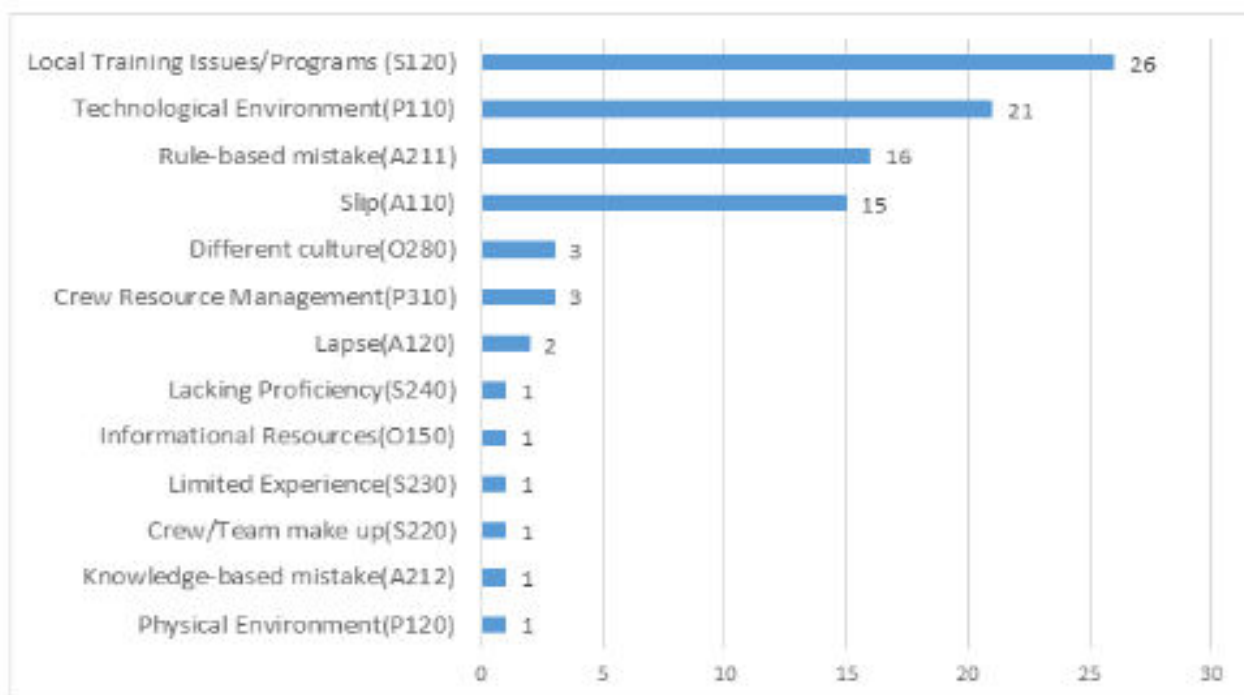
Source: "Distribution of cost structure in the Indian aviation industry in financial year 2022", Statista, <https://www.statista.com/statistics/644008/aviation-industry-cost-breakdown-india/#:~:text=Air%20fuel%20and%20oil%20accounted,percent%20to%20the%20total%20expenditure.> Accessed on April 10, 2024.

(b) *Potential for more flexible scheduling, especially for short-haul flights:* The reduced crew requirement would enable easier planning and a simpler roster, thereby increasing flexibility. This would also mean the availability of the best pilots for bad weather periods, leading to fewer cancellations of flights.

**Cons:**

(a) *Increased workload on the single pilot:* This increased workload may affect the performance of the pilot, especially during emergencies or unexpected situations. **‘Statistical Summary of Commercial Jet Airplane Accidents Worldwide Operations’<sup>1</sup>** by Boeing brings out that between 1959 and 2016, a total of 1345 accidents occurred due to Loss of Control In-flight, while another 1156 accidents occurred due to Controlled Flight into Terrain (CFIT). This means that 45 per cent of accidents were not caused due to technical failure but due to pilot error.

(b) *Reliability concerns with automation systems:* Cockpit automation is aimed at enhancing safety and efficiency in aviation operations by reducing pilot workload. However, it has been recognised as a significant factor in aircraft accidents. A comprehensive study of accidents due to automation by Young-Pil Kwak, Youn-Chul Choi and Jinyoung Cho using the HFACS showed that the technological environment is the second most frequent cause under preconditions for unsafe acts.

**Automation-Related Human Error Analysed by HFACS**

Source: Young-Pil Kwak, Youn-Chul Choi and Jinyoung Choi, "Analysis between Aircraft Cockpit Automation and Human Error Related Accident Cases", *International Journal of Control and Automation*, Vol. 11, No. 3 (2018), pp.179-192, [https://article.nadiapub.com/IJCA/vol11\\_no3/16.pdf](https://article.nadiapub.com/IJCA/vol11_no3/16.pdf).



(c) *Potential for pilot fatigue on long-haul flights:* Long flights are physically as well as mentally exhausting for the pilots. In the present system, pilots take turns to be on watch, thereby keeping themselves fresh and focussed.

(d) *Acceptance by the Passengers:* Flying is not natural to human beings. The main factors that impact their decision to fly on a single-pilot aircraft would be the fitness/health of the pilot, the pilot's ability to single-handedly accomplish all tasks, the passenger's trust in the technology, difference/reduction in the ticket price and safety record of the airline. Many passengers have issues with travelling in an aircraft due to their safety apprehensions. The passengers are made to believe that in case of any emergency, there are two fully trained pilots, and in the worst-case scenario of incapacitation of one pilot, there would at least be one pilot to take care of the aircraft. This safety net, once removed, might adversely affect the enthusiasm of passengers to board an aircraft with just one pilot. The savings in ticket costs are not very significant (2-3 per cent), and they are not seen as a big factor affecting public acceptance. The airlines will have to prove that the technology has reached a level of automation where the aircraft is capable of fully automated flight and the single pilot is only an additional safety. If the passengers are not going to accept it, then there is no reason for developing such an aircraft and making regulations to implement it.

### **The Opinion of Regulatory Authorities**

(a) *EASA (European Union Aviation Safety Agency):* While open to exploring the concept, EASA emphasises the paramount importance of safety. They have ruled out the industry's push for SPO by 2030, but they are currently evaluating the feasibility of extended Minimum Crew Operations (eMCO) by 2027, with a strong focus on mitigating potential hazards.<sup>2</sup>

(b) *FAA (Federal Aviation Administration):* The FAA has a more cautious stance, currently not endorsing SPOs for commercial passenger flights. However, they have proposed a dual-pilot configuration during taxi take-off and landing stages (TTOL configuration) and single-pilot operation during the cruise phase. This means that the second pilot can officially rest during this duration. This would help in reducing pilots' minimum rest criteria.

## **Opinion of the Pilots Association**

It is amply clear that the pilots would be the most affected party in the whole gamut if this concept were to be implemented. Reduction in the cockpit vacancies would definitely impact their employment opportunities. Added to this would be the more challenging job and increased responsibility in the cockpit. The mandatory rest periods are also likely to be revised if TTOL operations consider the cruise phase as the rest time for the second pilot. As per the European Cockpit Association, SPOs are hazardous, and they are an outcome of a 'profit over safety' mentality. Pilot unions, like the ALPA (Air Line Pilots Association), are generally against SPOs.<sup>3</sup> They express concerns about pilot workload, the potential for errors due to overreliance on automation, and the irreplaceable value of crew resource management (CRM) in critical situations.

## **Opinion of the Aircraft Manufacturers**

Airbus is carrying out 'The Dragonfly Project' aimed at automated landing systems. Airbus and Fedex have discussed single pilot A-321 and A-350 plans. A-321F and A-350 F are being manufactured with the aim of eMCO certification in future.<sup>4</sup> Boeing, a major aircraft manufacturer, hasn't taken a definitive public stance. However, they are likely to be receptive to SPOs if safety concerns are addressed and there is a clear market demand.

## **Implications for Indian Armed Forces**

The core idea of the SPOs is cost-cutting by reduction in manpower, and it is mostly applicable to the airliners. Military aviation, which is driven by mission requirements and not by cost considerations, is not directly affected by this concept, but there are some lessons that are apt for the Indian Air Force as well. Over the years, the IAF has continuously reduced aircrew in aircraft like HS 748 and An-32 by flying without a navigator for routine cross-country missions. This has been possible due to an upgrade in avionics and a reliable GPS system coupled with the enhanced SA given by the Electronic Flight Bags (EFBs). The navigators in IL-76/IL-78/AWACS aircraft are directly flying the aeroplane and are directing the missions. The Co-pilot, too, is an integral part and can't be done away with because the captain's panel and the co-pilot's panel are not entirely the same. It is only the control column and the basic instruments that are duplicated. The air conditioning and pressurisation system and the management of the undercarriages are done by the co-pilot, and it is not accessible to the captain of the aircraft sitting in the left seat. The same ergonomics are available in most of the transport aircraft flown by IAF, barring the Do-228.

The Indian Navy is operating Do-228 and P8I aircraft, and the crew composition for both is as per the mission requirements. The observers are an integral part of the mission and directly

contribute towards its success. The mission is mostly reconnaissance and surveillance and needs more eyes on board.

## **The Way Forward**

Air travel is becoming the most reliable and preferred international mode of transport. Any accident in this industry causes a loss of aircraft and human lives, and it may also trigger inter-state conflicts. We must understand that the present cockpit has evolved over a century and, together with automation, Crew Resource Management (CRM) or synergy between the captain and co-pilots, can possibly prevent an accident. It is also important to understand that this system ensures supervision, mentoring and training of younger and inexperienced pilots.

Extensive research and testing are necessary to ensure the safety and reliability of SPOs before their adoption, even as a pilot project. This includes developing highly sophisticated automation systems, robust backup plans, and clear regulatory frameworks. Additionally, pilot training and support systems would require significant adaptation. Pilots should properly understand automation systems in aircraft. The current training and licensing systems are designed to help pilots learn a particular type of aircraft, and they do not address the peculiarities of automation systems.

For safe and efficient SPOs, increased coordination will be required between air and ground components. There is a need for extensive research in nature and methods of air/ground communication and coordination.

The future of SPOs remains uncertain, but one may assume that technologically, it is feasible, and the level of automation needed for this would be developed by aircraft manufacturers in the near future. While the potential cost benefits would be only marginally attractive, safety concerns and public acceptance are going to be the key issues to be addressed. Open communication and collaboration between airlines, regulatory bodies, pilots, and manufacturers would be crucial to implement this. Most importantly, passengers need to be convinced that they are in safe hands, only then would the single-pilot cockpit operations be cleared for take-off.

**Notes:**

<sup>1</sup> Boeing (2017), Statistical Summary of Commercial Jet Airplane Accidents Worldwide Operations, 1959 – 2022, [https://www.boeing.com/content/dam/boeing/boeingdotcom/company/about\\_bca/pdf/statsum.pdf](https://www.boeing.com/content/dam/boeing/boeingdotcom/company/about_bca/pdf/statsum.pdf).

<sup>2</sup> D Harris, Single-pilot airline operations: Designing the aircraft may be the easy part, (Cambridge University Press, 2023), *The Aeronautical Journal*, Vol. 127, Issue 1313.

<sup>3</sup> “Single-Pilot Operations are under Increased Scrutiny”, *Aviation Week Network*, October 04, 2023, <https://aviationweek.com/air-transport/safety-ops-regulation/single-pilot-operations-are-under-increased-scrutiny>. Accessed on April 09, 2024.

<sup>4</sup> Ibid.

