THE MAHARAJA'S NEW AVTAAR:
AIR- REFUELLING STRATEGY FOR THE INDIAN AIR FORCE

BY
WING COMMANDER SHARAD PASRICHA

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This thesis begins by outlining India???s geo-political situation, and examines the likely role of the Indian Armed Forces in providing national security. More specifically, it highlights the characteristics of responsiveness, reach, and mobility that will empower the Indian Air Force (IAF) with a key role in mitigating India???s security concerns. Flight Refuelling Aircraft (FRA) will be critical to the success of the IAF in this venture. FRA, however, are expensive; and India???s defence budget is limited. Moreover, India???s pragmatic approach to foreign policy is unique and ensures that the IAF???s peacetime requirements for air-to-air refuelling are drastically different from those during war. Thus, it is possible to maintain a small fleet of FRA during peacetime. Building an air-to-air refuelling capability for an air force necessitates a large lead time. These conditions create a conundrum, as the number of FRA required by the IAF during wartime operations is much higher than the peacetime requirement. Procuring the requisite quantity entails a sunk cost during peacetime. Conversely a small peacetime FRA fleet shall be grossly inadequate during war. This situation is unique to India and the fourth largest air force in the world.

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COL. JEFFERY J. SMITH (Date)

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The conclusions and opinions expressed in this document are those of the author. They do not reflect the official positions of the Indian or the U.S. Governments; Departments of Defence, or Defense; the Indian Air Force or the United States Air Force; or The Air University.

ABOUT THE AUTHOR

Wing Commander Sharad Pasricha was commissioned as a fighter pilot into the Indian Air Force in 1993. He has 2900 hours in jet aircraft and was part of the Indian Air Force's 9-aircraft Formation Aerobatic Team, *Suryakiran* from 2004 to 2007. He also participated in the All-India Air Race-2003, which was held to commemorate the Centennial of Flight. He is a Qualified Flight Instructor and has had two tenures as the Flight Commander of frontline Fighter Squadrons. He has also taken part in numerous operations conducted by the Indian Air Force since 1993. Wing Commander Pasricha was Commanding a premier fighter Squadron of the Indian Air Force, when he was selected to attend the School of Advanced Air and Space Studies, at Maxwell Air Force Base, Alabama. His academic qualifications include Bachelor of Arts (Mathematics and Economics) from the Delhi University and Master of Science (Defence Studies) from Chennai University. Wing Commander Pasricha is a graduate of the Defence Services Staff College, Wellington, India.

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ABSTRACT

This thesis begins by outlining India's geo-political situation, and examines the likely role of the Indian Armed Forces in providing national security. More specifically, it highlights the characteristics of responsiveness, reach, and mobility that will empower the Indian Air Force (IAF) with a key role in mitigating India's security concerns. Flight Refuelling Aircraft (FRA) will be critical to the success of the IAF in this venture.

FRA, however, are expensive; and India's defence budget is limited. Moreover, India's pragmatic approach to foreign policy is unique and ensures that the IAF's peacetime requirements for air-to-air refuelling are drastically different from those during war. Thus, it is possible to maintain a small fleet of FRA during peacetime. Building an air-to-air refuelling capability for an air force necessitates a large lead time. These conditions create a conundrum, as the number of FRA required by the IAF during wartime operations is much higher than the peacetime requirement. Procuring the requisite quantity entails a sunk cost during peacetime. Conversely a small peacetime FRA fleet shall be grossly inadequate during war. This situation is unique to India and the fourth largest air force in the world.

Equally unique is the likely solution. India's national carrier Air India (*Maharaja*) has a fleet of 101 commercial aircraft. The Government of India, exercises operational and functional control of Air India and has often tasked the airline to undertake non-profit commitments to meet national interests. As the Government pays for the aircraft of the IAF and Air India, could multi-role tanker aircraft be used by Air India in peace and meet the air-to-air refuelling requirements of the IAF during war, when commercial operations are likely to be curtailed?

This thesis provides a holistic analysis of the IAF's conundrum. It first identifies all likely options that might satisfy the IAF's air-to-air refuelling requirements during war. It then examines whether multi-role FRA are a viable option. Thereafter, theoretical principles of the use of commercial assets by the military are appraised. This body of theory is then connected to the real world by analyzing cases that embody military use of commercial assets. Finally, the pros and cons of the various options are evaluated in a comparative analysis to select the most viable solution, within these constraints.

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Introduction

The tremors caused by the crumbling of the Berlin Wall were felt in all parts of the world, including India, which had remained ostensibly non-aligned throughout the cold war. The ensuing shift of world order from a bipolar to a unipolar one resulted in a reduction of support to India from the USSR in areas of military hardware and technology. This aspect, when coupled with China's recent transformation from a regional to a global power, and the possibility of terrorist strikes against its interests, necessitates a reassessment of India's security environment.

India remains committed to resolving its problems unilaterally. Thus, the Indian armed forces will need to be adequately prepared to meet future challenges. These challenges cover a wide spectrum of options, ranging from a high-intensity, short-duration, regional conflict at one end, to protecting vital national interests within India's sphere of influence at the other.

There is little doubt that the Indian Air Force (IAF) shall have an important role to play in overcoming these security challenges. To be effective, it would aim to exploit its offensive capability, reach, and flexibility. Vital to the IAF's strategy would be an adequate number of Flight Refuelling Aircraft (FRA). Although air forces are dependent on technology; balancing the budget among aircraft, weapons, force-multiplier capabilities, with other essential costs is a real challenge in the modern era. Moreover, maintaining an air-to-air refuelling capability is especially expensive due to the cost of aircraft involved. It is nonetheless a necessary cost, but one given to many alternatives.

During peacetime it is possible (and much cheaper) to maintain a small fleet of FRA. This would enable training at optimal cost. However, a small peacetime fleet of FRA imposes a large lead-time to procure the quantity of FRA necessitated by war. One solution may lie in procuring wide-bodied commercial aircraft that are also capable of air-to-air refuelling. This is indeed possible in countries which have a national air carrier, as then the Government would bear the financial burden for the aircraft of both its air force and its national airline. This alternative provokes two questions. First, is this solution feasible from operational and technical viewpoints? Second, is this the most

cost-effective option for the IAF, Air India (India's national carrier)[1], and the Government of India?

This thesis seeks to answer these questions by comparing the available options. It also highlights the most beneficial option; from an operational perspective for the IAF, from a commercial perspective for other parties, and a strategic perspective for Government of India.

The first chapter outlines India's current geo-political situation and the challenges confronting the IAF. It also broadly answers the question of how many FRA the IAF might need. The second chapter analyzes certain imperatives of air-to-air refuelling and explores the technical and operational feasibility of multi-role tanker aircraft. The next chapter provides a theoretical foundation for the military use of commercial assets using precepts of Clausewitz, Mahan, Douhet and Mitchell and compares their principles to the IAF doctrine. It also provides precedents for the use of commercial assets by the military, highlighting crucial lessons from the use of merchant ships by the Royal Navy during the Falkland's War and the USAF's use of Civil Reserve Air Fleet (CRAF) during Desert Storm. Against this backdrop, the fourth chapter analyses the various options available to the IAF vis-à-vis operational implications for the IAF, strategic implications for the Government of India, and commercial incentive for other parties. It then synthesizes these implications and compares them to identify the most suitable option. The thesis concludes by suggesting areas for further study and discusses the significance of this research.

[1] Air India's logo is the *Maharaja* or "Great King". On a related note, as per the Oxford dictionary, Avtaar means "an incarnation, embodiment, or manifestation of a person or idea," *Oxford Dictionaries*, 2013. http://oxforddictionaries.com/definition/english/avatar?q=Avatar (accessed April 23, 2013).

Chapter I

Fuelling India's Strategic Growth

As the world's largest democracy, India is established on a path of growth and development and may emerge as one of the fastest growing economies of the world.[1] The Indian armed forces play an important role in providing the stability and security to ensure that India is able to pursue this path. Against this background, it would be pertinent to examine the Indian Air Force's (IAF) responsibilities in general and the role of Flight Refuelling Aircraft (FRA) in particular. To do this, it would first be necessary to identify India's strategic sphere of influence and the geopolitical threats therein. This would help identify the combat potential and thus the broad force structure, including the quantity of FRA required by the IAF, to be effective in meeting its operational commitments.

On 19 Oct 12, the Prime Minister (PM) of India, Dr Manmohan Singh laid down his strategic vision. Addressing the Commanders-in-Chief of the three defence forces at the Combined Commanders' Conference at New Delhi, he said, "Our immediate geo-strategic environment comes with its own conventional, strategic and non-conventional security challenges. India's strategic calculus has long encompassed the waters from the Gulf of Aden to the Straits of Malacca. Very recently, we have seen precisely these areas turn once again into fresh theatres of contestation."[2] The Prime Minister also stressed that a sustained economic growth rate of 8% per annum was essential to unlocking the human potential of India and reiterated his Government's commitment in this direction, saying:

> As India grows, so will the responsibilities associated with protecting our new-found equities. For example, an expansion of our exports and a diversification of their destinations will call for equal measures to protect them from threats**,** such as piracy. The security of our sea lanes would be equally vital in ensuring our energy security and access to other vital natural resources. Indian expatriates and our overseas investments, already present around the globe, are also going to be in need of assurances regarding their well-being. Security, therefore, will remain a pre-eminent and key pillar of our national strength. The Services, which are an

[1] Economic Survey of India, Government of India. "Highlights of Economic Survey: 2011-2012." (*Press Information Bureau Government of India,* 2011), http://pib.nic.in/archieve/esurvey/esurvey2011/eng2011.pdf, (accessed February 02, 2013), 1.

[2] Prime Minister's Office Government of India, "Prime Minister's Address to the Combined Commanders' Conference: 19 October 2012," news release, *Government of India, Press Information Bureau*, October 19, 2012, http://pib.nic.in/newsite/PrintRelease.aspx (accessed January 21, 2013). The entire transcript of the PM's speech is available on the website.

> important institution of our democratic and secular structure, will have to equip themselves to meet these evolving challenges.[3]

The PM also urged the service chiefs to come up with comprehensive solutions to resolve the immediate security threats facing India. His speech implies that external threats**,** perpetrated either indirectly or directly against Indian interests**,** have the potential to result in conflict with either non-state or state actors. To mitigate these threats, the nation shall turn to the Indian armed forces. This inference prompts identification of immediate threats to India's security within its geopolitical sphere of influence.

As amplified by the PM, India's economic growth is dependent on a secure supply of energy and free trade. India imports 80% of its crude oil.[4] Given the current instability in the Middle East and the limited number of Sea Lines of Communications (SLOCs), an attack by belligerents could prove detrimental to India's energy security. Similarly, though international efforts to reduce piracy are taking effect,[5] attacks on Indian economic interests near the Straits of Hormuz and in the Malacca straits continue to be of great concern and have prompted the Government of India to initiate appropriate measures to counter them.[6]

Additionally, a terror attack on Indian soil or on Indians elsewhere in the world**,** either by an ideological group or one supported by another state with malicious intent, would also qualify as a significant threat to Indian interests. This would prompt the Government of India to initiate appropriate action against perpetrators of such crimes. Together, these scenarios represent the lower end of the spectrum of immediate threats

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[3] See n.2.

[4] Ministry Of Petroleum & Natural Gas, "Background Material For Economic Editors' Conference 2010," news release *Government of India Press Informatio Bureau*, 2010, http://www.pib.nic.in/archieve/eec/2010 /PetrobackEEC2010.pdf, (accessed January 23, 2013). Pg. 18 of the document specifies oil imports by India.

[5] The Associated Press, "Somalia: With Navies on Guard, Pirate Attacks Decline," *NYTimes.com*, October 22, 2012, http://www.nytimes.com/2012/10/23/world/africa/somalia-navies-cause-pirate-attacks-to-decline.html, (accessed January 23, 2013).

[6] Express news service, "Piracy: Govt Plans Weapons On Merchant Ships," news article *indianexpress.com.* March 12, 2011, http://www.indianexpress.com/story-print/761441, (accessed March 26, 2013), Extract of the statement given by India's Foreign Minister to the Indian Parliament on 12 Mar 2011 deals with various actions that the Ministries of Shipping, External Affairs and Defense would undertake to curb piracy off the Somalian coast and would include" legal, administrative and operational aspects of combating piracy." See also, AartiBetigeri, "As China Eyes Indian Ocean, Japan and India Pair Up on Defense," news article on *india.blogs.nytimes.com,* July 27, 2012, http://india.blogs.nytimes.com/2012/07/27/as-china-eyes-indian-ocean-japan-and-india-pair-up-on-defense/ ?pagewanted%20=print, (accessed March 28, 2013), the article discusses measures taken by India and Japan to counter piracy and project Naval Power around the Malacca straits.

that might prove to be detrimental to the growth of the Indian economy. At the higher end of the spectrum lies the possibility of a high-intensity, short-duration regional conflict between India and any of its neighbours.

Of these, a conflict with China would be the most detrimental to the growth of the Indian economy. In recent years, China has transformed from a regional to a global economic power, and to secure its energy requirements and other strategic initiatives, it has initiated a policy called *String of Pearls*, illustrated in figure 1 (emphasis added).[7] This policy requires China to build and develop ports, construct military facilities, and foster better relations with countries that are located in Southeast Asia and around the Indian sub-continent.

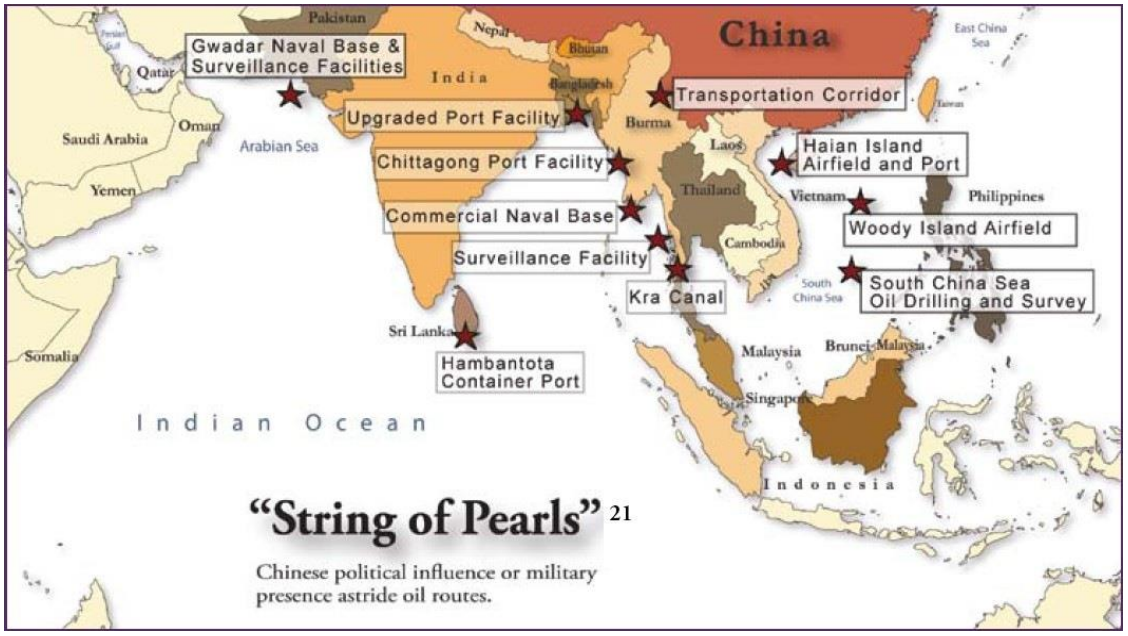

Figure.1: China's *String of Pearls*

Source: Internet (http://abhijit-suryawanshi.blogspot.com)
Note: Each pearl is represented by a star

While such posturing by China does give cause for concern, India remains committed to maintaining regional stability and peaceful relations with its neighbours. India's response has thus been watchful and measured. In a speech given at the Asia Security Summit (Shangri-La Dialogue) in Singapore on 03 June 2006, India's then Defence Minister, Shri Pranab Mukherjee**,** reiterated this by stating that India seeks the

[7] Juli A.MacDonald, Amy Donahue, and Bethany Danyluk. *Energy Futures in Asia: Final Report.* A Booz-Allen Hamilton Report sponsored by the Director of Net Assessment-2004, 15.

peaceful resolution of all disputes, and this is premised on the twin policies of *no extra-territorial ambition* and *no export of ideology* (emphasis added).[8]

The String of Pearls, however is not the only area of concern. India and China are also bilaterally engaged in resolving existing border disputes.[9] Further, India's oil exploration program in the South China Sea has also been a source of potential friction between the two nations.[10] Given these diverse flashpoints, prudence demands that the Indian Armed Forces remain prepared for the worst-case scenario; a military conflict between India and China. Preparing for a conventional war with China would also assist the Indian Armed Forces in defending the country against external aggression by any other country, as China is the most powerful amongst them.

Having identified the mid-term threats to India's interests, let us examine the Indian Air Force's (IAF) role in meeting these challenges. Essentially, these threats cover the entire spectrum of coercion; from political signalling in a low-intensity operation against pirates (inclusive of non-lethal application of air power) to a conventional air campaign (against China). The IAF therefore needs to maintain a capability that is not only superior to the Peoples Liberation Army Air Force (PLAAF), but also one that retains the ability to undertake out-of-area low-intensity operations.

Let us first examine the capability required to overcome the PLAAF. The geography of both countries is significant; India and China share a 3488 km border **(**shown in figure 2**)**. This border is in three distinct parts, which are separated by two breaks. The first break 1751 km of the Indo-Nepal border - is situated roughly in the centre. The second one, comprising of the Indo-Bhutan border is 699 km long and situated towards the North-Eastern part of India. These breaks are extremely important

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[8] Ministry of Defence, "Text of Raksha Mantri Shri Pranab Mukherjee's address at Shangri-La Dilogue in Singapore," news release *Press Information Bureau, Government of India*, June 03, 2006, http://pib.nic.in/newsite/erelease.aspx?relid=18213 (accessed January 23, 2013), Extract of the statement given by India's Defence Minister.

[9] Lt Col JS Dalal, *The Sino-Indian Border Dispute: India's Current Options* (thesis submitted to the US Army CGSC-1993). The thesis can be accessed at, http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA272886 and presents a comprehensive historical synopsis of the Indo-China border dispute.

[10] Jane Perlez, "Dispute Flares Over Energy in South China Sea," news article in *nytimes.com*, December 04, 2012, http://www.nytimes.com/2012/12/05/world/asia/china-vietnam-and-india-fight-over-energy-exploration-in-south-china-sea.html (accessed January 23, 2013). The article discusses friction between India, Vietnam and China over oil exploration in the South China Sea.

because they divide the likely area of conflict into two distinct theatres, one west of and the other east of Nepal.

Figure.2: India's Border with China, Nepal & Bhutan (India's Island Territories are also shown)

Source: Internet (http://www.indiandefencereview.com/spotlights/india-strategic-challenges-and-responses)

Further**,** the Himalayan mountain range extends along the entire length of India's border with China. As two key characteristics of airpower, flexibility, and mobility are best suited for offensive action in such mountainous terrain, the IAF will likely play a decisive role in any future conflict in these theatres.

What quantity of aircraft would the IAF require**,** vis-à-vis the PLAAF? Presently, the strength of combat aircraft in the PLAAF is approximately 2200; of these nearly 300 are modern fighter aircraft, comparable in performance of the F-16.[11] It is therefore

[11] Roger Cliff, John F Fei, Jeff Hagen, Elizabeth Hague, Eric Heginbotham, and John Stillion. *Shaking the Heavens and Splitting the Earth: Chinese Air Force Employment Concepts in the 21st Century*, a RAND

evident that India would have to quadruple its present strength of fighter aircraft to come close to matching this figure. Also, both the numerical superiority of the PLAAF, and the inevitability of operating in two distinct theatres necessitate that the IAF increases the numerical strength of its fighter aircraft.

Reflecting on two other factors might help narrow the quantity of fighter aircraft required by the IAF. The first factor is economic, in that a larger quantity of aircraft has a huge financial implication; and it would take a large portion of India's economy to procure and then maintain such a large air force. Given the inherent cost of aircraft and munitions, a very large air force would prove to be detrimental to the growth and development of India. A recent news report on CNN-IBN India, states, "The armed forces may have to trim some of their ambitious weapon procurement plans, after indications that the defence budget could be cut by around four to five per cent if not more, as part of Finance Minister P Chidambaram's plans to lower this deficit. This could delay the Indian Air Force's plans to buy the Rafale fighter jets or the Army's plans to buy light artillery for use in the hills."[12]

Also, in a speech given at the Asia Security Summit in Singapore on 03 June 2006, India's then Defence Minister, Shri Pranab Mukherji, reiterated this viewpoint by stating, "The country finds that its peaceful stance has to be backed by a credible and stable military deterrent**,** with necessary command and control structures. [...] This defence preparedness is not at the cost of developmental expenditure. Hence, India's defence expenditure remains modest at less than 2.5% of GDP and in per capita terms among the lowest."[13] Thus, the IAF shall face problems in matching the quantity of combat aircraft held by the PLAAF.

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research sponsored by the USAF (Santa Monica: RAND Corporation-2011). Pg 19/20 of the report states that "From around 50 aviation divisions during the early 1970s, the total number has dropped to fewer than 30 divisions, including 20 fighter, three bomber, three ground attack, and three transport […] Divisions typically have two or three regiments of 24–40 combat aircraft each and, in some cases, an additional reconnaissance aircraft regiment. Each aviation division has 72–120 fighters or 72–91 bombers." Thus, by extrapolation the total figure of fighter aircraft held by PLAAF is assessed to be between 1440-2400. I have used a figure higher than the mean of 1990 to include bombers and ground attack aircraft as well.

[12] CNN IBN India. "Indian Armed Forces' Weapons Procurement Plans On Hold As Cuts In Defence Budget Expected," news article on *CNN IBN India live*, February 01, 2013, http://www.bharat-rakshak.com/NEWS/newsrf.php?newsid=19889 (accessed February 27, 2013).

[13] Ministry of Defence, "Text of Pranab Mukherjee's address Singapore," news release *Press Information Bureau, Government of India*, June 03, 2006.

The second factor addresses whether quality offsets quantity. Presently, the IAF has a slight edge in the ratio of modern aircraft vis-à-vis the PLAAF. Further, the elevation of the Tibetan Plateau would reduce the effectiveness of the PLAAF's offensive capability and thus offset a portion of its quantitative edge.[14] These factors suggest that the IAF does not need to match the exact quantity of aircraft of the PLAAF. Instead, the IAF needs to build a capability that would guarantee comprehensive defense, as well as provide a credible offensive. Once again**,** this brings us to the original question of determining the quantity that is sufficient.

In an article "Indian Air Force 2020"published in 2008, Air Chief Marshal (retired) AY Tipnis, PVSM, AVSM, VM, a former Chief of the IAF, has suggested a figure of 55 Squadrons of fighters, constituting approximately 1000 aircraft.[15] This figure seems realistic, considering that to achieve this strength by the year 2020, 80% of the IAF inventory would consist of new fourth-generation aircraft. The remaining 20% would comprise upgraded platforms**,** capable of fourth-generation performance. Together, these would provide a technological edge to blunt the PLAAF's numerical advantage. Thus, a force structure of 55 Squadrons of fighter aircraft seems to be a reasonable planning figure that meets India's defensive requirements.

The reach and flexibility of the IAF would also play a crucial role in defending the Lakshwadeep Islands and the Andaman and Nicobar Islands, as well as protecting economic interests within the Indian sphere of influence (see figure 1). What force structure would be adequate for these scenarios? As any operation against the PLAAF would likely need to cater to two theatres, it is envisaged that such a force structure would also meet the additional requirement of deploying an expeditionary force to support an**y** out-of-area contingency. Hence India's operational functions**,** at both ends of the spectrum**,** can be met by this recommendation for fighter-aircraft strength.

To ensure that these fighter aircraft sustain an effective combat potential during operations, it is imperative that an adequate number of force multipliers like FRA be

[14] The higher elevation of the Tibetan plateau reduces the range and payload due to higher density altitude.
[15] Air Chief Marshal (retd) AY Tipnis, PVSM, AVSM, VM, "Indian Air Force 2020," *Security Research Review: The Journal of Bharat-Rakshak.com*, Vol 1, Issue 2, October 22, 2008. http://www.bharat-rakshak.com/SRR/2005/02/12-indian-air-force-2020.html (accessed September 06, 2012), 7.

available to support them. In his article**,** Air Chief Marshal AY Tipnis also assessed that two Squadrons of FRA would be sufficient to support IAF operations against China.[16] However, two Squadrons seem sub-optimal for the IAF to exploit its offensive combat capability.

In December 2012, while addressing the fifth National Seminar on Aerospace at New Delhi, the IAF vice chief, Air Marshal D.C. Kumaria said, "In a major step to increase its operational reach, the Indian Air Force (IAF) has decided that all its aircraft and helicopters meant for combat and combat support will henceforth have the capability for mid-air refuelling" and that "the decision applies to all its current and future acquisitions – whether combat jets, transport aircraft, helicopters or other assets."[17] This projection clearly indicates that by 2020, two squadrons of FRA would be inadequate for the IAF. Additionally, "IAF 2020" does not seem to factor-in the aerial refuelling requirements of the Indian Navy; operations within India's sphere of influence, and simultaneous operations in two distinct theatres.

To quantify the number of FRA required, a comparison of the aerial refuelling carried out by NATO during 'Operation Unified Protector' may help. In a press conference at Brussels on 31 May 2011, the NATO military spokesman**,** Wing Commander Mike Bracken said, "Roughly a quarter of the sorties flown in this mission so far have been by refuelling tanker aircraft. And of note, nearly every sortie not flown by a tanker had to get fuel in flight**,** in order to accomplish its assigned mission […] To meet our refuelling needs seven nations have provided over 40 tanker aircraft to support Operation Unified Protector under the command of NATO and this effort is made up of six different aircraft types […] these aerial refuelling operations involve 35-40 tanker sorties per day."[18]

Despite this quantity of air-to-air refuelling, a report by the Royal Aeronautical Society assessed that the availability of FRA during the Libyan air campaign limited

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[16] Tipnis, "Indian Air Force 2020,"7.

[17] Indo-Asian News Service, "Indian Air Force To Have Mid-Air Refuelling Capability On All Combat Aircraft," news article on *NDTV.com*, December 09, 2012, www.ndtv.com/article/india/indian-air-force-to-have-mid-air-refuelling-capability-on-all-combat-aircraft-303115 (accessed March 23, 2013).

[18] NATO, "NATO: Operation Unified Protector Press Conference," briefing to the Press by NATO Spokesperson, Oana Lungescu and Operation Unified Protector military spokesperson Wing Commander Mike Bracken on 31 May 2011, *NATO Operation Unified Protector,* http://www.jfcnaples.nato.int/Unified _Protector/page190903919.aspx.

operational capability and flexibility and that it fell short of the requirement.[19] In terms of FRA requirements, the Libyan air campaign is similar to the IAF's situation vis-à-vis an out-of-area contingency. First, like the Libyan air campaign, it will not be possible for the IAF to be effective in an out-of-area contingency or a two-theatre scenario without an air-to-air refuelling capability. Second and more importantly, it will not be possible for the IAF to provide air-to-air refuelling for every mission, as the quantity of FRA required for this task would prove economically prohibitive. While the time/distances involved during the Libyan air campaign are about double those envisaged in the Indian scenario,[20] the numbers of aircraft, capable of air-to-air refuelling (as receivers) that the IAF could deploy shall be nearly triple.[21] Therefore, using the figure of 55 fighter squadrons for the IAF and the Libyan air campaign as analytical frames of reference, it is assessed that a planning figure of nine Squadrons of FRA (54-60 aircraft) would suffice for the IAF to meet its future air-to-air operational requirements**,** with adequate flexibility to respond to strategic threats.

However, due to the conundrum facing the Government of India regarding defence spending for procurement of combat assets vis-à-vis the economic growth and development of the country, the purchase and maintenance of a large fleet of FRA is likely to have a very low priority.[22] This position is corroborated by the fact that in 2010, India cancelled an order for the purchase of six FRA from Airbus**,** even after the IAF had indicated a preference for its aircraft over other competitors. The Defence Minister was quoted as saying that the Finance Ministry had "expressed certain reservations relating to

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[19] Royal Aeronautical Society, "Lessons Offered from the Libya Air Campaign," a specialist paper by the *Royal Aeronautical Society*, July 2012, http://aerosociety.com/Assets/Docs/Publications/Specialist Papers/LibyaSpecialistPaperFinal.pdf (accessed March 23, 2013), 7.

[20] John A.Tirpak,"Lessons From Libya," *Air Force Magazine: On Line Journal of the Air Force Association Vol. 94 No. 1*, December 2011, http://www.airforcemag.com/MagazineArchive/Pages/2011/ December%202011/1211libya.aspx (accessed March 15, 2013). In an interview Maj. Gen. Margaret H. Woodward, Commander of 17th Air Force and the joint force air component commander for Odyssey Dawn, said that the distances involved were daunting. Fighter sorties out of bases in Europe averaged eight hours and required five air refuellings "to generate just one hour on station." In contrast IAF missions in an out-of-area contingency (or against PLAAF) are expected to have an average duration of four to five hours.

[21] North Atlantic Treaty Organization. *Operation Unified Protector Final Mission Stats.* November 02, 2011. http://www.nato.int/nato_static/assets/pdf/pdf_2011_11/20111108_111107-factsheet_up_factsfigures _en.pdf (accessed February 15, 2013). The NATO fact sheet reports that there were roughly 260 air assets (of all types) that were involved in OUP. In contrast the IAF is likely to have close to 750 to 800 receiver aircraft (of all types) available for operations.

[22] See n.12 and n.13.

the competitiveness of the bids and the reasonableness of the price."[23] This procurement, from Airbus was finally cleared by the Government of India in January 2013 after a re-bidding process.[24]

To summarize, this chapter outlines the Indian geopolitical situation, the likely threats, and the responsibility of the IAF to overcome these threats. It also postulates that 54 to 60 FRA would likely suffice for the IAF to be effective in such operations. However**,** the Government of India has indicated that budgetary constraints will have an over-arching impact on the decision matrix for procuring equipment for the IAF in general and FRA in particular. It would, also be pertinent to note that the full expansion of the IAF to a strength of 55 fighter squadrons is not likely to be complete till at least 2030. Therefore, prudence demands spacing the procurement of FRA and matching it with the requirement of IAF's receiver aircraft. What then, are the options available to the IAF to ensure an adequate quantity of FRA to meet its strategic responsibilities?

A first option is the procurement of the requisite quantity of FRA for the IAF. A second is for the Government of India to form an alliance with another country and depend on its support in times of crises. A third option is for the IAF to lease the services of FRA from a contractor (either private or Government). A fourth option is to buy multi-role aircraft that can be used commercially by Air India during peace-time and by the IAF if and when required for a war. For ease of reference these options are henceforth referred to as, *Direct Purchase*, *Alliance*, *Lease*, and *Air India* respectively. Comparing them could provide a solution to the IAF's conundrum. As a prelude, the next chapter ascertains the operational and technical viability of multi-role FRA and examines certain imperatives of air-to-air refuelling.

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[23] Manu Pubby, "MoD Cancels Contract for Mid-Air Refuelling Aircraft," news article on *indianexpress*.com, January 07, 2010, http://www.indianexpress.com/news/mod-cancels-contract-for-midair-refuelling- aircraft/56 4415 (accessed February 15, 2013).

[24] RajatPandit,"Europe Pips Russia in Mega Mid-Air Refueling Aircraft Deal," news article on *timesofindia .indiatimes.com*,January 04, 2013, http://timesofindia.indiatimes.com/india/Europe-pips-Russia-in-mega-mid-air-refueling-aircraft-deal/articleshow/17879413.cms? (accessed February 15, 2013).

Chapter 2

Basics of Air-to-Air Refuelling and the Acid Test for Multi-Role Tanker Aircraft

The previous chapter concluded by listing various options available to the Indian Air Force (IAF) to ensure that it operates a quantity of Flight Refuelling Aircraft (FRA) that is adequate to meet India's strategic responsibilities. Of the options highlighted, the feasibility of using of multi-role tanker aircraft hinges on the consideration that such aircraft would prove successful, both from an operational and a technical point of view. Inclusion of this option as a solution to the IAF's conundrum therefore depends on viability. This chapter ascertains the operational and technical potential of multi-role tanker aircraft.

The success of multi-role tanker aircraft vis-à-vis other aircraft of similar size dedicated for passenger or cargo roles, depends on various factors. A multi-role tanker aircraft is a FRA that is also capable of carrying cargo or passengers, and its performance would be a compromise due to the inherent trade-offs associated with the requirements of undertaking such multiple roles. Its success would therefore depend on factors such as tanker survivability during hostilities; the capability to satisfy operational demands of each role reasonably, while adhering to mission safety; the time required to switch between roles; aspects of specialized training; life-cycle costs; and acceptance by the global market as a viable product.

Understanding certain aspects of air-to-air refuelling would help in examining the operational and technical feasibility of multi-role tanker aircraft. The aspect of survivability is addressed first. The Indian Air Force Doctrine-2012, states, "if air operations are to be successful, they need to be sustained and supported by dedicated air and ground activities termed as *combat-enabling air and ground operations*,"(emphasis added) and recognizes air-to-air refuelling as a combat-enabling air mission.[1] While the Indian Air Force Doctrine-2012 recognizes that air-to-air refuelling acts as a force-multiplier, it also stresses the importance of carrying out air-to-air refuelling operations in

[1] Directorate of Operations (Space): IAF, *Basic Doctrine of the Indian Air Force: IAP 2000-12*. (New Delhi: Indian Air Force-2012), 75.

areas free of hostile air threats.[2] Similarly, the Air Force Operations & Planning SMARTbook also emphasizes that, while air-to-air refuelling "significantly expands the force options available to a commander," such missions should be conducted over hostile territory "only after careful risk considerations and when at least regional air superiority is achieved."[3] This reiterates the need to ensure that the volume of airspace envisaged for air-to-air refuelling operations is sanitized prior to undertaking such missions.

The requirement for clean airspace then appears to pose no additional risk to a multi-role tanker aircraft during hostilities. As regular air-to-air refuelling missions involving pure FRA would likely be undertaken only within sanitized airspace, no additional risk is envisaged for multi-role tanker aircraft. On the contrary, as compared to other scheduled passenger or cargo flights, multi-role tanker aircraft are likely to enjoy the protection of dedicated fighter escorts, thereby increasing chances of their survivability during hostilities.

Another operational requirement pertains to specialized training for the aircrew of the FRA. The Air Force Operations & Planning SMARTbook specifies that:

> AR [aerial refuelling] is normally conducted in one of two ways: in an anchor area or along an AR track […] In anchor areas, the tanker flies a racetrack pattern within defined airspace while waiting for receiver aircraft to arrive. Once joined with the receiver, the tanker then flies in an expanded racetrack pattern while refuelling the receiver [...] An AR track is a published track or pre-coordinated series of navigation points which can be located anywhere throughout the world. To maximize effectiveness, AR tracks will normally be placed along the receiver's route of flight. However, AR track location(s) must sometimes be balanced with tanker availability and basing to develop an integrated AR plan making the best use of limited receiver and tanker assets overall.[4]

This stipulation seems to imply that both the Anchor area and the AR track patterns require the FRA to carry out manoeuvres (or patterns) that are similar to those used in commercial aviation.

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[2] Directorate of Operations (Space), *Doctrine of the Indian Air Force.* Pg.86 postulates the advantages of air-to-air refuelling and it force-multiplier capabilities. Pg.87 highlights the vulnerability of undertaking air-to-air refuelling in a hostile air environment.

[3] Norman M.Wade, *The Air Force Operationa and Planning SMARTbook Leader's Guide to Planning & Conducting Airpower Operations.* (Lakeland, Florida: The Lightning Press-2011). Pg 2-48 highlights the advantages of air-to-air refuelling. Pg. 2-49 emphasizes the need to attain at least regional air superiority prior to carrying out air-to-air refuelling operations. Permission to cite this source received in an email from Norman M. Wade on Sunday, February 24, 2013 at 3:44 AM.

[4] Wade, Operations & Planning SMARTbook, 2-49.

Could aircrew of commercial multi-role tanker aircraft adjust to the requirements that this role entails with additional flight training? What about factors such as additional knowledge about the on-board air-to-air refuelling system and the ability to handle any in-flight emergencies that pertain to this specific system? The crew of multi-role tanker aircraft vis-à-vis those of regular commercial aircraft, would need additional training to cater to specific contingencies arising from such operations. The crew would also likely include a dedicated air-to-air refuelling systems operator on-board. As these requirements of training and interoperability, equally affect all other options for the IAF, it would be prudent to examine their impact comprehensively in Chapter IV.

Aspects of tanker survivability and specialized aircrew training for FRA apart, the process of ascertaining whether multi-role tanker aircraft are feasible, begins by first identifying existing platforms. At present, Airbus and Boeing have produced multi-role tanker aircraft. Airbus' aircraft is based on the A-330 platform and is called the Multi-Role Tanker Transport (MRTT) and is the larger aircraft, while Boeing's aircraft is called the KC-46 and is based on the B-767 platform. The MRTT and the KC-46 are constructed in a manner that gives them an existing air-to-air refuelling capability with simultaneous cargo, passenger, or aero-medical evacuation options.[5]While these two platforms differ in capability and configuration, it is imperative that their performance in each operational role be compared with other commercial aircraft of similar class to ascertain their success.

Let us first compare the primary consideration of fuel off-load capacity (or the quantity of fuel that an FRA can give to a receiving aircraft) for the multi-role FRA vis-à-vis present USAF FRA. From table.1, we find that when compared with the KC-135 variants, the multi-role tanker aircraft have better fuel off-load capacity. When compared to the KC-10, the fuel off-load capacity is significantly lower; while this may be attributed to the large weight of the KC-10, it nonetheless highlights the penalty that multi-role aircraft incur due to their inherent mandate to undertake other missions.

[5] Airbus Military, *Airbus Military: A330 MRTT Specifications,* 2012, http://www.airbusmilitary.com/Aircraft/A330MRTT/A330MRTTSpec.aspx (accessed February 24, 2013), for data on MRTT. Data on the KC-46 was received in a series of emails to the author from Boeing Defense, Space & Security representative, Mr Jerry A. Drelling, from Dec 5, 2012, to Feb 26, 2013.

Table.1: Comparison of Fuel Off-Load Capacity (Multi-Role FRA and USAF FRA)

Aircraft	Gross Wt (lbs)	Take Off Fuel (lbs)	Fuel Off-Load (lbs)	
			at 500 NM	at 1000 NM
KC-135 E	275,700	160,000	101,200	78,600
KC-135 R/T	301,100	180,000	122,200	99,400
KC-10	593,000	327,000	233,500	195,200
MRTT	514,000	245,000	132,300	110,230
KC-46	415,000	212,299	***Data not available****	

Lbs- Pounds, NM- Nautical Miles

Sources: Pg. 18 of U.S. Air Force Pamphlet 10-1403: Air Mobility Planning Factors Operations for data on existing USAF FRA, Department of the Air Force, http://webapp1.dlib.indiana.edu/cgi-bin/virtcdlib/index.cgi/821003/FID1/pubs/af/10/afpam10-1403/afpam10-1403.pdf .

Data on the Airbus A330 MRTT from Airbus Military: A330 MRTTSpecifications, http://www.airbusmilitary.com/Aircraft/A330MRTT/A330MRTTSpec.aspx.

Data on the KC-46 was received in a series of emails to the author from Boeing Defense, Space & Security representative, Mr Jerry A. Drelling, from Dec 5, 2012, to Feb 26, 2013.

Note: *****This data was not released by Boeing to the author. However, by interpolating the data for Gross weight and take off fuel with that of the MRTT, it is inferred that the figures for fuel off-load for the KC-46 will likely be lower than those of the MRTT.

How do, multi-role FRA perform in the transport role compared to regular cargo/commercial aircraft? Table.2 shows a comparison of the load carrying capacity (in various configurations) between USAF FRA, multi-role FRA, and other commercial aircraft.

Table.2: Comparison of Load Carrying Capacity (Multi-Role FRA and USAF FRA)

Aircraft	Gross Wt (lbs)	Pallets (463 Ltr capacity)	Cargo (s/t)	Passengers
KC-135 E	275,700	6	18	53
KC-10	593,000	25	60	75
MRTT	514,000	26	45	300/270
KC-46	415,000	18	***Data N/A****	114/58
B-767	352,000	25	65	205
DC-10	593,000	30	72	210
MD-11	626,000	35	80	315

Lbs- Pounds, Ltr- Litres, N/A- Not Available

Sources: Pgs. 12 & 13 of U.S. Air Force Pamphlet 10-1403: Air Mobility Planning Factors Operations for data on existing USAF FRA, DC-10, Boeing-767 and MD-11, Department of the Air Force, http://webapp1.dlib.indiana.edu/cgi-bin/virtc dlib/index.cgi/821003/FID1/pubs/af/10/afpam10-1403/afpam10-1403.pdf .

Data on the Airbus A330 MRTT from Airbus Military: A330 MRTTSpecifications, http://www.airbusmilitary.com/Aircraft/A330MRTT/A330MRTTSpec.aspx.

Data on the KC-46 was received in a series of emails to the author from Boeing Defense, Space & Security representative, Mr Jerry A. Drelling, from 05 Dec 12 to 26 Feb 13.

Note: *****This data was not released by Boeing to the author. However, by interpolating the data for Gross weight, pallet and passenger capacity, with those of the MRTT, it is inferred that the figures for cargo capacity for the KC-46 will likely be lower than those of the MRTT.

The comparison indicates that the performance of the multi-role FRA is better than the KC-135 variants. The performance of the MRTT with respect to the KC-10 is better while carrying passengers, comparable for pallets and lower with respect to carrying cargo. On the other hand the performance of the KC-46, when compared to the KC-10, is much lower in all three areas, but this can be attributed to the difference in gross weight of 172,000 lbs.

When comparing the load-carrying capacity of the MRTT to the DC-10 and Boeing-767, we find that it performs better while carrying passengers, is comparable for pallets, and worse when carrying cargo. The performance of the KC-46 is much lower in all three areas, but this might be attributed to a trend that is evident in tables 1 & 2.[6]

At this juncture a trend that emerges is that the operational philosophy of Boeing (the manufacturer of both the KC-46 and the KC-10) focuses primarily on the air force mission. This is supported by the fact that though the KC-l0 can combine the tasks of a tanker and cargo aircraft, the aircraft was marketed primarily for its Air Force mission.[7] Moreover, clubbing the KC-10 in the multi-role FRA category helps strengthen the argument that multi-role FRA are viable from a technical and operational point of view.

The comparison of the load-carrying capacities of the various multi-role FRA with the MD-11 shows that their capabilities are lower, which can be attributed to the differences in gross weights of the aircraft.

Overall, the comparative analysis of multi-role FRA vis-à-vis commercial aircraft shows that their performance is comparable (relative to their size) in either the air-to-air refuelling or the commercial transport roles. This gives these aircraft true multi-role operational capability, as no time is wasted to switch between the roles of an air-to-air refueller or its factory-configured commercial role. Additionally, the time taken to switch

[6] For the Cargo capacity of the KC-46, see Note * for Table.2 on Pg 21.

[7] United States Air Force, "USAF Information: Factsheet KC-10 Extender," *The Official Website of the USAF*, December 29, 2011, http://www.af.mil/information/factsheets/factsheet.asp?id=109 (accessed February 24, 2013). The fact sheet states that, "Although it retains 88 percent of systems commonality with the DC-10, it has additional systems and equipment necessary for its Air Force mission. These additions include military avionics; aerial refuelling boom and aerial refuelling hose and drogue; seated aerial refuelling operator station; and aerial refuelling receptacle and satellite communications."

between the cargo, passenger or aero-medical roles is about 4 hours for the KC-46,[8] and is expected to be similar for the MRTT. The flexibility that these multi-role FRA provide is therefore quite significant.

The comparison also highlights that while the KC-10 outperforms the MRTT and the KC-46, the aircraft has been sold with the focus on the air force mission. This leads us to the question of whether multi-role FRA have a future in commercial aviation markets. Cost benefit is an important aspect. A study undertaken by RAND Corporation in 2006, defines the cost of any given fleet "as the present value of all the life-cycle research and development, procurement, military construction, operations and support, modification, and disposal costs for the fleet."[9] This definition is important for two reasons. First, it is indicative that a multi-role aircraft is logically likely to be more expensive to purchase than an aircraft dedicated to a single role; though dated, the RAND report finds that, "A fleet in which all the aircraft have cargo and passenger-carrying capability has a present value of life-cycle cost about 6 percent greater than that of a fleet in which none of the aircraft have cargo or passenger-carrying capability. A fleet with cargo and passenger-carrying capability has the benefit of additional military utility and flexibility. How much to weigh the cost against the benefit of acquiring cargo and passenger-carrying capability in the tanker fleet is a matter of military judgment."[10]

The finding also highlights the second aspect of the definition, those of life-cycle costs. Depending on the situation and the requirement for air-to-air refuelling in peacetime, procuring multi-role FRA might be beneficial in the long run. The first chapter estimated that nine Squadrons of FRA (54-60) might suffice for the IAF to meet its operational requirements**,** providing adequate flexibility to respond to strategic threats in two theatres. This scenario, however, is representative of meeting air-to-air requirements in two theatres during operations. In contrast, peace time air-to-air refuelling requirements for the IAF consist of supporting a single theatre, thereby lowering the ante. Here, multi-role FRA may prove to be beneficial by ensuring optimum utilization of aircraft in other air transport duties while providing the benefit of retaining

[8] Email from Boeing representative, Jerry Drelling for data on KC-46.
[9] Michael Kennedy et al, *Analysis of Alternatives (AoA) for KC-135 Recapitalization: Executive Summary,* (Santa Monica, CA: RAND Corporation-2006). http://www.rand.org/pubs/monographs/MG495, 9.
[10] Michael Kennedy et al, *Analysis of Alternatives for KC-135,* 14.

the capability to respond to strategic threats in two theatres. This factor will play an important role when comparing the various options available to the IAF to meet its FRA requirements in Chapter IV.

Studying the current market share of multi-role FRA would also indicate their success. The Airbus website shows that the MRTT (as on 31 Jan 2013) has been purchased by Australia, Canada, Germany, Saudi Arabia, UAE and the UK.[11] India has also placed an order for the purchase of six MRTT.[12] Similarly the USAF has placed an order with Boeing for the purchase of 179 KC-46 aircraft.[13] These global orders indicate that the multi-role FRA is a viable option not only from operational and technical viewpoint but also from the viewpoint of acceptance as a viable product by the global market. As there are two main manufacturers of such aircraft, it is likely that future competition would benefit interests of potential customers. Of significance is, however, currently all operators are using multi-role FRA in direct support of air force missions.

This naturally begs the question of whether it is a viable option for the Government of India to procure such multi-role tanker aircraft for commercial use by Air India in peace and by the IAF during hostilities. Does military theory support the use of commercial assets during war? Are there successful precedents of such use of commercial assets by the military to validate such theories? The next chapter examines these questions by providing theoretical perspective and analyzing pertinent lessons from two cases.

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[11] Airbus Military, "Airbus Military Aircraft Orders and Deliveries," *airbusmilitary.com*, January 31, 2013, http://www.airbusmilitary.com/Portals/0/Images/Aircraft/OrdersAndDeliveries/AirbusMilitaryOrdersDeliveries_31Jan2013.pdf (accessed February 24, 2013), 3.

[12] Rajat Pandit,"Europe Pips Russia in Mega Mid-Air Refueling Aircraft Deal," news article on *timesofindia .indiatimes.com*,January 04, 2013, http://timesofindia.indiatimes.com/india/Europe-pips-Russia-in-mega-mid-air-refueling-aircraft-deal/articleshow/17879413.cms? (accessed February 15, 2013).

[13] Donna Cassata and Lolita C Baldor, "Boeing gets $35 Billion Air Force Tanker Order," *Aviation on NBC News.com.* Feruary 24, 2011. http://www.nbcnews.com/id/41766812/ns/business-consumer_news /#.UWtm3KLbTFm (accessed November 10, 2012).

Chapter 3

Military Use of Commercial Assets

Chapter II showed that, though multi-role tanker aircraft are a viable option from the technical and operational points of view, their present market share is restricted to customers who are focused predominantly on missions that support air force tasks. As these aircraft are also capable of performing the transport role (cargo and passenger), the question of why commercial aviation companies have not yet purchased them needs to be answered. One possibility is that an aircraft of the same weight category which is dedicated to a cargo or transport role would definitely be cheaper. Another might be linked to the validity of the use of commercial assets by the military and the operational feasibility of such use.

In order to include the option of multi-role tanker aircraft that Air India might use regularly for commercial purposes and the IAF during war; this chapter highlights that military theory does indeed support this concept. Gaining theoretical acceptance is important, as Clausewitz says, "Theory exists so that one need not start afresh each time sorting out the material and plowing through it, but will find it ready to hand and in good order."[1] Mere theoretical knowledge however is insufficient, as Dr Harold R Winton avers, "a theory performs several very useful functions when it defines, categorizes, explains, connects, and anticipates."[2]This chapter also briefly analyzes the evidence provided by two cases, with a two-fold objective. First, derive lessons that would prove crucial while determining the best option for the IAF. Second, establish a precedent by connecting these theoretical and practical findings to an Indian perspective to highlight that such concepts are not radically new either for the IAF or the Government of India and thus provide a template by which the IAF's use of commercial assets may be anticipated in the future.

Not surprisingly, key theorists representing different services have postulated the concept of the use of commercial assets by the military forces, albeit in diverse degrees and contexts. While the context, breadth, and depth of their argument regarding the use of

[1] Carl.Von. Clausewitz, *On War.* Edited by Michael Howard and Peter Paret. Translated by Michael Howard and Paret Peter. (Princeton, New Jersey: Princeton University Press-1984), 141.
[2] Dr Harold R Winton, "An Imperfect Jewel: Military Theory and the Military Profession," *Journal of Strategic Studies*, December 01, 2011, 857.

commercial assets by the military might differ, their theoretical precepts nonetheless do provide a tacit endorsement of the feasibility of this concept and its potential to enhance military power. Let us examine the views of each theorist.

In *On War*, Clausewitz, while discussing maintenance and supply, wrote, "how vast a difference there is between a supply line stretching from Vilna to Moscow, where every wagon has to be procured by force, and a line from Cologne to Paris, via Liège, Louvain, Brussels, Mons, Valenciennes and Cambrai, where a commercial transaction, a bill of exchange, is enough to produce millions of rations!"[3]

Clausewitz's statement is related to the supply of an army in an under-developed area vis-à-vis a developed area. It also, however, supports the point of view that, situation warranting, an army might consider exploiting the opportunity presented by the availability of commercial assets. This would ease the strain on the logistical chain of the army, which might be put to better use in other areas where such services would likely prove essential for operational success.

Mahan, includes the concept of military use of commercial assets, in his definition of sea power, "[...] sea power in the broad sense, which includes not only the military strength afloat, that rules the sea or any part of it by force of arms, also the peaceful commerce and shipping from which alone a military fleet naturally and healthfully springs, and on which it securely rests."[4] Mahan expounds this concept further by suggesting that the inherent infrastructure of commercial shipping might be exploited during war to significantly enhance a navy's strategic power:

> The mutual dependence of commerce and the navy is nowhere more clearly seen than in the naval resources of a nation, the greatness of which depends upon peaceful trade and shipping. Compared with a merely military navy, it is the difference between a natural and a forced growth. Among resources, dry docks occupy the place first in importance: (1) because to provide them requires the longest time; (2) because they facilitate various kinds of repairs; (3) because by the capacity to clean and repair several vessels at once, and so restore them with the least delay to the fleet, they maintain offensive energy. Dry docks represent in condensed form the three requirements of a strategic seaport. In position they should be as near the scene of war as possible. Strength is represented by

[3] Clausewitz, *On War*, 340.
[4] Alfred T. Mahan, *Mahan on Naval Strategy: Selections from the writings of Rear Admiral Alfred Thayer Mahan.* Edited by John.B Hattenedorf and Jr. Wayne.P Huges.(Annapolis, Maryland: Naval Institute Press-1991), 31.

> numbers; the more numerous the docks, the greater the offensive strength of the port.[5]

It was Giulio Douhet, who first suggested that the development of civil aviation could promote national security, as he regarded some activities of civil aviation to have a direct bearing on national defense.[6] He also identified the possibility of the dual use of civil-aviation assets; commercially during peace and by the air force in war; "I believe we should hasten and bend all our energies to this end: *to organize a civil aviation capable of being converted into a powerful military air force in case of national need* […] On the other hand, a civilian plane capable of conversion immediately on the opening of hostilities has a potential value identical with that of the military plane. But it also represents a real value in peacetime in that it can perform useful civilian services."[7](emphasis original)

On very similar lines, William 'Billy' Mitchell included commercial assets in his definition of airpower as the ability to do something in or through the air,[8] and linked the influence of airpower as being decisive in the "ability of one nation to impress its will on another in an armed contest."[9] He also stated that:

> The elements of air power are very numerous and complicated. To begin with, the personnel: officers, mechanics, designers, manufacturers, engineers, and inspectors, all have to be created especially for aviation work. This requires a long period of time. It must be based on the proper system of training, while training, itself, must be based on how air power is to be used. The work of an air force depends on the men that fly the planes, not primarily on those that remain on the ground. The avenues along which military, civil and commercial air power is to be developed must be selected. What we call airways must be organized just as roads had to be laid down for automobiles and refueling stations installed; or, as lines for steamships had to be established with ports where fuel, coal, and oil could be obtained. Just so do our airways have to be made for air power. These airways can be used for both commercial and military planes. In the future we will see the merchant aeronautics alongside the military aeronautics, one being a direct assistance to the other, both using the same airways, the same navigating instruments, and the same methods of flying as the other.[10]

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[5] Mahan, *Mahan on Naval Strategy,* 140-141.
[6] Giulio Douhet, *The Command of the Air,* Edited by Joseph Patrick Harahan and Richard H Kohn, Translated by Dino Ferrari. (Tuscaloosa, Alabama: University of Albama Press-2009), 82.
[7] Douhet, *Command of the Air,* 123.
[8] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power- Economic and Military.* (Tuscaloosa, Alabama: The University of Alabama Press-2009), 3& 4.
[9] Mitchell, *Winged Defense,* 214.
[10] Mitchell, *Winged Defense,* 31-32.

Mitchell's statement must be read in context of the era, however, there is no denying the coherence in his argument that infrastructure, industry, and commercial assets do contribute to strengthening national airpower. Like Douhet, he identified the fiscal conundrum associated with the simultaneous development of infrastructure for both military and civil aviation:

> Airplanes have a great application in time of peace in useful civil and commercial pursuits. The same airplanes can do this work that are suitable for duty in war and for national defense. In fact all aircraft developments, the factories that make them, the air-ways that are established for civil aviation and the civilian pilots and crews, are distinct military assets, and bring in a return in time of peace, thereby reducing the national expenditure necessary in their maintenance if they were kept solely and exclusively for war.[11]

Where the theories of Douhet and Mitchell differ is in their recognition of which assets might be used in dual roles. Douhet suggests the dual use of commercial assets during war, Mitchell, however, suggests the dual-use of military assets for commercial activities in peace:

> In time of peace, the bulk of the effort and thought of a nation in an aeronautical way may be applied to civil and commercial development of aeronautics and this same effort and thought can be shifted at once to military purposes. There is no reason, for instance, why the air forces in time of peace should not be employed in mapping the country, patrolling the forests to prevent forest fires, carrying the mail, eliminating insect pests from cotton, fruit trees and other vegetation, and in making an aeronautical commercial transportation survey of the country to determine what can be carried economically and at a profit through the air instead of on boats, rail-roads, and by automobiles, and in working out new commercial air routes throughout the world.[12]

Overall, neither Clausewitz nor Mahan or Douhet rule out the possibility of the military use of commercial assets (with Mitchell arguing for the commercial use of military assets). Arguably, Mahan, Douhet, and Mitchell do provide adequate theoretical background to support such a concept. Moreover, the theories of Douhet and Mitchell go beyond the concept of military use of commercial assets as they propose counter-factual views to the dual use of aircraft in military-commercial roles; this dichotomy in their hypotheses shall be evaluated in Chapter-IV. At this stage, however, it is reasonable to deduce that eminent military theorists do support the concept of the military use of commercial assets. How does the IAF identify with their theories?

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[11] Mitchell, *Winged Defense*, 120-121.
[12] Mitchell, *Winged Defense,* 98.

The Basic Doctrine of the IAF, is the product of eight decades of historical legacy and operational experiences of the IAF, combined with a perspective that is unique to Southeast Asia. The doctrine defines air power as, "the total ability of a nation to assert its will through the medium of air. It includes both civil and military aviation, existing and potential."[13] In this respect, the IAF doctrine identifies with the theory of Billy Mitchell. The IAF doctrine also recognizes that, "Air power is a derivative as [sic] also an indicator of national power. The ability of a nation to utilise all air power resources at its disposal determines its air power capabilities. Air power, hence, is the sum total of a nation's aviation and related capabilities. It comprises national aviation assets usually described as air forces, air arms and civil aviation, along with their associated organisations, infrastructure, logistics and personnel."[14]

It is evident that here that the IAF doctrine aligns with the theory of Douhet, as it also specifically recognizes the contribution of civil aviation and its latent combat-support capabilities; "Civil aircraft and infrastructure also contribute to a nation's air power. They augment airlift capabilities and if suitably modified, could also be used for combat support operations."[15] On the whole, the IAF's perceptions of the definition of airpower and its constituting elements resonate best with the theories of both Douhet and Mitchell. It can therefore, be inferred that, from a theoretical perspective, the IAF is pragmatic about the use of commercial aviation assets during war to project airpower.

A brief analysis of two cases; the Royal Navy's use of commercial assets during the Falkland's war; and the USAF's use of Civil Reserve Air Fleet (CRAF) shall help to connect this theoretical perspective to operational success.

Use of Merchant Shipping by the Royal Navy during the Falklands War. Unable to resolve differences over territorial sovereignty of the Falkland Islands with Britain, Argentinean forces invaded the islands on 02 Apr 1982.[16] As the Falklands were situated 8000 nautical miles from the British Isles, Britain turned to the Royal Navy to repel the invaders.

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[13] Directorate of Operations (Space): IAF, *Basic Doctrine of the Indian Air Force: IAP 2000-12,* (New Delhi: Indian Air Force-2012), 5.
[14] Directorate of Operations (Space): IAF, *Doctrine of the Indian Air Force*, 22-23.
[15] Directorate of Operations (Space): IAF, *Doctrine of the Indian Air Force*, 23.
[16] BBC NEWS UK, *The Falklands War: Key Date*, March 30, 2012, http://www.bbc.co.uk/news/uk-17444526 (accessed 1150hrs, March 22, 2013).

This was a task that neither key British planners nor the Royal Navy was prepared for. In his book *Merchant Ships at War,* Captain Roger Villar maintains:

> No one in Britain had ever, in recent years, envisaged having to mount an opposed amphibious assault 8000 miles from home in the face of strong opposition and without allies or friendly bases near at hand. Official defence policy had indeed ruled it out entirely since 1966. Such war plans as existed were for entirely different circumstances and only a few could be adapted to the new situation. The Fleet itself was beginning to run down its surface warship strength following on the Government's 1981 white paper 'The Way Forward', and a further concentration on the NATO defence of Europe to exclusion of 'out of area' operations.[17]

Despite being faced with a situation that required a large sea-lift capability and not having enough organic assets to meet such requirements, the British response was adaptive and flexible as Villar illustrates:

> At 6pm on Sunday 4 April 1982, two days after Argentina's invasion of the Falkland Islands, Queen Elizabeth II approved an Order in Council in the presence of her Privy Councillors at Windsor Castle. It was the start of a story which has no parallel. Some 50 merchant ships were taken up in the ensuing weeks to support and eventually outnumber the Royal Navy in its Operation Corporate for retaking the Falkland Islands. There was a speed and urgency about which had not been seen since the days of the Second World War.[18]

The concept of using merchant ships taken up from trade (STUFT) is not new to the British and dates back to the reign King Richard I in the twelfth century.[19] This concept enables the "Government to requisition all British shipping in defence of the Realm or the Sovereign Territories, and the Falkland Islands were a part of the Sovereign Territories."[20] In hindsight, STUFT contributed to the success of the campaign by bridging the shortage of the Royal Navy's ships and were used not only as "troop transports but also as assault ships, minesweepers, dispatch vessels, fleet and support tankers, aircraft ferries, ammunition and stores ships, repair ships, hospital ships, and in many other roles."[21]

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[17] Captain Roger Villar, *Merchant Ships at War: The Falklands Experience.* (Annapolis, Maryland: Naval Institute Press-1984), 7.
[18] Villar, *Merchant Ships at War,* 7.
[19] Villar, *Merchant Ships at War,* 11.
[20] See n.17.
[21] See n.17.

This type of support by STUFT was made possible due to various modifications that had to be undertaken on the merchant ships to enable them for such roles. Villar cites the conversion of the Atlantic Conveyor as an example, "Most remarkable perhaps was the 14,946-ton container ship Atlantic Conveyor, taken up on 14 April as she was returning to commercial service from reserve. She sailed from Liverpool to Plymouth with a team on board carrying out redesign work, and 11 days later she left as a ship capable of carrying and flying on and off both Harrier V/STOL aircraft and helicopters. She eventually went south from Ascension Island with 25 fixed and rotary wing aircraft on board."[22]

The Falklands campaign provided many lessons for the British. Some are relevant to deciding the best option for the IAF to meet India's strategic requirements. The first lesson pertains to legal aspects of requisitioning commercial assets for military use. In the British case, the powers provided by the Queen to the Government were significant both to the Government and to the ship-owners. Villar explains:

> […] they were needed primarily because the owners of some essential ships could not have volunteered their services as they wished without breaking existing contracts and becoming liable to legal action. It was for example the start of the peak cruise season with many bookings already made. These powers were however used carefully and, when ships did not have to be requisitioned, they were chartered through the Government ship broker.[23]

Highlighted here, if the military plans to use commercial assets, it is important to frame rules and regulations that would not only protect the parties involved, but also ensure that such capability is made available for use when required. This key factor would have to be considered when deciding the best tanking option for the IAF. Too, when the military uses commercial assets, remuneration needs consideration.

The second lesson pertains to the manner in which the British adapted to the situation in terms of organization, infrastructure, and cooperation demonstrated by the "Ministry of Defence, the Department of Trade, the Dockyards, commercial industry, the ship-owners and General Council of British Shipping."[24] This lesson highlights the significance of peacetime planning and provisioning for out-of-area contingencies, and

[22] Villar, *Merchant Ships at War,* 15.
[23] Villar, *Merchant Ships at War,* 11.
[24] Villar, *Merchant Ships at War,* 162.

shows that it is a continuous process. This kind of "advance work" begs consideration for the decision at hand.

The third lesson pertains specifically to the planning and developing of the long-term capability for merchant shipping to "support the Fleet and the nation by having the right types of ships in sufficient numbers."[25] Villar identifies the main problem as being one of cost-benefit; as it augurs a disincentive for commercial entities to operate commercial vessels that are modified to meet military specifications, as they reduce profit margins during peacetime:

> In the main these are questions of money. Provision of equipment in peacetime for the contingency of war will itself be costly. The design of merchant ships themselves for ready adaptation to a wartime role could be even more expensive. Additional equipment can detract from a ship's normal economy of operation by, for example, reducing the space available for cargo. The additional accommodation which has to be provided for the men to operate the equipment will also take up valuable space. So too would additional watertight bulkheads over and above the normal peacetime needs. Although the effects may appear small, they can add up over a number of voyages to something quite considerable. Ships which are fighting for cargos in the international markets will then become uncompetitive without a substantial subsidy.[26]

As is evident, commercial viability shall continue to be a major incentive for private parties to consider operating multi-role platforms, a trend highlighted by the present market share of multi-role tanker aircraft.

Apart from the elements of danger associated with war, Villar also identified other factors that could have adversely affected operations while using of Merchant ships during the Falklands War:

> Nor were the Argentineans all that they had to fear […] The seas could be mountainous. Gales blew frequently with the highest wind speed reported being 105 knots just off Port Stanley. It was a strange and sudden business for merchant seamen even down to the simple matter of navigation. Many had not operated satellite navigators or had any need to on the cross-Channel run. Others were so accustomed to coastal navigation that one Master sought a quick navigational refresher course from the Navy. Their Masters were subject to the operational orders of strange naval officers posted to them at the last minute. Their whole lives and accustomed procedures were totally upset without warning.[27]

[25] Villar, *Merchant Ships at War*, 166.
[26] Villar, *Merchant Ships at War*, 166.
[27] Villar, *Merchant Ships at War*, 16.

The use of merchant ships by the Royal navy in the South Atlantic illustrates the need for regular cross-training between military and commercial operators, in order to ensure a high degree of interoperability. This factor highlights the necessity of ensuring regular continuity-training during peacetime, and when combined with the other pertinent issues of training and interoperability, discussed in Chapter II, it assumes great importance. The area of aircrew training shall, therefore, need to be addressed specifically when considering the various options for the IAF.

The Falklands War also shows how the element of time affected British forces; both in terms of the time taken to modify various merchant ships, as well as the three weeks that were required to sail to the Falklands from England.[28] For the British, time may have benefited their invasion force, in terms of both training and preparation required for the out-of-area contingency. Such luxury of time, however, may not be available to India if in a defensive posture. These elements of cost-benefit and time shall be of special relevance when considering the various options for the IAF.

Overall, the Royal Navy's experience with merchant ships during the Falklands War was successful operationally, economically and strategically.

Use of CRAF by the USAF. Commercial air-carriers had already been sucessful in contributing to the USAF's airlift commitments during the Berlin airlift and the Korean War,[29] even before the Memorandum of Understanding between the Departments of Defense and Commerce, signed on 15 Dec 1951 signalled the birth of CRAF.[30] It was, however, in 1960 under President Eisenhower, that a true national airlift policy emerged when a report titled "Presidentially Approved Courses of Action", first established a relationship between the government and the nation's air carriers.[31] Sections of this report catered to emergency needs of the DOD, assessed tariff rates filed with the Civil Aviation Bureau, and ensured responsiveness of commercial airlift services under all conditions.[32]

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[28] BBC NEWS, *The Falklands War: Key Dates.* March 30, 2012. http://www.bbc.co.uk/news/uk-17444526 (accessed 1150hrs, March 22, 2013).
[29] Ronald.N Priddy, *A History of the Civil Reserve Air Fleet in Operations Desert Shield, Desert Storm, and Desert Sortie* (Cambridge, MA: Volpe National Transportation Center-1994). Details of the Berlin airlift are discussed on Pgs. 11-12 and the Korean War on Pgs. 12-13.
[30] Priddy, *A History of the Civil Reserve Air Fleet*, 16.
[31] Priddy, *A History of the Civil Reserve Air Fleet*, 25.
[32] Priddy, *A History of the Civil Reserve Air Fleet*, 25.

Under President Kennedy in 1962, the mandate of CRAF was extended further to respond to national emergencies both domestically and internationally[33] in three different stages.[34] In its history, CRAF has been activated only twice - during Desert Storm, and during Operations Iraqi Freedom and Enduring Freedom - both were Stage-I activations.[35] The scope of this analysis is however, restricted to examining the lessons of Desert Storm.

Despite the overwhelming success of its use during Desert Storm, CRAF does have some restrictions. The heavy-lift capability of CRAF was restricted by the capacity of its participating platforms, therefore the bulk of the capability to lift over-sized cargo was retained by the USAF.[36] Attempts to coax CRAF carriers to provide similar capability were made in the 1980s. The modification, however, did not fit the commercial business strategy of CRAF partners, and the DOD would not subsidize modifications or higher operating costs.[37] As a result, only 23 new and existing aircraft were modified for such roles; and, though few in number, they would play a significant role in Desert Storm.[38] Hence, both reluctance and difficulty seem to typify the modification of aircraft, merchant ships appear easier. Pertinent elements shall be examined thoroughly in Chapter IV.

A significant characteristic of the CRAF program is that it is a voluntary contractual partnership between the DOD and most commercial air-carriers.[39] The incentive for commercial air-carriers to participate in CRAF is provided by a guaranteed portion of the DOD's peacetime business.[40] Both these factors differ from the Royal Navy's concept of using STUFT and therefore also need to be considered when determining the best option for the IAF in Chapter IV.

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[33] Priddy, *A History of the Civil Reserve Air Fleet*, 27.
[34] Lt Col Michael W. Grismer Jr, *Transforming the Civil Reserve Air Fleet (CRAF) to Enable Combat Power in a Fiscally Constrained Environment* (a thesis submitted to the Naval War College, Newport-2010).Pg. 4 covers the various stages. Stage-I activation is for expanded peacetime requirements or a minor regional crisis and is comprised of long-range assets only. Stage-II is for one major theater war and comprised of national, international, and Aeromedical Evacuation (AE) segments. Finally, stage III is for periods of national mobilization, and involves a total CRAF airlift recall.
[35] Grismer, *Transforming the Civil Reserve Air Fleet*, 4.
[36] Grismer, *Transforming the Civil Reserve Air Fleet*, 8.
[37] Grismer, *Transforming the Civil Reserve Air Fleet*, 8.
[38] Priddy, *A History of the Civil Reserve Air Fleet*, 33.
[39] Priddy, *A History of the Civil Reserve Air Fleet*, 34.
[40] Captain Pamela S. Donovan, *The Value of the Civil Reserve Air Fleet: How Much Could the DOD Spend on Incentives*, (a thesis, submitted to the Air Force Institute of Technology, Wright Patterson Air Force Base Ohio-1996), 2-20.

Of the many lessons that were learnt during the activation, those that are likely to be most relevant to India follow. The first lesson pertains to accountability. During the activation for the Desert Storm, CRAF providers were wary of participation due to issues of insurance in a war zone, and the potential loss of market share (especially for large carriers).[41] Also, a few CRAF aircrew refused to fly into the war zone, which forced the USAF to deploy its aircraft to carry the load.[42] Similarly, some carriers delayed at en-route airfields so as to arrive at the final destination during daylight hours. As a lack of accountability and responsiveness directly impacts operational effectiveness, honoring contractual obligations warrants critical examination when determining the best option for the IAF.

The second lesson was the reduced interoperability of CRAF aircraft with the USAF's Command, Control and Communications grid, which affected efficiency at offloading bases, thus causing delays due to unannounced arrivals, delayed offloading, and refueling.[43] Interoperability assumes greater significance in an out-of-area contingency.

Lack of accountability and interoperability led to congestion on the ground & delays, which in turn contributed to the third lesson, that of under-utilization of CRAF aircraft.[44] Under-utilization of CRAF aircraft is also attributable to the reduced operating capacity of aircraft due to either the heavier weight of military soldiers and their equipment (as much as 400lbs per person) and the non-standard and excessive size of military cargo.[45] Moreover, CRAF providers initially anticipated regular commercial ground-times of an hour or less between sorties but frequently encountered times that were in excess of five hours, thus, leading to the underutilization of aircraft.[46]

Overall, while the USAF's activation of CRAF was successful, the lessons from this experience highlight the need to carefully scrutinize aspects of interoperability,

[41] Donovan, *The Value of the Civil Reserve Air Fleet*, Element of insurance discussed on Pg 2-12 and the loss of market share is discussed on Pg 2-17.
[42] Priddy, *A History of the Civil Reserve Air Fleet*, 148.
[43] Priddy, *A History of the Civil Reserve Air Fleet*, 89-90.
[44] Priddy, *A History of the Civil Reserve Air Fleet*, 148.
[45] Priddy, *A History of the Civil Reserve Air Fleet*, 124.
[46] Priddy, *A History of the Civil Reserve Air Fleet*, 243.

responsiveness, accountability, and effectiveness when choosing the best option for the IAF.

The brief analysis of the use of commercial assets by the Royal Navy and the USAF demonstrates that such use was warranted by the prevalent geo-political requirements. Moreover, the analysis also suggests that the operational successes of these campaigns validate the applicability of this theoretical concept. As the IAF does not have a formal contract akin to the USAF's CRAF policy, much work needs to be done for India to pursue this option.

Brief Analysis of the Indian Perspective. This portion of the chapter highlights historical instances when the Government of India has considered the military's use of commercial assets.[47] To establish a precedent for the IAF's use of commercial aviation assets in general, legal and practical examples from Indian aviation history are highlighted first. Thereafter, to establish a likely precedent for the IAF's use of Air India's commercial assets; examples which show that Air India often functions on a non-profit basis are highlighted. The intent of ascertaining this linkage is to show that the Government of India, as the major stakeholder in India's national air carrier, exercises operational control of Air India. This linkage shall help establish factors for consideration as well as help in identifying pros and cons while choosing the best FRA option for the IAF.

At this stage it would be pertinent to bring out that Air India is the national air carrier of India, initially Air India (international) and Indian Airlines (domestic) were separate companies. On 30 March 2007, however, they amalgamated into one company called National Aviation Company of India Limited (also a Government of India Undertaking), the company is now called Air India Limited, and has retained its corporate logo of the "*Maharaja*" (emphasis added).[48] The merger focused on reducing organizational and administrative inefficiencies.

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[47] Here the term ***use*** also implies, exercising command and control to achieve a given task.

[48] Air India Limited, "Particulars of Organisation, Functions & Duties (Sec 4(b)(i); Right to Information Act," *Air India Limited*, July 30, 2012, http://airindia.in/SBCMS/downloads/RTI/RTI-Manual-1-new.pdf (accessed April 03, 2013). The site lists various funtions of Air India. It also provides information, on the company's logo "*The Maharaja*" and that Air India has may subsidary companies (including cargo and a low cost airline) and is in the process of a reform to improve efficiency.

The first operational precedent that supports this concept is provided by the Indian Navy. In the late 1980s, two ships INS *Nicobar* (Yard No.B-561/1; launched on 12 Apr 90) and INS *Andamans* (Yard No. B-561/2; launched on 05 Oct 90 and completed as *Nancowry*) were delivered on 05 Jun 91 and 31 Mar 92, respectively, to the Shipping Corporation of India (SCI).[49] These vessels were later acquired by the Indian Navy in April 1998 and April 2000.[50] A report on the website of a U.S security analysis firm called Global Security based at Alexandria (Virginia), states:

> Contrary to other published reports, these ships were not built at Hindustan Shipyards, Vizag. These are Type B-561 cargo-passenger vessels designed & built by Szczecin Shipyard in Szczecin, Poland. They were originally ordered by the Ministry of Transport & Navigation for service with the Shipping Corporation of India Ltd (SCI) and were later acquired by the Indian Navy for troop transport duties. The design of the Type B-561 was however sold to India for license construction. The ships have large davits for LCVPs (Landing Craft, Vehicle, Personnel) and feature a high bridge forward, funnel aft and helicopter platform at the stern. The vessels could have a more general purpose role, other than troop transport.[51]

Such acquisitions could not have been possible without at least an in-principle approval by the Indian Ministry of Defense. This acquisition of modified merchant vessels therefore establishes a toehold into a precedent that the Government of India might view favourably when considering the use of commercial assets by the IAF.

Legal precedence also exists to utilize commercial aviation assets in an emergency; paragraph 6 (d) of "The Aircraft Act of 1934," entitles the Indian Government (by means of notification of an Official Gazette) with special powers to, "direct that any aircraft or class of aircraft, or any aerodrome, aircraft factory, flying school or club, or place where aircraft are manufactured, repaired or kept, together with any machinery, plant, material or things used for the operation, manufacture, repair or maintenance of aircraft shall be delivered, either forthwith or within a specified time, to

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[49] Bharat Rakshak: The Consortium of Indian Military Websites, *Nicobar Class*, ed. Bharat-Rakshak webmaster, April 12, 1990, http://www.bharat-rakshak.com/NAVY/Ships/Active/156-Nicobar-Class.html (accessed at 1600hrs on March 23, 2013).

[50] See n.49.

[51] Global Security, *Nicobar Class Transport Ship*, ed. John Pike, September 07, 2011, http://www.globalsecurity.org/military/world/india/ap-nicobar.htm (accessed at 1630 hrs on March 23, 2013).

such authority and in such manner as it may specify in the order, to be at the disposal of Government for the public service."[52]

The provisions of the act also authorize the Central Government to order Indian citizens to contribute in any manner deemed appropriate. Overall, the clauses of the act do provide the Government of India with a strong legal foundation to authorize the use of commercial aviation assets by the IAF.

An article written by Group Captain AK Sachdev, highlights that, "when India was confounded by Chinese military action in 1962, civil flying clubs were overnight converted to flying schools churning out military pilots on fast track, i.e. in six months instead of the usual 12 months it took to complete their training in the normal course. This improvisation proved extremely useful for the IAF and was possible only because there existed a civil flying base to augment the IAF's training capacity which, though adequate for normal training requirements, was unequal to the task of training a large number of pilots in a short time."[53]

The example of converting civil flying clubs to meet emergent flying training requirements of the IAF is indicative that paragraph 6 (d) of the "The Aircraft Act," is likely to have been invoked in 1962.

Precedence of using Air India in a non-commercial role to protect national interests also exists. The IAF doctrine cites examples when the Government of India authorized the air-lift of its citizens to protect their interests, "The IAF has conducted numerous such operations as for instance: evacuating thousands of people during snowstorms in Jammu and Kashmir in 2005; airlifting of more than 100,000 Indian citizens from Iraq and Kuwait during Gulf War I in conjunction with Air India and Indian Airlines which are the other elements of Indian air power."[54]

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[52] Director General Civil Aviation (DGCA) India, "The Aircraft Act, 1934," *DGCA Rules*, February 15, 2008, http://dgca.nic.in/rules/act-ind.htm (accessed March 30, 2013). Para 6(d) of the Aircraft Act 1934, provides the legal framework to empower the Government of India to authorize the dual-use of commercial aviation assets by the IAF.

[53] Gp Capt A.K Sachdev, "Civil Aviation: Component of Aerospace Power," the article appeared in the *Indian Defence Review (Vol 26.2 Apr-Jun 2011), indiandefencereview.com/spotlights/*, February 06, 2012, www.india
ndefencereview.com/spotlights/civil-aviation-component-of-aerospace-power/2/ (accessed January 25, 2013).

[54] Directorate of Operations (Space): IAF, *Doctrine of the Indian Air Force*, 8.

While in 1991, there was no requirement to place all air assets under a single manager and the threat assessment probably did not warrant fighter escorts for these air-lift operations, it is reasonable to assume that the Government of India would have placed the IAF in charge of the situation, had the geo-political situation so warranted.

This was demonstrated in 2001, in the aftermath of a massive earthquake in the Indian state of Gujrat. In this case, not only did the Government authorize Indian Airlines (the national domestic carrier) to "provide free air transportation of relief materials on its flights," more specifically, it placed at the disposal of the IAF the services of three B-737 freighter aircraft that Blue Dart had made available to the Ministry of Civil Aviation (the expenses were borne by the Ministry of Civil Aviation).[55] This example highlights the use of Indian Airlines in a non-profit role. Both this and the use of civil flying clubs in 1962 establish a precedent for the IAF's use of commercial aviation assets in a national emergency.

As the major stakeholder of the company, the Government of India provides substantial subsidizes to Air India for non-profit functions the carrier undertakes. Most recently, the Government of India subsidized a loan (valid till Financial Year 2021) of approximately 3.4 billion dollars as equity against the purchase of aircraft for Air India. It has also given approximately 550 million dollars in 2012 "towards equity infusion in Air India, which were utilized by Air India for payment to Oil Companies, for payment of salary, payment of service tax and to the vendors etc."[56] The Government also subsidizes Air India for the airfare of the pilgrims who travel for the Haj pilgrimage to Mecca each year. The average total subsidy was approximately 109 million dollars per year from 2007 to 2011.[57]

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[55] Ministry of Civil Aviation, "Relief Measures by Ministry of Civil Aviation in Earthquake Hit Gujarat," press release on website if the *Press Information Bureau Governement of India*, February 01, 2001, http://pib.nic.in/archieve/others/gujaratequake/civila.html (accessed 0700 hrs on April 02, 2013). The report also highlights voluntary contributions/ measures undertaken by other airlines, however for sake of expediency, these have not been mentioned.

[56] Ministry of Civil Aviation, "Bailout Package for Air India," press release on the website of *Press Information Bureau Government of India*, August 14, 2012, http://pib.nic.in/newsite/erelease.aspx?relid= 86166 (accessed March 15, 2013). This information was given in a written reply to a question in Rajya Sabha, on 14 Aug 2012, by the Minister of Civil Aviation Shri Ajit Singh.

[57] Ministry of Civil Aviation, "Operation of Haj Flights by Air India," press release on the website of *Press Information Bureau Government of India*, April 26, 2012, http://pib.nic.in/newsite/erelease.aspx?relid=826

Apart from monetary subsidies, operational control of Air India is established by the fact that the Chairman & Managing Director of Air India is a member of the Indian Administrative Service. On 12 August 2011, Shri Rohit Nandan, IAS (UP cadre, 1982 batch), Joint Secretary, Ministry of Civil Aviation, was appointed by the President of India as the Chairman & Managing Director, Air India Limited, on deputation for a period of three years or until further orders, whichever is earlier.[58]

This level of financial and administrative involvement by the Government of India in the operational functioning of its national air carrier strengthens the argument in support of the IAF's use of commercial assets.

To summarize, this chapter has shown that eminent theorists of land, sea and air power have supported the use of commercial assets by the military. It has also highlighted the IAF doctrine, which reaffirms these theoretical precepts in the Indian context. The chapter also shows that the use of merchant shipping by the Royal Navy during the Falklands War and the use of CRAF by the USAF demonstrate operational success of this theoretical concept. The lessons from the two cases also provide a broad spectrum of factors that merit consideration when choosing the best option for the IAF. More importantly, the chapter establishes that the Government of India does have sufficient legal and historical precedents to suggest consideration of the IAF's use of commercial aviation assets in general, and Air India's assets in particular.

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38 (accessed March 13, 2013). "During the years 2007, 2008, 2009, 2010 and 2011, Government of India has spent an amount of approximately 4.77, 8.95, 6.9, 6.0 and 6.05 billion rupees (excluding service tax) as subsidy on air travel of Haj pilgrims," the Minister of Civil Aviation Shri Ajit Singh said on 26 April 2012.

[58] Ministry of Civil Aviation, "Rohit Nandan Appointed CMD, Air India for Three Years," press release on the website of *Press Information Bureau Government of India*, August 11, 2011, http://www.pib.nic.in/newsite/erelease.aspx?relid=74520 (accessed April 01, 2013).

Chapter 4

Choosing the Best Option for the Indian Air Force

Chapter I estimated that the Indian Air Force (IAF) might require a total quantity of 54 to 60 Flight Refuelling Aircraft (FRA) to meet its strategic responsibilities. The chapter also listed various options available to the Government of India to satisfy the demand of the IAF. To recap, a first option is the *direct purchase* by the IAF. A second is forming an *alliance* with another country. A third option is for the IAF to *lease* this service from a contractor. A fourth option is to buy multi-role tanker aircraft for commercial use by *Air India* which could also be used by the IAF in war.

Chapters II & III also highlighted certain factors that would play a causal role in choosing the best option. Some factors have a fairly broad deterministic power, like the element of risk posed to the FRA during air-to-air refuelling operations that would therefore apply equally to all options. To avoid unnecessary repetition and for the sake of brevity, factors that affect all options equally along with some basic assumptions are examined prior to comparing the various options.

Other factors are more specific, like the subject of remuneration for air-to-air refuelling services which would merit consideration only if the FRA were leased by the IAF. As choosing the most beneficial option broadly involves satisfying operational imperatives for the IAF, commercial imperatives for a Contractor/Air India, and strategic imperatives for the Government of India (and those of a potential ally), these imperatives demand further examination. This analysis therefore compares the various options available from the perspectives of operational effectiveness and interoperability for the IAF; incentive and accountability for a Contractor/Air India; and overall cost-benefit and strategic advantage for the Government of India (and a potential ally).

Basic Assumptions and Common Factors

The first factor is the element of risk to the FRA. Chapter II established that the element of risk to the FRA would be the same irrespective of whether the aircraft is a dedicated FRA, or a multi-role tanker aircraft, highlighting the necessity to conduct air-to-air refuelling in sanitized airspace. The IAF's responsibility to provide adequate force-

protection to FRA significantly alleviates a major concern when evaluating the options that consider the leasing of FRA, using FRA of an ally, or those of Air India.

The second factor pertains to an important requirement highlighted by Chapters II and III, that of specialized training of aircrew for this role. With the exception of the *alliance* option, all others necessitate a requirement to train aircrew, system operators, and maintenance crews to the rigors and demands of FRA operations. Operational effectiveness therefore dictates that the responsibility to create the requisite pool of such specialists and their subsequent continuity training shall likely fall on the IAF.

Moreover, even in the *alliance* option, the IAF would like to provide the refuelling-system operator, or at least have an operational representative on board, as a crewmember, to liaise between the receiver and the FRA. He/she would also prioritize fuel offload between various receivers, and would be a competent authority to take executive decisions in unplanned contingencies; such as unforseen weather forcing a change in the rendezvous point, an operational requirement that forces the undertaking of air-to-air refuelling without the use of radar or communications, or an emergency that necessitates a re-prioritization of fuel to receivers who are identified as critical to mission success. The *alliance* option would, therefore, call for a very high degree of interoperability between the air forces of India and the ally. Such interoperability would require a commonality of tactics, training, and equipment, thereby necessitating that the IAF maintain proficiency in these core competencies. Overall, irrespective of which option is chosen, operational effectiveness of the FRA, and prudence demands that the IAF be accountable for the training of these aircrew.

The third factor is the element of time. In Chapter III, the analysis of the Falklands War and Desert Storm highlighted that an out-of-area contingency confers on the invading force the advantage of choosing the time and place of attack. India's twin foreign policies of, no extra-territorial ambition, and no export of ideology,[1] suggest that she is not likely be an aggressor. Therefore, the element of time shall be significant when considering various options, as, unlike other wide-bodied jets, FRA need a large lead-time to procure and operate.

[1] Ministry of Defence, "Text of Pranab Mukherjee's address Singapore," news release *Press Information Bureau, Government of India*, June 03, 2006, http://pib.nic.in/newsite/erelease.aspx?relid=18213 (accessed on January, 23, 2013). Extract of the statement given by India's Defence Minister.

Moreover, in Chapter III, a dichotomy emerged between the theories of Douhet and Billy Mitchell regarding the dual use of military commercial aircraft. While Douhet proposed the military's use of commercial aircraft in war; Mitchell suggested that military aircraft might be used for commercial purposes in peacetime. The use of military aircraft for commercial roles (profit generation) is generally not a world-wide accepted norm.[2] The IAF too is not permitted to use its aircraft for commercial purposes.[3] Therefore, when comparing the various options, only the use of commercial aircraft by the IAF is considered and not the converse.

Also, the peacetime requirement for air-to-air refuelling by the IAF is low, unlike that of the USAF. It is re-emphasized that the quantity of 54 to 60 FRA caters to the strategic requirements of a two-front scenario, with a full strength of 55 fighter squadrons. During peace-time, it is possible for the IAF to operate with a much smaller number of FRA, as the necessity of air-to-air refuelling is reduced largely to satisfying the demands of continuity training (both tanker and receiver fleets) of the IAF, and

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[2] Executive Office Of The President: Office Of Management And Budget, "Office Of Management And Budget: Circular No. A-76 (REVISED)," May 29, 2003, http://www.whitehouse.gov/sites/default/files/omb /assets/about_omb/a76_incl_tech_correction.pdf (accessed March 06, 2013). Para 4 specifies that "the longstanding policy of the federal government has been to rely on the private sector for needed commercial services. To ensure that the American people receive maximum value for their tax dollars, commercial activities should be subject to the forces of competition." To do this it is necessary to categorize whether services are inherently Governmental or commercial. As per Attachment A, paragraph B, Sub para 1a, "An inherently governmental activity is an activity that is so intimately related to the public interest as to mandate performance by government personnel. These activities require the exercise of substantial discretion in applying government authority and/or in making decisions for the government[…]An inherently governmental activity involves:(1) Binding the United States to take or not to take some action by contract, policy, regulation, authorization, order, or otherwise; (2) Determining, protecting, and advancing economic, political, territorial, property, or other interests by military or diplomatic action, civil or criminal judicial proceedings, contract management, or otherwise." It is evident that USAF aircraft fall under the category of an inherently governmental activity, and therefore their commercial use is not intended.

[3] Indian Air Force, "Defense Service Regulations-Indian Airforce," *Regulations for the Air Force 1964 (RE).* 1964, http://indianairforce.nic.in/RTI/airforceregs.pdf (accessed March 31, 2013). Pg 190, lists regulations 868-870 that are implicit in the procedures to be followed by the IAF when providing aid to civil authorities. Specific authorization is required to carry civilians on aircraft. See also, the Govenment of India, Ministry of Defence website, that deals with Aid to Civil Authorities. (http://mod.nic.in/assistcivilauth/welcome.html; 01 May 2002), which specifically mentions that, "Besides ensuring inviolability of the borders of our country, the Armed Forces are also mandated to assist the civil authorities for maintenance of law and order and/ or essential services as well as for rescue and relief operations during natural calamities. Besides providing actual relief, the Armed Forces continue to maintain regular liaison with the civil authorities to refine contingency planning and ensure timely response." As both sources do not mention a commercial role for the IAF it is inferrred that such use is not intended and therefore prohibited.

limited deployments. The IAF already operates seven FRA (IL-78)[4] and a deal for an additional six FRA (MRTT) has already been approved. Considering that all future aircraft of the IAF shall be capable of air-to-air refuelling, this quantity is assessed to be suboptimal to satisfy peacetime requirements. This is due to factors such as; FRA serviceability, number of refueling points per FRA, airspeed of the FRA and time taken per receiver to refuel while other aircraft in the package are burning fuel. Therefore, it is assumed that the IAF shall need to procure another five to six FRA, bringing the quantity of its organic FRA to 18 and by utilizing this small, but optimal, fleet in rotation, it would satisfy the peacetime training requirements of both its receiver[5] and FRA[6] aircrew. Moreover, as these organic FRA would constitute one-third of the total envisaged requirement, their peacetime operation provides the opportunity to exploit an optimal aircraft-utilization rate, which may prove cost-effective in the long term. This analysis, therefore also assumes that that it is around this nucleus of 18 FRA that the IAF shall induct the balance 36 to 42 FRA that it requires during war.

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[4] Flight Global, "SPECIAL REPORT WORLD AIR FORCES 2010," *Flight Global Insight*, December 2010, http://img.en25.com/Web/FlightGlobal/WorldAirForces2010.pdf (accessed March 31, 2013), 17.

[5] Open-source data for aircrew currency of air-to-air refuelling is not available for the IAF, thus statistics of the USAF are used. The currency of an aircrew varies between different types, for the KC-10 the currency is 45 days, on the other hand for F-16/F-35 aircrew the currency is 180 days. The lower figure of 45 days is therefore assumed as the basis for calculation. With this benchmark, it is assumed that of the 18 FRA, only 9 are available (50% availability) for one sortie per day, and each FRA refuels only two pairs of receivers per sortie. Then they will meet the currency requirements of 36 cockpits per day. Every 45 days they will therefore be able to meet the currency requirements of 1620 cockpits. This capacity is more than adequate to satisfy the peacetime currency of IAF pilots. The data for the KC-10 is available on Pg. 41, Table 4.4, of USAF, "AIR FORCE INSTRUCTION 11-2KC-10, KC-10 AIRCREW TRAINING," *e-Publishing website*, June 05, 2012, http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-2kc-10v1/afi11-2kc-10v1.pdf (accessed March 04, 2013). The data for the F-16 is available on Pg. 28, Table 4.1, of USAF, "AIR FORCE INSTRUCTION 11-2F-16,F-16--PILOT TRAINING," *e-Publishing website*, August 11, 2011, http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-2f-16v1/afi11-2f-16v1.pdf (accessed April 07, 2013). The data for the F-35 is available on Pg. 25, Table 4.1, of USAF, "AIR FORCE INSTRUCTION 11-2F-35A, Volume 1, F-35—AIRCREW TRAINING," *e-Publishing website*, September 13, 2010, http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-2f-35av1/afi11-2f-35av1.pdf (accessed April 07, 2013).

[6] The currency of a FRA aircrew (KC-10 & KC-135) is specified as six sorties/every 6 months (continuity training). Therefore, in meeting the currency requirement of the receiver aircrew the tanker aircrew could easily fulfil their continuity training requirements as well. The data for the KC-10 is available on Pg. 41, Table 4.4, of USAF, "AIR FORCE INSTRUCTION 11-2KC-10, KC-10 AIRCREW TRAINING." The data for the KC-135 is available on Pg. 50, Table 4.4, of USAF. "AIR FORCE INSTRUCTION 11-2KC-135, Aircrew Training KC-135." *http://static.e-publishing.af.mil/.* June 04, 2012. http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-2kc-135v1/afi11-2kc-135v1.pdf (accessed May 07, 2013).

The distinction between the air-to-air refuelling requirements of the IAF in peacetime when compared to those envisaged during war is important to make, as it highlights a significant difference vis-à-vis other large air forces whose air-to-air refuelling requirements are roughly the same in both cases.

Another element is the cost of fuel. As this shall have an equal impact on all options, fuel costs are not factored into the analysis. Let us examine now each option.

Option 1: The IAF Directly Procures the Requisite Number of FRA

In this option the Government clears the direct purchase for the requisite quantity of FRA by the IAF. No alliance or lease is required. The responsibility of organizing, training, and equipping (OTE) lie solely with the IAF. Pros and cons follow.

From a perspective of operational effectiveness, this is an ideal solution for the IAF, as the entire quantity of FRA is organic to its force structure. Every other option entails the necessity of coordination with an agency that is external to the IAF to ensure interoperability. Therefore, the operational freedom and flexibility that this option provides to the IAF is the greatest as the element of interoperability does not arise.

Another inherent advantage in the outright purchase option is that it widens the scope for the IAF to procure dedicated FRA instead of considering only multi-role tanker aircraft. As brought out in Chapter II, the overall life-cycle costs of dedicated FRA are likely to be 6% lower than multi-role tanker aircraft. While in present value, this appears to be an expensive option, further analysis raises questions. Although this option assures operational effectiveness, the IAF has to cater to the second-order effects associated with force expansion. The peculiarity is important to highlight, as this is not merely a question of replacing an existing fleet of aircraft; it involves induction of a significant quantity of additional wide-bodied aircraft into the IAF. Thus apart from life-cycle costs of the equipment per se, the option entails an enhancement of overall IAF infrastructure to support this new fleet. Broadly, these relate to costs of operating infrastructure (ramp space for 36 to 42 wide-bodied jets), allied equipment not directly related to the FRA (like provisioning of additional fuel for the FRA; either fuel bowsers or underground storage; & the maintenance this involves), and long-term human-resource imperatives (training, pay and accommodation) for this expanded force.

While this option presents the Government of India with an ideal solution from a strategic perspective, it also presents a conundrum. For a major disadvantage of procuring this balance quantity 36 to 42 FRA for the IAF, is the sunk-cost associated with the OTE function. Moreover, the excess capacity that these 36 to 42 FRA entail can't be used commercially during peacetime to generate a profit and thus offset this sunk-cost. Further, the allied costs associated with the overall force-expansion of the IAF that this option entails shall also have to be borne by the Government of India.

Chapter I also highlighted the Government of India's commitment to concentrate on prioritization of economic growth while balancing defence spending.[7] Therefore, the high sunk costs matter. Though this option provides the best solution operationally for the IAF and from a military-security perspective for the Government, the high cost is likely to prove decisive, should another option meet both these requirements.

Option 2: An Alliance with Another Country to Support the IAF in Times of Crises

In this option the Government of India, forms a strategic alliance with another country to support the IAF's requirement for FRA. The option implies complex operational and strategic caveats, as the IAF shall be dependent on the ally to provide the requisite quantity of FRA, entailing close coordination and interoperability. From a perspective of strategic advantage, the Government of India needs to carefully consider the likely quid pro quo associated with this step.

From a perspective of operational effectiveness, this is the least ideal solution for the IAF, as the FRA belong to another country. This implies a strong possibility that at the commencement of hostilities these assets might not even be in India. It therefore highlights that the full operational freedom and flexibility the IAF enjoys would be curtailed by the unavailability of these assets.

The aspect of interoperability between the IAF and this ally also assumes great significance. It would require frequent training, a high level of coordination, and

[7] CNN IBN India. "Indian Armed Forces' Weapons Procurement Plans On Hold As Cuts In Defence Budget Expected," news article on *CNN IBN India live*, February 01, 2013, http://www.bharat-rakshak.com/NEWS/newsrf.php?newsid=19889 (accessed February 27, 2013). See also, Chapter I, notes 14, 24 & 25.

necessitate formulating common tactics and using common systems. These measures, though similar to the other options of leasing FRA or using assets of Air India, also have the additional element of dealing with a foreign nation. Thus, while Options 3 & 4 may be structured more along the lines of a principal-agent relationship, this option entails a partnership, thereby necessitating a higher degree of compromise for the IAF.

The weakest link of this option is that of accountability and responsiveness. It must be remembered that FRA are constructed for a specific purpose and in case of a no-show by the ally, the IAF would be stuck without an adequate quantity of FRA. In all the other options, the bulk of the FRA would likely be on Indian Territory. The Indian Government would therefore be legally empowered with the authority to commandeer the FRA (for Options 3 & 4), under the provisions of clause 6 (d) "The Aircraft Act of 1934."

Linked to this is the operational posture that the IAF might ***have to adopt*** as opposed to the posture it might ***want to adopt***. It is likely that the ally might insist on operating its FRA from bases in-depth to obviate risk. Such bases might not coincide with the IAF's basing plan for FRA as an organic fleet. This factor might make a difference between an offensive posture and a defensive posture, which in turn might impact the manner in which the IAF flies and fights at the operational & strategic levels.

The IAF shall likely prefer to have an operational representative on-board to coordinate fuel off-take and thus ensure mission viability. This necessitates a higher degree of interoperability and training. The IAF would retain the responsibility of training for these system operators.

Cost-benefit also plays an important role. The Government is likely to have to bear operating costs and insurance costs for these FRA. While these costs are lower than an outright purchase of the FRA, the Government is also likely to bear the costs associated with operating infrastructure, as in the option of *direct purchase*. Overall, these costs are likely to be much lower. The option would also mitigate the requirement of aircrew training to a large extent. Does this option satisfy the strategic perspective of the Government of India?

From a historical perspective, the concept of an alliance does not bide well with India. This was reiterated by the Prime Minister on 13 Sep 2010, at New Delhi while

addressing the Commander's conference: "We have always prided ourselves on preserving our strategic autonomy, and this is an article of faith for us. India is too large a country to be boxed into any alliance or regional or sub-regional arrangements, whether trade, economic or political."[8] Such ideological premise is influenced by two challenges that an alliance imposes on a nation's autonomy.

The first is highlighted by the Libyan Campaign. In an interview with Maj. Gen. Margaret H. Woodward, Commander of 17th Air Force and the Joint Force Air Component Commander, Executive Editor for the Air Force magazine, John A. Tirpak reports, "The integration of more and more participants—both new types and new nations—represented an ongoing challenge, Woodward said. While each brought unique and welcome assets, they also brought idiosyncratic rules about what they would and would not do. Germany, for example, refused to participate in any direct attacks."[9] This is indicative that an alliance necessitates compromise which might prove detrimental to operational freedom, or worse, strategic autonomy.

The second challenge is the burden of quid pro quo that an alliance imposes on its members. This is a valid concern for India, as while discharging its responsibility as a member of an alliance it might get forced into fighting a war that is not of its own choosing. This element is highlighted in an article by Warren Bass, which comments on President Obama's speech at Jerusalem on 21 March 2013, saying "Obama was both warm and strong, wise and supportive, reiterating yet again that the United States will take no options off the table on Iran."[10] Such commitments might force the U.S into a situation it does not want, as Dalia Kaye, highlights, "The main variable in weighing the likelihood of a military attack against Iran in the coming year is the cost-benefit assessment of such an option in Israel. Unfortunately, Israelis who believe the advantages of attacking Iran outweigh the dangers may have the upper hand at the moment, making

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[8] Prime Minister's Office Government of India, "Prime Minister's Address to the Combined Commanders' Conference: 19 September 2010," *Government of India, Press Information Bureau, Prime Minister's Office, September 19, 2010* http://pib.gov.in/newsite/PrintRelease.aspx (accessed April 01, 2013).

[9] Tripak, John A, "Lessons from Libya," *Air Force Magazine: Online Journal of the Air Force Association*, December 2011, http://www.airforcemag.com/MagazineArchive/Pages/2011/December%202011/1211 libya.aspx (accessed March 01, 2013).

[10] WarrenBass,"Demonstration Effect," *RAND: Commentary*, March 22, 2013, (the article originally appeared on ForeignPolicy.com), http://www.rand.org/commentary/2013/03/22/FP.html (accessed April 17, 2013).

the odds of an attack higher now than in previous months […] Let's hope we can find other ways to convince the Israelis that a military strike against Iran is a bad idea. But assuming the Israelis aren't serious is not an option.[11]

Similarly, Christopher Chivvis in his article published on the RAND website, mentions, "as the crisis along the border between Syria and Turkey intensifies, Turkey appears on the brink of a formal request to the North Atlantic Council that NATO deploy Patriot missiles to help defend the border. Such a demand falls short of requesting a NATO intervention or even a full-fledged allied defense of Turkish territory, but if the alliance agrees to provide the missile system, it will move NATO a step in that direction."[12]

As per article 5 of the NATO treaty, its alliance members are obliged to, "assist the Party or Parties so attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force, to restore and maintain the security of the North Atlantic area."[13]

These examples highlight that alliances limit strategic autonomy, and the burden of responsibility might lead to unwanted participation. Also, participation of foreign aircrew in India's wars might result in the conflict spreading beyond the strategic desires of the Indian Leadership.

The high number of FRA that the IAF requires creates other complexities. One is that if India were to form an alliance, the high quantity of FRA indicates that its choices would be limited to the few countries in the world that can provide such services. This limits potential allies with whom India shares common strategic interests. Second, if India were to form an alliance with multiple countries, then it would merely exacerbate the compromises that India might have to make with each one of them, without a corresponding increase in net benefits.

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[11] Dalia.D Kaye, "Concerns Over Protecting Israel's Credibility May Heighten Odds of Iran War," *RAND: Commentary*, August 29, 2012, (the article originally appeared on TheAtlantic.com), http://www.rand.org /commentary/2012/08/29/ATL.html, (accessed April 17, 2013).

[12] Christpoher.SChivvis, "Turkey Edges Toward Seeking NATO Support in Syria Crisis," *RAND: Commentary*, November 2012, 2012, (the article originally appeared on *RAND.org*), http://www.rand.org/commentary/2012/11/21/RAND.html, (accessed April 17, 2013).

[13] NorthAtlantic Treaty Organization, "The North Atlantic Treaty: Washington D.C," *NATO e-library: Official texts*, April 04, 1949, http://www.nato.int/cps/en/natolive/official_texts_17120.htm (accessed April 17, 2013), Article 5.

Overall, this option therefore does not provide the IAF with the operational flexibility that it is already has. It also calls for a high degree of interoperability. From a strategic perspective this option shall likely restrict India's autonomy. It does entail a favourable cost-benefit in terms of aircraft and aircrew, when compared to the first option. What needs to be kept in mind, however, is that this benefit is purely economic, and when weighed against the elements of national security and strategic autonomy, this option ranks lower than the *Direct Purchase* option.

Option 3: The IAF Leases FRA Services from a Contractor

In this option the Government of India permits the IAF to sign a contract for FRA services that shall be provided by a contractor. The option entails similar considerations of interoperability and accountability as the *alliance* option. Legal issues of utilizing non-combatants (contractor aircrew) shall also assume importance. Remuneration is also important and would be a significant part of the cost-benefit decision matrix for the Government of India.

From a perspective of operational effectiveness, this option is slightly better than the *alliance* option. No doubt the contract would be drafted in a manner to provide the IAF with the widest operational flexibility, however, the assurance that the contractor would honor contractual obligations during war can never be guaranteed. Even if the contractor honored his commitment, the possibility of his aircrew balking exists. Chapter III highlighted such an instance during Desert Storm. What is critical is that there isn't an immediate remedy to resolve such issues; legal recourse (and penalties therein) take time to materialize but shall not ensure that the FRA are operationally available when needed.

Unlike the *alliance* option though, a positive advantage is that at the commencement of hostilities these FRA will be available to the IAF. Prudence therefore demands that the IAF keep additional aircrew on standby to operate these FRA, should the contractor or his aircrew renege on their obligation. In terms of training this would be similar to the requirement of *direct purchase* option, but it has the additional advantages of reducing friction resulting from interoperability issues and also rules out the legal aspects of using contractor aircrew (non-combatants) during war. This solution, however, necessitates a higher degree of interoperability for the IAF to maintain its desired

operational effectiveness and therefore is adjudged to be similar to the *alliance* option. The contract would also need to cater to carrying IAF system operators on-board and the training of these system operators would remain the responsibility of the IAF.

The contract would also have to provide legal authorization (and remuneration) to protect the contractor aircrew during war. In this regard, The Reserve and Auxiliary Air Forces Act, 1952 and Act Rules 1953 of the IAF, permits the Central Government to "raise and maintain in the manner hereafter in this Chapter provided an Air Force Reserve to be designated the Air Defence Reserve which shall consist of persons deemed under the provisions of section 16 to be enrolled therein."[14]

The act also specifies that registration is an obligation for:

> Every citizen of India who, holds or has held a public transport pilot's licence ('B' Licence) issued under the Indian Aircraft Rules, 1937; or has had not less than two hundred hours' experience of solo flying, including not less than thirty landings; or holds or has held a first class navigator's licence issued under the Indian Air Craft Rules, 1937; or has had at least four years' aviation experience during which at least six hundred hours shall have been spent in the air, not less than one hundred hours of such experience being experience of navigation in the air.[15]

The provisions of this act empower the Government of India to authorize the formation of an Air Force Reserve from a pool of commercial pilots. Therefore, in conjunction with the Aircraft Act of 1934, it provides the necessary framework to ensure that the contractor's aircrew are legally authorized to fly during war. Activation in peacetime shall compel contractor aircrew to participate in the program. This might obviate the IAF's requirement to cross-train aircrew on the contractor FRA, however, in this case the Government shall have to include the element of pay and allowances of these aircrew in its cost-benefit analysis. It would also call for the IAF to monitor the standard of training of the contactor aircrew on a regular basis.

Another significant factor is the incentive for the contractor to consider offering services for this program. The contractor would likely be motivated by profit; in the

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[14] Chief of the Air Staff, Indian Air Force, "Air Force Order No. 96: The Reserve And Auxiliary Air Forces Act, 1952 and Act Rules 1953; IAF webpage Right to Information Act (Legal & Discipline)," *The Official Home Page of Indian Air Force*, September 02, 1978, http://www.indianairforce.nic.in/RTI/ReserveAuxiliaryAFAct52Rules53.pdf (accessed 1645hrs on March 23, 2013).

[15] See n.14.

Indian scenario where the IAF requirement for air-to-air refuelling during peacetime is fairly low, the contractor would have two options to generate profit. First, offer the FRA services to other potential consumers or, second, increase the cost of services. Given the geography of the Indian subcontinent and the negligible peace time demand for air-to-air refuelling from within India, the contractor would be forced to offer services elsewhere. This would entail basing the fleet outside India, which might adversely impact availability of FRA at the onset of a crisis. If the contractor decided to increase the cost, then it would be detrimental for the cost-benefit to the Government of India.

Put differently, the contractor would look to recover the long-term costs of procuring, operating, and maintaining a fleet of FRA, as well as generating a profit. This money shall be recovered entirely from the Government of India unless the contractor is permitted to lease FRA services to other customers. This situation is unique to India due to the distinction between low peace-time requirements of air-to-air refuelling vis-à-vis those required during war. Certain elements of cost can be mitigated, like landing and parking fees or the cost of fuel, however, such subsidies shall likely be offered only when the contractor is not permitted to use the FRA commercially.[16] Thus, the overall the cost incurred by the Government of India in choosing this option might be very similar to the *direct purchase* option. As the reliability of the contractor shall remain doubtful, the strategic benefit of this option falls between those provided by the options of *direct purchase* & an *alliance*. We find that this option does not satisfy operational effectiveness and strategic perspective to the same degree of the *direct purchase* option, while the cost is similar.

Option 4: Procure Multi-Role FRA for Air India in Peace and IAF in War

In this option the Government of India, buys multi-role FRA for Air India, its national carrier, and permits the IAF to use these aircraft during war. This option is very

[16] In case the contractor is granted subsidies, then it would be difficult to account for the quantity of fuel consumed during commercial flights and that consumed during IAF operations. Considering that large quantities of fuel are involved during air-to-air refueling, there exists a potential for the contractor to misuse the subsidy on fuel to enhance his profit. Hence, it might be prudent to provide such subsidies only if the contractor is not permitted to use excess capacity during peacetime for commercial activities.

similar to the previous option when considering factors of accountability, legality and incentive.

The broad implications that this option entails for the IAF are very similar to those of the *lease* option, when viewed from a perspective of operational effectiveness and interoperability. Accountability, to some extent is, however, mitigated, as Air India is a Government-owned undertaking and the availability of FRA for IAF operations can be assured to a higher degree than in the *alliance* and *lease* options.

As in the *lease* option, the assured availability demands that the IAF keep additional aircrew on standby to operate these FRA, should Air India aircrew renege on their obligation. Once again the importance of having a pool of trained aircrew is highlighted. Alternately, to alleviate this situation, activating the, "The Reserve and Auxiliary Air Forces Act, 1952 and Act Rules 1953 of the IAF," during peace time might provide the Government of India with additional benefits. First, enforcing the IAF Reserve Act also resolves the legal issues of using non-combatants during war. Second, the Government of India already bears the burden of paying the salaries of the employees of Air India, hence the cost-benefit may be advantageous.

This distinction is important to make, for in the *lease* option the contractor is responsible for payment of peace time salaries of aircrew, and the Government would have to pay suitable remuneration to the aircrew (registered under this act) once the IAF Reserve Act is initiated. This additional cost was a determinant of whether the IAF Reserve Act should be activated during peacetime for the *lease* option. These implications shall be examined further when comparing the cost-benefit for the Government of India.

Overall, we find that when the IAF Reserve Act is activated, accountability and responsiveness is satisfied by this option better, than the options of an *alliance* or *lease*, although it does not match the assurance provided by a *direct purchase*. What incentive does Air India have to participate in this program?

Incentive for Air India appears to be the weakest link of this option. During war, the option has a potential advantage, as scheduled operations will likely be suspended, entailing a loss for Air India (and any other commercial airline) until the IAF can assure sanitized air space. This option provides an incentive, as the use of these 36 to 42 multi-

role tanker aircraft of Air India, by the IAF at a contract rate, would contribute significantly to generating profit during war.

In peacetime this situation is a little different for Air India, as peacetime cross-training with the IAF entails reduced profit or even a loss, as commercial capacity is diverted. As the nation is at peace for longer durations than at war, this is perceived as a disincentive for Air India. This perceived disincentive is, however, related purely to the cost of operations and not life-cycle costs, as the Government of India subsidizes the procurement of aircraft for Air India. Further, this option would be detrimental to Air India only if it were operating at a 100% load factor. Table 3 shows a comparison of the passenger load factor of various commercial airlines in India from 2009 – 2011.[17]

Table 3: Passenger Load Factor of Air India and Private Airlines

Passenger Load Factor (%)							
Year	**Air India**	**Jet Airways**	**Jetlite**	**Kingfisher**	**Spicejet**	**Go Air**	**IndiGo**
2009	66.1	69.3	73.1	70.8	74.7	75.8	78.6
2010	71.4	75.1	78.6	81.0	81.2	78.0	83.6
2011	71.6	73.8	77.6	81.1	75.8	77.9	83.3

Source: Government of India,Press Information Bureau

It is evident from table 3 that Air India is not operating at the maximum load factor. The table also shows that Air India's performance is lower than the market average. This indicates that the requirement to undertake cross-training with the IAF might not result in a loss for the airline. On the other hand, as Chapter III indicates, the airline is in the process of improving its efficiency. This option therefore provides the national carrier with an opportunity to retain sectors that are making a profit and curtail operations in sectors that are incurring a loss. The excess capacity thus gained could be diverted to cross training with the IAF, in turn offsetting the cost of operations.

Moreover, when compared with the options of a *direct purchase* or *lease*, where the major disadvantage in peacetime is the high sunk-cost, or nil return for investment to

[17] Ministry of Civil Aviation, "Passenger Load Factor of Air India and Private Airlines 28 March 2012," *Press Information Bureau Government of India*, March 28, 2012, http://pib.nic.in/newsite/erelease.aspx?relid=81863 (accessed at 1115 hrs on March 22, 2013). This information was given by Shri Ajit Singh, the Minister of Civil Aviation in Lok Sabha today (28 March 2012) in a written reply.

the exchequer, the *Air India* option actually provides the *Maharaja* with an avenue to continue its routine commercial activities during peacetime.

Therefore, we find that while Air India does not have an overarching incentive to participate in this program, it has no disincentive either. It has also been established in Chapter III that being a government-owned undertaking, Air India has often been tasked to undertake tasks on a no-profit basis. This clearly indicates that the Government of India is determined to protect national interests.

From a strategic perspective for the Government, this option appears more beneficial than the options of an *alliance* or *lease*, as it already exercises administrative and functional control over Air India. Does the option compare favorably in terms of cost-benefit?

This option is unique in that it entails that all 36 to 42 FRA be multi-role tanker aircraft. As brought out by the RAND Corporation report in 2006, the overall life-cycle costs of dedicated FRA are likely to be 6% lower than multi-role tanker aircraft.[18] Would this analysis be similar while comparing multi-role FRA and commercial aircraft, in the Indian context?

There are two problems. Neither the specifics on the life-cycle costs of multi-role tanker aircraft, nor details of operating costs and revenues of Air India, are readily available in the public domain. Therefore, to facilitate a comparison, the analysis is based on multiple sources and detailed calculations are attached as Appendix A to this thesis.[19] It is also pertinent to reiterate certain assumptions. First, the cost of fuel and oil has not been considered in the calculation, as it is expected to be equal for either option. Second, the cost of manpower has not been considered, primarily as the cost of initial conversion training onto a new platform would have to be borne by Air India irrespective of which aircraft it buys. Moreover, costs incurred for specialized training would affect only the IAF, as it would bear the burden of this additional training.[20] On the other hand, multi-role tanker aircraft entail a fleet replacement for Air India, and the company already has

[18] Michael Kennedy et al, *Analysis of Alternatives (AoA) for KC-135 Recapitalization: Executive Summary,* (Santa Monica, CA: RAND Corporation-2006). http://www.rand.org/pubs/monographs/MG495, 14.
[19] See pages 62-64.
[20] See the second assumption under the sub-heading Basic Assumptions and Common Factors on page 37.

on its payroll, manpower to operate and maintain 101 aircraft.[21] Third, a quantity of six aircraft has been chosen for the calculation, as data for six MRTT is available, and each squadron shall likely comprise six aircraft.

In January 2013, the Government of India cleared the procurement for six MRTT aircraft for the IAF from Airbus at a cost of 1.45 billion dollars.[22] The initial cost of six Airbus 330-200 aircraft is assessed as $ 1.296 billion.[23] The 20 year costs incurred for passenger amenities, and maintenance and repair, are estimated to be $ 130,447,000.[24] Therefore, the life-cycle costs are approximately $ 1.426 billion. While this difference is only about 1.6%, when compared to the MRTT option, it must be remembered that costs of expansion, like additional infrastructure, manpower, refuelling vehicles, etc, have probably not been included in the deal for six MRTT by the IAF, thereby narrowing the relative cost differential. Also, the 6% difference highlighted by the RAND report was between FRA and multi-role tanker aircraft and not between commercial aircraft and multi-role tanker aircraft.

Moreover, the likely revenue that shall be generated over a 20-year period by these six aircraft is estimated to be $ 778, 058, 000, with a possible increase in this figure.[25] The net cost of purchasing six MRTT for Air India is therefore calculated as $ 671,000,000. This suggests that the purchase of multi-role tanker aircraft for Air India is viable and probably will not reduce the airline's profit.

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[21] Planespotters.net, *Air India Fleet Details and History*, January 07, 2013, http://www.planespotters.net/Airline/Air-India (accessed April 16, 2013). The site has comprehensive details regaring the history of each aircraft.

[22] RajatPandit,"Europe Pips Russia in Mega Mid-Air Refueling Aircraft Deal," news article on *timesofindia.indiatimes.com*,January 04, 2013, http://timesofindia.indiatimes.com/india/Europe-pips-Russia-in-mega-mid-air-refueling-aircraft-deal/articleshow/17879413.cms? (accessed February 15, 2013). See also, ShishirGupta, "Def Panel MP Raises Red Flag on $20-bn Rafale Deal," Hindustan times news article posted on *Bharat Rakshak News Section.* March 23, 2012, http://www.bharat-rakshak.com/NEWS/newsrf.php?newsid=17448, (accessed April 15, 2013). The article mentions that the IAF selected the Medium Multi Role Combat Aircraft (MMRCA) by comparing lifecycle costs amongst other factors like extensive trials and complex calculations, including unit cost, and transfer of technology. It is therefore assumed that similar to the 20 billion dollar price of the MMRCA, this stated price of the MRTT implies lifecycle costs for operations, ground equipment and maintenance (it probably however does not cater to expansion costs, like airfield infrastructure etc).

[23] Airliner World, "Airbus Lists Prices for 2013," *Airlinerworld.com*, January 01, 2013, http://www.airlinerworld.com /view_news.asp ?ID=5596 (accessed April 16, 2013). Price of each Airbus 330-200 is $ 216,100,000.

[24] See Appendix A, Pg 63.

[25] With three aircraft each in the cargo and passenger roles, this calculation is based on the average revenue per seat earned by Air India from 2009-2012, and a passenger load factor of 71.4% for the MRTT (with 270 seats). See Appendix A, Pg 64 for exact calculations.

Thus, from a perspective of cost-benefit, this option has significant advantages. First, paying for the cost of modification of the multi-role capability from the IAF budget ensures that Air India's budget caters only to actual load capacity. Second, a significant benefit of this option is that it entails a potential saving of $ 1.36 billion for the Government of India, as the option for *direct purchase* by the IAF may prove redundant.[26] Therefore the Government buys only one fleet of multi-role FRA at an additional 6% (of life cycle costs) as opposed to two entire fleets that the *direct purchase* option dictates. Third, this fleet of 36 to 42 multi-role FRA can generate a profit in peace time. This is significant as it resolves the issue of sunk-cost.

Fourth, since the aircrew could be recruited under the IAF Reserve Act, it would entail saving of salary, and when activated these aircrew could be paid the risk/combat allowance in addition to their regular salary. This would also provide legal basis to use non combatants in war. The activation of the IAF Reserve Act would also aid in recruitment for the IAF; as the IAF could recruit, train and utilize these aircrew for a period of say 10-12 years, after which they could be inducted into Air India. The airline would therefore be assured of qualified and competent aircrew, and the IAF confident that its reserve force comprises pilots who are familiar with tactics, training, ethos, and the rigors of an operational environment.

Conversely, in case aircrew for the multi-role FRA are to be chosen from the existing pool of pilots of Air India, then, choosing this option would entail additional requirements, such as specialized aircrew training, and a degree of interoperability that is much higher than the *alliance* option. An extract of the syllabus for Pilot Initial Qualification (PIQ) on the KC-10 and expected proficiency levels is attached as Appendix B.[27]

A fifth advantage of this option for the Government lies in the cost-benefit of utilizing the existing infrastructure of Air India, which already operates a fleet of 101

[26] The figure of $ 1.36 billion is arrived at by using the RAND analysis that multi-role FRA are likely to be 6% more expensive that dedicated FRA, and the cost of six multi-role tanker for the IAF is $1.45 billion.
[27] See Appendix B, Pg 65.

aircraft and has the infrastructure to support this fleet.[28] By choosing this option, the Government of India would incur lower costs associated with replacing a fleet. This distinction is important to make as the analysis for the *direct purchase* option implied additional expansion costs, if that option were chosen.

Also, using the existing infrastructure of Air India, which is widely dispersed across the country,[29] would help in protecting these high value assets. Julian Corbett is famous for postulating the *fleet-in-being* concept, and stresses the dispersion of assets when on the defensive, "it follows that so long as the enemy's fleet is divided, and thereby retains various possibilities of either concentrated or sporadic action, our distribution will be dictated by the need of being able to deal with a variety of combinations and to protect a variety of objectives. Our concentrations must therefore be kept as open and flexible as possible."[30]

At this juncture it would be prudent to assess whether buying 36-42 aircraft for Air India actually entails a fleet replacement? The average age of Air India's aircraft is 8.5 years, which is quite good. Assuming the average life of a wide-bodied jet to be 20-25 years, this indicates that the bulk of the aircraft would be replaced after only 17 years, in 2030. The breakdown of the older aircraft, of the 101, in the fleet follows; eight aircraft are nearly 25 years, 15 are 18-20 years, two are 16.5 years and three are 12.5 years.[31] Using the MMRCA process as a template it is fair to assume that, from issuing the RFP to inducting the first aircraft, could take as many as 4-5 years. By then, 23 aircraft of Air India would be ready for immediate replacement and five would have between 3 to 7 years to be replaced. Thus by, 2018 Air India would be ready to replace 23 aircraft and another five by 2025.

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[28] Air India Limited, "Air India Limited Fleet Details," *Air India Limited*, Jul 31, 2011, http://airindia.in/SBCMS/Webpages/Fleet-Details1.aspx?MID=196# (accessed April 02, 2013). As per the website Air India operates a total of 101 aircraft, of which 26 are leased.

[29] Air India,"Air India Destinations," *Air India Limited*, Jul 31, 2011, http://www.airindia.in/SBCMS/Webpages/Destinations.aspx?mid=26 (accessed March 31, 2013). The website lists a total of 55 destinations within India, which have infrastructure already established to support its aircraft, thus significantly reducing cost of developing such infrastructure for the IAF.

[30] Julian S.Corbett, *Some Principles of Maritime Strategy*, eds. John B.Hattendorf and Wayne P.Huges, (Annapolis, Maryland: Naval Institute Press-1988), 133. For a detailed explanation see pp. 209-224.

[31] Planespotters.net, *Air India Fleet Details and History*, January 07, 2013, http://www.planespotters.net/Airline/Air-India (accessed April 16, 2013). The site has comprehensive details regaring the age of each aircraft.

It must be remembered that Chapter I highlighted that the full expansion of the IAF to a strength of 55 fighter squadrons is not likely till at least 2030, by which time Air India would be ready to replace the bulk or approximately 60% of its present fleet. Moreover, the requirement for FRA would materialize based on the strength of the receivers. Thus, it is estimated that by 2025, the IAF might require 45 FRA. Moreover, by 2025 the IAF would also be required to replace its first six FRA. Therefore, by 2025 the total requirement would be for 45-12= 33 FRA. It is therefore estimated that the scheduled replacement of the 28 older aircraft of Air India could meet this projection, while the requirement for the remaining five aircraft would be met by replacing the IAF's organic FRA. Therefore, this option does not entail unnecessary expansion of Air India, and thus doesn't result in any inefficiency or loss for the airline.

Overall, this option has significant cost-benefits for the Government of India. From a perspective of operational effectiveness and interoperability, it is better than the options of an *alliance* or *lease*, if the IAF Reserve Act is activated. From a strategic perspective it is acceptable to the Government of India. It would therefore rank first from a perspective of cost-benefit and second from a perspective of operational effectiveness and strategic advantage.

Comparing the Various Options

There is no doubt that from the perspectives of operational effectiveness and interoperability the *direct purchase* option is the best. Similarly from the perspective of cost-benefit the *Air India* option is the best. The issues of operational effectiveness and interoperability are nearly similar for the options of an *alliance*, *lease*, and *Air India*. These considerations improve for options of *lease* and *Air India*, if the IAF Reserve Act is activated. Given a choice between a contractor and a Government-owned company, it is likely that the determining factor shall be one of cost-benefit. Therefore, this benefits *Air India*.

From a perspective of incentive, accountability, and responsiveness the option of *direct purchase* is the best, and forming an *alliance*, the worst (with adverse quid pro quo implications). Among the options of *lease* and *Air India*, incentive for a contactor is profit, the burden of which shall transfer to the exchequer. Air India does not have any

particular incentive. Arguably the requirement for the IAF to provide trained manpower to either a contractor or Air India is real, but by activating the IAF Reserve Act, mutual benefits might accrue for both the IAF, and a contractor/Air India, in terms of recruitment and interoperability. Conversely, if the IAF Reserve Act is not activated, the contractor shall merely pass on the cost of specialized aircrew training to the IAF; Air India, on the other hand would have to rely on the IAF to bear the burden of this specialized training (initial and continuity) of its aircrew.[32] Thus, for the coherence of this argument, it is reiterated that irrespective of which option is chosen, the IAF shall likely bear the impact of the additional training specified in Appendix B.

Notwithstanding the specifics of the training syllabus, gaining adequate experience and proficiency in this role, as necessitated by the operational environment shall demand continuous practice and training. It is assumed that, with an organic fleet of 18 FRA, the IAF would be able to train the aircrew of Air India in the air-to-air refuelling role, as per standards similar to those contained in Appendix B. The IAF would also be able to ensure the proficiency of Air India aircrew by regular continuity training through contact programmes and live exercises.

Amongst all options discussed, the cost of training and maintaining proficiency in this role would be the maximum in the *direct purchase* option and the *lease* option, as the first involves a full force expansion, while the second entails a business venture. The *Air India* option would rank lower than these two options, while the option of an *alliance* would be the most economical from this perspective. **It is important to reiterate that the requirement to create the requisite pool of proficient tanker pilots is common to all options except the *alliance* option, the cost of which shall ultimately transfer to the Government of India**. Overall, barring the *alliance* option, the IAF would have to accept a greater responsibility in the initial and subsequent training of the aircrew and system operators for the other options. In a decision matrix, driven by opportunity cost, the *Air India* options seems to provide an acceptable balance.

Training aircrew of Air India might also lead to a higher utilization rate of IAF aircraft. The operational demands of air-to-air refuelling, however, necessitate that both

[32] See Appendix B Pg. 65-66, and also the second and fifth assumptions under sub-heading; Basic Assumptions and Common Factors, pp 37 & 39.

the receiver and tanker fleets carry out regular practise. As this requirement mandates the utilization of aircraft, the peacetime demands of the IAF's air-to-air refuelling continuity training might satisfy both concerns.

As far as accountability and responsiveness is concerned, the impact of the activation of the IAF Reserve Act is assessed as being similar for the options of *lease* and *Air India*. The advantage, if any is that an established working relationship with Air India already exists and the Government has tasked Air India for non-profit tasks, whereas the concept of using a non-governmental contactor would be new, and it might take time to establish an effective working relationship.

From the perspective of strategic messaging, the *Air India* option has a unique advantage when compared to the other choices, as the purchase of multi-role FRA for use by Air India may help reinforce the peaceful intent of India's foreign policy; that of no extra-territorial ambition, and no export of ideology.[33]

Overall, we find that the choice narrows down between the options of *direct purchase* and *Air India*. This essentially points to a perceptible difference in operational effectiveness and interoperability in favour of *direct purchase*, vis-à-vis a significant difference in cost-benefit that favors the *Air India* option. The Government of India has already made it amply clear that economic growth shall have precedence. This focus on economic development and defense budget is not new. In fact this aspect was recognized by Mahan, when he stated:

> A country can, or will, pay only so much for its war fleet. That amount of money means so much aggregate tonnage. How shall that tonnage be allotted? And, especially, how shall the total tonnage invested in armoured ships be divided? Will you have a very few big ships, or more numerous medium ships? Where will you strike your mean between number and individual size? You cannot have both, unless your purse is unlimited.[34]

While Mahan concentrates on balancing a defence budget, he does tacitly acknowledge that the defence budget is fixed by an upper limit. Douhet on the other

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[33] Ministry of Defence, "Text of Raksha Mantri Shri Pranab Mukherjee's address at Shangri-La Dilogue in Singapore," news release *Press Information Bureau, Government of India*, June 03, 2006, http://pib.nic.in/newsite/erelease.aspx?relid=18213 (accessed January 23, 2013), Extract of the statement given by India's Defence Minister.

[34] Alfred.T Mahan, *Mahan on Naval Strategy: Selections from the writings of Rear Admiral Alfred Thayer Mahan*, eds John.B Hattenedorf and Jr. Wayne.P Huges (Annapolis, Maryland: Naval Institute Press-199), xxi-xxii.

hand, recognizes the important fiscal contribution that civil aviation provides while enhancing a nation's airpower:

> As for the planes themselves, even in military aviation circles the misconception is held that civilian planes cannot be used for war purposes because the two types of plane must have different characteristics. I call this opinion a misconception because, apart from any other consideration, the fact is that no nation on earth, Is rich enough to keep up an adequate military air force ready for instant action. All nations, rich and poor alike, will be forced by necessity to put the resources of their civil aviation facilities to military use.[35]

Though these statements were made nearly a century ago, they are still valid today not only from a theoretical perspective but also from an economic one- that of opportunity cost.[36]

Therefore, in final analysis, the option of buying multi-role tanker aircraft seems to be the optimal choice for the IAF from an operational perspective and for the Government of India from a strategic perspective. In satisfying these two requirements, these multi-role FRA also fulfil the commercial aspirations of Air India and in doing so presents the *Maharaja* in a *new Avtaar*.

[35] Giulio Douhet, *The Command of the Air,* eds. Joseph Patrick Harahan and Richard H Kohn, trans Dino Ferrari. (Tuscaloosa, Alabama: University of Albama Press-2009), 83.
[36] Jurgen Brauer & Hurbert Van Tuyll, *Castles Battles & Bombs*, (Chicago: University of Chicago Press-2008), 12. As per the authors, the principle of opportunity cost is, "the cost of not pursuing the opportunity of doing something else."

Conclusion

India is at a strategic crossroads, and the basic challenge that confronts Indian leadership is choosing the correct path to transition from a developing nation to a modern power. On the one hand lies the challenge of infrastructure development to compete in the global economy, on the other lies uplifting its masses to enable them to contribute towards this capability. Either path entails an economic choice, a choice that implicitly demands an umbrella of national security for it to succeed. The nexus between economic growth and national security merely complicates this choice, as one feeds off the other.

This thesis has examined one specific piece of the much wider strategic puzzle that challenges the Government of India. Chapter I highlights that, given the present geo-political situation of South East Asia, India's sphere of influence and its aspirations, the nation shall have to turn to its armed forces to overcome the myriad security challenges and protect its vital interests. The Indian Air Force (IAF) shall have an important role in such situations; and to maximize the offensive capability, reach, and flexibility of its combat force, the IAF might need as many as 56 to 60 Flight Refuelling Aircraft (FRA). This however, is an expensive proposition, and calls for a solution that satisfies both the operational requirement of the IAF as well as the strategic requirement of the Government of India.

Because India operates a Government-owned national airline (Air India), unique opportunities for dual use of its assets by the IAF emerged. It was, however, prudent to identify all possible solutions to this problem. Therefore, Chapter I also drew attention to various options that were available to the Government of India. Essentially, these options fall into two very broad categories. The first entails the direct procurement of an organic fleet of FRA to satisfy the demands of the IAF. The second ensures operational availability via an indirect method, either by an alliance with another country; leasing this service from a contractor; or use of multi-role aircraft belonging to Air India during war.

Prior to comparing these options, it was necessary to confirm two factors. First, whether such multi-role tanker aircraft were operationally and technically viable. Second, as no commercial airline has bought these multi-mission aircraft, whether the use of commercial assets by the IAF was a practical proposition. Chapter II showed that multi-role tanker aircraft are technically and operationally proven. Further, with the number of

orders placed globally, it seems that this technology might have long-term practicality. Chapter III showed that such use of commercial assets was supported not only by theory but also in practice by successful military operations.

With this confirmation, Chapter IV analysed each option and compared the merits of each in order to identify the best solution. Not surprisingly, the option of directly purchasing an organic fleet of FRA ranked highest when assessing operational effectiveness, training, and flexibility of the IAF. The option, however, represents significant sunk costs.

As each of the other options requires the IAF to coordinate with an external agency to meet its operational requirement; the factors of training, interoperability, remuneration, and, most importantly, responsiveness had substantial deterministic value. For the Government of India, cost-benefit was also a major consideration. Overall the option of forming an alliance ranked the lowest. Between the options of leasing the services of a contractor or using Air India, the latter, a Government-owned and run airline and with significant infrastructure satisfied both responsiveness and cost-benefit.

Choosing between a *direct purchase* and *Air India* boils down to, selecting between the advantages of operational effectiveness, and flexibility, on one hand, and strategic messaging and significant cost-benefit on the other. This element of cost-benefit ranked very high in the decision matrix. Therefore the *Air India* option is ascertained to be the best solution to meet the IAF's additional FRA requirements during wartime operations, given the present context.

To mitigate issues of training and interoperability, this option entails activation of the "The IAF Reserve Act." This and other considerations, therefore form the basis to recommend further study in areas that are beyond the scope of this thesis.

1. Activation of The IAF Reserve Act. At a tactical level, the armed forces require a large number of personnel to comprise the fighting force; conversely, a leaner command, control, and support force is required at the operational and strategic levels. The activation of "The IAF Reserve Act" might help in this regard, as recruiting, training and employing aircrew for 10-12 years by the IAF and then inducting them into Air India might have an inherent advantage. Assessing the long-term impact of this activation and identifying causal effects for both the IAF and Air India mandates further study.

2. Size of the Organic Fleet of FRA for the IAF. A study to assess the future force-enabling requirements of air-to-air refuelling and heavy-lift capacity for the IAF is also necessary. It would answer critical questions such as the exact quantity of FRA required, in what timeframe, and what mix (multi-role tanker, dedicated FRA, and heavy-lift aircraft). More importantly undertaking this study would help the IAF, by providing a framework for future planning and procurement of platforms and aircrew.

3. Future Induction for Air India. Air India operates aircraft manufactured by both Airbus and Boeing and is expected to replace nearly 25% of its fleet by 2018. It may also procure additional cargo capacity to fulfil its obligation to India Post. It might be prudent to undertake a study comprising of members of the Ministry of Defence, IAF, Ministry of Civil Aviation, Air India, and National Airports Authority to jointly analyse which multi-role tanker aircraft (Airbus or Boeing) might be best suited to satisfy the requirements of each party. The group may also deliberate on whether the aircraft configuration ought to be primarily, passenger, cargo, or a mix. The group might also reflect specifically on the framework to enhance interoperability viz continuity-training, legality, and responsiveness.

The Maharaja's New Avatar. In various addresses to combined Commander's conferences, the Prime Minister of India has highlighted the responsibility of the Indian Armed Forces in defending national interests. He has repeatedly urged Commanders of the Indian Armed Forces to equip their respective forces in a manner that would respond to evolving threats. The IAF is already in the process of modernization, and procuring FRA is essential to ensure that the IAF can effectively discharge the PM's orders both in letter and in spirit. Understandably, the accompanied financial burden entails either a piecemeal procurement or the appropriation of a large slice from someone else's budget.

Procuring FRA involves acquisition and training (of the entire IAF), and necessitates a large lead time to operationalize this capability. Clausewitz classifies defense as "awaiting the blow",[1] signifying that the element of time is crucial for the defender. It is therefore vital that the Indian Government and the IAF plan for appropriate

[1] Clausewitz, *On War*. Edited and Translated by Michael Howard and Paret Peter. (Princeton, New Jersey: Princeton University Press- 1984). On pg. 357.

responses to various contingencies, and decide on how the IAF's requirements for FRA are to be met. Irrespective of which option is chosen, when faced with an imminent attack on the Indian mainland, a last minute attempt to procure a large quantity of FRA might prove futile or extract great strategic cost. Piecemeal procurement therefore, is likely to prove detrimental in protecting India's national security, as it ironically violates the very responsibility that the PM placed on the armed forces. Such responsibility should never be imposed without providing adequate resources to undertake the task, for just as the IAF bears the responsibility to protect India's national interests, the Government too, is accountable to the nation in ensuring that the Indian Armed Forces remain suitably equipped to respond to future challenges effectively.

This thesis suggests an alternative that might satisfy the requirement. It calls for an innovative use of national resources to meet common strategic objectives. The greatest hurdle might lie in overcoming established organizational practices and mindsets. Unique situations, however, call for unique solutions, and this *new avtaar of the Maharaja* might help the Government of India enhance economic growth under an umbrella of assured security.

APPENDIX A: DETAILED CALCULATION OF COSTS

The calculations are based on the findings of the Comptroller and Auditor General of India's report, "Performance Audit of Civil Aviation in India (Ministry of Civil Aviation)."[1] Chapter 6 of the report, details the following:

Annual Cost in 2009-2010 (Entire Fleet of 101 Aircraft): Passenger amenities totalled Rupees 3.1 billion and Maintenance and Repair costs totalled Rupees 2.94 billion.[2] Thus the recurring costs in 2009-2010 were Rupees 6.04 billion (costs for fuel and manpower are considered to affect both options equally). This figure is considered for these calculations for two reasons. First, a new fleet shall have lower maintenance for the initial 5-8 years. Second, providing passenger amenities is subject to the management's perceptions of market-trends. Due to large fluctuations, predicting this for 20 years is beyond the scope of this thesis. A case in point is the recent decision to charge air tickets based on the weight of the passenger.[3]

Annual Revenues for 2009-2010: The annual revenue from passengers was 46.54 billion rupees and that from cargo was 4.93 billion rupees.[4] In these calculations the report also highlighted that the available seats per km (or the total seats on the entire fleet of aircraft) were 28877.[5] The report also mentioned that the revenue seats per km were calculated at 18,110,[6] in other words, the total revenue earned from passengers came from these seats.

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[1] Comptroller and Auditor General of India: Supreme Audit Institution of India. "Report No. - 18 of 2011-12 for the period ended March 2011 - Performance Audit of Civil Aviation in India (Ministry of Civil Aviation)." *Comptroller and Auditor General of India: Supreme Audit Institution of India.* March 31, 2011. http://saiindia .gov.in/english/home/Our_Products/Audit_Report/Government_Wise/union_audit/recent_reports/union_performance/2011_2012/Civil_%20Performance_Audits/Report_18/Report_18.html (accessed April 15, 2013). While the report deals with the financial health of Air India, the method used is relvant in calculating the lifecycle costs of Air India.

[2] Comptroller and Auditor General of India, "Performance Audit of Civil Aviation in India." Chapter 6, Table 6.9 on Pages 106-107.

[3] Martin, Hugo, "Airfares Based on Passenger Weight Won't Fly, Experts Say," news article on *LATimes.com; Business*, April 07, 2013, http://www.latimes.com/business/money/la-fi-mo-air-fares-based-on-passenger-weight-20130405,0,1854313.story (accessed April 18, 2013). While this example is a case of attempting to cut overhead costs, it highlights that, to remain competitive, Air India may have to vary passenger amenities in response to the prevailing market trends, and thus calculating these costs over a 20-year period is difficult.

[4] Comptroller and Auditor General of India, "Performance Audit of Civil Aviation in India." Chapter 6, Table 6.2 on Pages 87-88.

[5] See n.4.

[6] See n.4.

Therefore by dividing the total revenue with the number of revenue seats, the report calculated the passenger revenue per km as Rupees 2.57 per km.[7]

A final variable is the passenger load factor (PLF), this is calculated by dividing the total available seats per km by the revenue seats per km, the report highlighted the PLF for 2009-2010 at 62% for Air India.[8] This variable is important, for if the PLF is known it is becomes possible to calculate the revenue seats per km as the available seats per km have remained constant. Also, if the passenger revenue per km, is known, then is possible to calculate the total revenue by multiplying its value with the quantity of revenue seats per km.

On 11 Dec 2012, in a written reply to a question on Air India's performance in the Rajya Sabha (Indian Parliament), the Minister of State for Civil Aviation K C Venugopal informed the house that Air India's performance had improved to Rupees 4.31per km, and the PLF had improved to 70.9%.[9] With these figures it becomes possible to estimate the revenue per annum for Air India. The cost, however, needs to be calculated first.

Unit Cost per Aircraft. As per the website "Airliner World", the price of an Airbus 330-200 aircraft is $ 216,100,000.[10] Therefore, the cost for six aircraft would be $1.296 billion.

Recurring Costs. As mentioned above, the total recurring costs (passenger amenities and maintenance & repair costs) for 2009-2010 were Rupees 6.04 billion. This figure was for the entire fleet of 101 aircraft, therefore the average cost per aircraft is Rupees 59,801,000, or at an exchange rate of Rs 55/- to a dollar, $1,080,000 million per aircraft per annum. Therefore, for six aircraft for 20 years the recurring costs shall be; 1.08 x 6 x 20 = $ 130,477,000.

Total Costs. The total expected cost is therefore 1,296 + 130.477 = 1,426.477 or $ 1.426 billion.

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[7] See n.4.
[8] See n.4.
[9] Press Trust of India, "Air India sees rise, registers growth in passenger revenue," news article in *The Economic Times: Air India Express.* December 11, 2012. http://articles.economictimes.indiatimes.com/2012-12-11/news/35749603_1_mangalore-airport-mangalore-crash-registers-growth (accessed April 16, 2013).
[10] Airliner World, "Airbus Lists Prices for 2013," *Airlinerworld.com*, January 01, 2013, http://www.airlinerworld.com /view_news.asp ?ID=5596 (accessed April 16, 2013). Each A-330 200 is $ 216.1 million.

Calculating Revenue. Table 3, Chapter IV showed that the PLF for 2010 and 2011 averaged 71.5%. In 2012, the PLF was 71.6. As per the airbus website, the Airbus 330-200 can carry 272 passengers and the MRTT can carry 270. Thus, using the PLF of 2012, we find that the revenue seats per km on one MRTT aircraft are = 270 x 71.6/100 = 193. Therefore for six MRTT = 193 x 6 = 1158.

Also, the 2009-2010 report listed the passenger revenue per seat as Rupees 2.57, while the 2012 statement of the Minister of State for Civil Aviation mentions a figure of Rupees 4.31. As the variation is large, the average revenue per seat is considered= 4.31 + 2.57/ 2 = Rupees 3.44 per seat per km. Therefore, the revenue earned by six MRTT is 1158 x 3.44 = Rupees 3,983,520,000. Moreover, as no data is available for revenue from cargo in 2012, the figure of the Comptroller and Auditor General of India's report of 2009-2010 is considered. Therefore in the absence of data, the revenue from cargo for six aircraft is 49.3 x 6 = Rupees 295,800,000.

As aircraft can't undertake maximum capacity simultaneously, it is assumed that they split the passenger and cargo roles equally for 10 years, thus the total revenue = (3983.52+ 295.8) x 10 = 4279.32 x 10 million rupees. = Rupees 42.7932 billion or $ 778,058,000. If however, all six aircraft are used in the passenger role for 20 years then the revenue = 3983.52 x 20 /55 = $ 1.4485 billion.

Thus the net cost in the mixed role = 1, 450[11] - 778.058 = $ 671,942,000, and ***in case all aircraft are utilized in the passenger role then the net cost = 1, 4500 - 1,4485 = $15,000***.

These calculations do not intend to imply that the purchase of the MRTT for Air India will not result a net profit. Instead, the calculations merely highlight that the PLF and revenue per seat are subject to market forces, and that they determine the commercial viability of an airline. What is of significance is that the seating capacity of the MRTT is comparable to the Airbus 330-200, hence, higher values of these factors would result in better profit margins. Ultimately, the commercial success of Air India would depend on its ability to capture and retain a larger market share, and not on whether it might operate the MRTT.

[11] Pandit, Rajat. "Europe Pips Russia in Mega Mid-Air Refueling Aircraft Deal." *timesofindia.indiatimes.com.* January 04, 2013. http://timesofindia.indiatimes.com/india/Europe-pips-Russia-in-mega-mid-air-refueling-aircraft-deal/articleshow/17879413.cms? (accessed February 15, 2013).

APPENDIX B: EXTRACT OF KC-10 PILOT INITIAL QUALIFICATION FLYING TRAINING SYLLABUS & EXPECTED PROFICIENCY

The Flying Training Syllabus for the initial conversion onto the KC-10 specifies the following:

> The goal is to produce a pilot capable of physically operating and flying the KC-10 from the left or right seat (with the exception of receiver air refueling).[1]

Paragraph 7 also specifies that the duration of this training is expected to be, "76 training days (52 days in Phase-IA and 24 days in Phase-IB),"[2] and it is expected that the conversion of pilots onto the KC-47 or the MRTT is likely to be similar. The breakdown of this syllabus is shown in table. 4.[3]

Table. 4: Breakdown of Training Syllabus for KC-10 PIQ

S No.	Phase	Type	Hours	Days
1.	Phase IA	Academic Training	367.0	52
2.	Phase IB	Ground Training	76.0	10
3.	Phase IB	Flying Training	33.6 (6 missions)	14
		Total	**476.6**	**76**

Source: AMC: Director of Operations (Flying Training Syllabus: KC-10 Pilot Initial Qualification)

Moreover, Chapter-4 of the flying training syllabus, covers the entire gamut of flying training, which includes ground operations, take off, departures, cruise, various types of approaches, landing, formation flying, and not just air-to-air refuelling.[4]

The U.S. Air Force Instruction 11-2KC-10, Vol II, KC-10 Aircrew Evaluation Criteria, specifies performance critera that KC-10 aircrew have to meet, in sub-areas of the air-to-air tanker role (rendezvous, platform control, breakaway, and overrun procedures), these are:

> **2.8.4.3.1. Q.** Aircraft control was smooth and positive. Performed all checklists and complied with procedures outline in the flight manual and other governing directives. Met the following criteria:
> 2.8.4.3.1.1. Airspeed: +10 / -5 KIAS

[1] AMC: Director of Operations. "Flying Training Syllabus: KC-10 Pilot Initial Qualification (PIQ)." *altus.af.mil/*, February 01, 2010, http://www.altus.af.mil/shared/media/document/AFD-111108-067.pdf (accessed May 10, 2013), 1.
[2] See n.1.
[3] AMC: Director of Operations. "Training Syllabus: KC-10 (PIQ).", 2.
[4] AMC: Director of Operations. "Training Syllabus: KC-10 (PIQ).", Chapter 4, pages 31 to 34.

2.8.4.3.1.2. Altitude: +/- 200 feet
2.8.4.3.1.3. Heading/Course: +/- 5 degrees

2.8.4.3.2. Q-. Aircraft control was not always smooth and positive, but was adequate. Accomplished procedures required by the flight manual, checklists, and other governing directives with deviation/omissions which did not affect safety of flight. Exceeded Q criteria but does not exceed:
2.8.4.3.2.1. Airspeed: +15 / -5 KIAS
2.8.4.3.2.2. Altitude: +/- 300 feet
2.8.4.3.2.3. Heading/Course: +/- 10 degrees)

Note: When refuelling with autopilot off, add 100 feet, 5 KIAS, and 5 degrees to all tolerances.[5]

The FAA website specifies the performance criteria required by pilots applying for an Airline Transport Pilot Licence (ATPL) for a holding pattern as:

> Maintains the appropriate airspeed/V-speed within ±10 knots, altitude within ±100 feet, headings within ±10°; and accurately tracks radials, courses, and bearings.[6]

It is evident that the evaluation standards required by the USAF and the FAA are nearly similar for a proficiency level of Q and an ATPL. It is therefore assessed that with similar specialized training (and regular continuity training), experienced aircrew of Air India shall likely adjust to the rigors and complexities that the air-to-air tanker role demands.

[5] USAF. "AIR FORCE INSTRUCTION 11-2KC-10, Vol II, KC-10 Aircrew Evaluation Criteria." *http://static.e-publishing.af.mil.* September 21, 2012. http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi11-2kc-10v2/afi11-2kc-10v2.pdf (accessed May 12, 2013). Pages 25 (Para 2.8.4.3.) & 26 specify the evaluation criteria for these proficiency ratings.
[6] FAA: Department of Transport. "Airline Transport Pilot and Aircraft Type Rating Practical Test Standards." *http://www.faa.gov/training_testing/testing/test_standards/.* July 2008. http://www.faa.gov/training_testing/testing/test_standards/media/FAA-S-8081-5F.pdf (accessed May 13, 2013). Pg. 54, Task B (Holding), Objective 10 specifies these criteria.

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