AN ASSESSMENT OF HICKAM AIR FORCE BASE'S CAPABILITY TO SUPPORT STRATEGIC AIRLIFT THROUGHPUT WHEN OPERATING UNDER AN AVIAN FLU PANDEMIC

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ABSTRACT

Hickam Air Force Base (AFB), Hawaii provides an ideal waypoint for U.S. strategic airlift aircraft to refuel and receive other services on their way to Northeast and Southeast Asia from the continental United States. Hickam AFB also serves as a critical aerial port of debarkation (APOD) for deploying U.S. forces and equipment to more distant lands as needed. Making use of the United States Transportation Command's Aerial Port of Debarkation Plus model, this paper examines the ability of Hickam AFB to serve in its important role as an APOD when operating under the effects of a major avian flu pandemic. In this regard, the major influence on Hickam AFB will be a serious degradation to the number of available personnel to service aircraft and operate Hickam AFB's aerial port. It is noted that the results presented herein are based on simplistic attrition rate assumptions. Nonetheless, it is envisioned that this work is applicable to more realistic input attrition rates as avian flu epidemiological models are refined, as well as attrition associated with other types of contagious pandemic disease or willful biological warfare attack.

INTRODUCTION

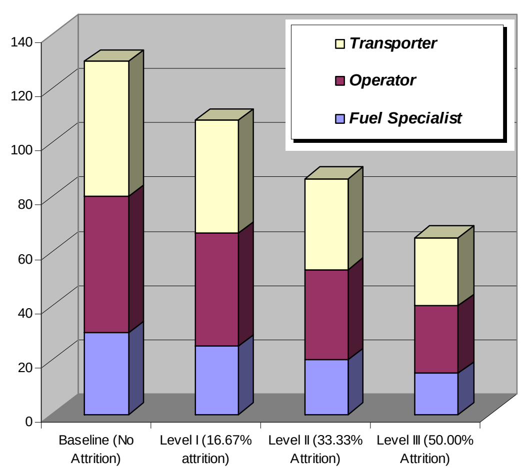
Situated on the island of Oahu, Hawaii, Hickam Air Force Base (AFB) is strategically located in the mid-Pacific Ocean as it provides an ideal stop for U.S. strategic airlift aircraft (e.g., the C-5 Galaxy and the C-17 Globemaster III) to refuel and receive other services on their way to Northeast and Southeast Asia from the continental United States. Furthermore, with a large number of military installations and personnel on the island of Oahu, Hickam AFB also serves as a critical aerial port of debarkation for deploying U.S. forces and equipment to more distant lands as needed. If an avian flu pandemic occurs, it will most likely originate in the Northeast Asia/Southeast Asia region. Given the large number of Asian passengers that transit the Hawaiian Islands, the avian flu could easily spread to Hawaii and the island of Oahu, infecting both civilian inhabitants and military personnel. In this regard, the major influence on Hickam AFB will be a serious degradation to the number of available personnel to service en route aircraft and operate Hickam AFB's aerial port.

Making use of the United States Transportation Command's Aerial Port of Debarkation Plus (APOD+) Model, this paper examines the ability of Hickam AFB to serve in its important role as a strategic airlift APOD when operating under the effects of a major avian flu pandemic. In this regard, Hickam AFB will be used to onload military personnel and cargo for transit off the Island of Oahu. The remainder of this paper discusses avian flu background and assumptions that were used to derive military personnel attrition rates, a hypothetical APOD operational scenario for Hickam AFB, and predicts results.

AVIAN FLU BACKGROUND AND ATTRITION RATE ASSUMPTIONS

The avian flu is still not yet a human-transmitted (i.e., passed from human to human) disease. However, the flu does exist within wild and domestic fowl in China, Japan, Indonesia and other Asian states. Recent reports also indicate that the avian flu is spreading to fowl located in other regions of the world (e.g., Romania). The main concern is that if the avian flu virus presently found in fowl (H5N1) should mutate to a human-transmitted form, millions to hundreds of millions of people around the globe could become infected as the disease spreads. In turn, there are insufficient quantities of anti-viral medicines (e.g., Tamiflu) to treat those that might become infected with the virus. Ultimately, if the avian flu should follow past worldwide flu pandemics (e.g., the 1918-1919 Spanish Flu (H1N1) which resulted in 20-50 million deaths worldwide and more than 500,000 U.S. deaths [1]), millions of souls could be lost to the disease. Center for Disease Control and Prevention (CDC) data suggests that approximately one-third of United States citizens could be infected with the avian flu.

Our initial modeling effort considered a baseline level (no attrition) and three different total infection levels for U.S. military forces stationed at Hickam AFB. For convenience, these infection levels are labeled as Level I (16.67 % become infected), Level II (33.33 % become infected), and Level III (50.00 % become infected). A summary of these levels are shown in Figure 1 (a). These rates were used to set the ground personnel levels according to three types that are represented in the APOD model – fuel specialists, transporters, and operators. An overview of functions performed by these personnel is provided in Figure 1 (b).



(a)

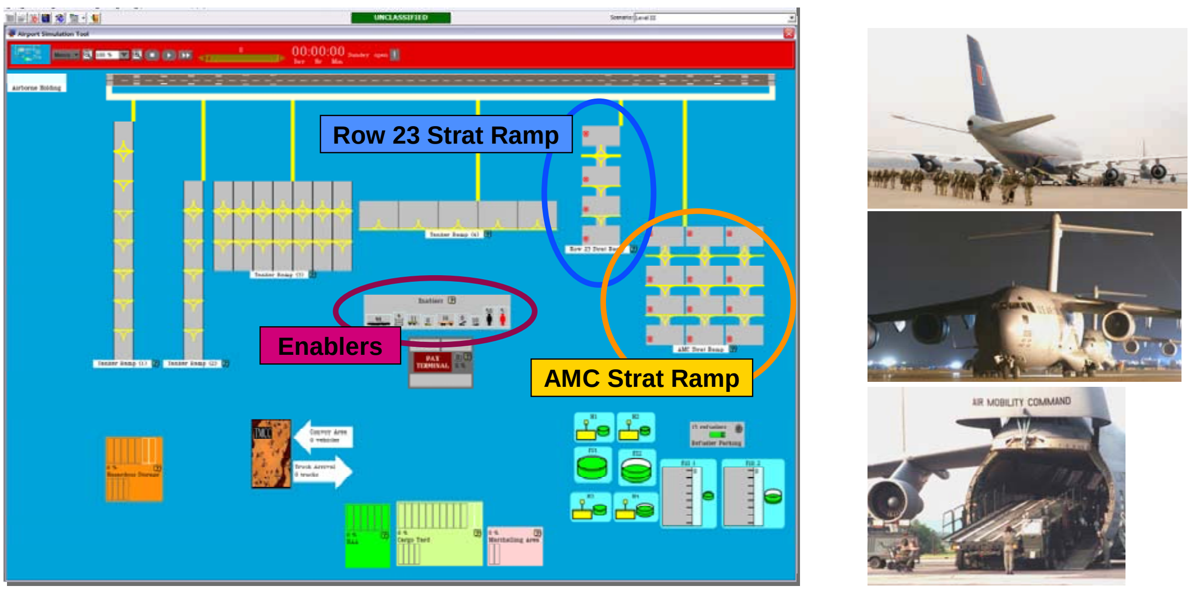
Function	Fuel Specialist	Operator	Transporter
Fuel truck ops	X		
Hydrant service equipment ops	X		
Fill-stand ops	X		
Bulk fuel ops	X		
Fuel laboratory ops	X		
Aircraft load teams		X	X
Cargo yard dock teams		X	X
Pallet netting/breakdown		X	X
Truck loading teams		X	X
Documentation teams		X	X
Operate MHE/Ground Equipment		X	

(b)

Figure 1. Modeled Percent Military Forces Infected. Panel (a) shows total number of modeled personnel under different attrition rates and panel (b) shows functions performed by different personnel.

HYPOTHETICAL APOD OPERATIONAL SCENARIO

In its APOD role, Hickam AFB has an aerial port whose primary role is to receive, load or unload, and transport materials to and from Hickam AFB. These materials either originate on the island of Oahu itself or they are delivered and transferred from other transiting military and civilian aircraft (Hickam AFB is located adjacent to Honolulu International Airport). In this paper, we considered a mix of incoming aircraft that arrive at Hickam AFB to pick-up these outgoing materials. In particular, civilian operated Boeing 747 aircraft arrive at a rate of 1 per hour to load outgoing military passengers (PAX). These aircraft can use either the Row 23 Strategic Ramp or the Air Mobility Command (AMC) strategic ramp. AMC operated C-5 and C-17 aircraft arrive randomly at a combined rate of 2 per hour to load cargo. These aircraft can use only the AMC Strategic Ramp. In part, these rates were based on previous infrastructure studies conducted by the United States Transportation Command (USTRANSCOM) [2, 3]. All aircraft are serviced by the personnel as depicted in Figure 1. The APOD+ model arrangement of this scenario is depicted in Figure 2. Material handling equipment (e.g., forklifts) inventory levels and other aerial port resources were set so they were not the limiting constraint. This was so the impacts of reduced crews to operate these resources could be assessed. Lastly, the APOD model was run for a 10 day scenario at the different attrition levels described previously.



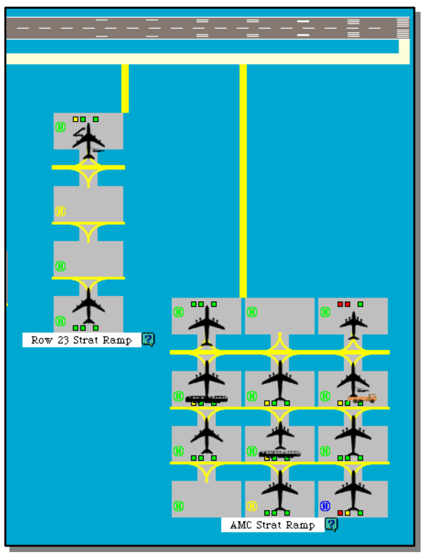
(a) (b)

Figure 2. APOD+ Model Arrangement. Panel (a) shows the Hickam AFB animation screen per provided model inputs. Panel (b) shows the modeled 747, C-5, and C-17 aircraft respectively.

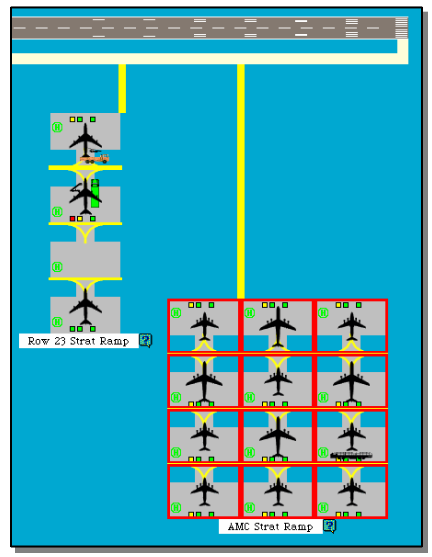
RESULTS

A number of different model runs were conducted under the assumptions/scenario presented in the previous sections. Figure 3 presents a graphical summary of these results. Panels (a) and (b) show screen shots of the Row 23 and AMC strategic ramps under the baseline and Level III attrition rates respectively. In Panel (a), the airfield is busy, but no major impacts/delays are observed in processing aircraft. However, in Panel (B), every one of the aircraft parked at the AMC Strategic Ramp will depart late as indicated by the boxed outline (i.e., the aircraft will not depart per the established scheduled take-off time determined by the APOD+ model which is a function of planned ground time processing for the aircraft). The main reason is that at 50% attrition rate, insufficient numbers of personnel are available to operate ground support equipment needed to service these aircraft.

Panels (c) and (d) show the effect of increasing attrition on aircraft and base level APOD performance. In particular, Panel (c) shows that as attrition increases, less and less aircraft are departing Hickam AFB in the 10 days of modeled operations. In addition, more and more aircraft must divert (i.e., incoming aircraft cannot land at Hickam because the airfield has no free space so they divert to another airfield to land after their fuel reserves are consumed). Likewise, Panel (d) shows increasing degradations in total cargo, pallets, and passengers onloaded at Hickam AFB for transport downstream as the attrition rate increases. Most notable in these panels, increasing attrition does not have a linear impact on airfield performance. This has to do with the stochastic nature of operations that is captured by the APOD+ model and this must be accounted for in dealing with the avian flu. Simple assessments that assign impacts as a direct proportion of total attrition are not accurate and could be severely over or understating true impacts.



(a)



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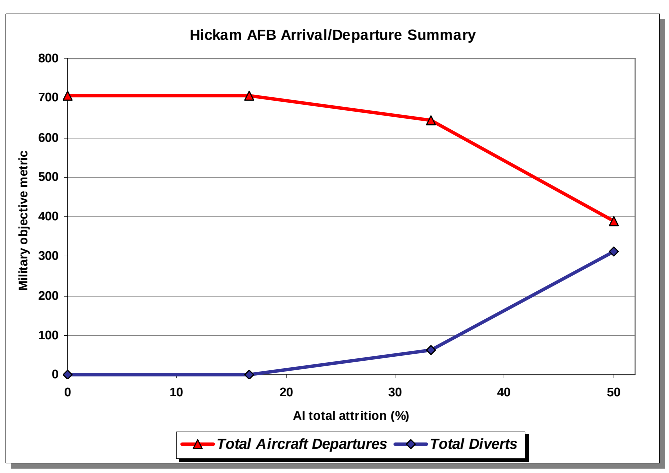
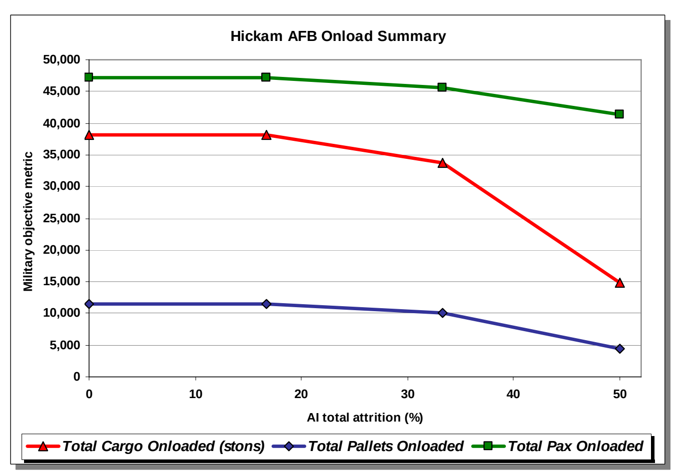


(c)



(d)

Figure 3. Avian Influenza Impacts to Hickam AFB APOD Operations. Panel (a) shows no major impact to operations at 0% attrition (Baseline). Panel (b) shows a major impact and a large number of late aircraft at 50% attrition (Level III). Panel (c) shows impacts to total aircraft departures and diverts

at different attrition levels. Panel (d) shows impacts to total cargo, pallets, and passengers onloaded at different attrition levels.

SUMMARY AND CONCLUSIONS

This paper presented an initial look at the potential impacts avian flu could have on military operations and in particular aerial port operations at Hickam AFB, Hawaii. It was shown that personnel attrition due to sickness or death as a result of an avian flu pandemic could have adverse effects on such operations. Of even more important consequence would be the compounding effects on overall military operations in the United States Pacific Command's Area of Responsibility as other military bases and other operations become degraded by an avian flu pandemic. We plan to continue conducting research in this vein in the future using larger scale transportation and combat models. At the same time, we also intend to explore impacts to Hickam AFB in serving in its important role as a strategic airlift en route airfield. Research will also be aimed at exploring various mitigation strategies to the avian flu pandemic (e.g., vaccination decision rules, quarantine strategies, and various different military concepts of operations). These strategies can be tested and compared against each other to demonstrate the most advantageous concepts.

We also again note that attrition does not have a linear impact on operations. This has to do with the stochastic nature of operations which must be accounted for in dealing with the avian flu and other pandemics. Simple assessments that assign impacts as a direct proportion of total attrition could severely over or understate true impacts. Lastly, it is noted that the results presented herein are based on simplistic attrition rate assumptions. Nonetheless, it is envisioned that this work is applicable to more realistic input attrition rates as avian flu epidemiological models are refined, as well as attrition associated with other types of contagious pandemic disease or willful biological warfare attack.

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