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TECHNICAL
REPORT

Costs of Flying Units in Air Force Active and Reserve Components

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Prepared for the United States Air Force

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Summary

The relative costs of operating and supporting Air Force active- and reserve-component units are an important consideration in programming the mix of forces for various missions. Unfortunately, there are no generally accepted or well-documented methodologies for compiling the costs and output measures to be included in these comparisons. This report describes the development of one such methodology, using recorded costs from past periods, and applies it to an exploration of force mix alternatives in several weapon systems.

The primary source of our cost data was the Air Force Total Ownership Cost (AFTOC) decision support system. Using this and other, minor sources, we determined, as fully as possible, the local costs of active and reserve flying wings, including their share of base infrastructure support costs, in fiscal years 2006 through 2010. We focused on the Air Force's C-130 tactical airlifter, KC-135 aerial refueler, and F-16 multirole fighter fleets—each well represented in the reserve components.

Since active and reserve flying wings differ widely in size, total unit costs do not provide a useful comparison. Rather, costs need to be related to comparable outputs. To that end, we gathered, primarily from AFTOC, information on each wing's annual average number of owned aircraft, total flying hours, and operational (as opposed to training) flying hours.[1,2] Additionally, for fighter wings, we found annual sums of aircraft-days tasked to meet combatant commander requirements. Dividing total annual wing costs by each of these outputs gave us comparable costs per output.

We found that annual costs per owned aircraft in reserve-component units are typically only one-half to two-thirds of the cost in active-component units. This is attributable primarily to the fact that reserve-component units generate about one-half to two-thirds of the annual flying hours per owned aircraft generated by active-component units.

Consistent with the above, we found that the average total costs per flying hour for reserve-component units are in roughly the same ranges as those for larger active-component units based in the continental United States (CONUS). The reserve components have significant cost advantages due to factors such as Spartan base infrastructures and more experienced (and hence more productive) workforces. We confirmed this, noting that *at any observed scale*

[1] In AFTOC terminology, aircraft in a unit's primary mission aircraft inventory (PMAI) are referred to as "owned" by the unit. This category includes all aircraft assigned to the unit that are devoted to the primary flying mission of the unit. It excludes backup, attrition, and reconstitution reserves.

[2] In AFTOC, flying hours are mapped to three categories—operations, training, and testing—based on the *mission symbol* (which indicates the purpose of a sortie) captured in documentation pertaining to each sortie.

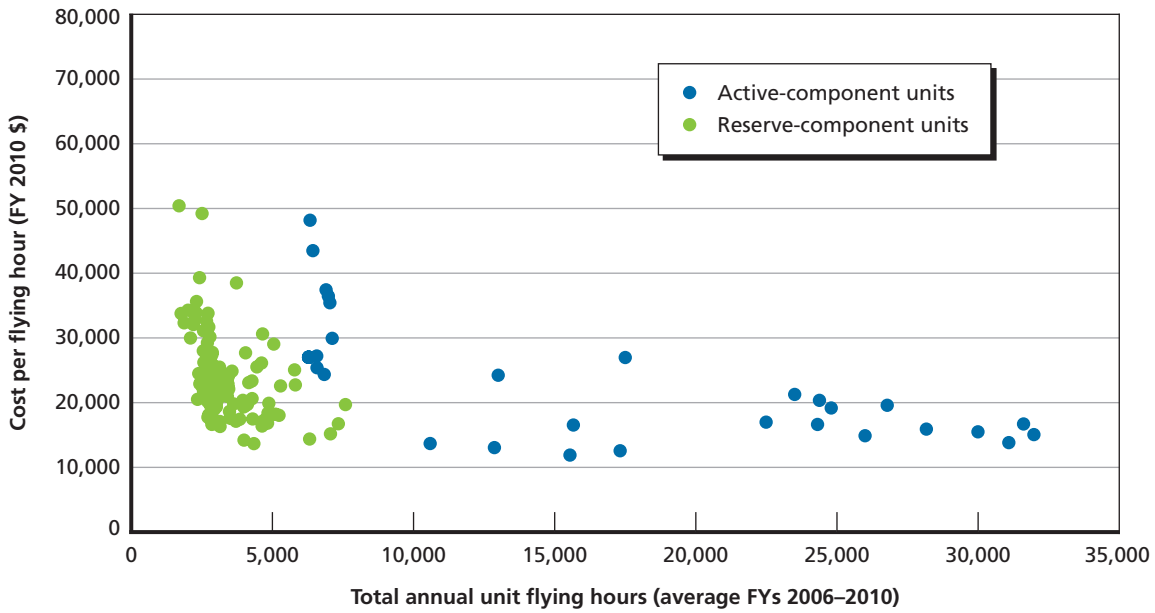
of operation, reserve-component units have a significantly lower cost per flying hour.[3] *Scale of operation* here refers to the number of flying hours per time period generated by a unit. So, for example, reserve component units that flew about 7,500 hours in a year had lower average flying costs per hour than did active-component units that also flew 7,500 hours. This is shown in Figure S.1, which shows the average costs per flying hour, arranged along the horizontal axis by total number of hours flown, for one of the aircraft we studied, the KC-135. Results for the C-130 and F-16 are similar.

But the reserve components face an offsetting disadvantage in that their fleets are dispersed across many small-scale operations—too small to realize available economies of scale. Most reserve-component KC-135 units flew less than 6,000 hours in a year, whereas no active component did so. As Figure S.1 shows, the costs per flying hour in those small-scale reserve-component units tend to be at or above costs per flying hour in larger-scale active-component units.

Compared with reserve-component units, active units typically fly a higher proportion of their total flying hours as operational. Table S.1 indicates the five-year averages of these proportions for the three aircraft types in our analysis. When total unit costs are spread across active units' larger proportions of operational flying hours, their costs per operational flying hour are often lower than in reserve-component units.

For the purpose of meeting strategic demands, reserve-component units provide mission-ready aircraft with competent aircrew and maintenance workforces at lower cost *per aircraft* than active units. In contrast, active units have often met operational demands at lower cost *per*

Figure S.1
Cost per Flying Hour as a Function of Flying Hours, KC-135 Wings



NOTE: Each dot represents one wing's average cost per flying hour and total flying hours in one fiscal year.
RAND *TR1275-S.1*

[3] Typically, only overseas-based active units are observed to operate on the more limited scale observed in reserve component units.

Table S.1
Operational Flying Hours as a Proportion of Total Flying Hours, FYs 2006–2010

Aircraft	Active Component (%)	Reserve Components (%)
C-130	68	55
KC-135	76	50
F-16	43	25

NOTE: Data are for aircraft with purpose codes CA (combat support) and CC (combat) only. Aircraft coded TF (training) or for various test or other special purposes are not included.

flying hour. To determine the cost-minimizing force mix suggested by these asymmetrical cost advantages, we constructed optimization models that minimize total fleet costs subject to a set of constraints, including that strategic, operational, and proficiency flying demands are met and that active and reserve units operate at feasible or desirable levels of intensity and operational tempo.[4] Our three output measures correspond to those demands—total owned aircraft indicates strategic capacity, total annual operational flying hours indicates operational capacity, and total annual flying hours indicates proficiency flying capacity. Using these models, in two of the three fleets we studied we found that demands satisfied during our five-year history could have been met less expensively with more of the fleets in the active component. Table S.2 indicates the result of these analyses for the five-year period (FYs 2006 through 2010) we examined. In these analyses, the cost-minimizing mix retains the same total fleet size and the same number of operational flying hours as the five-year average (or a modified two-year average in the case of the C-130 fleet).

In excursions using our optimization models, we found that reducing operational demands would tilt the cost-minimizing mix in the direction of the reserve components, while reducing planned strategic capacity (fleet size) would have the opposite effect. In general, as illustrated in Figure S.2, the greater the ratio of strategic capacity to operational demand, the greater the proportion of the cost-minimizing mix that would be in the reserve components.

In the near term, the Air Force faces budget-driven reductions in its fleet sizes but no immediate reduction in operational demands. For the three fleets we examined, this suggests that near-term fleet reductions should be taken in the reserve components. This will allow the remaining fleets to meet continuing operational demands with fewer total flying hours and less deployment stress on individual active aircrews and maintenance workforces. If operational demands subsequently subside, the stage will then be set for tilting the mix back toward the reserve components.

Anticipating future strategic and operational demands is beyond the scope of this research, and due to the issues associated with transferring aircraft between components, prudence will be required in applying the insights noted here. That prudence will naturally be applied as part

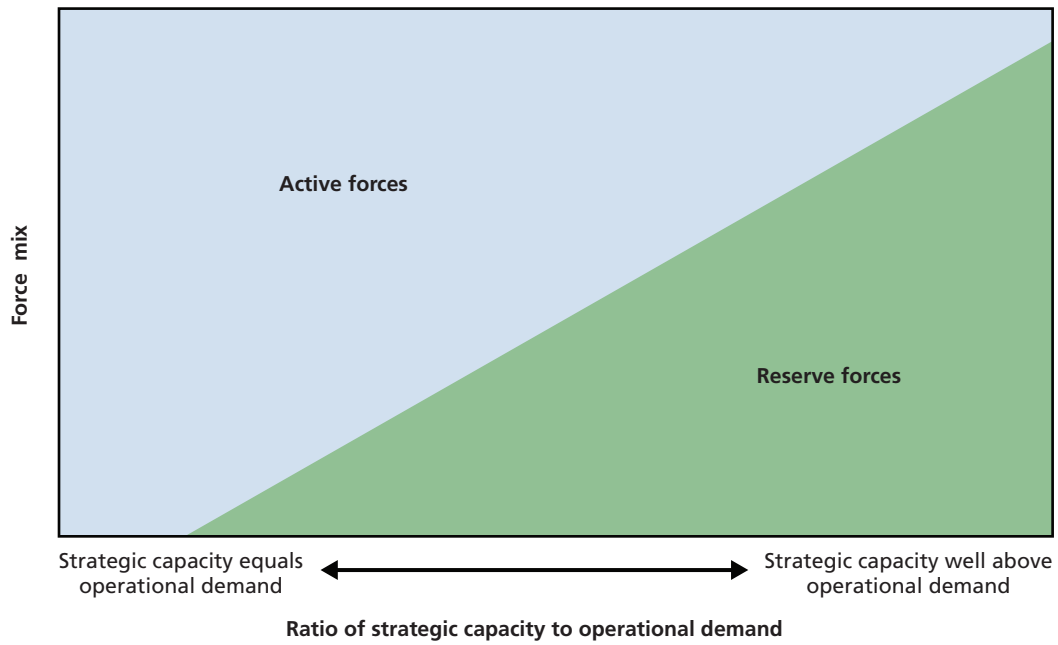
[4] *Strategic* demand refers to the surge capacity needed for major theater warfare, as represented in defense planning scenarios. *Operational* demand, sometimes called *steady-state* demand, refers to the capacity to meet ongoing combatant commander taskings.

Table S.2
Cost-Minimizing Active/Reserve Mixes

		Recent Average			Cost-Minimizing Mix			
Aircraft	Component	Total PMAI	Total Flying Hours	Annual Fleet Cost ($, billions)	Total PMAI	Total Flying Hours	Annual Fleet Cost ($, billions)	Potential Annual Savings ($)
C-130	Active	88	63,200	1.42	73	58,000	1.28	
	Reserve	198	84,200	1.76	213	90,700	1.90	
	Associate		6,100	0.22		6,100	0.22	
	Total	286	153,400	3.40	286	154,800	3.40	0 (0.0%)
KC-135	Active	128	106,800	2.05	331	161,100	3.08	
	Reserve	203	83,800	1.83				
	Associate		9,300	0.19		9,300	0.19	
	Total	331	199,900	4.07	331	170,400	3.27	800 million (19.7%)
F-16	Active	340	107,700	2.80	421	120,400	3.17	
	Reserve	319	69,700	1.55	239	47,800	1.12	
	Associate		4,100	0.07		4,100	0.07	
	Total	660	181,500	4.41	660	172,300	4.35	60 million (1.4%)

NOTE: Values shown for KC-135 and F-16 are averages for FYs 2006 through 2010 for units included in our analyses. Values for the C-130 are for 2009 and 2010 (period truncated due to deactivation of an active wing in 2008). Cost-minimizing mixes retain the same fleet size and produce the same total annual operational flying hours as the recent average (see five-year-average data in Table 3.2).

Figure S.2
Strategic Capacity, Operational Demand, and Ideal Force Mix



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of the Air Force's total force enterprise review process, which examines the costs and benefits of active and reserve component partnerships.

Since active and reserve component units experience roughly comparable overall costs per flying hour, active-component units that regularly operate at a higher operational tempo can satisfy operational demand at lower total costs than non-activated reserve-component units operating at a lower operational tempo. However, reserve component units may currently be constrained in their contribution to meeting operational demand by factors that can be changed, to include activation and/or mobilization policies, mission scheduling procedures, and man-day funding. If these constraints can be relaxed, reserve component units might accept more operational missions, resulting in a higher proportion of flying hours flown operationally and a lower cost per operational flying hour. To be prudent, increased operational contributions from the reserve components should be demonstrated before force mix decisions are based upon them.

Generally speaking, for the purpose of meeting strategic surge demand, reserve component units provide mission-ready aircraft with competent aircrew and maintenance workforces at lower cost than active component units. The asymmetrical cost advantages in the two components are reflected in the agility and responsiveness relied upon in the active component, and by the complementary depth and capacity provided by the reserve components. From a cost perspective, the nation is therefore well served by a sustained active component/reserve component mix in its air arm.