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Why Has the Cost of Fixed-Wing Aircraft Risen?

A Macroscopic Examination of the Trends in U.S. Military Aircraft Costs over the Past Several Decades

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Summary

As with many other military weapon systems, military aircraft have experienced long-term, unit cost increases that are greater than the rate of inflation.[1] These increases, largely driven by the desire for greater capabilities, appear likely to persist and could have dire implications for aircraft inventories, particularly given relatively fixed defense investment budgets. Commenting on the continually increasing costs for aircraft, one industry executive (Augustine, 1986, p. 143) famously wrote,

> In the year 2054, the entire defense budget will purchase just one aircraft. The aircraft will have to be shared by the Air Force and Navy 3½ days per week except for leap year, when it will be made available to the Marines for the extra day.

Given increasing costs for military aircraft, relatively fixed budgets to procure them, and resulting decreased procurement rates, the Air Force and the Navy asked RAND to examine the causes of military aircraft cost escalation. From available data, we calculated cost escalation rates as well as their "economy-driven" and "customer-driven" causes.

For every type of aircraft we examined—patrol, cargo, trainer, bomber, attack, fighter, and electronic warfare—annual unit cost esca-

[1] Throughout this document, we use the terms *price* and *cost* interchangeably. Formally, in most cases we are referring not to cost but to what cost estimators term as *price*, that is, the actual dollars required to buy the system (including all fees and profits). By *cost increase* (or *cost escalation*), we mean the differences in actual prices paid for aircraft over time and not the difference between the estimated and actual values.

lation rates in the past quarter century have exceeded common inflation indices, such as the Consumer Price Index, the Department of Defense procurement deflator, and the Gross Domestic Product deflator. This trend is true whether cost escalation is measured using either procurement or flyaway cost. Patterns of cost escalation differed by aircraft—some showed cost improvement over time, while others steadily increased—but, again, all exceeded that for other inflation measures.

We considered two groups of contributors to cost escalation: economy-driven variables, which include costs for labor, equipment, and material, and customer-driven variables, which include costs for providing performance characteristics that the Services want in their aircraft.

We found that the rates ($/hr) of aircraft manufacturing labor, in both direct and fully burdened wages, have increased much faster than other measures of inflation. Nevertheless, increased productivity has meant that overall, labor costs have grown only slightly faster than inflation. Furthermore, the proportion of labor cost in the overall cost of aircraft has been steadily decreasing (from a prime contractor perspective) as more manufacturing is outsourced. With two exceptions (specialty metals and avionics systems, such as navigation equipment), materials and equipment used in aircraft manufacturing have increased in cost at roughly the same rate as other measures of inflation. Altogether, we find that labor, material, equipment, and manufacturer fees and profits have helped increase the cost of aircraft about 3.5 percent annually—which is less than the rate of increase for some inflation indices during the same time.

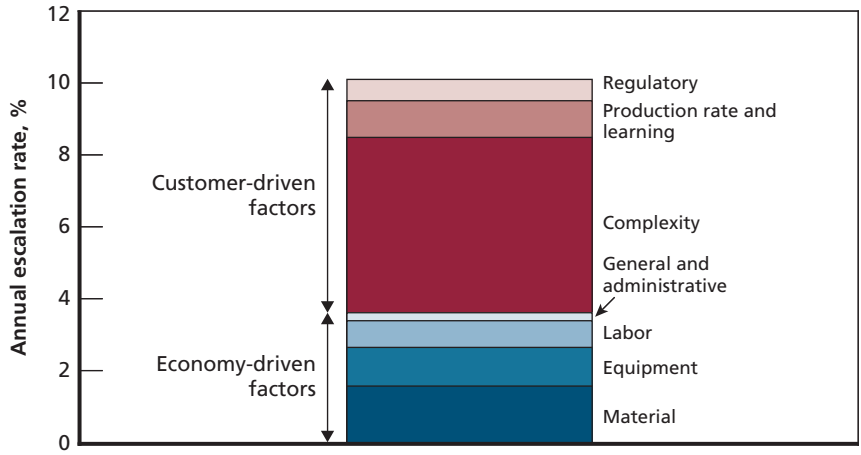
The government can affect the cost of military aircraft in several ways, particularly through the quantity it demands and the characteristics it specifies. Although we did not find a consistent cost improvement effect stemming from purchases over time in aircraft procurement, we did find a procurement rate effect by which higher production rates helped reduce unit prices. One reason for this may be the economic leverage from larger purchases that allows manufacturers to invest in efficiency improvements. Other possible reasons are the spreading of fixed overhead costs over more units—thus reducing average unit price.

Another explanation could be more efficient use of labor and tooling when production rates are higher.

When considering comparison pairs of aircraft, we found that complexity of the aircraft (performance characteristics and airframe material) contributed to aircraft cost escalation, often at rates far exceeding those of inflation. Figure S.1 shows the contributions of the various factors to cost escalation when comparing an F-15A (1975) to an F-22A (2005). The chart shows that roughly a third of the overall cost escalation is due to economy-driven factors. The remainder is due to customer-driven ones—mainly system complexity.

Interviews that we conducted with representatives of aircraft manufacturers confirmed many of these findings. In particular, these representatives noted that the increased demand for greater aircraft stealth and reduced aircraft weight contributed to cost escalation. They also cited government regulations, such as those designed to protect American industry and technology and those for environmental protection and occupational health as sources of aircraft cost escalation.

Figure S.1
Contributors to Price Escalation from the F-15A (1975) to the F-22A (2005)



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The Services could choose to address cost escalation in several ways, some more feasible than others. Improved procurement stability and longer-term contracts could encourage manufacturers to make investments to increase efficiency and cut costs. Fewer change orders to aircraft may help reduce costs as well. International competition and participation in the construction of military aircraft could also reduce costs, although this would likely be opposed by Congress and might be feasible only for noncombat aircraft. Focusing on aircraft upgrades in successive model improvements rather than on acquisition of new aircraft types, as has been done for several aircraft (e.g., the F/A-18E/F), could help contain procurement cost escalation, although the age of some existing aircraft may limit the application of this practice.

At present, the Air Force and the Navy appear to be opting for fewer aircraft but with the highest technological capabilities. Such a strategy helps ensure that U.S. aircraft remain far superior to those of any other military in the world. Maintaining such capabilities, however, does have a cost. We do not evaluate whether this particular tradeoff is good or bad. We note only that it exists and point out related issues that the Services will have to address in deciding how to allocate future appropriations for aircraft procurement.