EIR Science & Technology

Aerospace production: a shadow of the 1960s

As one industry source told EIR's *Marsha Freeman and Robert Gallagher, if current trends prevail, the industry has "five years to go before it's through."*

It will come as a surprise to most readers, that even aerospace and defense industries have not fared well during the Reagan administration "economic recovery." The American aircraft industry has undergone a collapse over the past decade that seriously weakens our ability to provide for an adequate defense, and undermines much of the infrastructure and research-and-development capability relevant to a program for the colonization of the Moon and Mars.

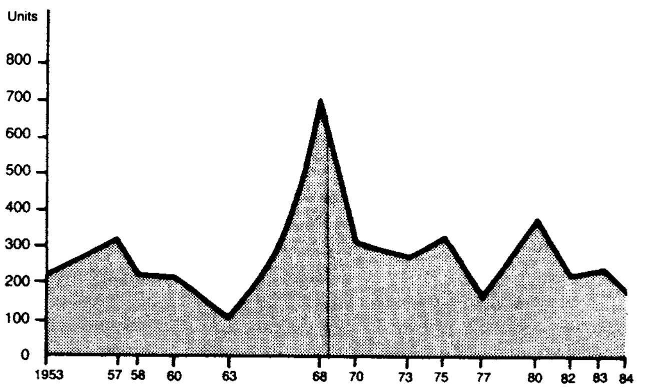
The condition of aircraft production is a general barometer for the state of the nation's aerospace-defense industry. Aerospace-defense has been the science driver for the American economy since World War II. Every sector of the domestic economy has been improved by research and development carried out by the industry and sponsored by the National Aeronautics and Space Administration (NASA) and the military services.

The capability to carry out the Strategic Defense Initiative, build an aerospace plane, orbit a space station, return to the Moon, and colonize Mars, rests entirely with aerospace-defense. For example, Rockwell International has used the same facility in California to assemble both Space Shuttle orbiters and B-1B bombers.

Since 1968 the production of civilian transports used by commercial airlines, has fallen 60% from 702 in that year to 278 in 1985 (see **Figure 1**). The production of military aircraft is down 48% since 1975, from 1,779 aircraft in that year, to 930 in 1984 (see **Figure 2**). Since 1980, production of helicopters for nonmilitary uses has fallen 72%, from 1,366 to 376 in 1984. Worker productivity has stagnated in some areas of production, and collapsed in others, in the same period.

The state of the production of civilian transports, military aircraft, and helicopters indicates the preparedness of the aerospace industry to meet a national emergency or mobilize for an ambitious space program. Civilian transport production represents the nation's military airlift capability in reserve, as the merchant marine before World War II represented our sealift capability at that time. Today, however, there are only two companies left in civilian transport production, Boeing and McDonnell Douglas.

FIGURE 1
Civilian transport production



Production of civilian air transports for use by airliners has collapsed about 60% since 1968. The fleet of civilian transports is the basis of our military airlift capability in reserve.

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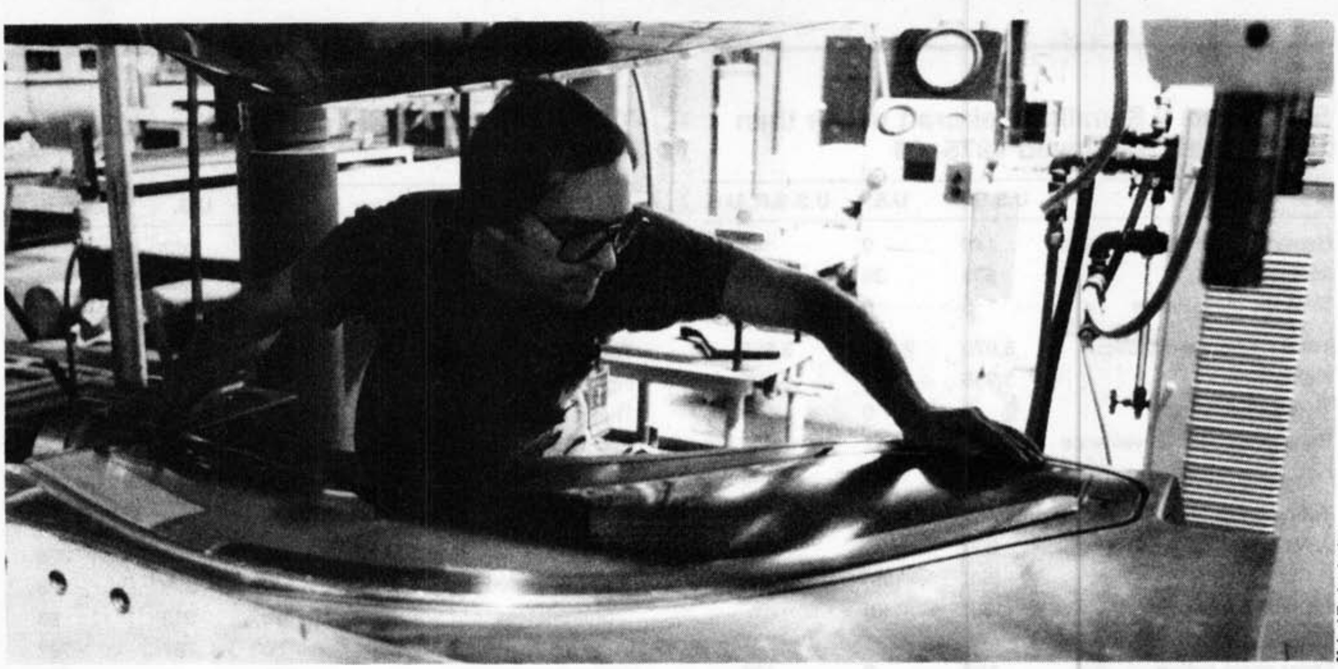


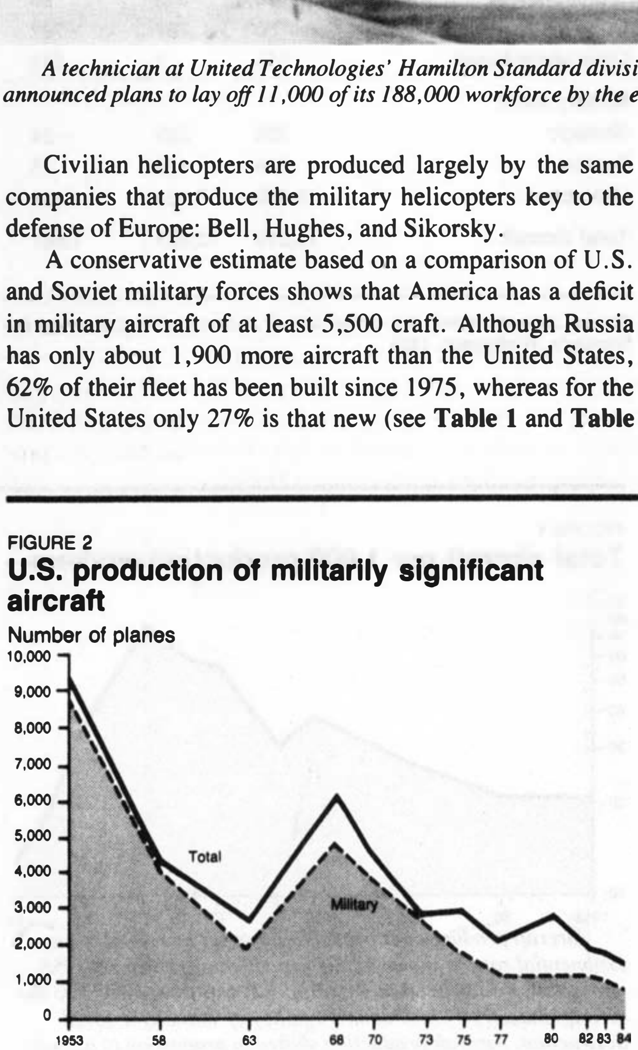
A technician at United Technologies' Hamilton Standard division inspects work on a propeller component. United Technologies has announced plans to lay off 11,000 of its 188,000 workforce by the end of 1987, as part of a "corporate restructuring program."

Civilian helicopters are produced largely by the same companies that produce the military helicopters key to the defense of Europe: Bell, Hughes, and Sikorsky.

A conservative estimate based on a comparison of U.S. and Soviet military forces shows that America has a deficit in military aircraft of at least 5,500 craft. Although Russia has only about 1,900 more aircraft than the United States, 62% of their fleet has been built since 1975, whereas for the United States only 27% is that new (see **Table 1** and **Table 2**). To rejuvenate America's military aircraft fleet to at least the level of Russia requires 5,500 new craft.

FIGURE 2

U.S. production of militarily significant aircraft



The production of militarily significant aircraft has fallen by one-half since 1975. These aircraft include military aircraft proper, civilian air transports, and helicopters for civilian uses.

Overall, since 1975, total U.S. aircraft production has collapsed 77% from 17,030 aircraft to 3,929 in 1984 (see **Figure 3**). Much of this fall-off was due to the collapse of production of general aviation aircraft, small recreational and executive airplanes, such as the Piper Cub or Cessna. The plant and equipment used in production of these craft, is not relevant to our mobilization capability.

The deployment of military aircraft is especially required by the Strategic Defense Initiative. One arm of the SDI program known now as the Aerospace Defense Initiative, involves the development of high-altitude aircraft armed with directed-energy weapons or relay optics, to attack lower-altitude enemy bombers, fighters, helicopters, cruise missiles, and short-range ballistic missiles in their boost phase. Other SDI aircraft will be equipped with laser radar and other sensing equipment.

From 1958 to 1968, aircraft industry productivity measured in aircraft per production worker per year, generally rose at an exponential rate (see **Figure 4**). Since then productivity in civil transport production has fluctuated between about 30 and 55 planes per 10,000 employees (see **Figure 5a-b**).

Productivity in civilian and military helicopter production has collapsed 60% from 57 per 1,000 employees in 1975 to 20 in 1984 (see **Figure 6**). In the same decade, military production fell faster than civilian: 60% versus 56%.

Overall, industry productivity fell 78% over that same period, from 63 aircraft produced per thousand production workers in 1975 to 14 in 1984 (see Figure 4). Most of this

TABLE 1
Soviet and U.S. military aircraft newer than 10 years old, deployed 1975–84

	U.S.S.R.	U.S.	U.S.S.R./U.S.
Heavy and medium bombers	148	0	148
Interceptors	575	36	539
Strategic surveillance	5	0	25
Total land-based tactical	**5,070**	**2,041**	**3,029**
Fighter/attack	3,955	1,362	2,593
Theater bombers	0	0	0
Reconnaissance/surveillance	285	37	248
Helicopter gunships	830	642	188
Total Naval	**455**	**390**	**65**
ASW	200	99	101
Carrier-based	(50)	(99)	
Shore-based	(150)	(0)	
Other carrier-based	60	291	–231
Other shore-based	195	0	195
Military airlift			
Strategic	240	259	–19
Tactical	140	80	60
Helicopters	2,300	572	1,728
Total	**8,933**	**3,408**	**5,525**
Percent total aircraft	62	27	

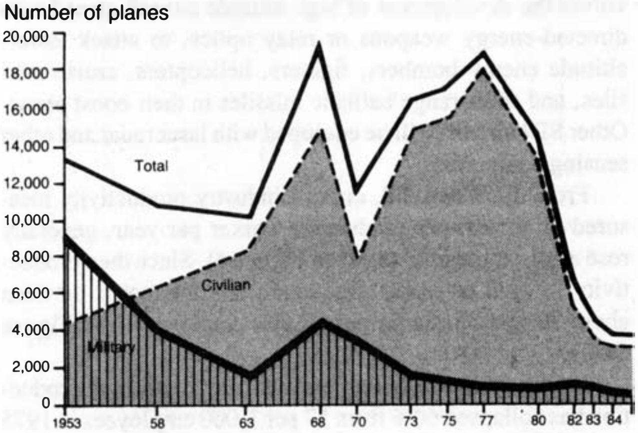
Source: John M. Collins, *U.S.-Soviet Military Balance 1980-1985*, Pergamon Brassey's, Washington, 1985

TABLE 2
Total U.S. and Soviet military aircraft forces, 1984

	U.S.S.R.	U.S.	U.S.S.R./U.S.
Heavy and medium bombers	303	297	6
Interceptors	1,210	282	928
Strategic surveillance	14	45	–31
Total land-based tactical	**7,418**	**4,787**	**2,631**
Fighter/attack	5,460	2,900	2,560
Theater bombers	423	198	225
Reconnaissance/surveillance	585	292	293
Helicopter gunships	950	1,397	–447
Total naval aircraft	**1,085**	**1,295**	**–210**
ASW	480	508	–208
Carrier-based	170	296	–126
Shore-based	310	212	98
Other carrier-based	60	787	–727
Other shore-based	545	0	545
Military airlift			
Strategic	305	329	–24
Tactical	525	520	5
Helicopters	3,650	5,098	–1,448
Total aircraft	**14,510**	**12,653**	**1,857**

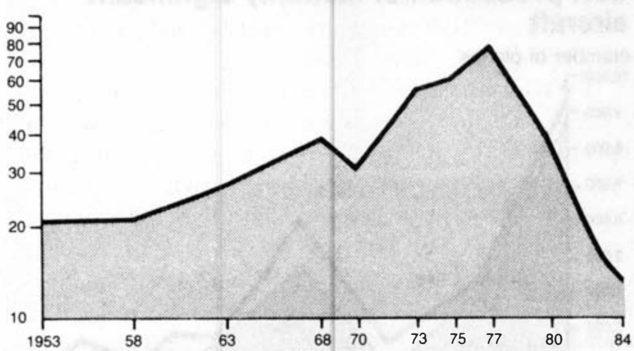
Source: John M. Collins, *U.S.-Soviet Military Balance 1980-1985*, Pergamon Brassey's, Washington, 1985

FIGURE 3
Total aircraft production



Production of aircraft of all kinds has fallen about 80% since 1975. Most of this decline is in the production of small aircraft used for recreational or other personal reasons. The production of general aviation aircraft does not represent defense mobilization capability, although the manpower used in its production includes aerospace machinists.

FIGURE 4
Total aircraft per 1,000 production workers



Aircraft produced per production worker increased at an exponential rate as shown in this logarithmic graph from 1958 until 1968. Following that, an instability was introduced into the aircraft industry by McNamara's policy of mutually assured destruction. Aircraft production shifted in proportion to aircraft for consumer or personal uses, and away from military uses or relevant civilian uses, such as the production of civilian air transports.

fall in units of aircraft produced per production worker, expresses the complete collapse in production of general aviation craft from 17,000 in 1979 to 2,400 in 1984. **Figure 7** shows the decline in aircraft industry employment over the past 30 years.

One industry source told *EIR* that if existing trends prevail, aerospace-defense has "five years to go before it's through."

Figure 3 shows that there has been a regressive structural change imposed on the aircraft industry since 1968. In the late sixties, the U.S. physical economy began to collapse, machine-tool production reached its peak in 1967, the Apollo program peak funding and employment passed in 1968, and the United States began its pullout from Vietnam. The ensuing collapse in aircraft production into 1970, produced a shift into consumer-oriented production of propellor-driven general aviation aircraft. By contrast, the total production of militarily significant aircraft—transports, helicopters, and military craft per se—has fallen continuously since 1968 (see Table 1).

This shift in the market served by aircraft manufacturers comes in the midst of an across-the-board "shake-out" in the industry. Between 1960 and 1976, in production of each type of significant aircraft, one-half of the companies involved, pulled out. For example, in 1960, five firms built airliners; by 1976, only three were left in that important area, and today only two.

The death knell for the industry had actually begun to sound in 1963, when Robert McNamara, with increased power following the assassination of President Kennedy, began to cancel programs right and left, and drove up costs throughout the industry in his campaign for "cost-effectiveness." The Air Force, for example, was barred from developing new long-range bombers. But McNamara's expansion of the Vietnam War, kept demand for military aircraft high relative to the 1970s. The 1960s consumer boom drove commercial airliner production to its peak.

Several events occurred between 1968 and 1970 to collapse the industry.

1) With the winding down of the Vietnam War, a large deficit in modern military aircraft existed due to the war-imposed policy of marginally extending the life of a craft beyond normal military practice. But the war had temporarily destroyed support for military production, and the new national security adviser, Henry Kissinger, used the opportunity to implement his policy that a weaker United States meant a safer world. Military spending as a percentage of the national budget, declined dramatically in the Kissinger years of 1969-77.

2) A wave of monetary crises hit the Western economies in the 1968-71 period, culminating in President Nixon's removal of the dollar from the gold standard. The consumer boom temporarily collapsed.

The fall in production of military aircraft, civilian trans-

FIGURE 5A

Civil transports per 10,000 employees

(year + 1 year)

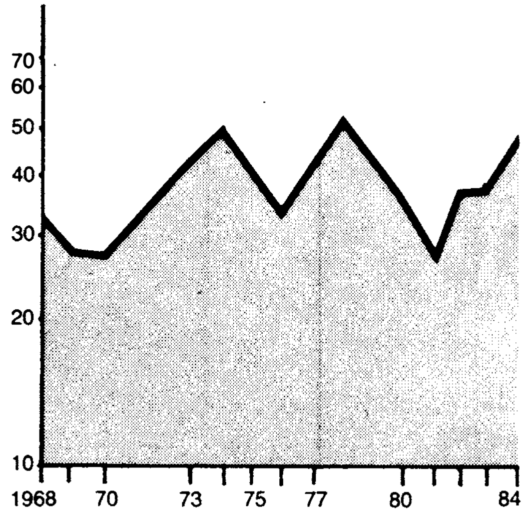
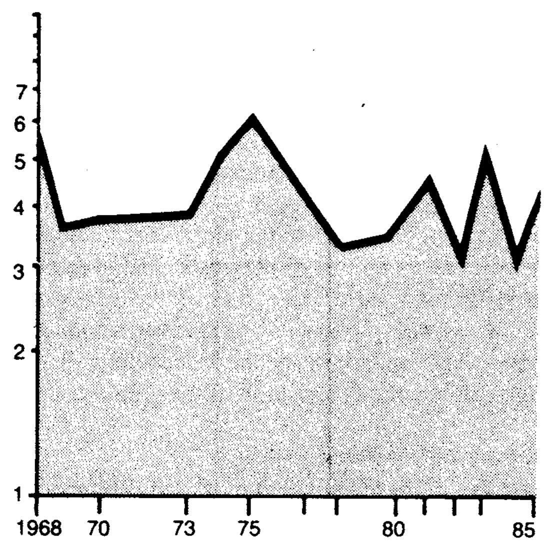


FIGURE 5B

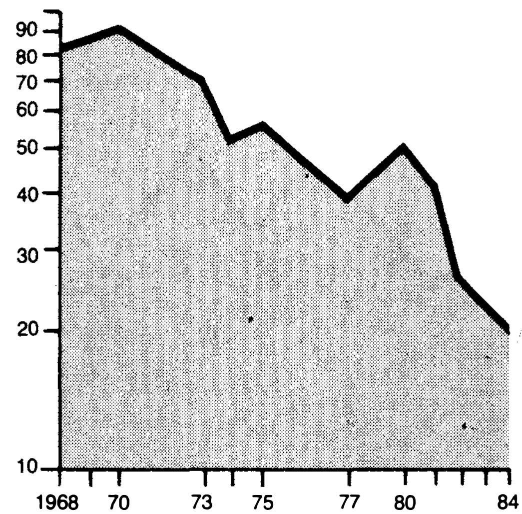
Civil transports per 10,000 employees

(year/year)



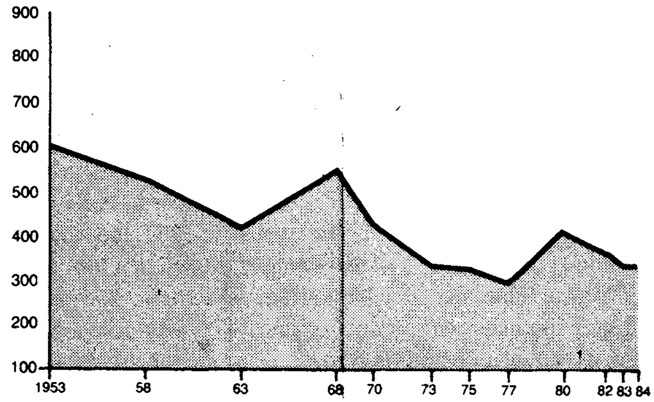
Worker productivity in the production of civilian transports has fluctuated between about 30 and 50 transports produced per 10,000 employees per year since 1968. Up until that time, productivity in the industry was increasing exponentially. This stagnation in productivity is shown in two different calculations. On the average, it takes 18 months to produce a civil air transport. On this basis, it seems reasonable to calculate productivity using a lag of at least one year between the shipment of the aircraft and the employment used to calculate the productivity in its production. So in Figure 5a, we show productivity measured in terms of the shipment of the number of civil transports divided by the number of employees in the industry of the previous year. In Figure 5b, we show the productivity in civilian transport production calculated without a lag. By either calculation, productivity has stagnated since 1968.

FIGURE 6
Helicopters per 1,000 employees



Productivity in helicopter production has fallen 80% since 1970. The number of helicopters, either military or civilian, produced per 1,000 employees is the measure used in Figure 6.

FIGURE 7
Aircraft production workers
(Thousands)



The number of production workers in the aircraft industry has fallen steadily since World War II. Industry employment of production workers is now about half what it was in 1953.

ports, and civilian helicopters has restricted funding for research and development and tool modernization in the major aerospace companies. According to an industry source, defense contracting is unprofitable today; as a result, the source reports, only the profits from commercial business are keeping these companies above water.

Nonetheless, today, aircraft production accounts for 55% of total aerospace industry employment, and even now, the collapsed aircraft industry has 10 times the number of machine tools as that portion of the aerospace industry that produces rockets, satellites, and the Space Shuttle. It has four times the number of machine tools as the ordnance industry.

Plant and equipment aging

Since the 1960s the physical plant and equipment in the aircraft industry has shrunk in total size, and efforts to modernize the stock of equipment have slowed. According to the *American Machinist Inventories of Metal Working Equipment,* the industry had 30% fewer machine tools in 1983 than in 1977, a drop from 139,200 metal-cutting and metal-forming machine tools to 97,708 (see Figure 7). Fully 65% of the 1983 inventory of tools, are considered "obsolete" by the standards of the machine-tool industry which regards equipment that is 10 years old, beyond its useful life. Prior to 1977, the percentage of aircraft-industry machine tools that were numerically controlled, that is, automated in some fashion, was growing exponentially. This modernization has since leveled off.

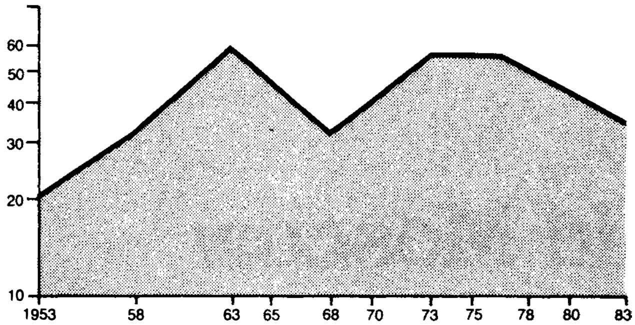
The number of machine tools per production worker in a metal-working industry gives a rough indication of its capital-intensity, that is, the ability of the production worker to transform nature. This ratio increased exponentially from the early 1950s until Defense Secretary Robert McNamara introduced the doctrine of Mutually Assured Destruction (MAD) in 1963 (see **Figure 8**). (The exponential growth appears in the logarithmic plot of Figure 8 as a straight line.) As James Schlesinger argued in his *Political Economy of National Security,* a MAD policy based on a sufficiently large fleet of ICBMs would make basic capital-goods industries unnecessary for national defense. Since the adoption of MAD, the number of aircraft industry machine tools per production worker has dropped 42%.

Some might argue that this drop is not important, citing the fact that newer numerical control machine tools can do the work of more than one of yesterday's tools. Actually, more modern tools have not been introduced in a significant way. This is recorded in the continual increase in age of aircraft industry machine tools since World War II. Even the rate of introduction of numerical control tools has slowed in recent years.

The argument that more modern tools mean that fewer total tools are required, is based on false, zero-growth premises. In a robust economy, the opposite is true: Capital-intensity will always increase, and in fact, will increase faster as man's increasing mastery over nature requires more advanced forms of technology.

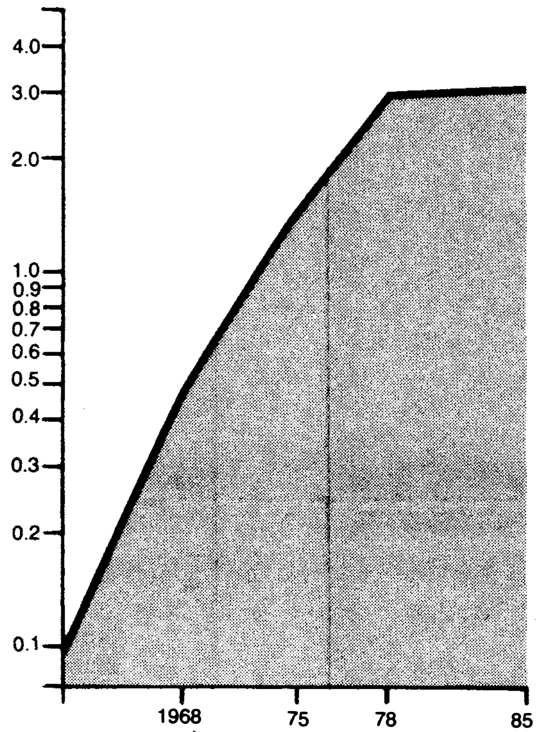
The number of numerically controlled (NC) machine tools per production worker in metal-working industries, gives a rough indication of the potential average energy flux density available to increase productivity.

FIGURE 8
Capital intensity: machine tools per 100 production workers



The number of machine tools per production worker measures the capital intensity of a metal-working industry, such as aircraft. Figure 8 shows that this capital-intensity increased at an exponential rate as shown in the logarithmic graph from 1953 until 1963, when Robert McNamara introduced the policy of mutually assured destruction. Since 1963, the number of tools per production worker, shown here as the number of tools per 100 production workers, has stagnated.

FIGURE 9
Capital intensity: numerical-control machine tools per 100 production workers



The number of numerically controlled, that is, automated machine tools per 100 production workers has leveled off in growth since 1977. Numerically controlled machine tools enable the production worker to organize a higher throughput of work in the aircraft industry shop. Numerical control saves time that is unfortunately wasted in the use of manually controlled machine tools: Time to set up the metal that the machine is to cut or otherwise work on, time to change tool bits, and other operations. As a result, the number of numerically controlled machine tools per production worker gives you an indication of the relative energy flux density available to the individual worker. A higher proportion of numerically controlled machine tools means that the cutting tool is in use a larger percentage of time, and therefore, the average energy flux density is higher.

In metal-working industries, energy flux density measures the concentration and rate of flow of energy through a surface being worked with, for example, a cutting tool. The instantaneous energy flux density of a tool, at its cutting edge, is very high. However, without numerical control, a machine is cutting only a small percentage of available machine time due to time wasted in setting up the piece of metal to be worked, in changing tool bits, and in a series of other time-consuming steps. As a result, the average energy flux density is low. The instantaneous energy flux determines what you can do; the average measures how often, in fact, you do it.

Numerical control automates some of the time-consuming manual work, preparatory to actual tool use. NC machine tools are capable of a much greater throughput than non-automated equipment; with numerical control, a cutting tool is spending more time cutting than otherwise, increasing the average effective energy flux density. The number of NC machine tools per production worker grew exponentially from 1963 to 1977 and then leveled off (see **Figure 9**).

There has been a steady decline in the percentage of aircraft industry machine tools less than 10 years old since World War II. At the end of the war, fully 98% of the industry-tool inventory was less than 10 years old. Until 1958, at least half of all tools fell into this category. By 1977, however, 77% of industry tools met the machine-tool industry definition of obsolete. The decline in this percentage since then, is only the result of the massive retirement of older equipment that occurred as the production of general aviation aircraft collapsed.

This pattern of increasing obsolescence has also occurred in the ordnance industry and in that portion of the aerospace industry devoted to the production of rockets and space vehicles. In fact, in the latter, fully 84% of all machine tools are over 10 years old. Although the sudden occurrence of six launch failures in the West since August 1985—two Titan 34Ds, two Arianes, the Space Shuttle Challenger, and the Delta—strongly suggest sabotage, the increasing obsolescence in the industry's equipment leaves open the possibility of another cause for the failures. Supporting the view that industry rocket-production equipment is obsolete, is congressional testimony by Martin Marietta and General Dynamics officials, that investment in new tools will be required to gear up Titan and Atlas rocket production.