Materials

Examinations and evaluations of the various aircraft metals systems found in the MIG-15, YAK-9, YAK-11, IL-10, and pieces of another MIG-15 have not only confirmed ATIC estimates made prior to the Korean police action, but have added appreciably to store of intelligence information elicited from other sources.

In the field of high temperature alloys ATIC predictions of 1948 and 1949 were confirmed when the British Nimonic systems were found. However, after metallographic examinations had been completed, it was affirmed that the Soviet turbine bucket material (Nimonic 80A) is superior to that made in both the U. S. and UK, which proved that the Soviets had been successful not only in theory but practice as well.

Other materials found in high temperature applications revealed the metallurgists of the USSR to be thoroughly capable of developing suitable alloy systems containing less critical materials. The turbine rotor disc, for example, in the RD-45 engine contained 66 percent less columbium and 25 percent less nickel than the conventional G-18-B alloy in the British Nene and J-48 engine made by Pratt-Whitney. Yet, creep and stress-rupture tests showed the Soviet alloy to be slightly superior to its UK and U.S. counterparts.

The aluminized low carbon steel found in the outer combustion chamber of Soviet jet engines was proof enough to the U.S. jet engine industry that many thousands of pounds of chromium and nickel could be saved yearly. (This step has now been implemented.) Other examples such as a ferritic turbine rotor disc found in later models of the VK-1, the use of 321 stainless steel in place of HR Crown Max in the turbine shroud, have pointed the way to possible conservation of critical materials in the U. S.

In the field of high strength-to-weight ratio metals, the cromansil steel samples removed from all the airframes and reciprocating engines received proved that the Soviets have developed a principal aircraft steel of their own. This composition, named after its alloying constituents, contains approximately 1 percent chromium, 1 percent manganese, 1 percent silicon, and approximately 0.30 carbon. 1.2 to 1.8 percents nickel and .001 boron are added when critical parts, e.g., the main wing spar of the MIG-15, landing gears, etc, are made of this steel.

Captured aircraft has made possible a complete study of this steel which compares favorably with the quality steel used in USAF aircraft.

The Soviet aluminum alloys have been copied from U.S. compositions, nearly all of which (including 75S) have been found, while magnesium has been found in only one critical application, the landing wheel of the MIG-15. Laboratory examinations of all the light metals used in critical areas reveal sound metallurgical and fabrication practices equal to and in places superior to those in the U.S. This was found to be the case in both wrought and cast parts, whereas in less critical applications evidence of poor heat treating, inferior welding, casting and forging were found, proving that the more skilled laborers are not utilized in the manufacture of parts not having a significant bearing on operational performance. The most appreciable lag in this connection lies in the field of heat-treating where Soviet practice, in numerous instances, has not shown application of theory contained in the Soviet overt metallurgical literature.

One of the most significant products to be elicited from the MIG-15 examination was the Bill of Materials covering the airframe.

This study has been made to fulfill the need for basic data that have been utilized to establish the following facts relative to the MIG-15 airframe:

1. Materials applications including the weights of each type of metals system (steel, aluminum, magnesium, etc) by composition and commodity form, viz, forgings, castings, extrusion, sheets, bars, and wire products.

2. Status of Soviet metallurgical technology and manufacturing methods employed.

3. Determination of the scopes of materials usage which in turn are being categorized to furnish quantitative data--the amount of raw stock to build one MIG-15--that can be statistically employed by other Intelligence and planning agencies to estimate the Soviet materials and industrial requirements necessary to support the USSR jet airframe program.

Comparison of the Soviet materials usage has revealed a number of interesting items. For example, the ratio of steel to aluminum percentages in the MIG-15 airframe is 0.90 as compared 0.33 in the F-80A, 0.4 in the F-86E, and 0.51 in the F-84F, which indicates Soviet preference to use as much steel as possible whereas U.S. practice tends to minimize the use of steel.

As a result of metallurgical analysis of captured aircraft and components from Korea, the Metallurgy Group has been able to confirm previous estimates as well as acquire new knowledge on the status of technology of aircraft metallurgy in the USSR. Future problems such as estimating the Soviet metallurgical capability to manufacture and support bombers, guided missiles, and other types of air weapons can now be undertaken with a fair degree of confidence.

Intelligence gained from Korea - Manufacturing Methods

Capture of hardware in Korea during the Korean police action gave USAF intelligence the first real insight into Soviet aircraft, engine and precision production methods and the level of industrial technology attained by the Soviets.

The captured MIG-15 permitted reconstruction of the MIG airframe production line, representing approximately one-third of the total floor area available in the USSR for aircraft assembly. Examination of physical items reflected the Soviet approach to production, confirming previous estimates: the emphasis placed on functional quality as a result of certain shortages in skills and machine tools; the consideration given to industrial technology and facilities during design and production planning of aircraft; the attempt to standardize with regard to numbers of aircraft types in production as well as materials of construction; a picture of the basic bottlenecks such as foundry and forge capacity; and the relatively greater number of man-hours required by the Soviets to produce than would be necessary in the U.S. Additional samples of Soviet airframes from Korea, for example, YAK-9, YAK-11, IL-10, and pieces of another MIG-15, assisted in substantiating the above conclusions.

Receipt of engines, both reciprocating and jet types, from Korea enabled ATIC to also piece together a picture of Soviet aircraft engine production methods and practices: the basic bottleneck in foundry and forge capacity which apparently influenced the decision not to use forged cylinder heads, and the conclusion that there was no appreciable lag in the Soviet jet engine technology as compared to the U.S.

In the field of Soviet precision production, such as instruments and ball bearings, receipts from Korea assisted materially in rounding out the overall picture of Soviet aircraft production technology: the uniform application of the Soviet principle of investing manpower and machine tools available to obtain the greatest return in end air weapon performance; the relatively high degree of adaptability of the Soviet aircraft industry, although lagging in certain areas, to "get around" production problems and to produce a product of adequate quality at a high rate of production.

As a result of analyzing the physical items from Korea, industrial engineers at ATIC now feel that they can now approach the next important question with some air of confidence -- could the Soviets with their level of technology produce a satisfactory heavy bomber and/or when?

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Intelligence Gained in Korea - Rubber and Plastic Materials

The most significant amount of technical intelligence on rubber and plastic materials to come out of Korea came from the salvaged MIG-15. Parts of YAK-9 and YAK-11 aircraft were obtained in Korea but these served only to confirm intelligence gained from similar complete aircraft previously obtained.

The MIG-15 denied some of our concept of Soviet workmanship heretofore thought to be generally inferior by U.S. standards. Rubber and plastic parts from this aircraft which were examined proved that the Soviets were capable of good quality workmanship when it was really necessary in critical applications. The MIG-15 tires are a good example of this. They are good tires made of good material and built to stand up well under hard service conditions, although they are not quite as good as our F86 tires.

Analysis of rubber and plastic parts from this MIG-15 helped to confirm the types of these materials available in the Soviet Union. The Soviet Union has similar types of rubber and plastic polymers to those available in the U.S. with the exception of those very recently developed in this country. Also confirmed were the Soviet methods of manufacture of rubber and plastic aircraft parts which were assumed and previously found to be largely the same as methods used in this country.

Technical intelligence gained from this MIG-15 was a good look at the Soviet jet aircraft's dependence on rubber and plastic materials. The Soviets tended to standardize on the use of only one or two rubber types throughout the aircraft where in U.S. practice as many as seven specialized types are used. The Soviets paid little attention to cold temperature properties of rubber. The same is true of plastics. One type is used for electrical insulation, one type for gasket material, etc. Also gained was a further look into the Soviet philosophy that a combat aircraft is a semi-expendable item. The plastic and particularly the rubber parts were made just good enough to last the expected life of the aircraft. Good workmanship and materials were used in very critical parts and poor work and material were used in less critical parts.

The estimates for this aircraft and presumably similar aircraft are that it will operate difficultly out of arctic bases and that the rubber parts will require considerable maintenance in any climate.

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