AID Report 61-100 7 July 1961

ITEM OF INTEREST

Prepared by

Science and Technology Section
Air Information Division

SUBJECT: Filter Clogging by TC-1 Jet-Fuel Sediment

SOURCE: Chertkov, Ya. B., N.A. Bogozin, and N.I. Marinichenko. Composition of deposits formed on fuel filters of transport jet aircraft. Khimiya i tekhnologiya topliv i masel, no. 4, Apr 1961, 57-60. TP315.K44 1961 (S/065/61/000/004)

A study of sediment from TC-1 fuel (ГОСТ 7142-54) which clogs fuel-system filters of transport jet aircraft and refueling unit filters is reported. The sediment formed on the 40-micron jet cruiser filter over 100 hours of flying time and on the filter of a refueling unit was separated ultrasonically from the filters in distilled water, washed with isopentane, dried at 105°C to constant weight, and analyzed.

On the fuel-system filter, sediment formed at 45-50°C, while in the refueling units sediment formation took place at the ambient temperature. Sediment in the aircraft had a very high ash content, 70 to 90%, and contained a high total of 44 to 57% ash-forming elements, such as Cu, Cd, Sn, Zn, Fe (originating presumably from the fuel system and engine), Si (storage and transportation contamination), Na (refining contamination), and some other elements present in small quantities. The high oxygen content of the sediment, 27 to 30%, is also to be noted.

The inorganic component of the refueling-unit sediment differed from that of the aircraft in higher Fe and Zn contents (predominantly in the ash) while the ash-forming elements remained at approximately the same level (46%). Zn and Fe apparently originated from the piping and the fuel containers. Na was found in much smaller quantities than in the aircraft sediment. In both cases considerable contamination by ground dust was found. The iron content increased with increasing density of the filters because of the small size of the iron particles, which pass through the 40-micron filter but are retained by the 10-micron one.

The organic component of the sediment amounted to 10-30% and consisted of the products of oxidation condensation of the nonhydrocarbon fuel components (oxygen, sulfur, and nitrogen compounds). The refueling-unit sediment contained a smaller amount of the organic component than the aircraft sediment, except in one case (a flight made in December) where the aircraft sediment contained high ash content and low organic-component content. The viscous organic component was found to bind the inorganic particles, thus

increasing the average size of the sediment particles. The inorganic particles on the other hand served as the centers around which the net structure of the clogging sediment formed. The authors suggest that jet fuels be stored in hermetic reservoirs provided with corrosion-resistant linings and that fuel to be dispensed be filtered until complete removal of mechanical impurities with particle sizes over 1 to 2 microns is achieved.

COMMENT:

The study seems important for its treatment of the problem of clogging of aircraft filters in spite of preliminary filtering through stationary and refueling-unit filters. It is similar to studies of Chertkov and associates on the thermal stability of jet fuels and filter clogging produced at elevated temperatures, i.e., over 140°C. In this case though, sediment formation was observed at much lower temperatures, and the complementary effect of both the organic and the inorganic components of the fuel on filter clogging is emphasized.

On the question of temperature, one of Chertkov's previous studies indicated that a considerable degree of deterioration of T-type jet fuels (e.g., T-1 and TC-1) can be expected to begin at 150° C and reach a maximum at 200°C. (See: AID Report 60-66, 7 Oct 1960.) However, in the present study the fuel contained a suspension of finely distributed metals and their corrosion products. Although the catalytic effect of wear and corrosion sludge constituents like Cu, Fe, and Pb could come into consideration, no discussion is given by the authors of the article on this possibility. It should be noted that on the one hand the authors state that iron oxide particles are smaller than the others, but can be "retained on the 10-micron filter", while on the other "complete removal from the fuel of mechanical impurities larger than 1 to 2 microns" is suggested. Though the latter measure is evidently aimed at reducing the net-structure formation effect, it could also contribute to reducing the possible catalytic effect. Further information on the subject will be closely followed. Other AID Reports related to the subject in addition to the one quoted above are SIR 3198, 4 Dec 1959; AID Report 60-43, 4 Aug 1960; and AID Report 60-58, 27 Sep 1960.