OXC-3818-62
10 August 1962
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MEMORANDUM FOR: Chief, Development Division, OSA/DD/R

SUBJECT : Preliminary Evaluation of the OXCART Contrail Problem

REFERENCE : OXC-3538-62, dated 23 May 1962, Memo for Chief, Development Branch, DPD/DD/P

1. The previous paper, referenced above, is a general discussion of the subject of possible contrail formation at altitudes between 80,000 and 100,000 feet. This paper presents the results of further investigation, with most of the information summarized in graphic form. At our request, the Air Weather Service Climatic Center compiled the necessary temperature data in statistical form. This was no small task, since representative data could be obtained only by extracting thousands of interpolated readings from individual analyzed weather charts.

2. Figures 1, 2, and 3 are cumulative frequency graphs of the temperature distribution near the 100,000 foot level, between latitudes of 50° to 80° North. Individual charts are presented for the summer period, the winter cold period and the winter warm period. Separate charts are presented for the two types of winter temperature regimes because the temperature distribution during that season is markedly bimodal. The colder temperatures are believed to prevail about two-thirds of the time, while the warmer temperature regimes prevail during the remaining third. The changes from warm to cold, and vice versa, take place rapidly. Thus, the arithmetic mean of the observed temperatures occurs only a small percent of the time.

3. Figure 4 is a graph of the probability of contrail formation versus altitude, temperature and relative humidity. The various contrail zones determined from this graph are indicated on figures 2 and 3. None of the temperatures plotted on figure 1, fall within the contrail range.

4. Figure 5 is a graph of the probability of contrail formation versus altitude and latitude along certain longitudes. The longitudes were selected on the basis of proximity to possible OXCART mission tracks and availability of high altitude temperature data. The chart is applicable to the winter period, October thru March, only. During the remainder of the year, temperatures at the altitudes and latitudes considered are not cold enough for contrails to form. Both figures 4 and 5 are based on data and computations pertaining to aircraft with turbojet engines, using JP-4 fuel.

5. The most definitive statement that can be made at this time is that, during the winter months, there is at least a 30% probability that the A-12 will produce contrails over a significant portion of a polar mission route. A critical factor in the detection of these contrails, by an observer on the ground, would be the degree of illumination at the altitude where the contrails were produced.

6. The weakest link in any evaluation of this problem is the lack of specific flight data from the A-12. Before the critical contrail formation temperatures applicable to the A-12 can be determined, numerous positive and negative contrail reports, coupled with specific altitude and temperature data, must be obtained over the full operating range of this aircraft. These observations should be made with the A-12 equipped with the engines and fuel it will use during operational missions.

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Major USAF
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