CURRENT JET FUEL TRENDS

Paul P. Campbell
United Airlines (Retired)

Relaxation of the limits in the widely used Standard Specification for Aviation Turbine Fuels ASTM D1655 for

a) Maximum aromatics content from 20 to 25 percent and

b) Minimum smoke point from 20 to 18

in 1976 and 1977 carried the proviso that the customer must be advised of supply of product within the relaxed range, i.e., over 20 percent aromatics or under 20 smoke point. This is frequently referred to as reportable fuel.

The amount of reportable fuel delivered to United Airlines gradually increased from a quarterly average of slightly over one percent total requirement for the year 1974 to a maximum of 17 percent in the third quarter 1978. At that time, the four quarter moving average reached a peak of slightly over 15 percent. Two thirds of this increase has taken place since the third quarter 1977 when Alaska North Slope crude shipments began to arrive at United States West Coast refineries. As this crude has fanned out across the country and fuel suppliers have developed improved refining techniques, the amount of reportable product was reduced to 7 percent in the first quarter 1979, the latest quarter for which data are available.

Information on United's fuel is drawn from a computerized data bank with input from fuel supplier refinery batch analysis reports. Refineries supplying United represent an estimated 60 to 70 percent of total United States commercial jet fuel production. Similar data are produced by IATA for fuel delivered to overseas carriers outside the United States. This information is developed for individual airports from data supplied by the various supplying oil companies. For 1977 and 1978, the amount of reportable fuel delivered to IATA carriers outside the United States fell in the same range as that experienced in the United States two to three years earlier. In 1979, it increased to between 7 and 8 percent, very close to the latest figure reported by United for domestic fuel.

Most reportable fuel is that with high aromatics content. While some fuel has both high aromatics content and low smoke point and some fuel has low smoke point only, such fuels represent less than 20 percent of the total amount reportable on the average. This has reached a high of 30 percent.

During the period under discussion (1974 - 1979) the average aromatics content for product for all refineries in the United data bank has increased from 16 percent to 17.5 percent. During most of this period, the aromatics content of fuel supplied to United has run somewhat below the average for all refineries. This situation has been reversed since 1977 as the effect of Alaska North Slope crude became more prominent. United's fuel is now running almost one percent higher in aromatics content than that from all refineries. This is believed to be the result of the very high proportion of United's fuel drawn from West Coast stations.

Despite the pronounced upward trend in aromatics content, during this five year period, the smoke point for all refineries has held steady between 22.5 and 23. This was also true for United's consumption until 1977 when it dropped to the range of 21.5 to 22.

It is evident that the arrival of Alaska North Slope crude in 1977 had a significant impact upon the aromatics content of jet fuel supply at West Coast points with less effect upon the entire United States domestic market. This increase in aromatics has not been accompanied by a corresponding reduction in burning quality as measured by smoke point. There has been a reduction of .6 smoke point on the average for United's fuel.

Looking at hydrogen content as a measure of burning quality, the all refinery average calculated hydrogen for 1978 was approximately 13.7 percent. The relationship between hydrogen content and aromatics content shows a slope of .043 percent reduction in hydrogen for one percent increase in aromatics. This would imply that the average hydrogen content of United's fuel has declined 0.1 percent between 1974 and 1979. Similar analysis for the hydrogen content - smoke point data indicates a smaller change. The slope here shows a .053 percent hydrogen reduction for a reduction of one smoke point. Thus the .6 reduction in smoke point between 1974 and 1979 would imply only a .03 reduction in hydrogen.

Certain trends in other specification parameters indicated by all the refinery data during the past three years include:

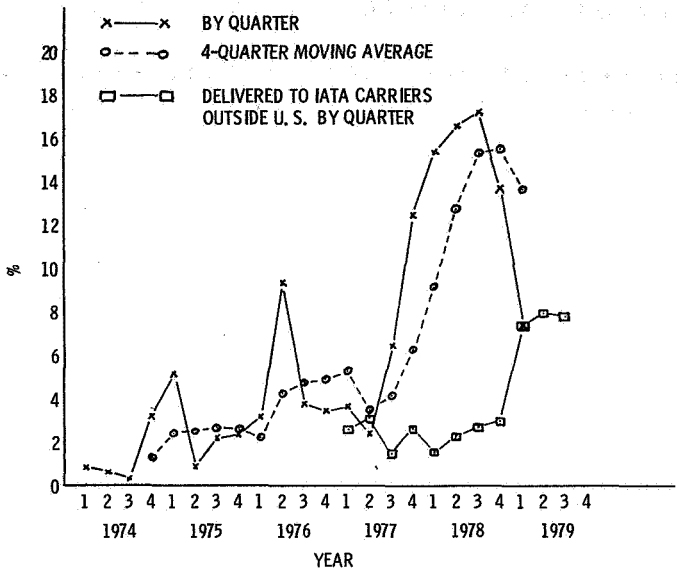
- Increase in average freezing point from -50°C (-58°F) to -47°C (-52°F).

- Increase in average flashpoint from 48° C (118° F) to 52° C (126° F)

- Slight increase in density of .6 percent

Total sulfur content has been holding steady at .06 percent after a gradual increase from .04 percent over a period of several years.

REPORTABLE FUEL
DELIVERED TO UNITED AIRLINES



AVERAGE AROMATICS CONTENT AND SMOKE POINT