A View of the Mustang:

by J Leland Atwood, Vice-President, North American Aviation

The Mustang aeroplane, authorized and ordered by the British Purchasing Commission in April 1940, did turn out to be a significant factor in aviation and military history. Its day to day service and performance in the latter stages of World War Two and its approach to the speed plateau that faced the reciprocating engine propeller driven designs of 1903 to 1945 did make it a sort of benchmark and paradigm standard for that class of aircraft.

Not being a qualified pilot, I cannot offer any comment on its military and combat characteristics except for general performance parameters, but I have every reason to believe that its armament, flying characteristics, and general utility were satisfactory and at least average for the time and conditions. Its principal points of merit were more related to basic engineering factors which were speed and range. These were interrelated, in that, range over enemy territory without a speed advantage could be almost sacrificial.

There is a fine article in the June 1995 issue of the Aeronautical Journal of the Royal Aeronautical Society by David Lednicer entitled "A CFD Evaluation of Three Prominent World War 11 Fighter Aircraft." As indicated, he employed modern computational fluid dynamics and finite element analysis to compare the Spitfire, FW190, and the Mustang. In summary, he rated the Mustang as 20 to 30 MPH (32-48km/h) faster than the others, and defined its drag from the radiator cooling system as only 2 to 3% of the total drag.

The achievement of this low cooling drag has a legitimate background of research and analysis, primarily from British sources most prominently presented in Royal Aircraft Establishment Report No 1683 by F. W. Meredith, BA, in August 1935. 1 had read a modified version of this report, published about 1939, and offered the rear fuselage mounting of the radiator, which I believed would optimize the potential of the Meredith Effect, in my representations to the British Purchasing Commission in 1940. This, along with other considerations, led to the initial order for the original Allison powered Mustang.

Rather interestingly, a considerable number of competent participants and observers have credited the low drag to other elements such as the wing section profile and the algebraic method of fairing the fuselage lines, etc. Lednicer's analysis supports the cooling drag reduction conclusion, although he does assign a small drag increment to the somewhat steeper slope of the Spitfire pilot's windshield.

In recent years, during retirement, I have spent some time and effort to trace the record of the cooling drag research and have learned quite a lot. David Birch of the Rolls-Royce Heritage Trust and author of Rolls-Royce and the Mustang has most generously supplied me with copies of some very pertinent documents involving Royal Aircraft Establishment reports, patents, and wartime research and typed reports from the Rolls Experimental Department then at Hucknall. Among these papers are RAE Report No 1702 by R. S. Capon, OBE, BA, FRAeS, dated 1936, in which he extends and amplifies Meredith's thesis, British Patents No #471, 371 and No #472, 555 in 1937 by Ellor and de Paravicini, and other papers on the same subject.

It is apparent that the principle of cooling drag reduction by restoration of the momentum of the air after it passed through the radiator was well known before the war and had been applied in aircraft configurations of the Spitfire, Me 109 and others, but it seems that, as is often the case, "the Devil was in the Details." Lednicer's analysis shows aerodynamic losses in the Spitfire's radiator air intake, and a Rolls-Royce report in July 1942 estimates that the Spitfire could have gained 13 MPH (20km/h) by utilizing a more complete air exit closure.

In all candor, I think the Mustang intake would probably have been little better except that flow separation created a serious vibration and irregular buffeting which forced a lot of wind tunnel work and detail improvement. I credit the North American Aviation aerodynamics and powerplant installation engineers with improving the air intake and smoothing the airflow so that most of the potential of the Meredith method could be realised. The difference in speed between the Spitfire Mk IX and the Mustang P-51D with the same engine is generally recorded and agreed as 405 vs. 437MPH (652 vs. 703km/h) most of which can be attributed to the difference in cooling drag at high speed.

The End