can be further simplified by reducing it from a 3-D to 2-D desktop calculation by the TARWI. The robustness of the latter for not-so-slender swept trailing edge wing bodies such as the WIM1T needs to be assessed.

5.3.3.6 SSLV WALL-INTERFERENCE COMPUTATIONS

Computations of the Tunnel 16T wall interference were part of an effort to study the difference between existing wind-tunnel database and flight-measured, transonic aerodynamic loads experienced by the SSLV during ascent. The AEDC wall boundary condition was incorporated into the NASA/ARC OVERFLOW code (Buning, *et al.* [31]). The computations were all performed with the OVERFLOW code which was used to solve the TNS equation with a Baldwin-Lomax turbulence model in all regions except the far field. All tunnel computations were performed with the AEDC wall boundary condition. Wall interference computations were performed at one high subsonic freestream Mach number and at two low supersonic freestream Mach numbers, M = 1.05 and 1.25. The former Mach number led to Group 3 flow.

A comparison of free-air and tunnel Mach number contours is shown in Figure 5.50 for $M = 1.05$ and $\alpha = -4.66°$. The contours are shown for the lateral plane of symmetry with subsonic flow shown in grey, while supersonic flow is shown in colour. The launch vehicle profile is shown in white along with supersonic flow that exceeds $M = 1.1$. The bow shock and downstream Mach contours are seen to obliquely cross the line where the wind-tunnel walls would be located.

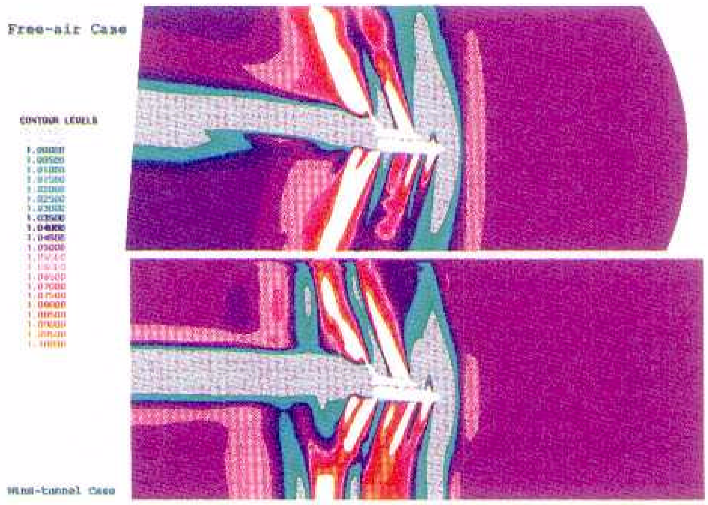

Figure 5.50 : Computed Mach number contours on the plane of symmetry, M = 1,05, $\alpha = -4.7$ deg.

A comparison of the Orbiter forebody (all surfaces except the base and top of the body flap) normal force and pitching moment for three 16T wind-tunnel tests is shown in Figure 5.51 along with the numerical results. The three wind-tunnel tests show very interesting trends. At $M = 0.95$ and $M = 1.25$, the data from IA-156 and IA-105A, which were conducted in 1977, agree very well thus indicating the lack of wall-interference effects at these Mach numbers. The data at $M = 1.05$ for the two-percent model (IA-156, blockage ratio = 0.3 percent) show a negative increment in forebody normal force, and a positive increment in forebody pitching moment, relative to the three-percent model (IA-105A, blockage ratio = 0.7%). These increments are attributed to wall interference effects in the data from the three-percent model.

In addition to the wall-interference effect, the bias between the recent IA-613A data and the two older tests is also very interesting. The difference between the test results could be due to the improved fidelity of the blockage between the Orbiter and ET at the aft attach station for the IA-613A test. Regardless of the cause, the data have moved closer to the Orbiter flight data.

The computed normal force and pitching moment from the free-air and wind-tunnel CFD solutions at $M = 1.25$ are in very good agreement with each other and the IA-613A data, indicating the absence of