3.4 Establish Position of Target at Time of Launch

As given in Section 2.5, $t_{if} = t_{2f} - t_t - t_w - t_{ascent}$ .Since the final orbit is circular, $e_f = 0$ and the eccentric anomaly equals the true anomaly ($E_{2f} = \theta_{2f} = 5.28°$). Therefore t_{2f} is simply $\tau_f(5.28)/360 = 92.58$ sec. Time in the transfer orbit has been determined to be 3028.5 seconds. Time in the waiting orbit may be taken as the number of revolutions in this orbit multiplied by its period, as the oblateness correction is very small. The time of ascent to 600 km for Ariane is 500 sec.

$$t_{if} = 92.58 - 3028.5 - 5801\ n - 500$$
$$t_{if} = -5801\ n - 3435.92$$
$$\theta_{if} = E_{if} = 360(t_{if}/\tau_f) \text{ as } e_f = 0.$$

The position of the target at the time of launch is established as a function of the number (n) of revolutions in the phasing orbit.

$$\theta_{if} = 360(-5801\ n - 3435.92)/6312$$

3.5 Establish Time Launch Site Crosses Orbital Plane

For this sample case the oblateness corrections are taken as negligible. For the northerly launch from Kourou,

$$t_L = (1/\Omega_e)[\Omega - \Lambda_L + \sin^{-1}(\tan L_L/\tan(180 - i))]$$
$$t_L = (1/\Omega_e)[\Omega - \Lambda_L + 0.88]$$
$$\Omega_e = 4.1781\ E-3$$
$$\Lambda_L = 307.23$$

3.6 Match Launch Time with Time Launch Site Crosses Orbital Plane

As developed in Section 2.7 this comprises setting $t_1 = t_L$.

$$t_1 = t_{if} + t^* = -5801\ n - 3435.92 + t^* = t_L$$

The time t^* for the satellite to travel from the projection of the perigee radius in the equatorial plane to the vernal equinox direction is also a function of the right ascension of the ascending node.

$$t^* = \frac{\tau_f}{360}\tan^{-1}(\tan\Omega/|\cos i|)$$

$$-5801\ n - 3435.92 + \frac{\tau_f}{360}\tan^{-1}(\tan\Omega/|\cos i|) = \frac{1}{\Omega_e}(\Omega - 306.35)$$

$$\Omega - \Omega_e\frac{\tau_f}{360}\tan^{-1}(\tan\Omega/|\cos i|) = \Omega_e(-5801\ n - 3435.92) + 306.35$$

This may be solved iteratively simply by the x = g(x) method.

$$\Omega = \tan^{-1}\frac{(6.04625\ \tan\Omega)}{13.65} - 24.2372\ n + 292$$

For each integer n a particular value of Ω results. Figure 3-1 gives some solutions for this sample case. Only the values corresponding to integer n are actual solutions.