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# Air-Spacecraft of the Third Millennium

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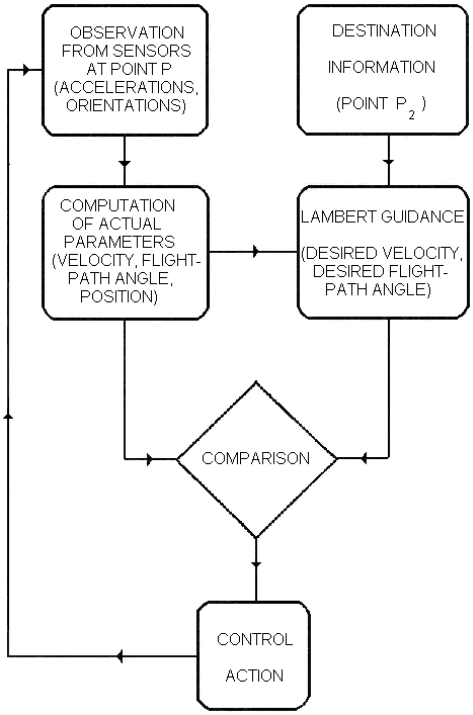


**Flow chart of the Lambert scheme**

This paper described the salient features of *Air-Spacecraft of the Third Millennium* (ASTM), which should travel, partly, in space in the ballistic orbits; this technology, already, being used in targeted spacecrafts. The product satisfied most of the requirements of *green engineering*. Technological benefits included**:**

*a)* Decrease in travel time — *comfort*
*b)* Minimization of fuel consumption (most of the flight in the ballistic phase, consuming no fuel), which could be passed on to customer as reduced ticket price — *economical/environmentally friendly*
*c)* Reduction in average engine noise during the flight (most of the flight in the ballistic phase, during which the engines shut down) — *comfort*
*d)* Absence of turbulence (most of the flight in the ballistic phase in space) — *comfort*
*e)* Reduction of engine-failure risk (engines are not required in the ballistic phase) — *safety*

ASTM should have its payload as passengers and cargo, and could reach New York from Karachi in less than an hour; the fare charged might be comparable to what was, currently, being charged by airlines for a trip from Karachi to Dubai. ASTM could have its own Inertial Navigation System (INS), in addition to Global Positioning System (GPS). These systems would generate navigational information, whereas the desired trajectory, drawn-up in the elliptic-astrodynamical-coördinate mesh (the ballistic orbit being ellipse), should be computed by a combination of the multi-stage Lambert scheme (incorporating cross-range error) and the multi-stage-Q system. Corrections to be achieved by applying control laws — the extended-cross-product steering and the ellipse-orientation steering. Final check, ascertaining that the corrections had been achieved, was made possible by employing the dot-product steering. For cargo transport, this seemed to be an ideal solution. Even before the necessary database is established for human travel, ASTM could be used to transport checked baggage of passengers (earlier than their own arrival at destination), leaving more space in conventional aircrafts for passengers, thus reducing fuel-per-passenger ratio. The real challenge, on the other hand, lay in modeling the effects of enhanced and reduced gravity on physiological systems, *e. g.*, functions of brain, heart and spinal column as well as flow of blood, *etc.*, in particular, for the pediatric and the geriatric populations. Some theoretical estimates had, already, been made. During reduced gravity, there would be increased blood flow to upper torso and brain. Moiré fringe topography and rasterstereography could be used to study and model changes in shapes and curvatures of upper torso during altered-gravity situations. In conclusion, ASTM had the potential to take over the travel market, after it passed through the designing and the development phase. The processes involved in the proposed product are *efficient* (economical, time saving) as well as *effective* (safe, environmentally friendly).

*Keywords***:** Green engineering, multi-stage-Lambert scheme, multi-stage-Q system, cross-product steering, dot-product steering, ellipse-orientation steering, elliptic-astrodynamical-coördinate system
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