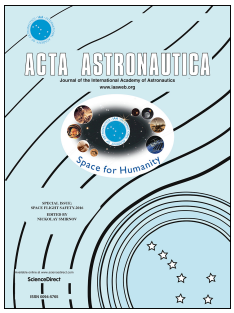
Accepted Manuscript



Geosynchronous inclined orbits for high-latitude communications

E. Fantino, R.M. Flores, M. Di Carlo, A. Di Salvo, E. Cabot

PII: S0094-5765(17)30716-6

DOI: 10.1016/j.actaastro.2017.09.014

Reference: AA 6465

To appear in: *Acta Astronautica*

Received Date: 25 May 2017

Revised Date: 9 August 2017

Accepted Date: 12 September 2017

Please cite this article as: E. Fantino, R.M. Flores, M. Di Carlo, A. Di Salvo, E. Cabot, Geosynchronous inclined orbits for high-latitude communications, *Acta Astronautica* (2017), doi: 10.1016/j.actaastro.2017.09.014.

Geosynchronous inclined orbits for high-latitude communications

E. Fantino[a], R. M. Flores[b], M. Di Carlo[c], A. Di Salvo[d], E. Cabot[e]

[a]*Space Studies Institute of Catalonia (IEEC), Gran Capitán 2-4, Nexus Building, Office 201, 08034 Barcelona (Spain)*
[b]*International Center for Numerical Methods in Engineering (CIMNE), Polytechnic University of Catalonia (UPC), Building C1, Campus Norte, UPC, Gran Capitán s/n, 08034 Barcelona (Spain)*
[c]*Department of Mechanical and Aerospace Engineering, University of Strathclyde, 75 Montrose Street, Glasgow G1 1XJ (United Kingdom)*
[d]*NEXT Ingegneria dei Sistemi S.p.A., Space Innovation System Unit, Via A. Noale 345/b, 00155 Roma (Italy)*
[e]*School of Industrial, Aeronautical and Audiovisual Engineering (ESEIAAT), Polytechnic University of Catalonia (UPC), Colom 11, 08222 Terrassa (Spain)*

Abstract

We present and discuss a solution to the growing demand for satellite telecommunication coverage in the high-latitude geographical regions (beyond 55°N), where the signal from geostationary satellites is limited or unavailable. We focus on the dynamical issues associated to the design, the coverage, the maintenance and the disposal of a set of orbits selected for the purpose. Specifically, we identify a group of highly inclined, moderately eccentric geosynchronous orbits derived from the Tundra orbit (geosynchronous, eccentric and critically inclined). Continuous coverage can be guaranteed by a constellation of three satellites in equally spaced planes and suitably phased. By means of a high-precision model of the terrestrial gravity field and the relevant environmental perturbations, we study the evolution of these orbits. The effects of the different perturbations on the ground track (which is more important for coverage than the orbital elements themselves) are isolated and analyzed. The physical model and the numerical setup are optimized with respect to computing time and accuracy. We show that, in order to maintain the ground track unchanged, the key

*Corresponding author: elena.fantino@gmail.com (E. Fantino)