Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Modeling of the Lightning Plasma Channel Stroke to a Spacecraft during Ascent ALFONSO TARDITI, JOHN NORGARD, ESCG - NASA Johnson Space Center — Lightning protection is an important aspect of modern aerospace design: the increased use of composite materials (*vs.* metals) reduces the shielding and robustness of the conducting path that the outer shell of a vehicle can present to a lightning discharge. A spacecraft during ascent becomes vulnerable to lightning strokes immediately after leaving the launch pad: in addition to natural lightning conditions, there is the possibility of triggered lightning events, caused by a perturbation of the atmospheric electric field [1]. The purpose of this study, in support of the NASA Constellation program, is to determine the evolution of the plasma current and its distribution on the spacecraft surface. Following earlier "gas dynamic" approaches [2], the model considers a plasma channel attached to the ascending spacecraft after a return stroke is established. The conductive exhaust plume [3] is an integral part of the model. The *NIMROD* 3D plasma fluid code [4] is used to model the plasma channel, reproducing the full transient due to the self-consistent magnetic field and the possibility of sweeping of the attachment point along the moving structure [5]. **References**: [1] M.A. Uman, Proc. IEEE, 76, 1548 (1988). [2] V. A. Rakov, M. A. Uman, IEEE Trans. EMC, EMC-2940, 403 (1998). [3] J. D. Norgard, G.S. Smith, IEEE Trans. EMC, EMC-29, 157 (1987) [4] C. R. Sovinec *et al.*, J. Comput. Phys. 195, 355 (2004). [5] Larsson *et al.*, J. Phys. D, 33, 1876 (2000)

Alfonso Tarditi
ESCG - NASA Johnson Space Center

Date submitted: 15 Sep 2009 Electronic form version 1.4