Performance Prediction Of A Folding Fin Aircraft Rocket Using Datcom, Sens5D, And 6Dof Gem

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Abstract:
An approach for the performance prediction of a Folding Fin Aircraft Rocket (FFAR) is presented. This prediction was compiled by calculating the gravimetrics, aerodynamics, and trajectory for a FFAR. The trajectory analysis utilized four computer codes: Rogers Aeroscience Rocket Performance Software, NASA Wallops Sens5d Trajectory and Wind-Sensitivity Calculations for Unguided Rockets, the United States Air Force (USAF) Stability and Control DATCOM, and the NASA Langley Research Center LRC-MASS program (GEM). Computations were performed for a rigid body configuration. This analysis was compared to radar data collected during the flight of a FFAR launched in February 1997 at the Poker-Flat Research Range. The comparison shows good agreement between the flight data and the predicted apogee and impact point of the vehicle. In addition, static and dynamic stability analyses were completed for the FFAR.

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The Mk 4 Folding-Fin Aerial Rocket (FFAR), also known as Mighty Mouse, was an unguided rocket used by United States military aircraft. 2.75 inches (70 mm) in diameter, it was designed as an air-to-air weapon for interceptor aircraft to shoot down enemy bombers, but primarily saw service as an air-to-surface weapon. The advent of jet engines for fighters and bombers posed new problems for interceptors. With closing speeds of 1,500 ft/s (457 m/s) or more for a head-on interception, the time available - Variation in rocket motor performance: because of the tolerance in rocket-motor design, propellant properties, and manufacturing, the total impulse of the rocket motor may vary. - Thrust and fin misalignments: it is an important source of dispersion in case of unguided rockets "flying on open loop". In order to predict the trajectory of an unguided artillery rocket, six degrees of freedom 6-DOF mathematical model is presented in [1,6], where the block diagram of this model is shown in Fig. 1. In this study, a trajectory calculation using a 6-DOF model was developed and applied for 122 mm unguided artillery rocket. All aerodynamic forces and moments coefficients of the given shell are calculated using Missile Datcom.