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ICBM reentry vehicle navigation system development at Honeywell

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Abstract:

Development of navigation systems for reentry vehicles launched by ICBMs was initiated at Honeywell in 1977. Maintaining an accurate navigation solution through the spinning coast phase, and high acceleration reentry phase, of a reentry vehicle (RV) flight was enabled by the development of the Ring Laser Gyro. The original product, the Dormant Inertial Navigation System (DINS), provided navigation for the US Air Force Advanced Maneuvering Reentry Vehicle (AMARV). The DINS, which employs strapped down technology, demonstrated the ability of the Ring Laser Gyro to accurately measure the millions of degree's rotation experienced in the coast phase of flight. The laser gyro's minimal sensitivity to acceleration, and the excellent linearity of the Bell XI accelerometer, provided the needed reentry flight navigation accuracy. The DINS development was followed by the USAF Advanced Inertial Measurement Unit (AIMU) project. The next generation of the laser gyro, with advanced radiation hardening, was introduced on this program. In 1991, the Lockheed Missiles and Space Division (now the Lockheed Martin Missiles and Space Company) contracted Honeywell to develop an instrumentation package for the US Navy Trident system reentry vehicles. The Reentry Inertial Measurement Unit (RIMU) program presented unique design constraints based upon the need to identically match the physical properties

of the predecessor IMU that was based upon spinning mass gyros and gimbale platform technology. The Honeywell RIMU has performed reliably and accurately on several Trident flights. Through experience on the AMARV, AIMU, and RIMU projects, Honeywell has achieved significant advancements in the real-time navigation software for strapped down technology. We have also developed the software tools to enable system and sensor configuration design trades for new missions. Additionally, our Post Flight Analysis software tool development, which started on the DINS program, has matured on the RIMU program. This paper presents the history of, and lessons learned during, the development of hardware and software for reentry vehicle navigation as conducted by Honeywell Space and Strategic Systems from 1977 through 1997. This experience provides the basis for a new generation of navigation systems for improved ballistic missile performance

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