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Title: On-Orbit Ephemeris Determination with Radio Doppler Validation

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On-Orbit Ephemeris Determination with Radio Doppler Validation

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Abstract:

Multiple CubeSats are often released from the same host spacecraft into virtually the same orbit at nearly the same time. A satellite team needs the ability to identify and track its own satellites as soon as possible. However, this can be a difficult and confusing task with a large number of satellites. Los Alamos National Laboratory encountered this issue during a launch of LANL-designed CubeSats that were released with more than 20 other objects. A simple radio Doppler method used shortly after launch by the Los Alamos team to select its satellites of interest from the list of available tracked ephemerides is described. This method can also be used for automated real time ephemeris validation. For future efforts, each LANL-designed CubeSat will automatically perform orbit determination from the position, velocity, and covariance estimates provided by an added on-board GPS receiver. This self-determined ephemeris will be automatically downlinked by ground stations for mission planning, antenna tracking, Doppler-pre-correction, etc. A simple algorithm based on established theory and well suited for embedded on-board processing is presented. The trades examined in selecting the algorithm components and data formats are briefly discussed, as is the expected performance.