A Unique Scheme for NavIC and INS Measurements Synchronization for High Accuracy Integrated Navigation System

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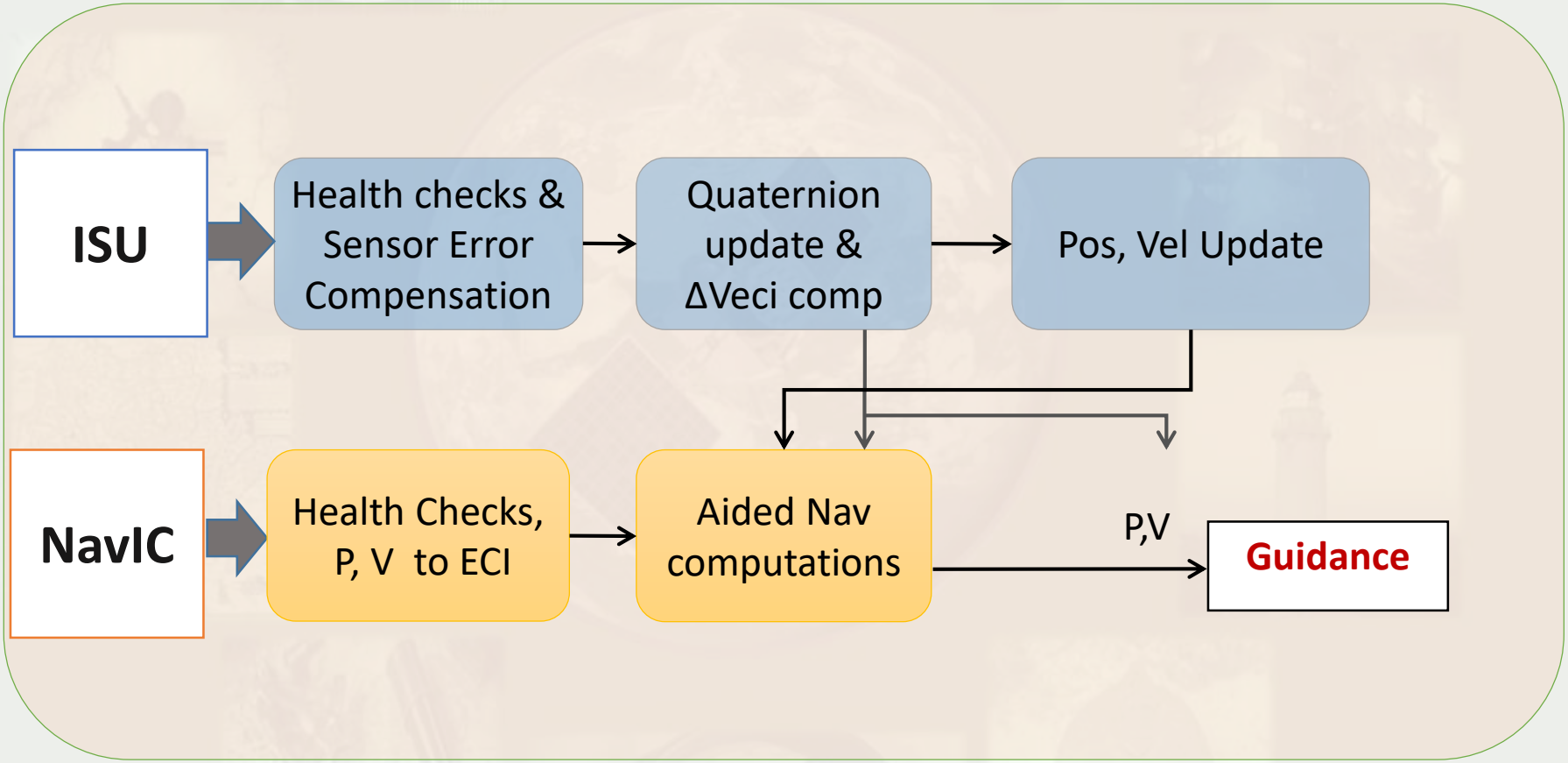
Introduction

- In launch vehicle, integrated navigation system is used for high accuracy navigation, especially for multi orbit missions
- INS error are estimated using NavIC/GPS solution and these errors are periodically corrected to ensure high accuracy
- The guidance algorithm uses aided state vectors to achieve mission accuracy in meter level
- In order to have proper integration of INS and NavIC, the measurements from these complimentary systems shall be synchronized

Integrated Navigation System

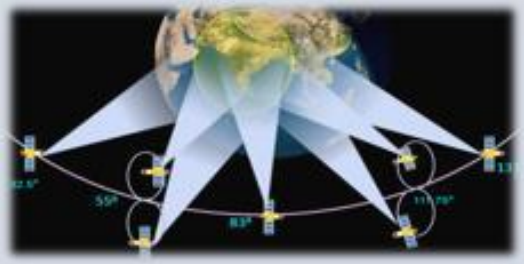


Synchronization Problem in INS-NavIC Systems

- Launch vehicle avionics system has two modes of operation, flight mode and pre-flight/monitor mode.
- In flight mode, the on-board computer (OBC) is the master clock.
- All remote terminals (including navigation system) has to be synchronized with OBC during flight mode
- Integrated navigation algorithm requires synchronization between INS and NavIC receiver measurements; avoiding extrapolation of data from one system to other.
- In pre-flight mode (when OBC is not active), NavIC receiver measurements are to be decoupled from OBC timeline.
- Receiver time base (TIC) shall be dynamically adjusted during the mode transition(flight mode/monitor mode), ensuring continuous NavIC solution availability.

New Scheme for NavIC-INS Measurement Time Synchronization

- In the new method, the total timing is based on OBC clock
- The uncertainty on OBC clock is measured using high stability NavIC receiver clock (TCXO/OCXO) and is accounted in NavIC measurements.
- Time base signal(TIC) is continuously steered to align with OBC timer during flight mode
- Integrated Carriers Phase measurement time interval may slightly vary depending on OBC clock drift.
- Drift in OBC clock is measured using high stability NavIC clock and this information also used for velocity computation.
- This achieves the INS-NavIC measurement synch with an accuracy of 50ppm (The accuracy of OBC clock) and NavIC measurement accuracy of <1ppm(accuracy of TCXO)



Thank You