ARIS - Localization of a Sounding Rocket via GPS

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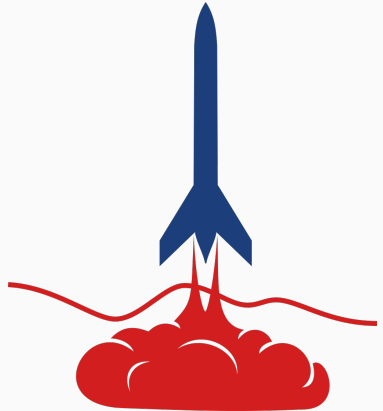
Interim Presentation Bachelor Thesis

Table of Contents

Definition of Task

Akademische Raumfahrt
Initiative Schweiz

Source: spaceportamericacup.com

Spaceport America Cup

Task

- Evaluate GPS positioning for a sounding rocket

- Determine external and internal disturbances

- Find error mitigation methods

- Demonstrate feasibility of one method

Requirements

- Positioning Standard Deviation(1σ): 1m

- Min. Update Interval: 60s

- Max. TTFF after Burnout: 2s

- Max. Uplink Datarate: 2kbit/s
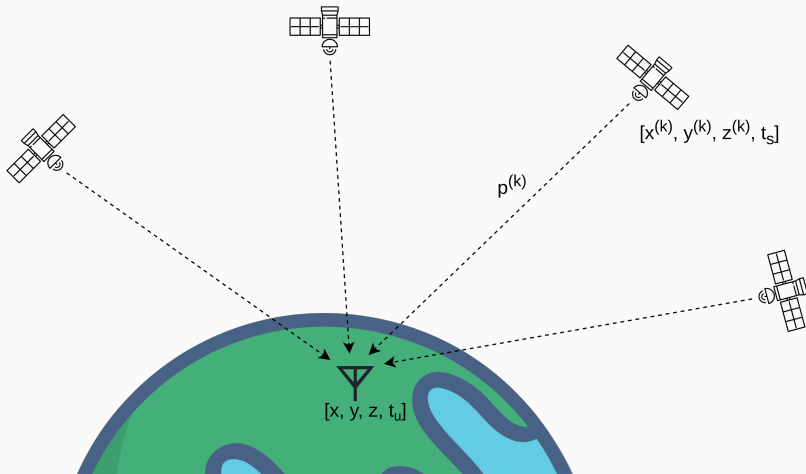
GPS Concept and Errors

GPS Overview

- Space Segment

    31 Satellites (min. 24) in
    Medium Earth Orbit

- Control Segment

    Monitorung and Maintanance
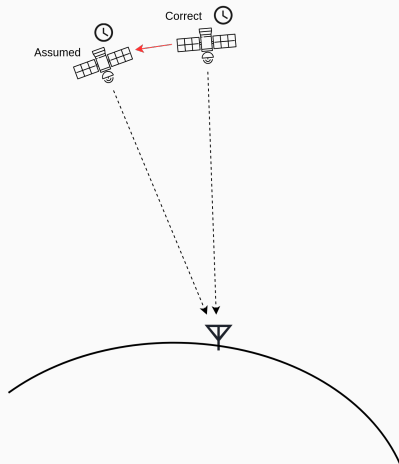   Stations

- User Segment

    Civil and Military Receivers

Source: gps.gov

$[x^{(k)}, y^{(k)}, z^{(k)}, t_s]$

$p^{(k)}$

$[x, y, z, t_u]$
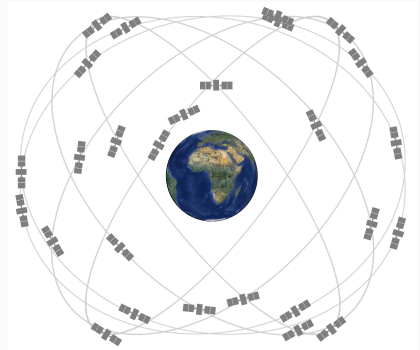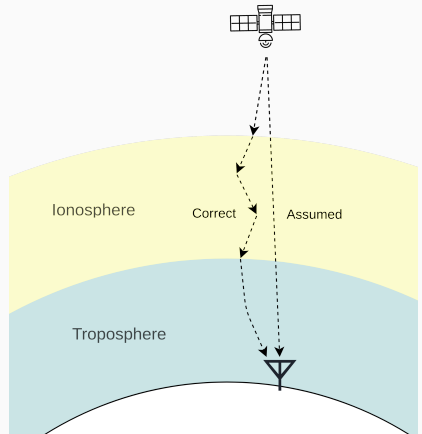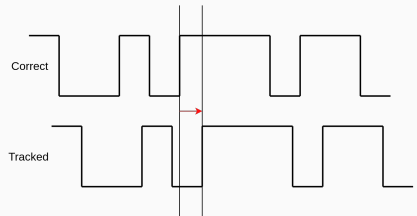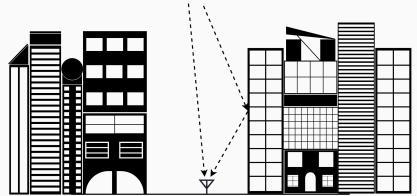
- Clock Error

- Ephemeris Error

Atmospheric Errors
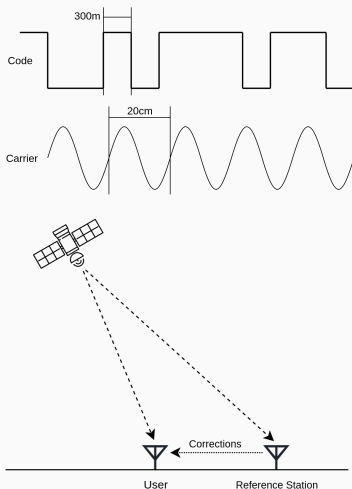
- Ionospheric Delay

- Tropospheric Delay

Receiver Errors

- Multipath

- Receiver Noise

Error Mitigation

- Carrier-Phase Measurements

- Differential GPS

- Real Time Kinematic

- SBAS

DGPS Concept for a Sounding Rocket

Concept

System Overview

Ground Station

Software Architecture

ToDo

ToDo

- Tests

Questions?