An Introduction to the Profile Envision and Splice Tool; PrESTo

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NE DOLWG
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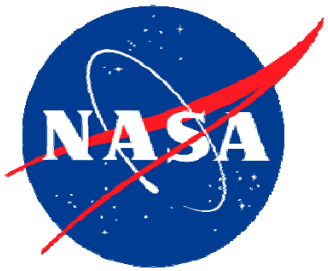


Outline

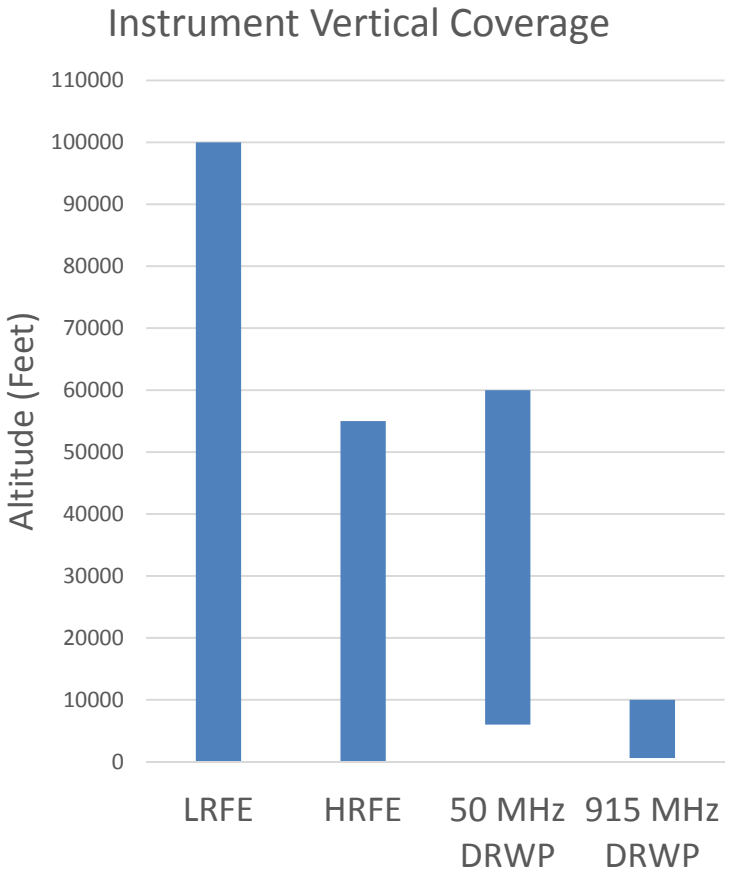
- Background
- Requirements
- Software Design
- Splicing Procedure
- Forward Work

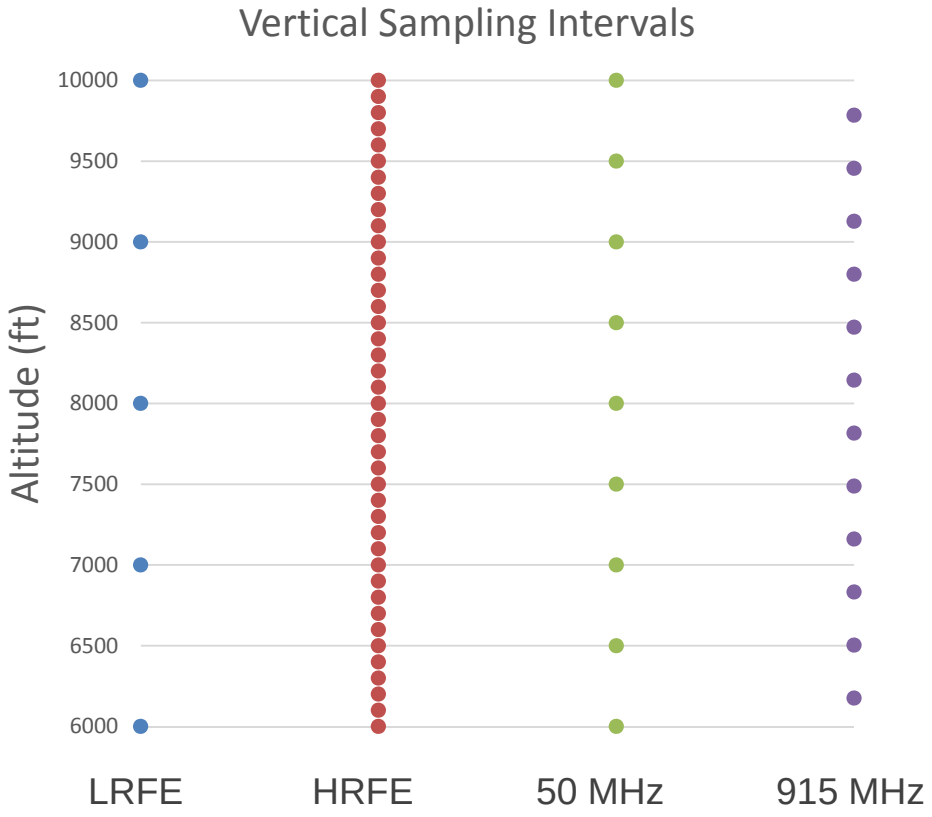
Background

- NASA's Space Launch System (SLS) requires vertically complete atmospheric measurements in vehicle design analyses and Day-of-Launch (DOL) operations support.
  - Designing the vehicle using wind energy spectral content not dependent on instrumentation source.
  - Allows for multiple data sources to be used in DOL assessments.
- The United States Air Force Eastern Range (ER) at Cape Canaveral Air Force Station provides atmospheric data through network of weather balloons and Doppler Radar Wind Profiler (DRWP) instruments.
  - Automated Meteorological Profiling Systems (AMPS)
    - Low Resolution Flight Element
    - High Resolution Flight Element
  - Jimsphere
  - 50 MHz DRWP – NASA owned
  - 915 MHz DRWP
- Each data source provides coverage (vertical or temporal) that the other sources do not.
- MSFC Natural Environments branch is developing software (Profile Envision and Splice Tool (PrESTo)) to produce vertically complete profiles from available sources.

Background

- Instrumentation Available:

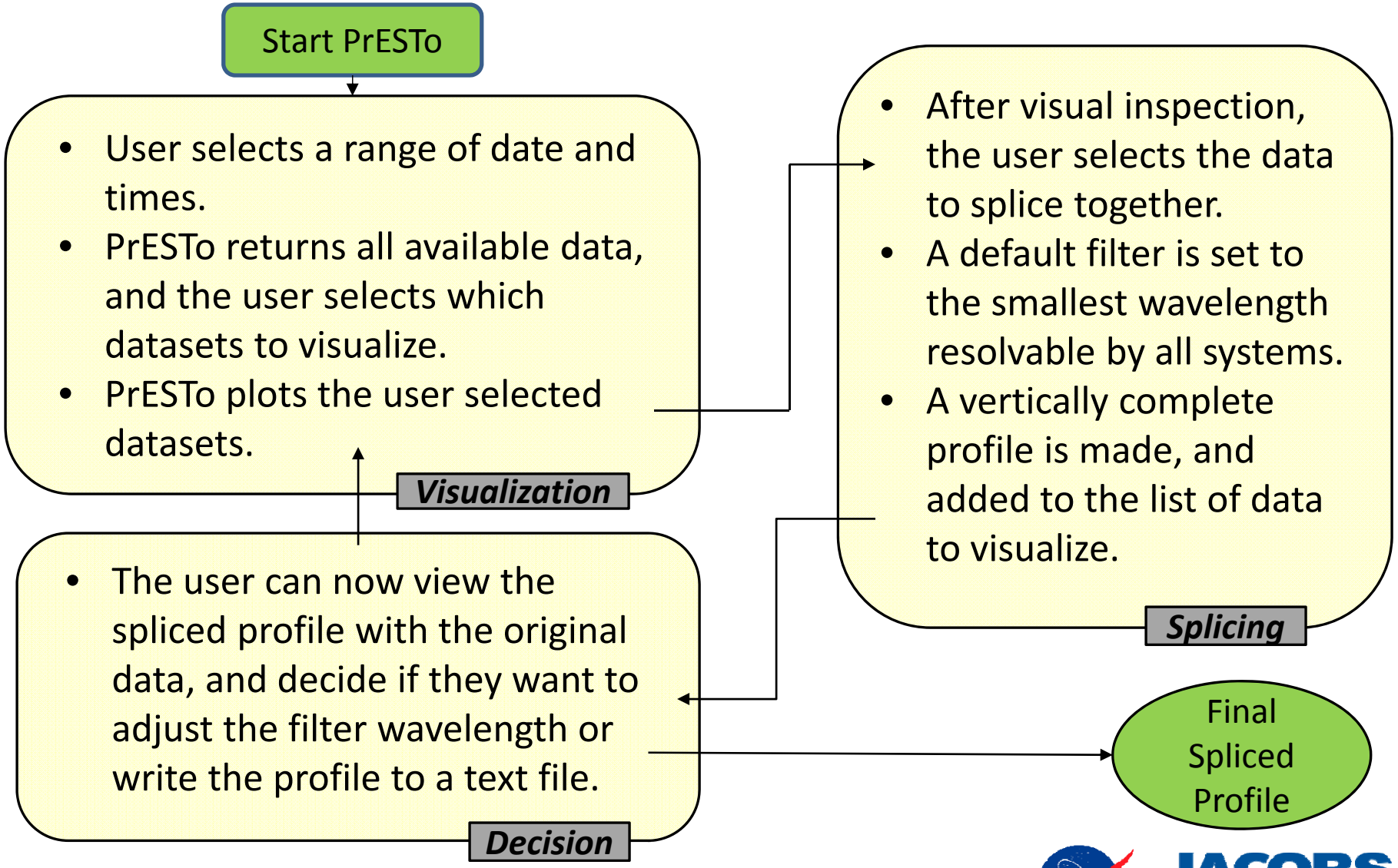




Software Requirements

- These were based on self-imposed and stakeholder requirements:
  - Program shall be capable of generating spliced wind and atmospheric data from surface up to 183 km.
    - Winds and thermodynamic (altitude, u, v wind components, temperature, density, pressure) data.
    - Altitude increment is 50 m from 0 to 20 km and 500 m from 20 km to 183 km.
  - Utilize multiple sources to generate a spliced atmospheric profile.
    - Below 60 kft (18 km): 915-MHz DRWP, 50-MHz DRWP, LRFE, HRFE, Jimsphere.
    - Between 60 kft (18 km) and 100 kft (30 km): LRFE.
    - Above 100 kft (30 km): Earth Global Reference Atmospheric Model (GRAM).
  - Allow user to select multiple measurement sources.
  - Have the capability to apply wind filtering.
  - Apply quality control algorithms to check input data.
  - Provides a text file summarizing quality control results.
  - Provides a text file containing the spliced profile for use in DOL vehicle assessments.
  - Use open source programming language.

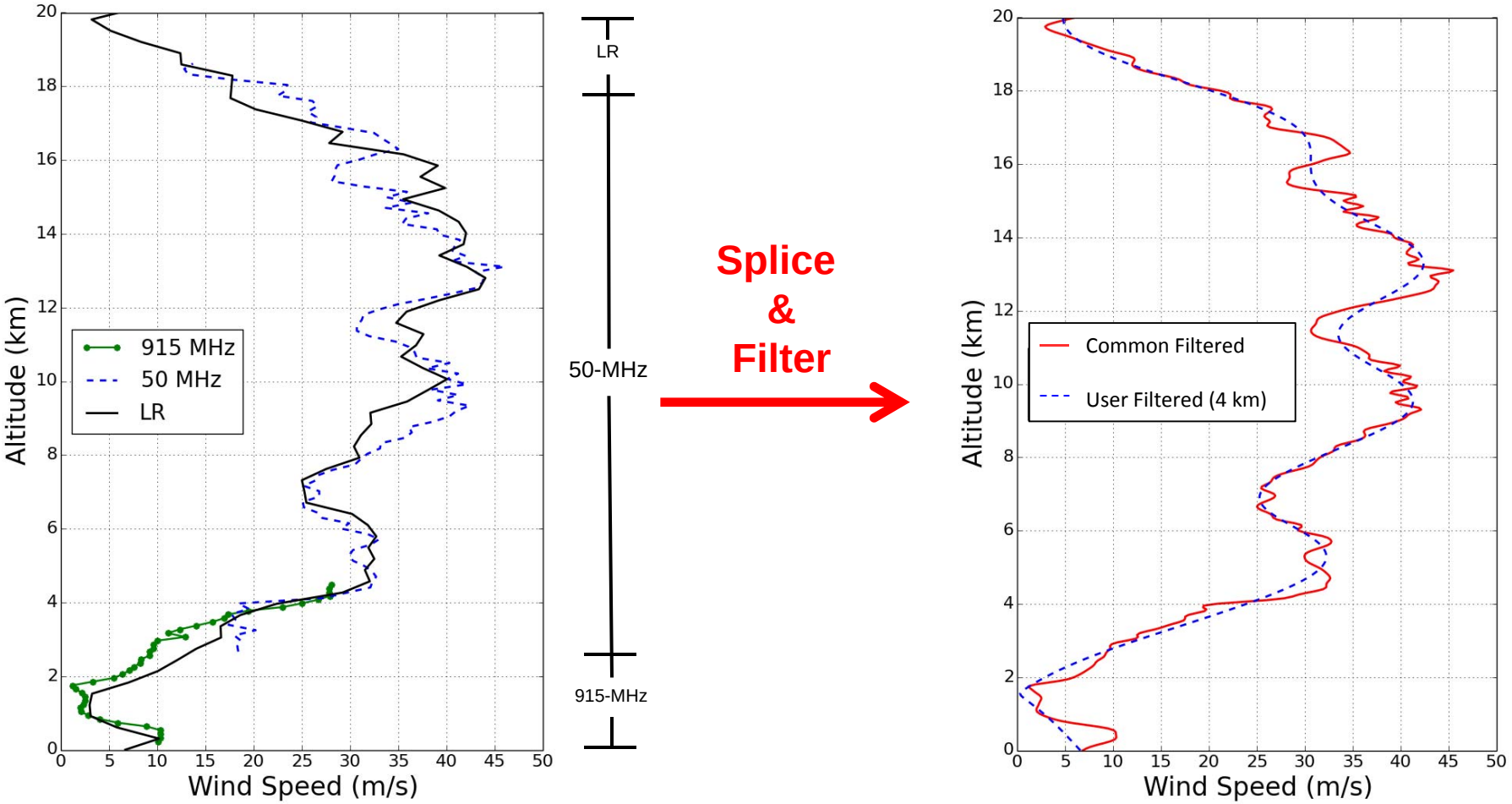
Software Design



Splicing Procedure

- Interpolate all the data to a constant altitude interval and range.
- If an overlap of data exists between two input sources, a weighted average is taken between the two profiles within the altitudes of concurrent data.
- If no overlap exists, values are interpolated from the lower dataset to the higher dataset.
- Based on the input, a common low-pass filter to remove wind component spectral content below a constant wavelength.
  - Set to the wavelength resolvable by the coarsest measurement systems.
  - Users have the capability to increase the filter applied to the spliced profile in order to remove non-persistent wind features; which can be utilized in vehicle assessments.

Splicing Procedure



Time correlated LRFE (1815 LST), 50- (1700 LST) and 915 MHz (1810 LST) DRWP profiles at the ER from 14 Jan. 2005 on left and the resulting spliced profiles (common low-pass filter in red, user defined filter in blue).

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Forward Work

- Continue source code development.
- Generate documentation per NASA software engineering requirements for space flight mission support software:
  - Requirements Specification
  - Configuration Management
  - Software Design
  - Test plan
- Integrate, evaluate and test software to achieve a baseline release version.
- Anticipated release in Spring 2016.

Questions?

Other contributors:

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Backup

Instrument	Vertical Range	Sampling of MIDDS output	Description
Low Resolution Flight Element (LRFE)	Near Surface - 100,000 ft (30 km)	1,000 ft (300 m) 500 ft (150 m) 100 ft (30 m) Released once daily and for mission support.	Sonde on a latex balloon, tracked by GPS.
High Resolution Flight Element (HRFE)	Near Surface - 60,000 ft (18.3 km)	100 ft (30 m) Released for mission support.	Sonde on a Jimsphere, tracked by GPS.
Radar tracked Jimsphere	Near Surface - 60,000 ft (18.3 km)	100 ft (30 m) Released for mission support.	Sonde on a Jimsphere, tracked by multiple radars.
50 MHz DRWP	6,000 - 60,000 ft (2 - 18.3 km)	500 ft (150 m), Profiles recorded at approximately every 5 minutes	Remote sensing using an antenna array with aperture of 15,600 m^2.
915 MHz DRWP	600 - 10,000 ft	328 ft (100 m), Profiles recorded at approximately every 15 minutes	Remote sensing using an antenna array with aperture of 6 m^2.