Alaska and Chugach National Forest SPOT 5 HRS Digital Elevation Model

AGDC Meeting
October 24, 2007

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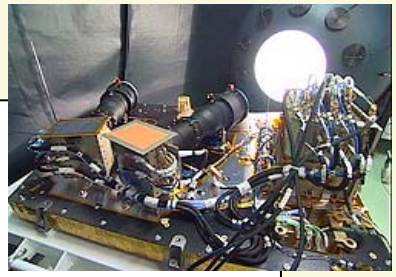
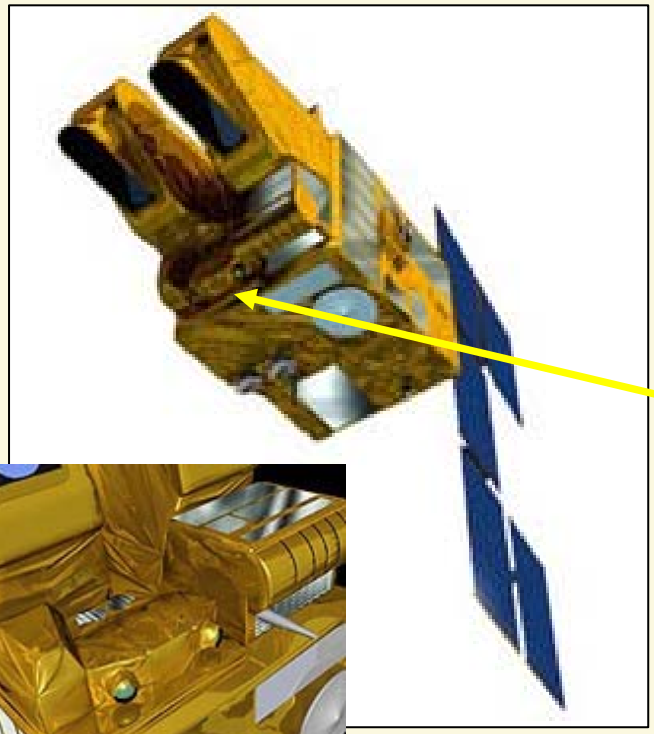
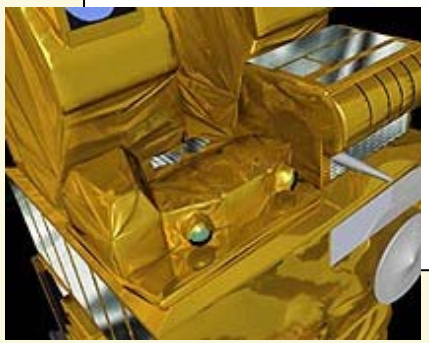
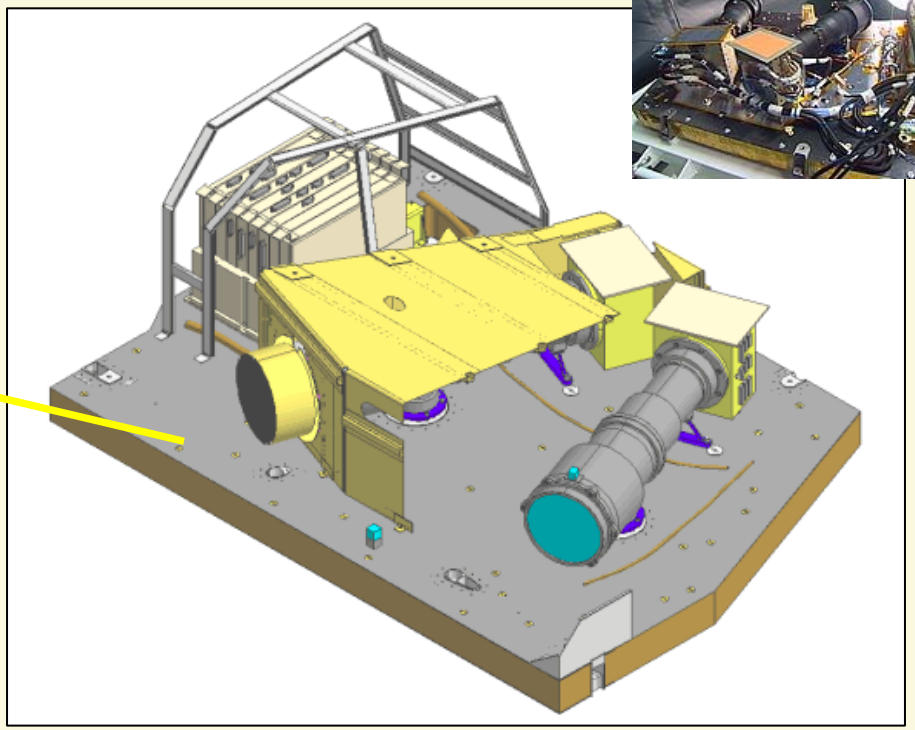
SPOT 5 launched May 2002









HRS Instrument +/- 20 degrees from nadir

Orbit: Sun-synchronous circular orbit (identical to those of SPOT-1 to -4), altitude = 822 km, inclination = 98.7º, period = 101.4 min, equator crossing on descending node at 10:30 AM, repeat cycle = 26 days, revolutions/day = 14 5/26.

http://www.spot.com

HRS instrument

blue - nir

Parameter	Value
Spectral range	0.48 - 0.70 µm (Pan)
Telescope focal length	0.580 m
GSD	10 m cross-track 5 m along-track
MTF; SNR	>0.25; >120
Instrument power	128 W
FOV	±4º (120 km swath)
Integration time per line	0.752 ms
Detectors/line; Detector pitch	12,000 6.5 µm
Instrument mass	90 kg
Instrument size	1 m x 1.3 m x 0.4 m

http://www.spot.com

SPOT HRS has two different products

SPOT DEM

DEM

A SPOT DEM is a gridded file with step sizes of 1 second of arc (30 m on the equator, E/W dimensions vary according to the latitude).

Resampling to 20 m available.

Accuracy

- Absolute planimetric accuracy: from 15 m to 30 m @ 90% without being tied to ground control points
- Absolute elevation accuracy: from 10 m to 20 m @ 90% for a slope < 20%

REFERENCE 3D

DEM

These files contain a uniform grid of terrain elevation values of an area of interest and are obtained through automatic correlation of SPOT HRS stereopairs.

- Sampling step: 1 second of arc (~ 30 m at the equator, varying according to latitude)
- Absolute elevation accuracy: 10 m @ 90% for a slope < 20°
- Absolute planimetric accuracy: 15 m @ 90%
- Includes orthoimage

HRS produces a digital surface model (DSM, canopy top, compare to digital terrain model)

http://www.spot.com

Elevation accuracy decreases as slope angle increases (Linear elevation error @ 90%)

Slope	absolute (LE 90)	relative (LE 90)
< 20%	≤ **10 m**	≤ **5 m**
> 20% and < 40%	≤ **18 m**	≤ **15 m**
> 40%	≤ **30 m**	≤ **28 m**

Actual DEM/DSM accuracy from HRS data has been assessed at ~5m relative and 10-15m absolute

A. Baudoin, M. Schroeder, C. Valorge, M. Bernard, V. Rudowski, "The HRS-SAP initiative: A scientific assessment of the High Resolution Stereoscopic instrument on board of SPOT 5 by ISPRS investigators," Proceedings of ISPRS 2004, Istanbul, Turkey, July 12-23, 2004

Z. Li, A. Gruen, "Automatic DSM Generation from Linear Array Imagery Data," Proceedings of ISPRS 2004, Istanbul, Turkey, July 12-23, 2004

P. Reinartz, M. Lehner, R. Müller, M. Schroeder, "Accuracy Analysis from DEM and Orthoimages Derived from SPOT HRS Stereo Data without using GCP," Proceedings of ISPRS 2004, Istanbul, Turkey, July 12-23, 2004

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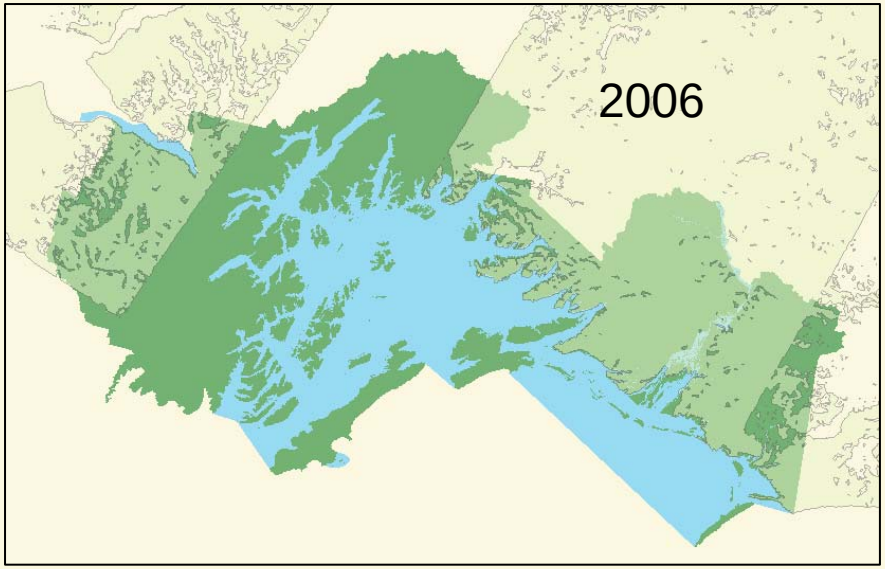
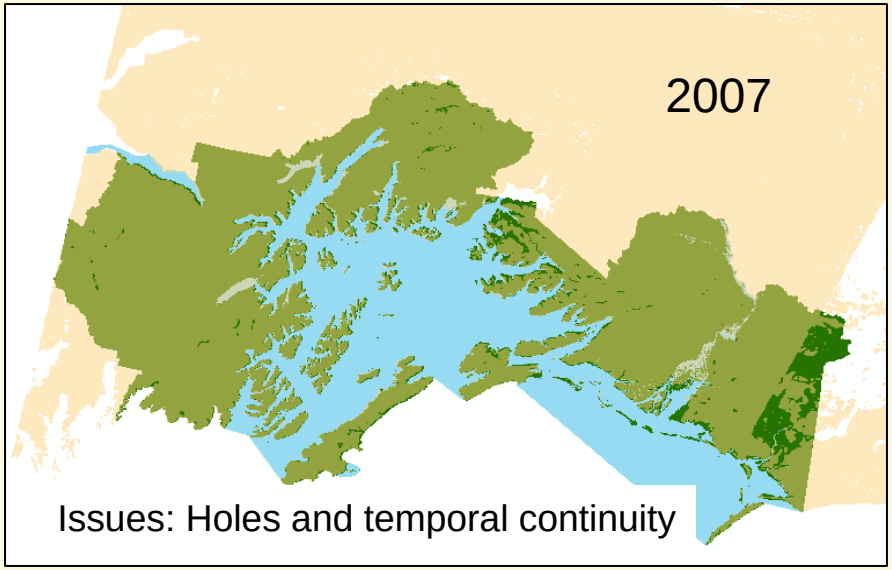
Chugach National Forest

HRS Digital Elevation Model Coverage



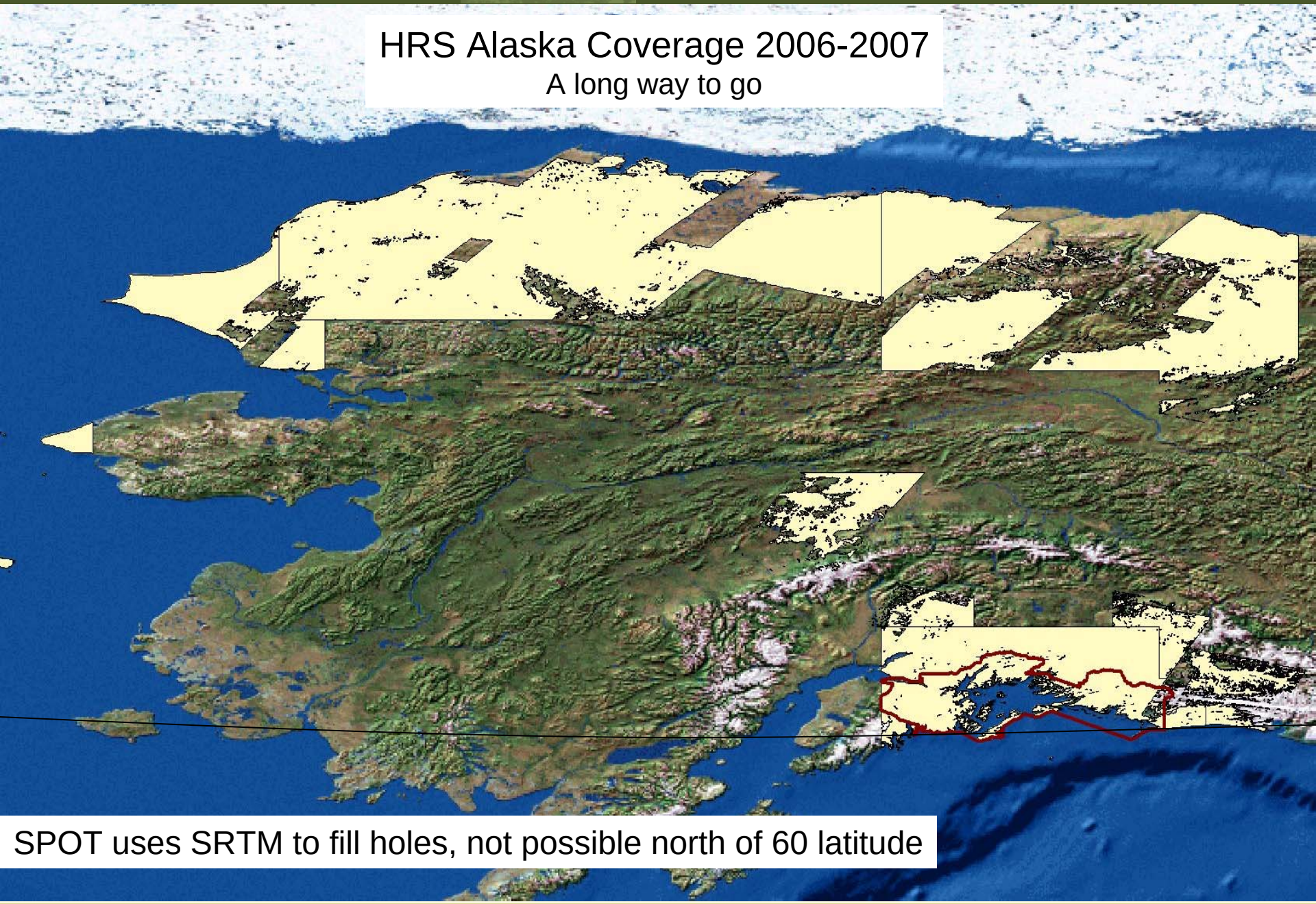


SPOT 5 stereo satellite (HRS)
20m GSD
10m-15m H and V accuracy
$4 sq km, agency licensing, possible tier 3 uplift (commercial)
No concurrent multispectral collection, DEM only

Status: probable partial delivery in 2007, continue collection in 2008, IDIQ

HRS Alaska Coverage 2006-2007

A long way to go

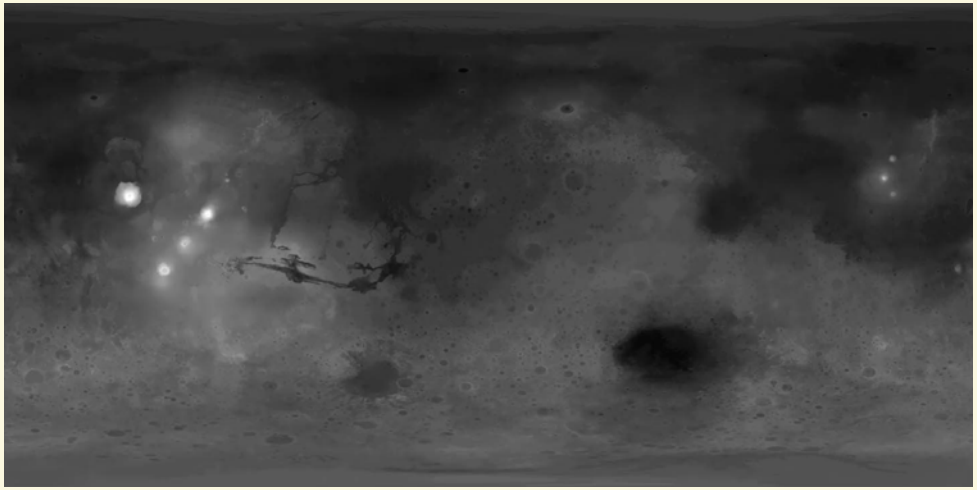


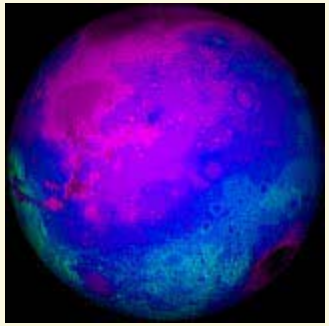
SPOT uses SRTM to fill holes, not possible north of 60 latitude

60m x 45m DTM NED for Alaska pre-dates statehood

Some lidar, photogrammetric, and insar coverage for relatively small areas

Planet Mars has more current, accurate, and extensive linear DEM coverage than the vast majority of the State of Alaska





Lidar (Mars Orbiter Laser Altimeter) and photogrammetry (Viking images)

(animation: Grant Hutchison, NASA, 1999)