BRIEF OVERVIEW OF SATELLITE-BASED REMOTE SENSING

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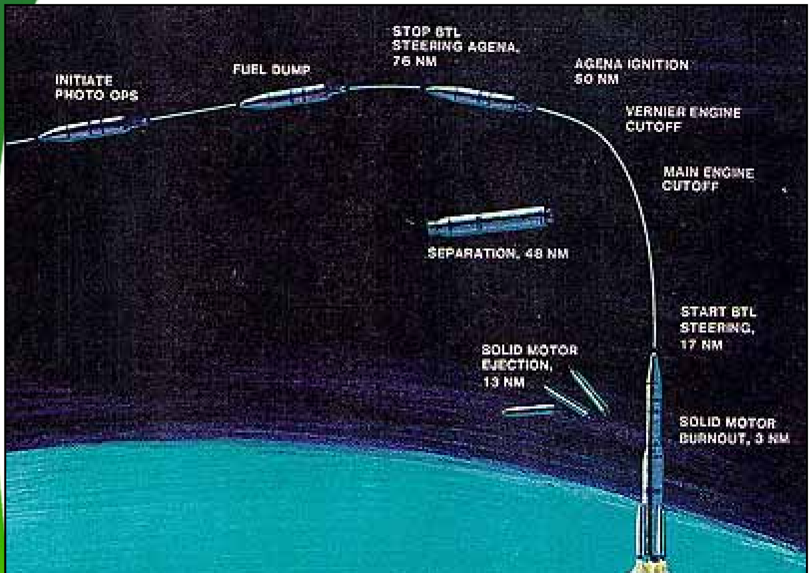
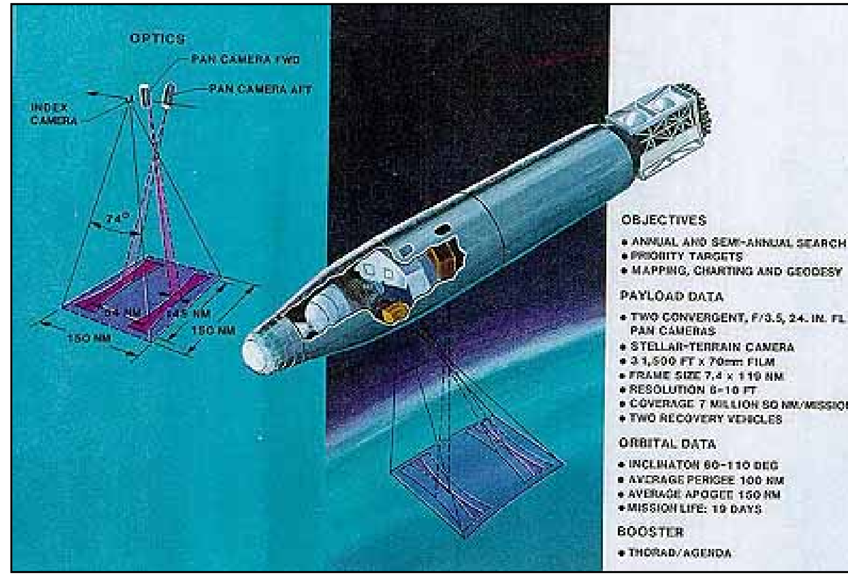
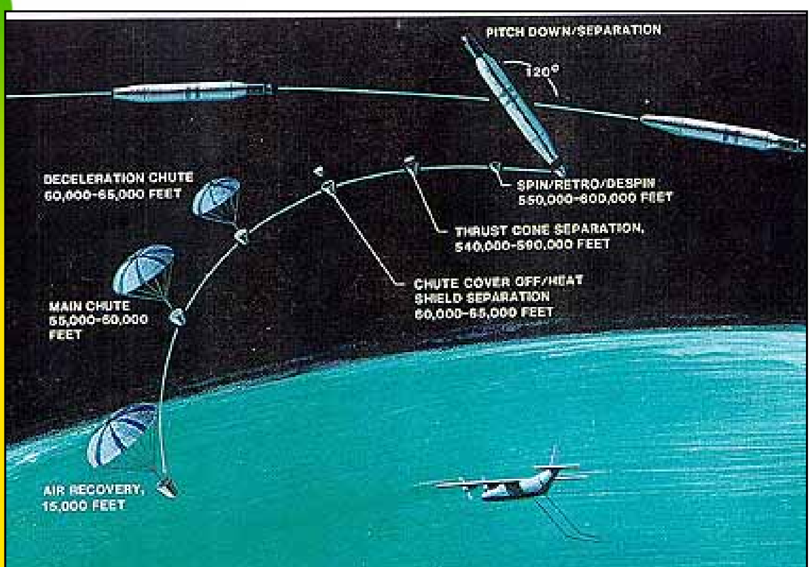
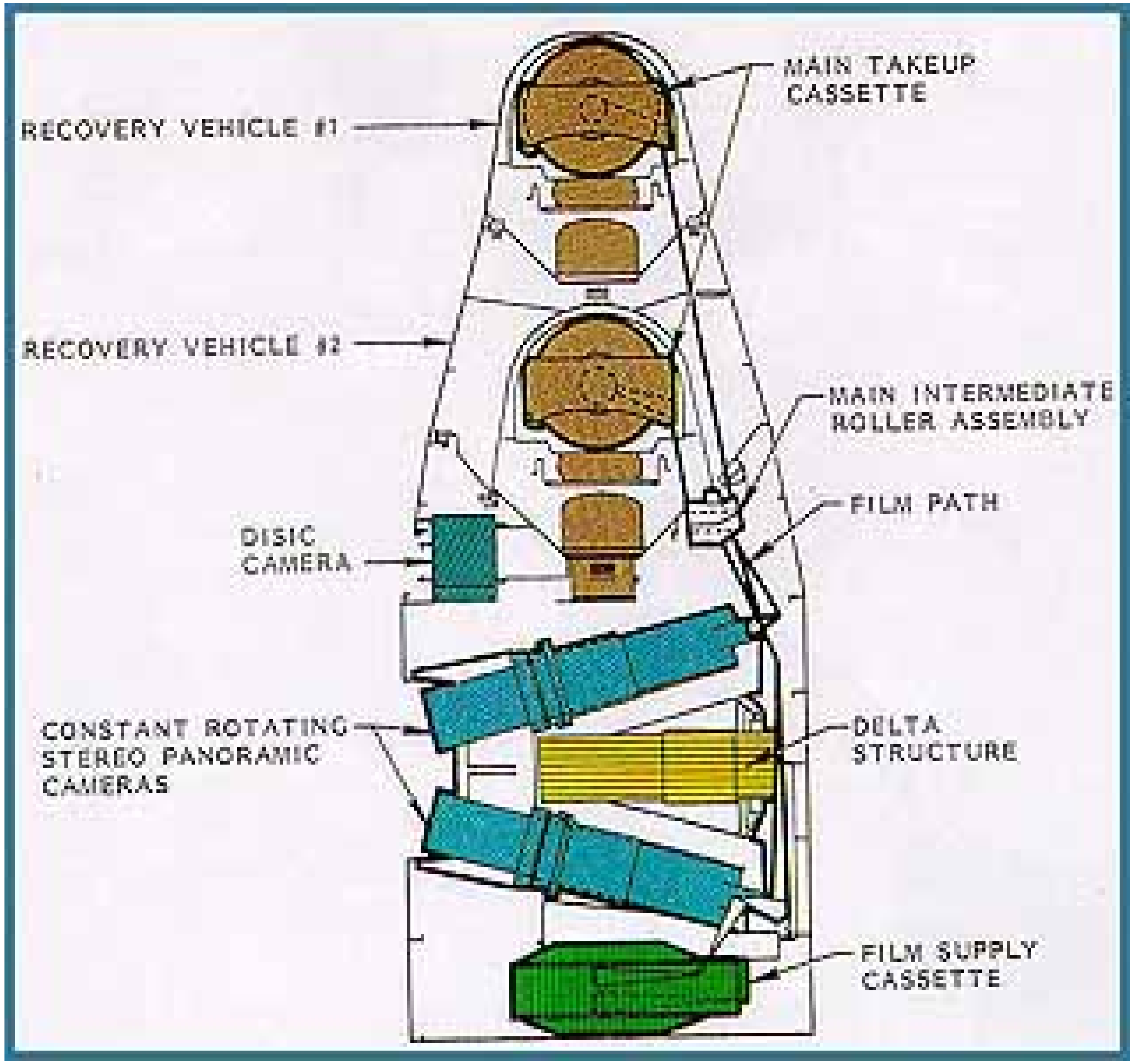
SPACE-BASED IMAGING







Between 1960-1972 the Corona Project collected 800,000 images, using KH-1 thru KH-4B cameras. Film had to dropped to Earth for processing.



A sophisticated set of static and rotating cameras evolved during the Corona Project to maximize coverage of large areas using rolled film from an altitude of 80 nautical miles

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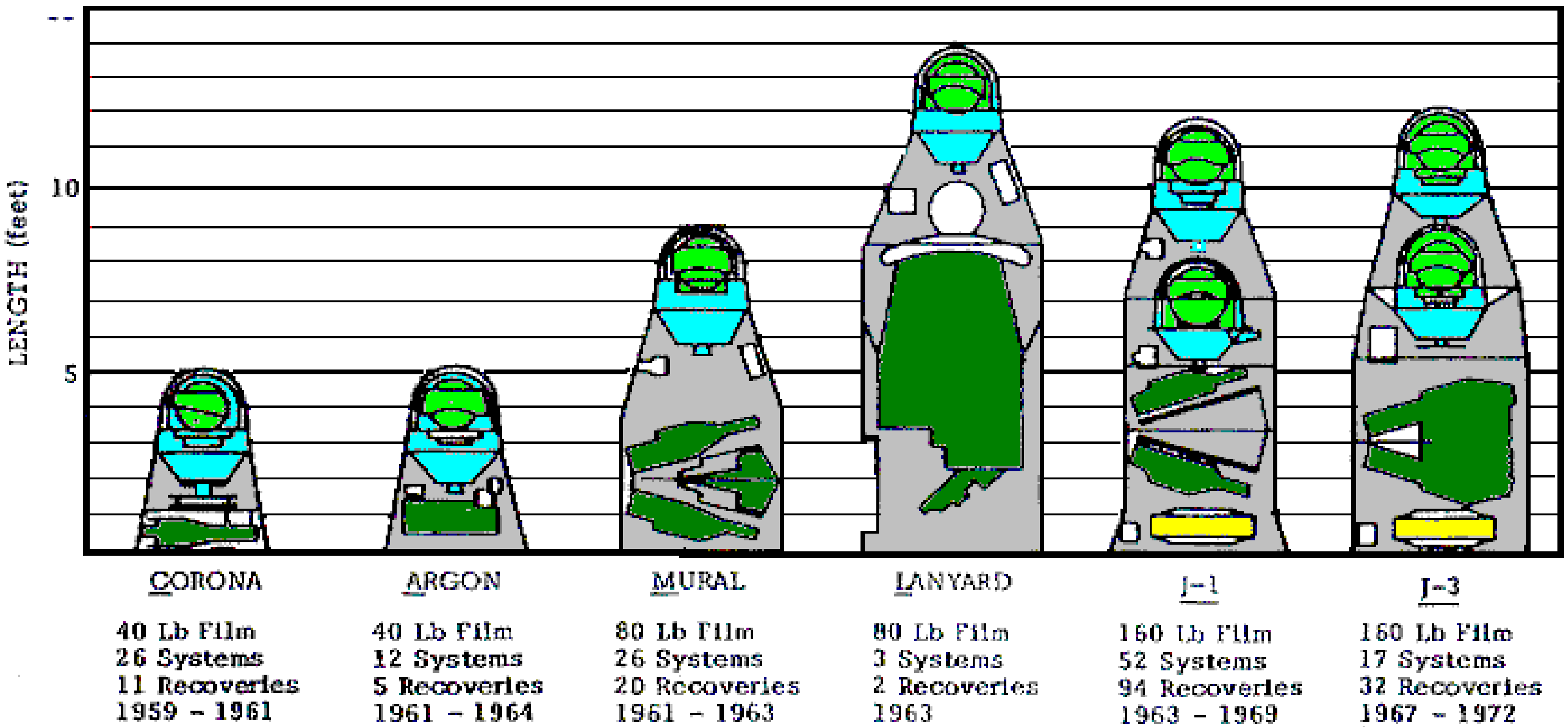
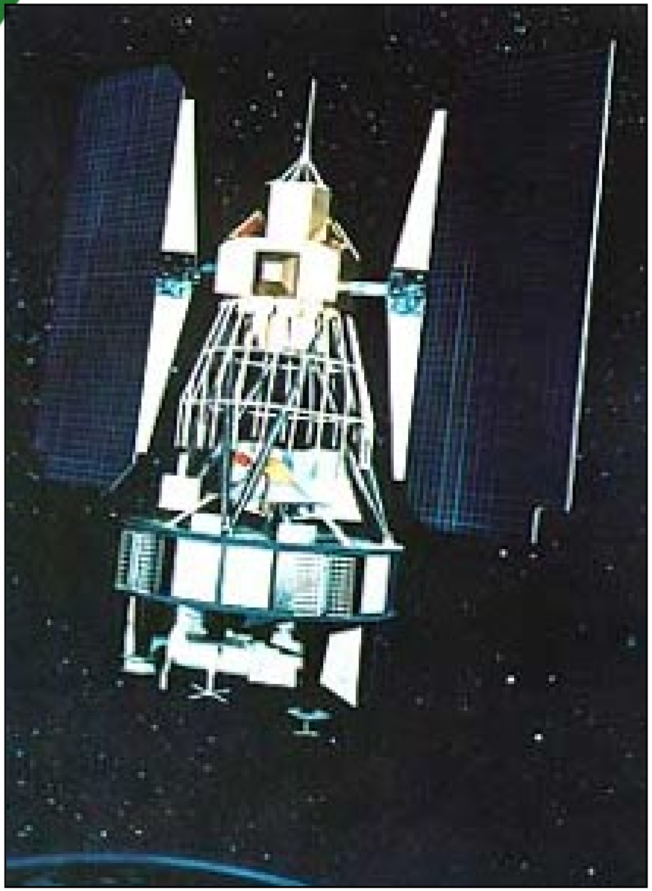
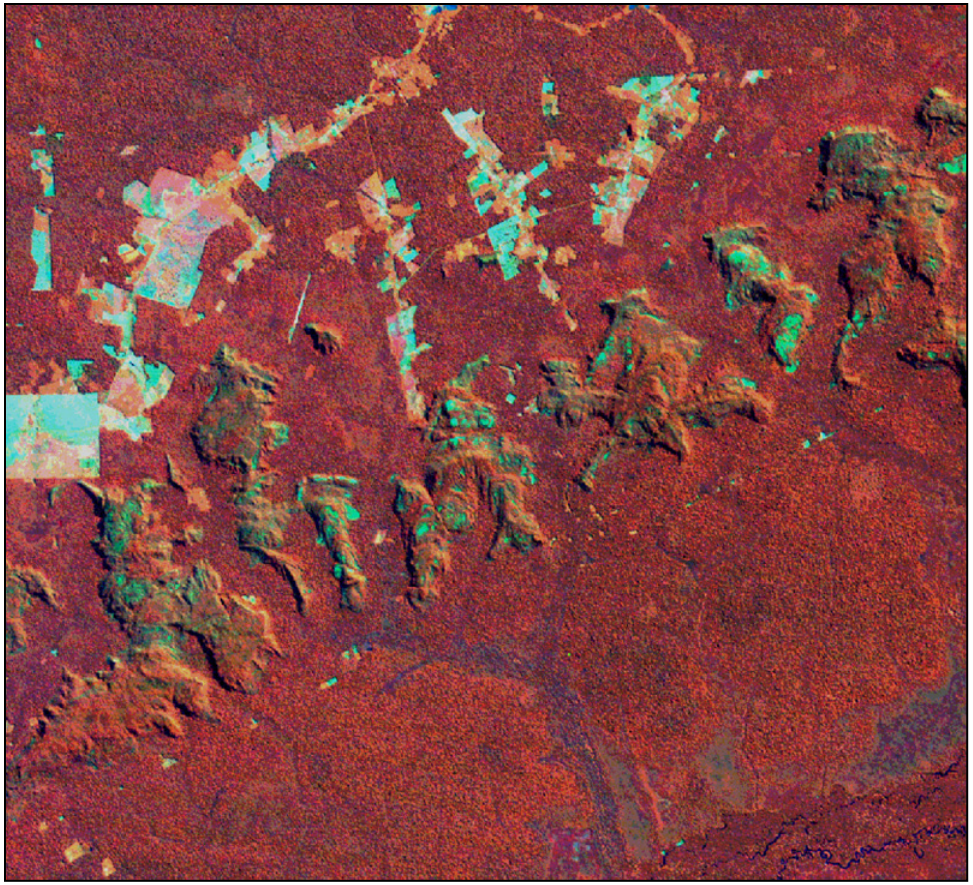
- Corona image of Tell Hamoukar in Syria. Note old channels and tracks across landscape, not visible on the ground
- Photo resolution is around 1 m



- **Spaced based cameras continued to evolve throughout the 1960s and early 1970s, when digital and multispectral collection began**





- Landsat 1 or Earth Resource Technology Satellite (ERTS) was launched in mid-1972; with new launches every 3 years.
- Carried 3 cameras, a near IR scanner and a 4 channel MSS at altitude of about 570 miles
- Digital images measured 111 x 102 miles, but with resolution of only about 100 ft

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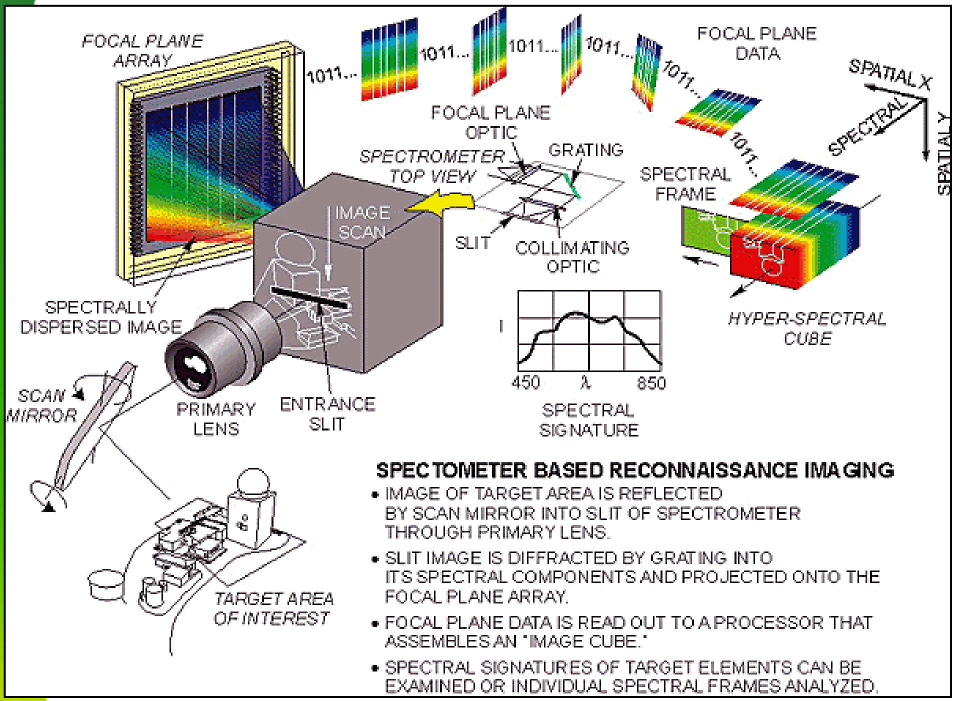
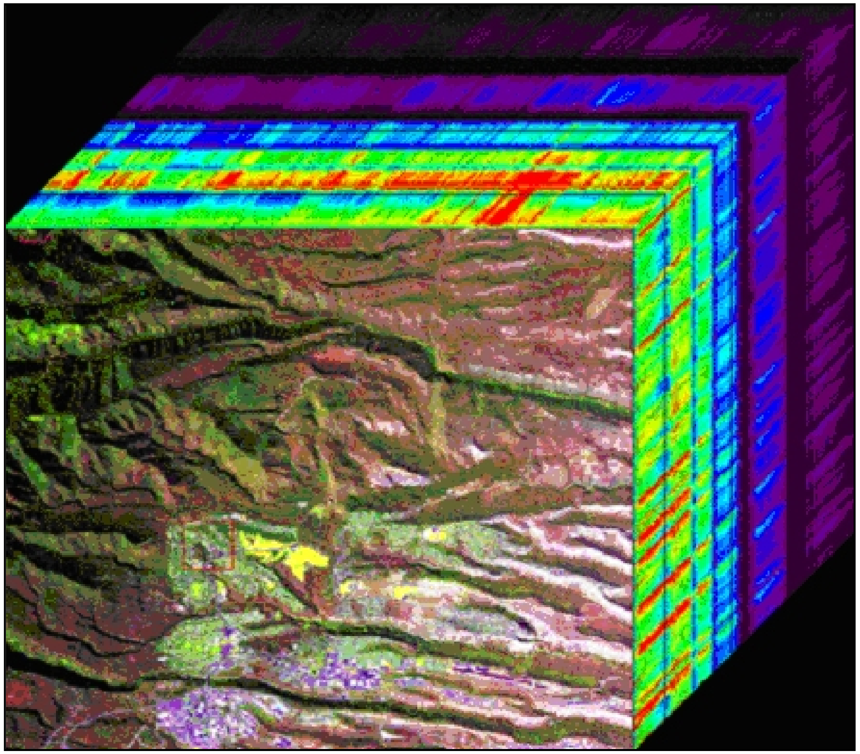
After 1989 reconnaissance satellites shifted to Synthetic Aperture Radar, IR and thermal IR, operating between 150 to 600 miles altitude. These systems are capable of sensing through clouds and brush cover.

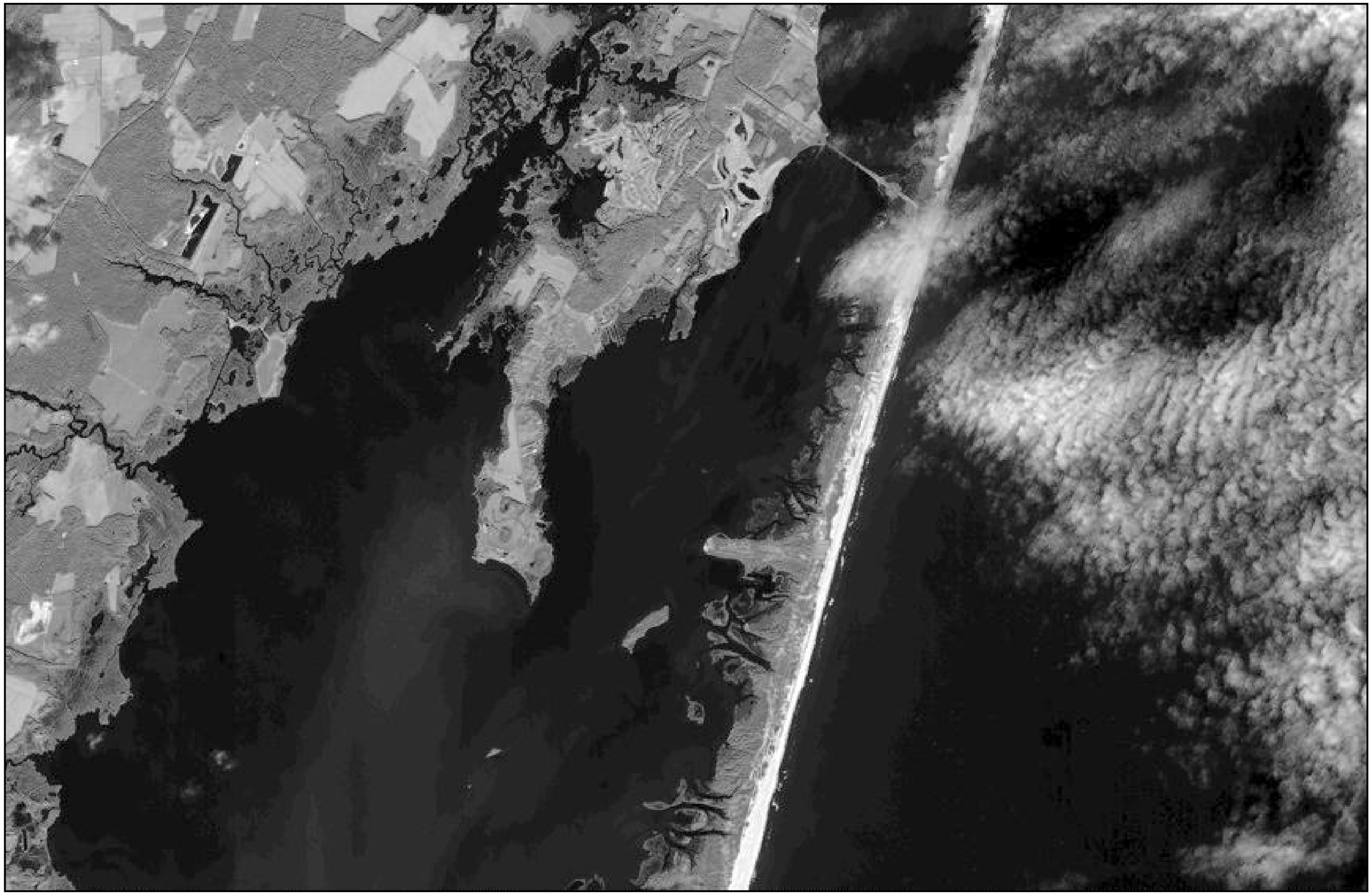
Transition to Hyperspectral Data



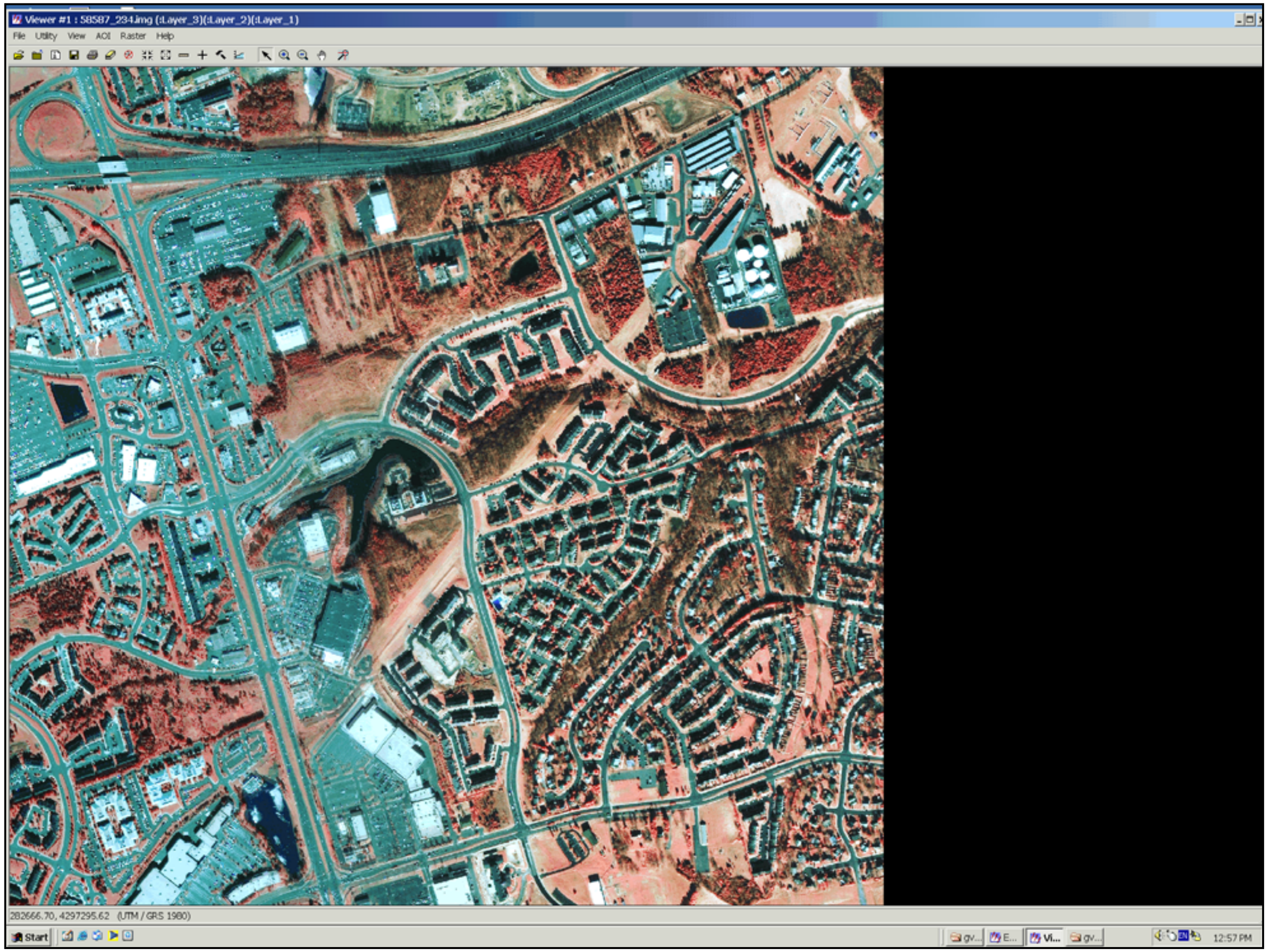


Multispectral scanners (MSS) have been increasing deployed on airborne and spaced-based sensing platforms. These allow large files of information to be collected across the electromagnetic spectrum; and will eventually change the way we look at the Earth (e.g. motor tracks across water)

- Mosul, Iraq as imaged by US reconnaissance satellite using Thematic Mapper Multispectral Scanners. Intelligence platforms are capable of resolutions < 6 inches for high interest areas



- In 1999 Space Imaging EOSAT launched Ikonos, offering commercial imagery with 1 m panchromatic and 4 m multispectral images, world wide.



- Ikonos imagery collects MSS data at rate of 2,000 sq km per minute, making fifteen 98- minute orbits each day. They offer digital imagery with RMSE of < 0.9 m for detailed urban analysis.

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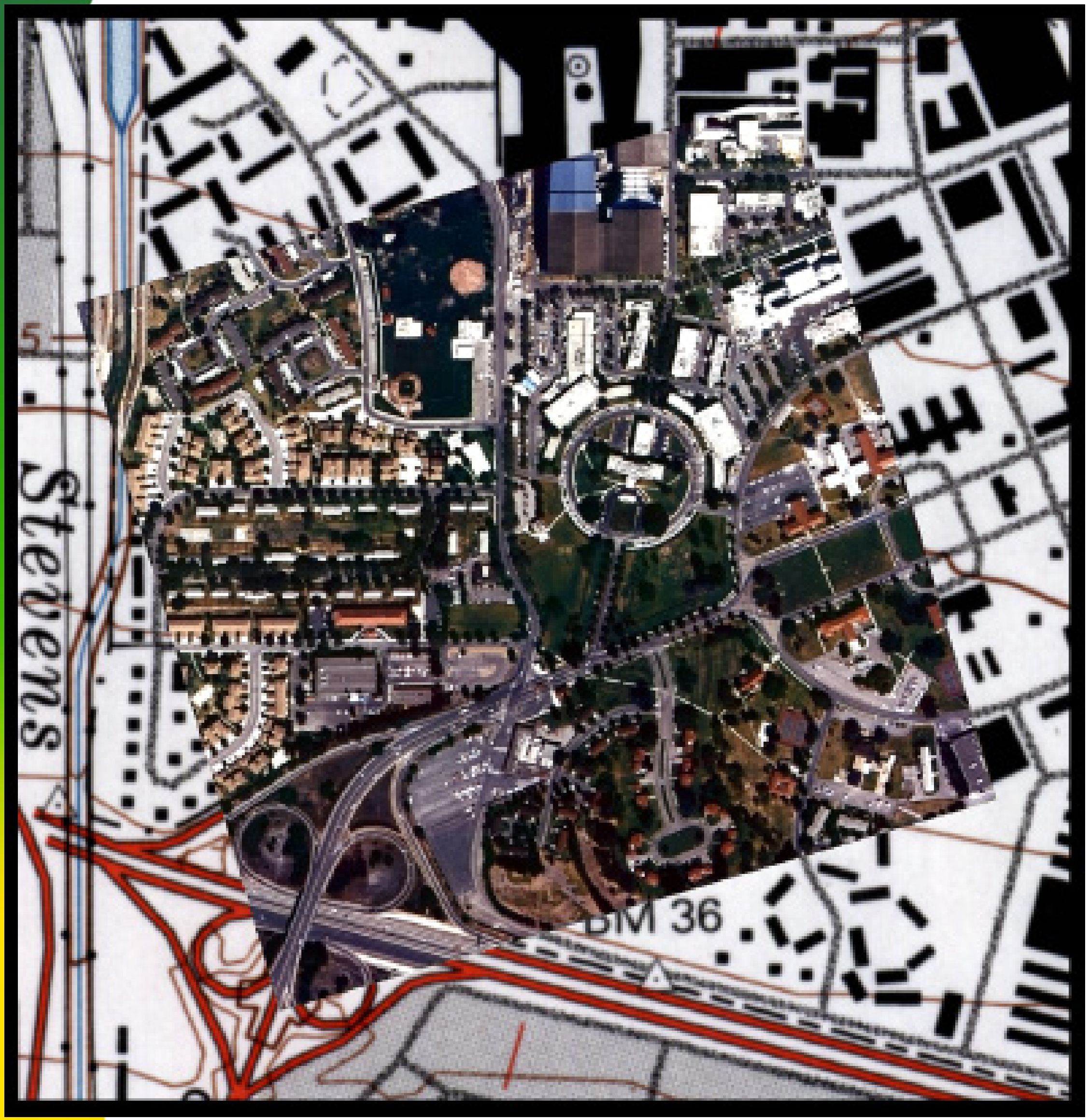

- Modern digital imagery is orthorectified
- This allows manipulation in GIS, integrating countless layers of information

Orthorectified digital images can be overlain to make meaningful comparisons, as shown here

This shows the Pentagon while under construction in 1940 (at right) and after completion in 1943 (at left)

Note details of support and frame layout

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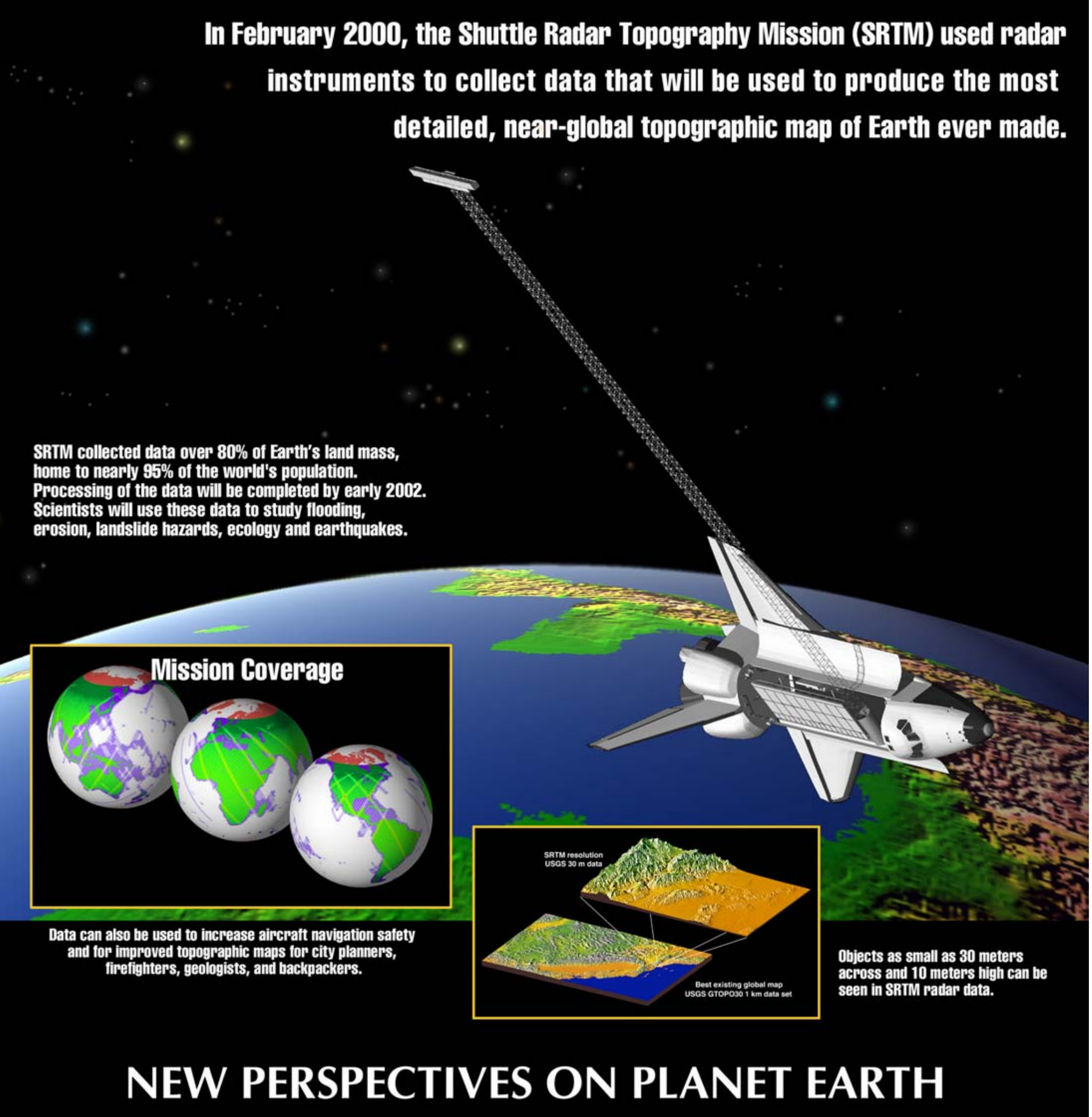
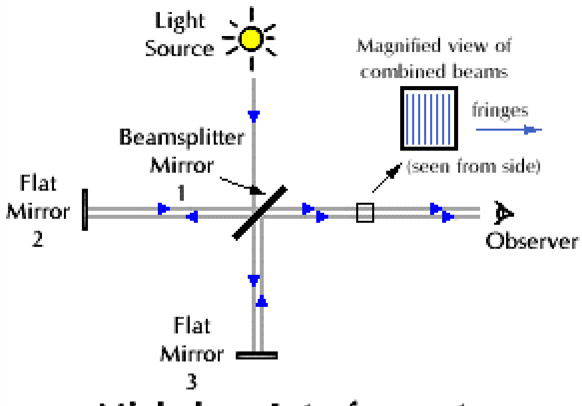
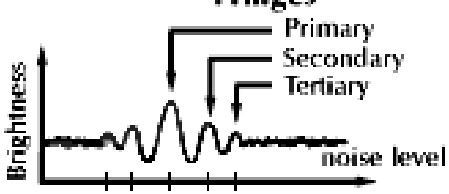


In February 2000 NASA launched Space Shuttle Mission STS-99, the Shuttle Radar Topography Mission (SRTM), which mapped the Earth using interferometric synthetic aperture radar (INSAR)

Interferrometric Synthetic Aperture Radar (INSAR)



Michelson Interferometer



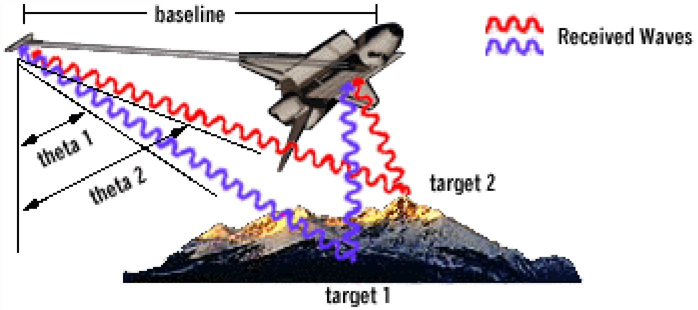
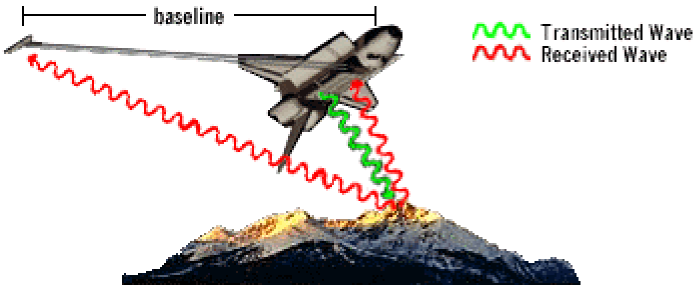
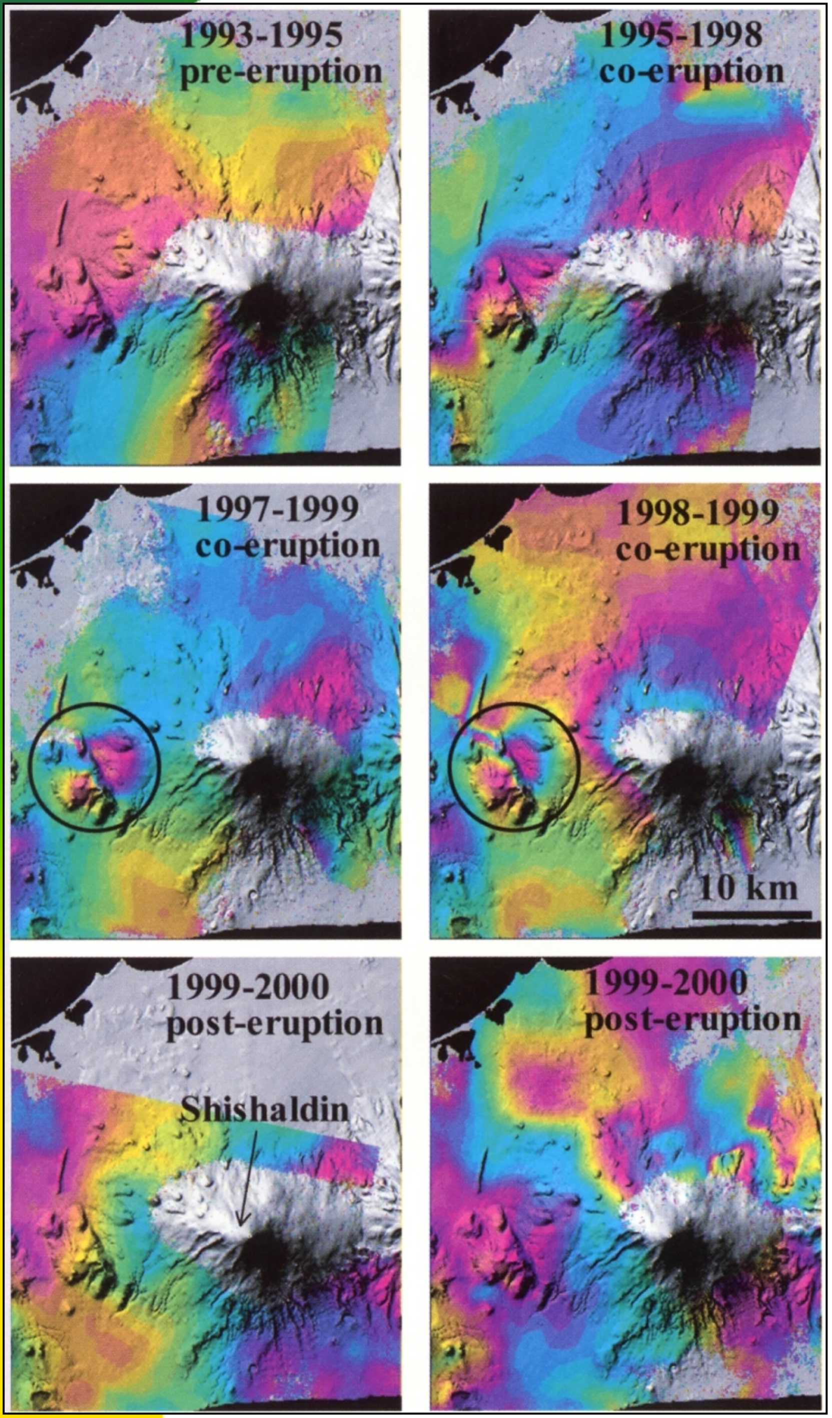


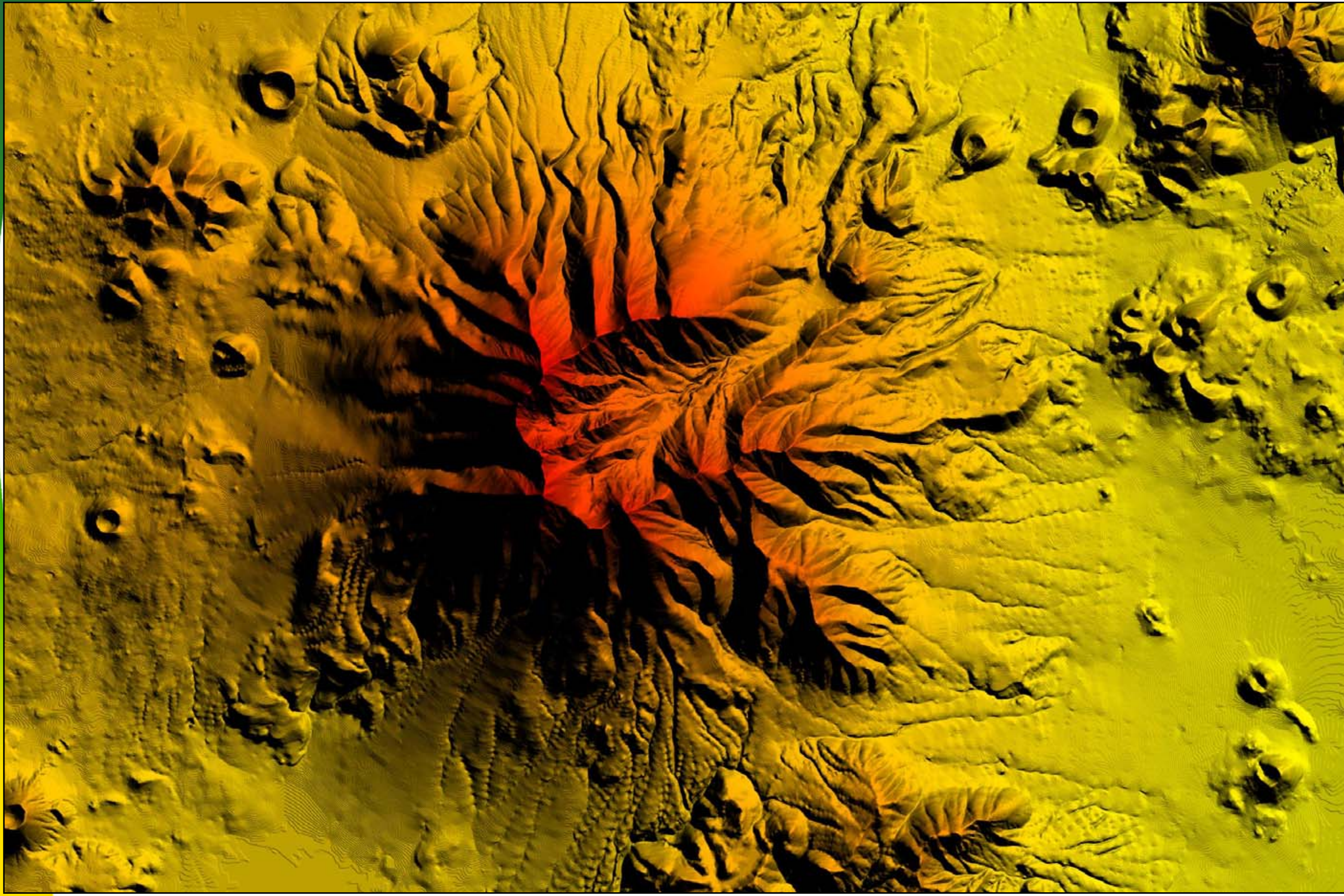
Figure 4: Differential Distance Gives Topography



Radar signals being transmitted and recieved in the SRTM mission (image not to scale).



- Repeated INSAR passes allow slight variations in elevation and spatial distribution to be monitored with amazing accuracy
- Topo-removed interferograms draped over shaded DEMs of Shishaldin volcano from 1993 to 2000
- Circles indicate areas of marked elevation change



INSAR image of the San Francisco Peak volcanic field near Flagstaff, AZ