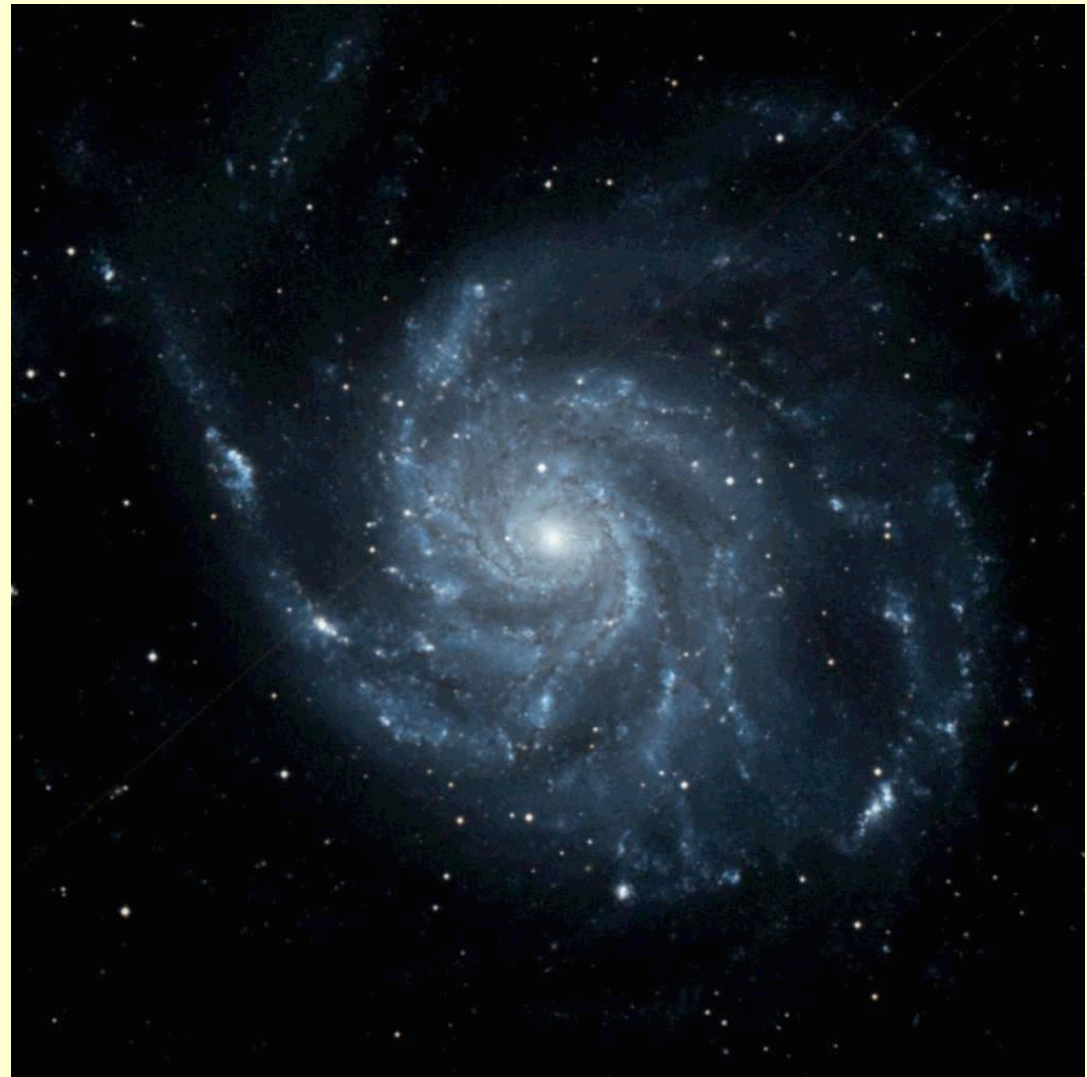




DSS, GoogleSky, & WWT

Using the Digitized Sky Survey
for Archive Research and
Educational Outreach

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DSS Distribution

- DSS remains one of the most heavily used MAST services
 - Over last year access has increased from ~175,000 to ~260,000 retrievals/month
 - 9TB image data, 1TB compressed data
 - Distributed compressed data to 15 data centers
 - Distributed compressed data to both Google and Microsoft for non-commercial use in visualization projects
- Accessible via webform, VOservices & scripted url requests
 - MAST currently only provides FITS or dynamically created single colour GIF file
- Increased interest in visualization
 - Development project to create colour images from multiple bandpasses (J, F, N)

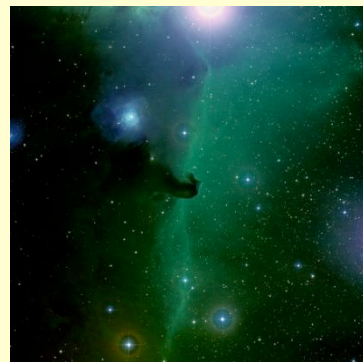
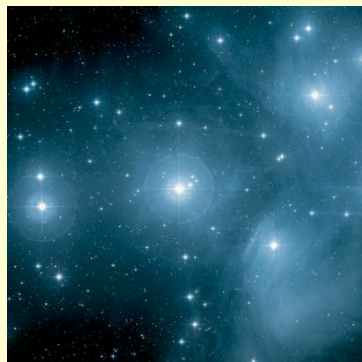


Increased Interest in Visualization

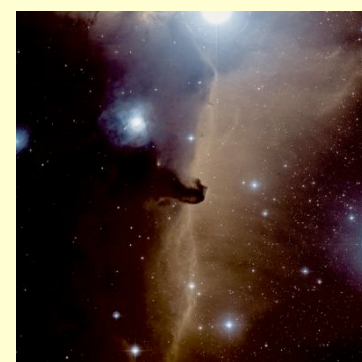
- **Hubble Legacy Archive**
 - Graphical display to visualize HST instrument footprints over DSS for context of observations.
- **ESO Archive Interface (VirGO)**
 - Similar concept to HLA but front-end to ESO archive of ground-based data.
- **Sky in Google Earth (Released 22 August 2007)**
 - Browse sky using GE engine.
 - Combined DSS, SDSS and HST images into single layer.
- **GoogleSky (Released 16 December 2007)**
 - Browse sky using GoogleMaps engine.
 - Added IRAS and CMB layers
 - Showcase for HST, Chandra, Spitzer, GALEX press releases
- **Microsoft Research World-Wide Telescope (Released 13 May 2008)**
 - Sky Chart UI with advanced search, collaborative capabilities and telescope control.
 - DSS, SDSS, 2MASS, HST, etc as separate layers
- **Increasing number of websites showing colour images constructed from DSS data.**



R=IV-N, G=IIIaF, B=IIIaJ



**R=IIIaF, G=(IIIaJ+IIIaF)/2,
B=IIIaJ**





DSS Colour Image Construction

- Current version constructed from J & F bandpass plates (best match to SDSS).
- RED (F) plate taken as reference.
- Field divided into 64x64 grid of tiles each 300x300 pixels.
- For each tile, the BLUE (J) image was astrometrically registered to the RED image and resampled.
- A mean of the red/blue image was created for the 3rd (GREEN) channel.
- Version 2 - Improved background computation to reduce tile to tile variation.
- The sky and saturation values for the red and blue plates were used to scale the 3 channel images between 0-1 and create a JPG image.
- JPG image was saved with a FITS header.

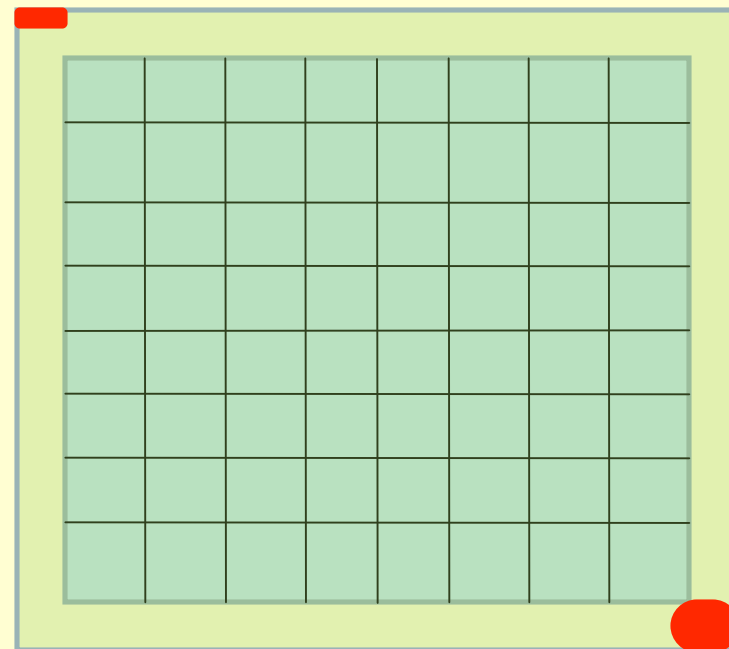
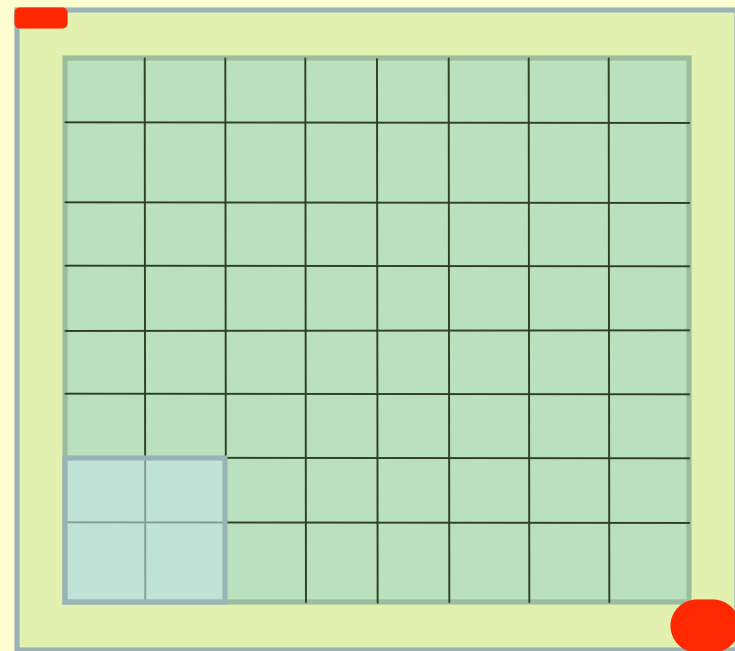




Image Pyramid Construction

- Combine each set of 4 adjacent tiles into a single tile at half the resolution.
- Repeat till entire plate is a single tile.
- We have created an image pyramid at multiple scale levels
 - 1x = 4096 tiles
 - 2x = 1024 tiles
 - 4x = 256 tiles
 - 8x = 64 tiles
 - 16x = 16 tiles
 - 32x = 8 tiles
 - 64x = 1 tile
 - 5461 jpegs x 1792 fields = 9,786,112 images
- Save all JPG images with updated FITS headers.



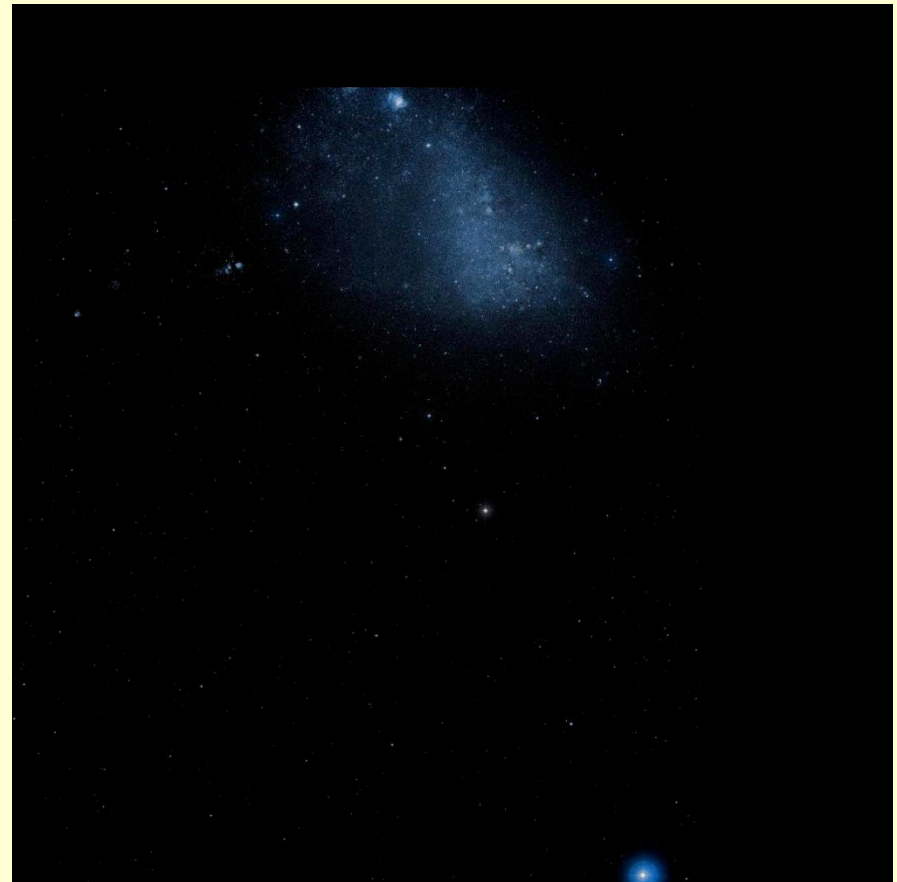


DSS Colour Image Access

- Loaded JPG data and FITS WCS information into SQLserver 2005 database (200GB).
- Index coordinates of each tile at each scale with HTM for fast lookup.
 - HTM functions are compiled into DLL and bound into SQLserver for fast execution within the database.
- Prototype web interface and VO SIAP service selects tiles and creates image cutout (at selected resolution).
 - IIS webserver, ASPX pages, C# code running within .NET framework.
- HLA interface (variable resolution, dynamically resamples DSS JPG to North up to overlay footprints).
 - C# code directly accessing SQLserver database



**Large Fields possible using image pyramid
Coma (1 degree) /SMC (6 degrees)**





Archive Research - HLA

Instrument	#Footprints
<input checked="" type="checkbox"/> ACS	12
<input checked="" type="checkbox"/> WFPC2	2
<input checked="" type="checkbox"/> STIS	8
<input checked="" type="checkbox"/> NICMOS	1
<input checked="" type="checkbox"/> NICMOS GRISM	0
<input checked="" type="checkbox"/> FOS	0
<input checked="" type="checkbox"/> GHRS	0

DSS Image On Off

Data Product

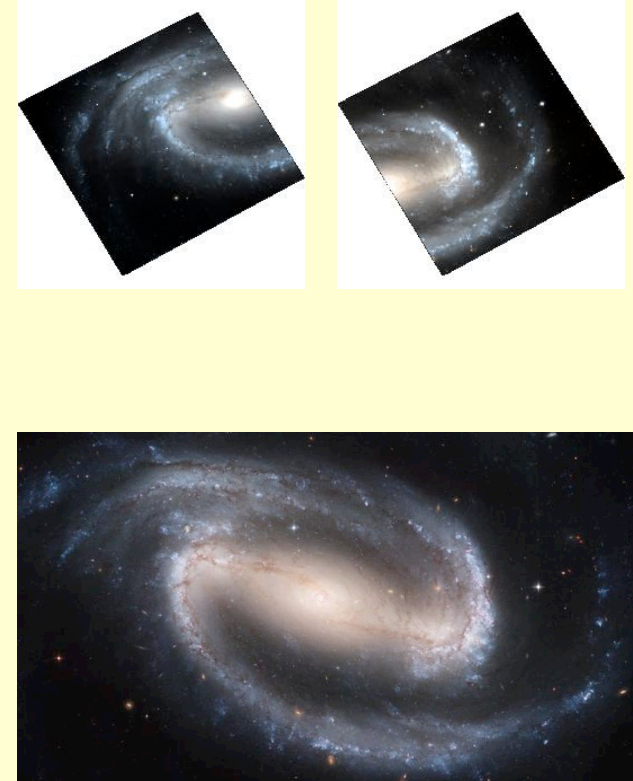
- Exposure (Level 1)
- Combined (Level 2)
- Best Available

To Zoom, go to Advanced Search and enter a smaller value for Radius (smallest value 0.01 degrees)

Footprint Science Table (Image and table selected fields are sorted to beginning of table)

Results: Viewing page 1 of 1 Selected 0 of 23

NGC 1300





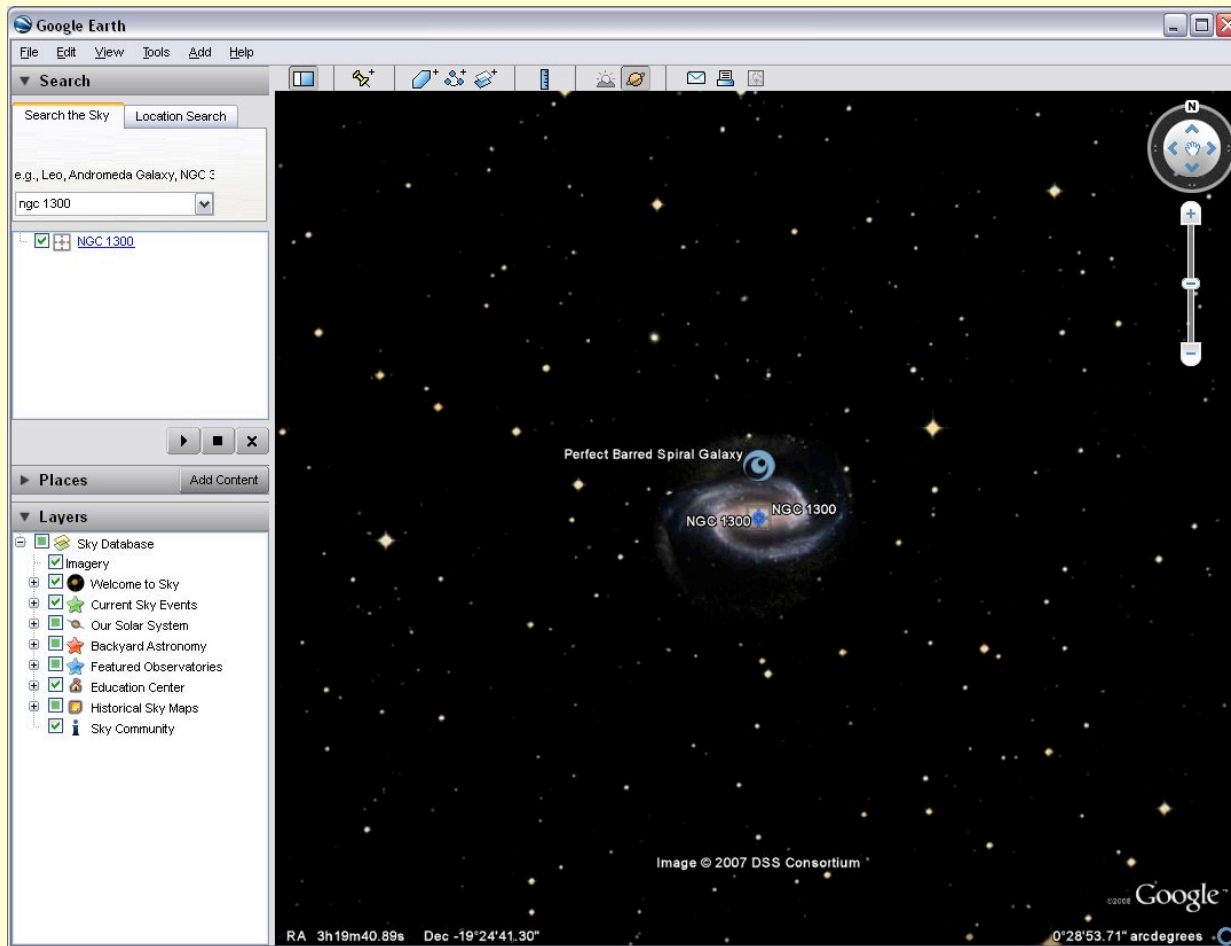
Archive Research – VirGO

The screenshot displays the MAST archive interface. The main window shows a star field with a grid overlay. A central region is highlighted in yellow, indicating a selected area. The interface includes several panels:

- Top Panel:** Shows the date "2008-07-15", the instrument "ESO VirGO 1.3.1", and parameters "FOV=0.213°" and "FPS=58.3".
- Right Panel (List Browser):** Displays a table of observations with columns for Date, F, ExpTr, Filter, and Instrument. The table lists observations from 2005 to 2008.
- Right Panel (Image Info):** Provides details for the selected image, including the instrument (SOFI), date (2005-12-11), program ID (076.C-0883(A)), PI Name (BIALETSKI/ALVES/BOUY), position (3h19m41.8s / -19°24'42.6"), and band (Ks).
- Right Panel (View Selector):** Allows users to filter data by instrument and filter. The selected filters are SOFI, H, Ks, and J.
- Right Panel (Target Selection):** Shows the search criteria for the target, including the name "ngc 1300" and coordinates (RA: 3h 19m 40.80s, Dec: -19° 24' 40.00").



Outreach : Sky in Google Earth

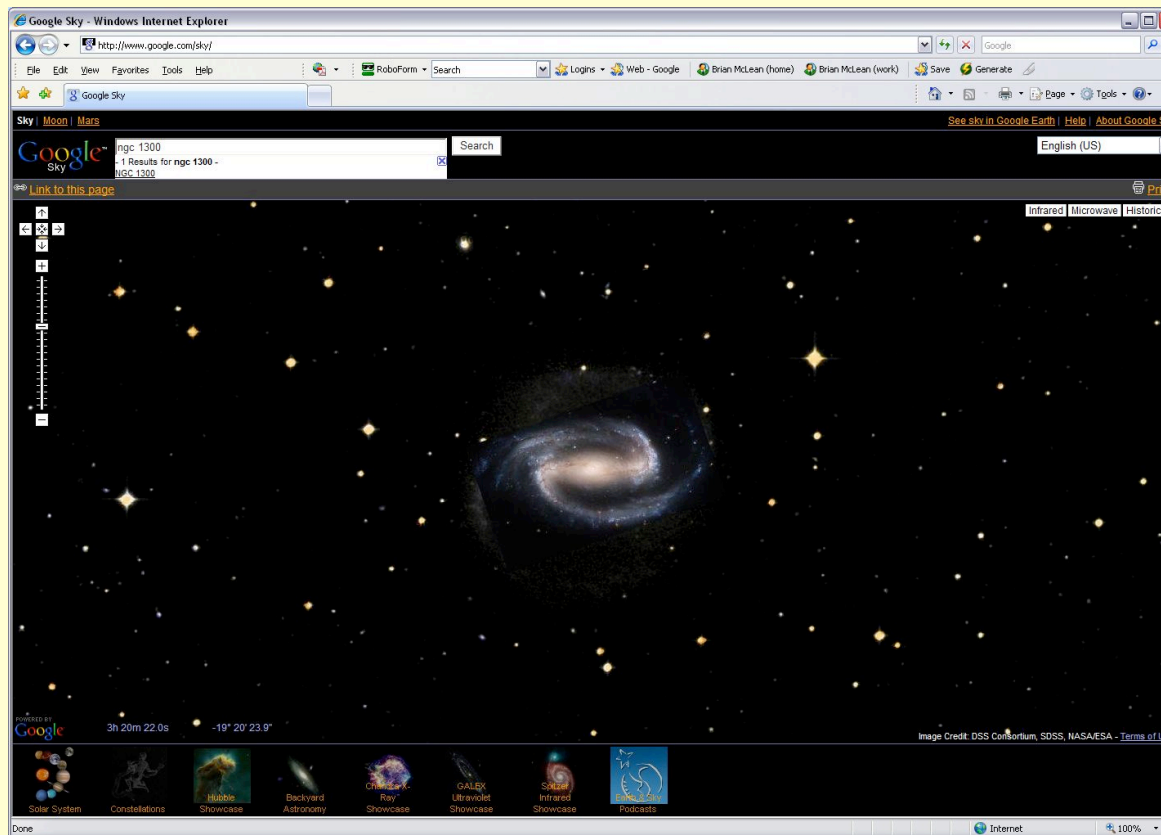


- Based on Google Earth client which must be downloaded and installed
- Blended DSS/SDSS/HST press release images into 'Optical' layer
- Showcase for HST press releases
- Problem with projections near poles
- Constellation names and boundaries
- Bright star and NGC catalogues
- Simple guides to stars and galaxies for educational use



Outreach : GoogleSky

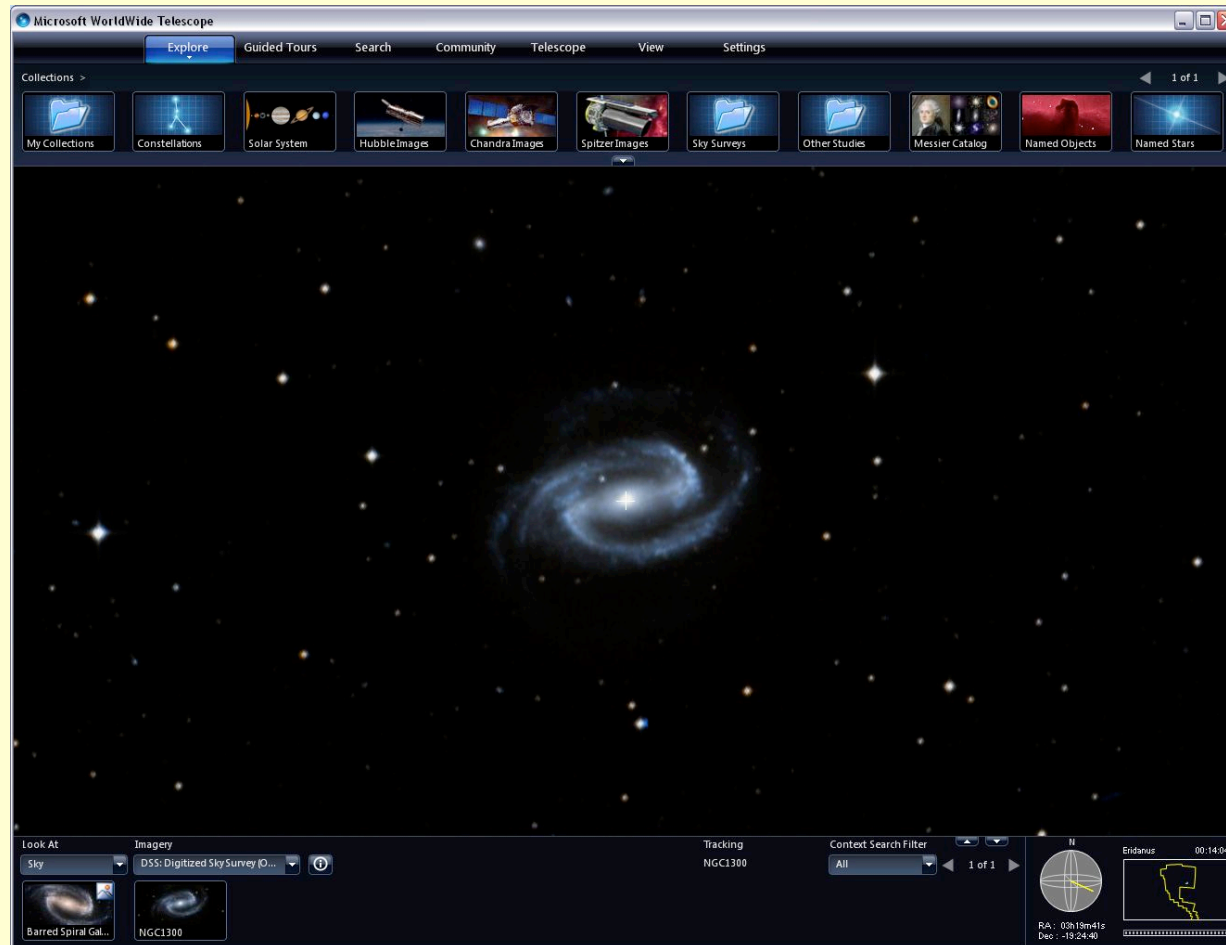
<http://www.google.com/sky/>



- Based on GoogleMaps API
- Blended DSS/SDSS/HST press release images into 'Optical' layer
- Added IRAS and CMB layers
- Showcase for HST, Chandra, Spitzer, GALEX press releases
- Problem with projections near poles (same images as GE)



Outreach : MS WorldWide Telescope



- Based on *new* graphics engine

- Each survey has own layer (MS re-used STScI JPG images)

- Showcase for HST, Chandra, Spitzer press release images

- Built-in tool for creating 'slideshows' for educational purposes

- Built-in tool for controlling computer controlled telescopes that use ASCOM as standard protocol

- Built-in tool for community sharing of slideshows and images

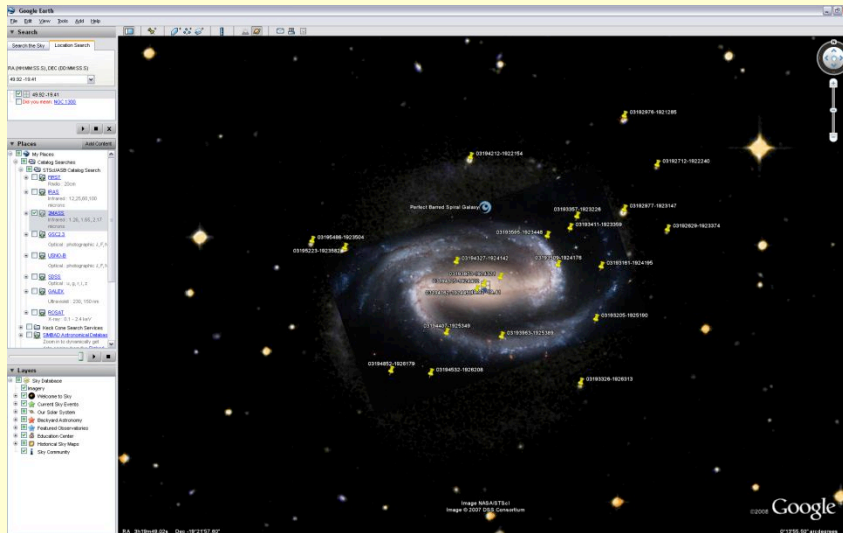


GoogleSky & WWT for Archive Research?

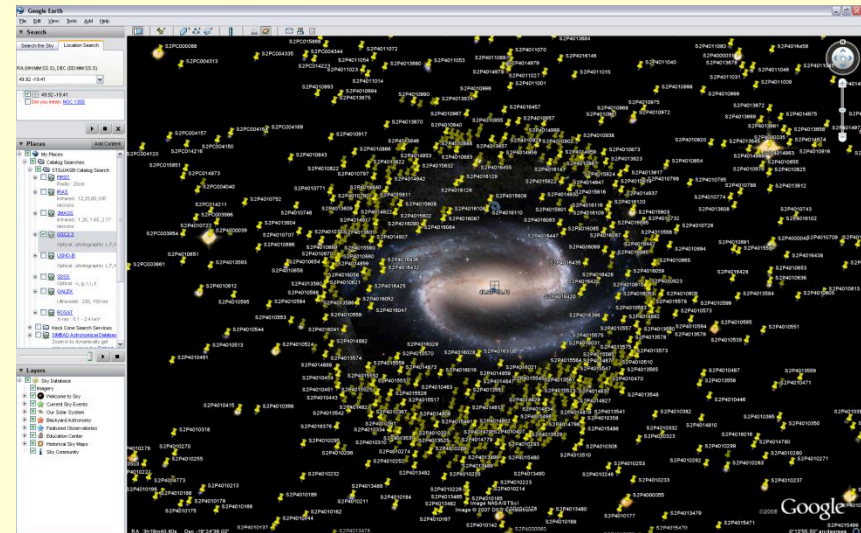
- Both Google and Microsoft products already understand KML files.
 - Allows one to open (local or remote) KML files which can plot/overlay images and catalogs in the tools.
 - KML has been adopted as an Internet Standard and the VO is planning to support it.
- Both sets of developers plan to support VO standards (SIAP/VOTables/Footprints etc) to allow use as front-end browser for VO-enabled archives.
 - STScI collaborating with both groups (and ESO)
 - improve DSS imagery (plate backgrounds/contrast/colour balance/image formats)
 - interface to VO-enabled archive (such as HLA)
 - Embed WCS into JPG files



Catalog Display using VO ConeSearch and KML output



2MASS



GSC2