

# Propagation

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By Jerry – N02T

In memory of Doris NW2B

It was Doris who started me thinking along the lines of "How To" rather than "Wonder What"? Before each major contest we would sit down and plan what the guestimated propagation was going to be. After the contest we would examine what actually happened.

# Propagation

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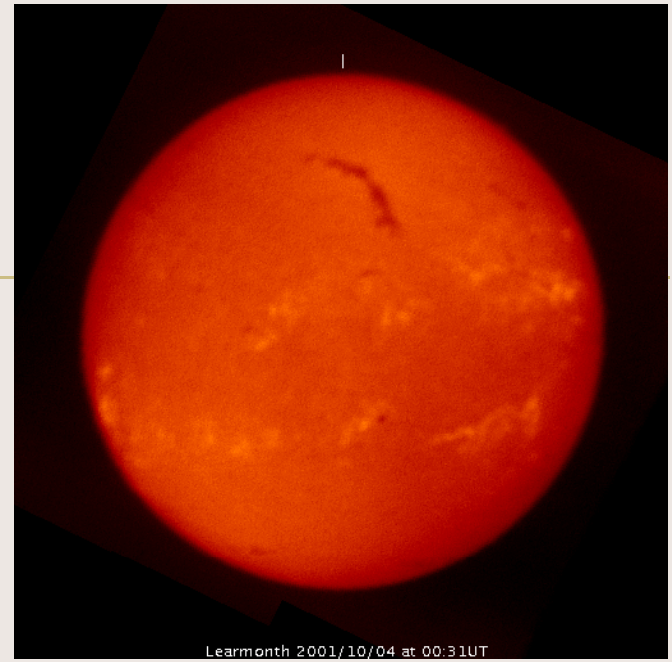
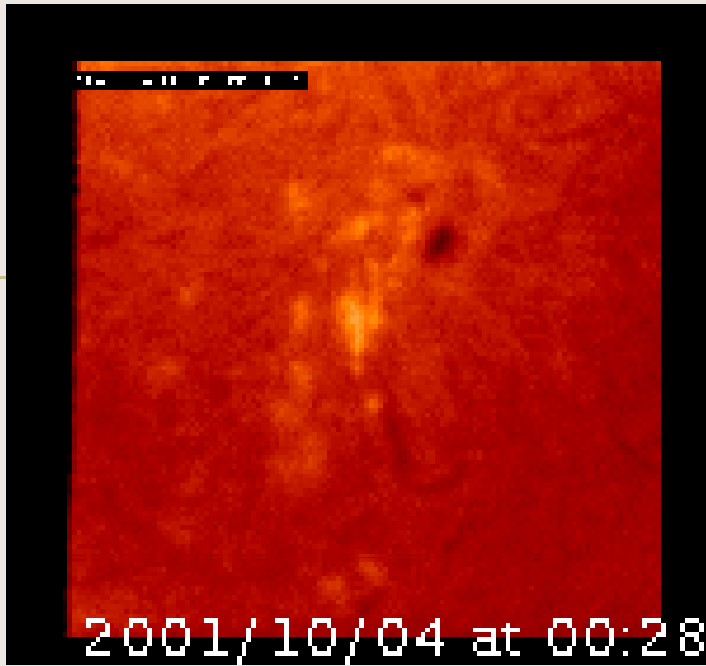
Here we will try to de-mystify the numbers used to describe the conditions on the sun that influence the use of Amateur Radio-- but more important provide tools for "Real Time" use

Credits for the Data and Images to: Google©,  
Google Earth© & Space Environmental Corp.

# The Sun

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- All radio propagation depends on the sun
- It emits UV radiation which activates our atmosphere
- How it activates these upper layers determines whether propagation is good or stinko!
- We bounce our radio signals off these layers to work DX



**SPOTS!!!**

WV 101

A HUGE and Complex Subject

# 2002 VS 2008

The screenshot shows a web browser window displaying the MSNBC website. The main content area features a "PICTURE STORIES" section titled "Solar cycle". It contains two side-by-side images of the sun, labeled "2002" and "2008", separated by a vertical line. The 2002 image shows a very active sun with bright, glowing regions, while the 2008 image shows a much calmer sun with very little activity. To the right of the images is a text block explaining the difference.

**Solar cycle**

If you compare the sun in 2002 with the sun in 2008 in extreme ultraviolet light, as seen by the Solar and Heliospheric Observatory, you'll understand what a difference half a solar cycle makes. In Aug. 4-7, 2002, the sun was near its maximum level of activity. Six years later, the view on the right, based on data collected July 4-7, 2008, shows the sun to be quiet with no active regions at all. This is all part of the normal 11-year solar cycle.

Navigation: [Space news](#) [More space pictures](#) [Write us](#) [Email this](#) [Help](#)

Page navigation: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#) [19](#) [20](#) [21](#) [22](#) [23](#) [24](#) [25](#) [Previous month](#)

Taskbar: Process Explorer - Sysint... Technology & Science Bre... http://www.msnbc.ms... 1:20 PM

## What are the Numbers?

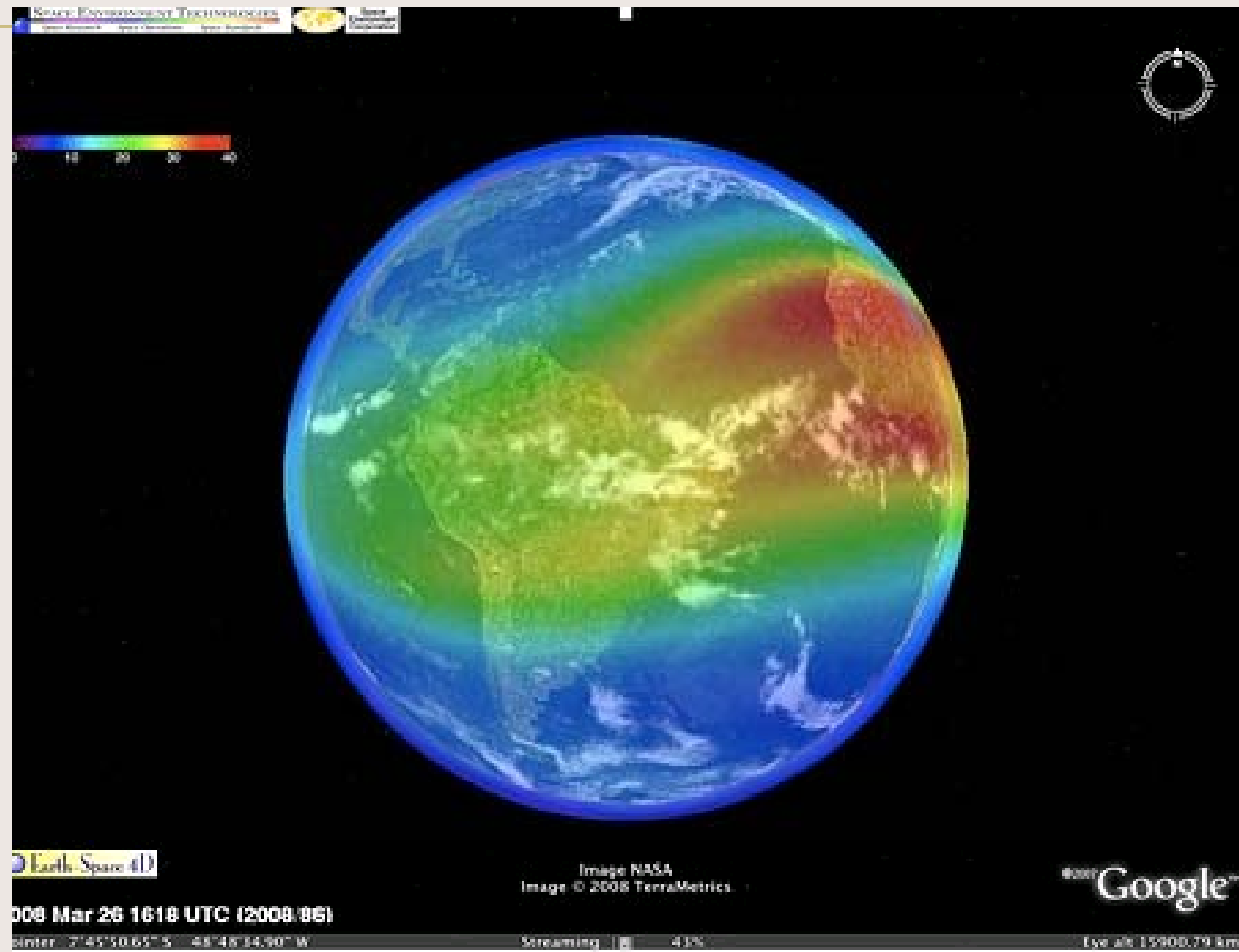
A typical WWV report (OH2AQ)  
-Also Packet/WWV 5 & 10 MHz

**02 Oct kh2d (15) I=217, A= 37, K= 3, R=289**  
**SA:mo=)mo-hi GF:un-mas=)un-ac**

**What do they mean? Don't Worry-  
See what is now possible!!**

$$\nabla \times (\nabla \times \mathbf{E}) = -\nabla(\nabla \cdot \mathbf{E}) - \nabla^2 \mathbf{E} = -\nabla^2 \mathbf{E} = -[\delta(\nabla \times \mathbf{B})/\delta t] / c$$
$$\nabla^2 \mathbf{E}_0 + (4\pi\mu\sigma / c^2) \delta \mathbf{E} / \delta t = 0 .$$

# The Latest Tool



# Read about It

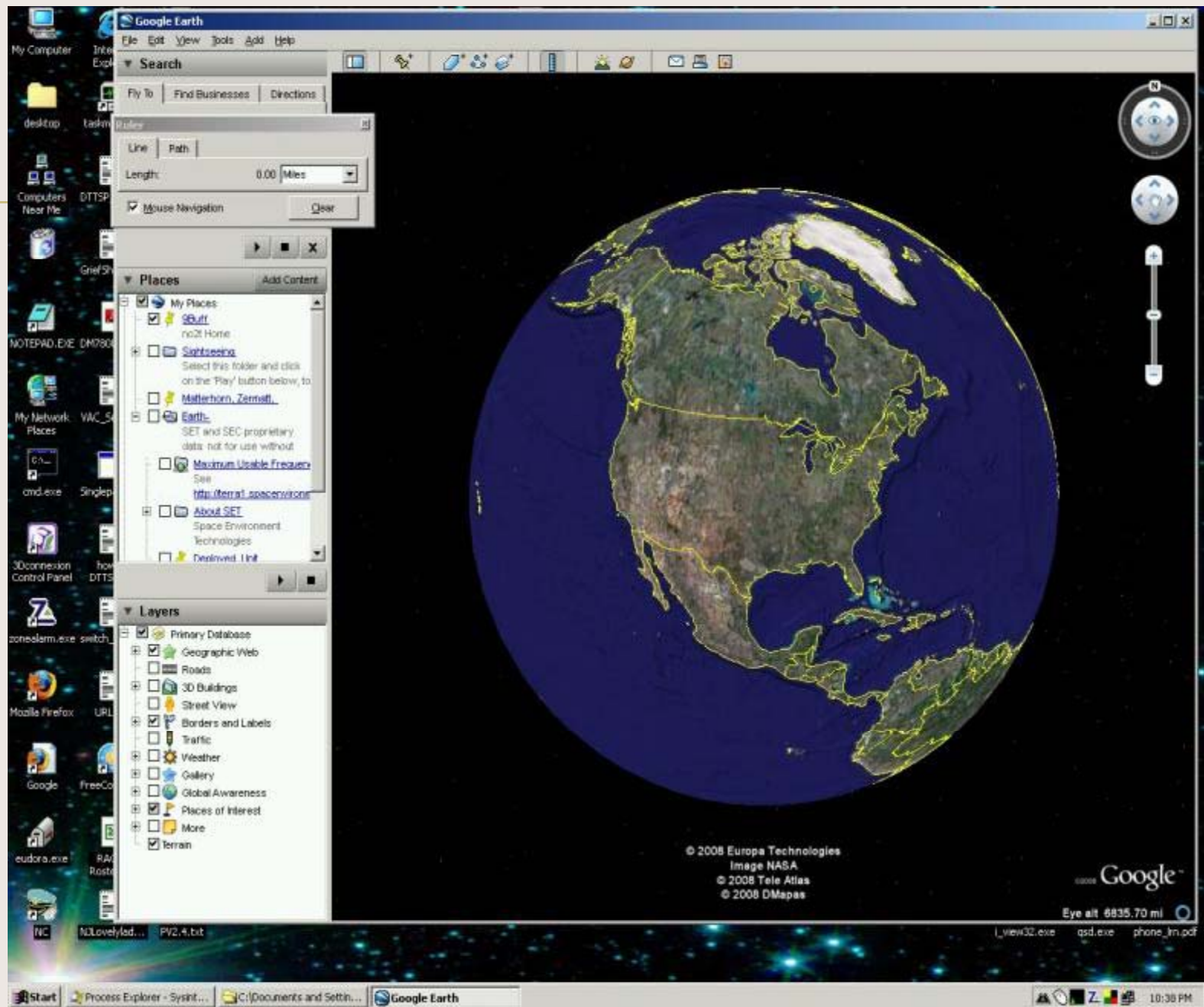
---

[http://science.nasa.gov/headlines/y2008/30apr\\_4dionosphere\\_launch.htm](http://science.nasa.gov/headlines/y2008/30apr_4dionosphere_launch.htm)

# START

---

- Get GOOGLE EARTH<sup>©</sup> running
- Play with it to be able to:
  - Rotate the earth
  - Zoom in and Zoom out



Google Earth

File Edit View Tools Add Help

Search

Fly To Find Businesses Directions

Distance

Line Path

Length: 0.00 Miles

Mouse Navigation Clear

Places Add Content

My Places

Stuff

no2 Home

Sightseeing

Select this folder and click on the 'Play' button below, to

Matterhorn, Zermatt...

Earth...

SET and SEC proprietary data: not for use without

Maximum Usable Frequency

See

<http://ferrari.spaceenv.com>

About SET

Space Environment Technologies

Derived Link

Layers

Primary Database

Geographic Web

Roads

3D Buildings

Street View

Borders and Labels

Traffic

Weather

Gallery

Global Awareness

Places of Interest

More

Terrain

© 2008 Europa Technologies  
Image NASA  
© 2008 Tele Atlas  
© 2008 DMapas

Google

Eye alt 6835.70 mi

l\_view32.exe qsd.exe phone\_fm.pdf

Start Process Explorer - Sysint... C:\Documents and Sett... Google Earth

10:38 PM

# Now navigate to NASA

---

- <http://terra1.spacenvironment.net:16080/~ionops/ES4Dintro.html>

Google Earth

Search

CAPS - Mozilla Firefox

http://terra1.spaceenvironment.net:16080/~ionops/ES4DIntro.html

CAPS / ES4D - *Earth Space 4-D*

Space Environment Technologies

Space Environment Corporation

Earth Space 4-D; Visualizing the Ionosphere using [Google Earth](#) \*

1. Download and install the [Google Earth](#) \* application
2. Download one or more of following ES4D KML files to your computer.
  - [Radio Availability](#)
  - [Total Electron Content](#)
  - [Maximum Useable Frequency](#)
  - [foF2](#)
  - [Past 24 hours TEC movie](#)
  - [Past 24 hours MUF movie](#)
3. Double-click or drag-drop the files selected above onto the Google Earth application icon
4. In Google Earth, select one or more the desired views under Places
5. Select optional Google Earth Views:
  - Weather in the Layers sidebar
  - Terrain in the Layers sidebar
  - Grid (lat/long) under View Menu
  - Atmosphere under View Menu
6. Navigate using the zoom, tilt, and rotate sliders in the upper right corner
7. View a movie of the past 24 hours using the time slider with 1 movie selected
8. It is recommended to download new KML files from this site each time Google Earth is started.
9. See [this brief user guide](#) for additional information.

http://terra1.spaceenvironment.net/~ionops/current\_files/Google\_MUF.kml

CAPS - Communication Alert Planning System

Process Explorer - Sysint... C:\Documents and Settin... Google Earth \*C:\Documents and Setti... CAPS - Mozilla Firefox

10:42 PM

**Ruler**

Line Path

Length: 0.00 Miles

Mouse Navigation

**Places**

- Sightseeing
  - Matterhorn, Zermatt
- Earth
  - Maximum Usable Frequency
    - http://terra.spaceenviro.net
  - About SET
  - Deployed Unit
- Temporary Places
- Earth

**Layers**

- Primary Database
- Geographic Web
- Roads
- 3D Buildings
- Street View
- Borders and Labels
- Traffic
- Weather
- Gallery
- Global Awareness
- Places of Interest
- More
- Terrain

**Earth-Space 4D**

Image NASA  
© 2008 Europa Technologies  
© 2008 DMaps  
© 2008 Tele Atlas

2008 Jul 30 0249 UTC (2008/212)  
lat 33.671528° lon -133.305069°

Eye alt 6864.19 mi

Start | Process Explorer - System... | Google - Mozilla Firefox | Downloads | Google Earth | 10:51 PM

# How to use the new tool

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- We can rotate the globe to examine what the MUF is over the entire Earth
- The data is current ( within 2 hours or better{ <90 minutes? })
- We can determine what bands are possible between different locations
- A few examples will be shown:

# What band to use for the South Pacific??

---

- Draw a Great Circle line (Using Google<sup>©</sup> Tools)
- Look for the MUF for each bounce off the F2 layer
- By inspection, 30 meters and maybe even 20 meters will work

Clipboard - Infa... Google Earth

File Edit Image... View 3D Tools Add 19th

Search

Fly to Find Businesses Directions

Fly to e.g., 37 25 81' N, 122 05 38' W

Places

- Spain
- Matterhorn, Zermatt
- Earth
- Maximum Usable Frequency
- About SET
- Space Environment Technologies
- Destroyed Link
- Temporary Places
- Earth

Layers

- Primary Database
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Ruler

Line Path

Length: 4,914.24 Miles

Mouse Navigation Clear

SPACE ENVIRONMENT TECHNOLOGIES

Image NASA  
© 2008 Europa Technologies  
© 2008 DMaps  
© 2008 Tele Atlas

Google

Eye alt 6864.19 mi

2008 Jul 30 0249 UTC (2008/212)  
lat 4.308803° lon -154.888733°

1200 x 1600 x 24 BPP Not a file 56 % Not a file / 5.49 MB Not a file

Process Explorer - Sysint... Google - Mozilla Firefox Downloads Google Earth Clipboard - InfaView (Zo...

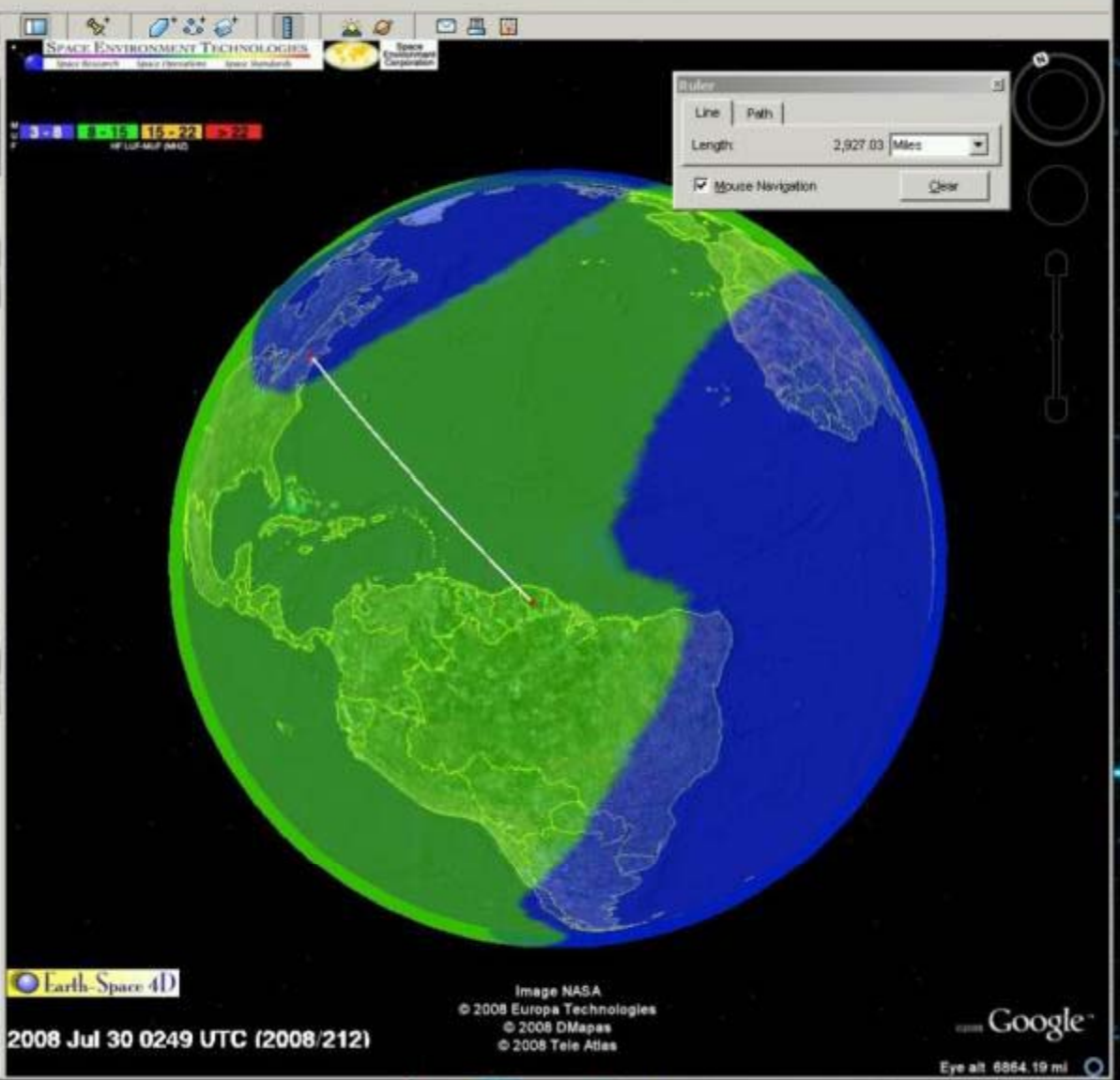
10:54 PM



# Path to Brazil

---

- Looks like the half way point will handle  $>8\text{MHz}$
- Good chance for 30 meters and maybe even 20 meters



Earth-Space 4D

2008 Jul 30 0249 UTC (2008/212)

Image NASA  
© 2008 Europa Technologies  
© 2008 DMages  
© 2008 Tele Atlas

Google  
Eye alt 6864.19 mi

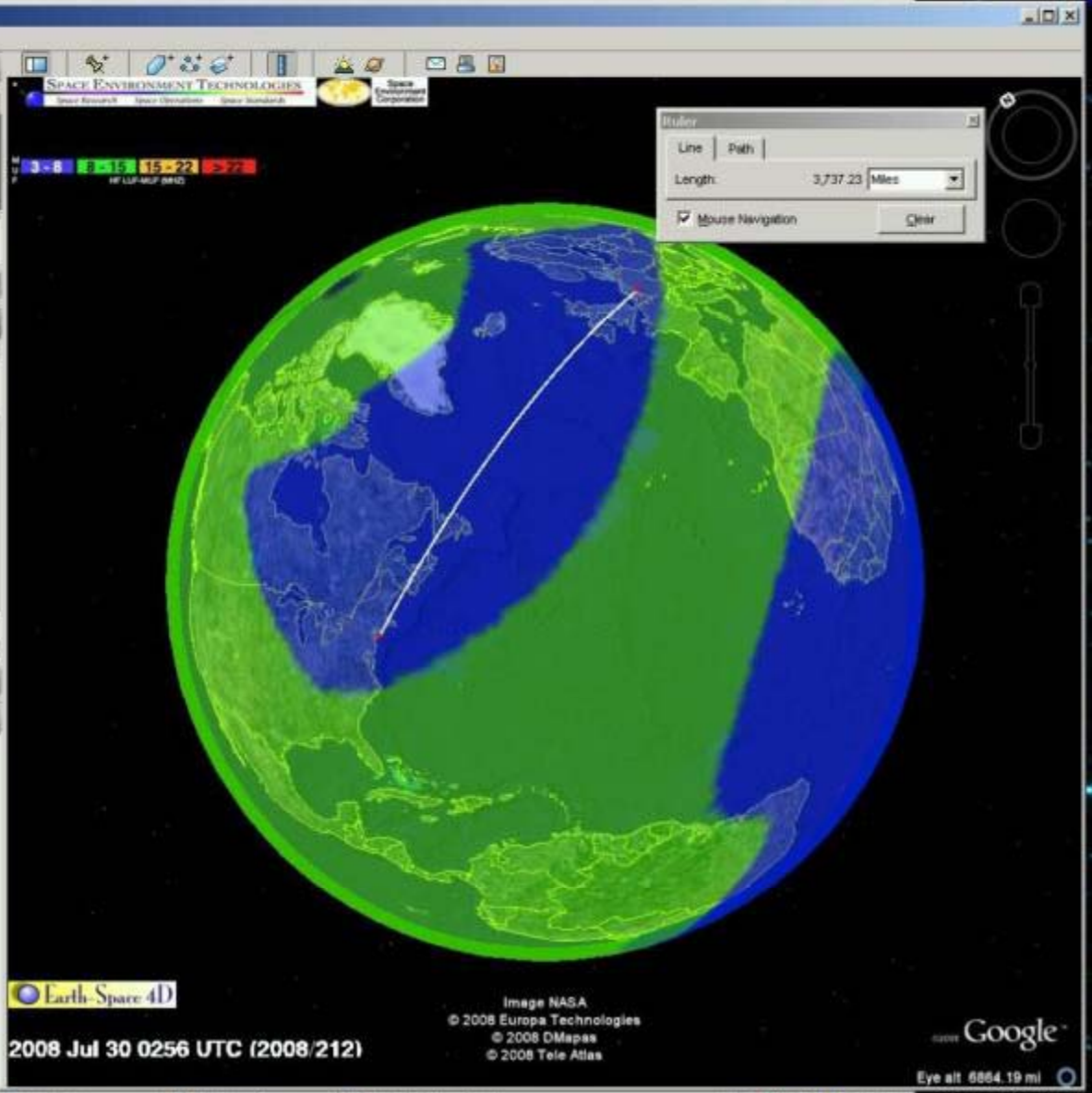
# Path to Europe

---

- Time: 0249UTC or 10:49 PM local
- MUF over the entire path is below 8MHZ
- Get on 40 to work this area of the world

Google Earth interface showing a 3D Earth model with a red line path. The interface includes a search bar, a 'Places' list, and a 'Layers' panel. A ruler window is open, showing a length of 3,737.23 Miles. The main window displays the Earth with a red line path and a ruler. The ruler window shows 'Line' and 'Path' tabs, with 'Length: 3,737.23 Miles' and a 'Mouse Navigation' checkbox checked. The main window shows a 3D Earth model with a red line path. The ruler window shows 'Line' and 'Path' tabs, with 'Length: 3,737.23 Miles' and a 'Mouse Navigation' checkbox checked.

- Search
- Fly to Find Businesses Directions
- Fly to e.g., 37 25 01.8' N, 122 05 38' W
- 
- Places
- Sightsenia
    - Select this folder and click on the 'Play' button below, to
    - Matterhorn\_Zermatt
  - Earth
    - SET and SEC proprietary data: not for use without
    - Maximum Usable Frequency
      - See
      - <http://www.set.com>
    - About SET
      - Space Environment Technologies
    - Deleted Link
  - Temporary Places
  - Earth
    - SET and SEC proprietary data: not for use without
- 
- Layers
- Primary Database
  - Geographic Web
  - Roads
  - 3D Buildings
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  - More
  - Terrain



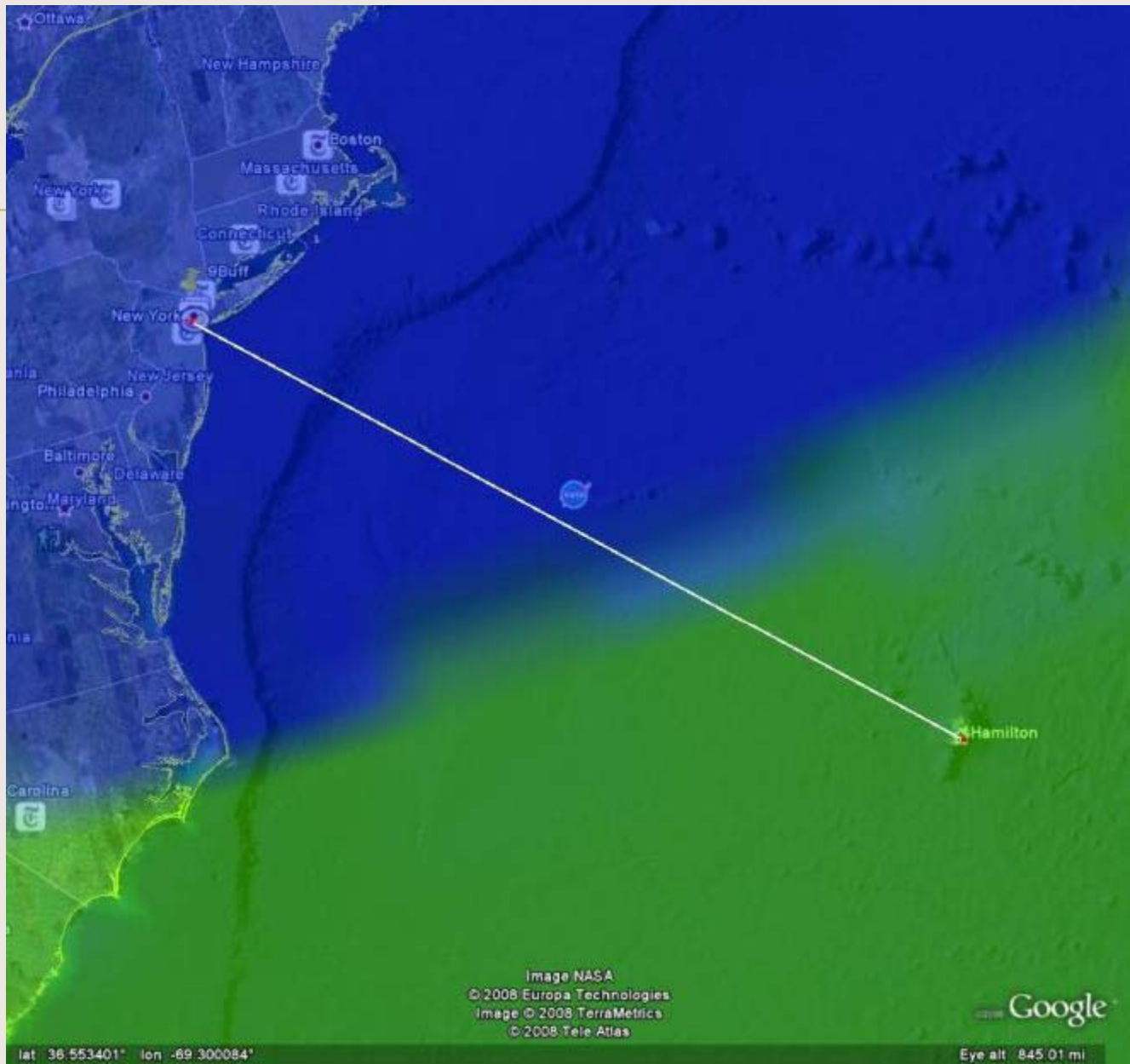
1280 x 1024 x 24 BPP Not a file 87 % Not a file / 3.75 MB Not a file

Start Process Explorer - Synt... Google - Mozilla Firefox Downloads Google Earth Clipboard - 3farview (D... 11:04 PM qsd.exe phone\_fm.pdf

# Path to Bermuda

---

- The mid point shows a MUF below 8 MHz
- This means 40 meter and below is required
- The time is 0200UTC or 10 PM




lat 36.553401° lon -69.300084°

Image NASA  
© 2008 Europa Technologies  
Image © 2008 TerraMetrics  
© 2008 Tele Atlas

Google

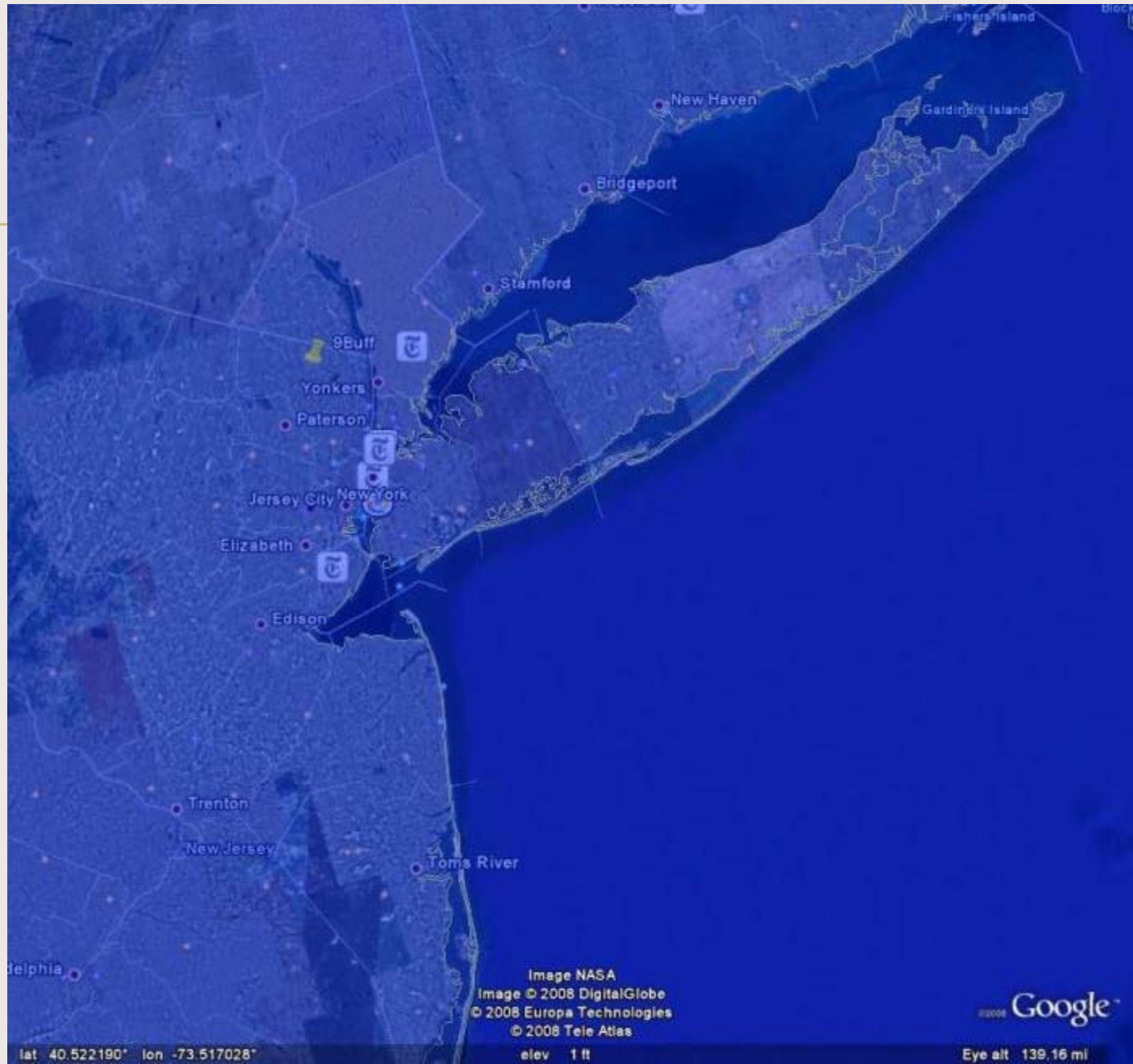
Eye alt 845.01 mi



## Now let us move overhead and to lower altitude

---

- At an altitude of over 130 miles our eyepoint is still above the F2 layer



lat 40.522190° lon -73.517028°

elev 1 ft

Eye alt 139.16 mi

Image NASA  
Image © 2008 DigitalGlobe  
© 2008 Europa Technologies  
© 2008 Tele Atlas

Google

# Moving below the F2 Layer

---

- The Blue (<8MHz MUF) Disappears
- The Altitude is now below 120 miles
- This shows the thickness of the F2 layer

\*\*\*\*NOW!\*\*\*\*



lat: 40.522190° lon: -73.517028°

Image NASA  
Image © 2008 DigitalGlobe  
© 2008 Europe Technologies  
© 2008 Tele Atlas

elev: 1 ft

Google

Eye alt: 117.02 mi

# Looking at the MUF from the ground

---

- From my QTH looking south
- Look for the change in MUF
- To the right is the ridge where K2ZB lives
- Towards South America MUF is above 8MHz (30M and maybe 20M)
- Looking west and north MUF <8MHz
- That means 40M to JA or EU (G, SP etc)

Google Earth

File Edit View Tools Add Help

Search

Find Businesses Directions

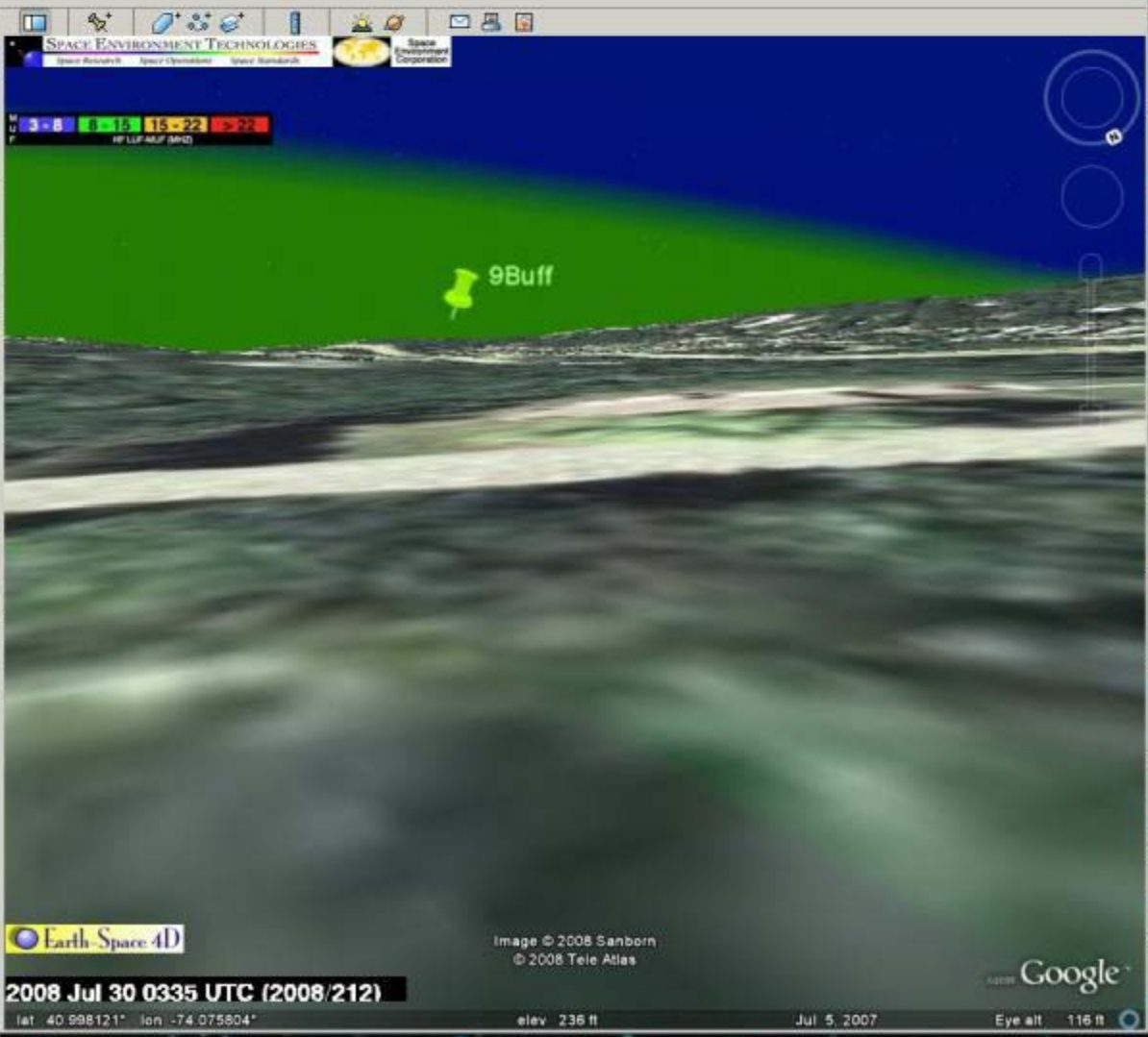
Find by location (e.g., 37.25.018° N, 122.05.36° W)

Places Add Content

- Sightseeing
- Select this folder and click on the 'Play' button below, to
- Matterhorn, Zermatt
- Earth
- SET and SEC proprietary data: not for use without
- Maximum Usable Frequency
- Site
- <http://terra.spacenv.com>
- About SET
- Space Environment Technologies
- Deployed Unit
- Temporary Places

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- Traffic
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- Gallery
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- HamRadio
- NIMM Logger.exe
- IO\_SDR.jpg
- OldPwdr
- XTALL
- New\_NIMM...
- SoftRock
- Digital Master.exe
- qsd.exe (2)
- audio speaker.exe
- MMTTY.DXE
- Profler SDR
- Profler SDR
- W2RF
- W2RF
- download\_v1.bit
- SDR\_Alf
- procepl.exe
- hsttime-32bit...
- Ham Radio Deluxe
- Rocky
- CW\_Rocky
- ve7cc.exe
- Motorola Phone Tools
- CwSkimmer...
- L\_view32.exe
- qsd.exe
- phone\_fm.pdf

Process Explorer - Sysint...

Google Earth

Start

11:46 PM

# WAIT ONE MOMENT!

---

- How about an instant check- That is:
- Where can “I” be heard, with my station
- This is now possible, believe it or not!
- It is called CWSkimmer
- Available 24/7 via the internet.
- No special equipment needed
- Of course you can send CW (?)

# CWSKIMMER

---

- A world wide group of amateurs
- They are using SDR receivers
- They automatically send what they hear to:
  - <http://skimmer.dxwatch.com>
- YOU send “CQ ur Call”
- Those stations that hear you send the report to the internet and it is printed!!!

reverse beacon project - skimmer.dxwatch.com - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://skimmer.dxwatch.com/

SKIMMER.DXWATCH.COM SF189 A-6 K:2 callsign lookup:

main dx spots skimmers dx tools downloads about contact us

showhide map  
showhide map options

Map Satellite Hybrid

world wide / zoom to US / zoom to Europe / zoom to North Atlantic

search callsign:  search

no filter selected, showing all spots rows to show: 50

de	dx	freq	cq/dx	time
NZ1U-2	N4KXG	14027.6	CQ	1716z 30 Jul
NZ1U-2	N9EP.M	14030.8	CQ	1716z 30 Jul
K4TD	K2UY	7030.4	CQ	1716z 30 Jul
NZ1U-2	W4TED	14009.9	CQ	1716z 30 Jul
this is skimmer test server at dxwatch.com!				
W0SEAE-2	N9BZH	7032.1	CQ	1713z 30 Jul
NZ1U-2	IS0GV	14027.4	CQ	1713z 30 Jul
K4TD	N4KXG	7027.9	CQ	1712z 30 Jul
K4TD	W7VR	14026.0	CQ	1711z 30 Jul
K4TD	W7VR	14026.7	CQ	1710z 30 Jul
K4TD	VE2WT	14022.1	CQ	1709z 30 Jul
K4TD	W7VR	14000.9	CQ	1709z 30 Jul
K4TD	K3CB	14014.1	CQ	1709z 30 Jul
NZ1U-1	AA4MC	7043.5	CQ	1708z 30 Jul
K4TD	VE2WU	14022.1	CQ	1708z 30 Jul
K4TD	W5MLG	14039.7	CQ	1706z 30 Jul
NZ1U-2	DL50SOP	14015.4	CQ	1707z 30 Jul
K4TD	K2UY	7030.3	CQ	1707z 30 Jul

Done

SF: A: K:

news

- added "what is CW Skimmer" text
- added "getting started" tutorial
- updated "link to us" area
- updated "history" area

statistics:

- we have 6 skimmers online
- we have 6 visitors online

skimmers online:

- K4TD - 40m
- NZ1U-1 - 40m
- NZ1U-2 - 20m
- W1UJ - 40m
- W0SEAE-2 - 40m
- W0SEAE-3 - 8m

Latest DX ZONE

On the left is the station I listening!

On the right who he heard

# This is better

---

- You can see a list of stations who heard your call
- A map to show where they are located
- How about that for propagation information

reverse beacon project - skimmer.dxwatch.com - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://skimmer.dxwatch.com/

## SKIMMER.DXWATCH.COM

SP169 A B K 2    callsign lookup:

main dx spots skimmers dx tools downloads about contact us

showhide map  
showhide map options

Map    Satellite    Hybrid

North Pacific Ocean    United States    North Atlantic Ocean    Mexico    Venezuela    Colombia    Peru    Brazil    Bolivia

South Imagery ©2008 NASA, Map data ©2008 Europa Technologies    Terms of Use

world wide / zoom to US / zoom to Europe / zoom to North Atlantic

search callsign:     search

no filter selected, showing all spots    rows to show: 50

dx	dx	freq	cqdx	time
K4TD	W2EZB	14029.6	CQ	1726z 30 Jul
W1UJ	VE2PIB	7029.0	CQ	1719z 30 Jul
NZ1U-1	VE2PIB	7026.5	CQ	1719z 30 Jul
W1UJ	AA-8AC	7034.0	CQ	1718z 30 Jul
NZ1U-2	VE2WU	14021.8	CQ	1718z 30 Jul
WDSEAE-2	W8TY	7045.9	CQ	1718z 30 Jul
K4TD	W8TY	7045.9	CQ	1718z 30 Jul
W1UJ	W8TY	7045.8	CQ	1718z 30 Jul
NZ1U-2	N-8XG	14027.6	CQ	1716z 30 Jul
NZ1U-2	H9EPM	14030.8	CQ	1716z 30 Jul
K4TD	K2UY	7030.4	CQ	1716z 30 Jul
NZ1U-2	W4TED	14005.9	CQ	1716z 30 Jul
this is skimmer test server at dxwatch.com!				
WDSEAE-2	H9BZM	7032.1	CQ	1713z 30 Jul
NZ1U-2	IS8GV	14027.4	CQ	1713z 30 Jul
K4TD	N-8XG	7027.9	CQ	1712z 30 Jul
K4TD	W7VR	14026.0	CQ	1711z 30 Jul
K4TD	W7VR	14016.7	CQ	1710z 30 Jul

**news**

- added "what is CW Skimmer" text
- added "getting started" tutorial
- updated "link to us" area
- updated "history" area

**statistics:**

- we have 5 skimmers online
- we have 7 visitors online

**skimmers online:**

- K4TD - 40m
- NZ1U-1 - 40m
- NZ1U-2 - 20m
- W1UJ - 40m
- WDSEAE-2 - 40m

**LINKS**    **DX ZONE**

Done

Start    Process Explorer - Sysint...    Eudora Pro - [Pete Smith...    Downloads    - reverse beacon proj...    SF: A: K:    1:20 PM

# URL's

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- <http://earth.google.com>
- <http://terra1.spacenvironment.net:16080/~ionops/ES4Dintro.html>
- <http://skimmer.dxwatch.com>
- Questions: [no2t@arll.net](mailto:no2t@arll.net)
- Unmarried and female: [no2t@arll.net](mailto:no2t@arll.net)

A spiral-bound notebook with a brown cover and a light beige page. A blue rectangular area is centered on the page, containing the text "THAT'S ALL FOLKS" in red, uppercase, sans-serif font. The text is arranged in three lines: "THAT'S" on the top line, "ALL" on the middle line, and "FOLKS" on the bottom line. The spiral binding is visible on the left side of the notebook.

THAT'S

ALL

FOLKS