LA-UR# 10-07158
27 OCT 2010

The New Geospatial Tools: Global Transparency Enhancing Safeguards Verification

Frank Pabian

International and Applied Technologies (IAT-1)

Global Security Directorate

Disclaimer: The opinion(s) expressed in this talk are the authors' alone and do not necessarily represent those of Los Alamos National Security, LLC., the Los Alamos National Laboratory, the U.S. Department of Energy, or any US Government entity.

Satellite Imagery for All:
A New Era of Global Transparency!

"Perhaps this is also a good moment to step back in awe at what modern technology has wrought the ability for any sufficiently concerned citizen or organization to scrutinize any desired spot on Earth within hours of making the request, and then being able to publish the result to a context-rich virtual globe that is universally available. That's a profound shift in favor of accountability, transparency and democracy. ***Monitoring the planet has been crowdsourced****."*
Stefan Geens of Ogle Earth

"Clearly it has an effect on the way diplomacy will be carried out in the future",
Einar Bjorgo (UNOSAT).

Applications Include:

- **Emergency Response**
- **Disaster Management /Humanitarian Assistance**
- **Risk Prevention**
- **Peace-keeping**
- **Environmental Monitoring & Rehabilitation**
- **Post Conflict Reconstruction**
- **Social and Economic/Resource Development**
- **Treaty Verification and Monitoring**

Sources: http://www.ogleearth.com/2009/09/qum_nuclear_sit.html#comments
http://www.unspecial.org/UNS621/UNS_621_T32.html

The Satellite Imagery Analysis Unit (SIAU)

- **Provide analytical services related to the exploitation of satellite imagery in support of inspection and verification activities**

- **Collect, process, analyze, and disseminate imagery-derived products to Safeguards**

- **Provide geospatial information - identifying the "what" and "where" of a feature or object on the Earth's surface**

IAEA

Source: Technical Seminar for Diplomats
Vienna, 3-5 February 2009
http://www-pub.iaea.org/mtcd/meetings/PDFplus/2009/36489/p36489/Top%206.2%20K.%20Steinmaus.pdf

What Are the New Geospatial Tools?

How can they Assist Imagery Analysis for Strengthening Safeguards?

- **"Digital Globes"** (i.e., ***GoogleEarth, Bing Maps, SkylineGlobe***) are far better visualization means than standard maps or plan-view line drawings or even just 2-D overhead commercial satellite images alone for:
  - **Site familiarization and geospatial context awareness**
  - **Pre-inspection planning**
  - **Onsite orientation and navigation**
  - **Post-inspection reporting**
  - **Site monitoring over time for changes**
  - **Verification of states' site declarations and for State Evaluation Reports**
  - **A common basis for discussions with member states**

  See: http://en.wikipedia.org/wiki/Virtual_globe
- **"Digital Globes"** also provide **a new, essentially free**, means to conduct **broad area baseline searches** to detect, identify, characterize, and monitor **clandestine sites and activities**...either alleged through open source leads, identified on internet **BLOG and WIKI Layers**, or through combination with other information including personal knowledge.
- **NEW 3-D modeling software** (e.g., ***SketchUp6, 3Dvia***) can significantly enhance individual building characterization and visualization (including interiors), allowing for greater contextual awareness through walk-arounds, drive-arounds, or fly-arounds. Sydney NSW, Australia.kmz
- Highly accurate terrain mapping for better geospatial context allows **3-D** perspectives of all sites or areas of interest. http://www.youtube.com/watch?v=YHe3ag3i8v8&feature=player_embedded
- More current imagery can be overlain (draped) onto these globes for updated visualization

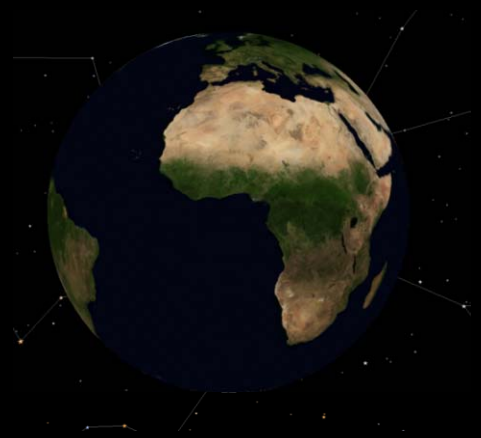
Additional Thoughts on the New Geospatial Tools

- **Virtual/Digital Globes now offer these data layers:**
  - Historical imagery
  - Sunlight shadowing effects for anytime of day, any date, any year
  - Real time weather (with real time clouds)
  - Direct access to Wikimapia, Panoramio, Flickr, and Placeopedia

    (and live web-camera feeds from all over the globe)
  - Blogger Community labeling
  - Along with the ability to measure objects and distances directly on the imagery and determine precise elevations
  - Access surveillance camera feeds, tracking of moving vehicles, and even underground modeling (SkylineGlobe)
- **The more satellites and virtual globes that become available, the more redundant and therefore reliable and useful the data**

NASA's Worldwind Mid-2004

GoogleEarth Mid-2005

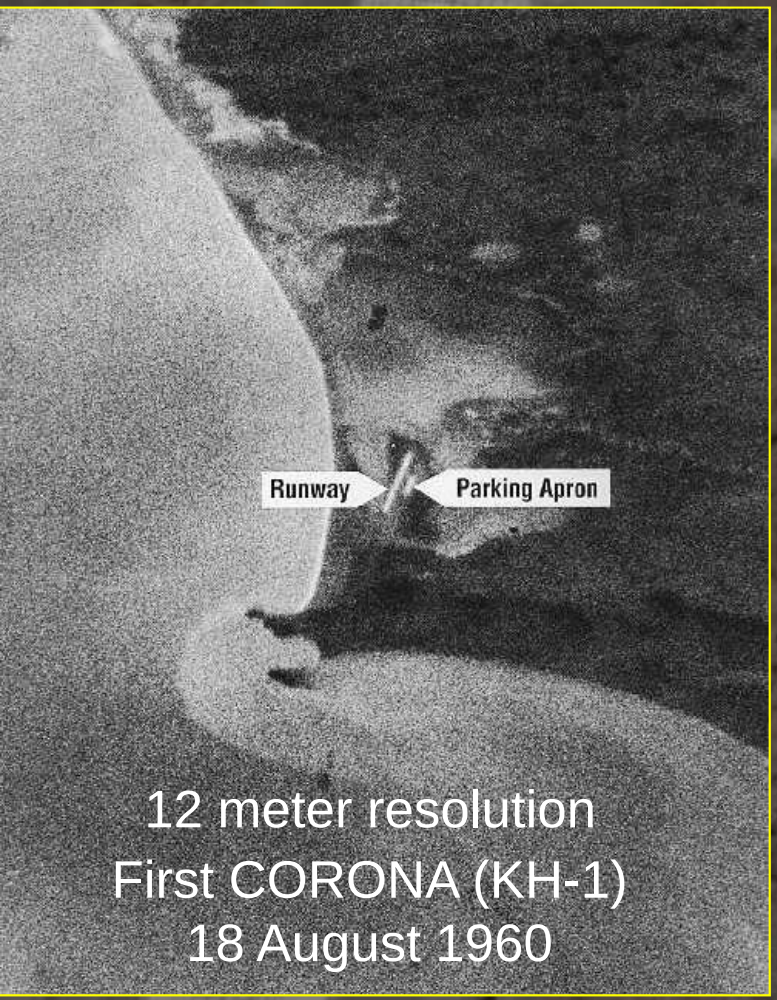


Microsoft's Bing Maps (Virtual Earth) late-2005

Skyline Globe 2006

First CORONA Compared with Google Earth

Russian (former Soviet) Airfield at Mys Shmidta



12 meter resolution
First CORONA (KH-1)
18 August 1960

Twin engine cargo plane

Antonov AN-2 "Colt" and
Mi-4 "Hound" Helicopter Exemplar

Fixed wing single engine light aircraft

Parking Apron

Digital Globe
Quickbird image
7 July 2004

←Helicopter (rotors present)

With KH-1, one could barely discriminate the parking apron from the airfield, but with Google Earth, one can discriminate between airplanes and helicopters.

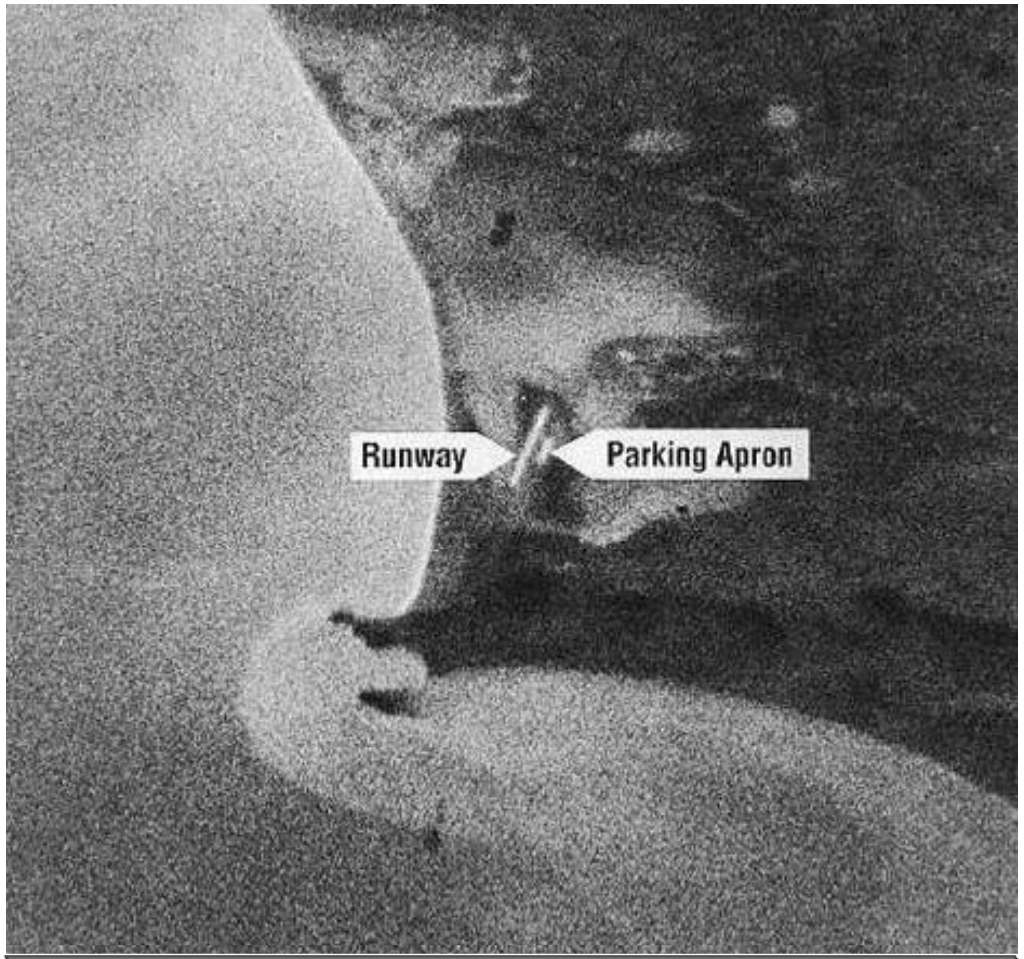
198 m

68°52'00.36" N 179°22'41.88" W elev 0 m

Eye alt 726 m

This was the Future - Then

U.S. Govt. Corona Spy Satellite



Mys Shmidta Air Field, Soviet Union

Collected August 18, 1960

This Is the Future - Now

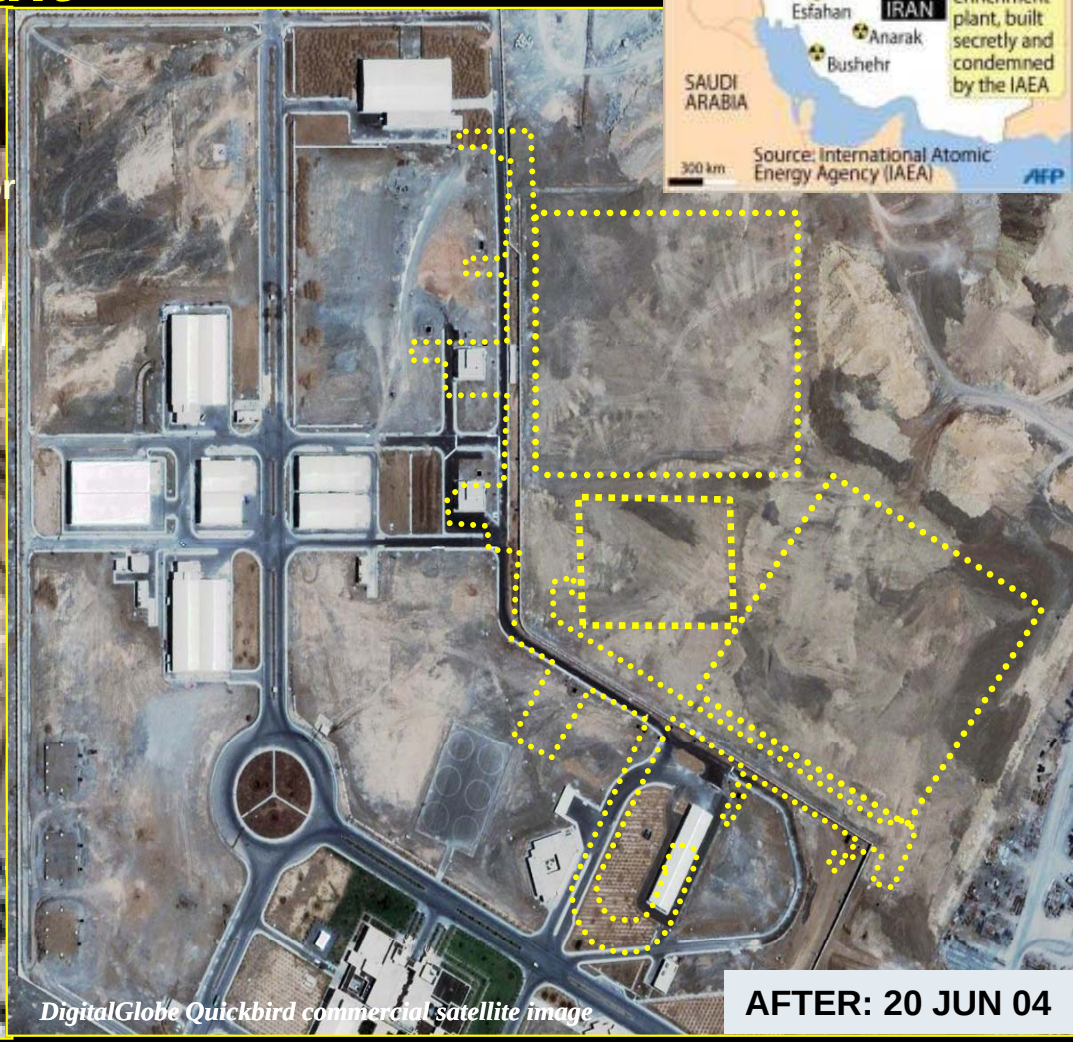
GeoEye-1 Commercial Satellite

Mys Shmidta Air Field, Soviet Union

Collected July 7, 2009

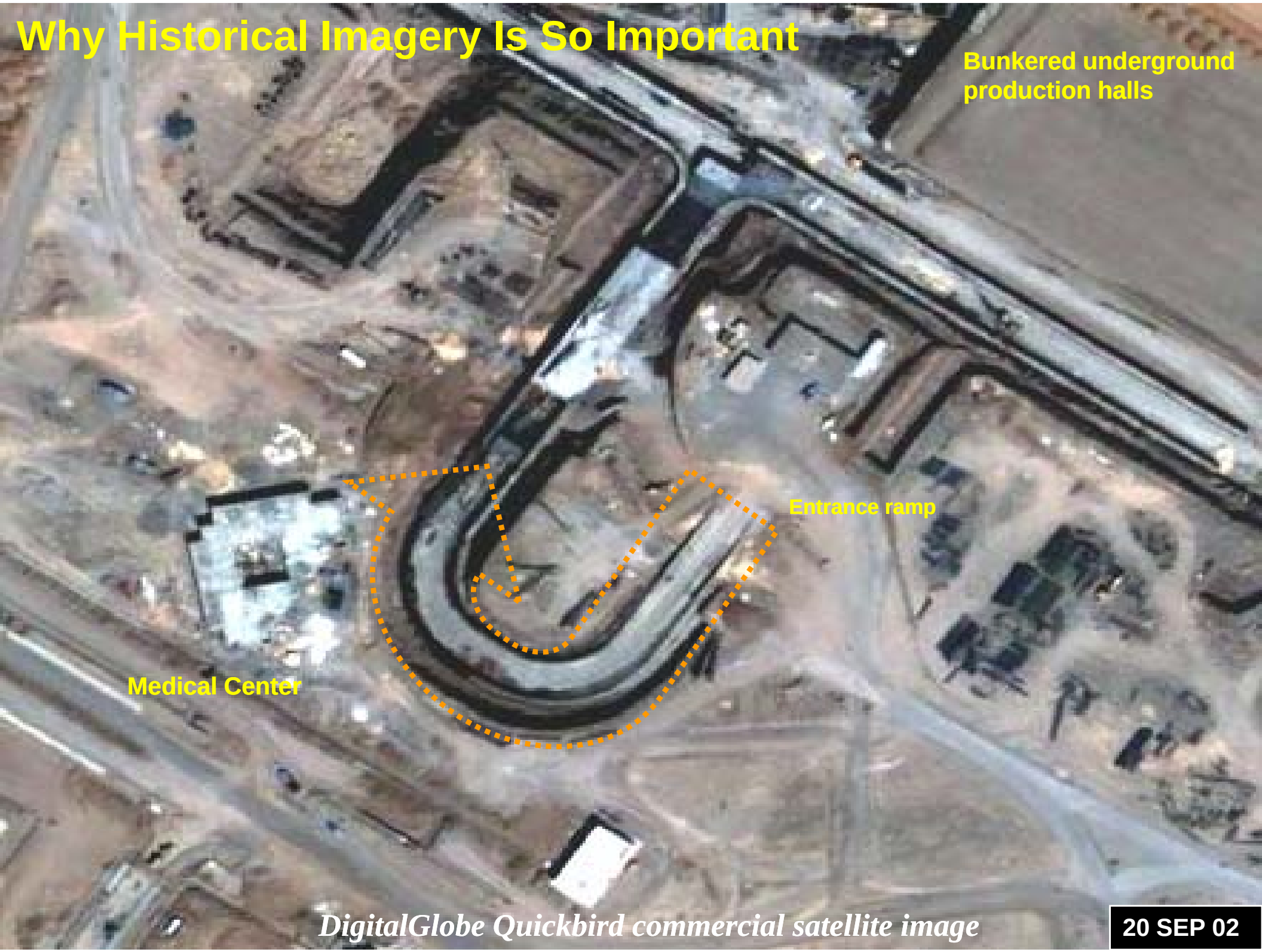
GeoEye

Case Studies and Why Historical Imagery for Change Detection Is So Important



- Covert facility in remote location: agriculture cover story
- Concealed underground, hardened, well defended
- Hidden support infrastructure

Why Historical Imagery Is So Important



Why Historical Imagery Is So Important

Ground View Showing Concealment Effectiveness

IAEA Atoms for Peace

Board of Governors

GOV/2009/35
Date: 5 June 2009

8. Iran's refusal to grant the Agency access to IR-40 could adversely impact the Agency's ability to carry out effective safeguards at that facility, and has made it difficult for the Agency to report further on the construction of the reactor, as requested by the Security Council. The completion of the containment structure over the reactor building, and the roofing for the other buildings on the site, makes it impossible to assess further progress on construction inside the buildings without access to the facility. **However, satellite imagery suggests that construction is continuing at the reactor site.**

Defense Update
Online Defense Magazine

Progress of the construction of the IR-40 Heavy Water Reactor, Arak, Iran 2007-2009

Role of Satellite Imagery Analysis

- **Monitor Nuclear Sites & Activities**
  (baseline, updates, change detection)
- **Verify Additional Protocol (AP) Declarations**
- **Verify Design Information (DIV)**
- **Support/Drive Complementary Access (CA)**
- **Investigate Alleged Undeclared Activities**
  (based on Open Source & Third Party information)

IAEA

Source: Technical Seminar for Diplomats
Vienna, 3-5 February 2009
http://www-pub.iaea.org/mtcd/meetings/PDFplus/2009/36489/p36489/Top%206.2%20K.%20Steinmaus.pdf

What is Imagery Analysis?

How Can It Help to Strengthen IAEA Safeguards?

- **Imagery Analysis: Image analysis is the extraction of meaningful information from images, which, for this review, is primarily commercial satellite imagery. Imagery analysis is another means of assessing raw data that can be combined with other safeguards pertinent data, in a manner sometimes referred to as "Data Fusion," that can often have significant synergistic results.**

- **For IAEA Safeguards purposes, this means deriving: New, "value-added," information from the raw un-annotated imagery, and then adding that information to the overall existing body of knowledge with respect to a particular nuclear activity, facility, or program. Much like John Maeda said, "***Simplicity is about subtracting the obvious, and adding the meaningful."***

- **Imagery analysis provides answers not only to the questions of What? and Where?, but even more importantly... Why?, How ?, and What is the significance?**

- **This briefing will show how organizations like the IAEA now routinely relies on imagery analysis for safeguards monitoring purposes, particularly as it applies to identifying "Undeclared facilities and activities".**

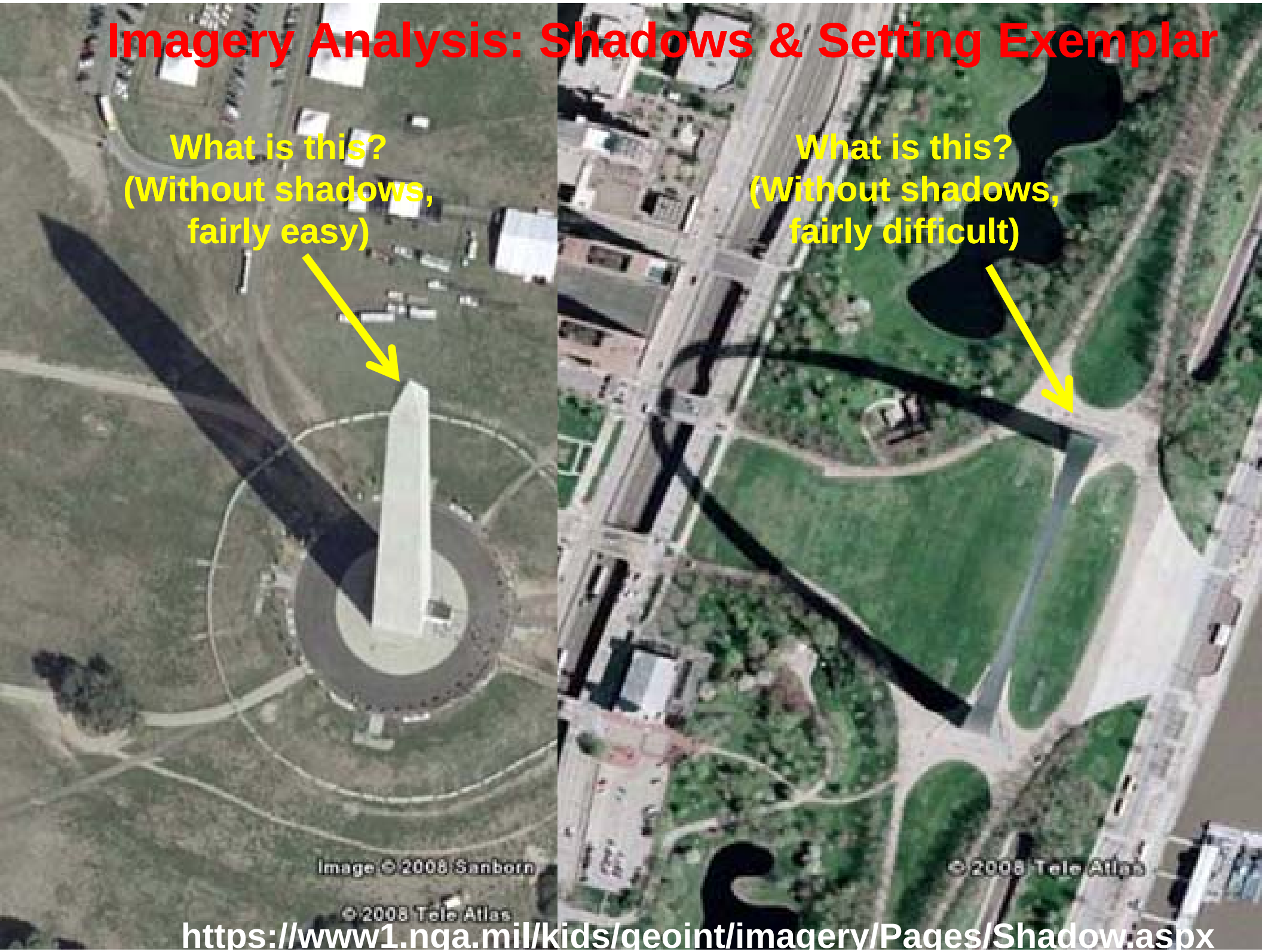
- **Finally, new "Geospatial Tools" have become available that can further facilitate the process of imagery analysis for Safeguards purposes.**

Imagery Analysis: *It's a Process*

- **Imagery doesn't come with labels...it is just "a pile of pixels" that requires human interpretation to add meaning**
- **Among the features of an image that lead to identification and aid in interpretation include:**
  - **Size: the true and relative scale of the objects in the image**
  - **Shape: the physical appearance ("anthropogenic" is often angular, vice "natural" amorphous)**
  - **Shadows: silhouettes provide insights**
  - **Shade : brightness and contrast variations of one object compared to another**
  - **Surroundings: the textual and cultural context ...What is the Setting?**
  - **Signatures: the *generally* consistent common functional characteristics (particularly when associated with the nuclear fuel cycle)**
  - **Time: Temporal changes including construction history, activity levels, operations, etc.**
- **"Convergence of Evidence": If it looks like a duck....**
- **Beware of "Signature Suppression": Deception is a constant threat**
- **Learn to think in** 

even when only working with 2-D imagery
- **Enlist collateral information: All other available sources should be tapped, including "the new Geospatial Tools" and always seek "Peer Review"**
- **Know the nuclear fuel cycle inside and out (materials, processes, equipment, infrastructure)**
- **Know your limitations: Use caveats to convey your confidence level**
- **Try a Quiz? Go to: http://www.defence.gov.au/DIGO/Imagery_Analysis/imageryQuizT3.htm**

Imagery Analysis: Shadows & Setting Exemplar



https://www1.nga.mil/kids/geoint/imagery/Pages/Shadow.aspx

Conclusions

- **Commercial satellite imagery is an integral part of Safeguards – operationally and routinely used**
- **Imagery analysis has proven to be a powerful safeguards tool:**
  - Supporting inspection & verification of declared activities
  - Identifying, characterizing & monitoring undeclared sites
- **SIAU analysts have unique knowledge/expertise in imagery based NFC signatures and observables**
- **Commercial satellite imagery is expected to play an increasing role in verification (20/20)**

IAEA

Source: Technical Seminar for Diplomats
Vienna, 3-5 February 2009
http://www-pub.iaea.org/mtcd/meetings/PDFplus/2009/36489/p36489/Top%206.2%20K.%20Steinmaus.pdf

US Intelligence Imagery Analysis of Nuclear Facilities Cold War Style

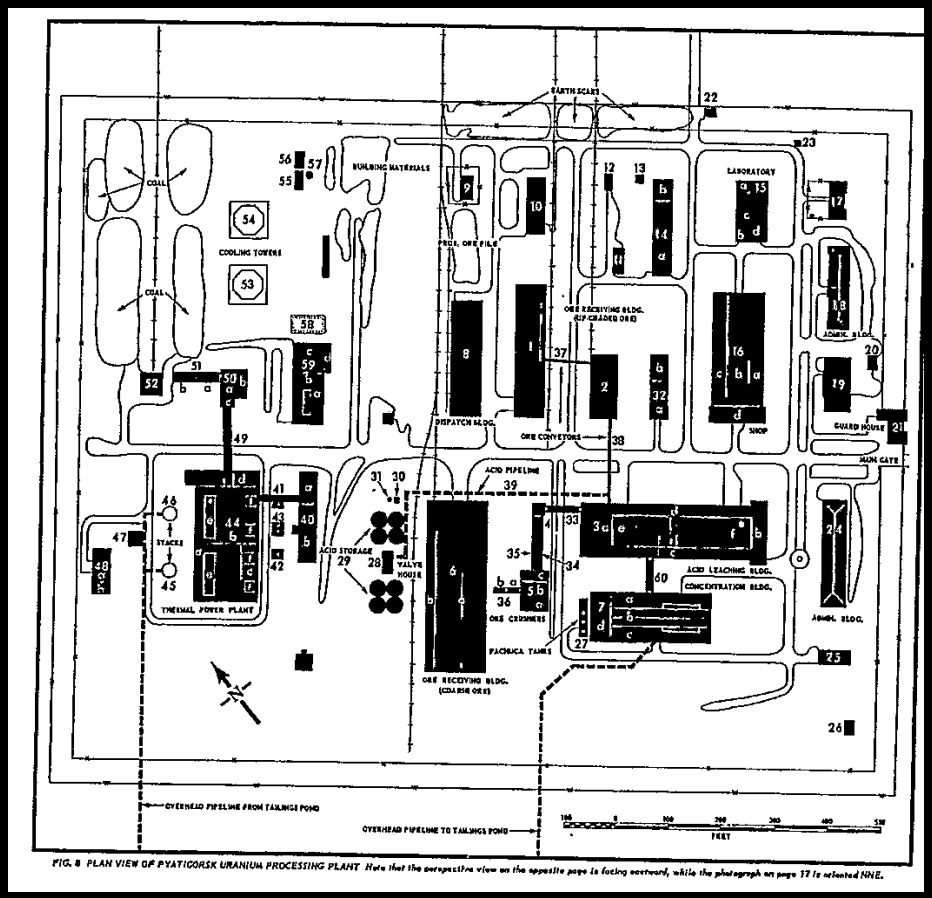


FIG. 8 PLAN VIEW OF PYATIGORSK URANIUM PROCESSING PLANT *Note that the perspective view on the opposite page is facing eastward, while the photograph on page 17 is oriented NNE.*

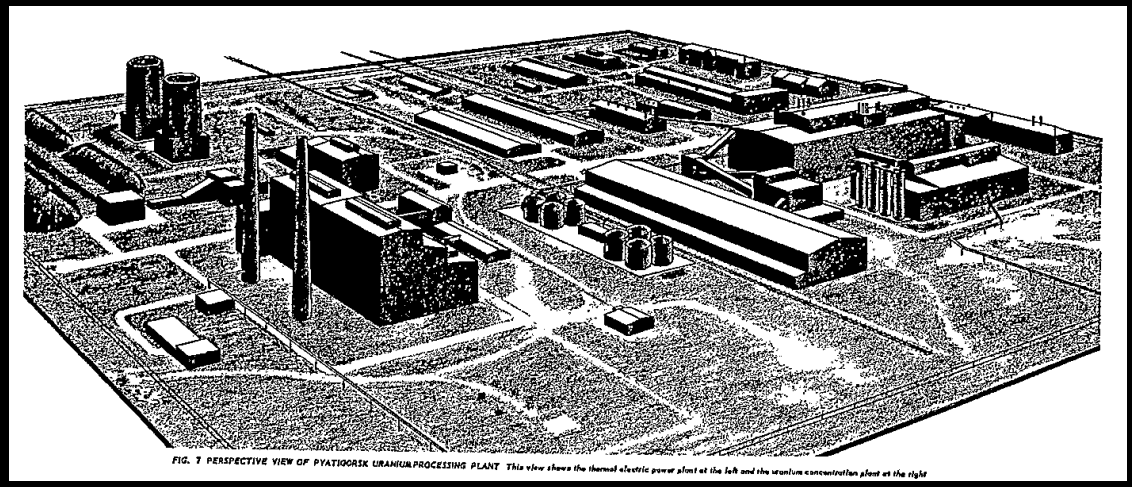
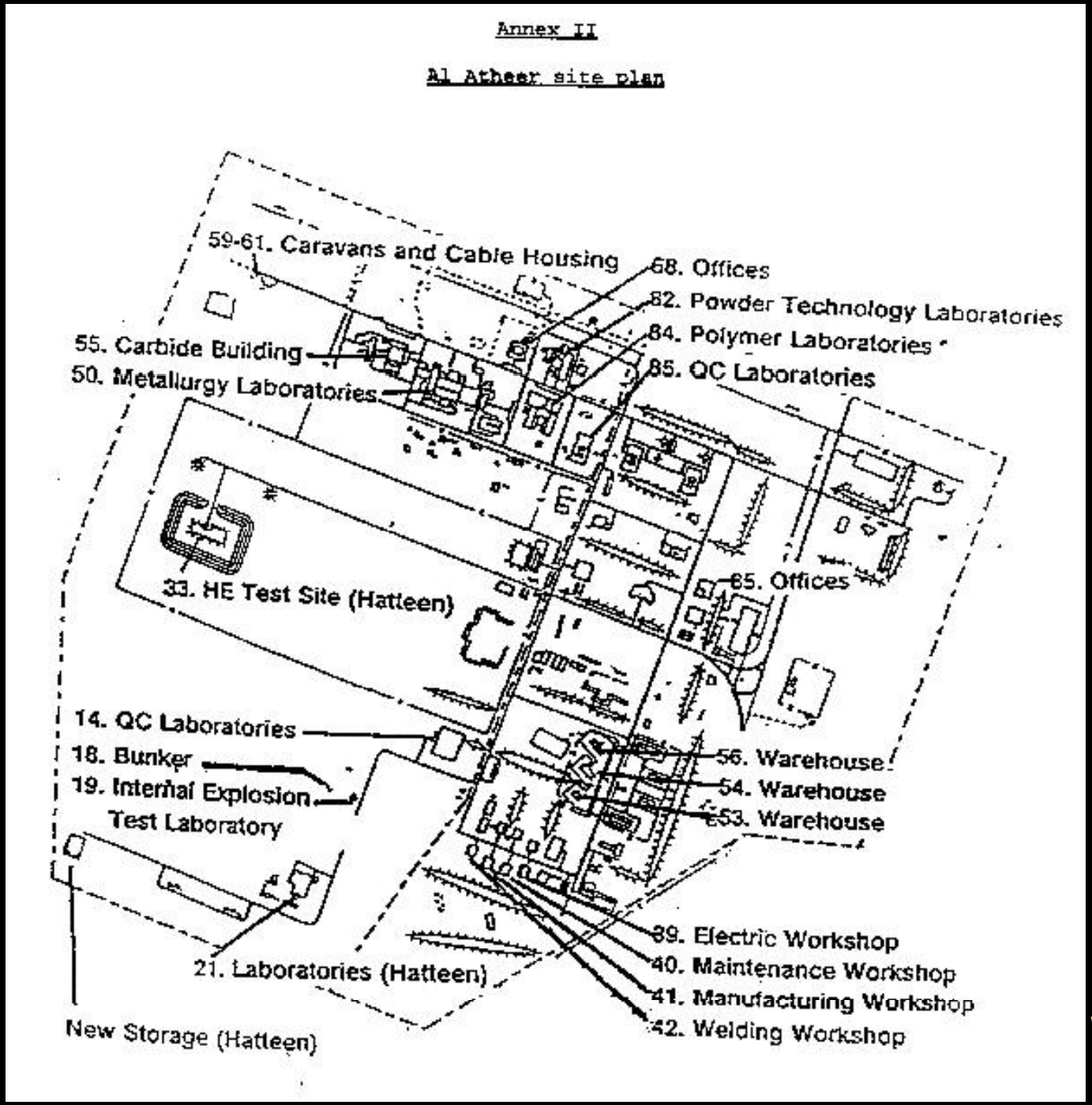


FIG. 7 PERSPECTIVE VIEW OF PYATIGORSK URANIUM PROCESSING PLANT *This view shows the thermal electric power plant at the left and the uranium concentration plant at the right*

Line Drawing and Artist's 3-D Perspective View of Pyatigorsk Uranium Processing Plant in the Former Soviet Union (Pre-CORONA, circa 1959)

Source: http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB186/doc01.pdf

The best that the IAEA previously had for site visualization (circa mid-1990s)



Typical plan-view line drawing used during IAEA site inspections in Iraq

NOTE: U-2 and helicopter imagery were also used in Iraq, but that was an exception not currently applicable to IAEA Safeguards

Source: http://www.iraqwatch.org/un/IAEA/s-1995-1003-a.jpg

What has been available to the IAEA since late 1999

January 2006 satellite image of the Natanz uranium enrichment complex. This image shows the location of the underground centrifuge cascade halls for the Fuel Enrichment Plant (FEP). This facility is designed to hold about 50,000 centrifuges, to be installed in modules of 3,000 centrifuges each. Also marked is the Pilot Fuel Enrichment Plant (PFEP), one of the locations where IAEA seals were removed on January 10, 2006 ending the suspension on uranium enrichment-related activities. The PFEP is the location of the nearly-operational 164-centrifuge test cascade. The building can hold six such cascades.

Typical annotated near-nadir view "2-D" commercial satellite images

Source: http://www.isis-online.org/images/iran/dg_jan2_2006_ann.jpg

3-D Perspectives Today

Model of Iran's Uranium Enrichment Complex at Natanz

Created using Google's free SketchUp software with building textures derived from Internet searches of ground imagery

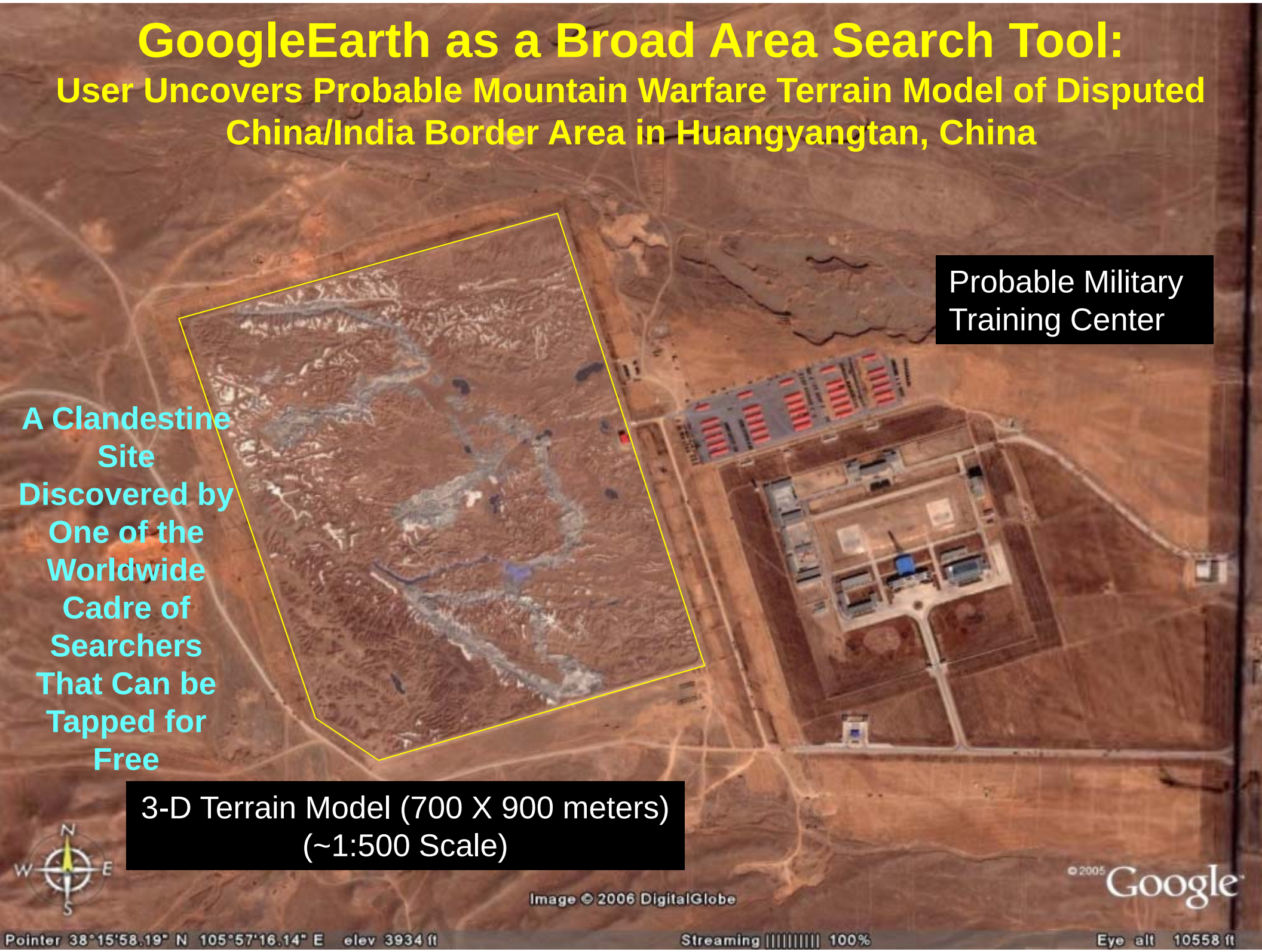
Jane's Intelligence and Insight You Can Trust

Building at Underground Centrifuge Facility, Iran
34.884N 050.996E

GeoEye's *GeoEye-1* satellite
Image Date: 04 October 2009

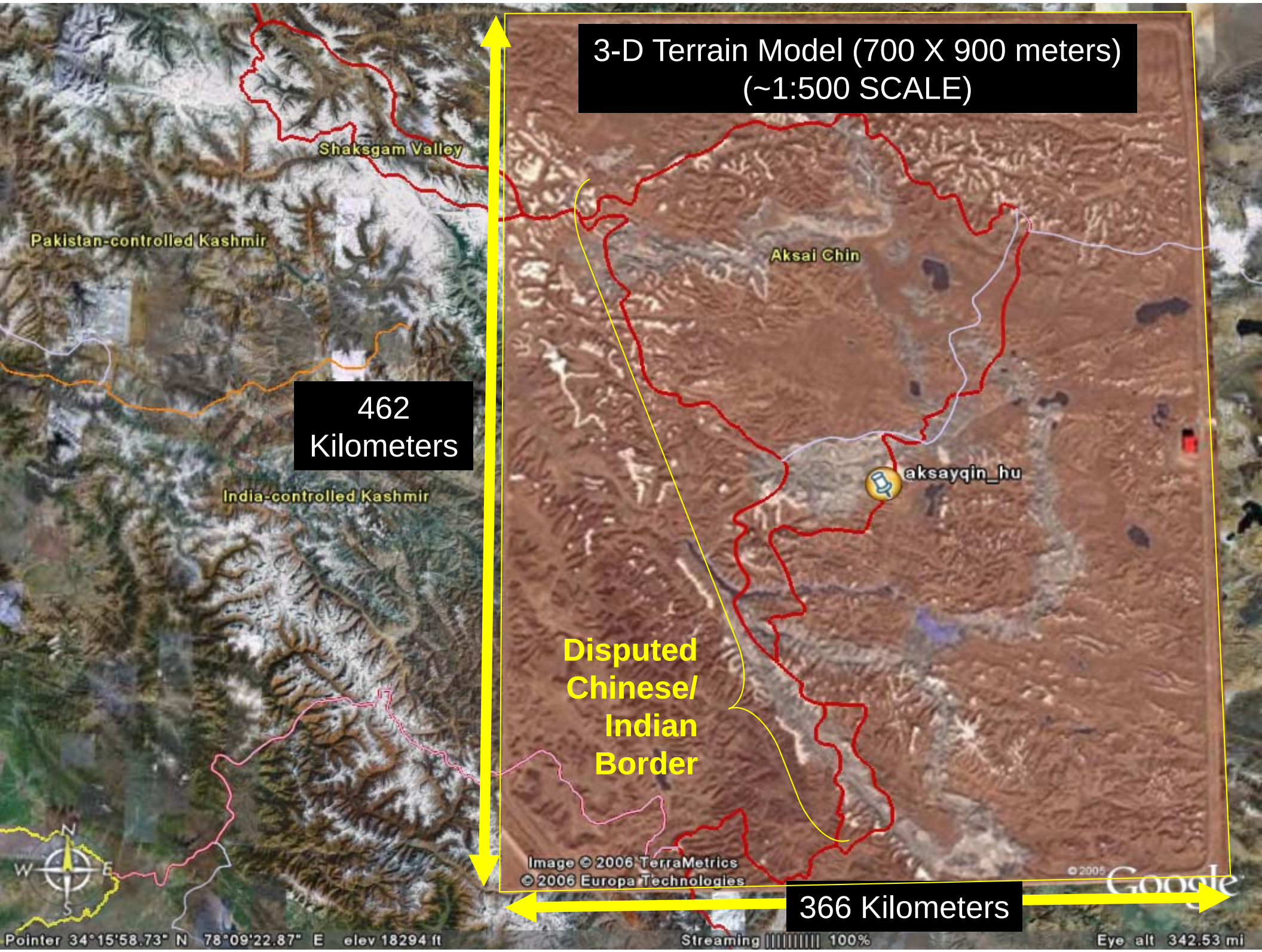
GoogleEarth as a Broad Area Search Tool:

User Uncovers Probable Mountain Warfare Terrain Model of Disputed China/India Border Area in Huangyangtan, China



Location of Huangyangtan Terrain Model

Area of Disputed border replicated by Terrain model


3-D Terrain Model (700 X 900 meters)
(~1:500 SCALE)
Shaksgam Valley
Pakistan-controlled Kashmir
Aksai Chin
462
Kilometers
aksayqin_hu
India-controlled Kashmir
Disputed
Chinese/
Indian
Border
Image © 2006 TerraMetrics
© 2006 Europa Technologies
© 2005 Google
366 Kilometers
Pointer 34°15'58.73" N 78°09'22.87" E elev 18294 ft
Streaming 100%
Eye alt 342.53 mi

A Local Law Enforcement Exemplar!

Google Earth Blog

The amazing things about Google Earth™...

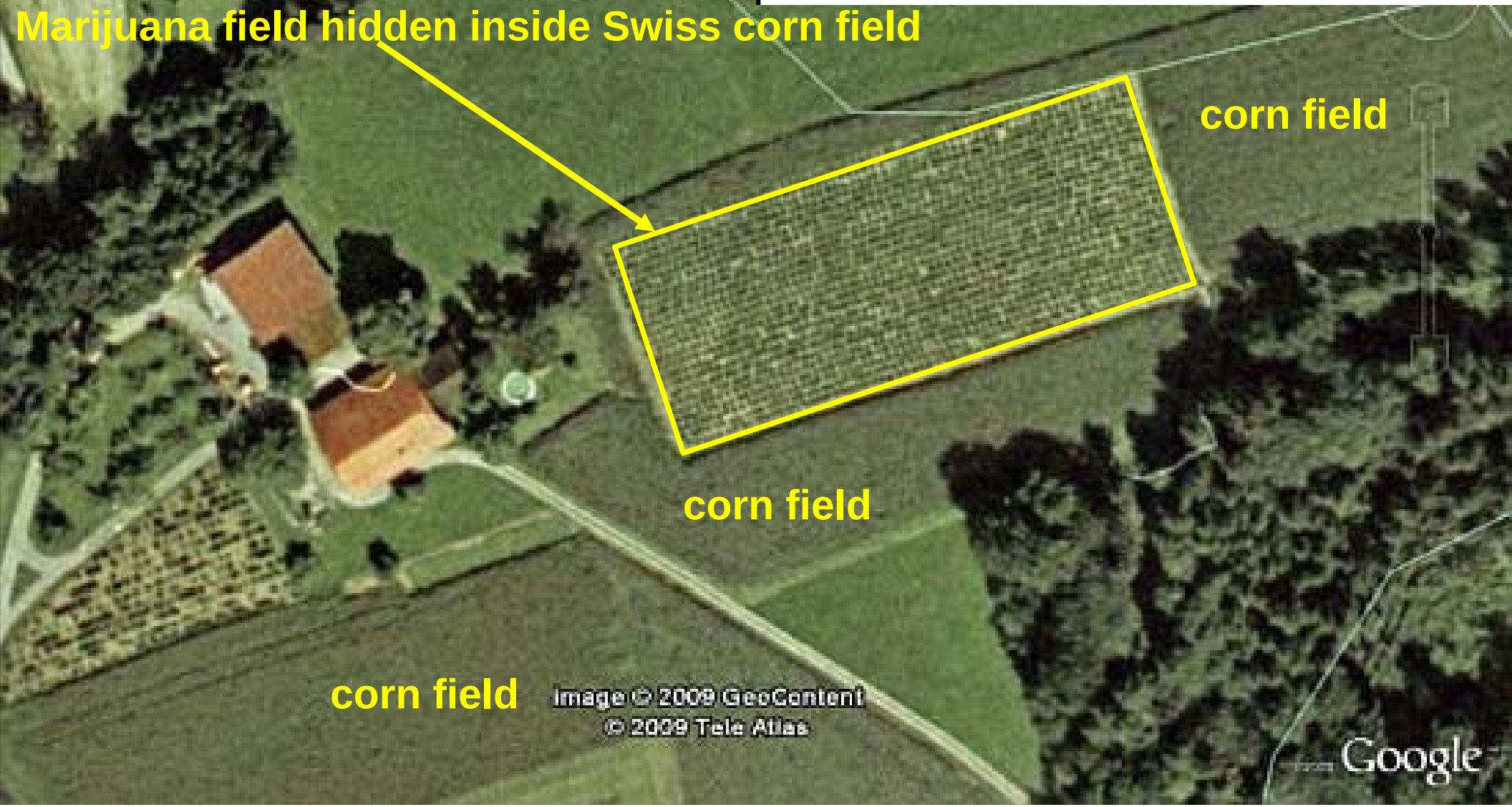
Home | About | Basics | Links | Tips | Flying | 3D Models | SightSeeing | Gallery

January 30, 2009

Marijuana Field Found?

[**UPDATE**: Another GEB commenter below, named 'dulk', posted a better location (coordinates: **47.629343,9.058503**), and this one seems to be the real location (German site) so I'm updating the screenshot/KML.]

A lot of sites have been sharing the news of the marijuana bust in Switzerland where police used Google Earth to discover the crop. As I said earlier today, I was a little speculative because the imagery in that part of the world was dated 1997. But, I noted the imagery had changed in early 2007 and it was possible newer imagery was used prior to then and the police had investigated this initially 2 years ago.



http://www.gearthblog.com/blog/archives/2009/01/marijuana_field_found.html

Strategic Security Blog

A project of the Federation of American Scientists

« More from NNSA: and more is less, or less is more. | Main | United States Removes Nuclear Weapons From German Base, Documents Indicate »

New Chinese Ballistic Missile Submarine Spotted

By Hans M. Kristensen

A new satellite image appears to have captured China's new ballistic missile submarine. Coordinates: 38°49'4.40"N, 121°29'39.82"E.

A commercial satellite image appears to have captured China's new nuclear ballistic missile submarine. The new class, known as the Jin-class or Type 094, is expected to replace the unsuccessful Xia-class (Type 092) of a single boat built in the early 1980s.

The new submarine was photographed by the commercial Quickbird satellite in late 2006 and the image is freely available on the Google Earth web site.

BLOGS & WIKIs with Google Earth provide synergistic results

http://bbs.keyhole.com/
http://www.gearthblog.com/
http://www.ogleearth.com/
http://googleearthuser.blogspot.com/
http://viavirtualearth.com/
http://virtualearth.spaces.live.com/
http://earthissquare.com/
http://wikimapiablog.blogspot.com/
http://www.virtualglobes.org/blog/
http://googlesightseeing.com/
http://www.armscontrolwonk.com/
http://geimint.blogspot.com/

A Double-Edged Sword!

Such Tools Can Be Used by Anyone:

Adversaries Can Use for Nefarious Purposes!

Google Earth Accused of Aiding Mumbai Terror Attacks

Wednesday, December 10, 2008

THE TIMES

Business Standard

Thursday, Dec 11, 2008

BS Online | Markets & Investing | Companies & Industry | Banking & Finance | Economy & Policy

Home > ICE World Live Markets | Smart Portfolios

Terrorists used Google Earth

Makarand Gadgil / Mumbai November 30, 2008, 0:04 IST

TIMESONLINE

NEWS | COMMENT | BUSINESS | MONEY | SPORT | LIFE & STYLE | TRAVEL | DRIVI

UK NEWS | WORLD NEWS | POLITICS | ENVIRONMENT | WEATHER | TECH & WEB | VIDEO

Where am I? › Home › News › Tech & Web › The Web

From Times Online

December 9, 2008

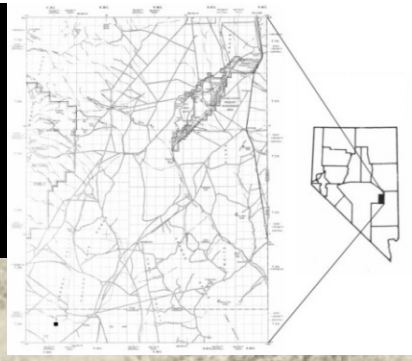
Google Earth accused of aiding terrorists

Mumbai lawyer demands Google Earth ban claiming satellite images are a terrorist 'security hazard'

Mail Online

And You Never Know What You May Find?

Detected Next to the US Nevada Test Site & Area 51?



It Could Be Just Art! (a mile long)

Gigantic Sculpture
Created over 36 years!

"As long as you're going to make a sculpture, why not make one that competes with a 747, or the Empire State Building, or the Golden Gate Bridge."

- Michael Heizer

Source: http://doublenegative.tarasen.net/city.html

1.62 Kilometers

Google

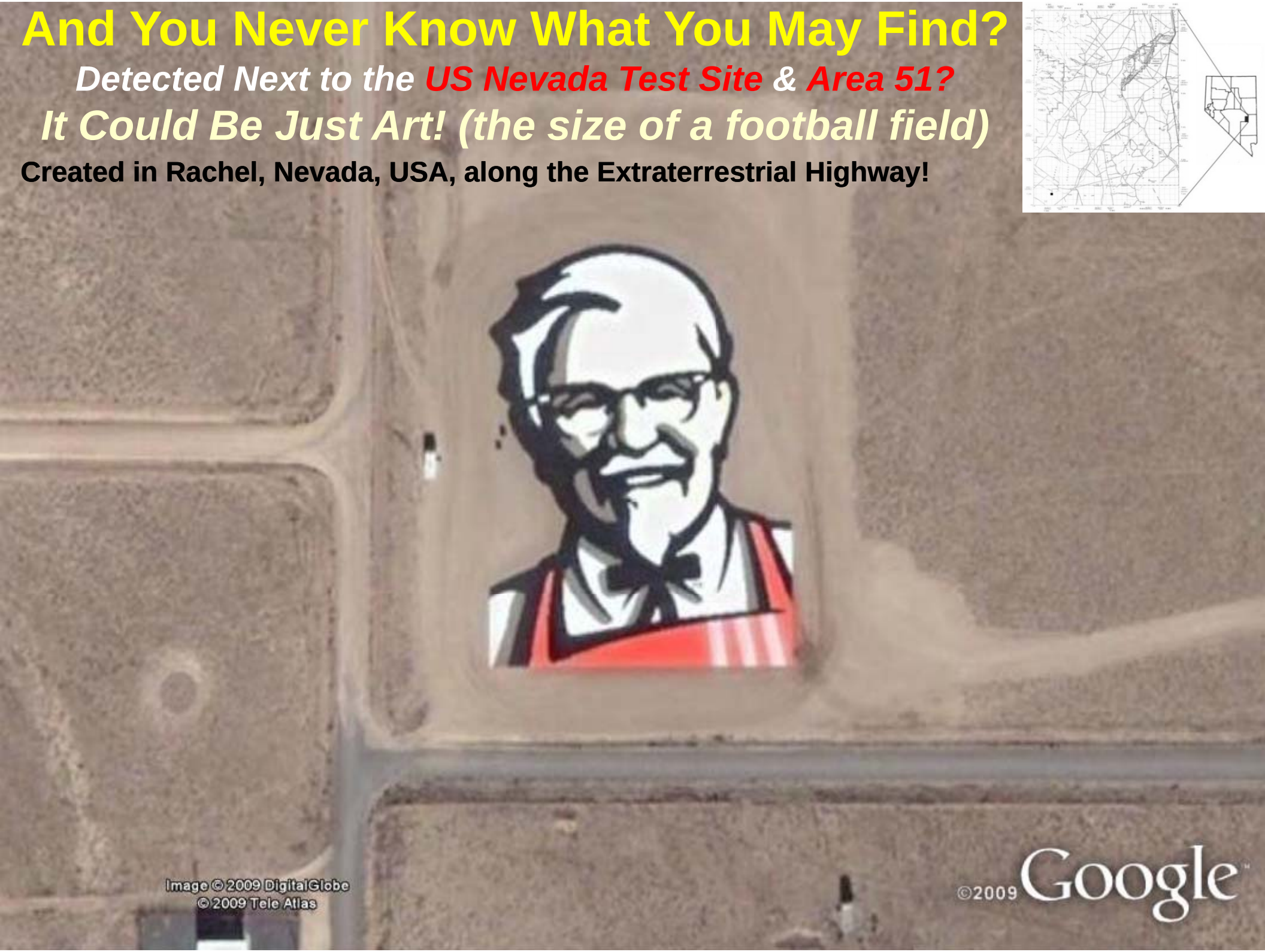
38°01'56.86" N 115°26'35.18" W elev 1576 m May 25, 2006 Eye alt 3.41 km

And You Never Know What You May Find?

Detected Next to the US Nevada Test Site & Area 51?

It Could Be Just Art! (the size of a football field)

Created in Rachel, Nevada, USA, along the Extraterrestrial Highway!



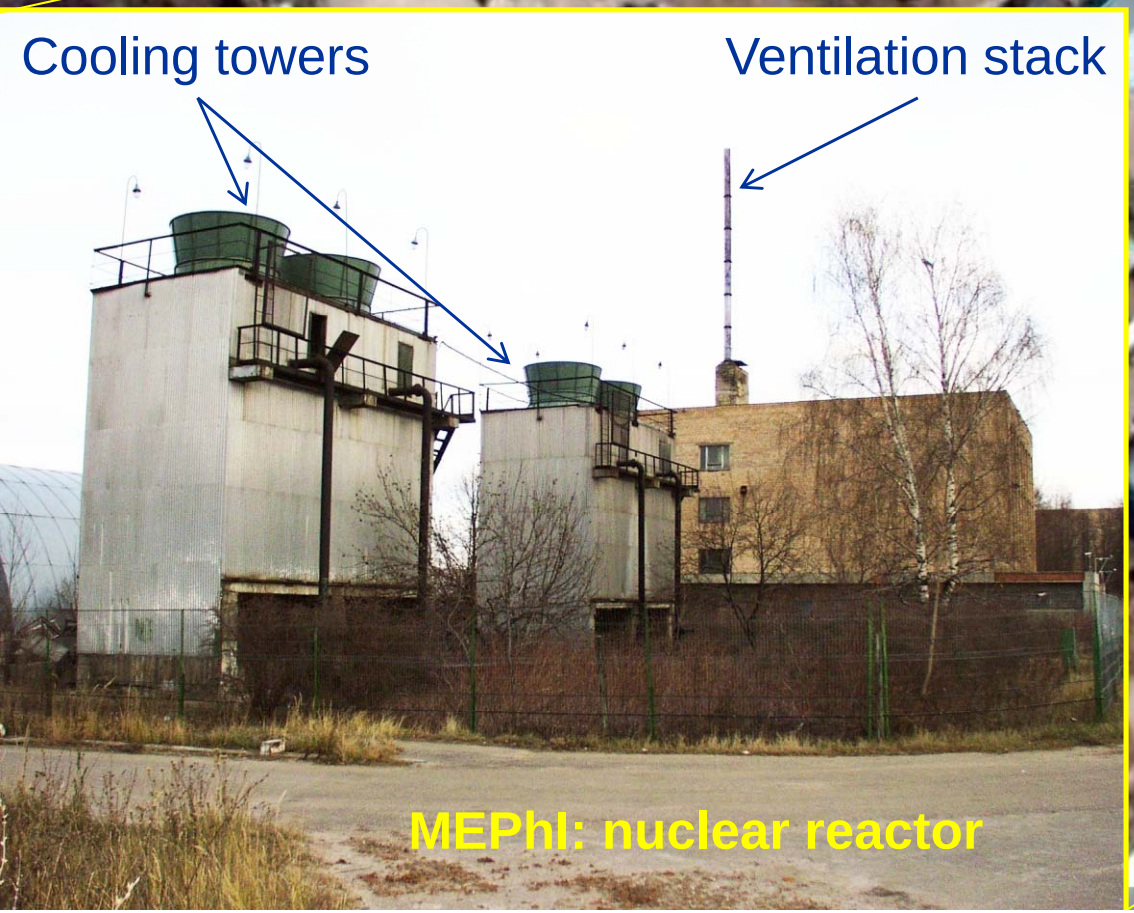
Finding the Earth's Most Recent Meteor Impact Crater with Google Earth

Note Ejecta Ray
Star Pattern

http://www.b14643.de/Sahara/Kamil_Meteor_Crater/index.htm

“Panoramio” and “Flickr”” Layer Exemplar

Moscow Engineering Physics Institute



Nuclear reactor
View or update this place information at Wikimapia.

©2008 Google

Eye alt 505 m

“Crowdsourcing” North Korea

http://gizmodo.com/5277184/north-korea-secrets-uncovered-in-google-earth-by-amateur-spies

PAGE ONE | MAY 22, 2009

Commercial Satellite Imagery and Global Transparency

Gulags, Nukes and a Water Slide: Citizen Spies Lift North Korea's Veil

With Sleuthing and Satellite Images, Mr. Melvin Fills the Blanks on a Secretive Nation's Map

By EVAN RAMSTAD

Friday, May 22, 2009
THE WALL STREET JOURNAL. | U.S.

SEOUL -- In the propaganda blitz that followed North Korea's missile launch last month, the country's state media released photos of leader Kim Jong Il visiting a hydroelectric dam and power station.

Images from the report showed two large pipes descending a hillside. That was enough to allow Curtis Melvin, a doctoral candidate at George Mason University in suburban Virginia, to pinpoint the installation on his online map of North Korea.

A Glimpse at North Korea

See some of the sites "North Korea Uncovered "users have identified.

Mr. Melvin is at the center of a dozen or so citizen snoops who have spent the past two years filling in the blanks on the map of one of the world's most secretive countries. Seeking clues in photos, news reports and eyewitness accounts, they affix labels to North Korean structures and landscapes captured by Google Earth, an online service that stitches satellite pictures into a virtual globe. The result is an annotated North Korea of rocket-launch sites, prison camps and elite palaces on white-sand beaches.

"It's democratized intelligence," says Mr. Melvin.

http://online.wsj.com/article/SB124295017403345489.html#project%3DNKGOOGLE0509%26articleTabs%3Dinteractive

LA-UR 10-04532
21 July 2010

Using the New Geospatial Tools to Locate a Newly Revealed

Underground Plutonium Production Complex in China

Los Alamos National Laboratory
U.S. National Nuclear Security Administration

China publicly declared that a previously “Top-Secret” underground nuclear complex was being turned into a “Tourist Attraction”

- In 1966, “**Project 816**” was established as the site for underground plutonium production reactor(s) and a reprocessing facility located near the village of Baitao, Fuling District, Chongqing Province, China.

- The project resulted in the construction of the world's largest “man-made cave” - 104,000 square meters, the equivalent of 20 football fields.

- The “military base” was scrapped in 1982 before it was ever finished (about “85 % complete”)

- After the nuclear facility was closed, Chongqing Jianfeng Chemical Industry Group (Jianfeng), converted it to a chemical-fertilizer plant.

Source: **“Nuclear reaction to tourist attraction”**

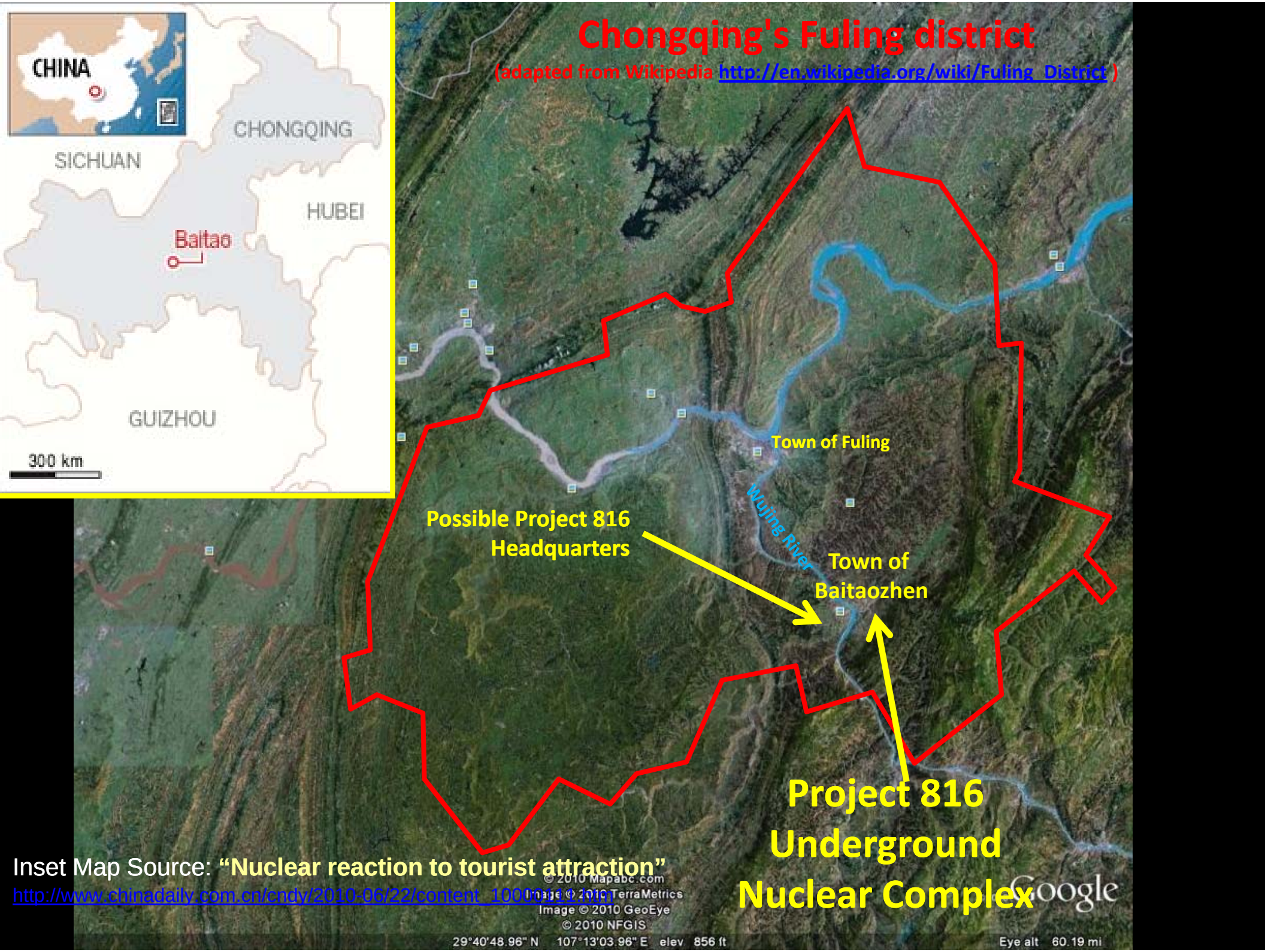
http://www.chinadaily.com.cn/cndy/2010-06/22/content_10000111.htm

“Project 816” Statistics

Source: **“Nuclear reaction to tourist attraction”**
http://www.chinadaily.com.cn/cndy/2010-06/22/content_10000111.htm

$109 Million

$30 Billion

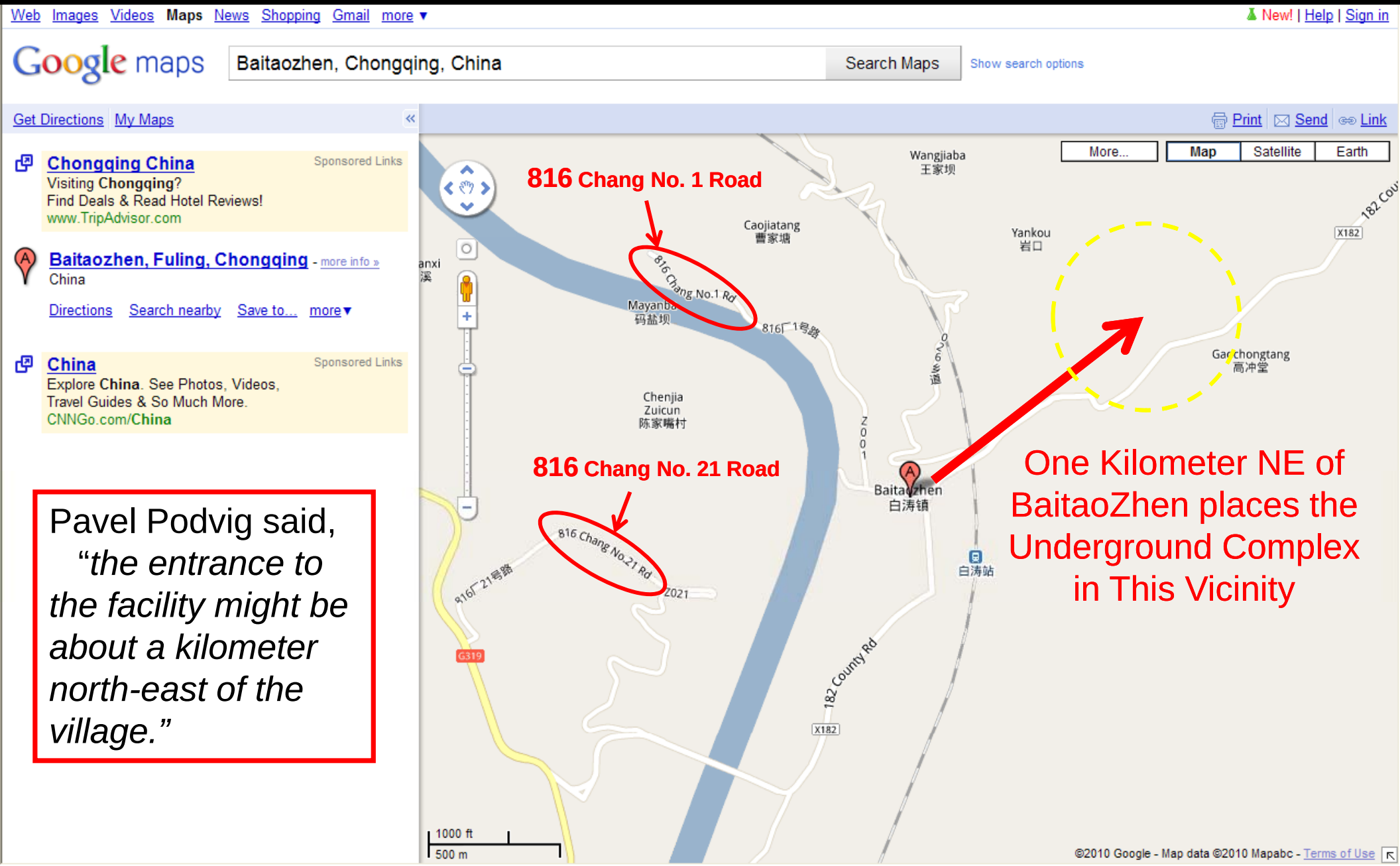


Inset Map Source: **"Nuclear reaction to tourist attraction"**
http://www.chinadaily.com.cn/cndy/2010-06/22/content_10000911.htm

Google Maps Link Provided by Pavel Podvig

http://www.fissilematerials.org/blog/2010/06/project_816_-_unfinished_.html

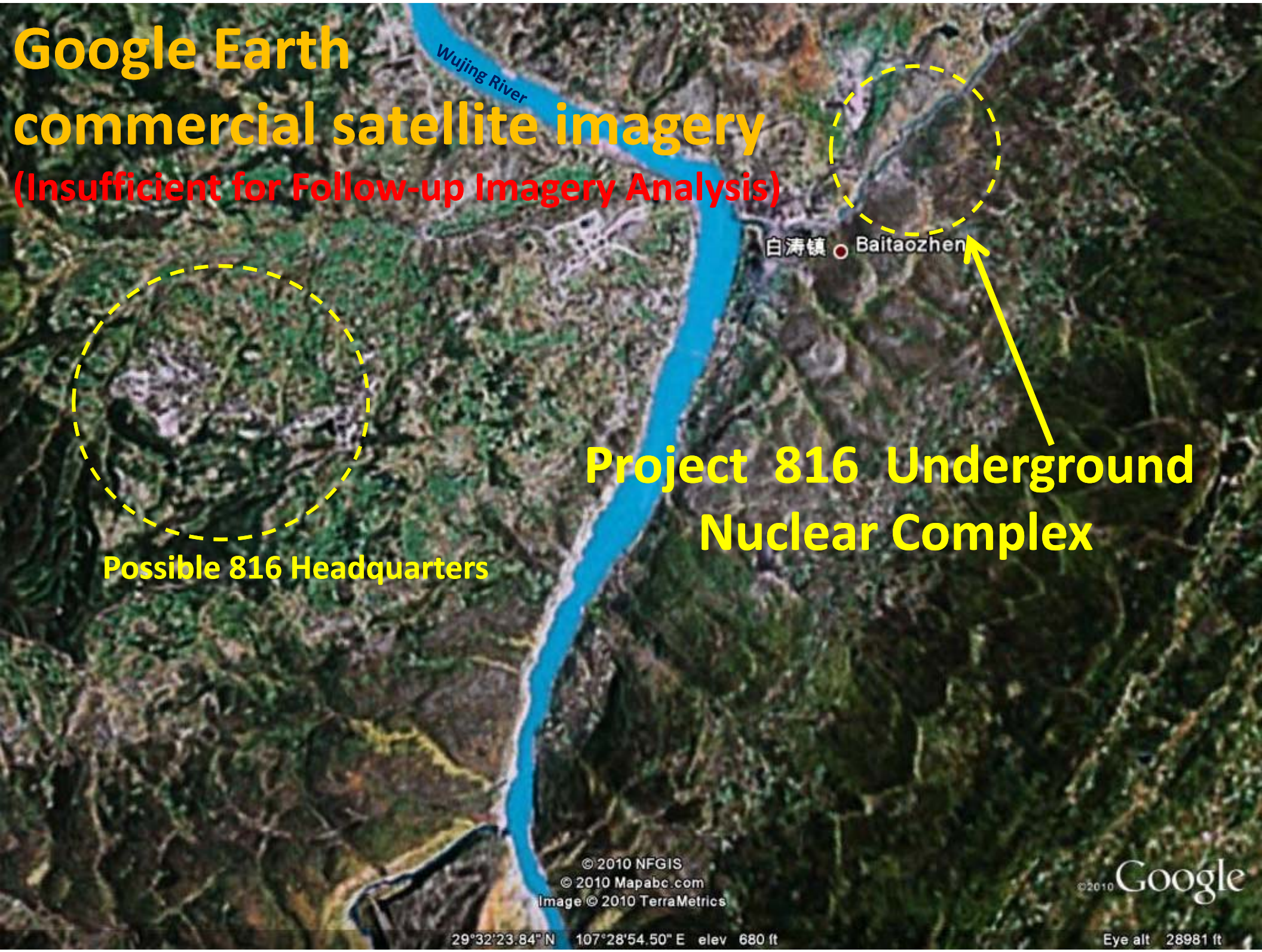
The Map Version Showing Roads Marked with “816”

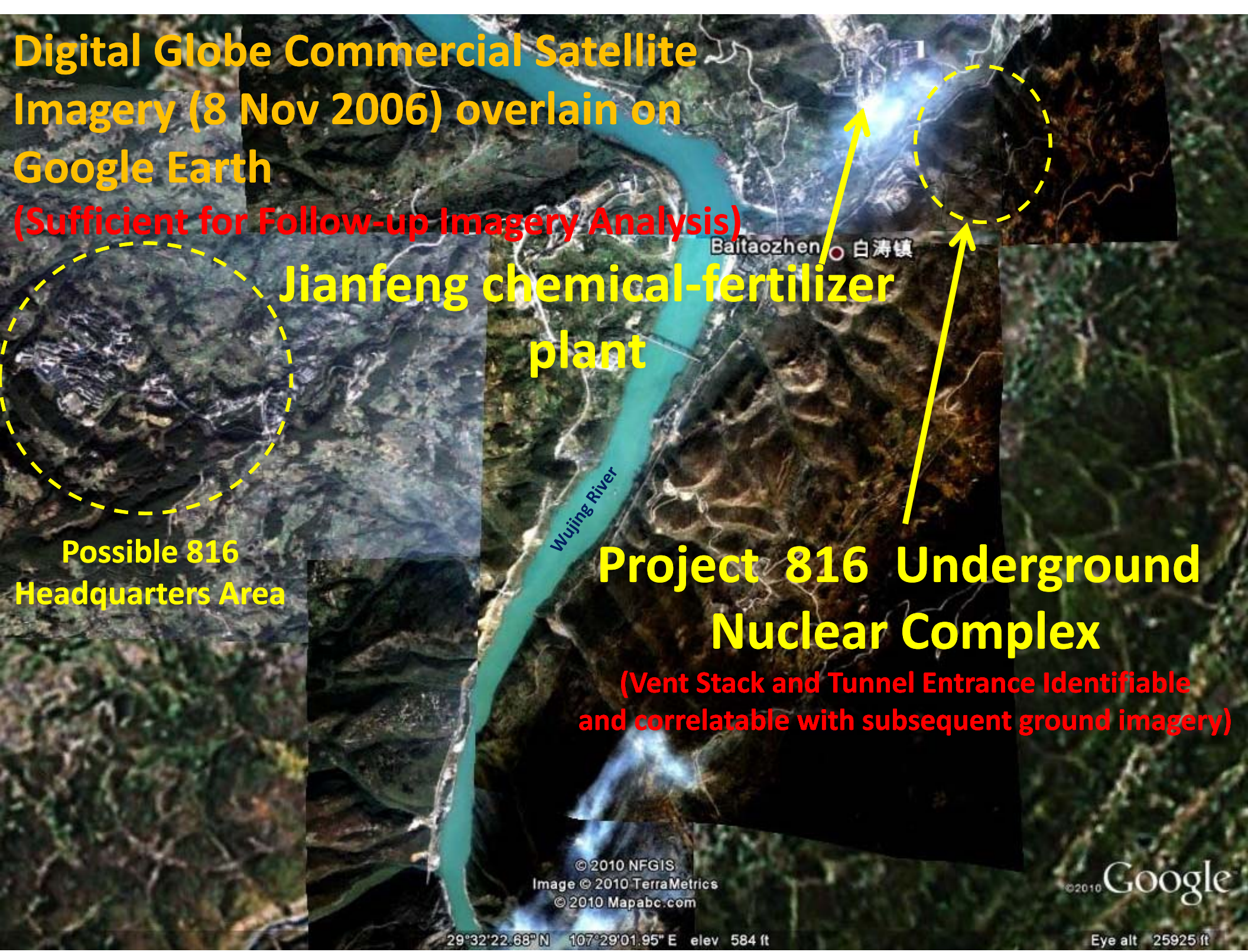


One Kilometer NE of BaitaoZhen places the Underground Complex in This Vicinity

Pavel Podvig said,

“the entrance to the facility might be about a kilometer north-east of the village.”


Google Earth
commercial satellite imagery
(Insufficient for Follow-up Imagery Analysis)
Wujing River
白涛镇 Baitaozhen
Project 816 Underground
Nuclear Complex
Possible 816 Headquarters
© 2010 NFGIS
© 2010 Mapabc.com
Image © 2010 TerraMetrics
©2010 Google
29°32'23.84" N 107°28'54.50" E elev 680 ft
Eye alt 28981 ft


Digital Globe Commercial Satellite Imagery (8 Nov 2006) overlain on Google Earth
(Sufficient for Follow-up Imagery Analysis)
Baitaozhen 白涛镇
Jianfeng chemical-fertilizer plant
Wujing River
Possible 816 Headquarters Area
Project 816 Underground Nuclear Complex
(Vent Stack and Tunnel Entrance Identifiable and correlatable with subsequent ground imagery)
© 2010 NFGIS
Image © 2010 TerraMetrics
© 2010 Mapabc.com
©2010 Google
29°32'22.68" N 107°29'01.95" E elev 584 ft
Eye alt 25925 ft

“816 Underground Nuclear Project Entrance”

Source: http://blog.sina.com.cn/s/blog_5a53af350100aqzk.html

Project 816 “Tunnel”

Source: http://www.chinadaily.com.cn/cndy/2010-06/22/content_10000111.htm

SHE YING / FOR CHINA DAILY

Just 10 percent of the 104,000-square-meter base was opened to the public in April.

Project 816 “Tunnel” (side drift intersection)

Source: http://news.qq.com/a/20100426/000373.htm Twitter Tourist photo

Project 816 “Tunnel” (side drift tunnel, one of 18)

Source: http://news.qq.com/a/20100426/000373.htm Twitter Tourist photo

Project 816 “Reactor Hall with Nuclear Reaction Cauldron”

Source: http://www.china.org.cn/china/2010-05/24/content_20106476.htm

Project 816 “Control Room”

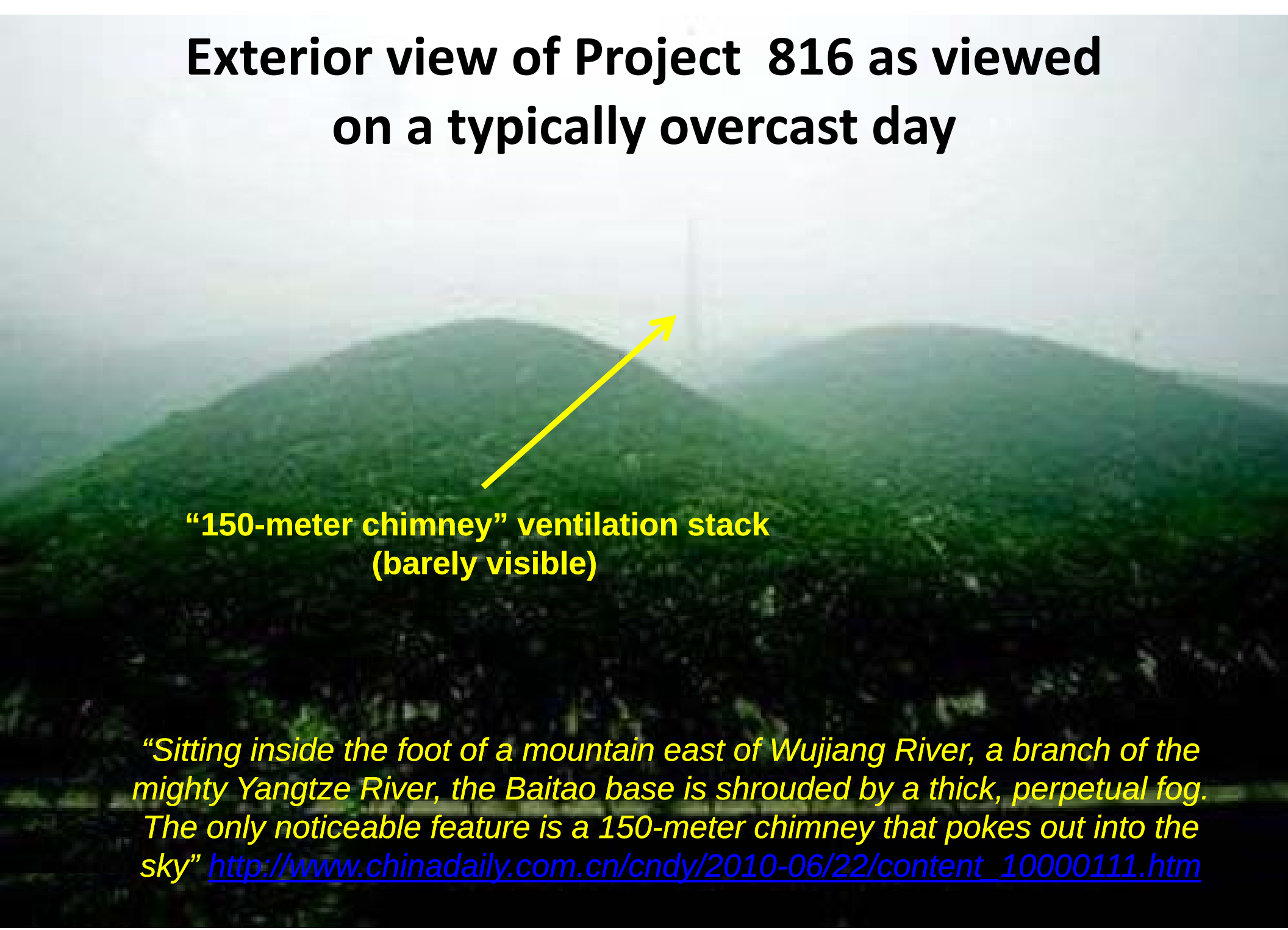
Source: http://news.qq.com/a/20100426/000373.htm Twitter Tourist photo

Project 816 “Control Room”

Tourists look around one of the control rooms of the once top-secret nuclear base at Baitao, a remote town hidden in the mountains east of Chongqing. The project was halted in 1982. Shen Ying / for China Daily

Source: http://www.chinadaily.com.cn/china/2010-05/24/content_9916476.htm

Exterior view of Project 816 as viewed on a typically overcast day



"Sitting inside the foot of a mountain east of Wujiang River, a branch of the mighty Yangtze River, the Baitao base is shrouded by a thick, perpetual fog. The only noticeable feature is a 150-meter chimney that pokes out into the sky" http://www.chinadaily.com.cn/cndy/2010-06/22/content_10000111.htm

Source: http://news.qq.com/a/20100426/000373.htm Twitter Tourist photo

Jianfeng chemical-fertilizer plant

Source: http://blog.sina.com.cn/s/blog_5a53af350100aqzk.html

“Crowdsourcing” the newly revealed underground plutonium production complex in China with PANORAMIO

Panoramio geo-coded image with date-stamp

29 33 25 N, 107 30 25 E

紅塵閑客 2010-05-02

Source: “涪陵816核工程”http://www.panoramio.com/photo/35081251

Project 816 Underground Nuclear Complex on Commercial Satellite imagery

"VERIFICATION"

2-Story Support Building

significant foliage is present

涪陵816核工程

Project 816 Vehicle Tunnel Entrance

"150-meter chimney" ventilation stack

Digital Globe Quickbird Commercial Satellite Imagery (Overlain on Google Earth)

8 NOV 2006

紅塵閑客 2010-05-02

Source: http://www.panoramio.com/photo/35081251

Project 816 Underground Nuclear Complex on Commercial Satellite imagery

"CONFIRMATION"

Project 816 Vehicle Tunnel Entrance

Source: http://www.panoramio.com/photo/35081251 红塵閑客 2010-05-02

New road cut

New road

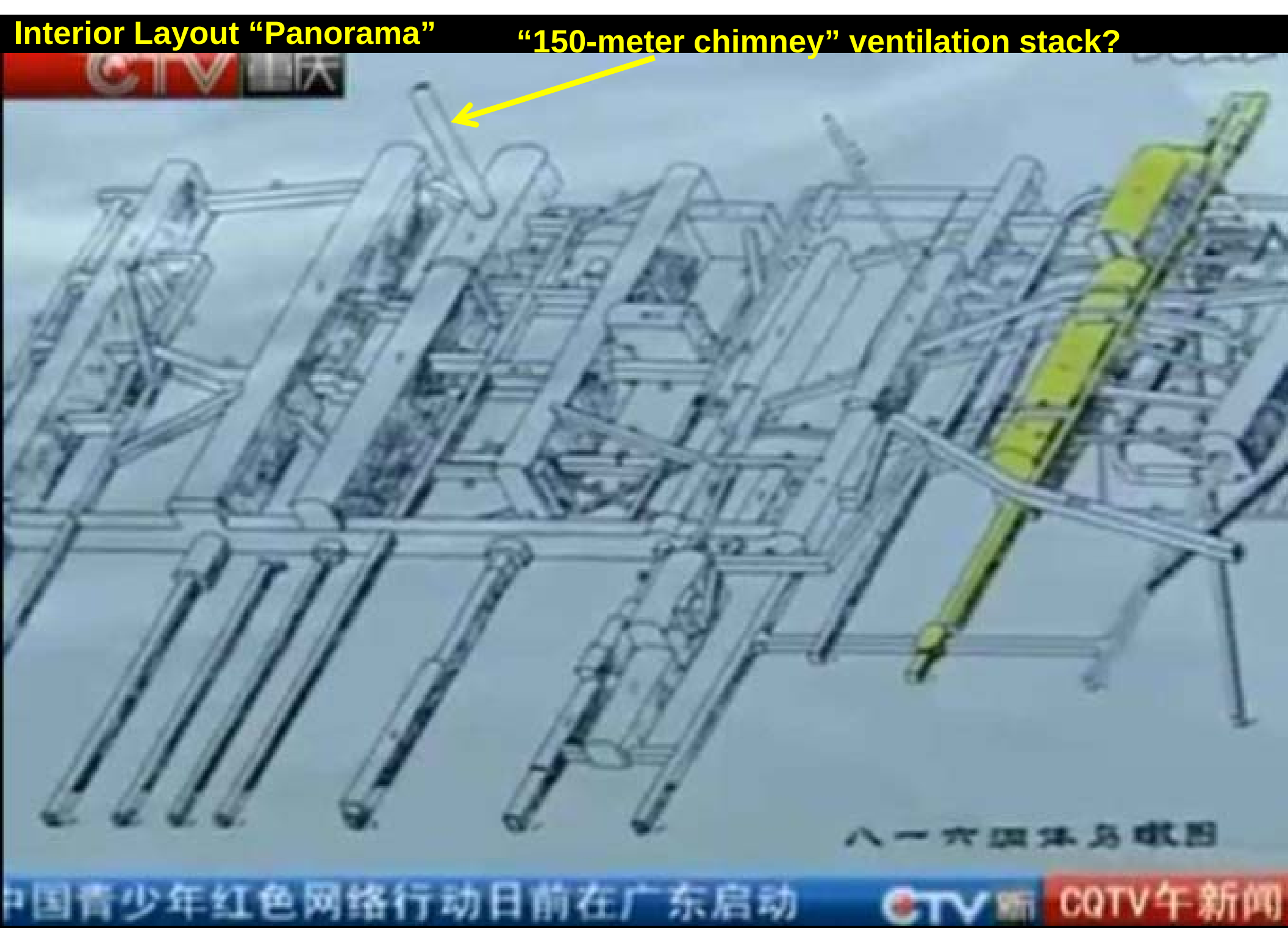
New Concrete Parking lot

Probable Tourist Buses


"CONFIRMATION"
Road cut
I am now at one of the 19 caves of Project 816
Source: http://www.fas.org/nuke/guide/china/facility/chongqing.pdf
Project 816 Vehicle Tunnel Entrance
Road cut
Camouflage netted building as seen in ground photos
2-Story Support Building (w/ new dark-toned roof)
Camera Panorama as obtained above
WorldView-2 Commercial Satellite Imagery
Courtesy of Digital Globe
3 AUG 2010

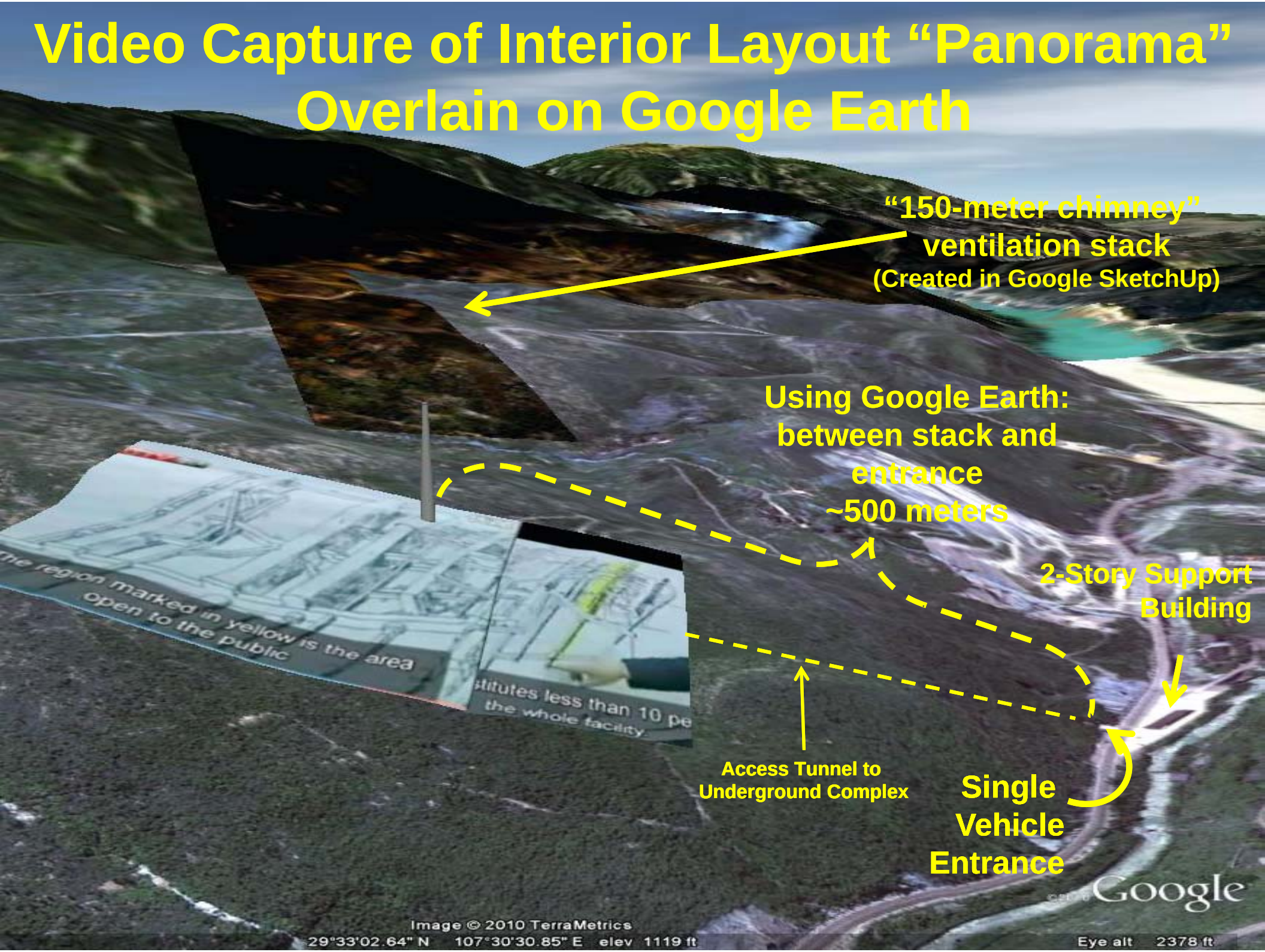
Interior Layout “Panorama”

“150-meter chimney” ventilation stack?



Source: http://blog.sina.com.cn/s/blog_5a53af350100aqzk.html

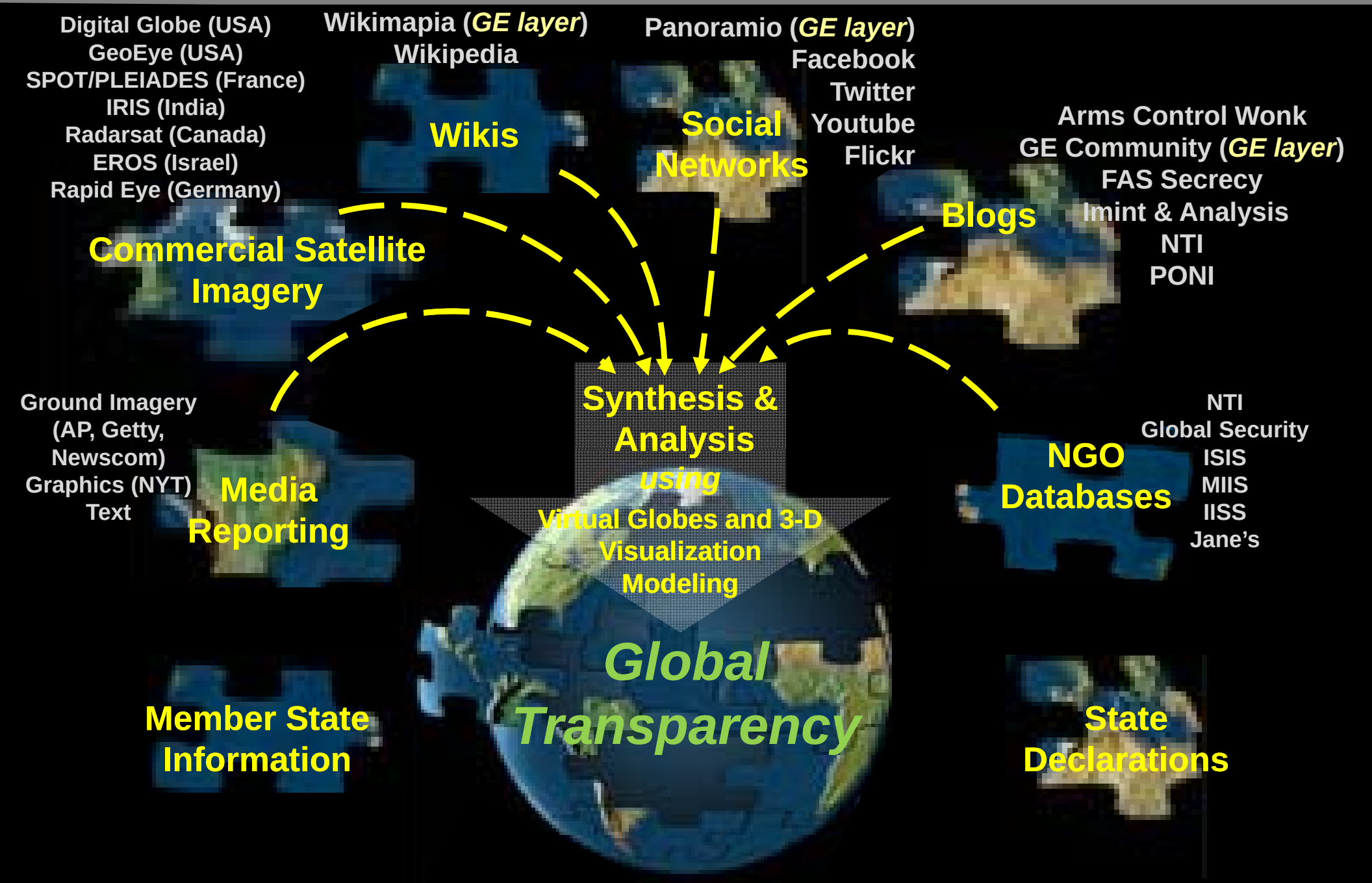
Video Capture of Interior Layout "Panorama" Overlain on Google Earth



CONCLUSIONS:

- **Virtual Globes Are a Great Starting Point for Any Assessments:** When cued to a specific area by any source...peruse the area, review the available historical archive, then, if warranted, follow-up with your own commercial imagery archive search and acquisitions, then verify details (*i.e.*, locational, spatial, temporal)
- **Ideal Global Visualization Tool:** 3-D Terrain layer combined with newest 3-D modeling tool allows for fly-arounds & unique and compelling perspective views
- **Broad Area Search Tool:** Allows for inexpensive independent detection of new construction, utility and transportation networks, & high security exclusion areas. (with more current, higher resolution, imagery coverage being added all the time)
- **Virtual Global Transparency:** With "Open Source" cadre (**>600 Million downloads!**) participating in the hunt for clandestine or enigma sites for free (monitor via BLOGs & WIKIs)
- **Ideal For Safeguards Inspector Training and Use**: For known IAEA Inspected Sites and State Evaluation Reports... **An amazing visualization, orientation, and monitoring aid!**

Using the New Geospatial Tools: Putting All the Pieces Together



Open Source "*Crowdsourcing*" + Geospatial Tools = Global Transparency

* Exemplars are NOT meant to be viewed as exhaustive