



Promoting Cooperative Solutions for Space Sustainability

An Open Source Analysis of China's Anti-satellite Testing in Space

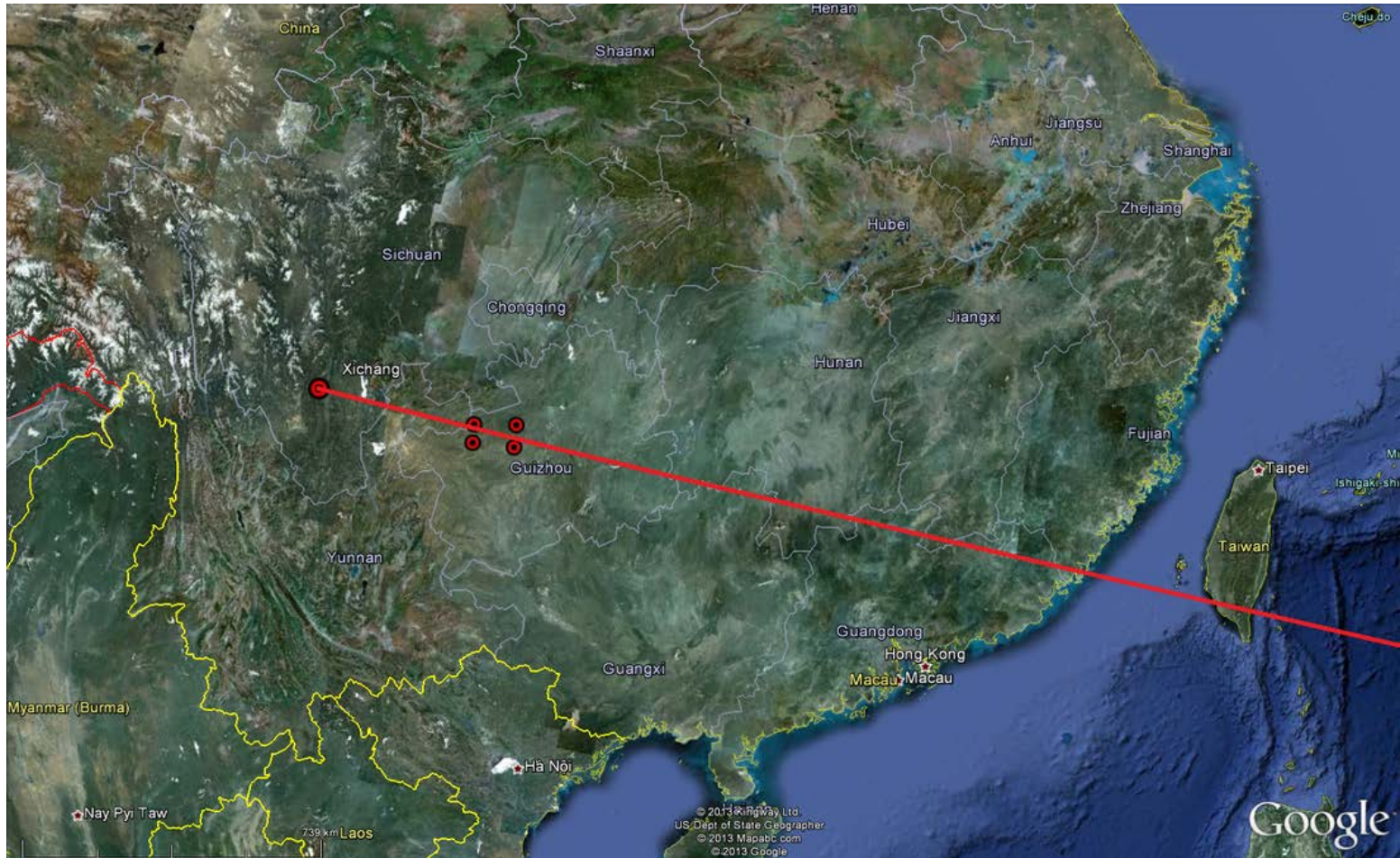
Brian Weeden

Technical Advisor

Secure World Foundation

- What was launched from Xichang Satellite Launch Center in May 2013?
 - From which launch pad?
 - How high did it go?
 - What rocket was used?
- Summary of what's known about Chinese ASAT testing in space since the mid-2000s
- ***Not covered today***: history of American and Russian ASAT testing in space & compares to what China is doing (see full report)

- May 13, 2013, a rocket was launched from Xichang Satellite Launch Center
- Chinese government
 - “Chinese Academy of Sciences has conducted a high altitude scientific exploration test”
 - Sounding rocket, reached 10,000 km height
 - Released barium cloud to observe upper atmosphere
- US government
 - “...the launch appeared to be on a ballistic trajectory nearly to [GEO]. We tracked several objects during the flight...and no objects associated with this launch remain in space”
- Beltway rumors
 - Was the test of a new ASAT weapon that could reach to GEO



Launch trajectory from the NOTAM (Source Spaceflight101.com) Image © 2013 Google Earth.



Image of the May 13 launch from Xichang taken from Hong Kong (Image credit [Wah!](#))



Promoting Cooperative Solutions for Space Sustainability

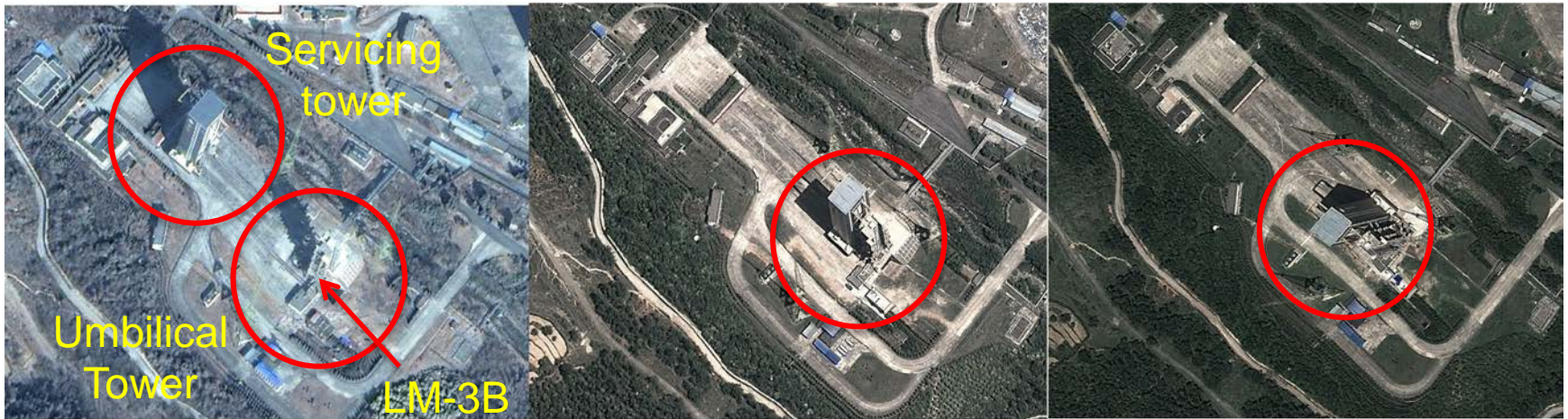
QUESTION 1: FROM WHICH LAUNCH PAD?

Launch Complex 2 (LC-2)

January 21, 2013

April 20, 2013

May 20, 2013



Imagery of LC-2 at Xichang. Images © 2013 Google Earth

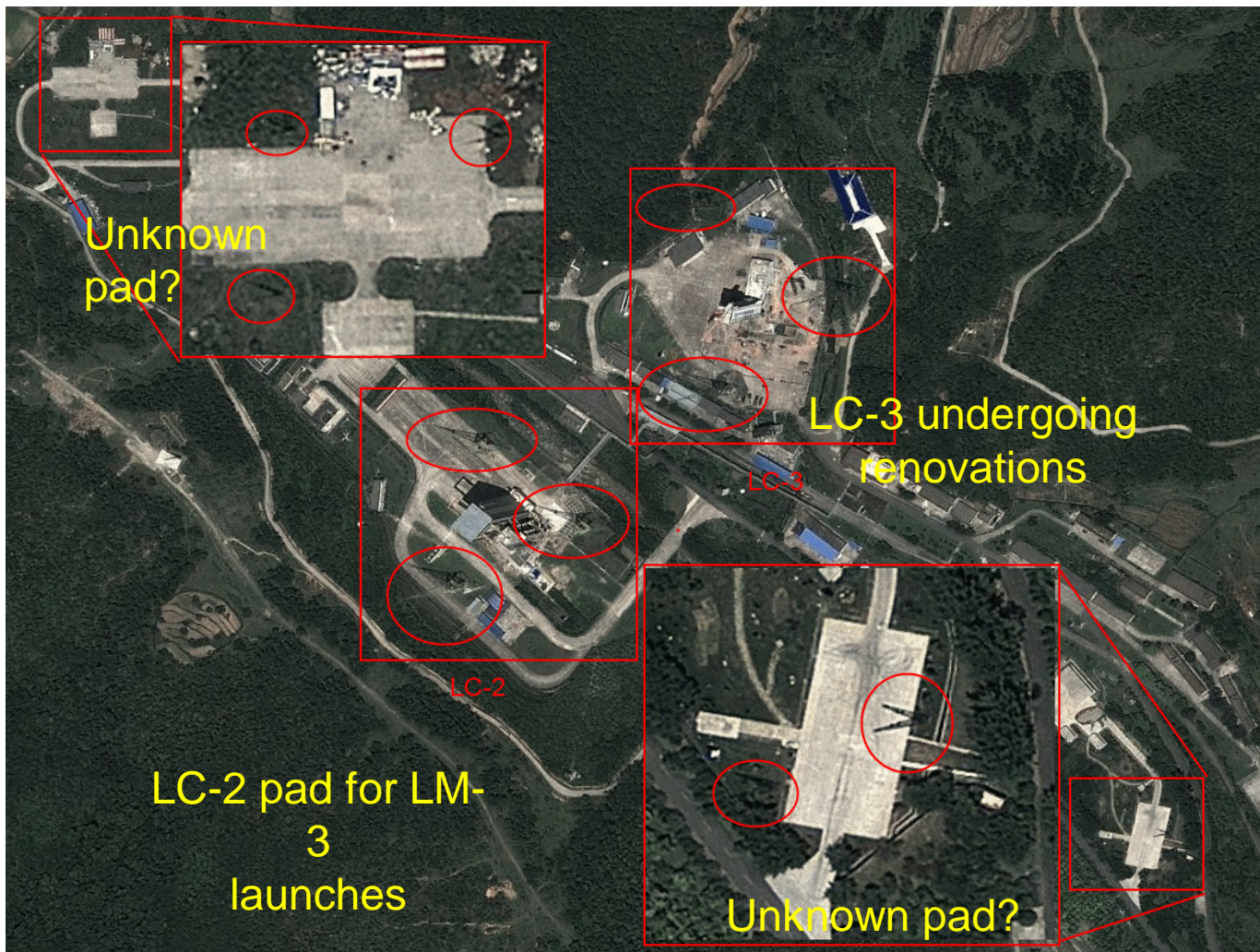
Possible to turn around the pad for a sounding rocket launch in 12 days?

Example of lightning masts



Lightning masts at Cape Canaveral Pad 39B. Image credit Wikimedia Commons ([source](#))

Lightning masts at Xichang



Lightning masts at Xichang (circled in red). Image © 2013 Google Earth.

Northwest unknown pad

April 9, 2005



November 6, 2005



November 15, 2005



April 30, 2012



April 20, 2013



May 20, 2013



Historical imagery of the northwest pad at Xichang. Images © 2005, 2006, 2012, & 2013 Google Earth

- Built to support mobile rocket launches, beginning some time in mid-2005

Southeast unknown pad

November 15, 2006



April 30, 2012



Historical imagery of the southeast pad at Xichang. Images © 2006, 2012 Google Earth

Digitalglobe image of Xichang, April 3, 2013



Imagery of Xichang from April 3, 2013, showing a TEL on the southeast pad. Image © 2013 DigitalGlobe. All rights reserved.

Comparison to an IRBM TEL



*TEL on SE launch pad at Xichang
April 3, 2013*



*DF-21C TEL elevated for launch.
(Image credit [Air Power Australia](#))*



Promoting Cooperative Solutions for Space Sustainability

QUESTION 2: HOW HIGH DID IT GO?

Re-entry point

U.S. officials:

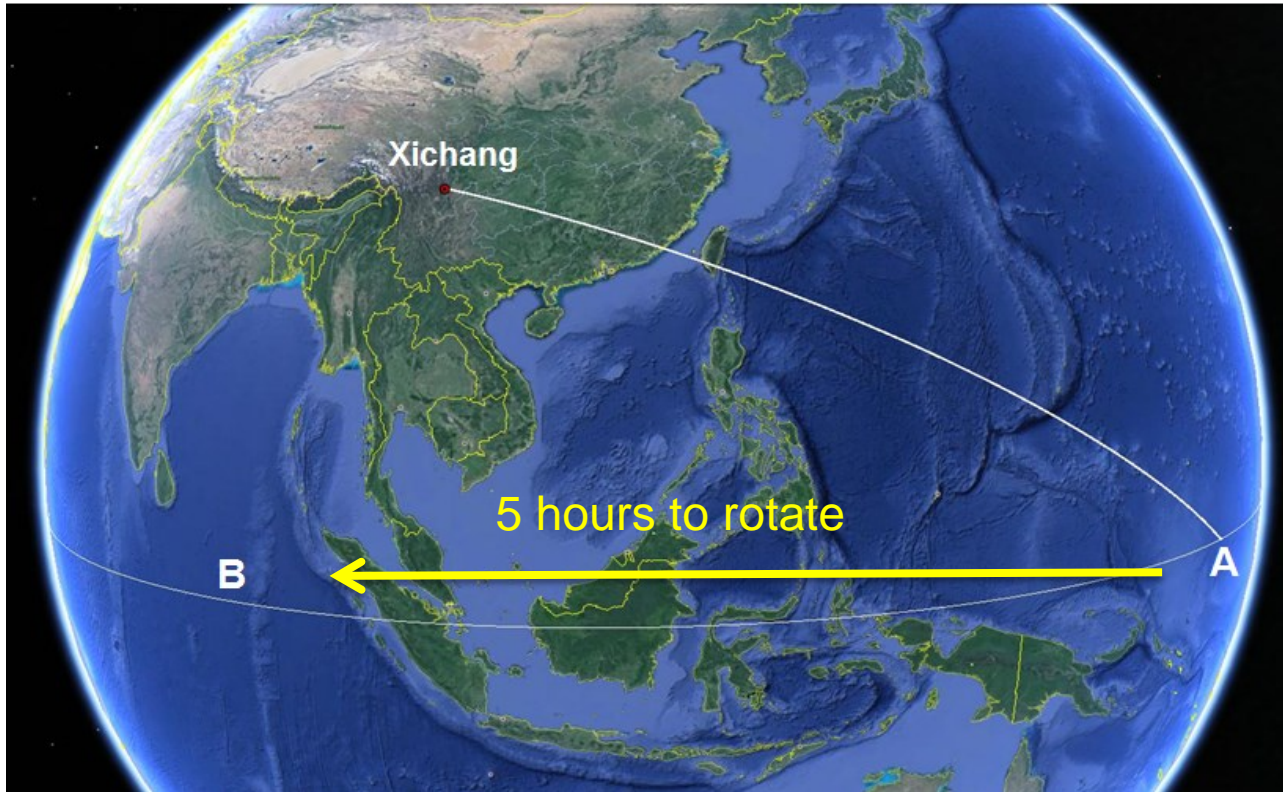
- “...the launch appeared to be on a ballistic trajectory *nearly to [GEO]**”
- “[objects from the launch] re-entered the Earth’s atmosphere above the Indian Ocean”



**assumed to be
30,000 km for this
analysis*

The boundaries of the Indian Ocean. Image credit [Wikimedia Commons](#)

Launch trajectory, Earth's rotation, and time



The ground track of a rocket from Xichang to the Equator for a non-rotating Earth indicated by Point A and a rotating Earth indicated by Point B (source: [David Wright](#)). Image © 2013 Google Earth.

Flight time for a notional SLV to 10,000 km: 2.2 hours

Flight time for a notional SLV to 30,000 km: 6.7 hours



Promoting Cooperative Solutions for Space Sustainability

QUESTION 3: WHAT ROCKET WAS USED?

- Based on the satellite imagery and launch pads, rocket needs to be of a mobile nature
- DF-21C IRBM
 - Estimated max horizontal range of 2,500 km or 1,250 km straight up
 - Not a possibility for May 2013 launch
- DF-31 ICBM
 - Estimated max horizontal range of 12,000 km or 6,000 km straight up
 - Possible to reach 10,000 km but not ~30,000 km

Mystery rocket program?

- After the 2007 Chinese ASAT test, there was much speculation about the heritage of the rocket used in that test as part of the SC-19 ASAT system
- Most of the speculation centered around the KT-1
 - Shown publicly at some Chinese trade shows, marketed as a “commercial” launcher
- Proposed heritage was DF-21C -> KT-1 -> SC-19
 - Didn’t quite fit
 - Also claims that the SC-19 borrowed from the DF-31

China's rocket program

- Currently centralized in two state-owned corporations who are competitors
- Chinese Aerospace Science and Technology Corporation (CASC), First Academy of Launch Vehicle Technology (CALT)
 - Long March family of SLVs
 - Silo-based DF-4 and DF-4 ICBMs
 - DF-31/DF-31A ICBMs
- Chinese Aerospace Science and Industry Corporation (CASIC)
 - Responsible for nearly all of China's tactical ballistic missiles
 - DF-21 IRBMs

Kuaizhou: China's "quick vessel" to space

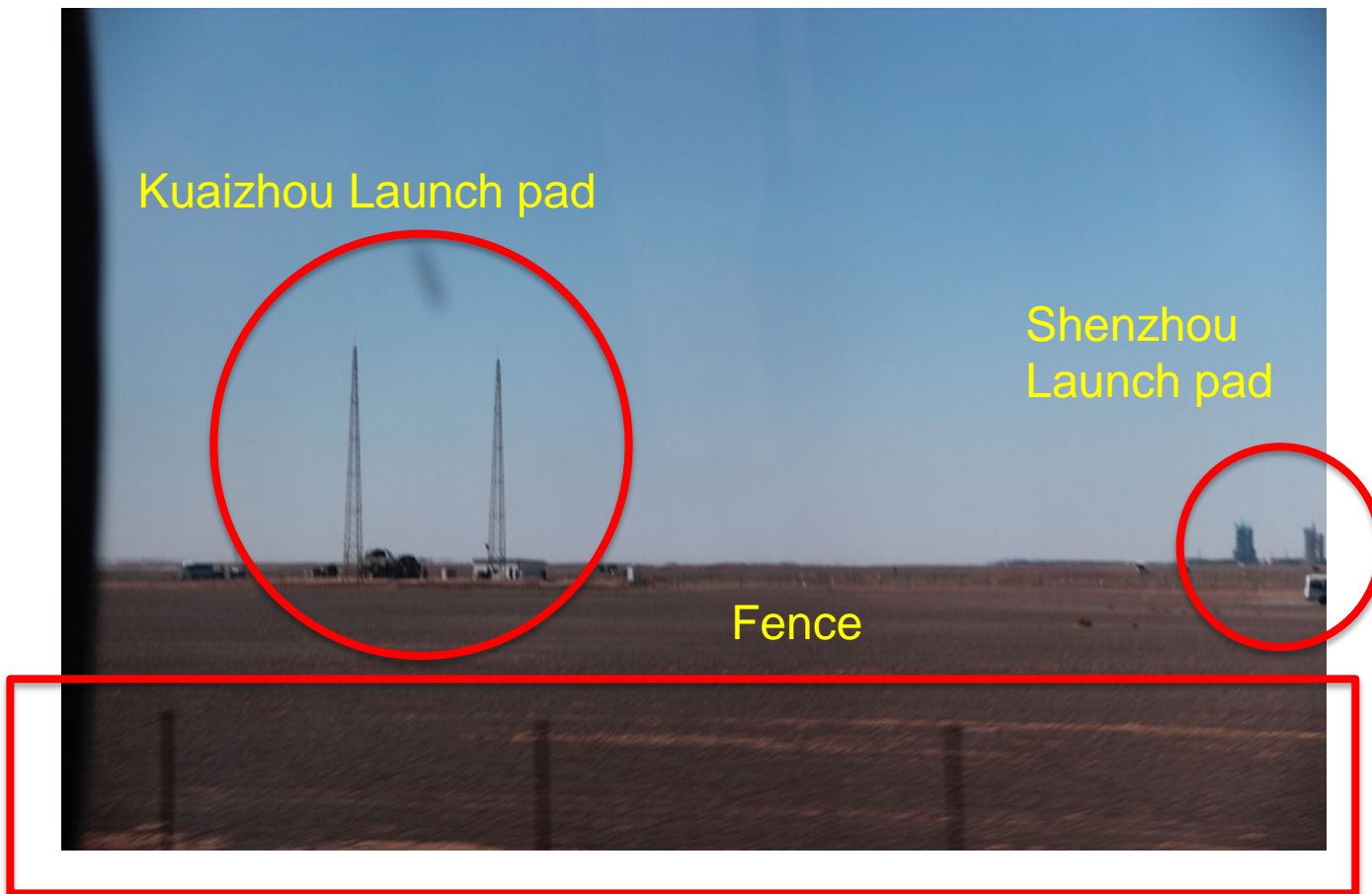


- September 25, 2013 launch from Jiuquan Satellite Launch Center
- Kuaizhou "Quick Vessel" solid-rocket SLV
- Part of China's "Operationally Responsive Space" program



Image of the Kuaizhou launch taken from an access road near the launch site. ([Source](#))

Is it authentic?



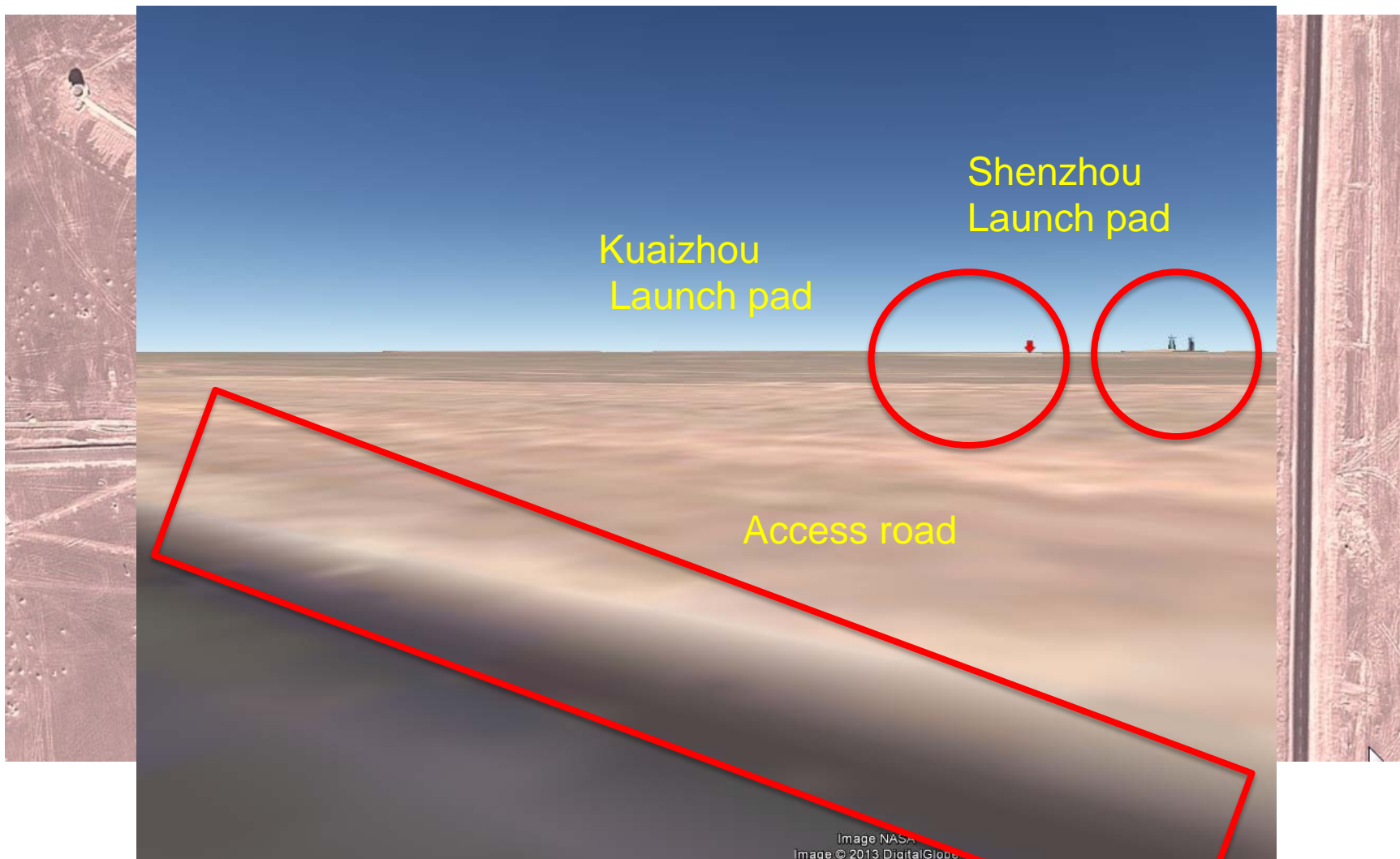


Image NASA
Image © 2013 DigitalGlobe

- From Chinese blogger kkt: “CASIC wanted to develop a new business in solid rocket SLVs by leveraging its expertise with solid rocket missiles”
 - KT-1: four-stage SLV 13.6 meters in length and 1.4 meters in diameter, tested twice unsuccessfully
 - KT-2: 1.7 meter diameter, never tested
 - KT-409: 1.4 meter diameter, four-stage rocket (three solid with a liquid upper stage), launched from a WS2500 TEL (same as the DF-21C)
 - Kuaizhou: 1.7 meter diameter, four-stage rocket (three solid with a liquid upper stage)

***Was the May 2013 Xichang launch
that of a Kuaizhou on a ballistic trajectory?***

Known SC-19 testing to date

Date of Test	Target Object	Interceptor Object	Interceptor Type	Amount of Trackable Debris Created	Notes
7/5/2005	None known	SC-19	direct ascent	0	Likely rocket test
2/6/2006	None known	SC-19	direct ascent	0	Likely flyby of an unknown orbital target
1/11/2007	FengYun 1C	SC-19	direct ascent	3,280	Successful intercept and destruction of an orbital target
1/11/2010	CSS-X-11 (ballistic)	SC-19	direct ascent	0	Successful intercept and destruction of a suborbital target
1/27/2013	Unknown (ballistic)	SC-19	direct ascent	0	Successful intercept and destruction of a suborbital target
Total Amount of Trackable Debris				3,280	

Launched from Xichang

Launched from Korla Missile Test Complex

Unknown launch site (Korla?)

Summary of findings for new ASAT

- Most likely candidate launch pad for the May 2013 launch was one of the mobile pads identified by the lightning masts
- A TEL was imaged on the SE pad six weeks before launch
- The TEL appears to be similar to the WS2500 TEL used for the DF-21C
- If objects from the launch landed in Indian Ocean, then they had to have gone much higher than 10,000 km
- Existing ballistic missiles do not have the power to reach 10,000 km, let alone “nearly to GEO”
- Likely heritage from DF-21C and related to SC-19 and Kuaizhou

Unanswered questions

- Has the SC-19 finished testing, and does that mean it is now “operational”?
- If the May 2013 launch was a scientific experiment, when will the data/results be published and where?
- Is the rocket used in May 2013 the Kuaizhou or derived from it?
- Was the May 2013 launch the first in a series of new tests of a new system?
- Is there a plan to test this new system with an actual intercept?
- Is this new system reusing the same KKV from the SC-19?
- What threat does this system pose to satellite systems in HEO/MEO/GEO?



Promoting Cooperative Solutions for Space Sustainability

Thank You Questions?

Brian Weeden
bweeden@swfound.org