Satellite Views of the Hermit Kingdom

New Perspectives on North Korea

by
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Berlin

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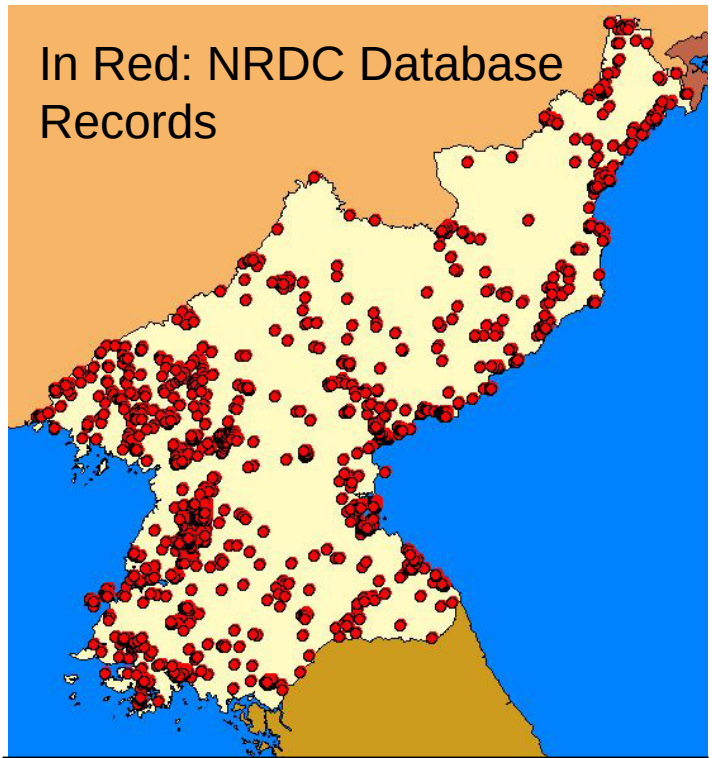
NRDC Geo-Spatial Database of North Korea

a new research tool to analyze security and human rights issues

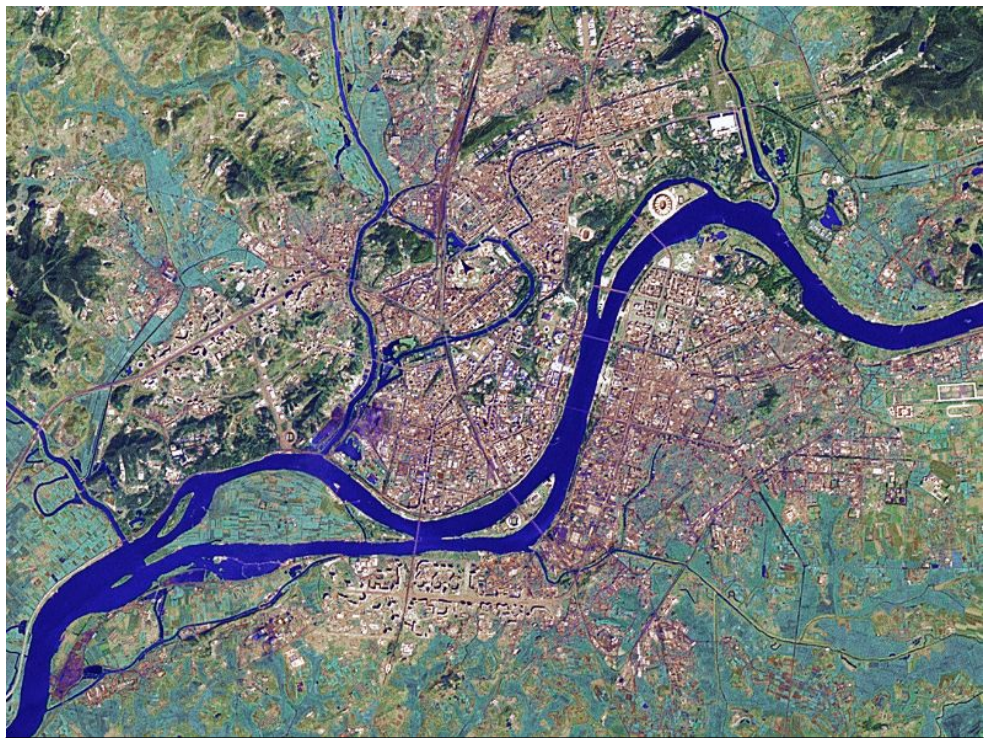
- High resolution commercial satellite imagery – first available to non-governmental researchers in 1999
- Ikonos (Space Imaging) – sun-synchronous, 98-minute orbit – produces a color photo at one-meter resolution [www.spaceimaging.com]
- QuickBird (DigitalGlobe) – can achieve 61-centimeter resolution under some conditions. [www.digitalglobe.com]
- Today's commercially available imagery is comparable to U.S. intelligence community of early 1970s
- Computing power – current laptops have speed and memory comparable to the Cray II that went to LLNL in 1985
- New research can refine military estimates, provide additional data to the public



NRDC's Database of Military and Other Features in the DPRK (about 3,800 Records).

Democratic Peoples Republic of Korea
Basic Facts

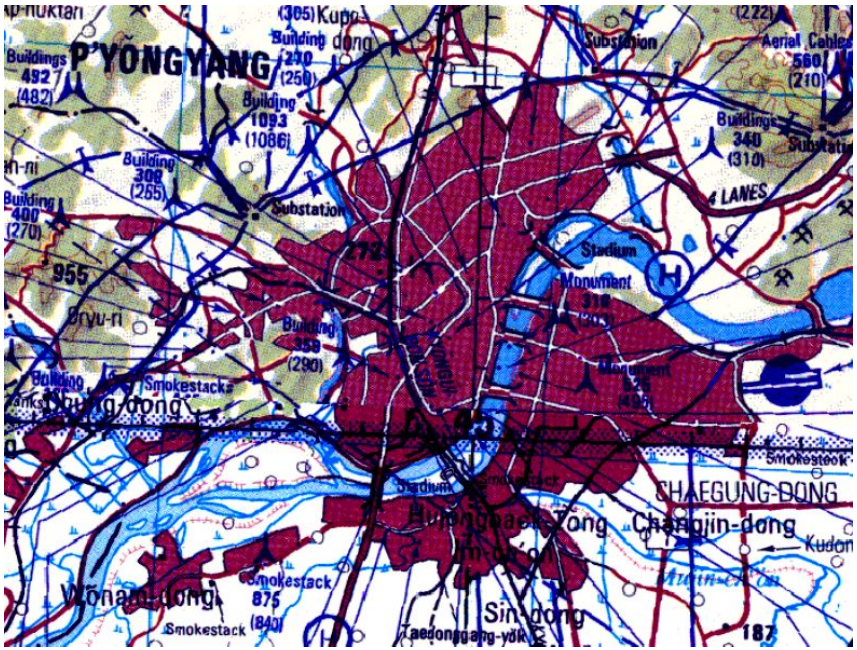
- Occupies 120,000 sq km – about the same size, population and latitude as New York State
- Population 22,700,000
- Coastline – 2,495 km
- Borders - Russia (19 km), China (1,416 km), ROK (238 km DMZ)
- DMZ – extends 2 km on either side of a military demarcation line for 238 km from the Yellow Sea to the Sea of Japan



LandSat7 Image of the DPRK Capitol, P'yongyang, built along the Taedong River.

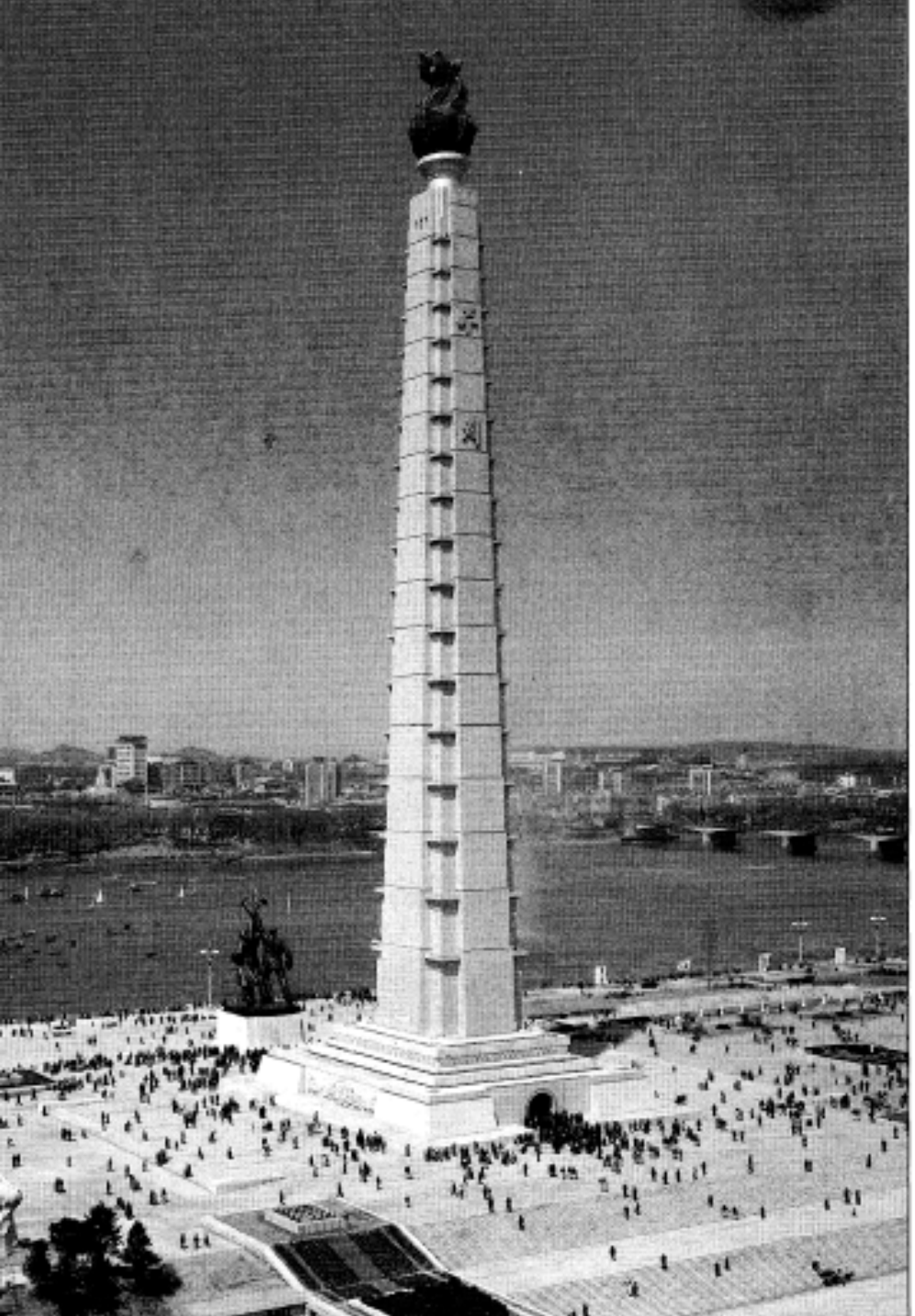
Democratic Peoples Republic of Korea

Two Virtual Tours…



P'yongyang

DMZ



Tower of the Juche Idea, P’yongyang

Completed for Kim Il Sung’s 70th Birthday in 1982.

Design Attributed to Kim Jong Il.

105-Story Ryugyong Hotel, P’yongyang.

Built for 1989 World Festival of Youth and Students, but never completed or opened.

DPRK Military Facts
a Highly militaristic society…

- 23% of GDP for military ($5.2 billion in 2002) (ROK 4%)
- 40 of 1,000 are in uniform (ROK 14 of 1,000)
- 1,200,000 active forces, 5,000,000 reserve, 4th largest in the world
- Army, Air Force, Navy and Special Operations Force (SOF)
- Military strategy – 1) reunify Korean Peninsula under North Korean control within 30 days of the beginning of hostilities 2) defend North Korea
- Most important facilities underground
- DPRK Steadily Building a Nuclear Weapons Capability

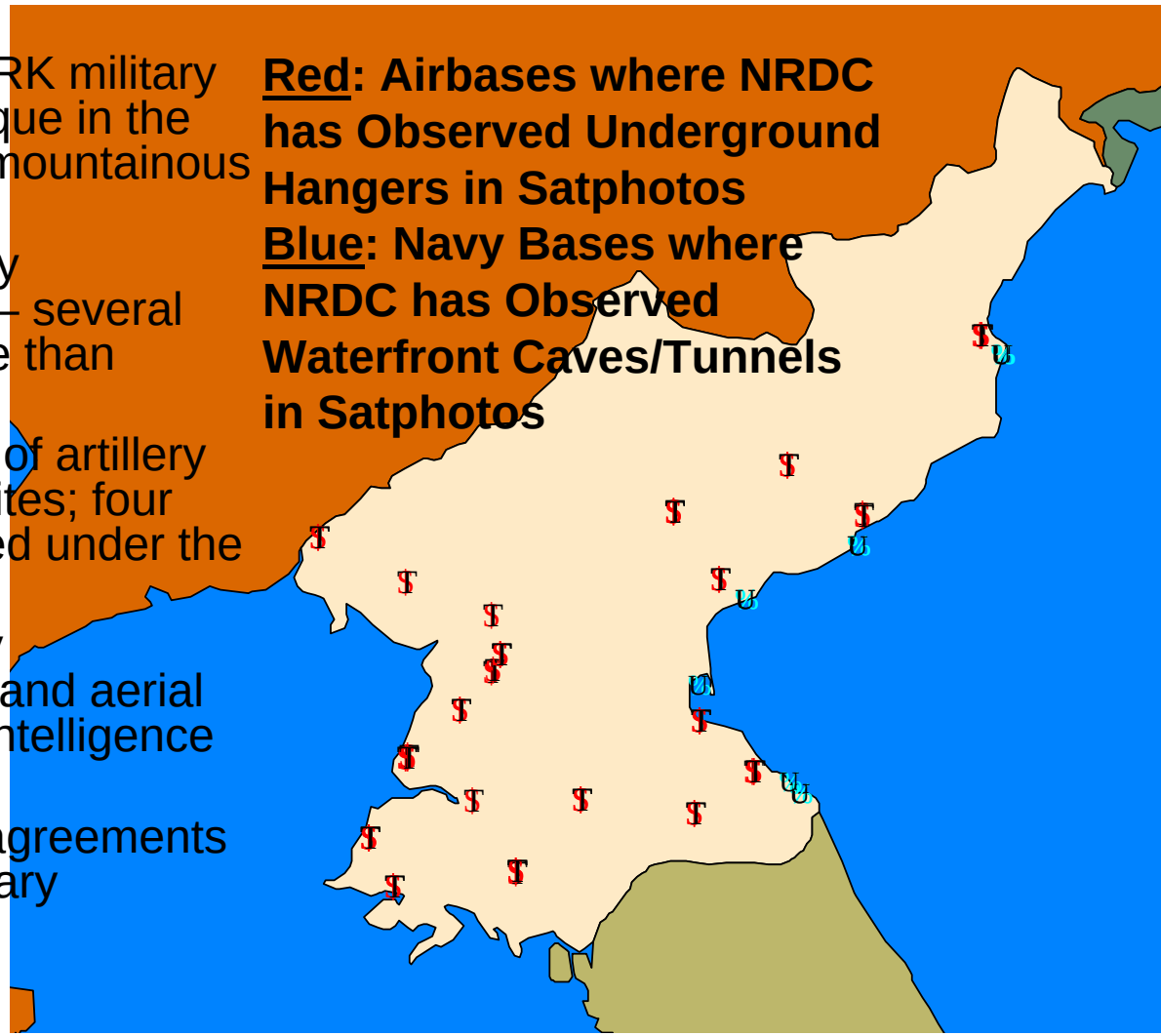
DigitalGlobe photo of “Juche Tower,” P’yongyang.

DPRK: an Underground Nation and Military

After the Korean War experience, Kim Il Sung said:

"The entire nation must be made into a fortress."

- The degree to which the DPRK military is based underground is unique in the world – takes advantage of mountainous topography;
- Virtually everything of military significance is underground – several hundred large facilities, more than 10,000 smaller facilities;
- It is reported that thousands of artillery pieces are at underground sites; four tunnels have been discovered under the DMZ;
- Concealment of their military infrastructure from satellites and aerial reconnaissance make it an intelligence challenge;
- A verification nightmare for agreements limiting nuclear or other military developments in the DPRK.



Underground Air Force

Twenty air bases that have associated underground aircraft hangers

Airfield Name	Coordinates	
	Latitude	**Longitude**
Changjin-up Air Base	40 21 51.9	127 15 50.1
Hwangju Air Base	38 39 13.3	125 47 17.3
Hwangsuwon Air Base	40 40 56.0	128 08 55.5
Hyon-ri Air Base	38 36 47.8	127 27 04.5
Iwon Air Base	40 21 37.9	128 43 08.4
Kaechon Air Base	39 45 10.0	125 54 04.7
Koksan Air Base (and Auxiliary Airstrip)	38 41 19.5	126 36 08.4
Kuum-ni Air Base	38 51 55.1	127 54 12.6
Kwail Air Base	38 25 32.2	125 01 09.4
Nuchon-ni Air Base	38 14 16.7	126 07 13.4
Onch'on Air Base Auxiliary Airstrip	38 53 14.0	125 16 49.9
Orang Air Base	41 25 45.3	129 38 52.7
Panghyon Air Base	39 55 38.4	125 12 28.1
Pukch’ang Air Base	39 30 16.5	125 57 52.9
Sunan Air Base/International Airport	39 12 25.7	125 40 09.8
Sunch’on Air Base	39 24 41.8	125 53 27.5
Taet'an Air Base	38 07 50.4	125 14 43.1
Toksan Air Base	39 59 47.8	127 36 43.3
U'iju Air Base	40 09 00.4	124 29 50.9
Wonsan Air Base	39 09 56.4	127 29 06.9

Underground Navy

Navy Bases with Submarine Caves

	Coordinates
• **Ch'aho-nodongjagu Navy Base**	
Entrance (1)	40 12 15N 128 39 00E
Entrance (2)	40 12 06N 128 39 03E
• **Kosong Naval Facility**	
Entrance (1)	38 44 04N 128 12 45E
Entrance (2)	38 44 00N 128 12 44E
• **Namae-ri Navy Base**	
Entrance	38 48 12N 128 08 17E
• **Puam-dong Navy Base**	
Entrance (1)	41 19 18N 129 46 05E
Entrance (2)`	41 19 30N 129 46 12E
• **Songjin pando Navy Base**	
Entrance	39 22 18N 127 26 18E
• **Yoho’ri Naval Facility**	
Entrance (1)	39 52 33N 127 47 39E
Entrance (2)	39 52 39N 128 47 17E

Other Underground Facilities
(Purpose Unknown)

- Haqap 40 04 54N; 126 11 22E

- Kumchang-ni 40 06 43N; 125 07 47E
  (under construction)
- Other suspect underground facilities, whose locations are not publicly known, are cited in the literature

Selected NRDC Imagery & Data

Database Feature Categories

- Air Bases and Defense
- Navy Bases and Commercial Ports
- Nuclear Facilities
- Missile Sites
- Political Prisons and Prison Camps (Forced Labor)

Satphoto: Hamhung, DPRK. NRDC has acquired images and highly detailed map data for nearly all major North Korean cities (database in red).

Korea People's Air Force (KPAF): Airfields and Highway Strips

<u>56 Airfields: (surplus)</u>

31 Hard Surface

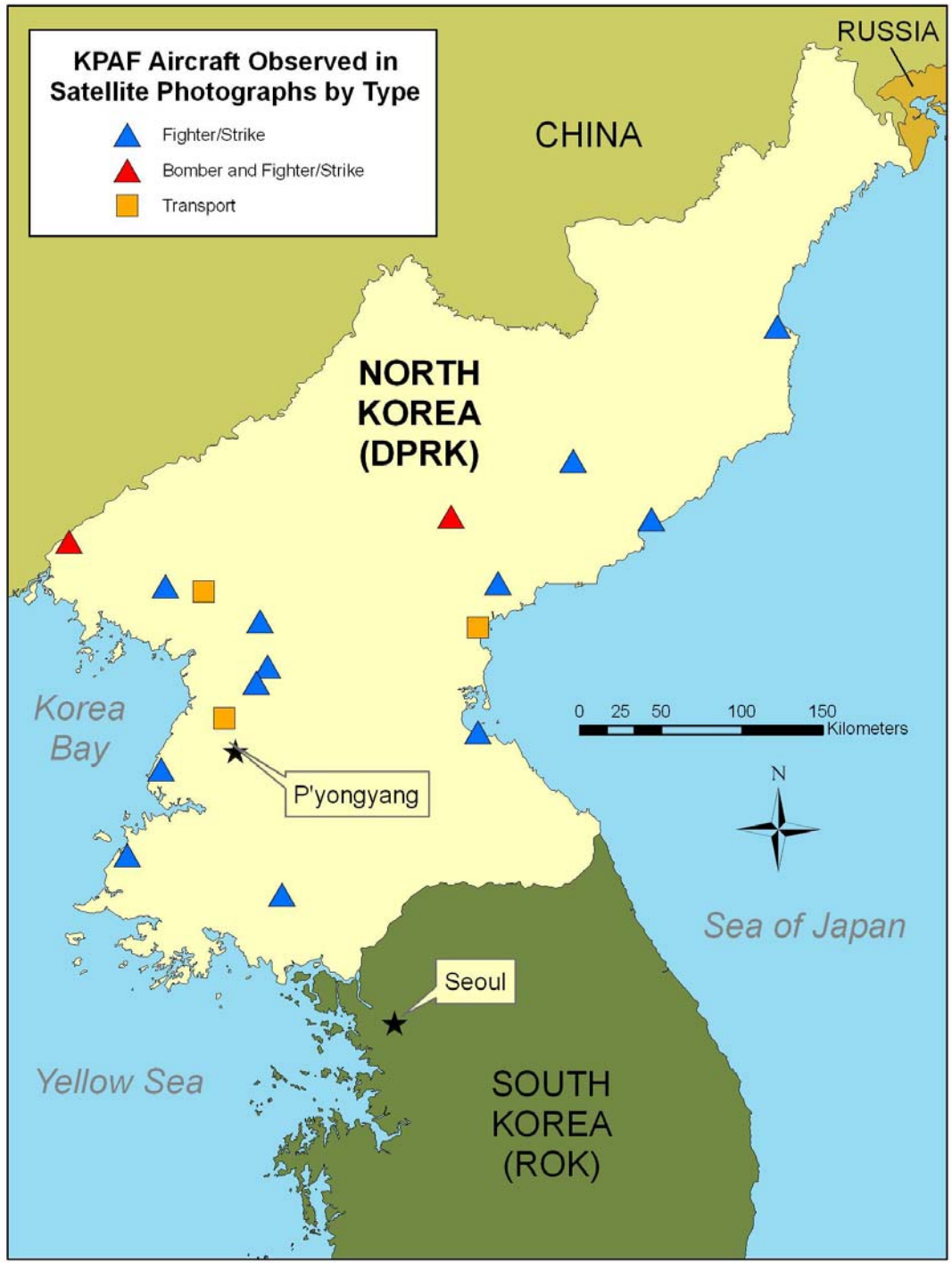
25 Unpaved

<u>19 Highway Strips</u>

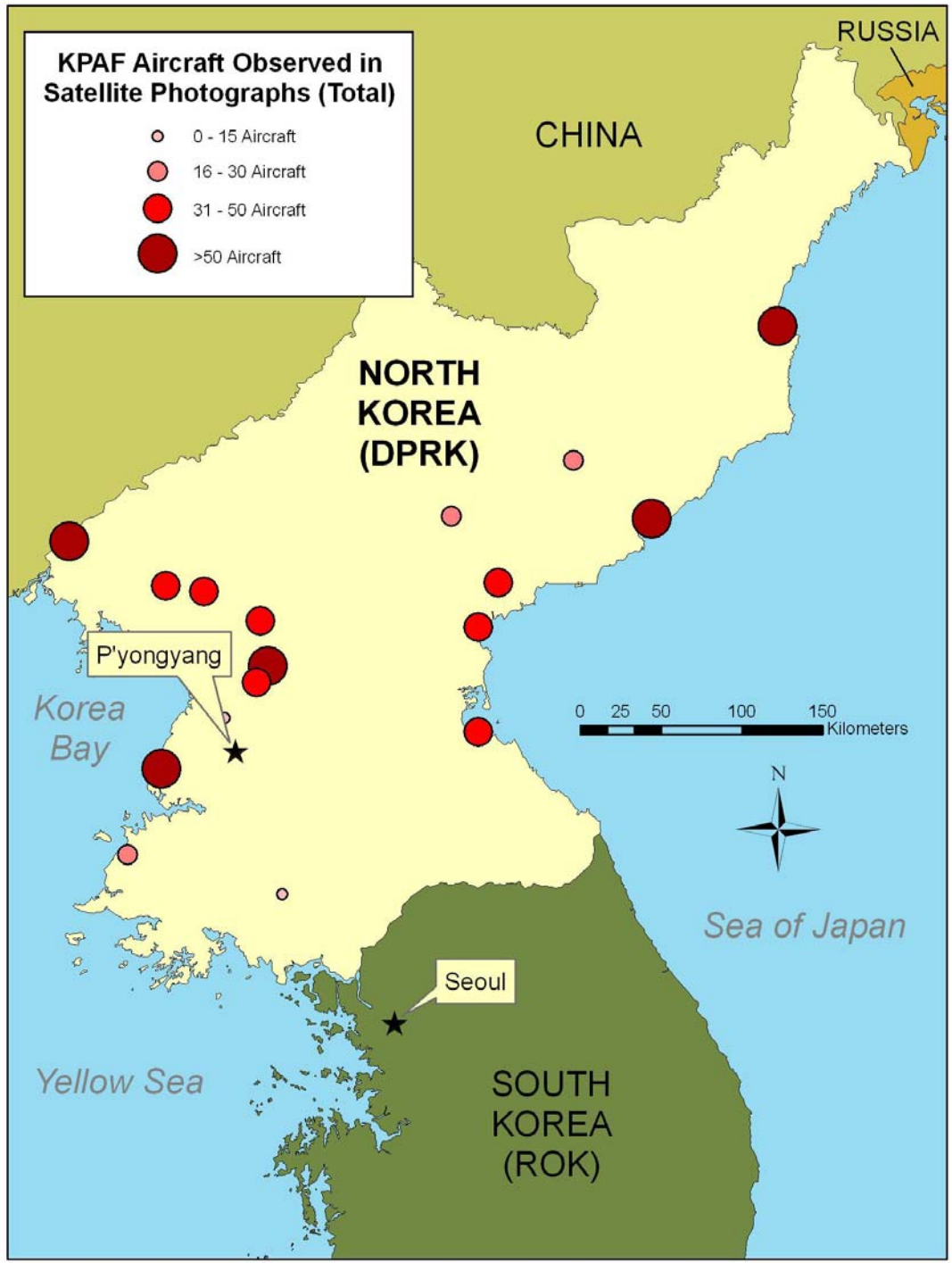
KPAF judged capable of a surge of offense operations at the start of a war and of guarding DPRK airspace during peacetime

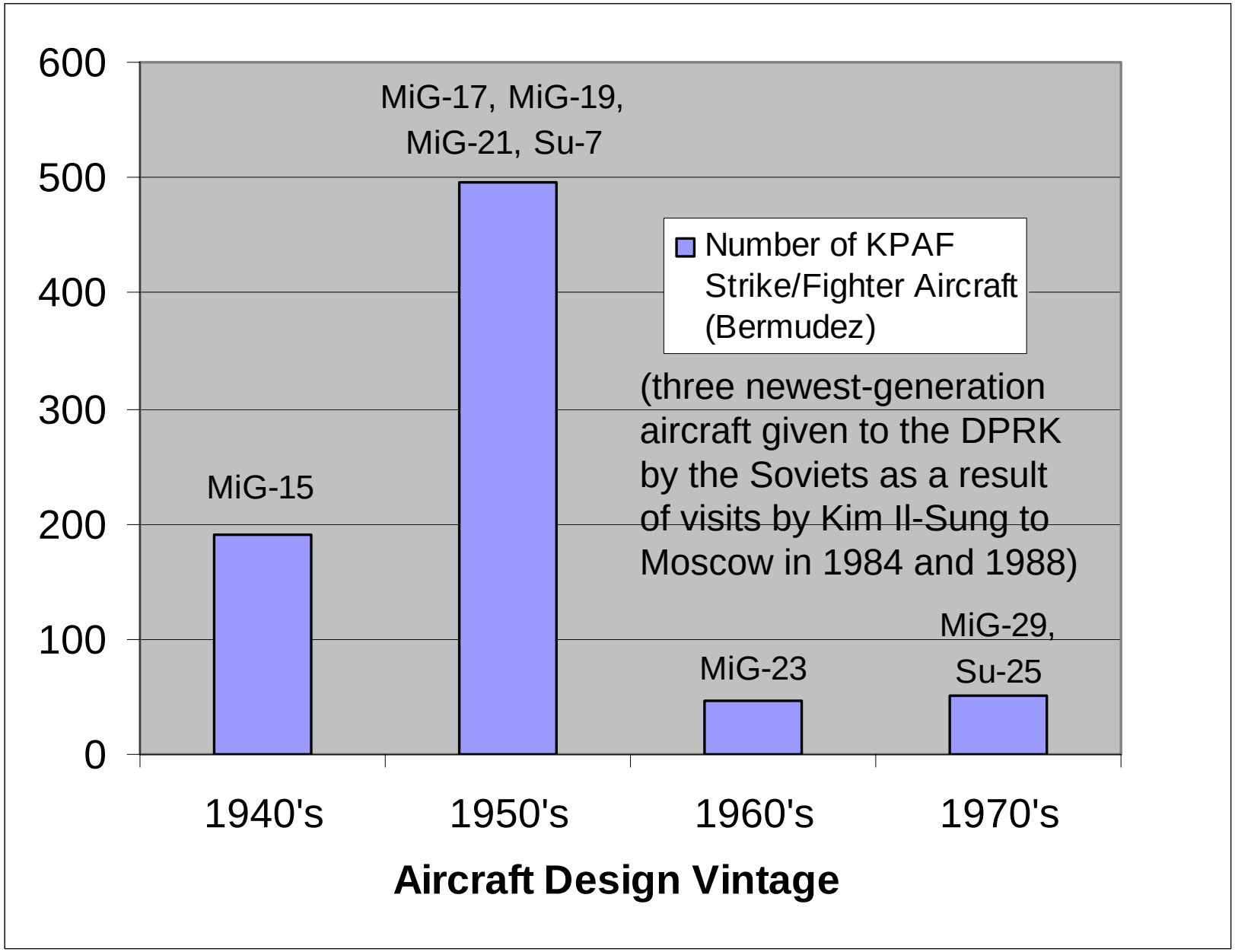
Korea People's Air Force (KPAF): Divisional Organization

Korea People's Air Force (KPAF): Observed Aircraft by Type



Korea People's Air Force (KPAF): Observed Aircraft by Number





*Joseph S. Bermudez, Jr., "The Armed Forces of North Korea," (I.B. Tauris: London, 2001), p. 148.

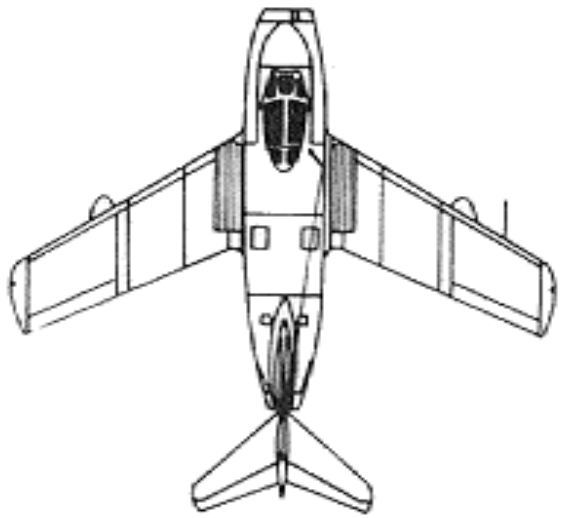
DPRK Fighter and Strike Aircraft

Date of Satellite Image	KPAF Air Base	MiG-15	MiG-17	MiG-19	MiG-21	MiG-23	MiG-29	SU-25	SU-7	U/I MiG	Total
31-Dec-03	Changjin-up				16						16
4-Jun-02	Hwangsuwon	2			15						17
29-Jun-02	Iwon	6	14	17	20						57
10-Dec-02	Kaechon (1st Air Div. HQ)	7	3	31							41
15-Oct-00	Koksan			18	32						50
21-Jun-02	Kwail		10		16					2	28
30-Mar-04	Nuchon-ni				9						9
23-Feb-04	Onch'on	21		63						7	91
15-Nov-02	Orang (8th Air Div. HQ)	51								0	51
22-Nov-03	Panghyon		32		8			1			41
10-Mar-02	Pukch'ang				22	31				6	59
7-Mar-04	Sunch'on				15			18		2	35
13-Apr-03	Toksan (2nd Air Div. HQ)				31						31
5-May-02	U'iju									20	20
22-Nov-02	Wonsan	28	5		13						46
	Total Observed Aircraft	115	64	129	197	31	0	19	0	37	592
	Bermudez Estimate (Aircraft)*	190	120	180	175	46	16	36	20		783
	MCIA Estimate (Regiments)**	5	5	2					1		
	MCIA Estimate (Aircraft)**			>100	120	46		36	20		

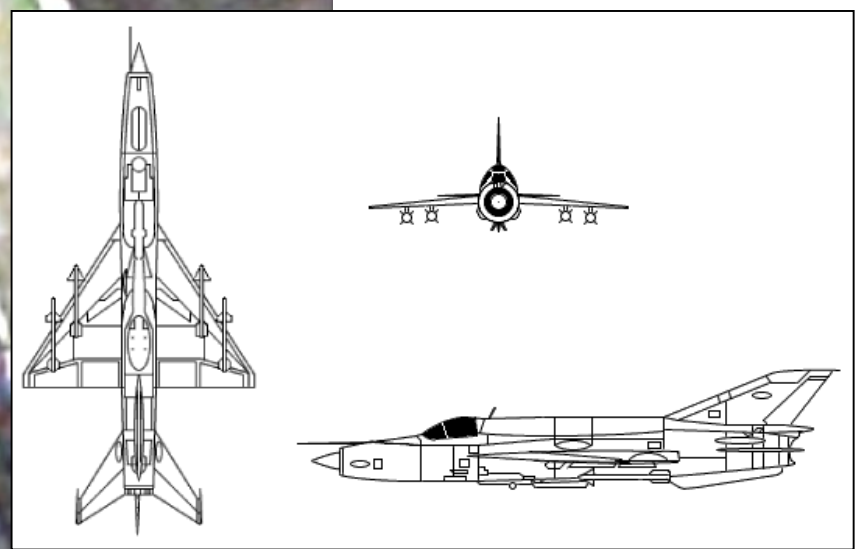
*Joseph S. Bermudez, Jr., "The Armed Forces of North Korea," (I.B. Tauris: London, 2001), p. 148.

**North Korea Country Handbook--Marine Corps Intelligence Activity (MCIA-2630-NK-016-97), May 1997, p. 36-38.

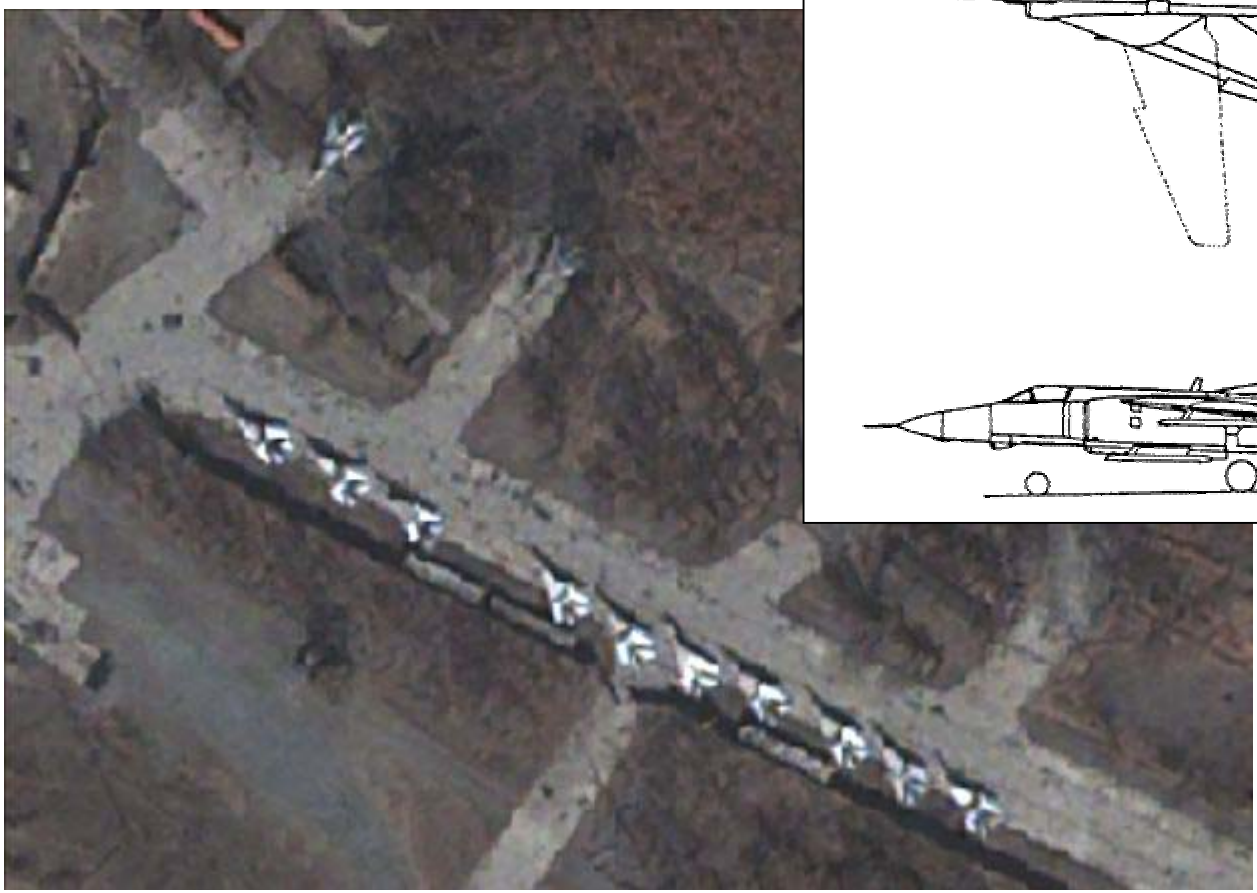
KPAF: F5
(MiG-15 Fagot)

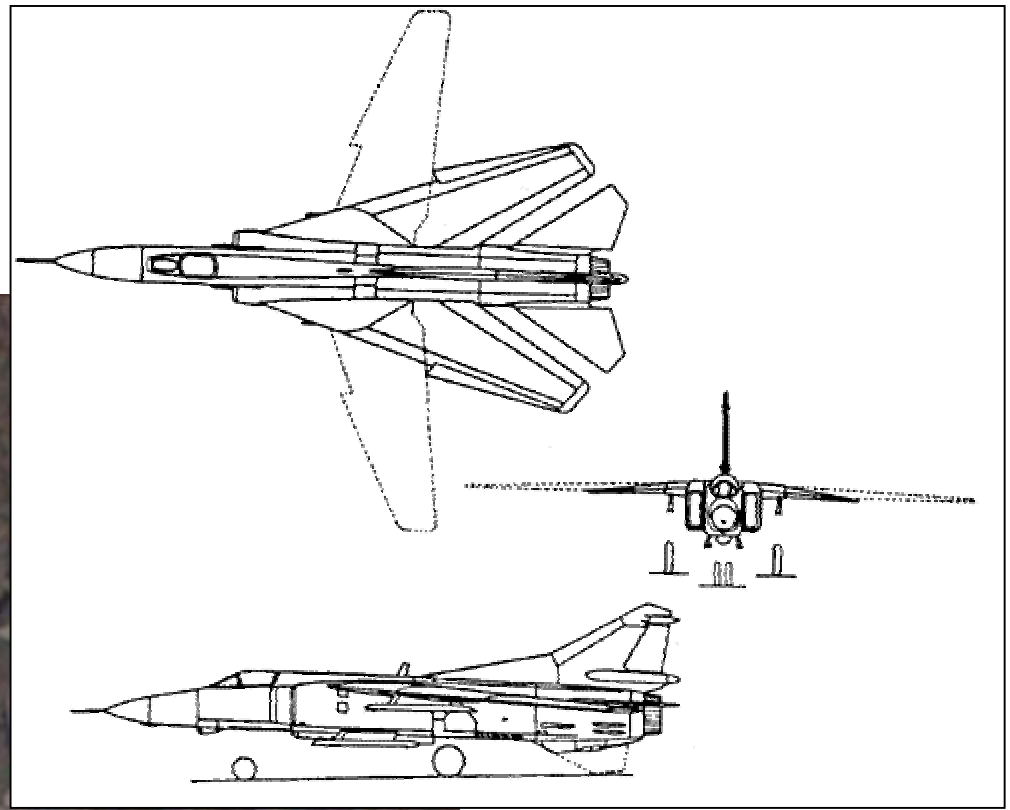


KPAF: MiG-21 Fishbed



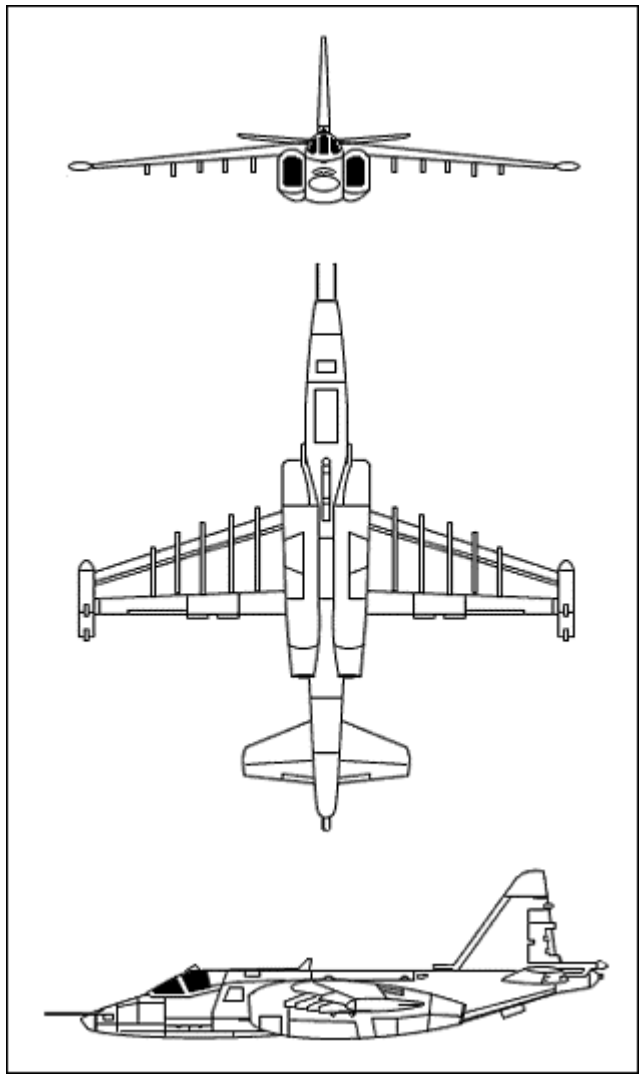
KPAF: MiG-23ML/UB Flogger G





third-generation fighter with limited all-weather and ground-attack capabilities

KPAF: Su-25/UBK Frogfoot A



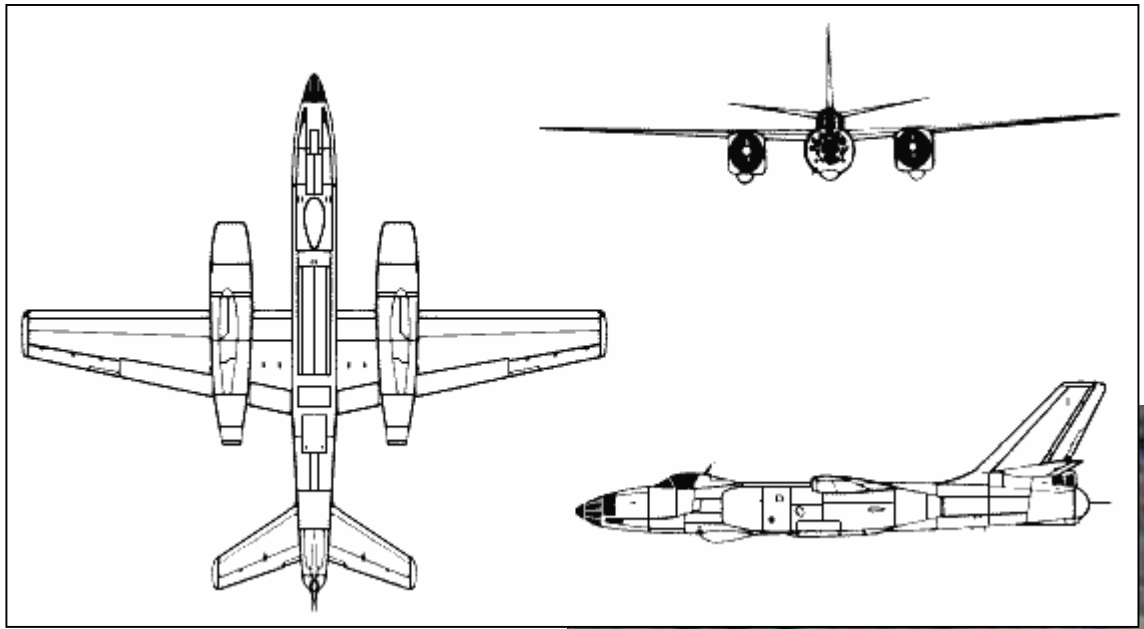
DPRK Bomber Aircraft

Date of Satellite Image	KPAF Air Base	H-5, H-5R, HJ-5
31-Dec-03	Changjin-up	10
5-May-02	U'iju	35
	Total Observed Aircraft	45
	Bermudez Estimate (Aircraft)*	82
	MCIA Estimate (Regiments)**	3

*Joseph S. Bermudez, Jr., "The Armed Forces of North Korea," (I.B. Tauris: London, 2001), p. 148.

**North Korea Country Handbook--Marine Corps Intelligence Activity (MCIA-2630-NK-016-97), May 1997, p. 36-38.

KPAF: HJ-5 (Il-28 Beagle)



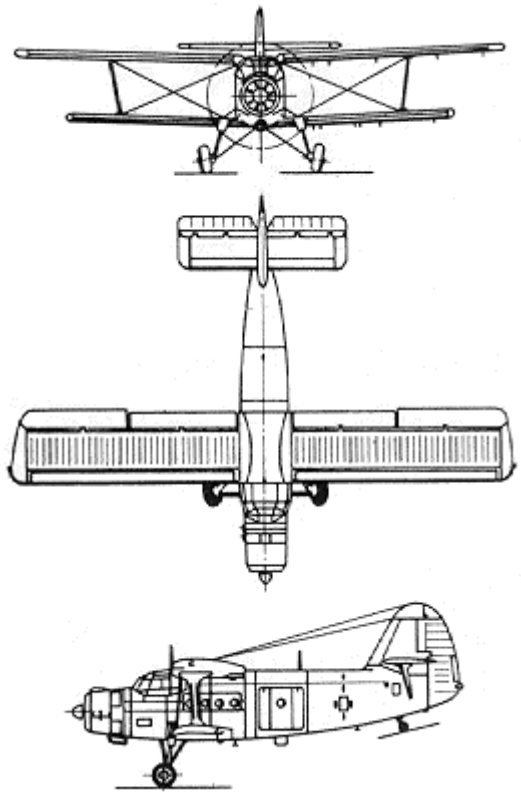
DPRK Transport Aircraft

Date of Satellite Image	KPAF Air Base	Y-5 (An-2 COLT)	An-24 COKE	Il-14 CRATE	Il-18 COOT	Il-62 CLASSIC	Il-76 FALSIE	Li-2 CAB	Tu-134B CRUSTY	Tu-154B CARELESS
8-May-02	Sondok	31						11		
20-Apr-02	Sunan				1			2		
8-Dec-03	Teachon	48								
	Total Observed Aircraft	79	0	0	1	0	0	13	0	0
	Bermudez Estimate (Aircraft)*	300	10	5	4	6	3	14	2	4
	MCIA Estimate (Aircraft)**	>270								
	MCIA Estimate (Regiments)**	6								

*Joseph S. Bermudez, Jr., "The Armed Forces of North Korea," (I.B. Tauris: London, 2001), p. 148.

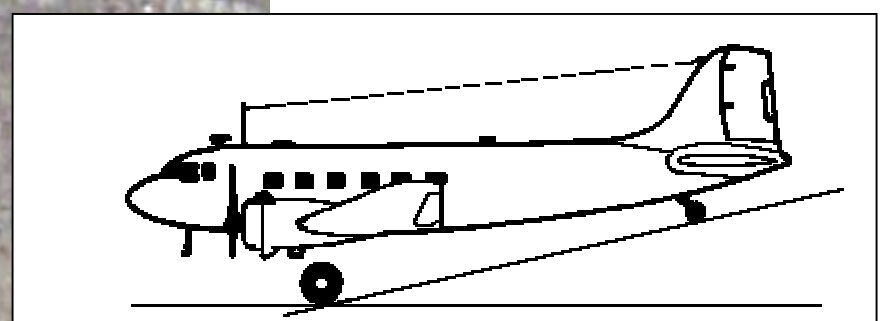
**North Korea Country Handbook--Marine Corps Intelligence Activity (MCIA-2630-NK-016-97), May 1997, p. 36-38.

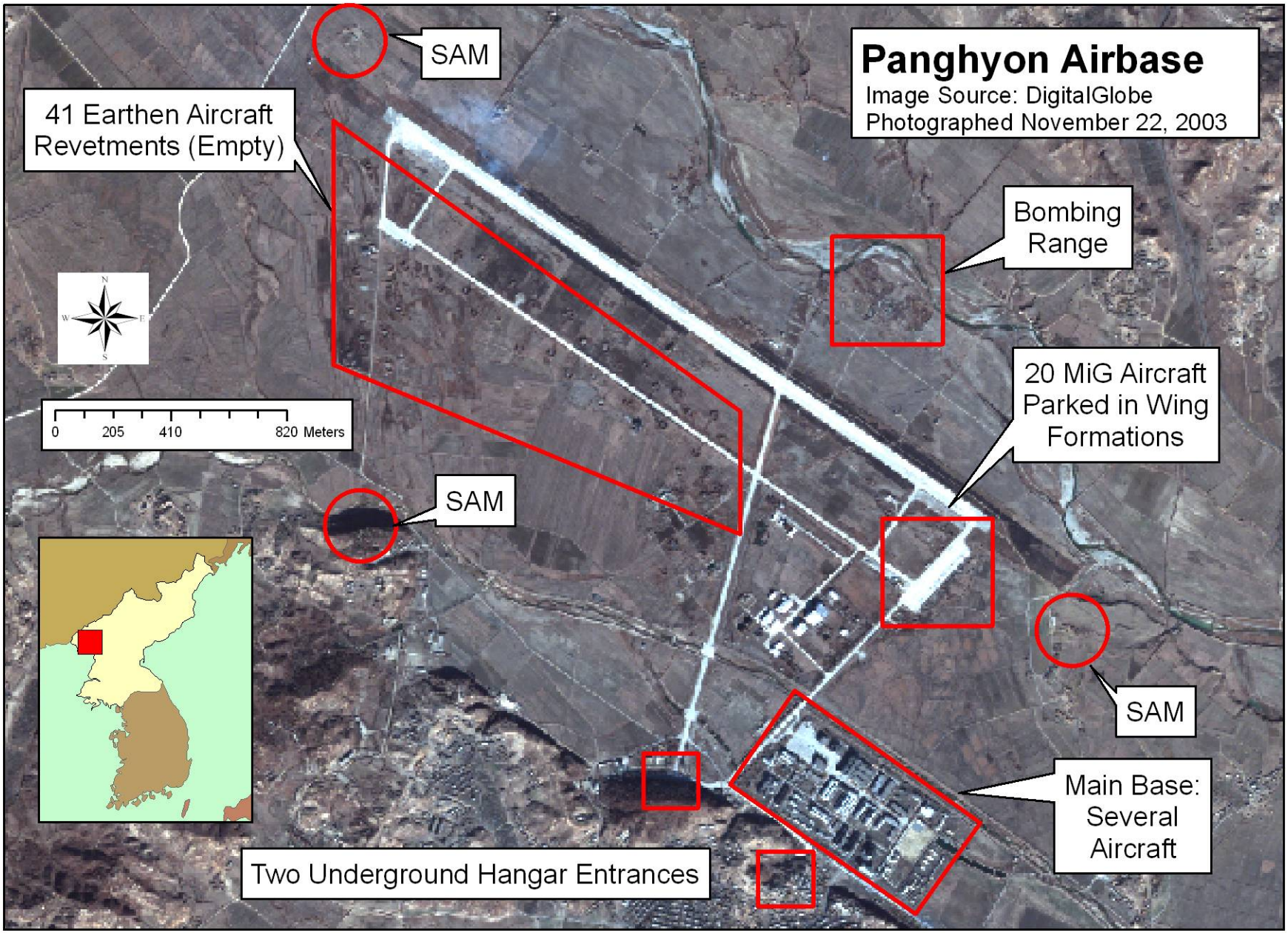
KPAF: Y-5 (An-2 COLT)

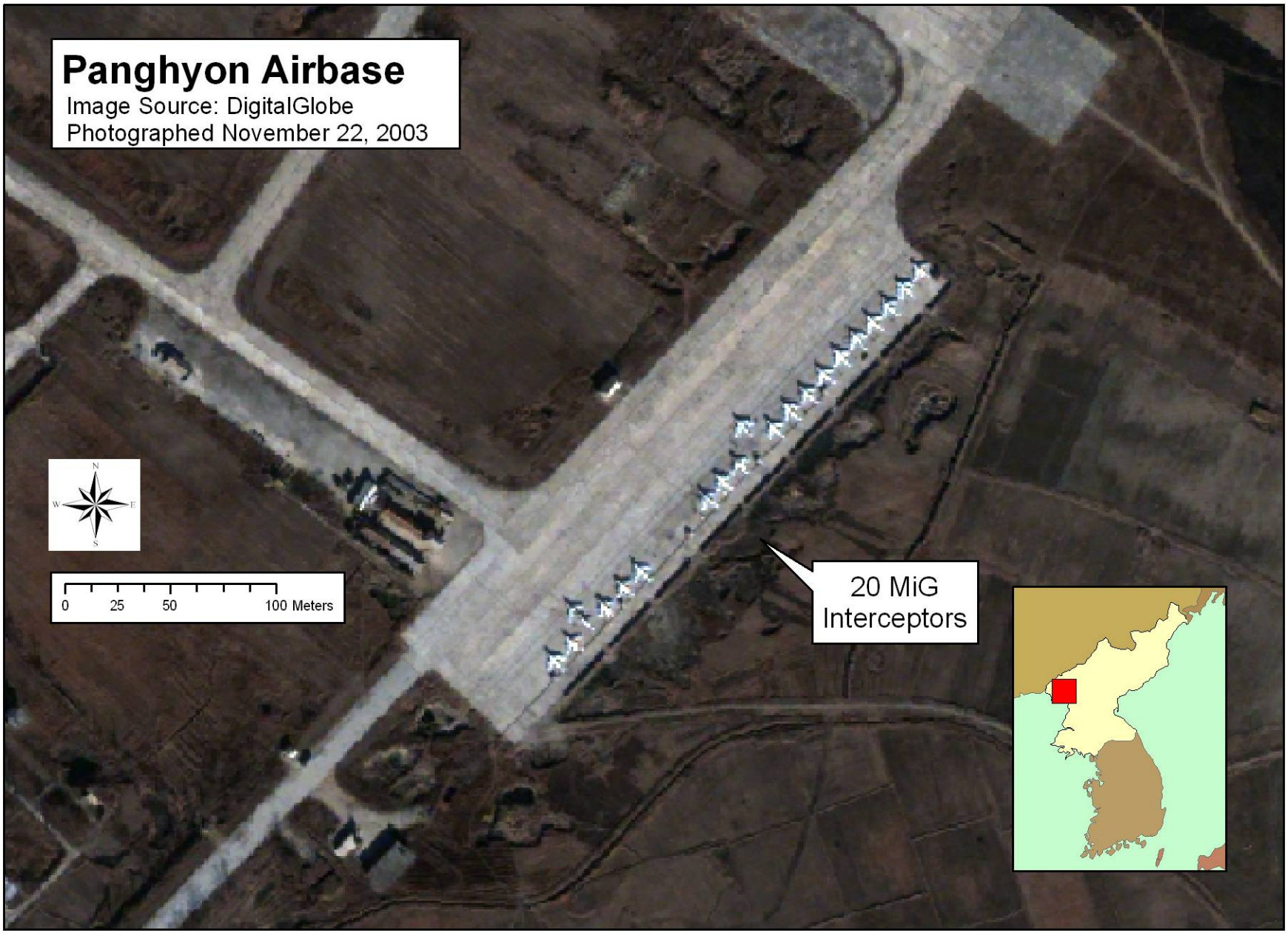


the An-2 Holds Symbolic Value for the DPRK from the Fatherland Liberation War

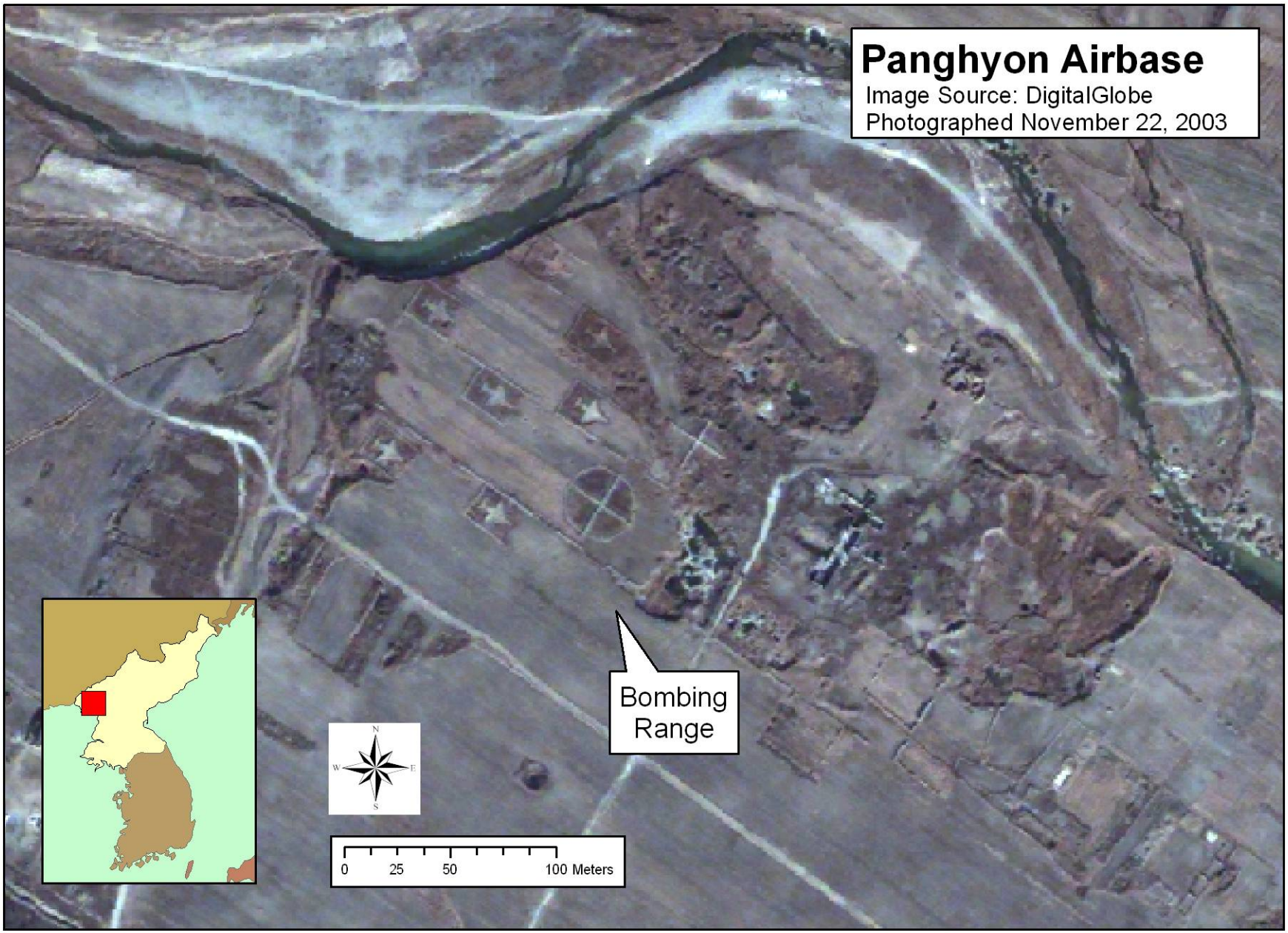
KPAF: Li-2 CAB

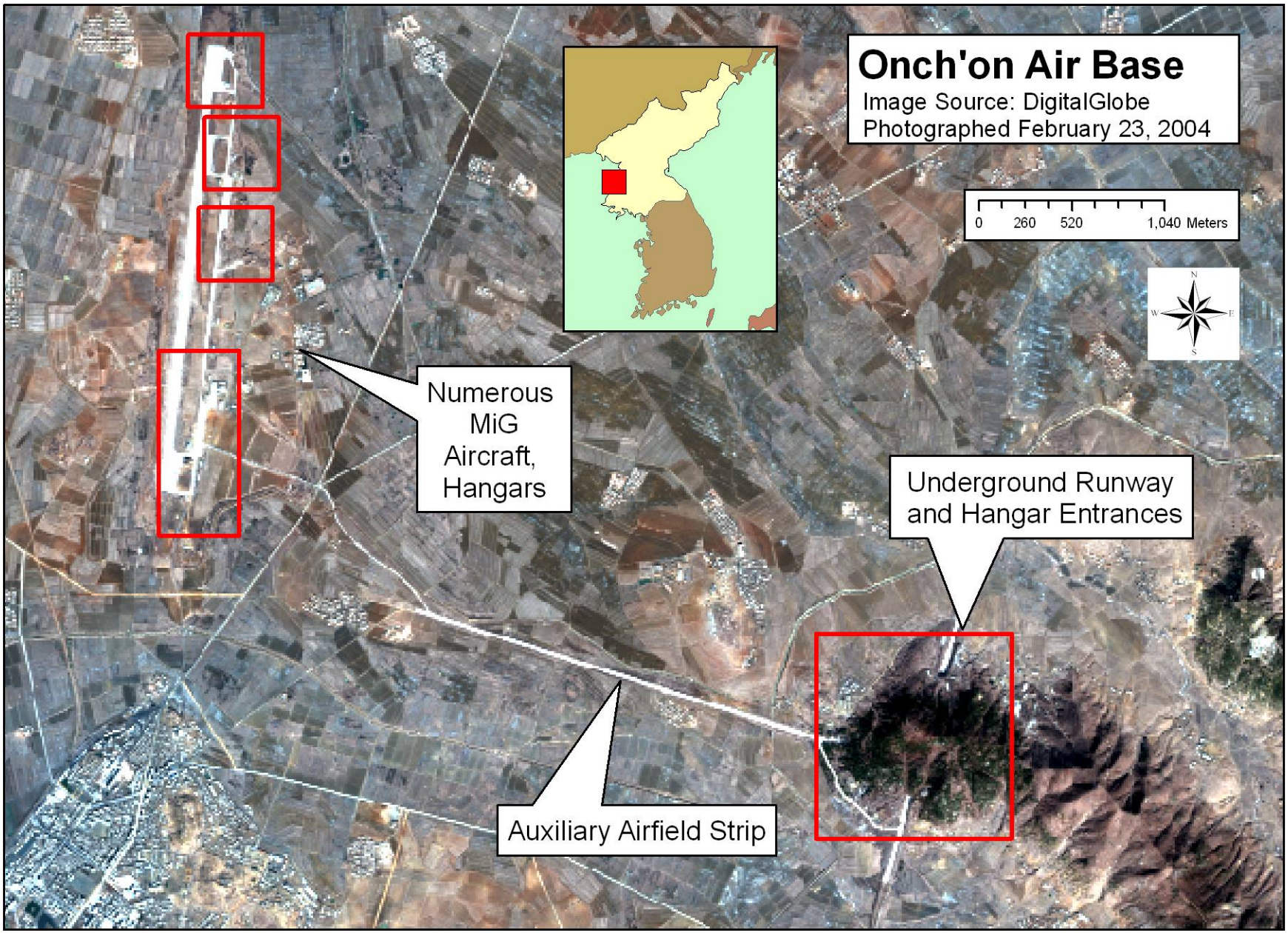


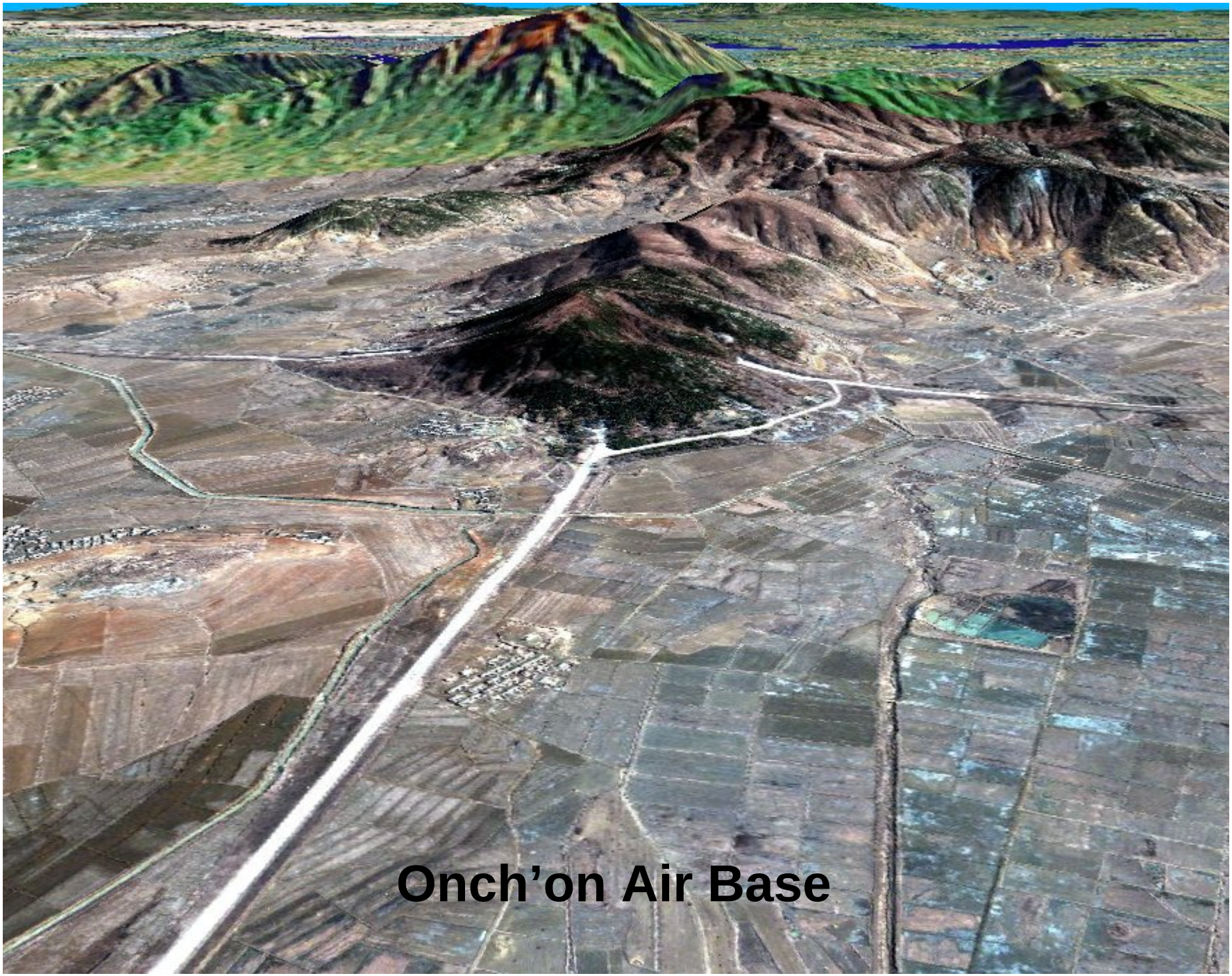

Panghyon Airbase
Image Source: DigitalGlobe
Photographed November 22, 2003
SAM
41 Earthen Aircraft Revetments (Empty)
Bombing Range
20 MiG Aircraft Parked in Wing Formations
SAM
SAM
Main Base: Several Aircraft
Two Underground Hangar Entrances
0 205 410 820 Meters

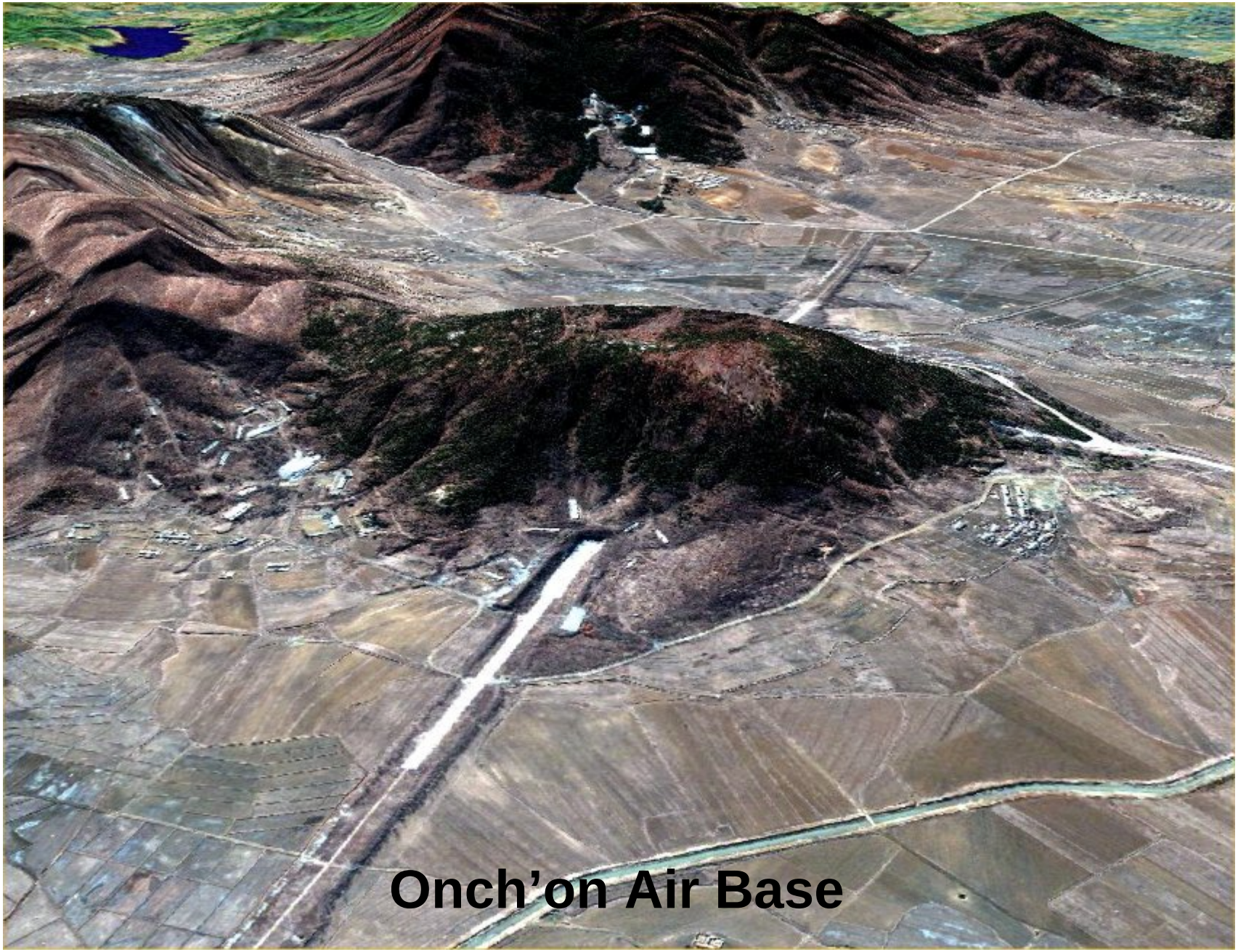

Panghyon Airbase
Image Source: DigitalGlobe
Photographed November 22, 2003
N
W
E
S
0
25
50
100 Meters
20 MiG
Interceptors

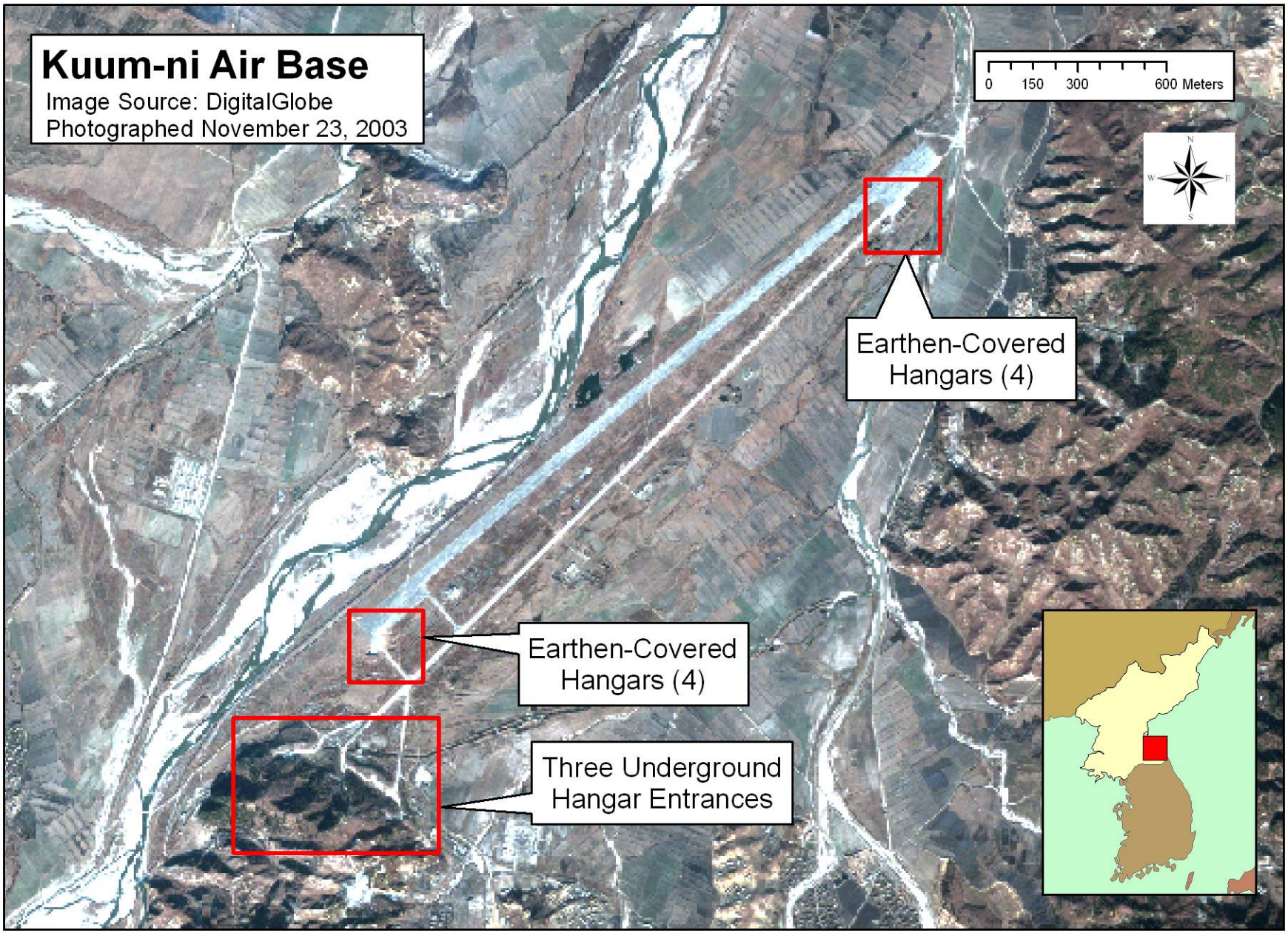

0 37.5 75 150 Meters
Main Base:
MiG Aircraft
Entrances to
Underground Hangars
Panghyon Airbase
Image Source: DigitalGlobe
Photographed November 22, 2003

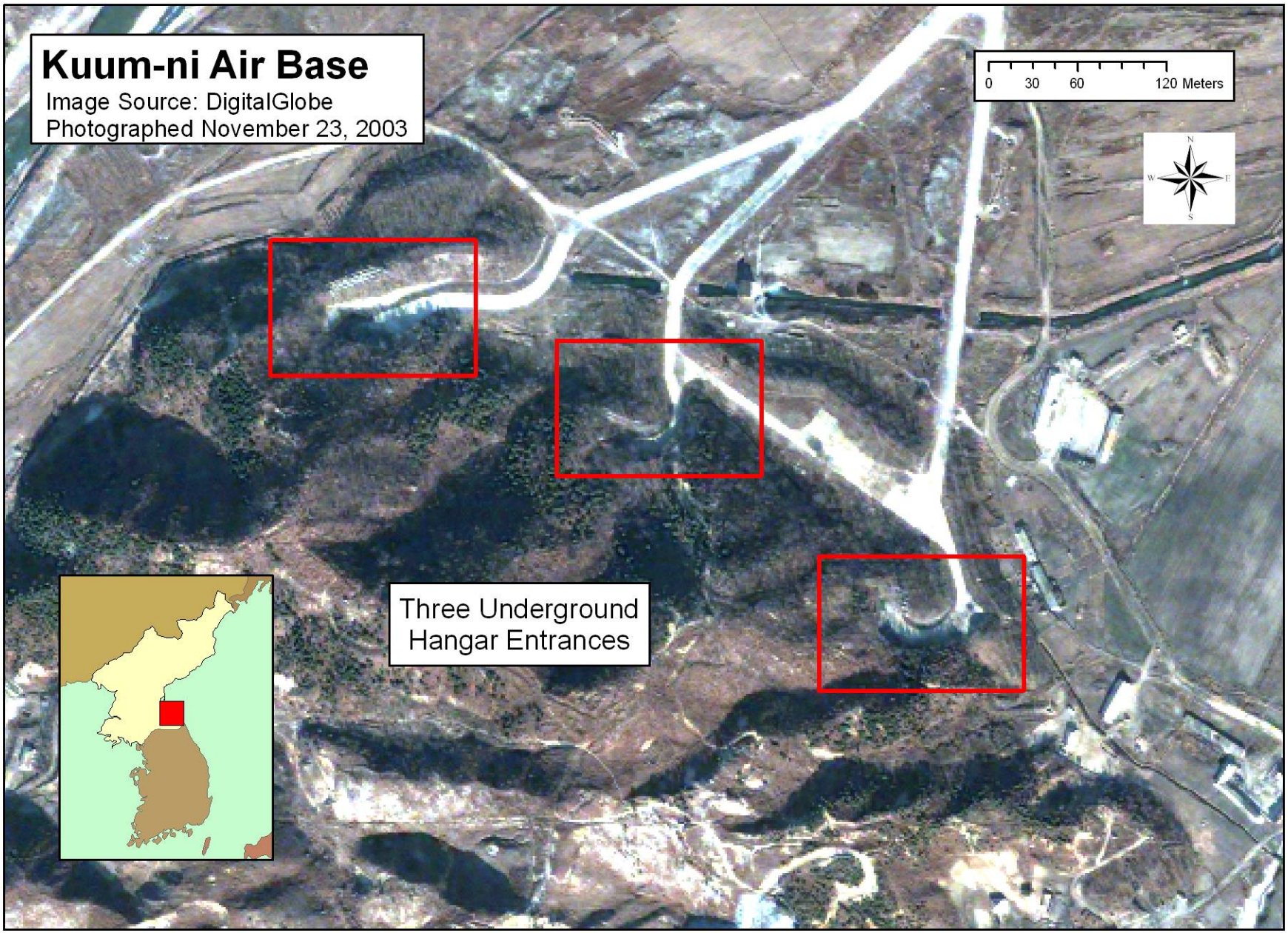

Panghyon Airbase
Image Source: DigitalGlobe
Photographed November 22, 2003
Bombing Range
N
W
E
S
0
25
50
100 Meters

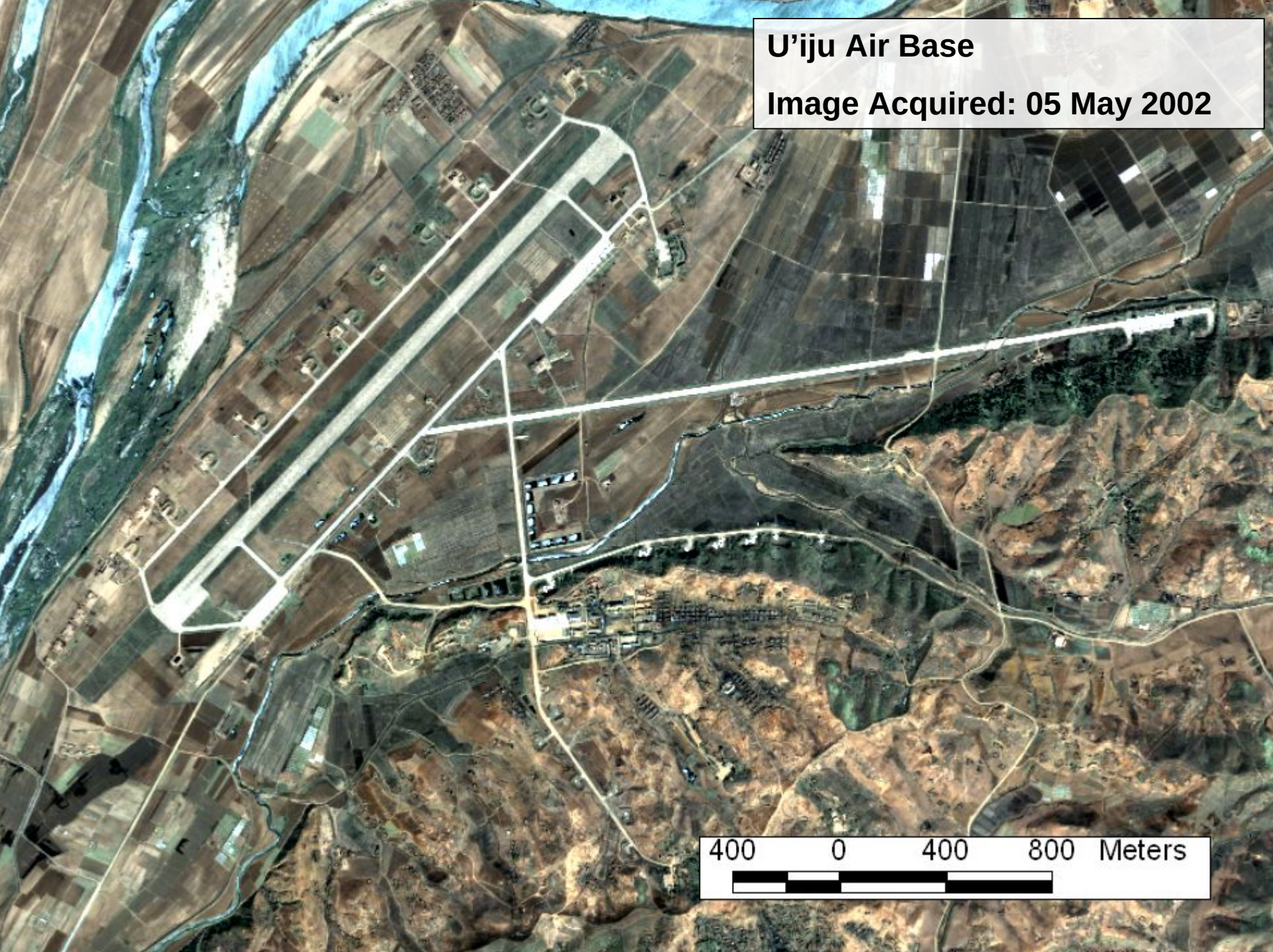

Onch'on Air Base
Image Source: DigitalGlobe
Photographed February 23, 2004
0 260 520 1,040 Meters
N
W
E
S
Numerous MiG Aircraft, Hangars
Underground Runway and Hangar Entrances
Auxiliary Airfield Strip

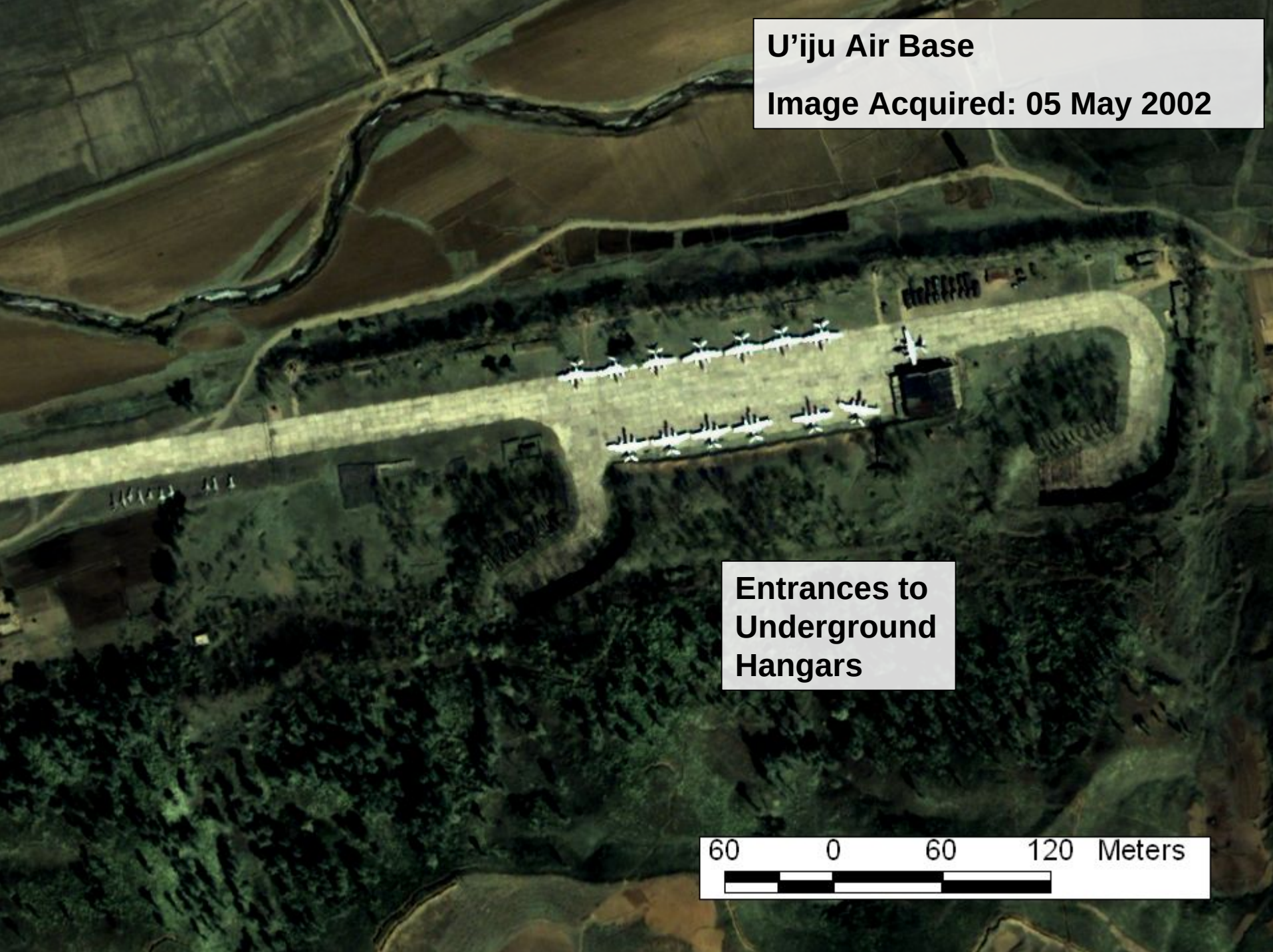

Onch’on Air Base


Onch’on Air Base

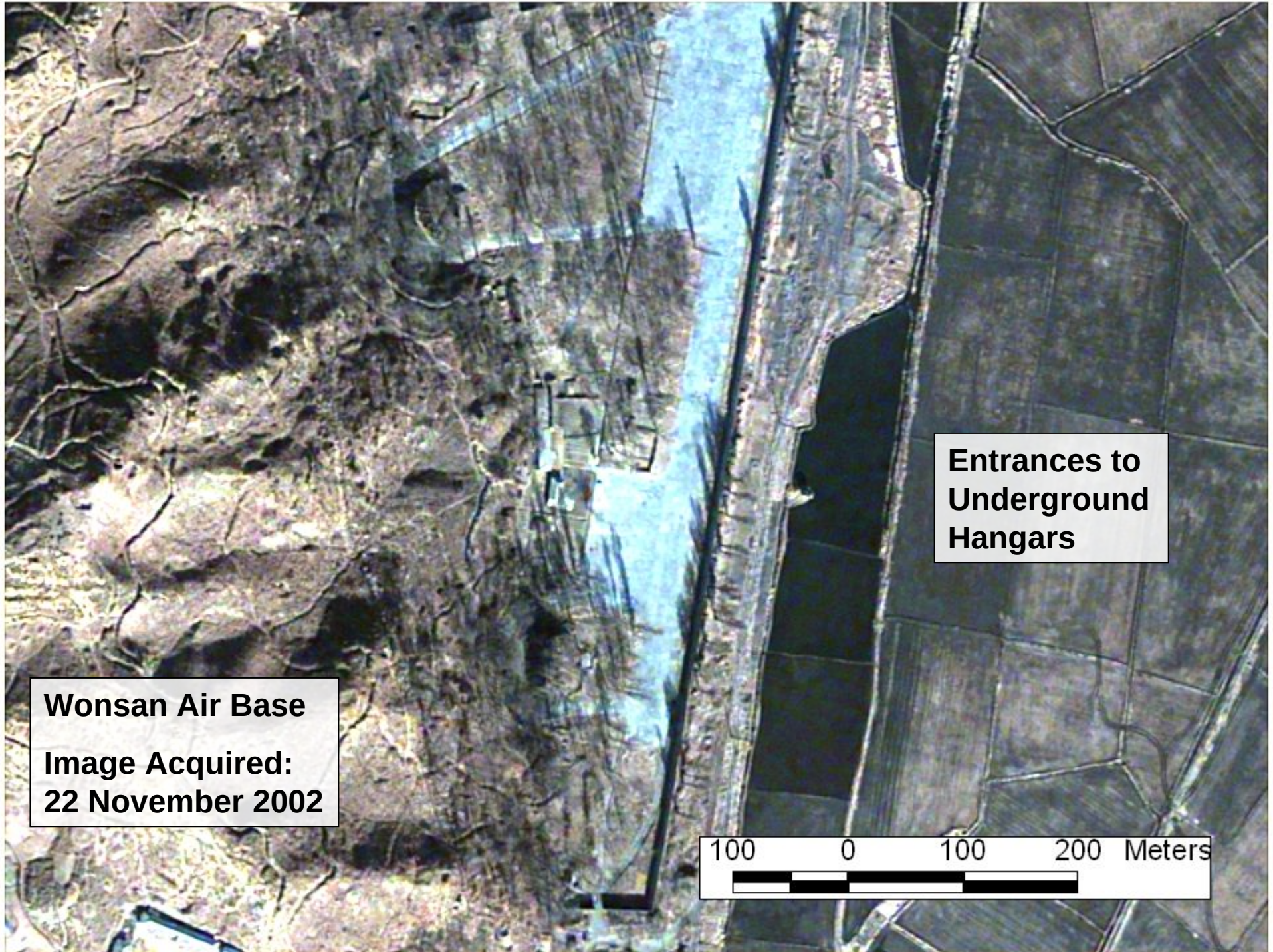

Kuum-ni Air Base
Image Source: DigitalGlobe
Photographed November 23, 2003
0 150 300 600 Meters
N
W
E
S
Earthen-Covered Hangars (4)
Earthen-Covered Hangars (4)
Three Underground Hangar Entrances

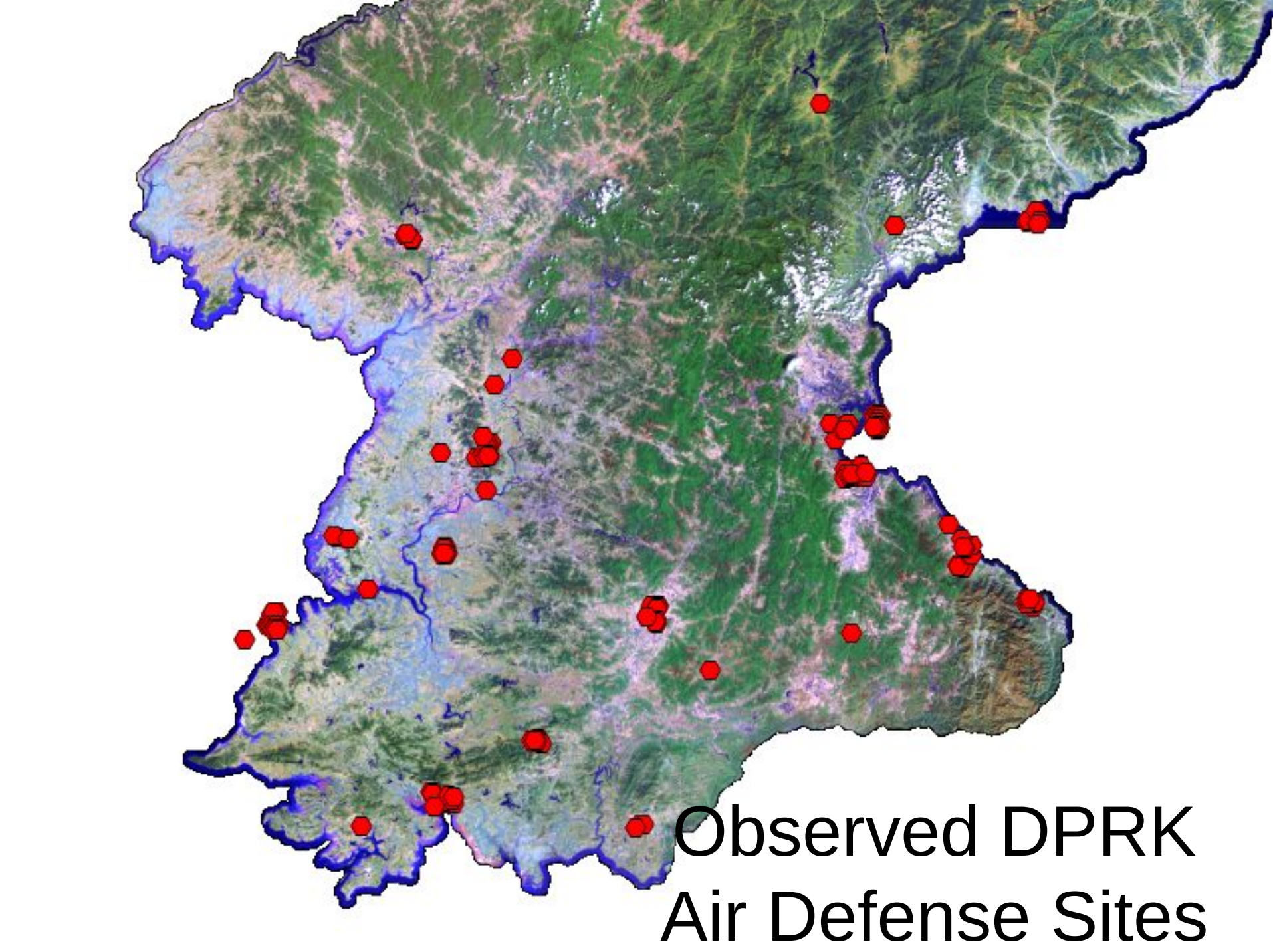

Kuum-ni Air Base
Image Source: DigitalGlobe
Photographed November 23, 2003
0 30 60 120 Meters
N
W
E
S
Three Underground Hangar Entrances


U’iju Air Base
Image Acquired: 05 May 2002
400 0 400 800 Meters

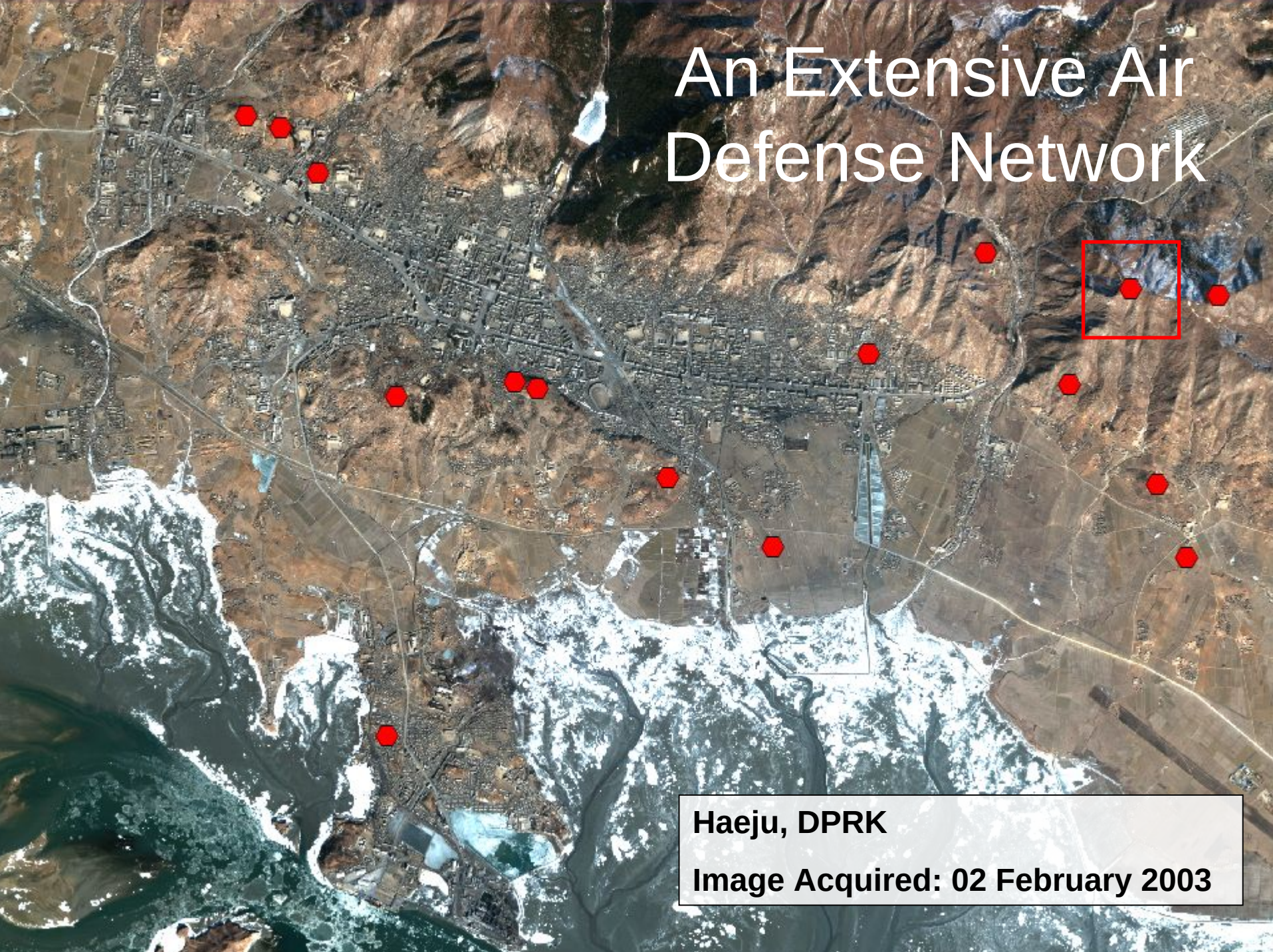

U’iju Air Base
Image Acquired: 05 May 2002
Entrances to Underground Hangars
60 0 60 120 Meters


Wonsan Air Base
Image Acquired: 22 November 2002
400 0 400 800 Meters


Entrances to Underground Hangars
Wonsan Air Base
Image Acquired: 22 November 2002
100 0 100 200 Meters


Observed DPRK
Air Defense Sites

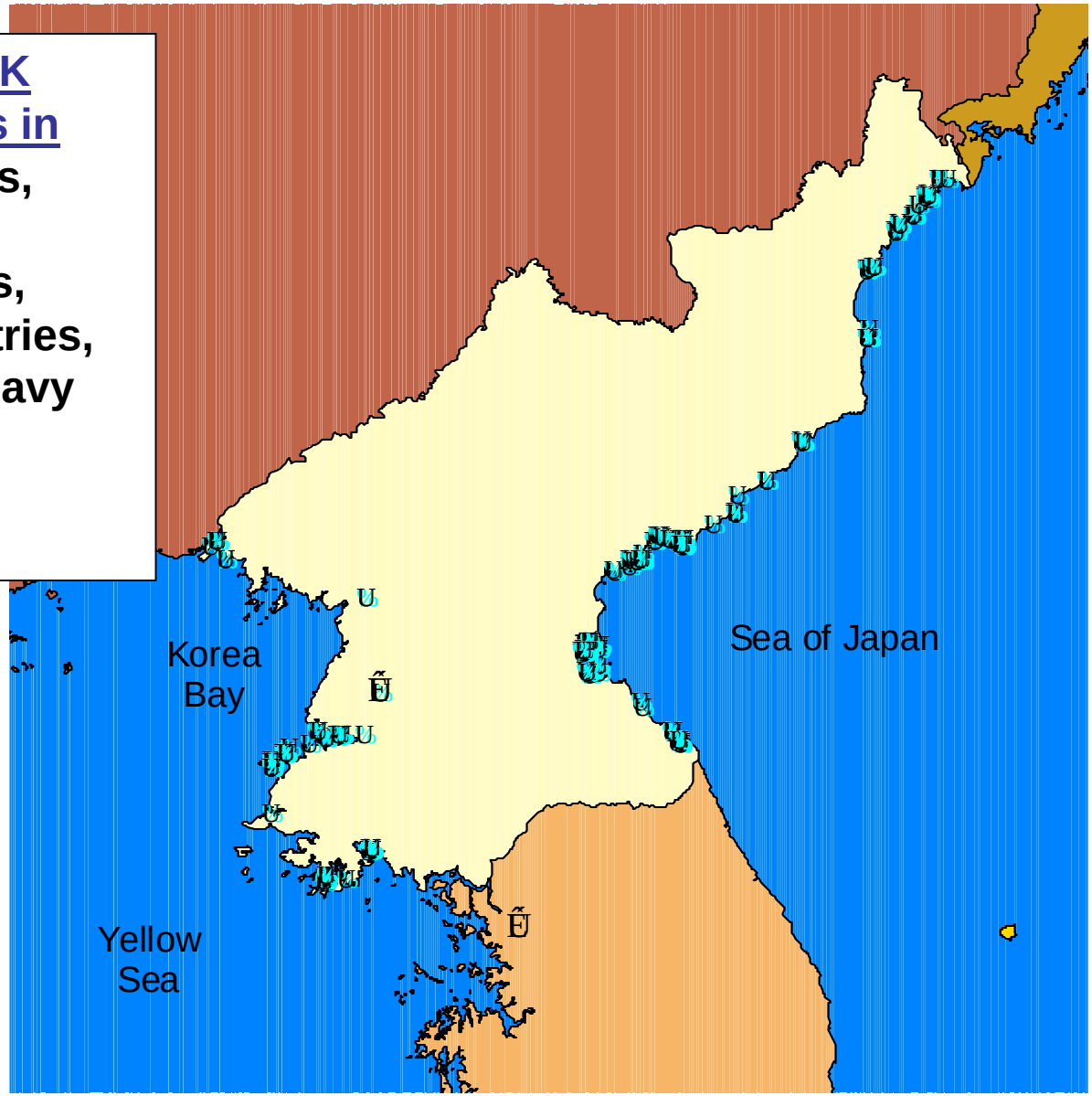

An Extensive Air Defense Network
Wonsan, DPRK
Image Acquired: 22 November 2002


An Extensive Air Defense Network
Haeju, DPRK
Image Acquired: 02 February 2003


Haeju Air Defense Site, DPRK
Image Acquired: 02 February 2003

DPRK Navy/Maritime

Over 400 Selected DPRK Navy/Maritime Features in NRDC's Database: Piers, Wharfs, Dry-docks, Shipyards, Lighthouses, Marine Products Industries, Cranes, Boat Ramps, Navy Bases, Navy Barracks, Surface Ships and Submarines

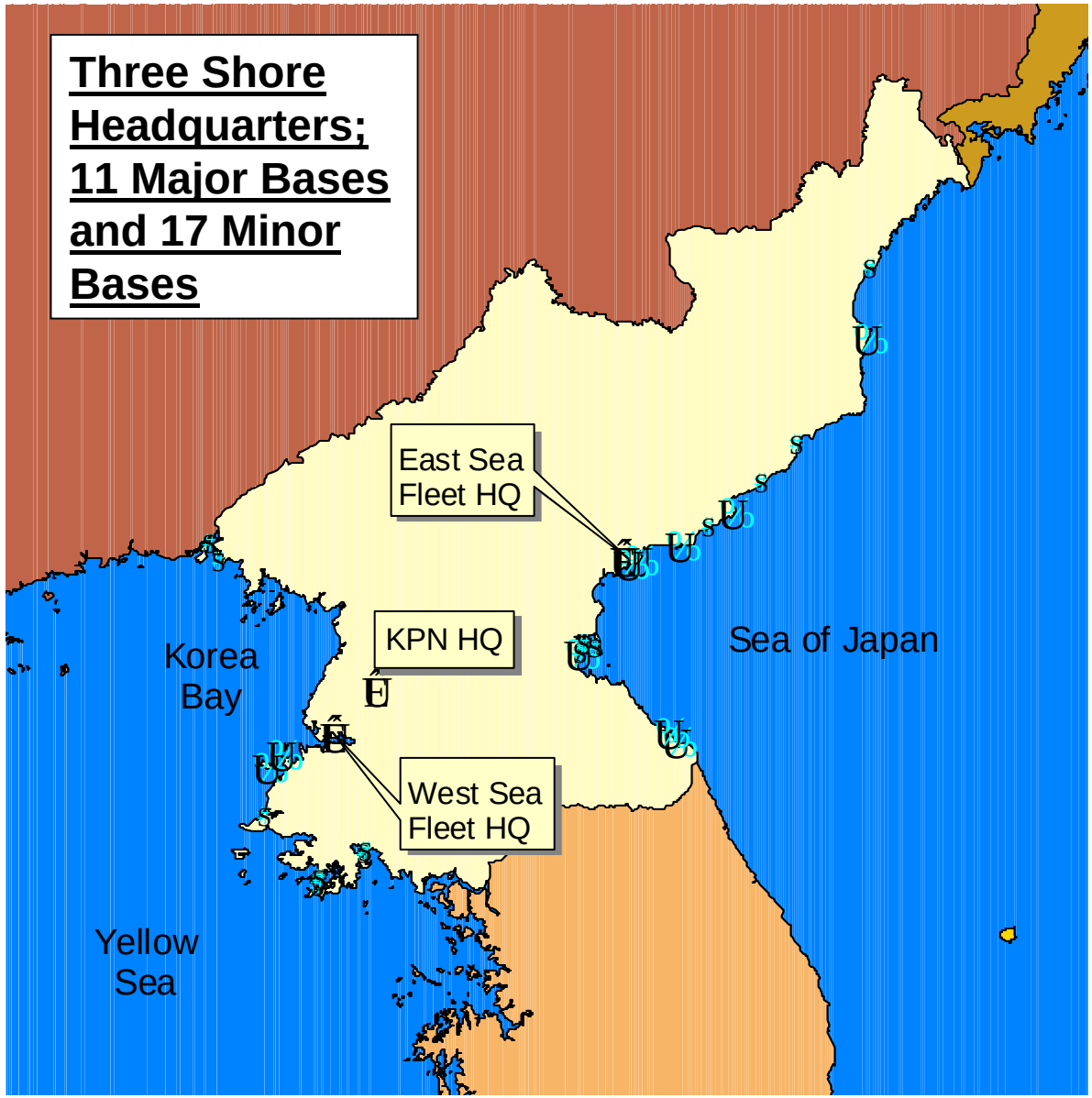


Korea People's Navy (KPN): Bases

KPN Primarily a Coastal Defense Force—limited capability to guard DPRK territorial waters

<u>West Sea Fleet:</u> about 400 vessels in 6 squadrons
<u>East Sea Fleet:</u> about 500 vessels in ten squadrons

KPN training exercises are irregular and of short duration because of lack of fuel



KPN Coastal Diesel Submarines

20 Romeo/Whiskey (Length: 76-77 m)

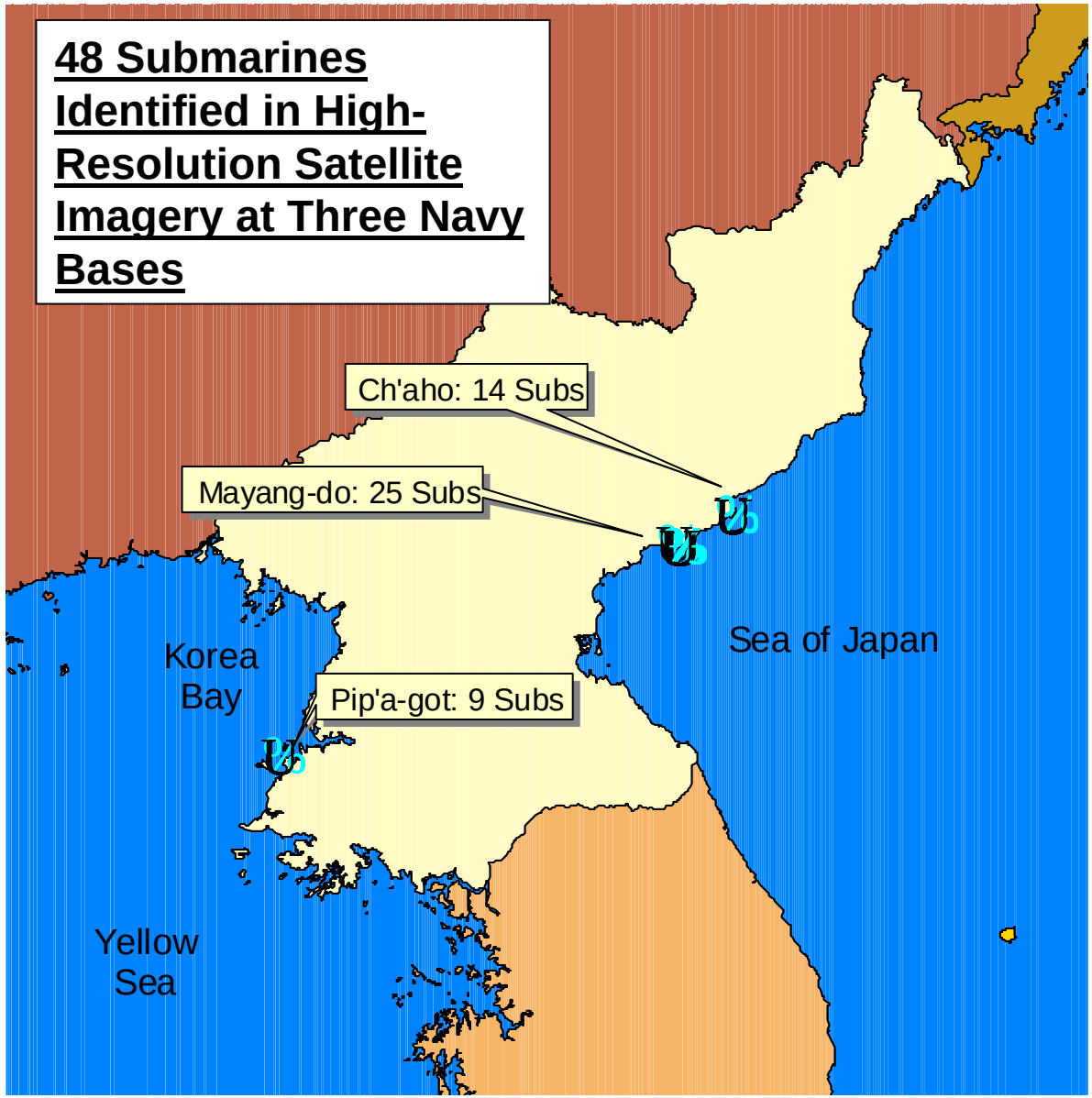
28 Sang-o (Length: 35.5 m)

~ 47 Yugo (Length: 20 m) ***not found***

Romeo produced by DPRK until late 1980's

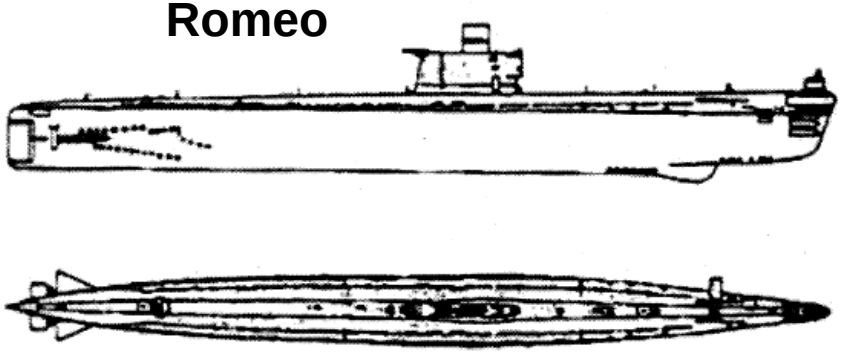
Sang-o produced after 1980's

Two versions of Sang-o: attack and reconnaissance

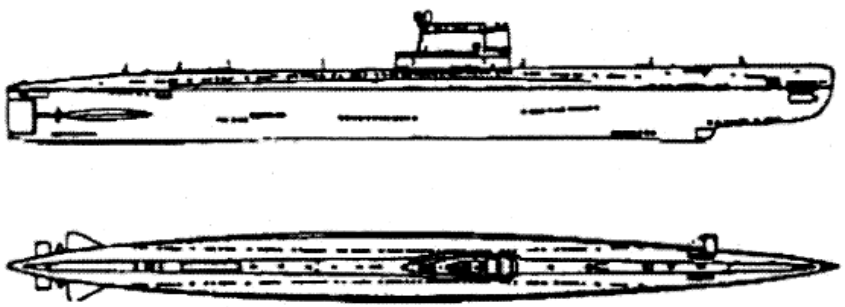


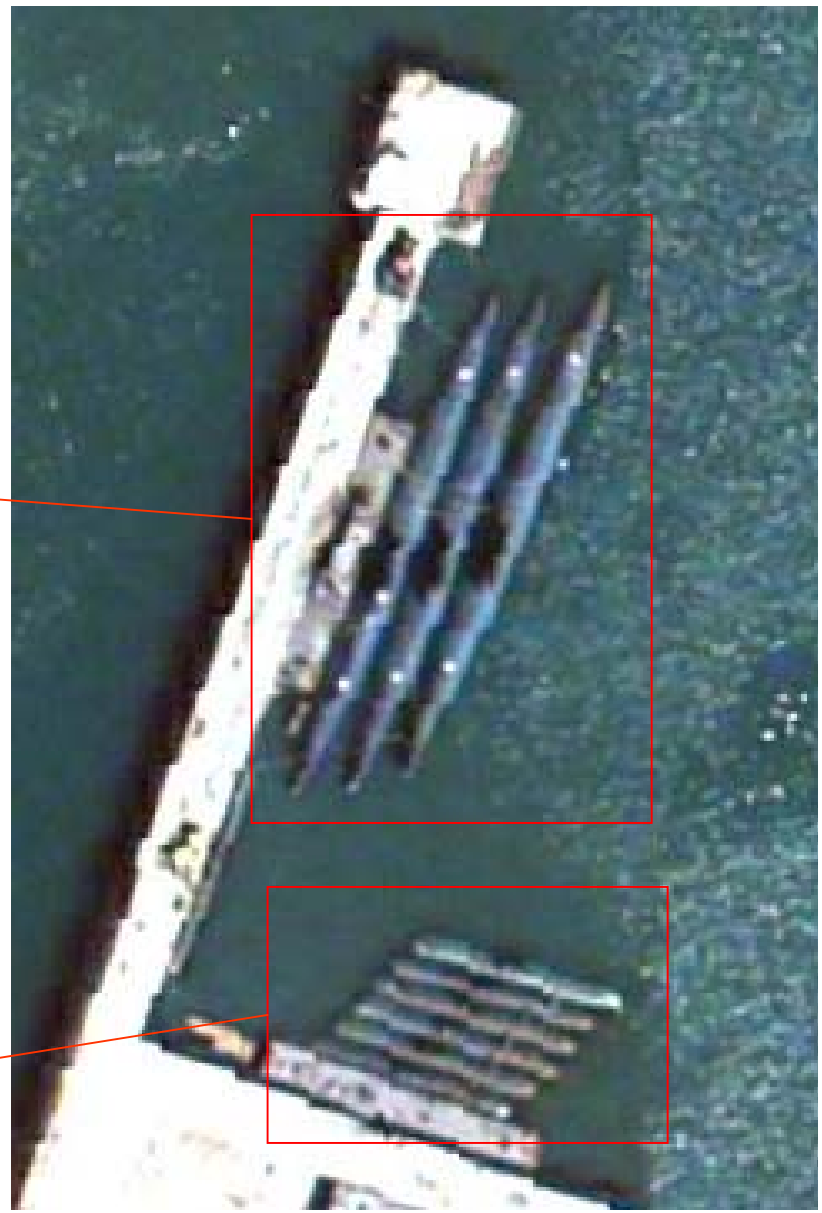
KPN’s Diesel Submarines

Romeo



Whiskey





Sang-o

KPN's Largest Surface Ships

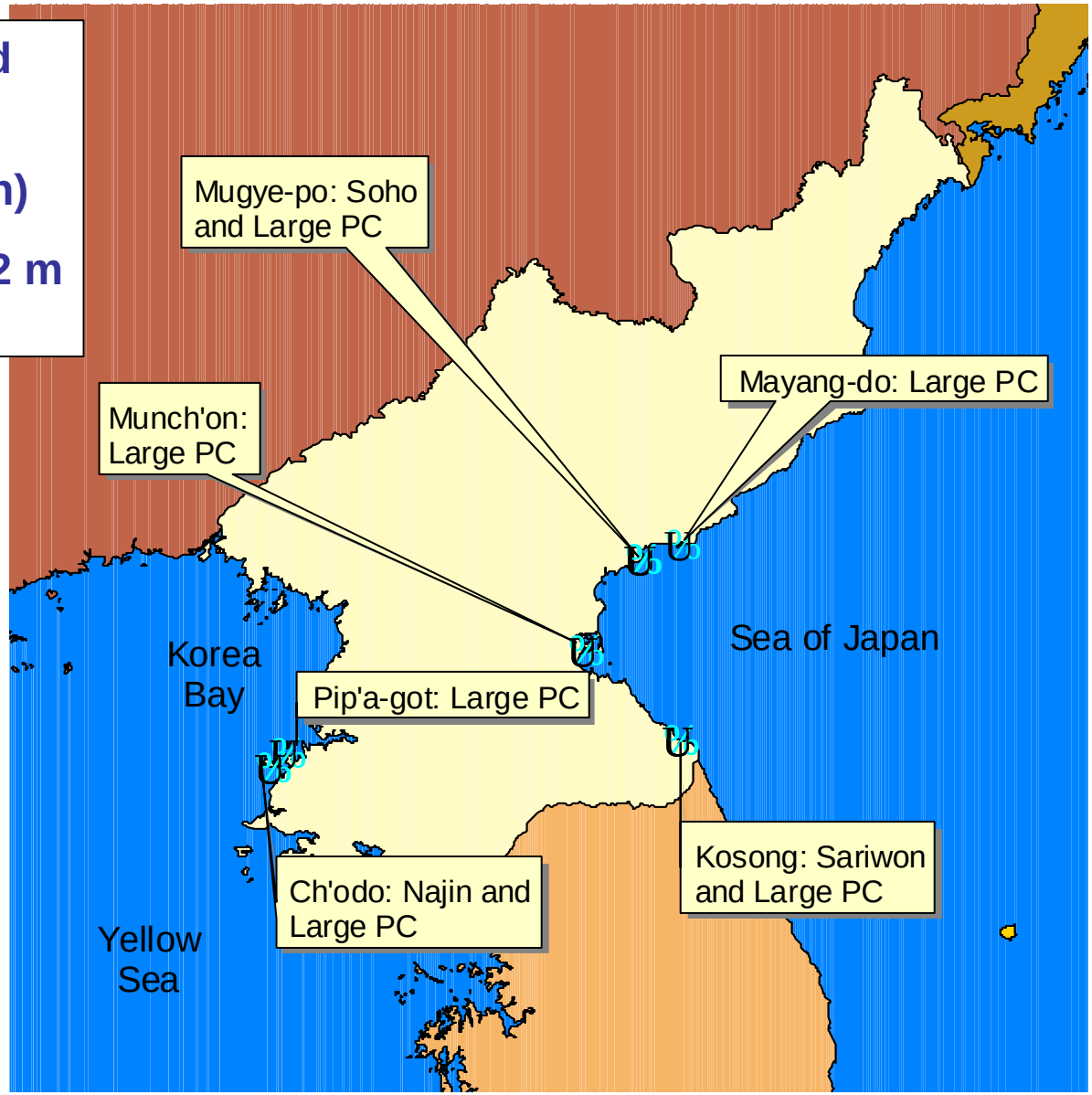
Frigates (74 m Soho and 102 m Najin)

Corvettes (62 m Sariwon)

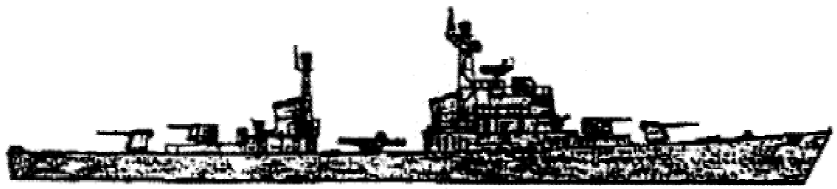
Large Patrol Craft (58-62 m Taechong and Hainan)

The combat ships of the DPRK are a mixture of former-Soviet, Chinese and DPRK construction

A significant fraction of vessels are more than 20 years old and most are small in size



KPN’s Frigate Najin (102 m)



Constructed within the DPRK

Armed with both guns and two SCRUBBRUSH missile launchers (46 km range, 500 kg warhead anti-ship cruise missile)

This Najin guards the DPRK’s south-west coastline

KPN’s Frigate Soho (74 m)

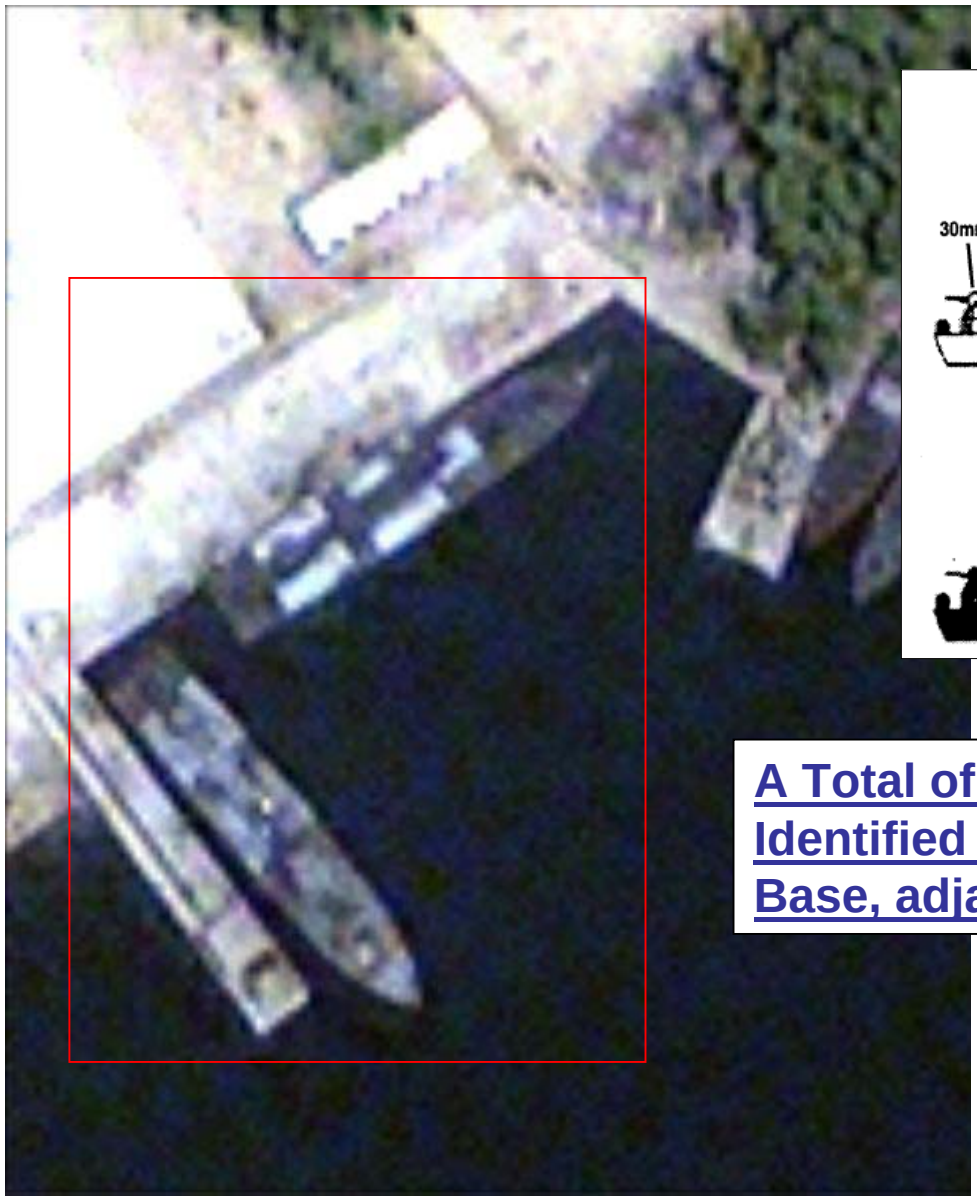
Armed with both guns and four SAFFLOWER missile launchers (85 km range 400 kg warhead anti-ship cruise missile)

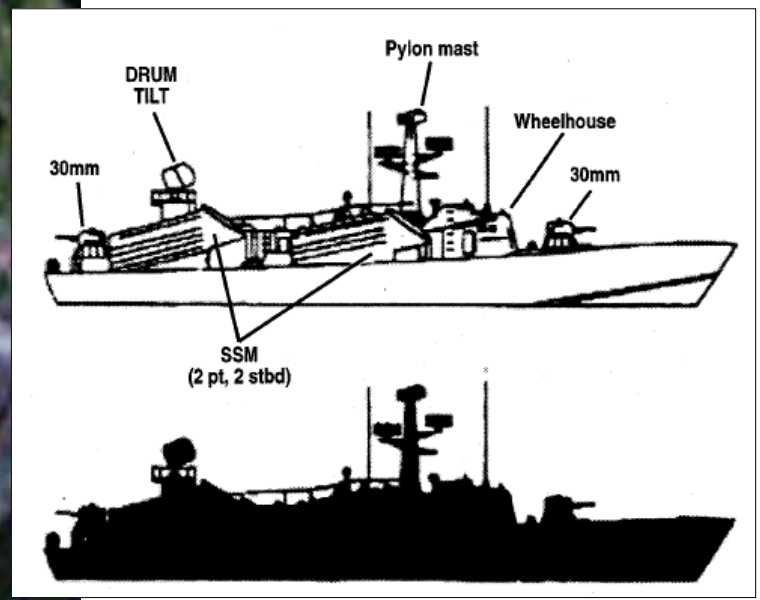
Unique in that it is one of the largest catamaran-hull design ships in the world and the DPRK’s only helicopter-capable vessel

We found it at an East Sea Fleet Base

KPN’s T-Class Patrol Craft (62 m)

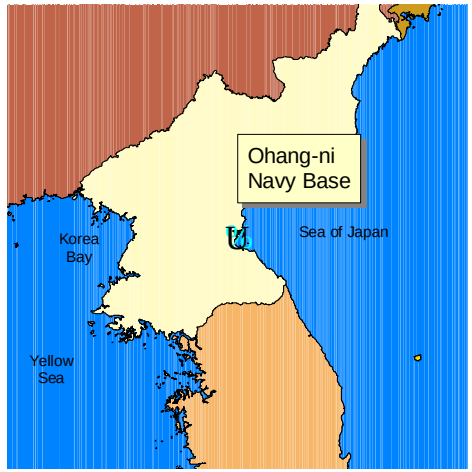
KPN SSM Missile Ships: PTG Soju (42 m)





A Total of Four PTG Soju Identified at Namae-ri Navy Base, adjacent to Cave Entrance

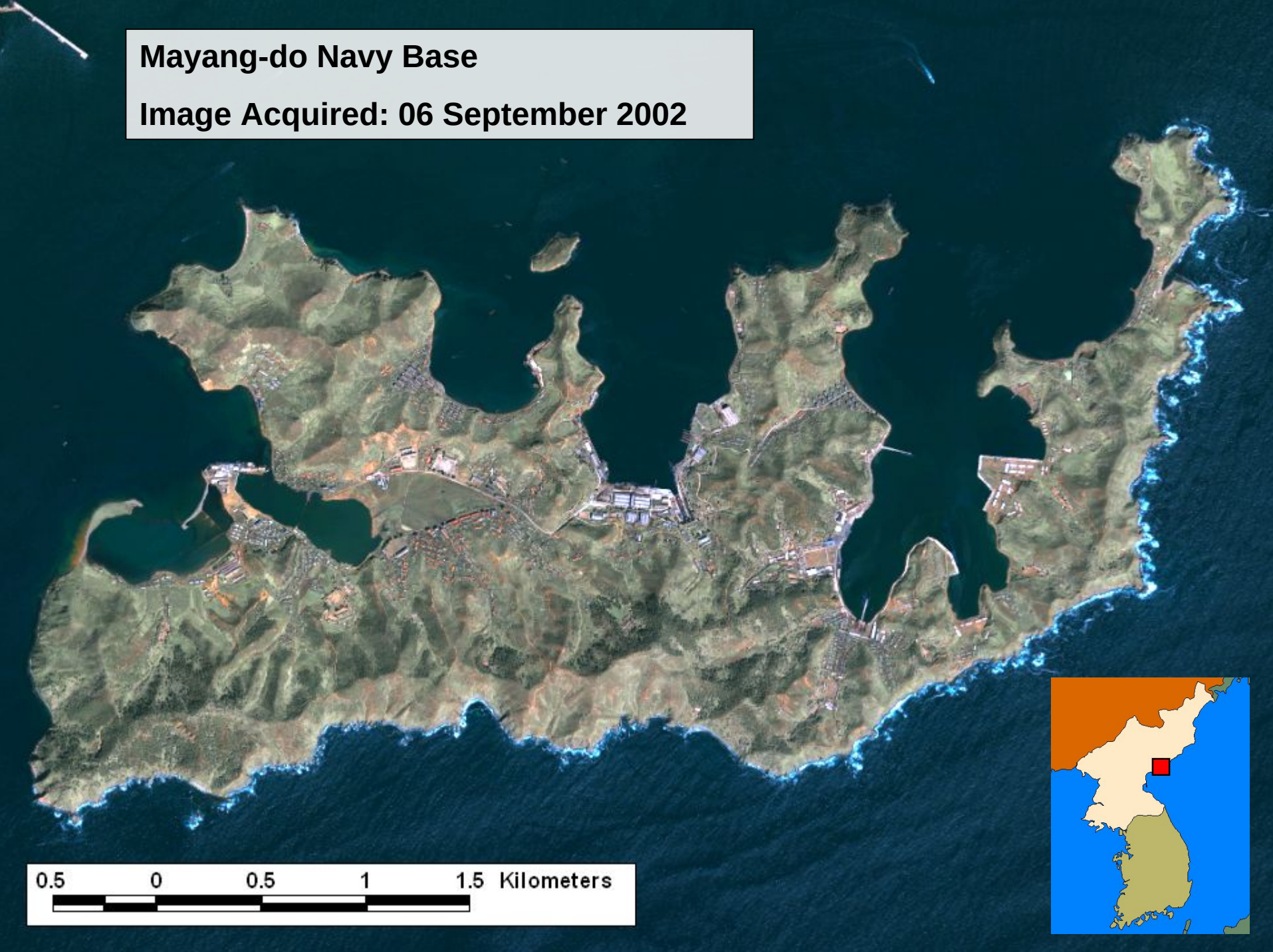
KPN Kongbang Class Hovercraft (~20 m)

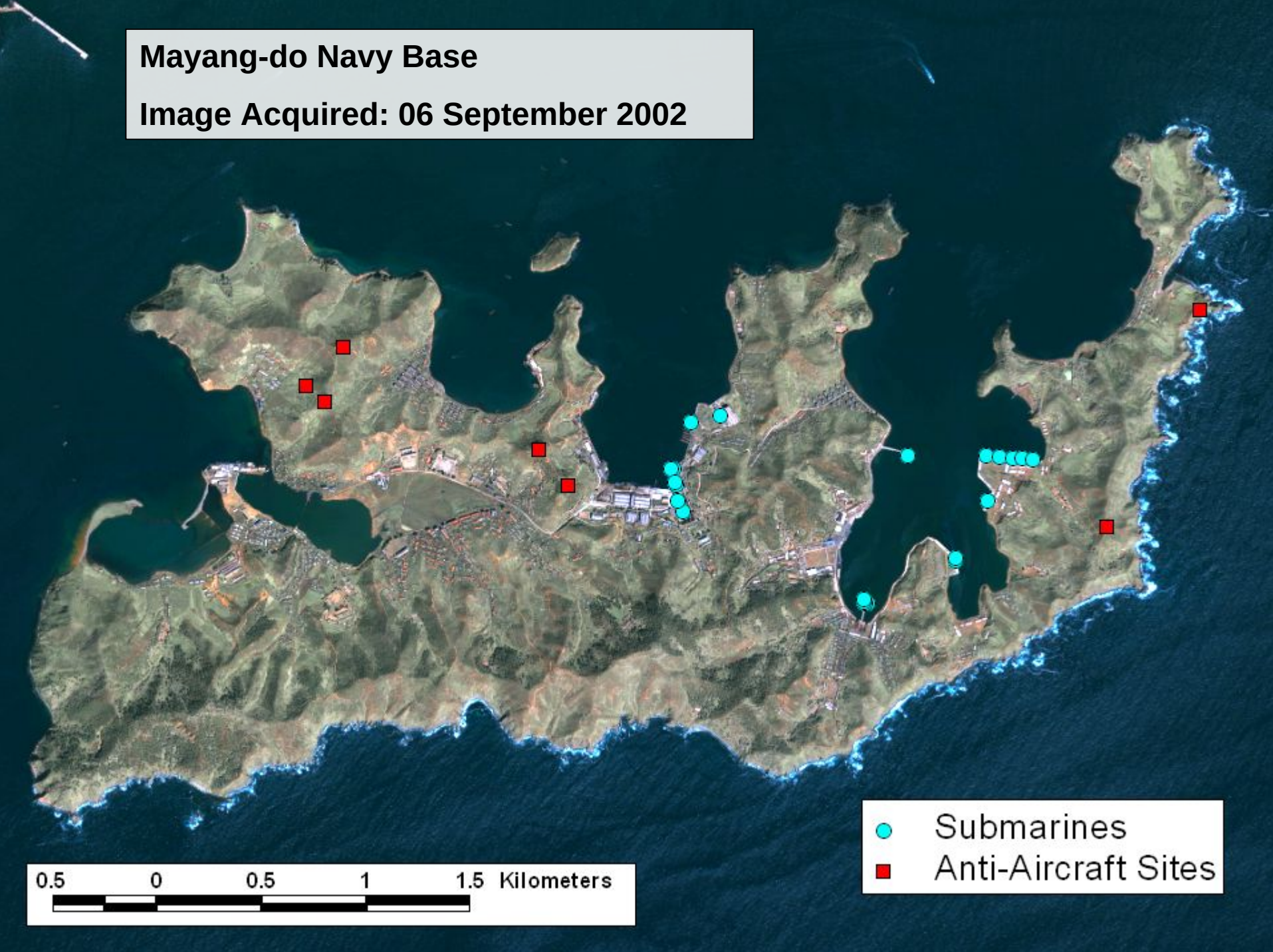


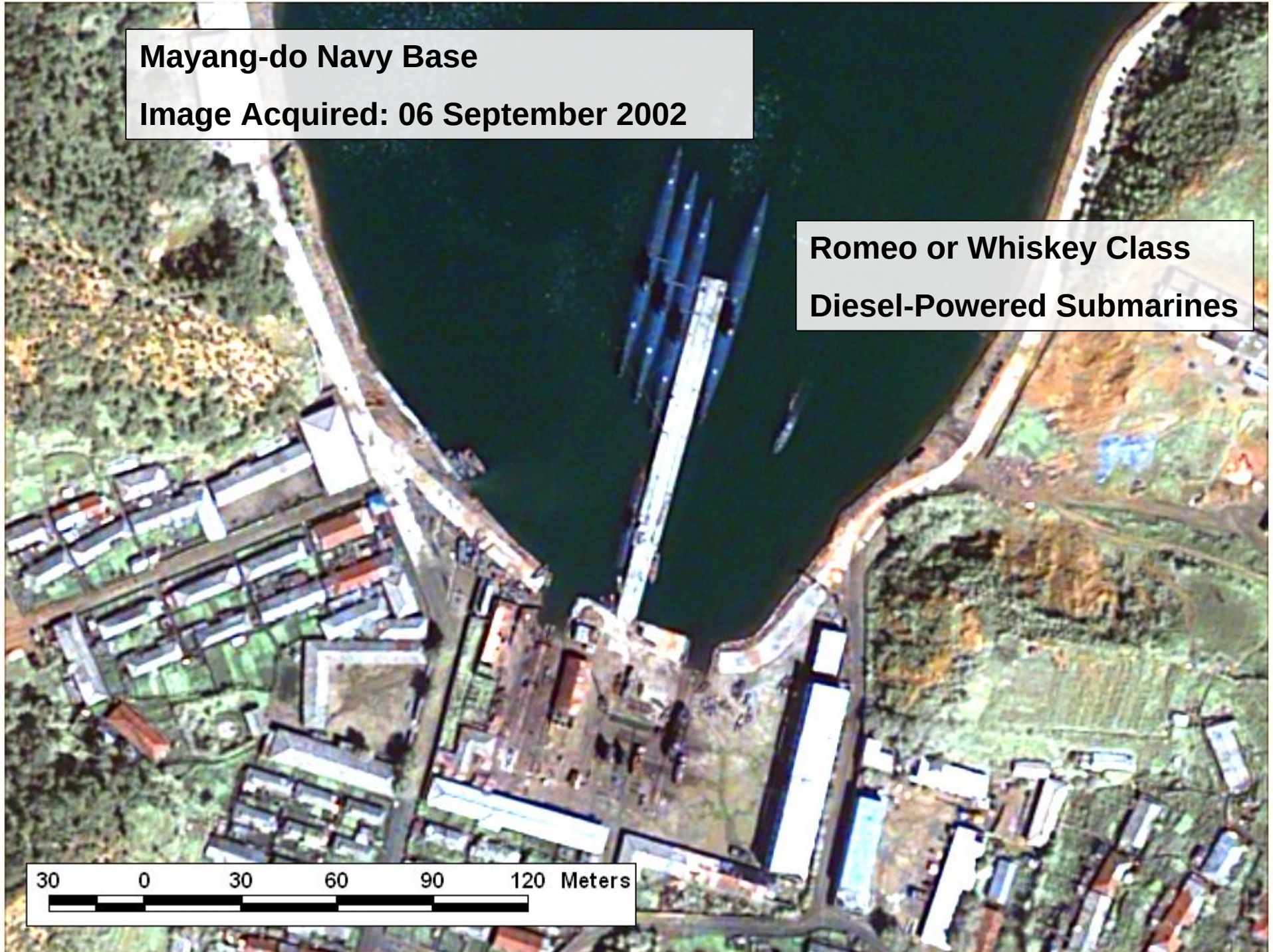
DPRK began constructing Kongbang class hovercraft in the late 1980's

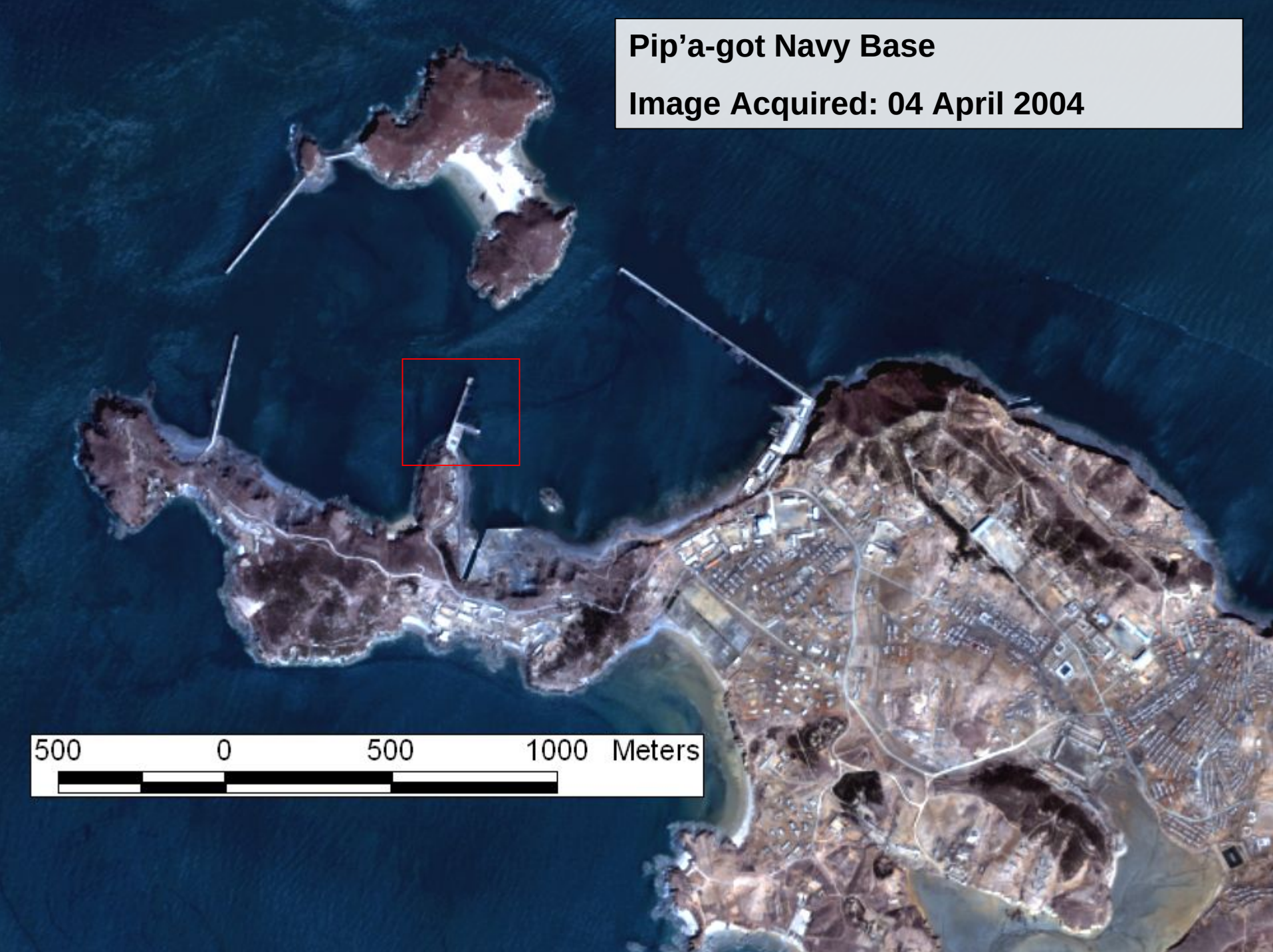
Each can carry 40-50 troops at 50-60 miles per hour

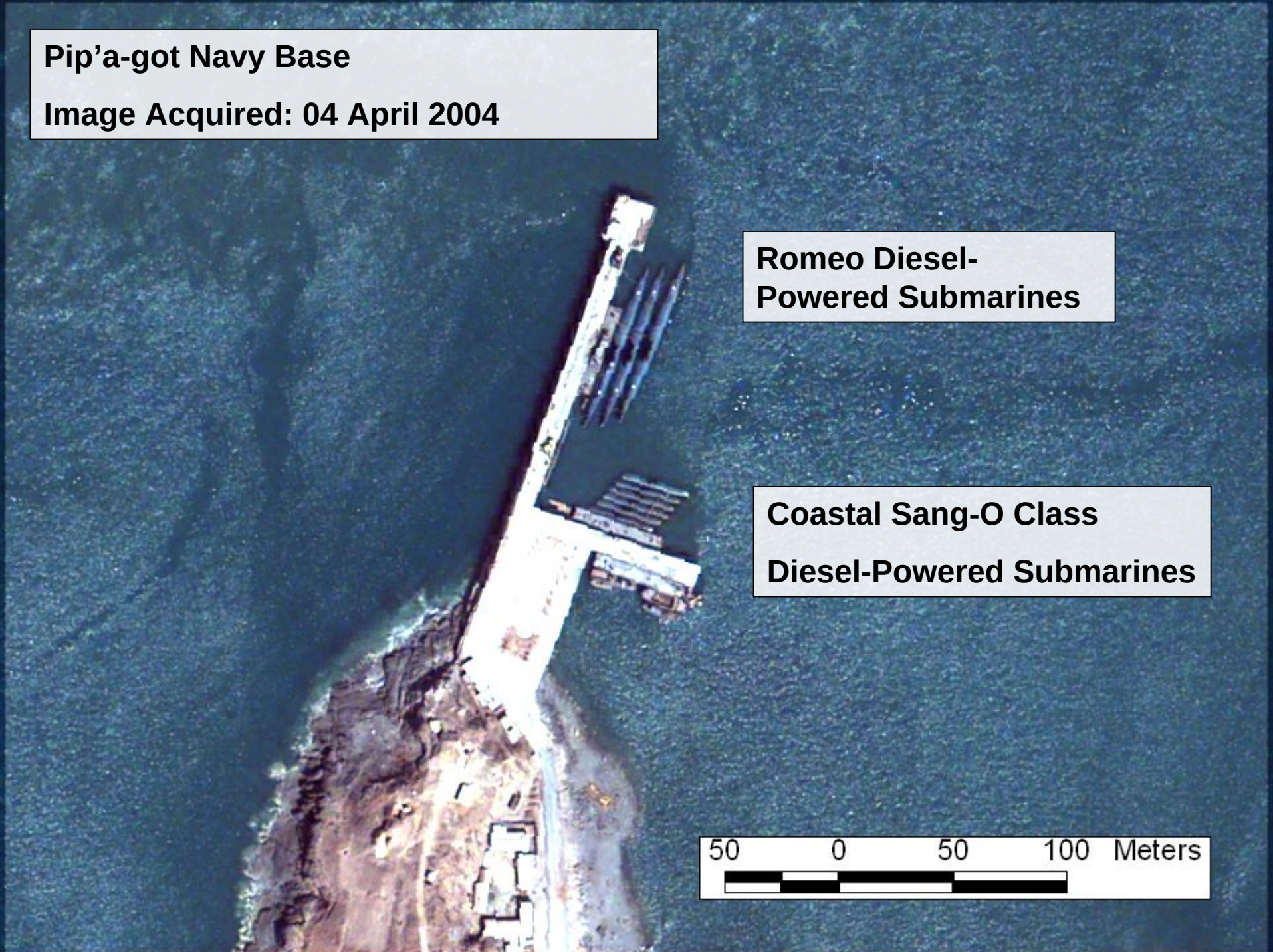
Hovercraft can navigate the tidal flats and mud pools of the DPRK's Yellow Sea coast


Mayang-do Navy Base
Image Acquired: 06 September 2002
0.5 0 0.5 1 1.5 Kilometers


Mayang-do Navy Base
Image Acquired: 06 September 2002
0.5 0 0.5 1 1.5 Kilometers
Submarines
Anti-Aircraft Sites


Mayang-do Navy Base
Image Acquired: 06 September 2002
Romeo or Whiskey Class
Diesel-Powered Submarines
30 0 30 60 90 120 Meters


Pip’a-got Navy Base
Image Acquired: 04 April 2004
500 0 500 1000 Meters


Pip'a-got Navy Base
Image Acquired: 04 April 2004
Romeo Diesel-Powered Submarines
Coastal Sang-O Class
Diesel-Powered Submarines
50 0 50 100 Meters

Puam-dong Navy Base

1. Shore Facilities
2. Entrance (2) to Underground Naval Facility
3. Entrance (1) to Underground Naval Facility
4. Boat Ramp
5. Boat Ramp

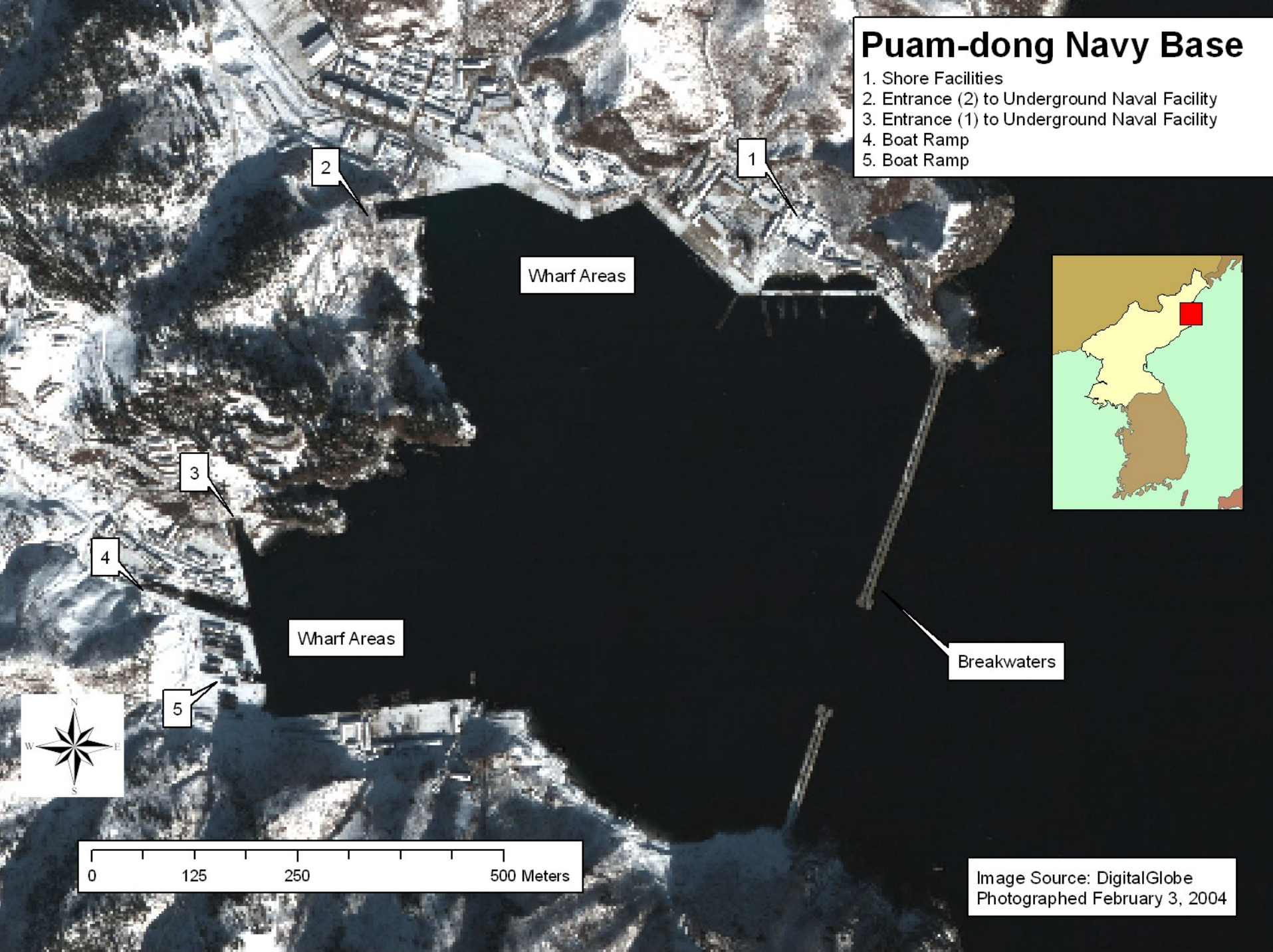
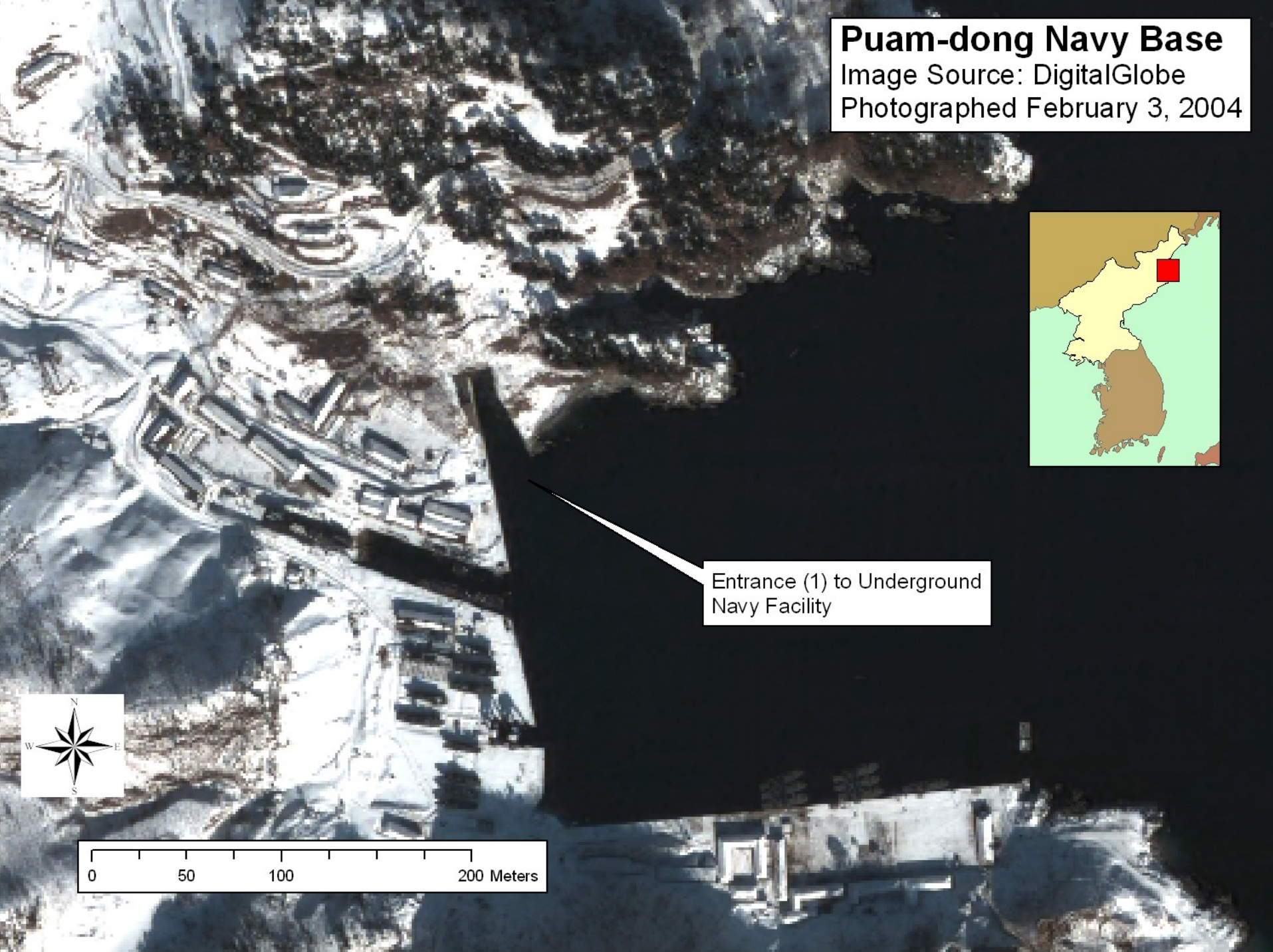


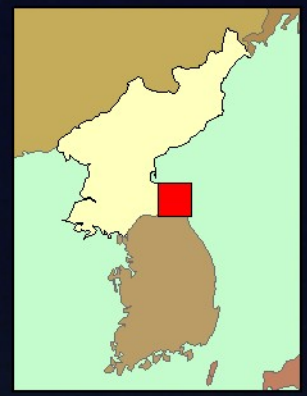
Image Source: DigitalGlobe
Photographed February 3, 2004


Puam-dong Navy Base
Image Source: DigitalGlobe
Photographed February 3, 2004
Entrance (1) to Underground Navy Facility
N
W
E
S
0
50
100
200 Meters


Puam-dong Navy Base
Image Source: DigitalGlobe
Photographed February 3, 2004
Entrance (2) to Underground Navy Facility
N
W
E
S
0
50
100
200 Meters

Kosong Navy Facility

Image Source: DigitalGlobe
Photographed April 26, 2003



In Yellow:
Anti-Aircraft
Emplacements

Shipyard

Port
Facilities

Navy
Base

Entrances to
Caves

Boat Repair
Yard

Piers

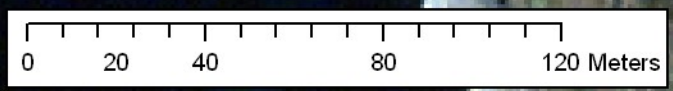
N
W
E
S

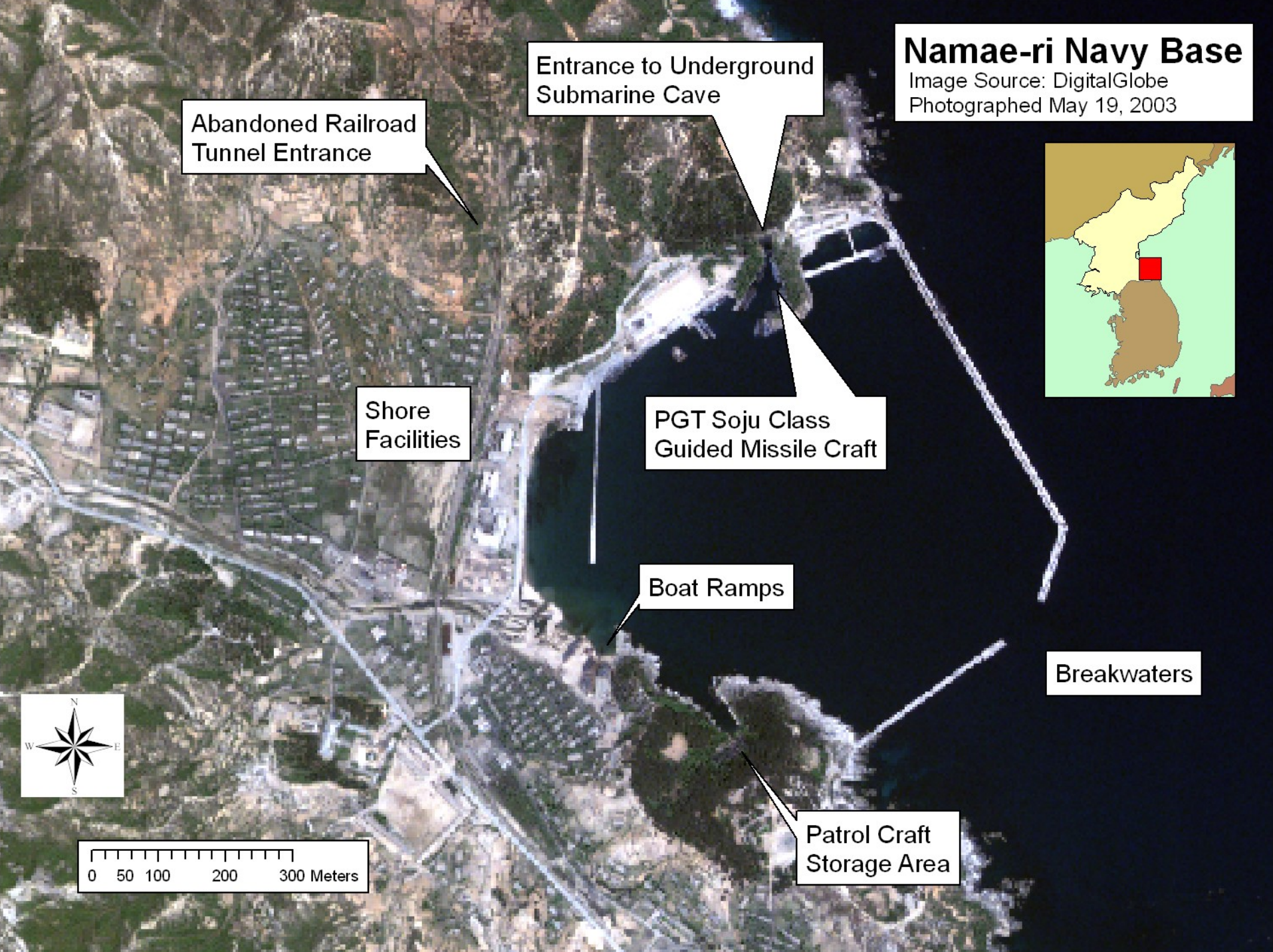
0 0.25 0.5 1 1.5 Kilometers

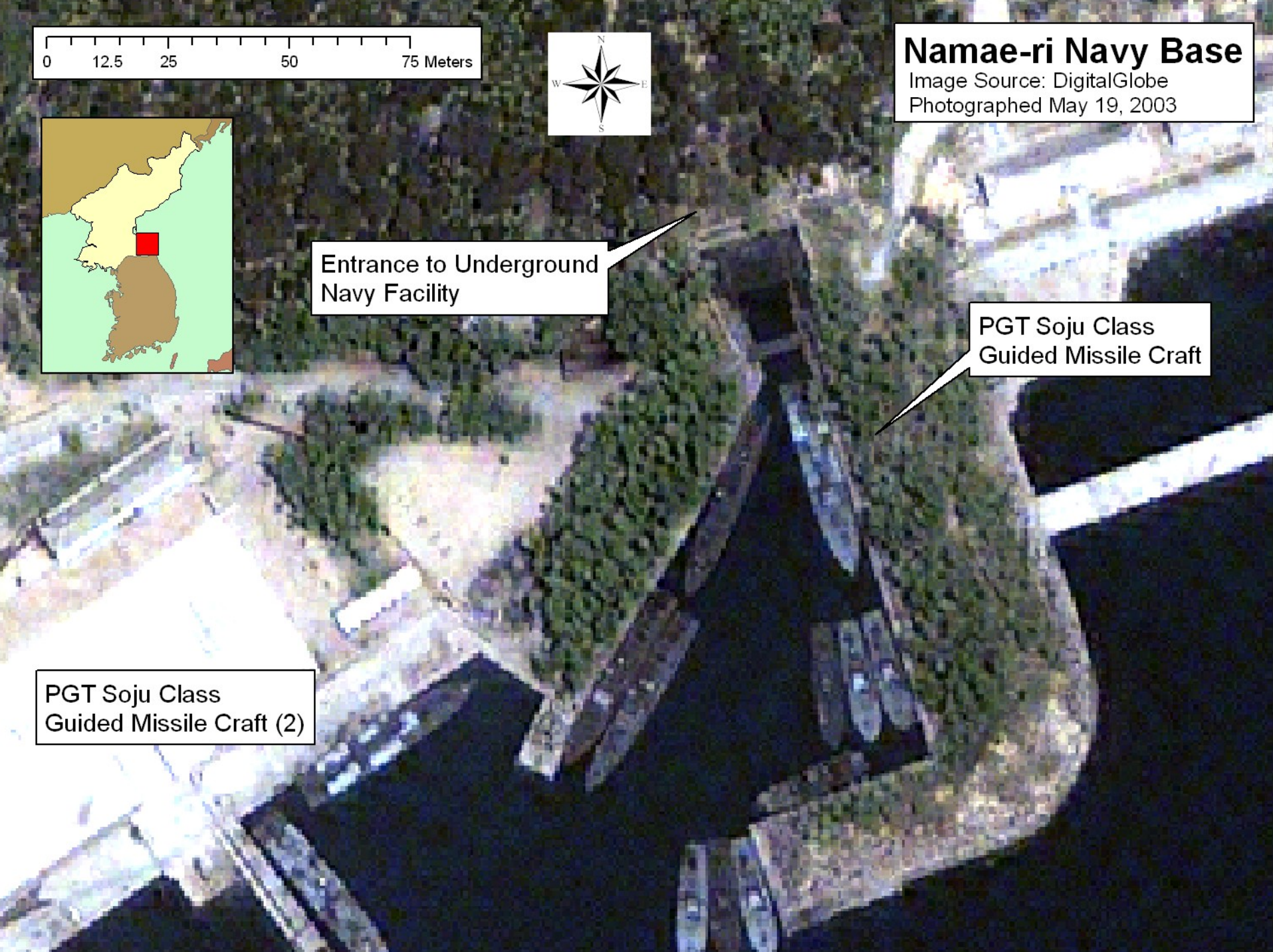
Kosong Navy Facility

Image Source: DigitalGlobe
Photographed April 26, 2003

Entrances to Caves

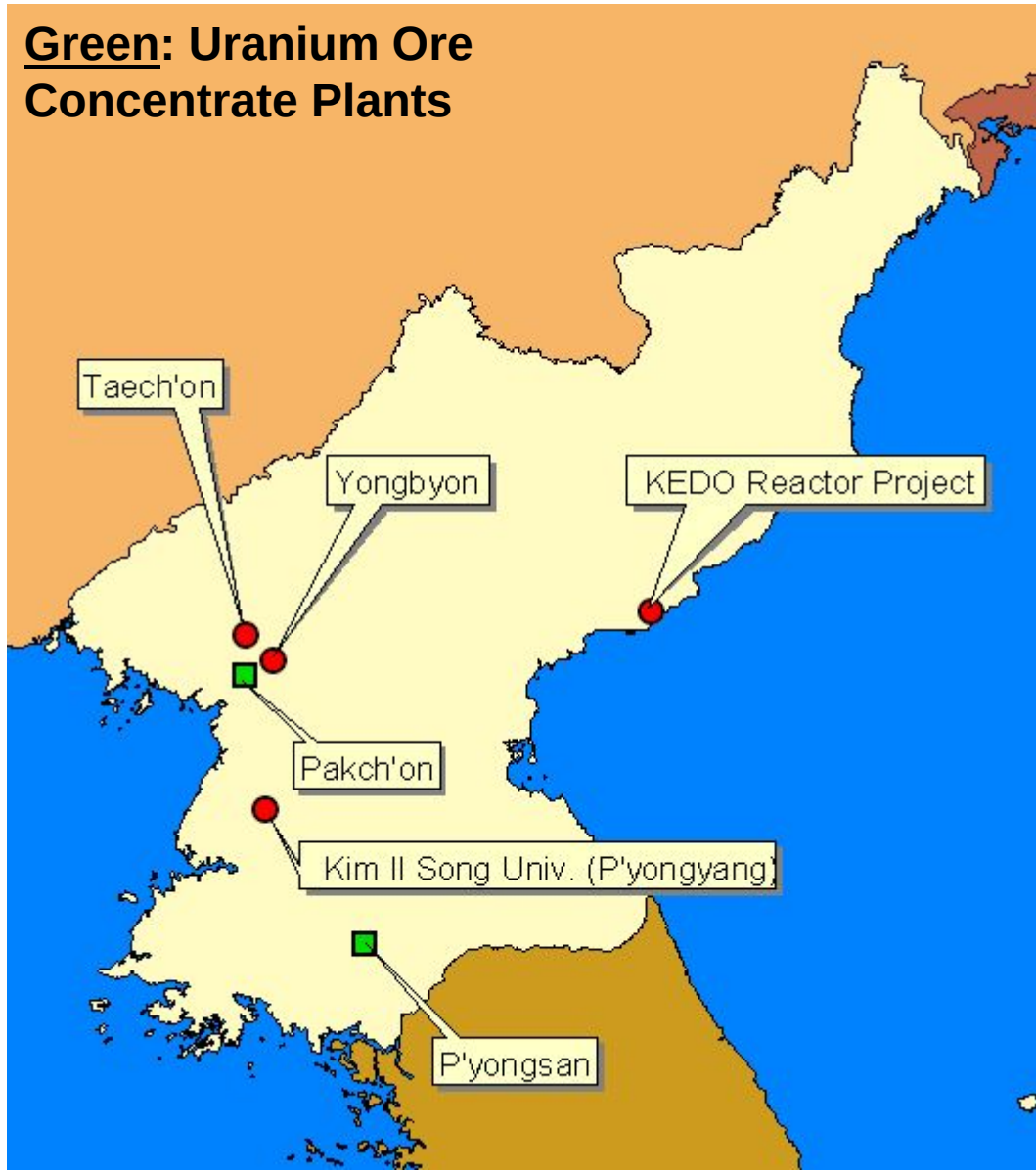


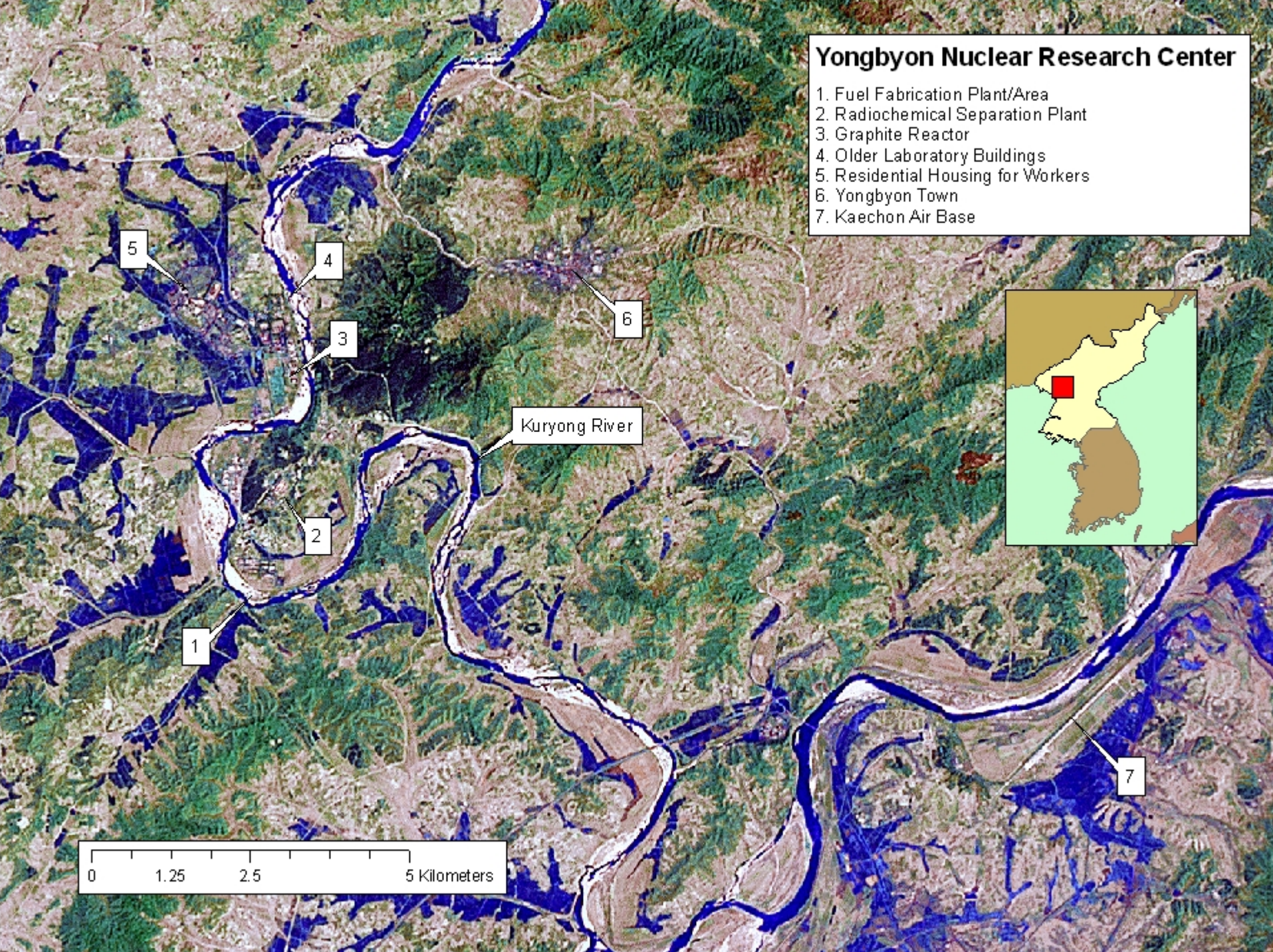

Namae-ri Navy Base
Image Source: DigitalGlobe
Photographed May 19, 2003
Entrance to Underground Submarine Cave
Abandoned Railroad Tunnel Entrance
Shore Facilities
PGT Soju Class Guided Missile Craft
Boat Ramps
Breakwaters
Patrol Craft Storage Area
N
W
E
S
0 50 100 200 300 Meters


0 12.5 25 50 75 Meters
N
W
E
S
Namae-ri Navy Base
Image Source: DigitalGlobe
Photographed May 19, 2003
Entrance to Underground Navy Facility
PGT Soju Class Guided Missile Craft
PGT Soju Class Guided Missile Craft (2)

Key DPRK Nuclear Sites

- Yongbyon Nuclear Research Center
- T’aech’on 200 MWe Graphite Nuclear Reactor (Unfinished)
- P’yongsan Uranium Concentrate Plant
- Pakch’on Uranium Concentrate Plant




Yongbyon Nuclear Research Center
1. Fuel Fabrication Plant/Area
2. Radiochemical Separation Plant
3. Graphite Reactor
4. Older Laboratory Buildings
5. Residential Housing for Workers
6. Yongbyon Town
7. Kaechon Air Base
Kuryong River
0
1.25
2.5
5 Kilometers

Yongbyon Graphite Reactor

Image Acquired: 13 August 2002 (IKONOS)

Yongbyon Radiochemical Separation Building

Image Acquired: 13 August 2002 (IKONOS)

16 June 2002

(IKONOS)

8 December 2003

(QuickBird)

T'aech'on Nuclear Reactor
(200 MWe Graphite, Unfinished)

P’yongsan Uranium Concentrate Plant

Image Acquired: 10 March 2003

Nam-ch’on River

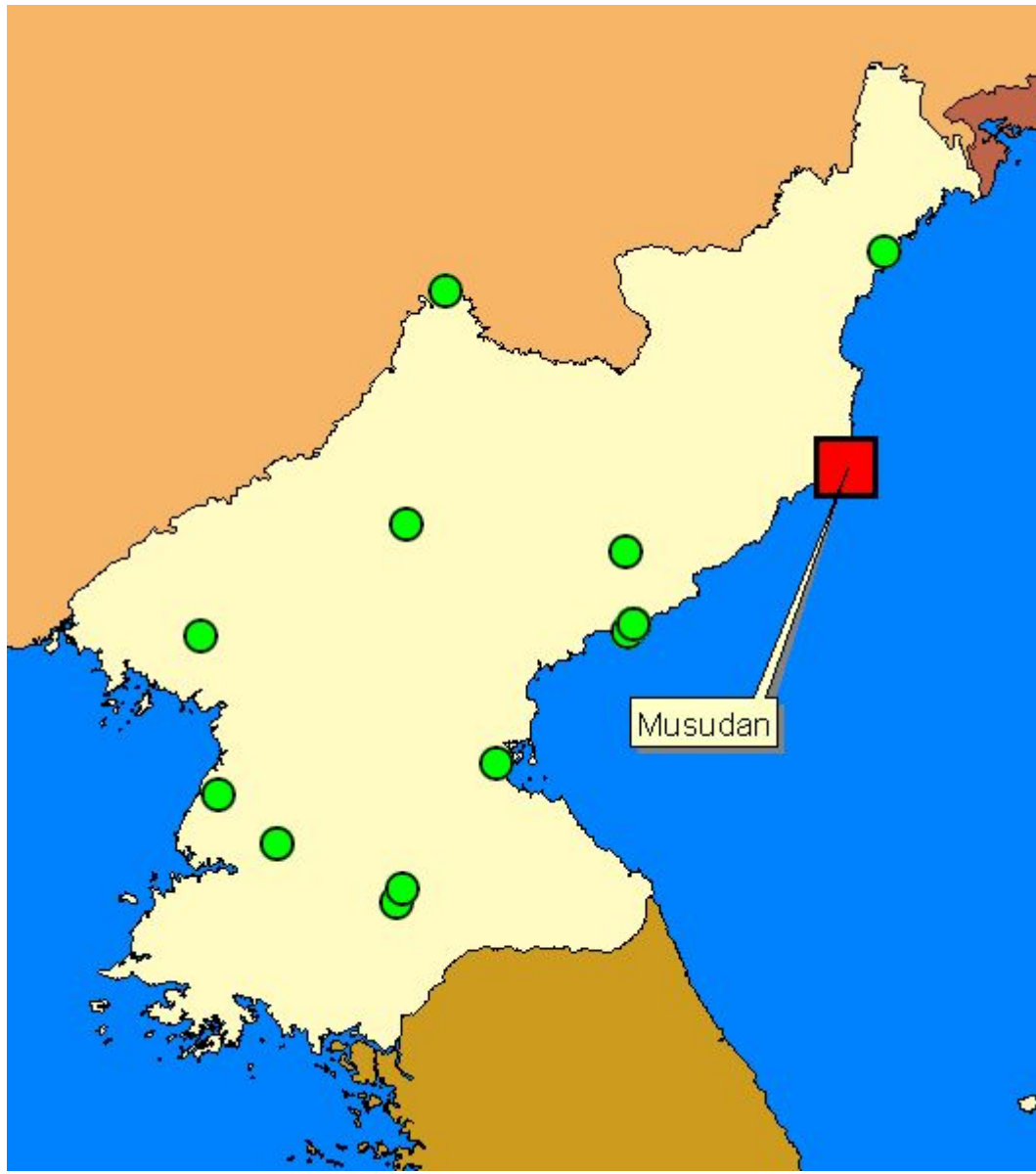
Pakch'on Uranium Concentrate Plant

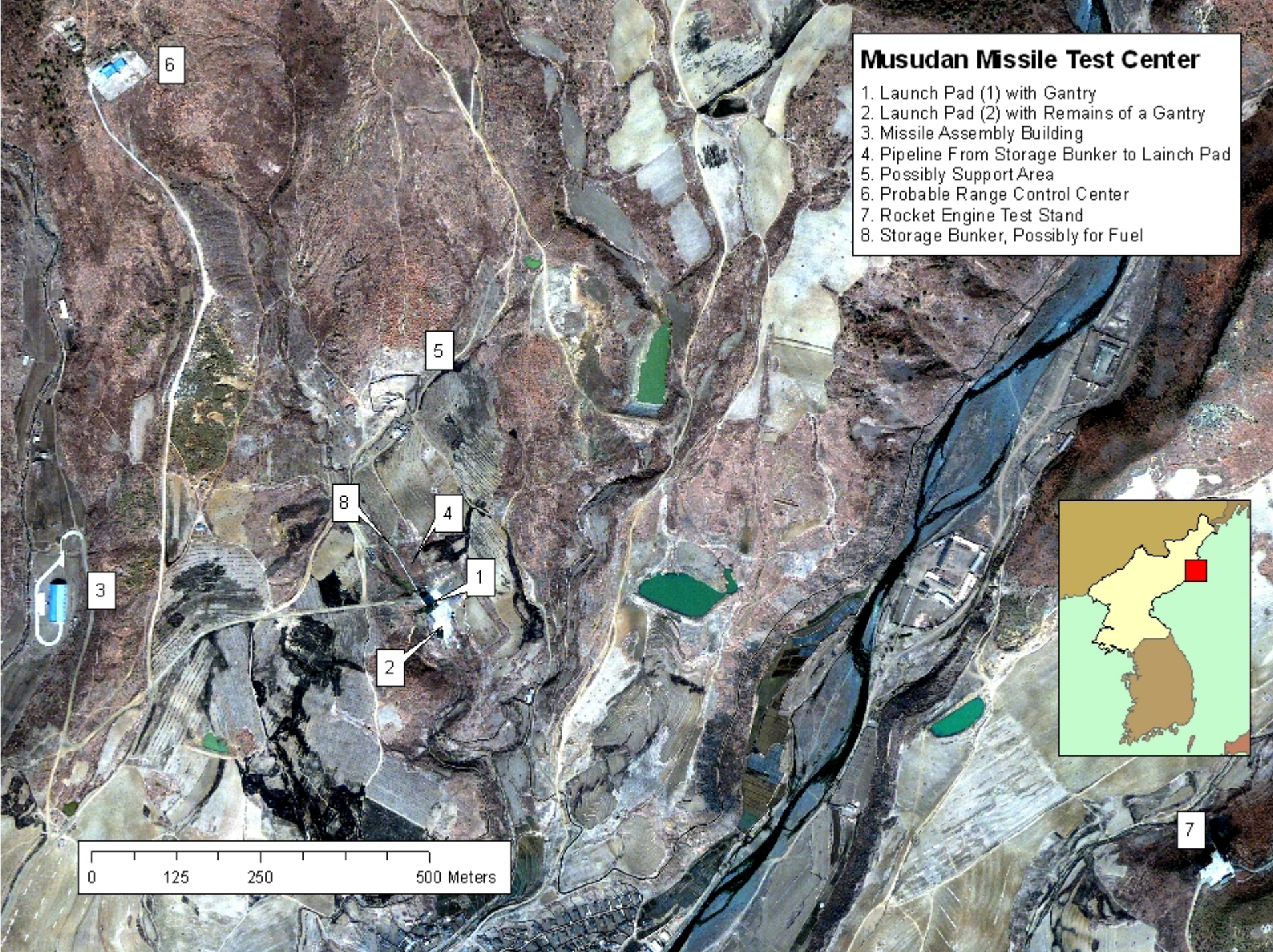
Image Acquired: 10 March 2003

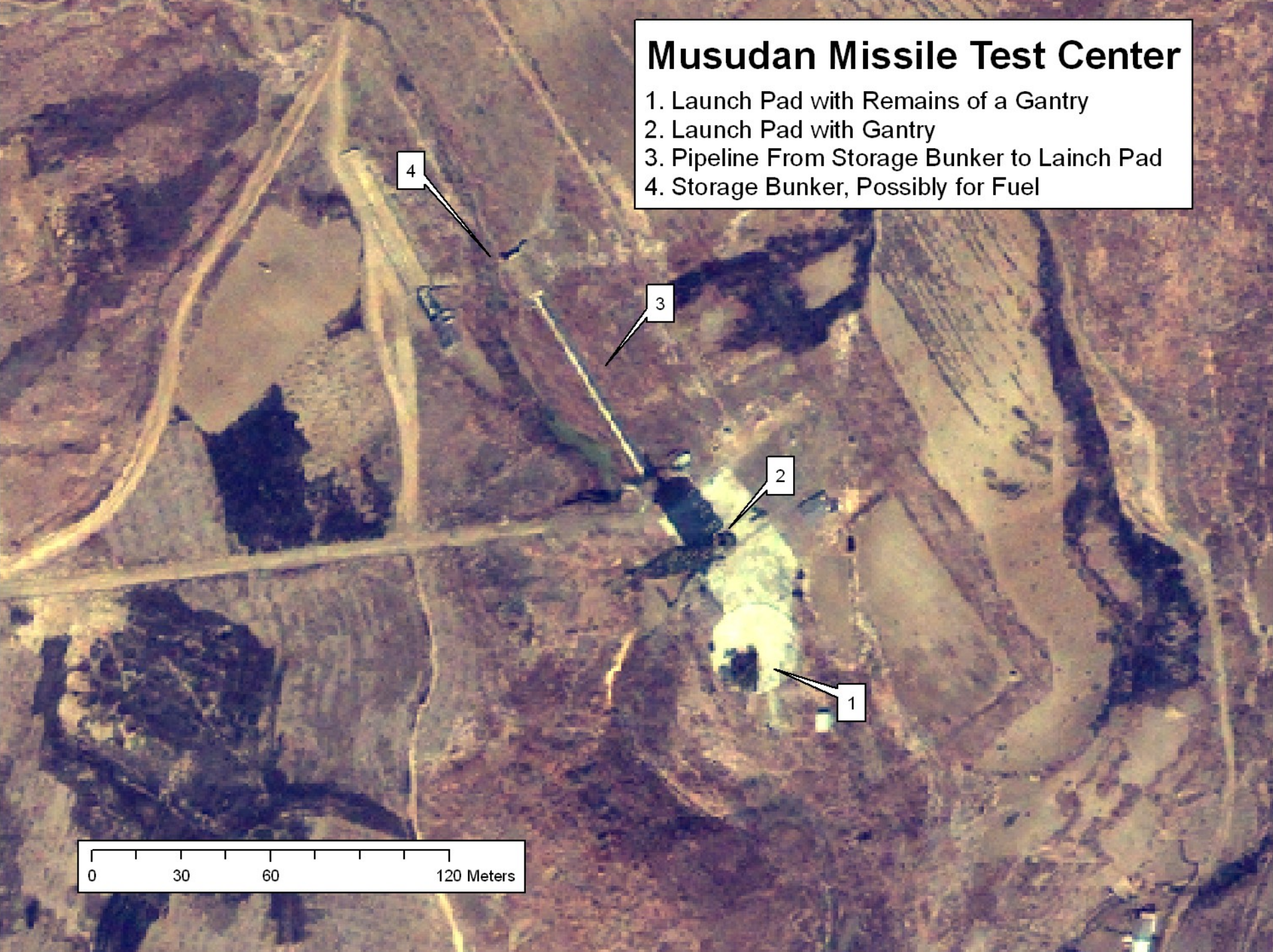
Taeryong River

DPRK
Missile Sites

Many missile bases are cited in the literature, but only the Musudan test facility has been identified in satellite imagery.




Musudan Missile Test Center
1. Launch Pad (1) with Gantry
2. Launch Pad (2) with Remains of a Gantry
3. Missile Assembly Building
4. Pipeline From Storage Bunker to Lainch Pad
5. Possibly Support Area
6. Probable Range Control Center
7. Rocket Engine Test Stand
8. Storage Bunker, Possibly for Fuel
0
125
250
500 Meters


Musudan Missile Test Center
1. Launch Pad with Remains of a Gantry
2. Launch Pad with Gantry
3. Pipeline From Storage Bunker to Lainch Pad
4. Storage Bunker, Possibly for Fuel
4
3
2
1
0
30
60
120 Meters


Musudan Missile Test Center
Rocket Engine Test Stand
0
25
50
100 Meters

Nuclear Use Scenarios on the Korean Peninsula

- Recent Changes in U.S. Nuclear Policy;
- Potential Targets for U.S. Earth-Penetrating Nuclear Weapons in North Korea;
- Nuclear Weapons Effects Simulation and Modeling

U.S. Nuclear Posture Review (December 2001)

- "More than 70 countries now use underground facilities (UGFs) for military purposes. In June 1998, the Defense Science Board Task force on Underground Facilities that there are over 10,000 UGFs worldwide. **Approximately 1,100 UGFS were known or suspected strategic (WMD, ballistic missile basing, leadership or top echelon command and control) sites. Updated estimates from DIA reveal this number has now grown to over 1,400.** A majority of the strategic facilities are deep underground facilities. These facilities are generally the most difficult to defeat because of the depth of the facility and the uncertainty of the exact location. **At present the United States lacks adequate means to deal with these strategic facilities.**"

- "**The United States currently has a very limited ground penetration capability with its only earth penetrating nuclear weapon, the B61 Mod 11 gravity bomb.** This single-yield, non-precision weapon cannot survive penetration into many types of terrain in which hardened underground facilities are located. Given these limitations, the targeting of a number of hardened, underground facilities is limited to an attack against surface features, which does not does not provide a high probability of defeat of these important targets."

U.S. Defense Science Board
Task Force on Future Strategic Strike Force
(February 2004)

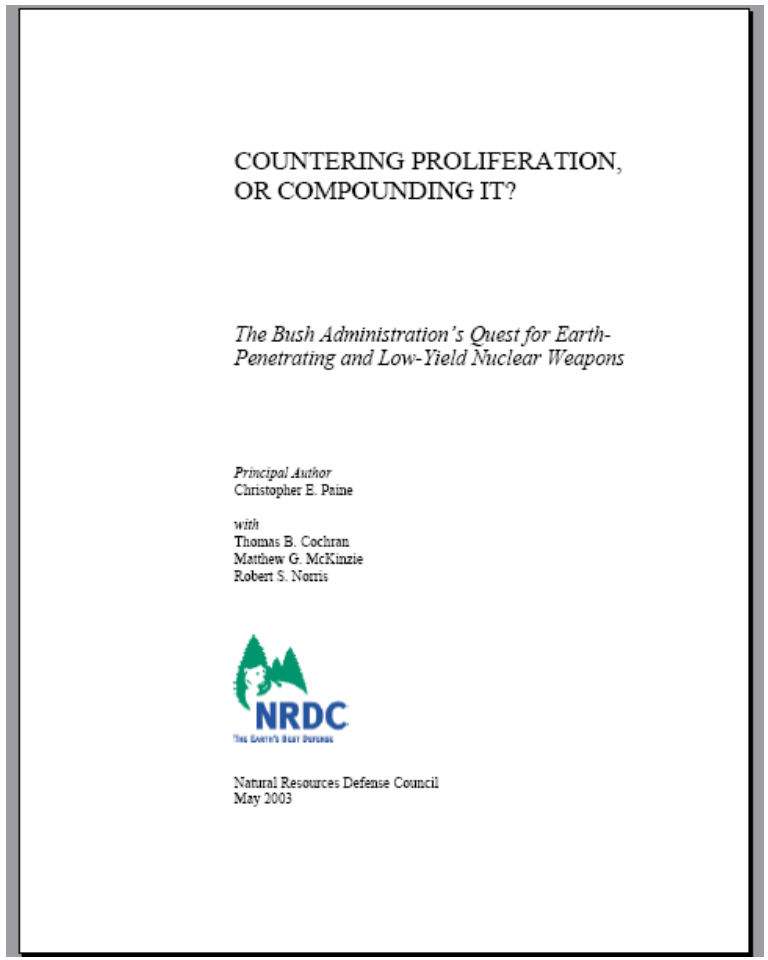
" Nuclear weapons are needed that produce much lower collateral damage (great precision, deep penetration, greatly reduced radioactivity): have robust performance margins: are devised for ease of manufacture and maintenance: and produce special effects (e.g., enhanced EMP, enhanced neutron flux, reduced fission yield). ***The Task Force recommends that research be initiated on weapons that meet this new vision.***"

Proposed candidates for the Robust Nuclear Earth Penetrator (RNEP)

- DOD asked for a study to determine if an existing warhead can be adapted, without nuclear testing, to destroy hardened, deeply buried targets.
- B61-11 – a 400 kiloton, fixed yield bomb weighing ~545 kg – approximately 50 were converted in mid-1990s from the B61-7 nuclear bomb. LLNL design
- B-83 – selectable yield, to 1.2 megatons weighing 1090 kg, LLNL design
- For FY 2005 administration requested $27.5 million to continue feasibility and cost studies. The five year budget request (FY2005-2009) was $484.7)
- House Energy and Water Development subcommittee on appropriations cut all of the money for the study (House Report 108-554, June 18, 2004, pp. 114-115)

Technical Limits of Earth-Penetrating Nuclear Weapons

- Limited penetration – in soil, concrete or rock, maximum 10-15 meters
- Cannot penetrate deeply enough to contain the nuclear explosion
- 1 kt at 20 foot depth – eject 1 million cubic feet of radioactive debris, crater size of ground zero at World Trade Center
- Higher yield = more fallout



COUNTERING PROLIFERATION,
OR COMPOUNDING IT?

The Bush Administration's Quest for Earth-Penetrating and Low-Yield Nuclear Weapons

Principal Author
Christopher E. Paine

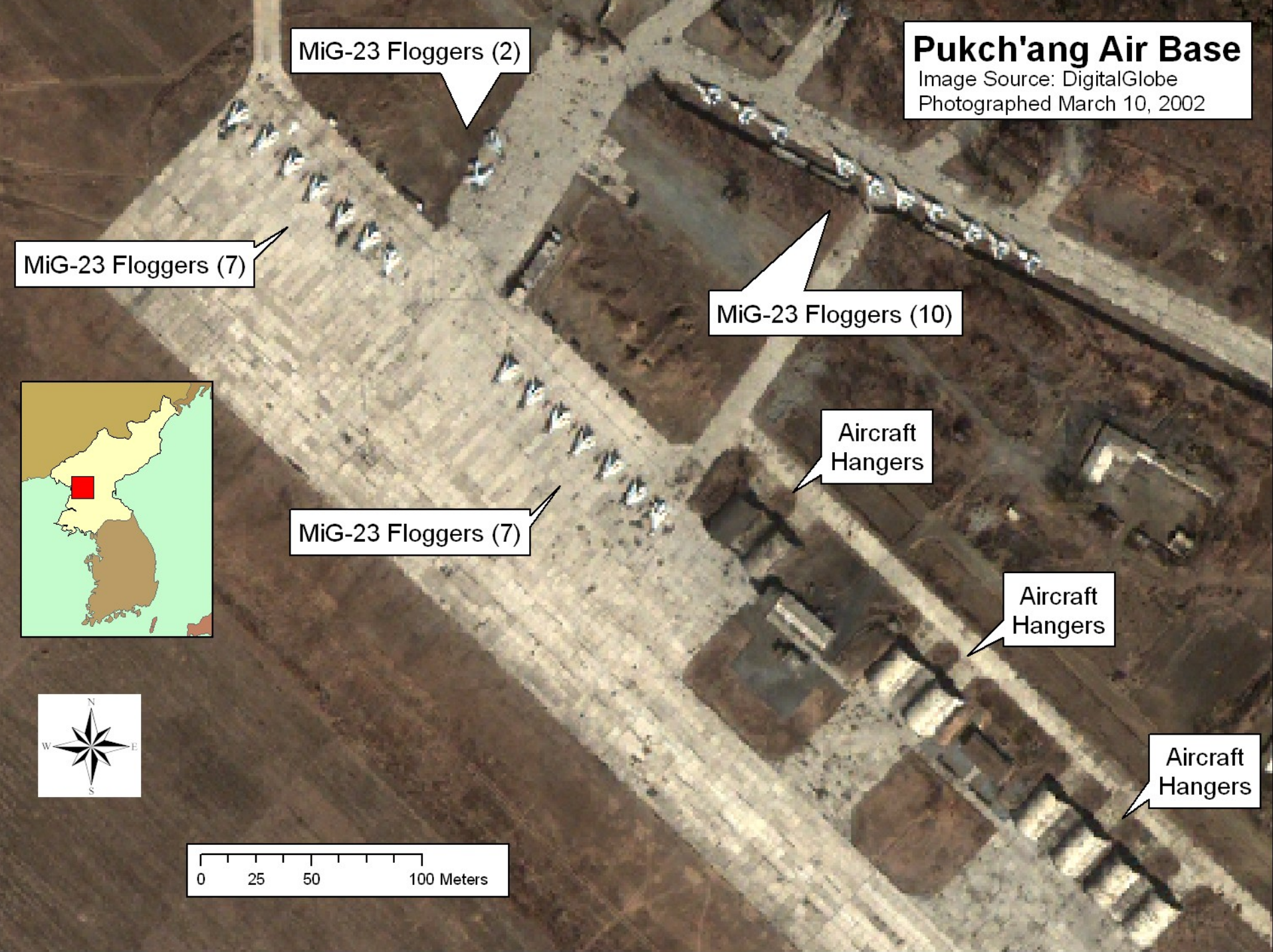
with
Thomas B. Cochran
Matthew G. McKinzie
Robert S. Norris

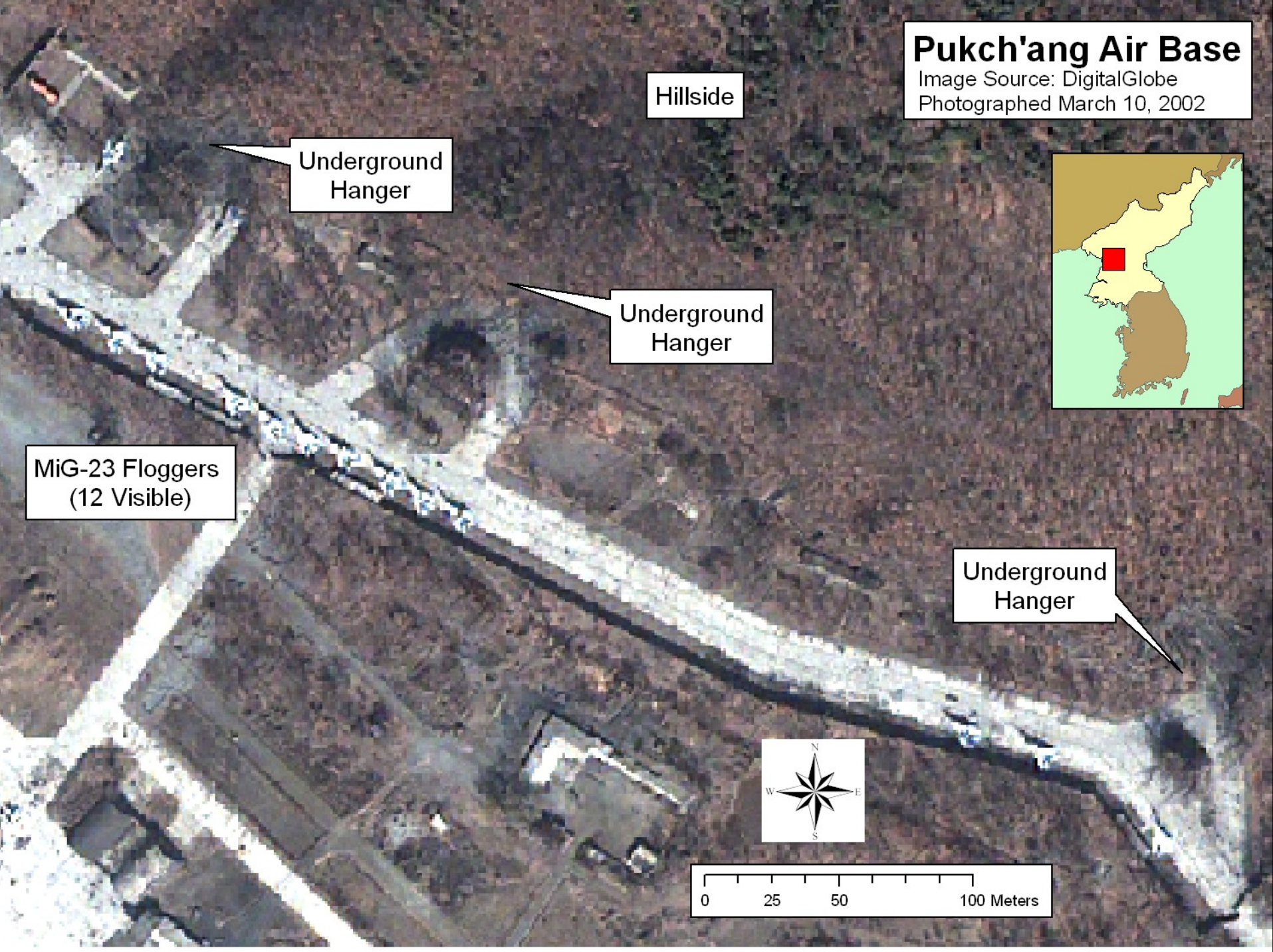
NRDC

Natural Resources Defense Council
May 2003

www.nrdc.org/nuclear/bush/abb.pdf

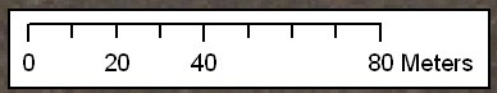

Pukch'ang Air Base
Image Source: DigitalGlobe
Photographed March 10, 2002
Railroad
Underground Hangers
Main Runway
Aircraft Revetments
Ferry
Taedong River
N
W
E
S
0
250
500
1,000 Meters


Pukch'ang Air Base
Image Source: DigitalGlobe
Photographed March 10, 2002
MiG-23 Floggers (2)
MiG-23 Floggers (7)
MiG-23 Floggers (10)
MiG-23 Floggers (7)
Aircraft Hangers
Aircraft Hangers
Aircraft Hangers
N
W
E
S
0
25
50
100 Meters


Pukch'ang Air Base
Image Source: DigitalGlobe
Photographed March 10, 2002
Hillside
Underground Hanger
Underground Hanger
Underground Hanger
MiG-23 Floggers (12 Visible)
N
W
E
S
0
25
50
100 Meters

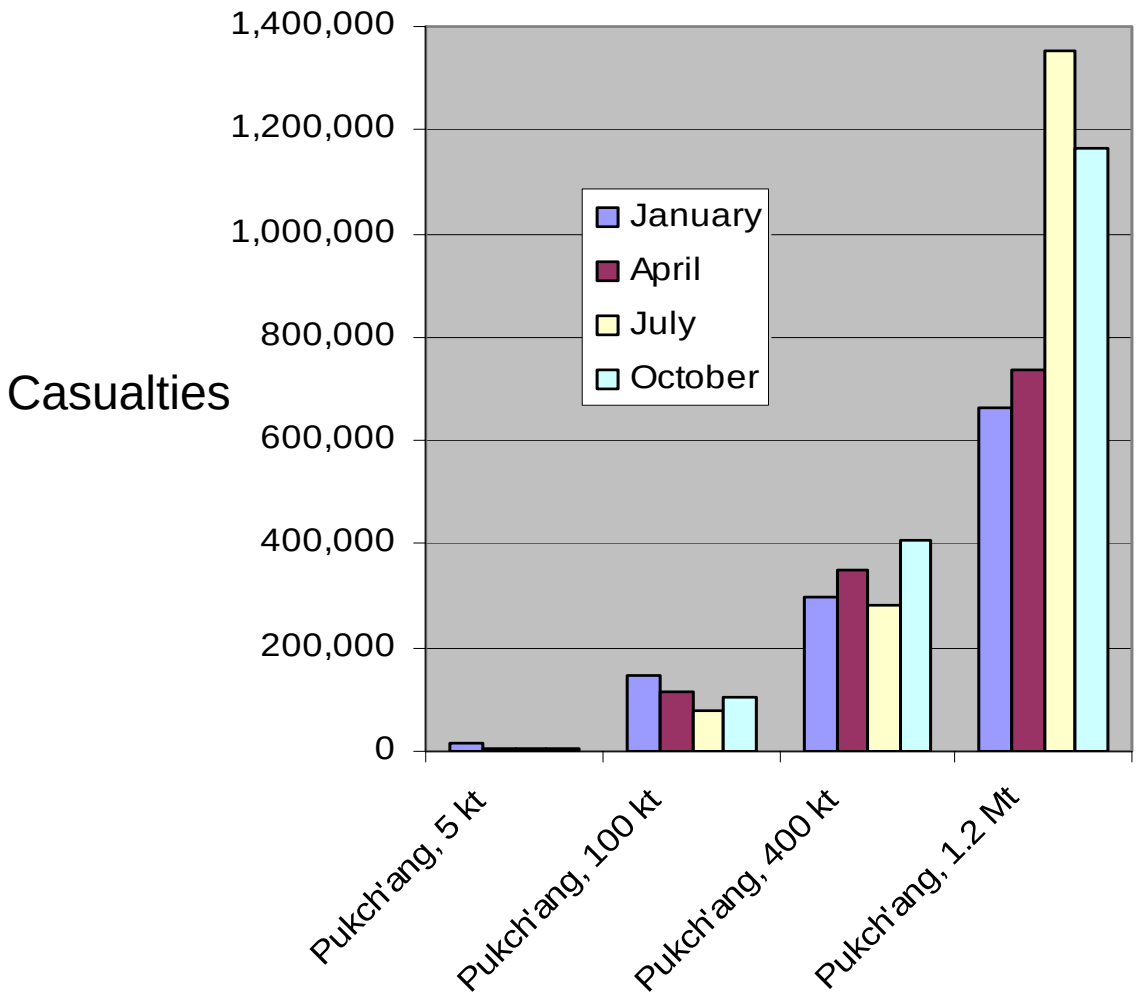
Pukch'ang Air Base

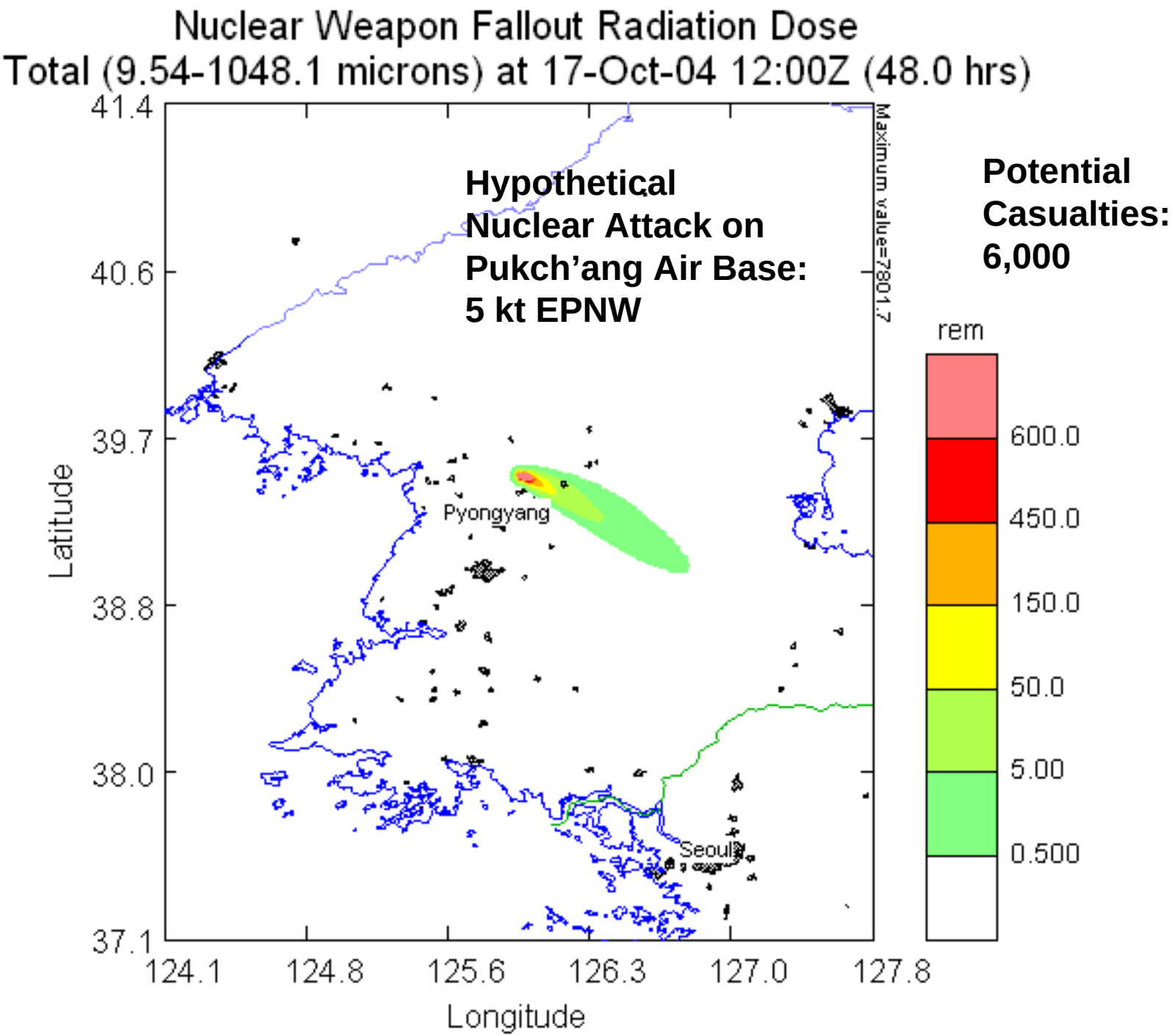
Image Source: DigitalGlobe
Photographed March 10, 2002

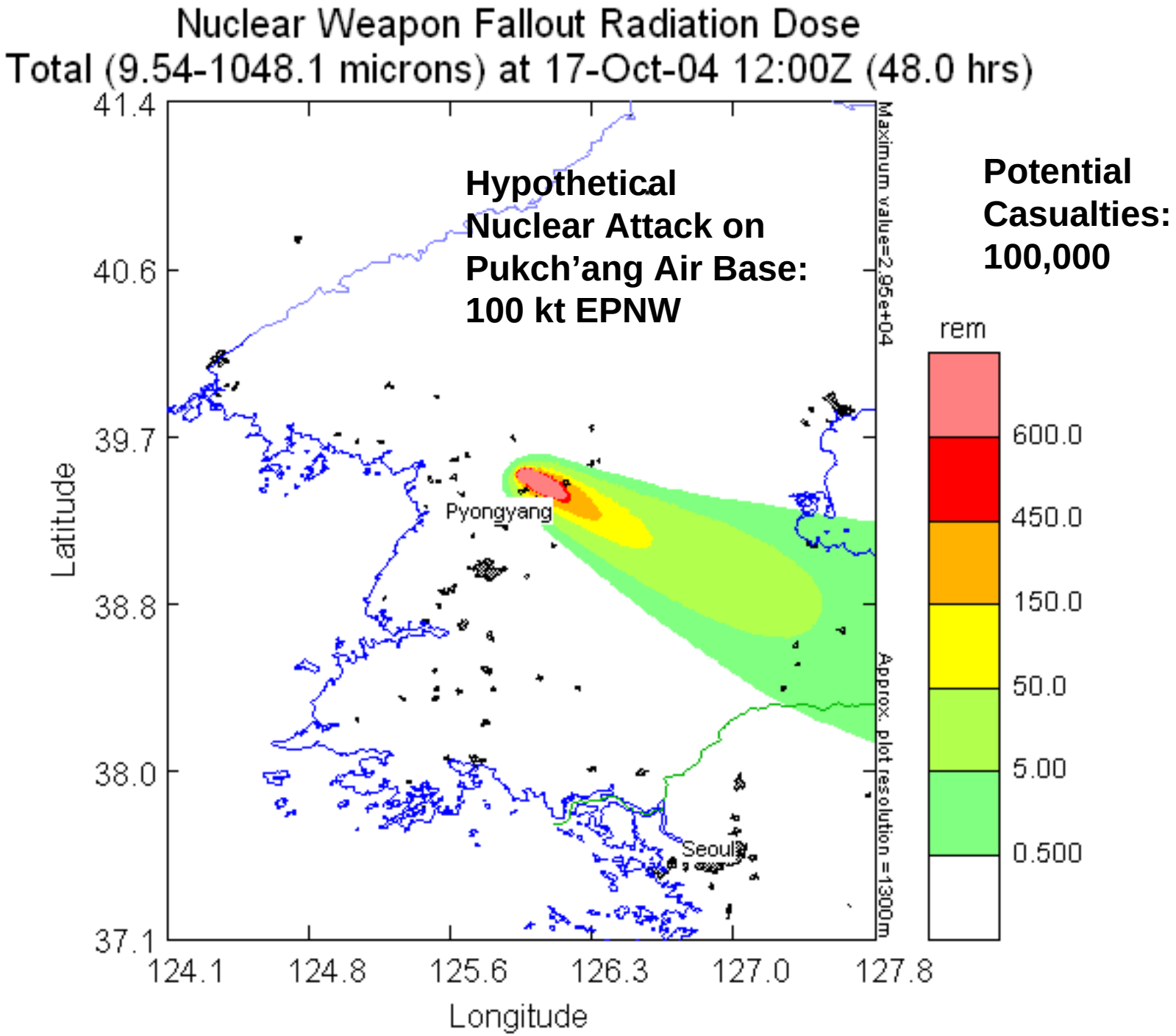


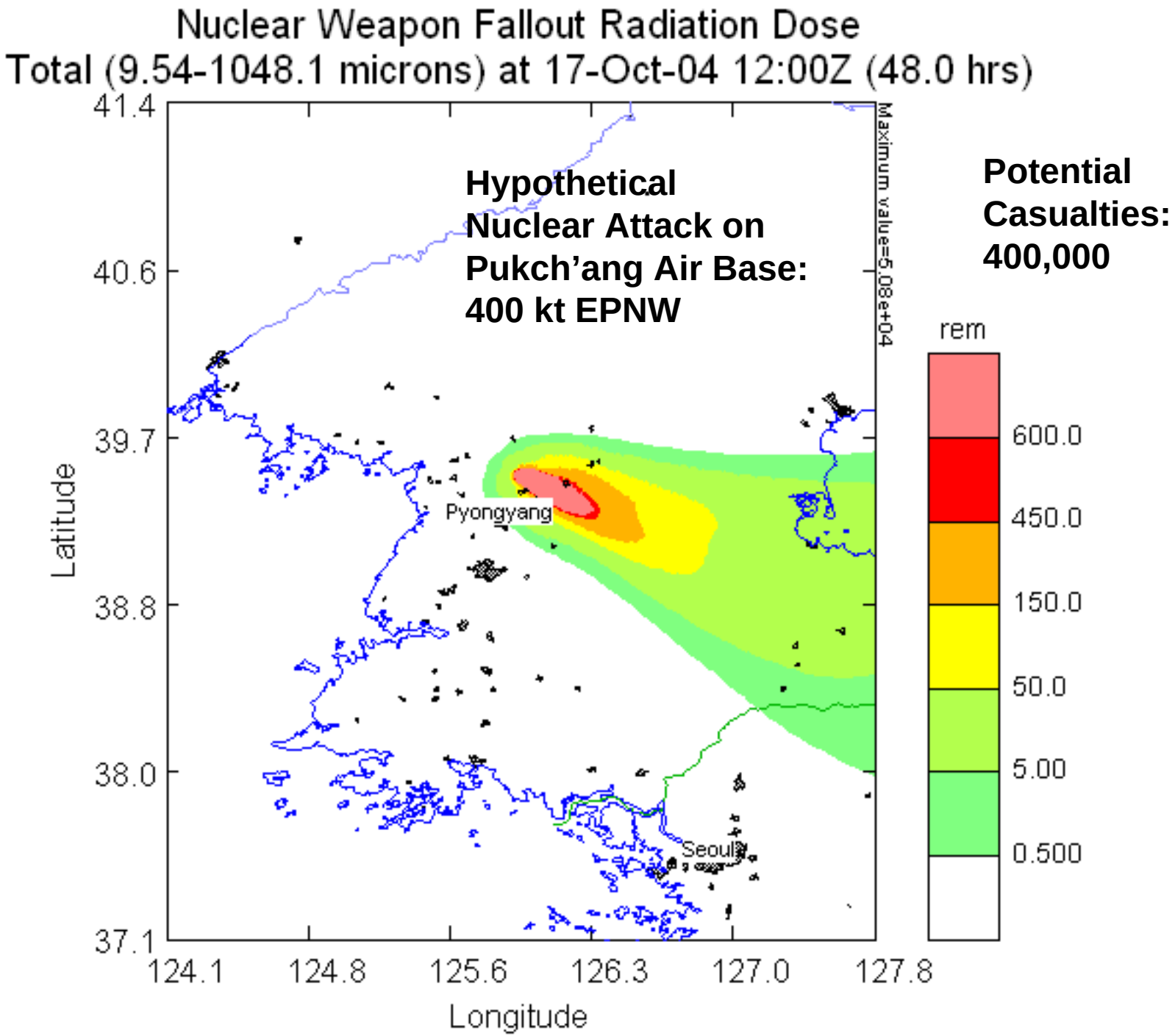
22 MiG-21 Fishbed and
6 UI MiG Aircraft

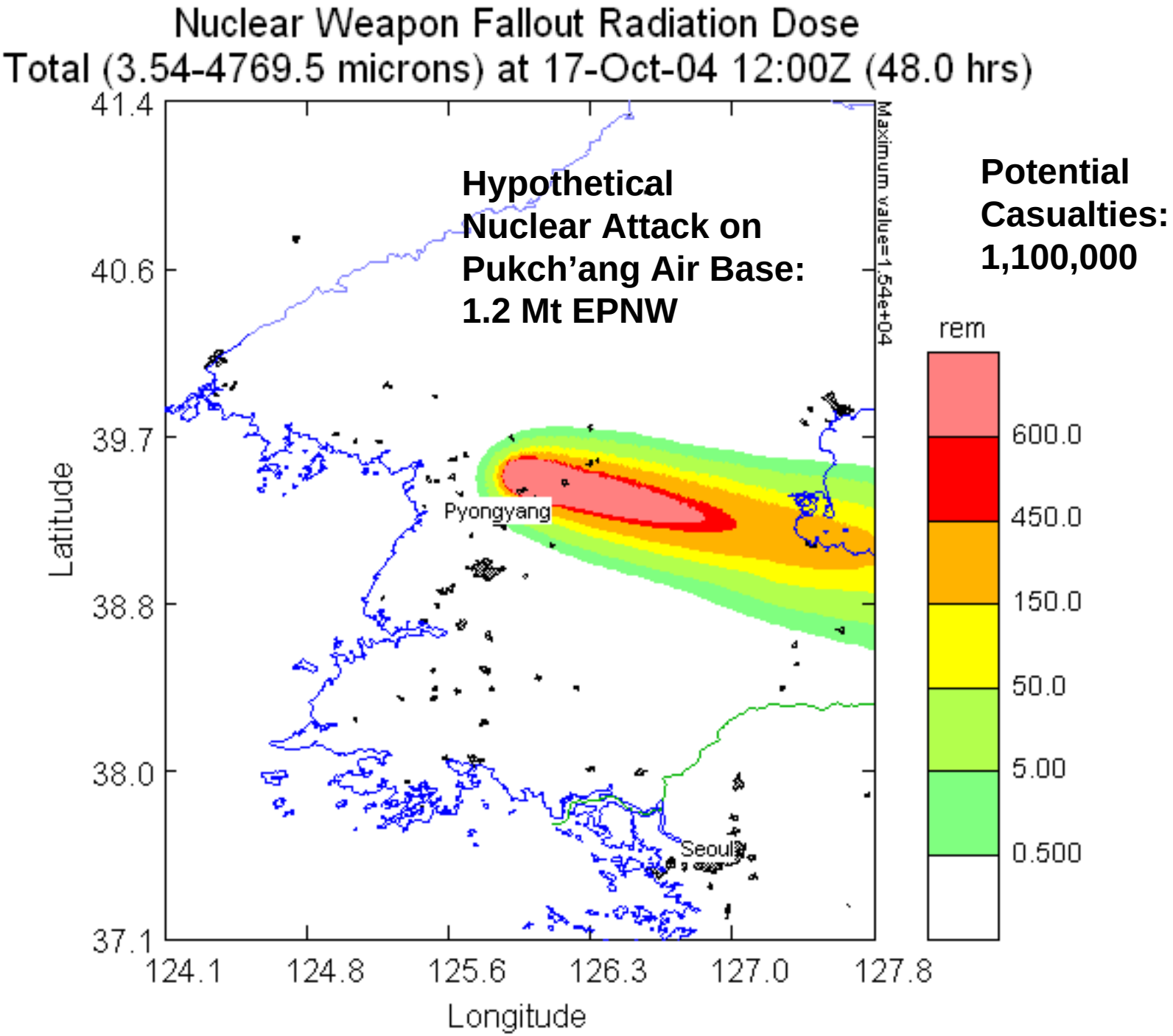
Casualty Calculations from a Hypothetical Nuclear Attack on the Pukch'ang Air Base

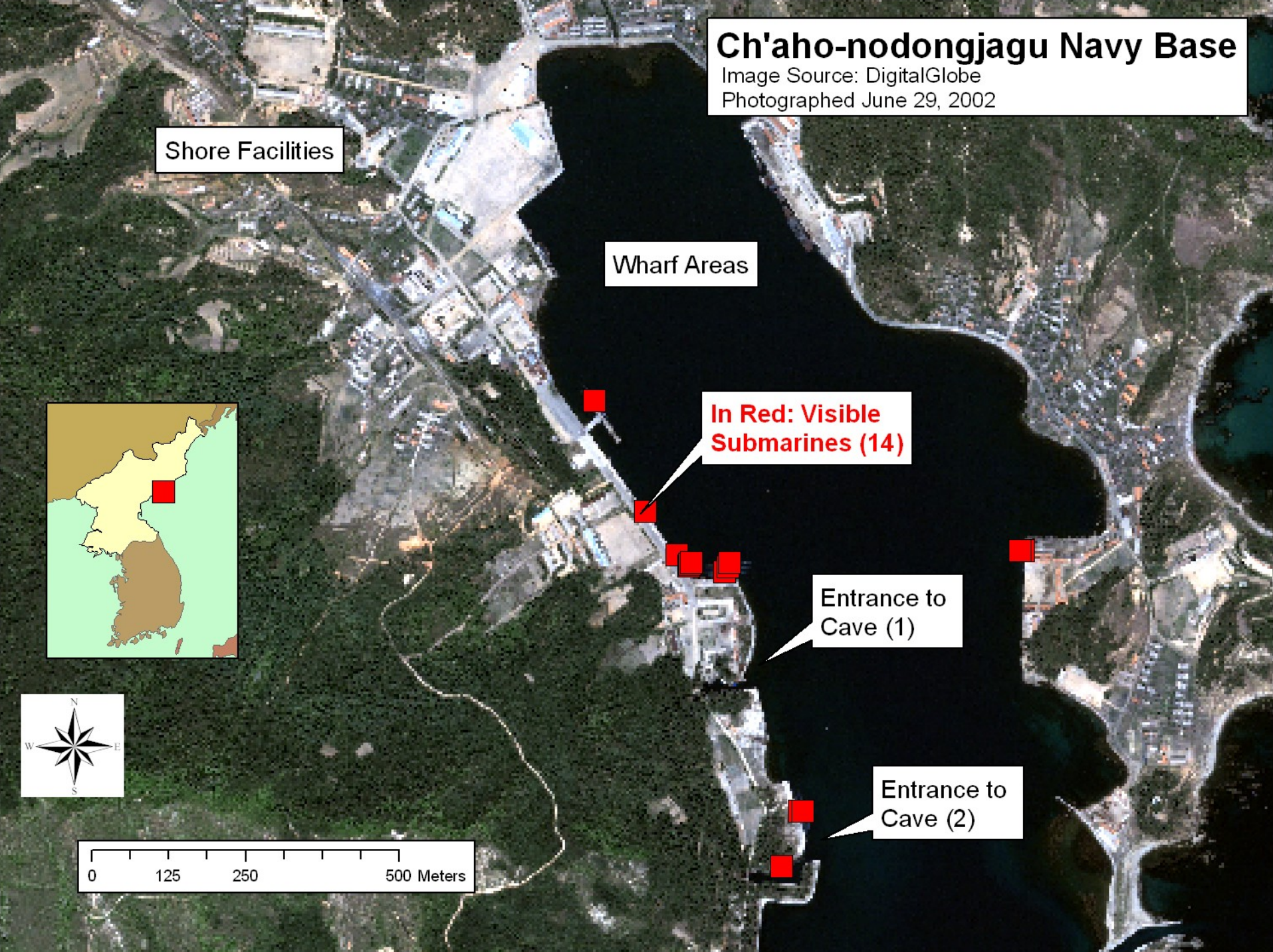


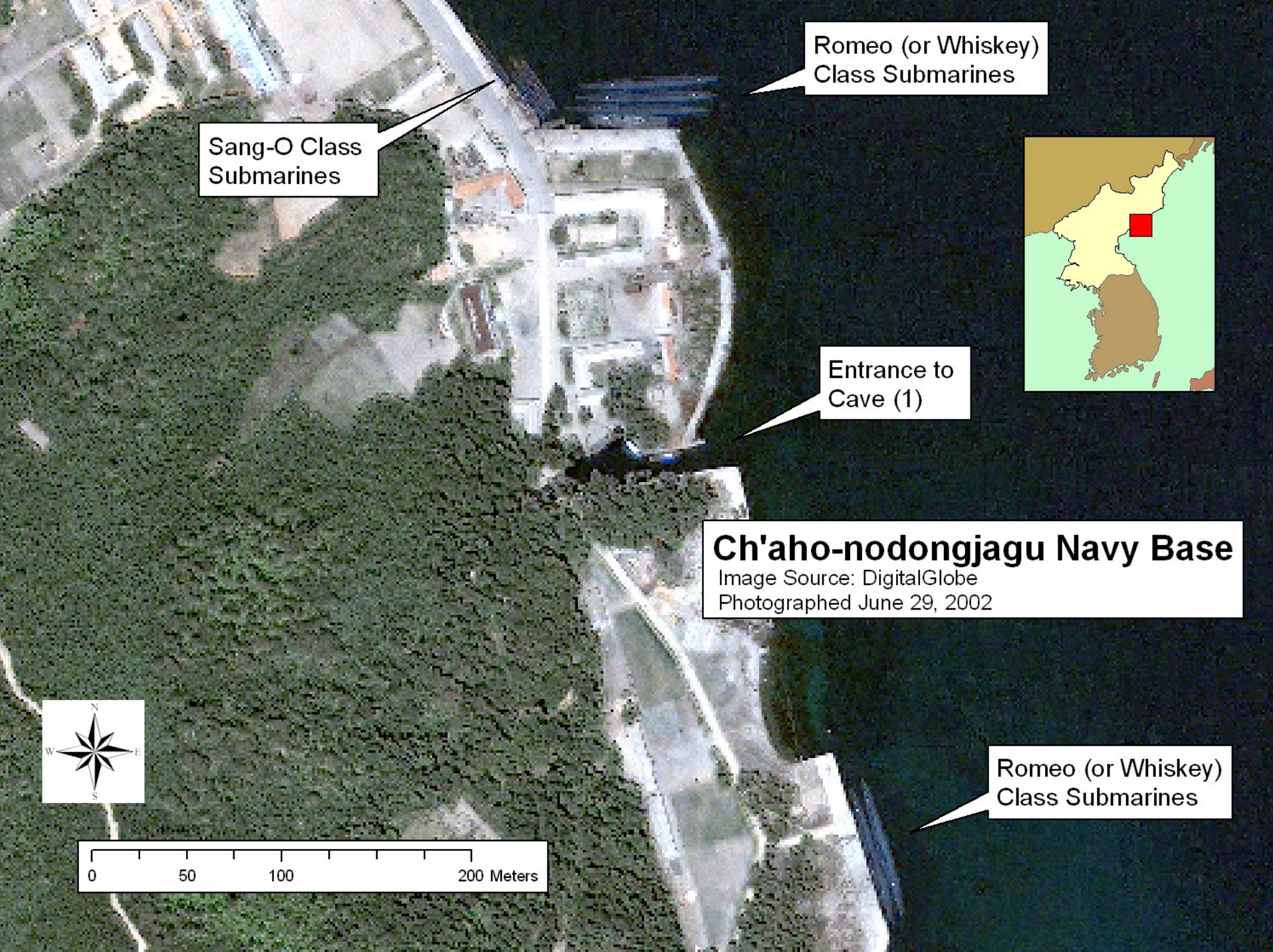

Nuclear Weapon Fallout Radiation Dose
Total (9.54-1048.1 microns) at 17-Oct-04 12:00Z (48.0 hrs)
Hypothetical
Nuclear Attack on
Pukch'ang Air Base:
5 kt EPNW
Potential
Casualties:
6,000
Maximum value=7801.7
rem
600.0
450.0
150.0
50.0
5.00
0.500
Pyongyang
Seoul
Latitude
Longitude
41.4
40.6
39.7
38.8
38.0
37.1
124.1
124.8
125.6
126.3
127.0
127.8

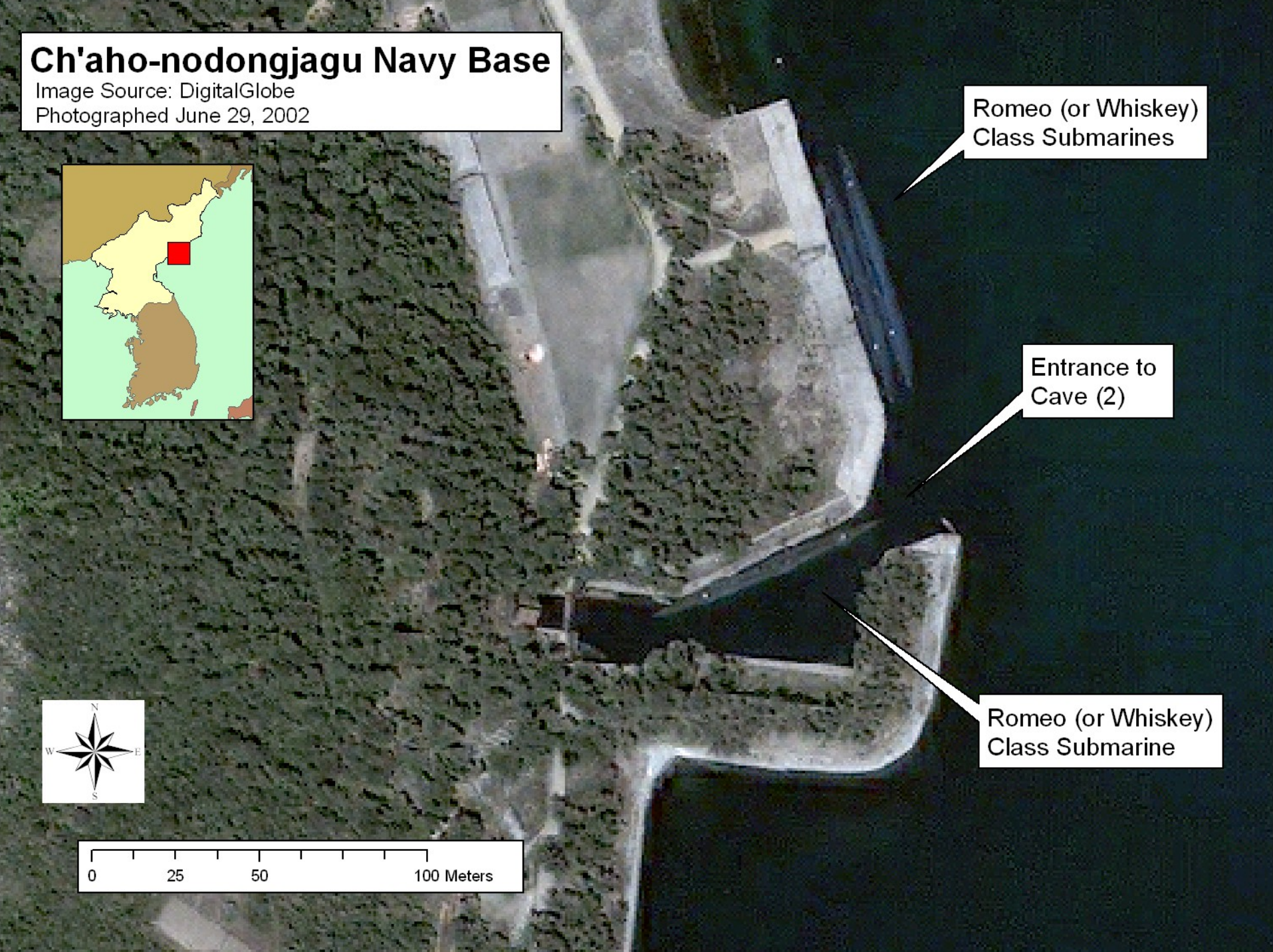

Nuclear Weapon Fallout Radiation Dose
Total (9.54-1048.1 microns) at 17-Oct-04 12:00Z (48.0 hrs)
Hypothetical
Nuclear Attack on
Pukch'ang Air Base:
100 kt EPNW
Potential
Casualties:
100,000
Pyongyang
Seoul
Latitude
Longitude
41.4
40.6
39.7
38.8
38.0
37.1
124.1
124.8
125.6
126.3
127.0
127.8
Maximum value=2.95e+04
Approx. plot resolution =1300m
rem
600.0
450.0
150.0
50.0
5.00
0.500


Nuclear Weapon Fallout Radiation Dose
Total (9.54-1048.1 microns) at 17-Oct-04 12:00Z (48.0 hrs)
Hypothetical
Nuclear Attack on
Pukch'ang Air Base:
400 kt EPNW
Potential
Casualties:
400,000
Maximum value=5.08e+04
rem
600.0
450.0
150.0
50.0
5.00
0.500
Pyongyang
Seoul
Latitude
Longitude
41.4
40.6
39.7
38.8
38.0
37.1
124.1
124.8
125.6
126.3
127.0
127.8

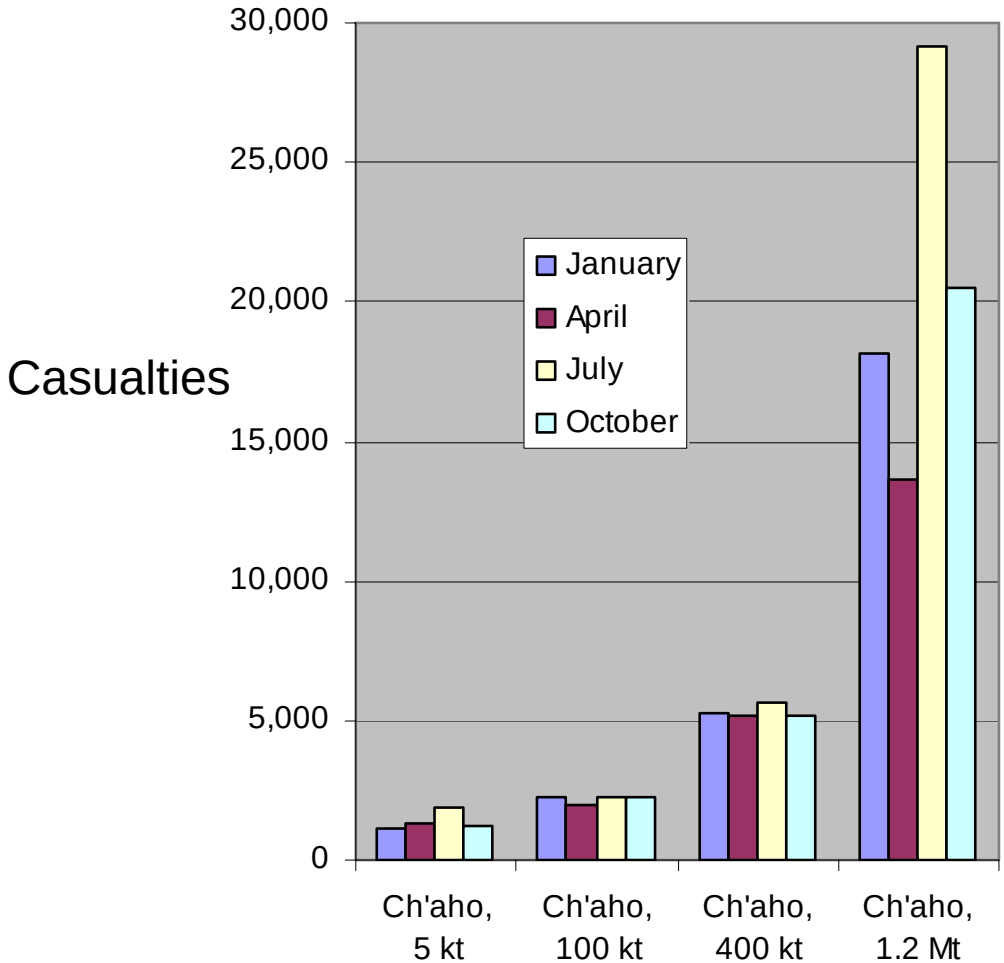

Nuclear Weapon Fallout Radiation Dose
Total (3.54-4769.5 microns) at 17-Oct-04 12:00Z (48.0 hrs)
Hypothetical
Nuclear Attack on
Pukch'ang Air Base:
1.2 Mt EPNW
Potential
Casualties:
1,100,000
Maximum value=1.54e+04
rem
600.0
450.0
150.0
50.0
5.00
0.500
Pyongyang
Seoul
Latitude
Longitude
41.4
40.6
39.7
38.8
38.0
37.1
124.1
124.8
125.6
126.3
127.0
127.8

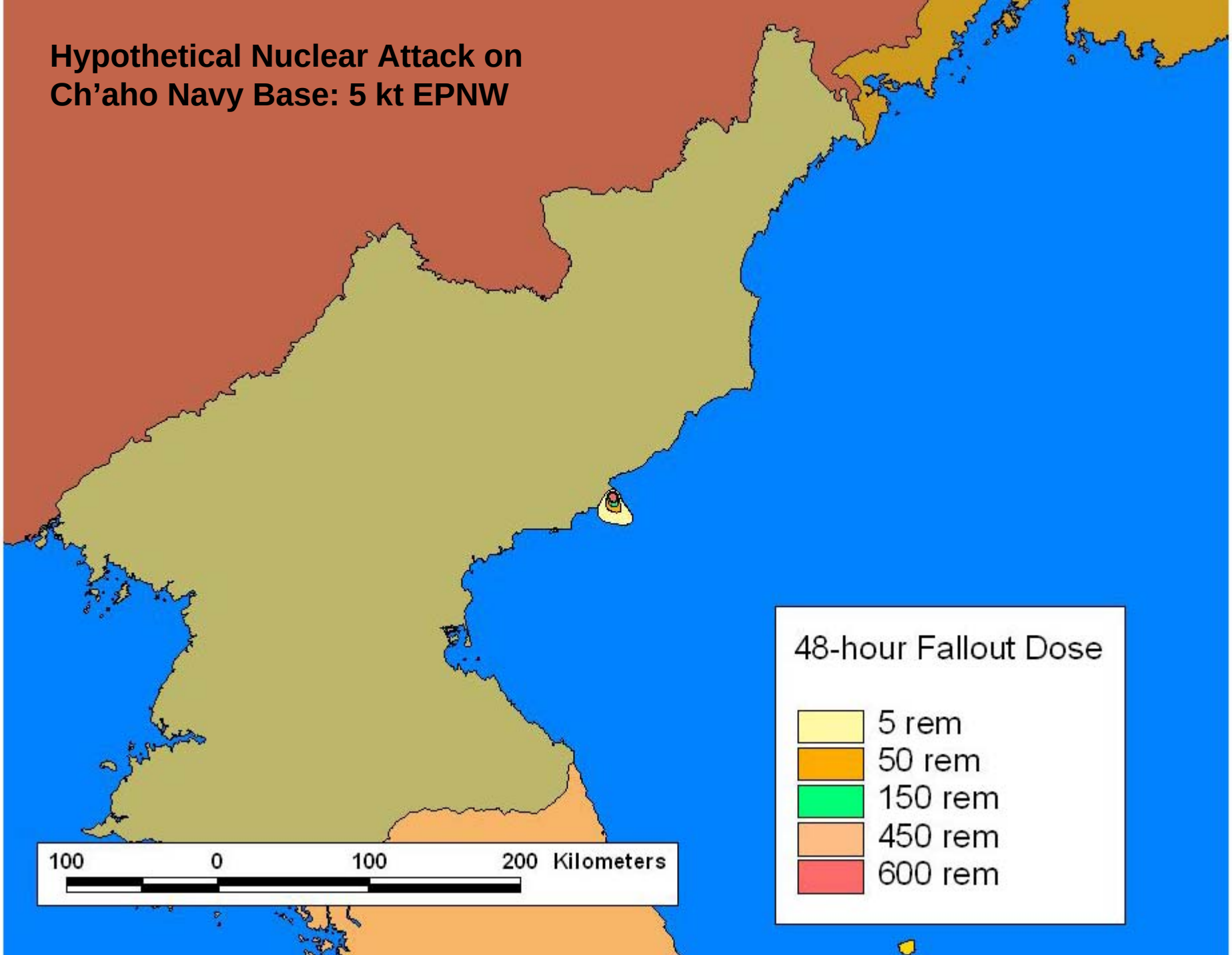

Ch'aho-nodongjagu Navy Base
Image Source: DigitalGlobe
Photographed June 29, 2002
Shore Facilities
Wharf Areas
In Red: Visible Submarines (14)
Entrance to Cave (1)
Entrance to Cave (2)
N
W
E
S
0
125
250
500 Meters

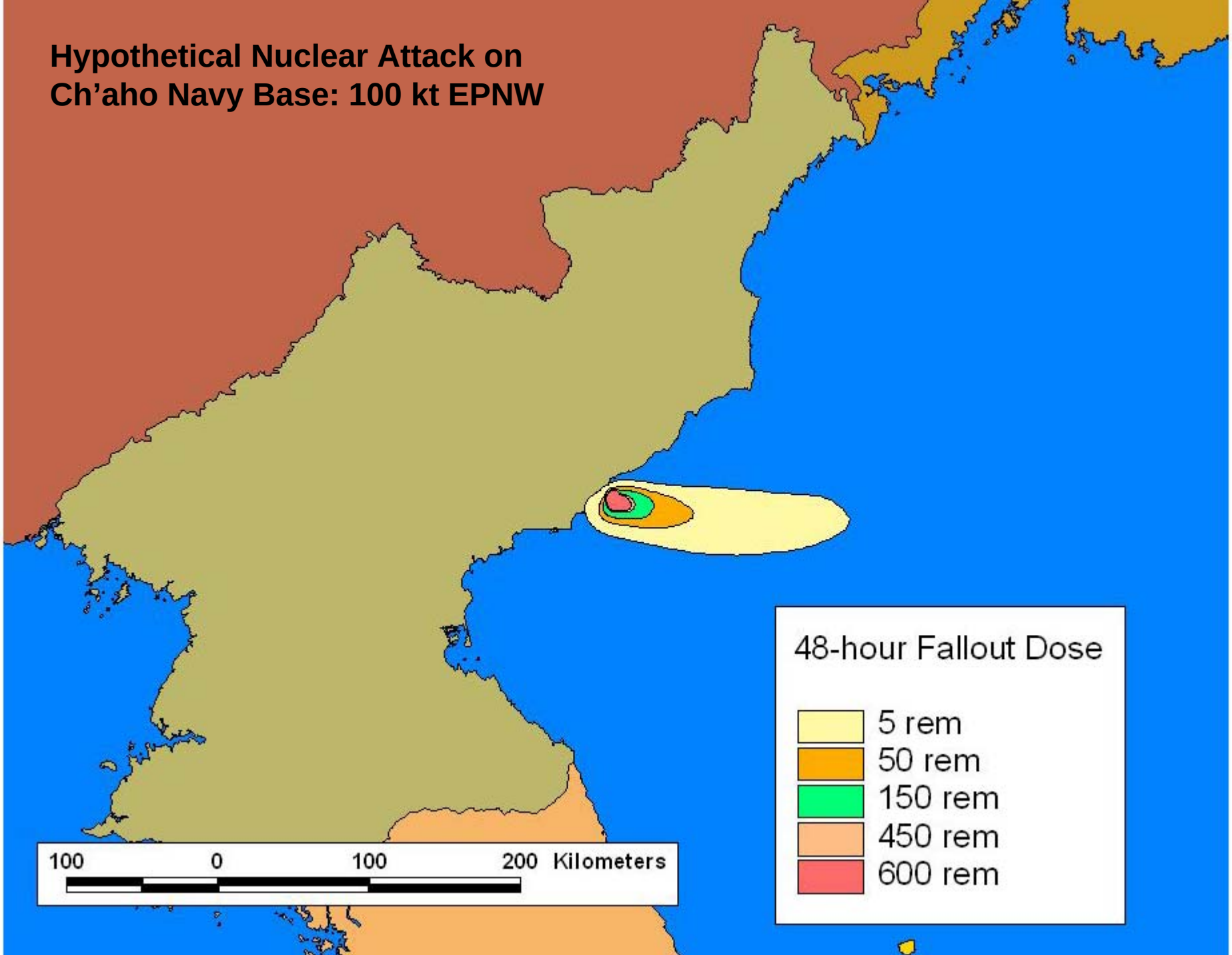

Romeo (or Whiskey) Class Submarines
Sang-O Class Submarines
Entrance to Cave (1)
Ch'aho-nodongjagu Navy Base
Image Source: DigitalGlobe
Photographed June 29, 2002
Romeo (or Whiskey) Class Submarines
N
W
E
S
0
50
100
200 Meters

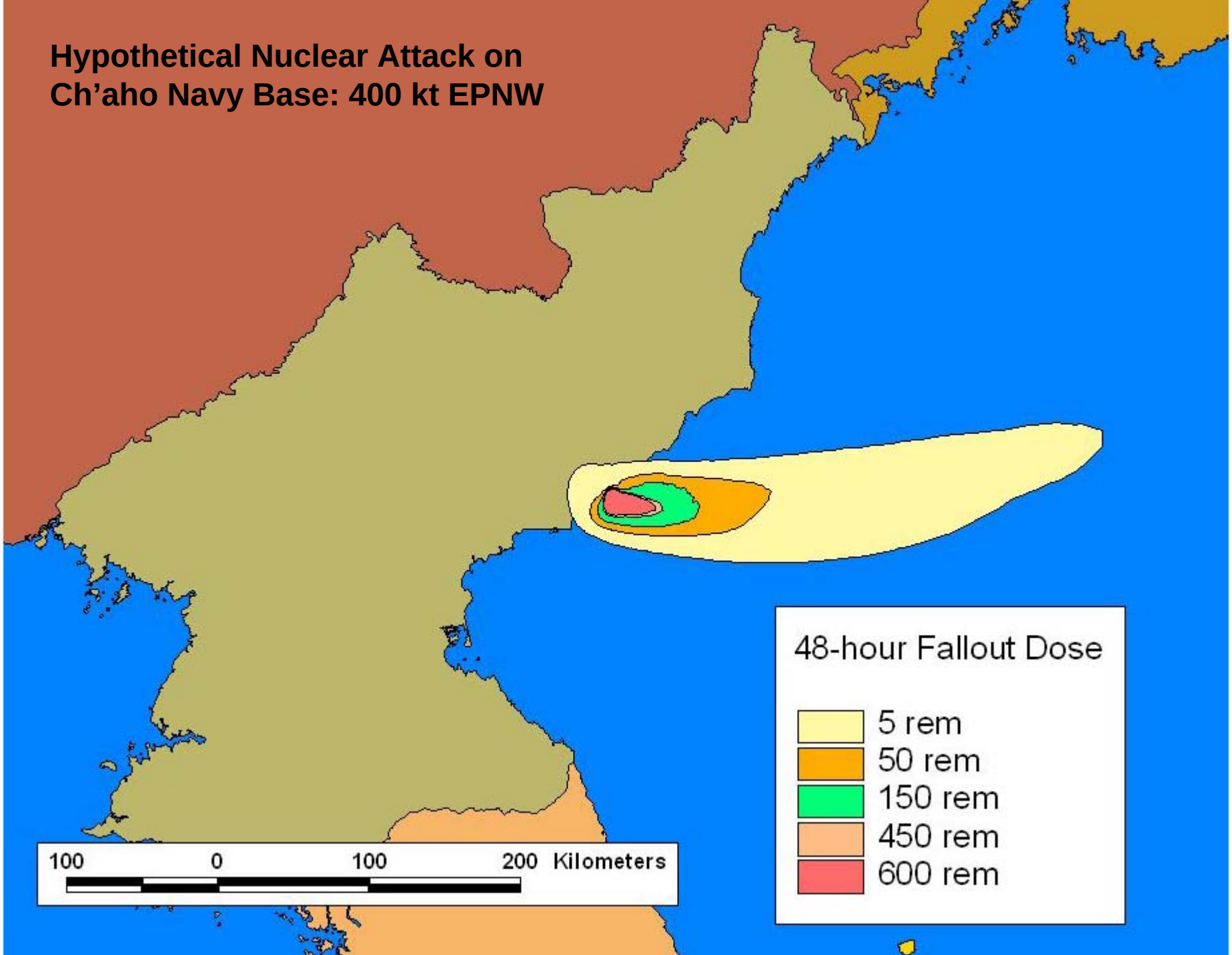

Ch'aho-nodongjagu Navy Base
Image Source: DigitalGlobe
Photographed June 29, 2002
Romeo (or Whiskey) Class Submarines
Entrance to Cave (2)
Romeo (or Whiskey) Class Submarine
N
W
E
S
0
25
50
100 Meters

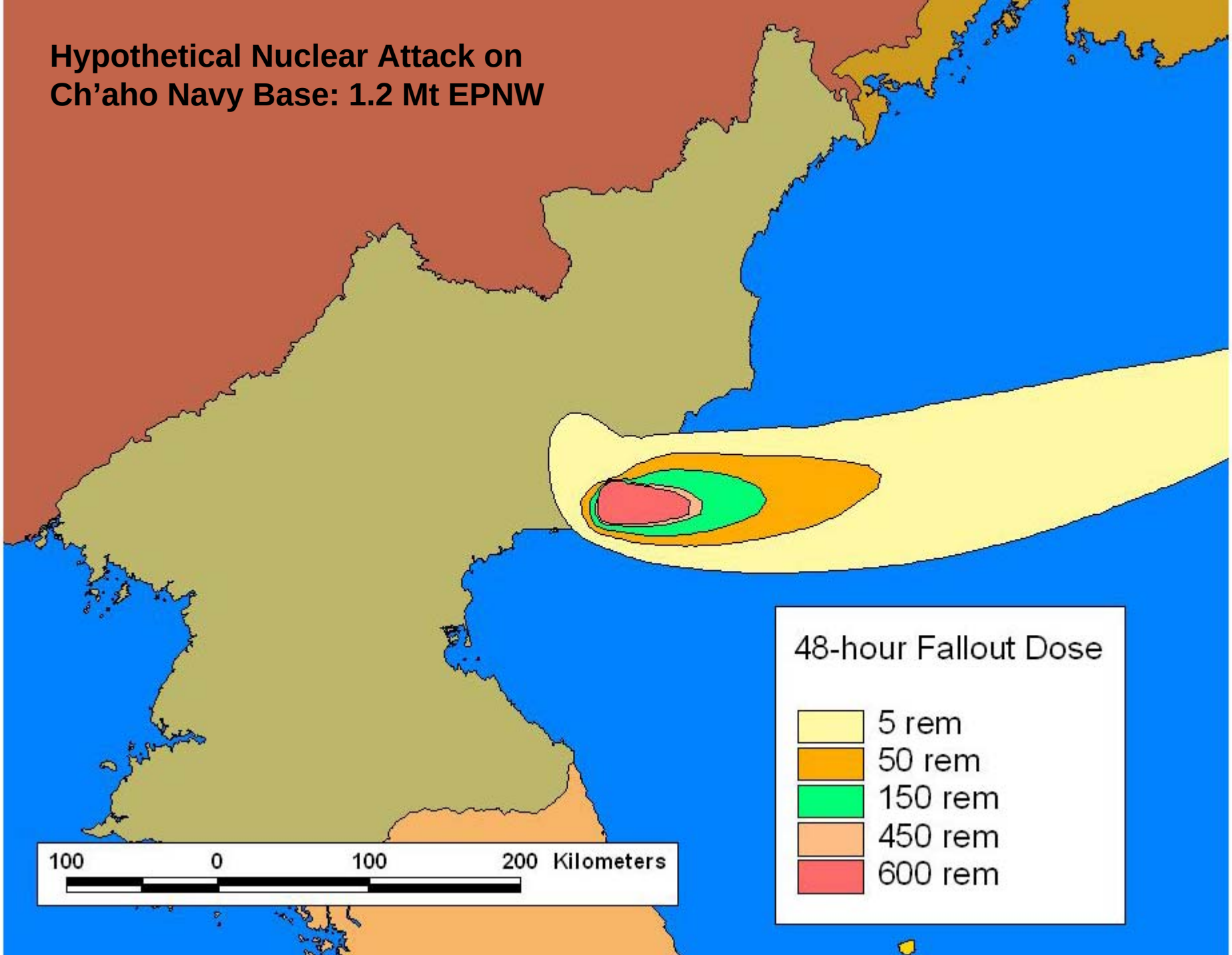
Casualty Calculations from a Hypothetical Nuclear Attack on the Ch'aho Navy Base




Hypothetical Nuclear Attack on
Ch'aho Navy Base: 5 kt EPNW
48-hour Fallout Dose
5 rem
50 rem
150 rem
450 rem
600 rem
100
0
100
200 Kilometers


Hypothetical Nuclear Attack on
Ch'aho Navy Base: 100 kt EPNW
48-hour Fallout Dose
5 rem
50 rem
150 rem
450 rem
600 rem
100
0
100
200 Kilometers

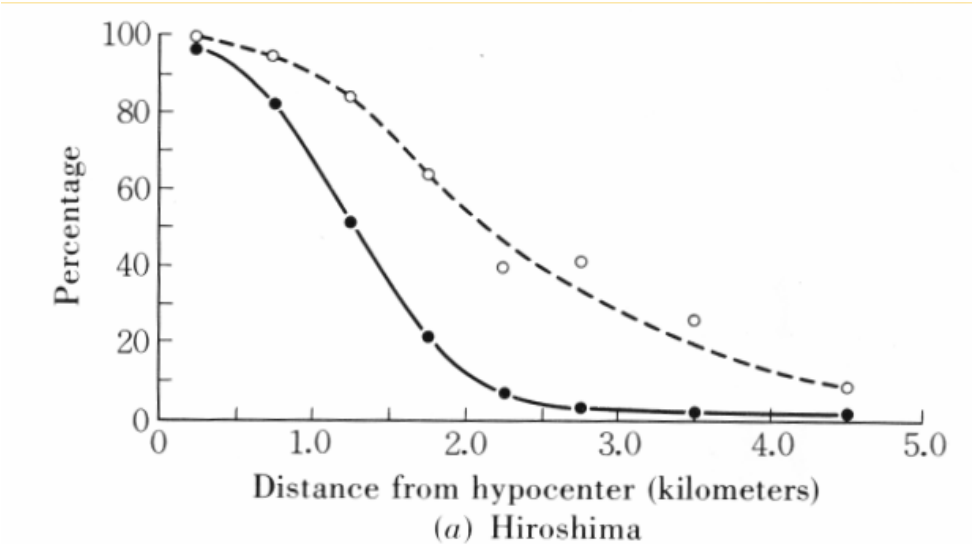

Hypothetical Nuclear Attack on
Ch'aho Navy Base: 400 kt EPNW
48-hour Fallout Dose
5 rem
50 rem
150 rem
450 rem
600 rem
100
0
100
200 Kilometers

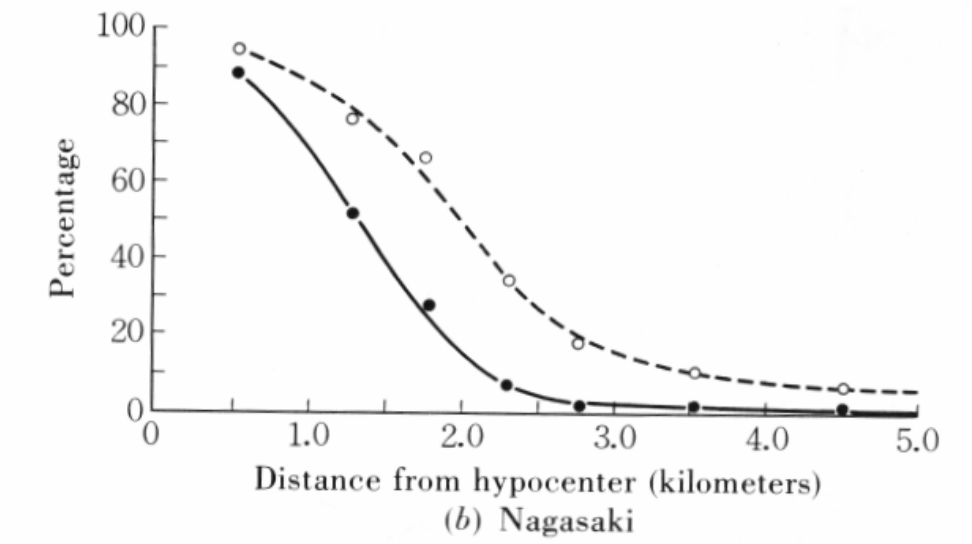

Hypothetical Nuclear Attack on
Ch'aho Navy Base: 1.2 Mt EPNW
48-hour Fallout Dose
5 rem
50 rem
150 rem
450 rem
600 rem
100 0 100 200 Kilometers

Ch’aho and Pukch’ang: Discussion

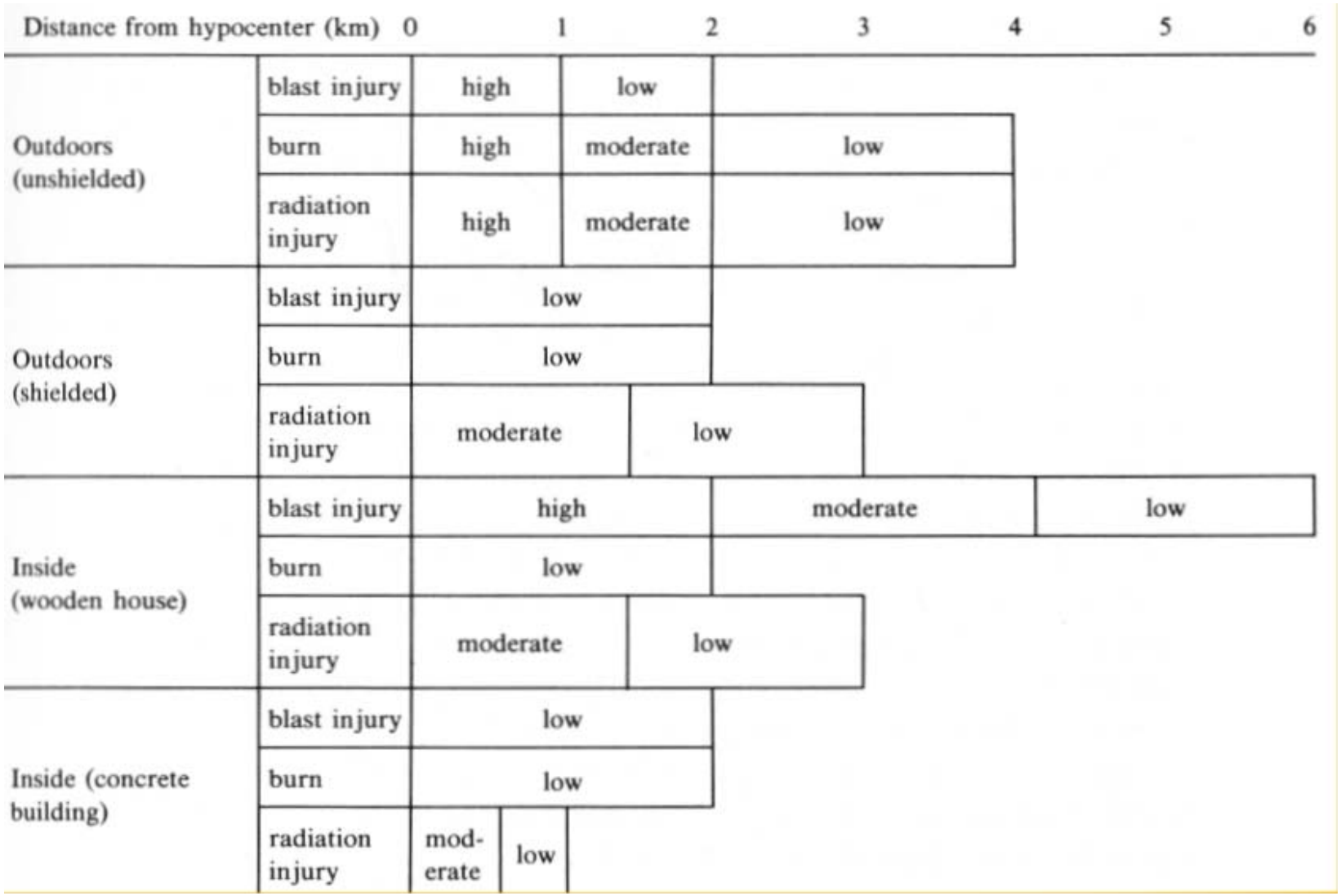
- Casualty estimates—primarily from fallout—will vary greatly depending on target location (potentially controllable) and ambient wind speed and direction (probably not controllable) …we illustrated this for two specific targets;
- While fallout is reduced with reduced yield, a 5 kt EPNW at 20 meters depth of burial still produces a lot of fallout!

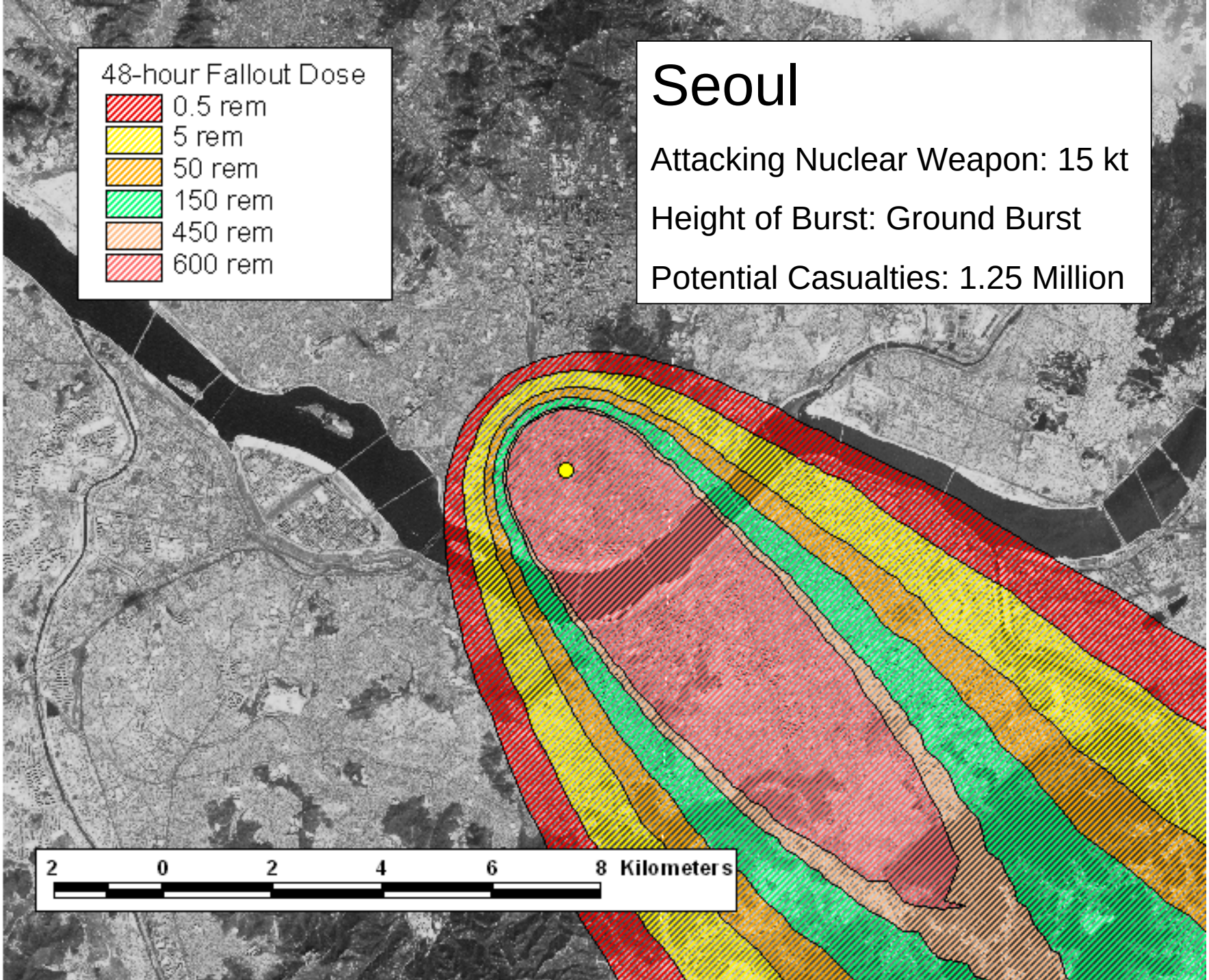
Calculating a Hypothetical Nuclear Attack on Seoul: *Reviewing the Data from Hiroshima and Nagasaki*

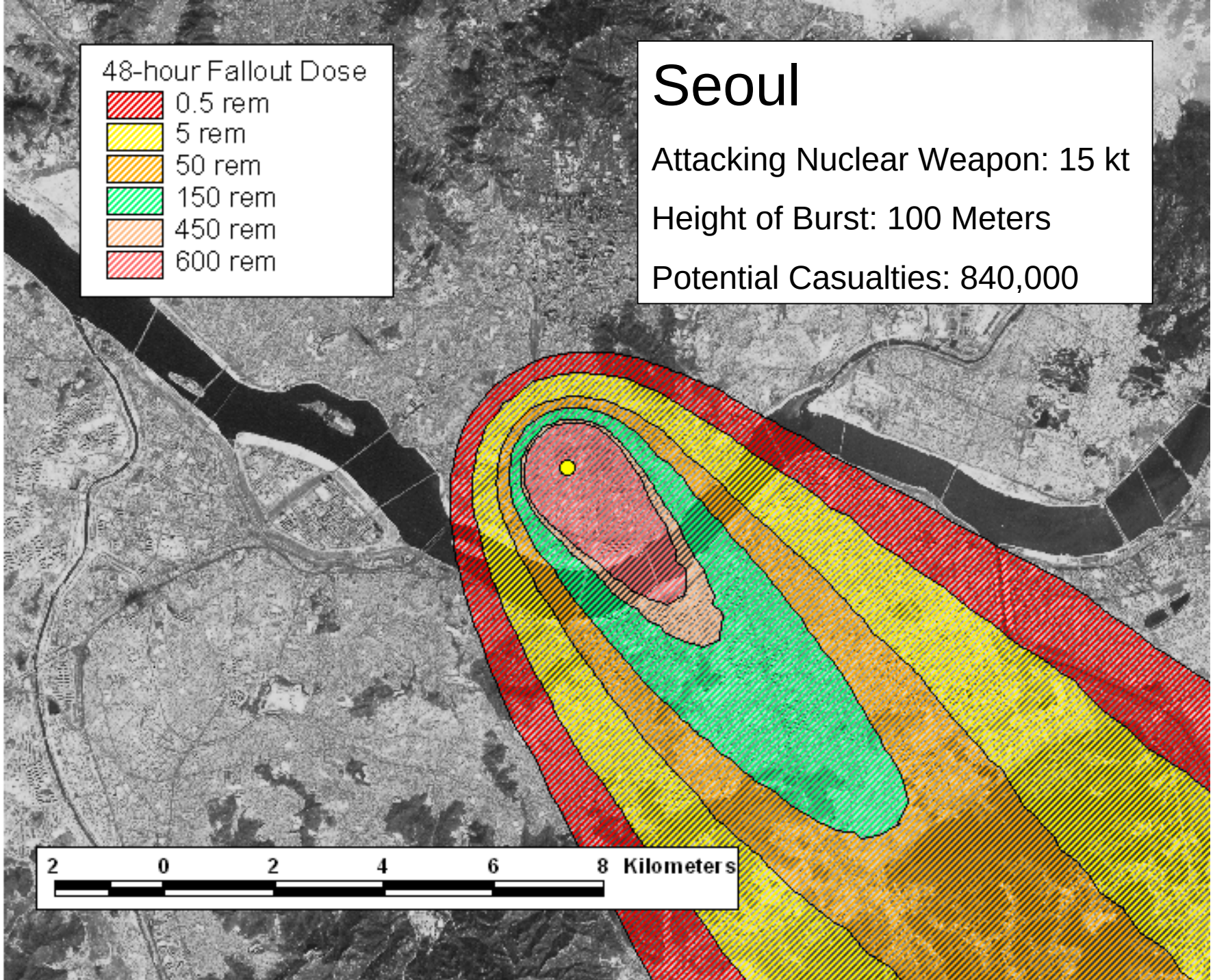


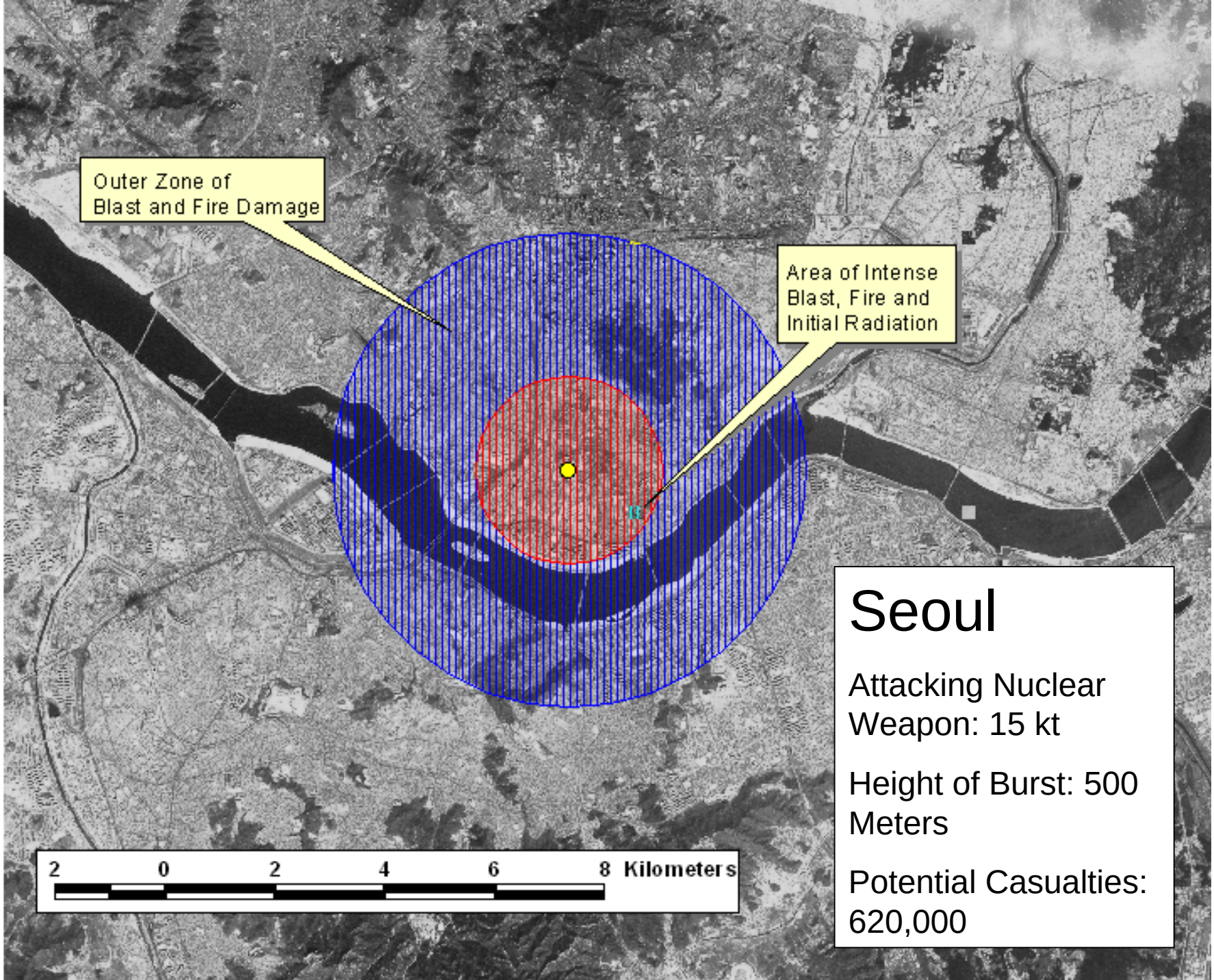


Calculating a Hypothetical Nuclear Attack on Seoul: *Reviewing the Data from Hiroshima and Nagasaki*




48-hour Fallout Dose
0.5 rem
5 rem
50 rem
150 rem
450 rem
600 rem
Seoul
Attacking Nuclear Weapon: 15 kt
Height of Burst: Ground Burst
Potential Casualties: 1.25 Million
2 0 2 4 6 8 Kilometers


48-hour Fallout Dose
0.5 rem
5 rem
50 rem
150 rem
450 rem
600 rem
Seoul
Attacking Nuclear Weapon: 15 kt
Height of Burst: 100 Meters
Potential Casualties: 840,000
2 0 2 4 6 8 Kilometers



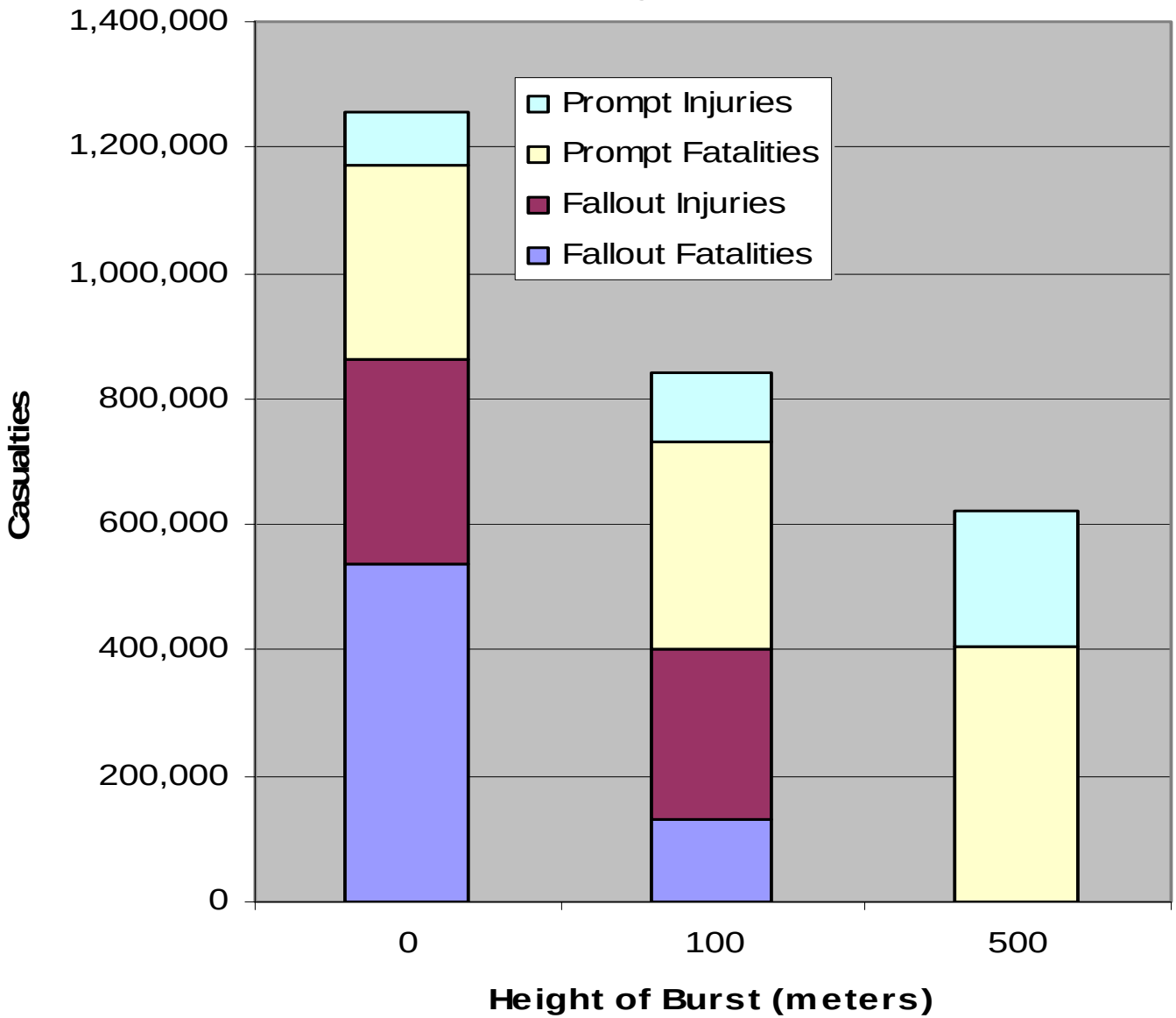
Seoul

Attacking Nuclear Weapon: 15 kt

Height of Burst: 500 Meters

Potential Casualties: 620,000

Calculating a Hypothetical Nuclear Attack on Seoul:
HPAC Casualty Calculations



Seoul: Discussion

- Because of the higher population density of Seoul (2004) versus Hiroshima and Nagasaki (1945), predicted casualties for the same kind of nuclear attack (air burst) are as much as six times worse;
- If the attacking nuclear weapon were a ground burst producing fallout, predicted casualties could be more than ten times worse and damage to South Korea would include widespread contamination.

Conclusions

- Development of nuclear weapons by North Korea and development of EPNW by the United States are destabilizing, dangerous and could lead to their use.
- While not demonstrated here, it would appear that underground aircraft parking areas and navy caves can be defeated by conventional means.
- These potential targets could also be defeated using existing surface burst nuclear weapons. The casualties from earth penetrator weapons will be greater than surface burst weapons of the same yield.
- The only sensible alternative is a diplomatic resolution of the nuclear crisis on the Korean peninsula.


SHINDAND AIRFIELD AIRCRAFT, AFGHANISTAN
POST STRIKE
DS341826