

I&A



PLAN Type 094 SSBNs at Huludao

Editor's Comments

This month, *I&A* presents two articles making extensive use of imagery analysis techniques to collect data. The first article, authored by frequent *I&A* contributor Raj Kumar, focuses on PLA airborne surveillance aircraft, including AEW&C and ELINT platforms. When reading the article, note the often-subtle differences that identify specific variants of a given aircraft.

The second article exploits satellite imagery and open-source information to make sense of the status of China's expanding Type 094 SSBN force. While the results are inconclusive beyond a certain degree, the article highlights how the analysis of imagery over time allows the researcher to gather pertinent information.

Finally, a Tech Notes feature introduces Russia's new RVV-BD long-range AAM, the export variant of a weapon intended for the PAK-FA. If the weapon develops into an export success, Western air arms may require a rethinking of ISR and support aircraft deployment in wartime.

Sean O'Connor

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Current Events

Varyag Begins Sea Trials

Sean O'Connor

In the early morning hours on 9 August 2011, the former *Varyag* left its berth at Dalian and headed for open water. The vessel returned to Dalian on 14 August after completing the first at-sea trials of an aircraft carrier in PLAN history.

While the ex-*Varyag* resides once again in Dalian for post-trials maintenance and evaluation, the importance of the brief, six-day excursion cannot be underestimated. Taken at face value, the beginning of the ex-*Varyag*'s sea trials only represent the next step in preparing the vessel for service with the PLAN. For the first time in history, however, China is on the verge of obtaining legitimate blue-water power projection capability. A carrier modeled on the ex-*Varyag* represents a significant defensive asset capable of protecting combined arms operations far from Chinese home waters.

Whether or not China chooses to deploy its future carrier force in a power-projection capacity remains speculation. The pieces are present to create a suitable CVBG centered on the ex-*Varyag* or a future Chinese CV. Type 052C DDGs provide a credible AEGIS-style defensive umbrella, with Type 093 or future Type 095 SSNs available for ASW escort. Furthermore, the PLAN is gaining experience with extended out-of-area (OOA) operations by conducting anti-piracy deployments off the Horn of Africa (HOA).

As China begins construction of new CVs and works up its first carrier air wing, the ex-*Varyag*'s sea trials provide a high visibility reminder of the PLAN's modernization efforts underway since the turn of the century. The potential of a well-defended Chinese CVBG operating in the Western Pacific is surely to have an impact on force structures and future planning considerations for Japan, the ROK, and the US Pacific Fleet, not to mention Taiwan.

Tech Notes

The RVV-BD

Sean O'Connor

At the MAKS 2011 airshow and defense exposition, held at the Gromov Flight Research Institute in Zhukovskiy, GosMKB Vypel displayed the next-generation RVV-BD long-range AAM. The RVV-BD is part of a new three-missile family also containing the short-range RVV-MD and medium-range RVV-SD.

The RVV-series weapons all represent modifications or upgraded variants of former Vypel designs. All RVV-series weapons represent export models, and are associated with the Sukhoi PAK-FA. Native designators remain unknown for the Russian AF variants.

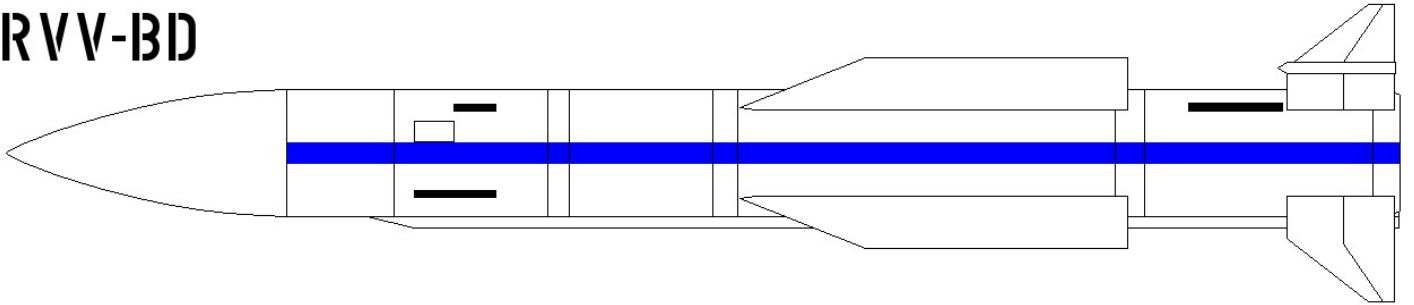
The RVV-MD is an enhanced R-73 (AA-11 ARCHER), incorporating a two-color IR seeker and an extended range of 40 kilometers. The RVV-SD is an enhancement of the RVV-AE (AA-12 ADDER) featuring a range expanded to 110 kilometers.

Contrary to current reporting, the RVV-BD does not represent a new variant of Vypel's R-33 (AA-9 AMOS), unsuccessfully offered for export as the R-33E. Rather, the RVV-BD closely resembles the R-37 (AA-X-13 ARROW), a weapon formerly associated with the MiG-31M (FOXHOUND-B). The R-37 represented the proposed follow-on to the MiG-31's R-33, although the native RVV-BD is not necessarily limited to MiG-31 carriage.

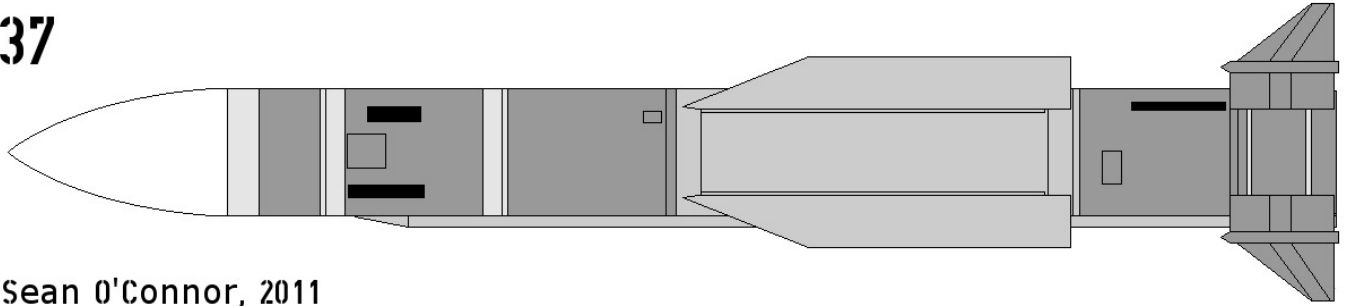
The RVV-BD as displayed at MAKS 2011 features a pair of folding rear fins, a configuration similar to that noted on the MiG-31's R-33 allowing for semi-conformal carriage. This feature implies that the native RVV-BD remains intended for MiG-31 carriage, likely forming part of the upgraded MiG-31BM's armament suite replacing the R-33 and R-33S (AA-9B AMOS).

Employment of the native RVV-BD on the PAK-FA appears technically feasible, provided the weapon is equipped with a

RVV-BD



R-37



(C) Sean O'Connor, 2011

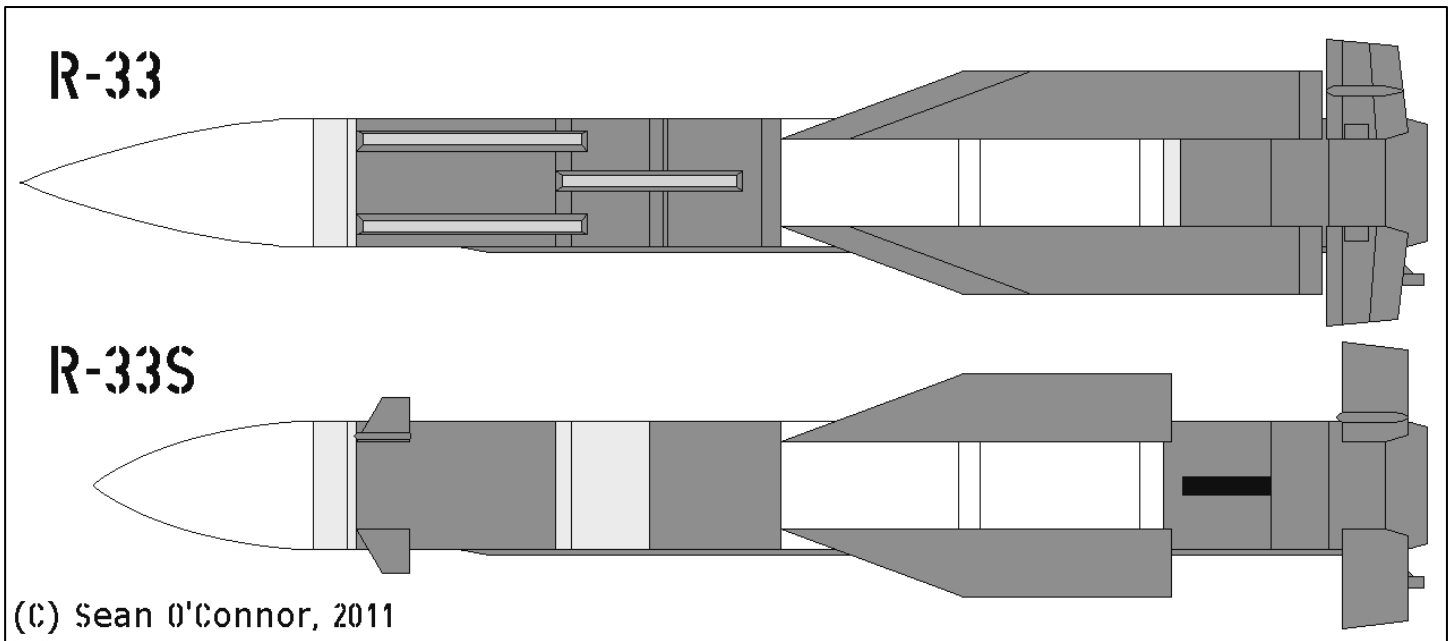
second pair of folding rear fins. The size of the PAK-FA optimized variant represents a potential design driver governing the size of the PAK-FA's two centerline weapons bays. Each bay appears sized to accommodate a pair of RVV-BD size AAMs, or alternatively a greater number of folding-fin R-77 derivatives.

The export-centered RVV-BD boasts a range of 200 kilometers, with an altitude reach of 25,000 meters. The missile employs active radar homing (ARH) and features a dual-mode solid rocket motor. While the range capability falls short of the former R-37's reported 240-300 kilometers, possibly attributed to reduced capability in the export weapon, the engagement envelope of the RVV-BD nevertheless remains the largest in the worldwide AAM export market.

The RVV-BD represents an extremely lethal weapon in a modern air combat environment. While reportedly capable of defeating a target maneuvering at 8Gs, the range of the RVV-BD provides a potential capability to engage ISR and support aircraft operating well beyond the front lines. As such, the RVV-BD represents a competitor to the longer range Novator K-100 BVR AAM, a weapon under development for nearly two decades and currently linked to the Indian Air Force as a future Su-30MKI (FLANKER-H) option.

The display of the RVV-BD at MAKS 2011, along with the public unveiling of the R-33S at Kubinka AB in 2009, provides an opportunity for speculation as to the R-37's development path. The R-33S, produced in response to the Tolkachev spy scandal of the 1980s, features a modified R-33 profile trending heavily towards the R-37 design. The R-37 began development in the early 1980s, with the R-33S following in the late 1980s. In light of the similarities between the two weapons, the R-37 design likely influenced the R-33S.

The R-33S features slimmer tail control surfaces with repositioned hinges on the upper pair, and abbreviated mid-body wings similar to those found on the R-37. Additionally, the modified guidance package necessitated the incorporation of canard surfaces behind the radome, potentially conferring a slight increase in maneuverability to the weapon. The radome itself appears blunter in profile, resembling that fitted to the R-37 rather than that of the R-33. The R-33's prominent warhead fusing assemblies are also absent on the R-33S. Various sources speculate on the guidance system employed by the R-33S, claiming either semi-active radar homing (SARH) as fitted to the R-33 or ARH, and often credit the R-33S with a small range increase over the R-33.



The R-37, in comparison, resembles an R-33S airframe modified with new tail control surfaces and slightly reprofiled mid-body wings. In contrast to the R-33 and R-33S, all four tail control surfaces on the R-37 fold for external carriage. This arrangement allowed the MiG-31M to mount six weapons under the centerline; a lack of folding surfaces would prevent a centerline weapon from launch if an adjacent weapon suffered from a failure.

Air Defense

The PLA's Airborne Surveillance Platforms

Raj Kumar

Today, the World is taking notice of the paradigm shift in its policies: from emphasis on defense to primacy of offense, from combined operations to joint operations. It clearly indicates the shift in aspirational levels from regional to global supremacy. In the early 1990s, the PRC set a goal for itself to become a super power by 2030. The PRC seems to be well on its path of achieving its goal.

The PLA translates this historic policy shift into bolstering its defensive as well as offensive capabilities over land, air, sea and under water. The PLA now focuses on joint operations to win small-scale regional conflicts, incorporating a highly information-saturated

environment. The PLAN has extended its reach by manufacturing indigenous SSBNs and refitted a former Soviet CV. The PLAAF needs to possess the reach to protect disputed offshore island territories and achieve a global capability.

Operationally, the PLAAF aims to extend its reach and its lethality in order to enable the joint operational concepts the greater PLA is adopting as it thinks through how to fight and win high-tech 21st century wars. In order to enhance the operational reach of the PLAAF and enable some of the new key doctrinal concepts that operational planners are working with, the air force has been fielding a variety of advanced multirole combat aircraft. In the last decade, the PLAAF introduced air-refueling capability and demonstrated its first stealth fighter, and is in the process of creating a substantial air defense system by fielding modern missiles, OTH radars and an aerial platform for its EW assets. The fulcrum of PRC airpower flows from the unmatched reach provided by AEW&C aircrafts.

This various airborne surveillance platforms of the PLA, especially the Y-8 series of aircraft known as GaoXin or High New program, can be difficult to identify in imagery. The examination and analysis of satellite imagery vividly displays that shadows are the

best friends of imagery analysts. The analyst needs only to know the small nuances that can be identifiable on satellite imagery to distinguish between various types of the same aircraft.

Organization

The PLAAF traditionally concentrates solely on the defense of China, but is currently expanding its scope to protect China's interests beyond its borders. Since the 1990s, China has largely shaped its modernization efforts around Taiwan, but the PLAAF is beginning to look at scenarios involving Japan, India and the South China Sea.

Much like the PLA as a whole, the PLAAF has been undergoing significant change over the past decade, transforming itself from a poorly equipped and trained organization into an increasingly capable fighting force. Dramatic changes have occurred, and continue to occur, in the areas of mission, organizational structure, personnel, education, training, and equipment. Transformation in the PLAAF began with a change in mission and expectations from a force focused on territorial air defense to a force with growing regional strike missions and capabilities, and now having long-term expectations of being able to perform extra-regional missions supporting the PRC's national objectives.

The PLAAF is organized into seven Military Region Air Forces (MRAFs) with 14 subordinate command posts:

- Beijing MRAF
 - Datong CP (former 10th Air Corps)
 - Tangshan CP
- Chengdu MRAF
 - Kunming CP (former Kunming Base)
 - Lhasa CP
- Guangzhou MRAF
 - Nanning CP (former 7th Air Corps)
 - Wuhan CP (former Wuhan Base)

- Jinan MRAF
 - No command posts or former air corps or bases

- Lanzhou MRAF
 - Hetian CP
 - Wulumuqi CP (former 9th Air Corps)
 - Xi'an CP (former Xi'an Base)

- Nanjing MRAF
 - Fuzhou CP (former 8th Air Corps)
 - Shanghai CP (former Shanghai Base)
 - Zhangzhou CP

- Shenyang MRAF
 - Changchun CP (former 1st Air Corps)
 - Dalian CP (former Dalian Base)

The PLAAF provides very little public information about its electronic countermeasures specialty troops. According to the PRC's white paper titled China's National Defense for 2008, "[u]nder each air command at the military area command level are aviation divisions, ground-to-air missile divisions (brigades and regiments), antiaircraft artillery brigades (regiments), radar brigades (regiments), ECM brigades (regiments and battalions), and other specialized service units." Therefore, the PLAAF organizes them into brigades or regiments, each of which has subordinate battalions. The PLAAF formed its first ground-based ECM units in the early 1970s and aviation ECM units in the 1980s. The PLAAF re-designated these units as specialized technical units in the 1990s.

The PLAAF's Headquarters Department has a subordinate Electronic Countermeasures and Radar Department that is responsible for providing guidance to all PLAAF radar and ECM units. ECM officers receive their cadet training at the PLAAF Radar College or the Telecommunications Engineering College. In addition, the Air Force Equipment Research Academy in Beijing has a subordinate Air Force Radar and Electronic Countermeasures Research Institute.

Operational Employment

The purpose of any airborne surveillance platform is to provide surveillance over land, air, sea and under water. It can also serve as a C4ISR platform with adequate equipment on board to become a true force multiplier. The employment envisaged for the PLA's platforms are:

- (a) Support nuclear strategy.
- (b) Global status of AF.
- (c) Command and control centre.
- (d) Air dominance of the battle area.
- (e) Air space management.
- (f) Monitoring air and naval activity

of other countries.

Adequacy

At least six AEW aircraft are required to maintain a single orbit surveillance mode and generate 24 hours of continuous surveillance over a particular zone of operation. The PRC has at least five zones of conflict in the north (Japan & ROK), east (Taiwan), and south (SLOCs & Island territories), as well as regional focuses on India and Russia. Thus, the PRC needs 30 AEW aircraft for a single orbit surveillance mode. It is evident that PRC does not intend opening all fronts at the same time, at least for the time being. The sale of AEW aircraft to foreign countries suggests that the PRC either has met its domestic requirements or is trying to boost funding through these sales.

Early Programs

Early AEW development work involved a Russian Tu-4 (BULL) airframe, which is presently in the PLA's Datangshan Museum. The Tu-4 was itself a Soviet clone of the American B-29 Superfortress. Later, SH-5 aircraft performed various tasks including maritime surveillance. At least one Y-7 aircraft on display in Datangshan features rear fuselage fairings suggesting its use for surveillance (ECM/ESM) purposes.



The Tu-4 AEW test platform at the PLA's Datangshan Museum (Google Earth)

Following the failure of talks for Israeli Phalcon surveillance systems, PRC leadership vowed to acquire similar technology on their own within a decade. Considering the timeframe for development of a new program and gestation period, in all probability PRC has used reverse engineering to cover the huge time lag. The CFTE produced the first KJ-2000 AEW with a rotodome similar to the Phalcon, employing an IL-76 (CANDID) airframe. The first flight took place in 2003 and shortly thereafter, the aircraft appeared in a satellite image of Nanjing's Dajiaochang-Yuxikou Air Base.



KJ-2000 in flight captured in January of 2005 near Dajiaochang-Yuxikou AB (Google Earth)

Testing

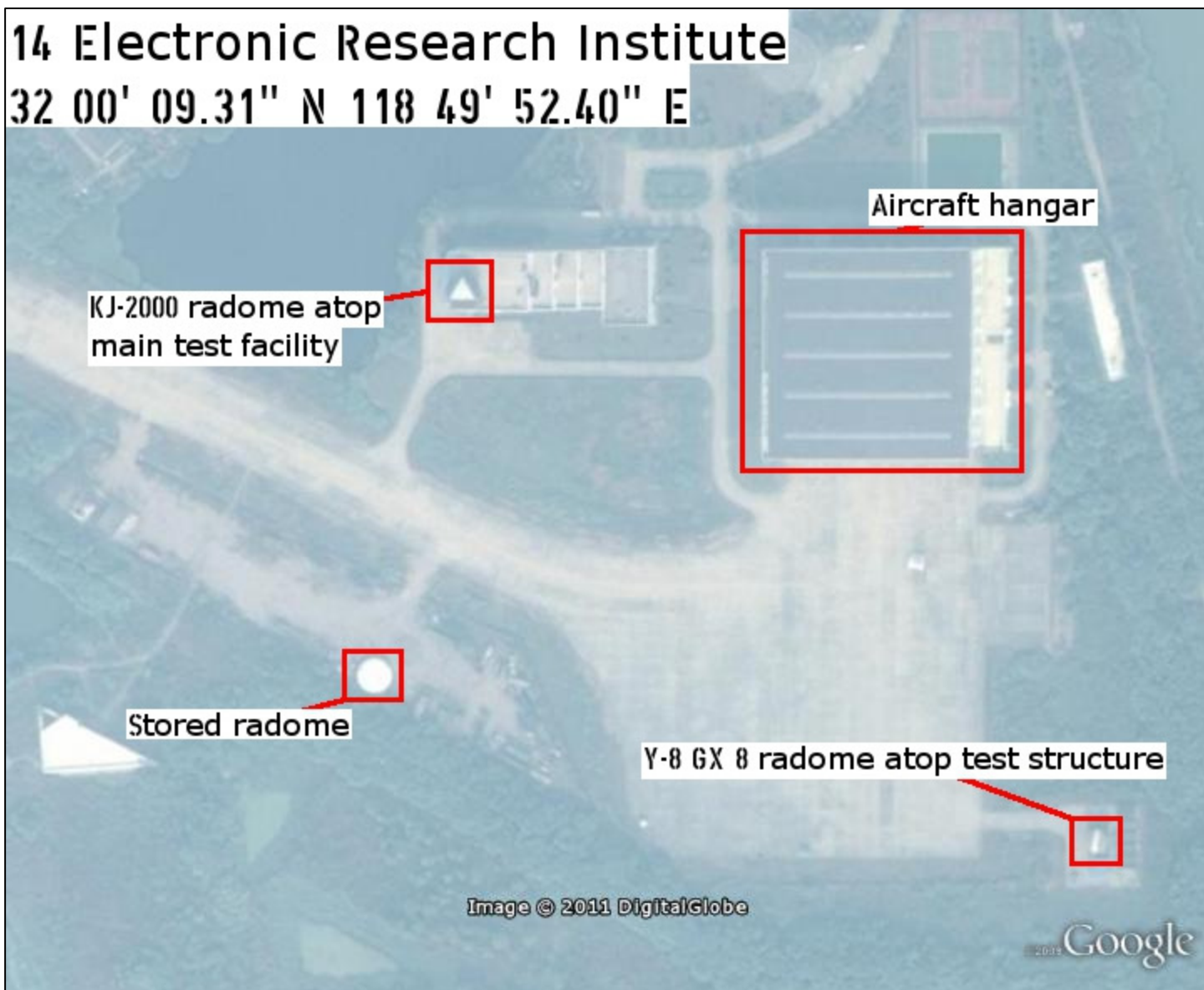
Testing for airborne surveillance platforms occurs at a number of places. Unmistakable evidence appears at the Nanjing Research Institute of Electronic Technology (also known as 14 Electronic Institute). Three rotodomes of different sizes, probably containing different types of radars, carried out testing on various types of targets including under water targets of different shapes. Through temporal analysis of this facility, it is apparent that research and development activity at this facility proceeded at a very hectic pace. Various facilities at Xian-Yanliang, Hanzhong, and Nanjing suggest the PRC's seriousness about its AEW program. The various types of AEW aircraft observed

suggest that the entire gamut of electromagnetic spectrum and complete operational requirements of all three services of the PLA have been adequately covered in totality.

The KJ-2000's radar is probably an indigenous electronically steered phased array (ESA) radar developed by Nanjing Research Institute of Electronic Technology. Unlike the Russian A-50 or U.S. E-3, which rotate their rotodomes to give 360-degree coverage, this rotodome does not rotate. Instead, three ESA antenna modules are placed in a triangular configuration inside the round radome at 60 degrees to each other to provide 360-degree coverage. Another one trialed at this location is probably a two phased ESA like ones used

14 Electronic Research Institute

32 00' 09.31" N 118 49' 52.40" E



in E-2 aircrafts. These Chinese manufactured radar systems could be similar in design to the Israeli Phalcon or US systems, but are not considered as capable.

Xian Aircraft Corporation (XAC) is supposedly responsible for converting existing IL-76MD transport jets into KJ-2000s for the AWACS role. There are new IL-76 aircrafts observed at the XAC's Xian-Yanliang Airbase. One such aircraft has a square base probably for the rotodome strongly suggesting the use of mechanically steered phased array radar on this aircraft.



Possible IL-76 awaiting KJ-2000 conversion at Xian-Yanliang in April 2006 (Google Earth)

Various Aircraft

KJ-2000: The KongJing-2000 (KJ-2000) is the first airborne warning and control system (AWACS) in service with the PLA Air Force, with four examples commissioned between 2006~07. The aircraft is outfitted with indigenous ESA radar in a rotodome on top of the fuselage. The aircraft at Nanjing are also observed to have special ventral stabilizers under the rear fuselage. Open source information claims that the aircraft's maximum flight range is 5,000 km and the flight endurance is 7 hours 40 minutes. This translates into six hours of patrol time considering a flight time of 50 minutes to the patrol area.



KJ-2000 on the ramp at the 14 Electronic Research Institute (Google Earth)

Y-8 GX 1: The "GaoXin 1" or "High New 1" project is an electronic warfare (EW) and electronic intelligence (ELINT) aircraft believed to be carrying equipment for electronic attack with VHF/UHF jammers. The aircraft's rear fuselage is widened to contain extra equipment and has had the rear loading ramp removed and replaced by an array of electronic equipment antennas. Two such wide rear fuselage aircrafts have been identified with a rear fuselage width of 4.5m.



Two probable Y-8 GX 1 airframes at Hanzhong AB (Google Earth)

Y-8 GX 2: The "GaoXin 2" or "High New 2" project is a maritime surveillance aircraft. It

is identified by the large semi-spherical radome on top of the fuselage attached to the vertical tailfin, probably used to house electronic equipment antennas including SATCOM.



Two Y-8 GX 2 airframes at Tuchengzi AB (Google Earth)



Three Y-8 GX 2 airframes at Laiyang AB (Google Earth)

Y-8 GX 3: The “GaoXin 3” or “High New 3” project is a communication relay aircraft designed to facilitate air/ground communications in the battlefield. The aircraft probably serves as a communication center in an integrated C4ISR environment to connect the ground forces commanders with combat aircrafts and other assets during any joint operation. The aircraft features a large semi-spherical radome located on the back of the fuselage, which possibly houses a satellite

communication (SATCOM) antenna. Some experts believe the aircraft will be used as an airborne command post.



Y-8 GX 2 airframe at Dajiaochang-Yuxikou AB (Google Earth)

Y-8 GX 4: The “GaoXin 4” or “High New 4” project is an EW aircraft designed for standoff electronic countermeasures (ECM) operations. The aircraft features two large cheek fairings, along with two smaller square fairings protruding outwards slightly ahead of the cheek fairings. The aircraft supposedly carries ECM equipment for jamming enemy radar and communications over a long distance, to assist in the suppression of an enemy’s air defenses. At least three of these aircraft have been identified at Dajiaochang-Yuxikou Air Base.



Two Y-8 GX 4 airframes at Dajiaochang-Yuxikou AB (Google Earth)

Y-8 GX 5: The “GaoXin 5” or “High New 5” project is also known as the Kongjing – 200 or KJ-200. It is dubbed ‘Balance Beam’ because of the radar it carries on top. The radar is a linear-shaped active electronically steered array (AESA) radar purportedly similar to the Swedish Ericsson PS-890 Erieye.

The latest versions are based on aircrafts with four turboprop engines featuring six-bladed propellers. The mission equipment pods on the wing tips and the nose increase the wingspan and length of the aircraft by almost two meters. The vertical stabilizer tip also has a pod that can be identified from its shadow. The aircraft also has two additional vertical stabilizers, one on each end of the standard horizontal stabilizer, to reduce directional instability caused due to aerodynamic drag and turbulence created by the ‘Balance Beam’.



Two Y-8 GX 5 airframes at Hanzhong AB (Google Earth)

Y-8 GX 6: The “GaoXin 6” or “High New 6” project is a specialized aircraft for antisubmarine warfare (ASW). The aircraft features a 6m long tail boom containing a magnetic anomaly detector (MAD). There are two aircraft observed at Kaifeng AB.



Two Y-8 GX 6 airframes at Kaifeng AB; the airframe on the left appears to be undergoing maintenance on the inboard engines (Google Earth)



Two Y-8 GX 7 airframes at Dajiaochang-Yuxikou AB (Google Earth)

Y-8 GX 7: The “GaoXin 7” or “High New 7” project is the SIGINT, electronic attack and psychological warfare aircraft using the most heavily modified version of the Y-8 series. It features two large plate antenna arrays protruding from each side of the rear fuselage, a large radome located on top of the fuselage and a pair of electronic antennas attached on the vertical stabilizer. The aircraft also features two large cheek fairings under the front fuselage. It is available to commanders for localized targeting of specific avenues of communication. Missions are flown at the

maximum altitudes possible to ensure optimum propagation patterns. Secondary missions include command and control communications countermeasures (C3CM) and limited SIGINT gathering.

Y-8 GX 8: The “GaoXin 8” or “High New 8” project is the old rotodome version based on the Y-8C airframe. The latest version, supposedly for export only, features six-bladed turboprop engines with wingtip mission pods. One example sold to Pakistan was designated ZBD 03K. This version again is at least 2m longer in wingspan. The aircraft is similar to the KJ-200 and also has two additional vertical stabilizers. Two of these aircraft have been identified, at Hanzhong AB and Xian-Yanlinag AB. The aircraft at Hanzhong can easily be identified as having six-bladed turboprop engines in satellite imagery.



Y-8 GX 8 airframe at Hanzhong AB (Google Earth)

Y-8 J-I: This is one of the projects of the CFTE for a Radar Electronic Testbed (Experiment) Aircraft featuring the Skymaster radar in the nose cone. The Skymaster radar is based on the earlier version of the Search Water Radar. This aircraft is likely to be used for ground, maritime surveillance and AEW. Some sources claim this aircraft to be having the capability of detecting ASHMs.

Y-8 X: This aircraft is rarely talked about. The X stands for Xun meaning search

or surveillance. This aircraft features two white strips on top of the fuselage containing SAR antennae. The SAR antennae on top strongly suggest that these are probably not for ground or water surveillance but for tasks like missile tracking.



Two Y-8 X airframes at Laiyang AB (Google Earth)



Three SH-5 airframes at Qingdao (Google Earth)

ShuiHong – 5 (SH – 5): The SH-5 (Shuishang Hongzha-5 or ShuiHong-5) is the amphibious aircraft developed by Harbin Aircraft Manufacturing Corporation (HAMC) in the 1980s. As its name implies, the aircraft was originally intended for anti-surface and anti-submarine warfare, but lack of suitable weapons resulted in only five aircrafts being built for maritime patrol and surveillance role. The aircraft features a black prominent tail boom MAD. During the 1990s, the MPA role was sidelined for unknown reasons and the

aircraft used for firefighting purposes. Presently it is yet again active in MPA role. Due to its unpressurised cabin and four underpowered turboprop engines, it is only suitable for low- to medium-altitude flights. Thus it can only be used in ASW mode within territorial waters.



Two Tu-154 airframes at Beijing-Nanyuan AB; note ventral SAR fairing (Google Earth)

Tu – 154M/D: This is an ELINT aircraft based on Tu-154M/D (CARELESS) airframe. Currently, the Tu-154M/D jets are equipped with ELINT systems and possibly synthetic aperture radar (SAR) for ground mapping purpose. The Tu-154M/D is believed to be the most sophisticated airborne ELINT/surveillance platform in service with the PLAAF to serve as a ‘force multiplier’ to increase the effectiveness of the PLAAF combat aircraft in an offensive air campaign.



Two 737-300 airframes at Beijing-Nanyuan AB; note radome atop forward fuselage (Google Earth)

Boeing 737-300: This project is still an enigma as to the purpose of the aircraft. Some experts believe it is a VIP aircraft with C4ISR

equipment on board and others say that it is a missile tracking aircraft. The only identifiable difference from a baseline Boeing 737 is that this aircraft has a radome on the top front of the fuselage.

Learjet: This business jet aircraft was purchased by PRC from the United States in April 1984. This aircraft was to be operated by the then Civil Aviation Administration of China (CAAC) for surveying, mapping and flood monitoring roles, but in reality it was flown by the PLAAF for the tactical reconnaissance role. One such aircraft was displayed at Dingxin AB.



Learjet displayed at Dingxin AB in March 2006 (Google Earth)

Y-5: There are a few Y-5 aircraft observed with special features with two specifically identified with tail boom MAD sensors. These could be suggestive of trials for an ASW platform for the CV. The Y-5’s extraordinary slow-flight and STOL capabilities make it supremely suited for short, unimproved fields, and have also been built to withstand cold weather and other extreme environments.



Y-5 with tailboom located at Hanzhong AB (Google Earth)

Y-7: There is one Y-7 with 'Balanced Beam' radar mounted on top located at Hefei. This is likely the trial version, which was not successful. Recently, the internet has been abuzz with rumors of Y-7 being trialed with a rotodome for the CV. Some evidence of Y-7 trials have been observed near Beijing.



Y-7 Balance Beam airframe displayed at Hefei (Google Earth)

UAVs: There are only three UAVs identified positively on satellite imagery at this date. The range and endurance of these UAVs is yet to be confirmed. The recent UAV crash near Huining, Xingtai County, Hebei suggests that it was either on a relay control mode or controls were being transferred from one station to another. This is merely a speculative assessment since most of the known UAV bases are quite distant from the crash site.



AVIC Sky Wing UAV at Dingxin AB (Google Earth)



Unidentified UAV located at Xian-Yanliang AB (Google Earth)



Unidentified UAV located at Chengdu (Google Earth)

Conclusion

The strategic importance of an airborne surveillance platform emanates from its capability to perform multiple tasks simultaneously and integrate them into the command and control apparatus for easy and quick decision making. The PRC is testing AEW/AWACS designs with different radar arrangements (rotodome, fixed dish radome phased array radar, and 'balance beam'-style electronically scanned array radar) and is testing them on variety of targets including under water targets; reflects its serious intention to develop a modernized AEW&C capability.

In the last decade, PRC AEW platforms have evolved and developed enormously its ability to perform variety of functions like surveillance, EW, ECM, ESM TBA management and above all C4ISR over an unmatched reach. Although the deployment is difficult to assess due to small fleet of surveillance aircraft, they are mainly observed in Jinan, Guangzhou and Shanxi suggesting coverage of ROK, Japan and Taiwan zones. The dispersal is probably to avoid detection and targeting. The PRC is yet to come out with a CV-based AEW platform to further enhance its maritime reach. The AEW programs observed in nascent stages seem to be quite advanced in technology. The entire airborne surveillance program projects an offensive policy of the PRC. These platforms will make PRC airspace impregnable to most of the regional air forces. The region is worried about the quick pace of progress as the PRC is modernizing its airborne surveillance platforms, which is surely tilting the balance of power in PRC's favor.

Strategic Warfare

Assessing China's Type 094 SSBN Force

Sean O'Connor

The first example of China's second SSBN, the Type 094 (JIN), launched in 2004 and began sea trials in 2005. The Type 094 represents a substantial improvement over the earlier Type 092 (XIA) class in terms of quieting and reach, with the JL-2 (CSS-NX-14) SLBM often credited with the capability to strike US soil from protected Chinese waters, a marked improvement over the first-generation JL-1 (CSS-N-3) SLBM employed by the Type 092.

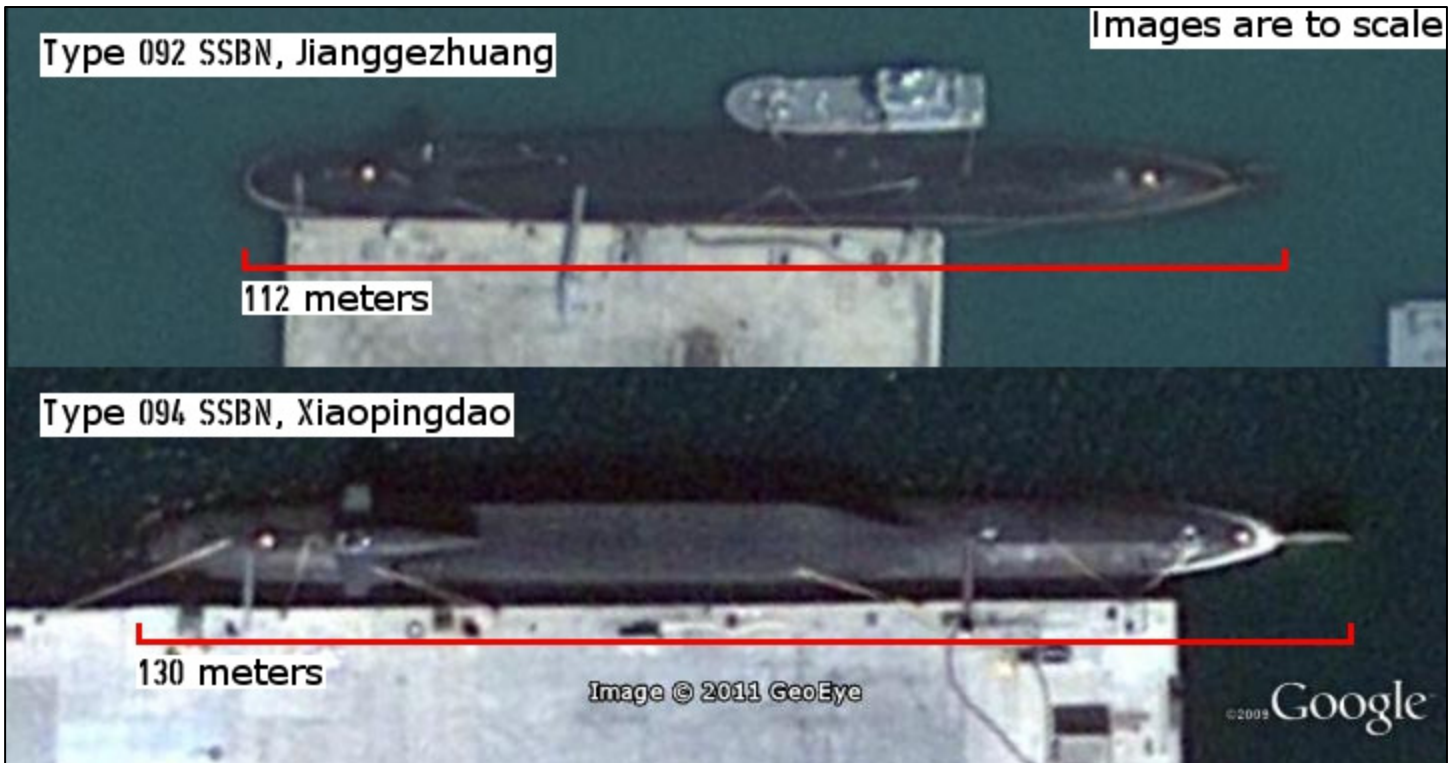
While photographs of the Type 094 are available online, the lack of hull numbers makes an accurate estimation of current Type 094 fleet strength, to include hulls both commissioned into service and undergoing trials prior to service entry, difficult to assess. For example, the DoD's 2011 report to

Congress on China's military power suggests that one hull is currently operational, while a 2011 report produced by the Congressional Research Service indicates that China commissioned two hulls, one in 2007 and one in 2009. An analysis of historical imagery, coupled with evidence found in some of these photographs, permits the generation of such an assessment.

Bohai Shipyard No. 431 in Huludao produces the Type 094 SSBN. Type 094 SSBNs appear in satellite imagery and handheld photography at Huludao, Xiaopingdao, Jianggezhuang, and Yulin, the latter two locations representing operational PLAN bases in the North Sea Fleet and South Sea Fleet, respectively.

Type 094 sightings in imagery following 2004 launch

Huludao			
Imagery Date	Number	White	Red
Oct 2005	0	0	0
May 2007	2	0	2
Mar 2010	2	1	1
Xiaopingdao			
Imagery Date	Number	White	Red
Nov 2004	0	0	0
May 2005	0	0	0
Sep 2006	1	0	1
Oct 2006	1	0	1
May 2007	0	0	0
Mar 2009	1	0	1
May 2010	0	0	0
Oct 2010	1	0	1
Mar 2011	2	1	1
Yulin (South Sea Fleet)			
Imagery Date	Number	White	Red
Jan 2006	0	0	0
Dec 2007	1	1	0
Feb 2008	1	1	0
Sep 2008	0	0	0
Jan 2009	0	0	0
Jul 2009	1	N/A, handheld photograph	
Jun 2010	0	0	0
Feb 2011	0	0	0
Jianggezhuang (North Sea Fleet)			
Imagery Date	Number	White	Red
Apr 2004	0	0	0
Nov 2004	0	0	0
Dec 2007	0	0	0
Apr 2009	0	0	0
Aug 2010	1	0	1
Mar 2011	0	0	0



The preceding data table depicts instances where Type 094 hulls appear at the four facilities known to accommodate the type. Imagery from Google Earth as well as other online sources provided the data. The Type 094, despite a superficial similarity to the Type 092, is easily distinguishable due to its greater above-water length.

One feature of the Type 094 visible in satellite imagery is the waterline. The waterline wraps around the hull from the bow sonar dome, crossing the tail between the turtleback SLBM housing and the vertical control surface. Type 094 hulls currently identified feature either a white or a red waterline. March 2010 imagery of Huludao depicts two hulls, with both waterline colors visible, indicating that the PLAN is not necessarily repainting the waterline prior to or following service entry. As such, the waterline color, coupled with an analysis of hull movements between the trials location and operational bases, provides a dataset for analyzing overall fleet strength.

Beginning with Huludao, May 2007 imagery depicts two hulls with red waterlines. The northern red lined hull has an access door open at the rear of the missile fairing,

potentially indicating the location of the reactor. The other hull is sitting lower in the water, implying a heavier internal load possibly related to the inclusion of service-related equipment not necessary for sea trials. March 2010 imagery apparently depicts the same red lined hull with the open compartment, along with a white lined hull.



Type 094 hulls at Huludao (Google Earth)

To create a complete picture of Type 094 activity, it is necessary to analyze hull

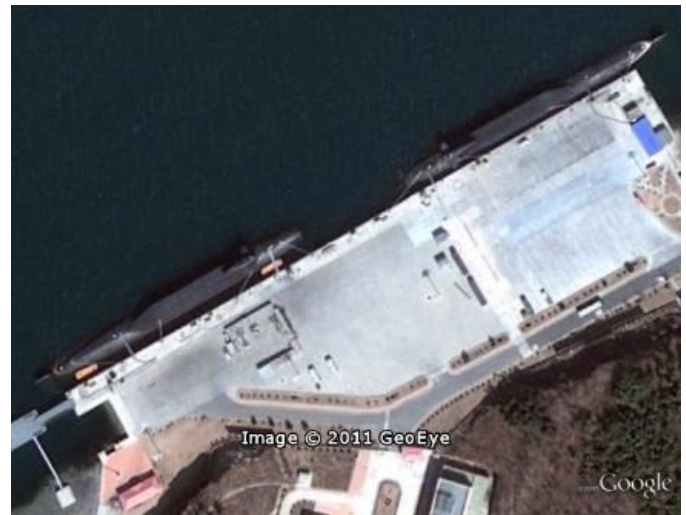
movement. Open source reporting indicates that the first Type 094 hull commenced sea trials in 2005, for a 2007 service entry. This corresponds with the appearance of a white lined hull at Yulin in late 2007. Various sources report that Yulin is the permanent home to a Type 094 hull. In this light, the white lined hull sighted at Huludao in March of 2010 may represent a fourth Type 094 hull. The southern red lined hull at Huludao in 2007 likely represents the second SSBN commissioned in 2009, and imaged at Jianggezhuang in 2010. In this light, the red and white waterlines may represent fleet assignments, with red lined hulls assigned to the NSF and white lined hulls assigned to the SSF.

Based on analysis of the available source material, one probable course of events is as follows:

1. A red lined hull (Red 1) launched in 2004, before reporting to Xiaopingdao in 2006 for JL-2 SLBM work following sea trials.
2. A white lined hull (White 2) launched in 2007, and reported to Yulin late in the year to begin service.
3. A red lined hull (Red 3) launched in 2007, and Red 1 returned to Huludao. Red 3 remained at Huludao with an open compartment until 2010.
4. A white lined hull (White 4) launched between 2007 and 2010, before reporting to Xiaopingdao in early 2011.
5. Red 1 entered service in 2009, reporting to Xiaopingdao and then Jianggezhuang.
6. Red 3 completed maintenance in late 2010 before reporting to Xiaopingdao.

March 2011 imagery of Xiaopingdao likely depicts Red 3 and White 4 undergoing final sea trials and missile installation prior to service entry. This course of events suggests that four Type 094 SSBNs currently exist. At a minimum, three hulls existed by the middle of

2010: two red lined hulls and one white lined hull. The smaller figure suggests that the Yulin-based white lined hull returned to Huludao, and later transited to Xiaopingdao in 2011. This is entirely possible given the problems with the JL-2 SLBM program. Operational Type 094 hulls at Yulin and Jianggezhuang likely lacked SLBMs as the JL-2 trials program was not complete. Modification work at Huludao to accommodate any changes to the JL-2 incorporated because of the trials program is a logical course of action. If the two Type 094 hulls imaged at Xiaopingdao in 2011 represent the in-service hulls from Yulin and Jianggezhuang, it is an indicator that JL-2 trials may be complete, and the hulls are being prepared for arming.



2011 imagery depicting two Type 094 hulls at Xiaopingdao; note the different waterline colors (Google Earth)

Whatever the case may be, three Type 094 hulls launched since 2004. With a launch in 2004 (Red 1), a launch in 2007 (White 2), and a launch in 2010 (Red 3), it appears that China produces an SSBN every three years, lending credibility to the assertion that three hulls currently exist. This line of reasoning indicates that a fourth Type 094 will launch around 2013.

Ultimately, given the available information it cannot be conclusively determined if there are three or four extant Type 094 hulls at the present date. The availability of more historical imagery will

dictate whether revision of the assessment can conclusively determine if the three hulls or four hulls theory is accurate.

Links

September 2011

Sean O'Connor

The overwhelming popularity of Google Earth often prevents other useful imagery analysis applications from getting fair attention. One such program is Falcon View. The Georgia Tech Research Institute created Falcon View for the US DoD, for use as a mission planning and route analysis tool. Recently, the DoD released a sanitized version of Falcon View for public use.

Falcon View can be downloaded at the following URL:

<http://www.falconview.org/trac/FalconView>

I&A advises users to read the download and installation instructions prior to attempting to use the program. Falcon View is highly recommended, as it offers numerous features that complement Google Earth. The program is free to download and install, and will be the subject of a future Software Review piece in I&A.

Source List

September 2011

Overhead imagery courtesy of Google Earth; exceptions are explicitly noted in image captions or as image annotations. All annotations and overlays depicted on such imagery are the work of the respective article's author unless explicitly noted below.

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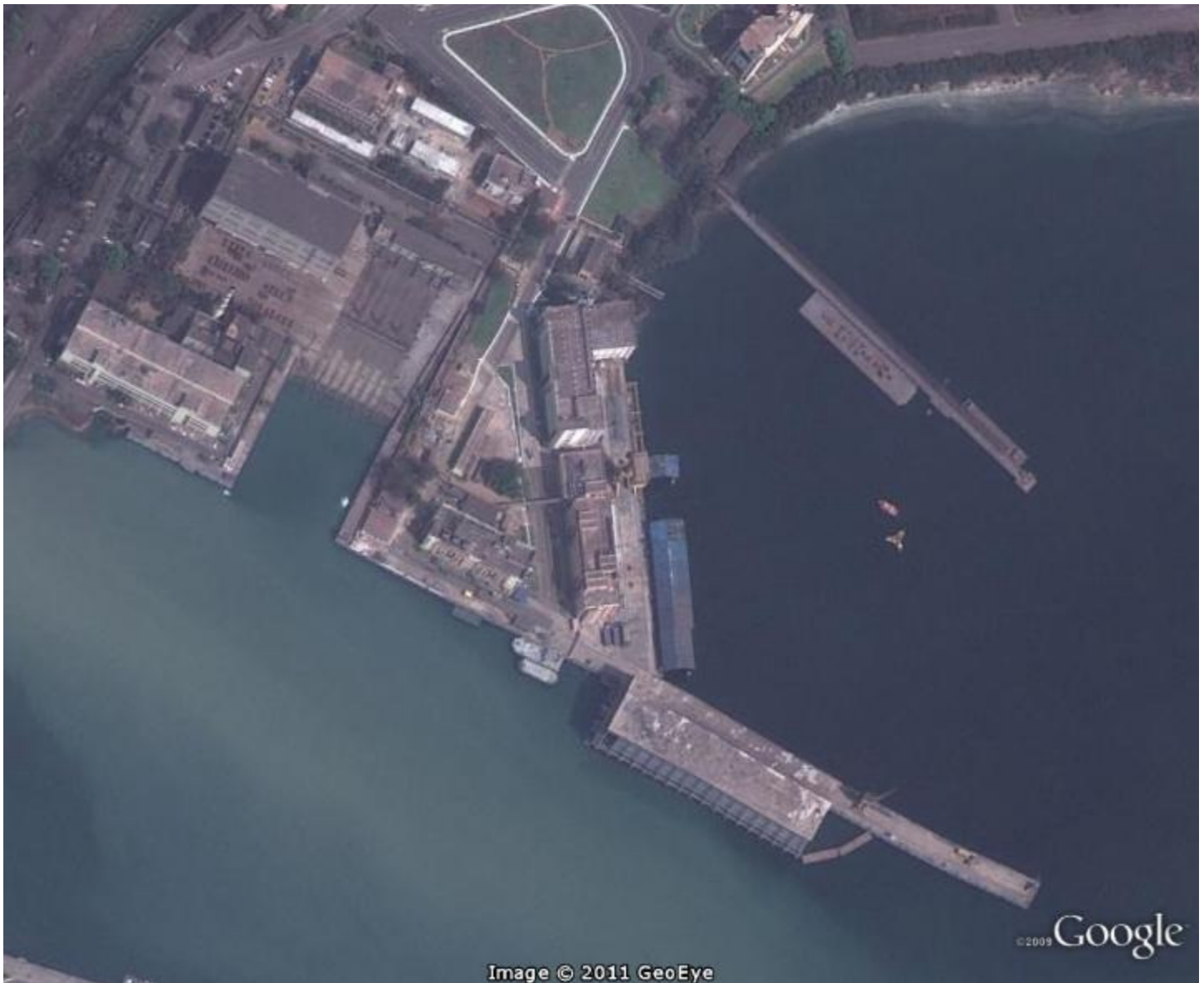
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What Is It? – September 2011

The ability to identify objects, locations, and activity in overhead imagery is an acquired skill, and like many acquired skills, it can degrade with time. Readers are encouraged to apply their analytical abilities and attempt to determine the answer to the question “what is it?”

The answer to the current “What Is It” will appear in this space next month, along with a detailed explanation of the analysis used to arrive at the proper answer.

What Is It? – August 2011

Last month’s What Is It? featured an interesting facility located southeast of Moscow near the town of Faustovo. The long, straight track present in the image is often indicative of two types of facilities: directed energy test complexes, and rocket sled test tracks. Close examination of the image illustrates an apparent earthen overrun at the northeast end of the track, a typical feature of rocket sled test tracks facilitating the recovery of the test vehicles. The Faustovo facility is famous for providing the first glimpse of Russia’s first ATF equivalent, the MiG 1.44. In 1995, an image taken at Faustovo depicted a forward fuselage mockup of the 1.44 used for ejection seat testing at the range complex.