KAMIKAZES

The Soviet Legacy

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Throughout history, despite the influence of Alfred Thayer Mahan's concepts, continental European and Asian navies have had a simple choice to make: either to create a balanced fleet to engage another balanced fleet at sea and defeat it in one or more "decisive battles" or to take an "asymmetrical approach," creating an "unbalanced" navy, able to prevent the enemy from achieving sea control and to keep one's own vital sea lines of communication (SLOCs), if one has any, untouched by the enemy's naval forces.

In the case of Russia, the era of a blue-water, balanced navy ended with defeat in the Russo-Japanese War of 1904–1905. Russia did not lose the capability to build capital ships, nor did the context for their employment evaporate. However, the war occurred in a region where Russia had little in the way of naval infrastructure—fleet bases or, more importantly, shipbuilding and repair facilities. Russia's main sources for these capabilities were (and still are) located in the European part of the country.[1] The Russian Empire, for various reasons, had insufficient strategic motivation to restore its naval strength in the Far East, nor did it until 1945, in the Soviet era. The key SLOCs for Russia after 1905 were the ones that had been established by Peter the Great on the eve of the eighteenth century: the Baltic Sea, with the Danish straits, and the Black Sea, with the Bosporus and Dardanelles. Both routes had been long used to send the main Russian exports, wheat and fur,

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to Europe. It was vital to Russia to keep these straits open, as payments for these exports filled the empire's treasury with gold and, later, solid currency.[2]

In other words, the historical background of the Russian Navy is almost the same as that of the German navy; only the names of the straits and the relevant seas differ.[3] The two countries have similar naval imperatives that involve confined and relatively shallow seas and their littorals. For this reason the asymmetrical approach to naval power struck roots deeper and stronger than those of the Mahanian balanced, blue-water-fleet approach, although the latter was occasionally important for both.

In any case, when a naval threat emerges involving an amphibious assault on home territory or the cutting of vital SLOCs close to one's shores, a navy will shift to the asymmetrical approach. The Imperial Japanese Navy (IJN), for example, from the fall of 1944, turned—although it still had a fleet of capital ships—to the clearly asymmetrical approach of suicide attacks from the sky. There was by that time no other way for the Japanese to engage the massive U.S. Navy carrier forces. It was, of course, a poor choice from the point of view of the individual human being, but it was effective from a naval tactics standpoint.

The American task forces, built around *Essex*-class carriers, had become an "air force at sea." This was not a traditional fleet, centered on capital ships and bound for decisive battle; rather, sea battle was just one of a number of tasks for this "wet air force." From one perspective, these task forces were themselves asymmetrical, pursuing a doctrine similar to the land-warfare concept of *blitzkrieg*. This point distinguished the U.S. Navy from the other two carrier navies, the Royal Navy and the Imperial Japanese Navy; its aircraft were more than extensions of ship weapons. Even today, British naval aviators see themselves as equivalents to a surface ship's torpedo or missile officers, as part of a pool of surface-fleet weapons systems. This outlook, while it defended the Royal Navy's Fleet Air Arm from the political pressure of the Royal Air Force, effectively prevented the navy from creating a floating air force of its own.[4]

By 1944 it was beyond the IJN's capability to oppose U.S. carrier task forces symmetrically, most of its ships and aircraft being on the bottom of the Pacific. The only way available to resist was to use land-based airpower to interfere with U.S. carrier operations. This interference involved not only crashing into the carriers but also, and equally important, knocking out radar-picket destroyers, deceiving carrier fighters, and fooling fighter-direction officers with primitive but effective electronic countermeasures, etc. The tactic used to accomplish these objectives was to make divided approaches with small groups of attackers, fighters, and trackers (surveillance aircraft shadowing the force), echeloned by height and bearing. It was hoped that this tactic would diffuse and neutralize

the strength of the American maritime air force, allowing the kamikazes to get through to their targets.

The key objective in the IJN kamikaze campaign was not suicide, which was just the price. Rather, the most important points were the composition and sequencing of the attack and the suppression of air defenses.

All the tasks that were valid for the IJN Tokkotai (Special Attack) units in 1944–45 were also valid for the Soviet Navy of 1955–95. They are still valid today, by extension of Dr. Samuel Huntington's argument, for the Chinese People's Liberation Army Navy, the Cuban Revolutionary Air and Air Defense Forces, the Venezuelan air force, the Pakistani air force, and the North Korean People's Army Air Force.[5]

KAMIKAZE TACTICS AND FIGHTER DIRECTION: KILL 'EM ALL

As far as we know now, the air-defense methods developed by the U.S. Navy against the kamikazes were centered on Commander John Thach's "big blue blanket" tactics, which included early-warning destroyer pickets and fighter-direction officers (FDOs), interconnected by very-high-frequency (VHF) voice radio circuits to combat air patrol (CAP) aircraft aloft.[6] Little attention was paid to the carriers' self-defense, which was provided by their own antiair (AA) batteries. In tight quarters, AA gunfire from one ship could damage another; it was almost inevitable in battles like Okinawa. Such issues were later studied by the Soviet Navy, from such data as were available—for example, damage to USS *Enterprise* (CV 6) from a screening destroyer's friendly fire in the spring of 1945.[7]

Apparently, according to available Japanese sources, kamikaze tactics originally involved low-level bombing attacks rather than the dive-bombing runs that became famous later in the war.[8] Amazingly, low-level attacks were to that date in widespread use in Allied experience, mostly in the U.S. Army Air Forces.[9] Skip-bombing and bracket bombing were in wide use in U.S. Army bombing squadrons in the Pacific and Mediterranean starting in the spring of 1942. Specially shaped bombs were developed to skip on the water's surface and hit the target from the side. In the U.S. Navy, a few seaplane patrol squadrons and (even fewer) carrier-based night torpedo squadrons used so-called masthead-level bombing.[10] The navy preferred relatively high-level approaches and the steep dives of dive-bombing. In the Japanese case, the effectiveness of low-level bombing was limited by the relatively small size of the bombs (551 pounds) carried by the main kamikaze aircraft, the A6M2 Zero. But the initial benefits of this kind of antishipping attack—that it complicated antiaircraft targeting and allowed the bomb to hit vital parts of the ship near or even below the waterline—were not forgotten. At least two U.S. ships, the escort carrier *Bismarck Sea* (CVE 95) in February 1945

and the destroyer *Twiggs* (DD 591) in June 1945, were sunk using this method, regardless of whether the bombs were dropped before the planes crashed.[11]

Nonetheless, there was a shift in kamikaze tactics from low-level to dive-bombing, because of the necessity to damage the flight decks of the target carriers. As this kind of attack can disrupt the flight operations of the ship and its air group, it was the proper approach, and the primary targeting points on the deck were highly vulnerable: elevator platforms, island superstructure, arresting gear, parked planes, and so on. The wood sheathing of the flight decks themselves, while adding to the overall combustibility caused by burning fuel and aircraft debris, were nonetheless easy to repair.[12] It is worth noting that the regular IJN dive-bombing units *(kanbakutai),* flying such planes as the D3A Val and D4Y Judy, typically used moderate dive angles, sixty degrees or less, carefully accounting for wind direction and speed. Kamikaze Zero pilots, in contrast, sometimes made near-vertical dives, though for accurate targeting they should have used less radical angles.

In addition to the bomb load—which, contrary to popular belief, was often not left attached to the plane's hard points at impact but was meant to be armed and dropped on the final stage of the suicide dive, at least for the target first attacked—there were two other damage mechanisms: the plane's engine and burning fuel from its ruptured internal and external tanks.[13] The plane's engine—torn from the plane in the crash, still hot, burning, and charged with enormous kinetic energy—could cause significant casualties to the ship's crew, as well as start fires on the hangar deck and even deeper in the hull. Also, fuel fires on the decks were hard to bring under control. So even a single hit by a well-aimed plane could be quite enough to send a carrier to the bottom or at least put it in the shipyard for months.

The greatest problems in defending against kamikaze raids, as became clear to the U.S. Navy at Okinawa, were, first, the uncertainties—the number of planes participating, their heights and directions, the presence of fighter escort—and second, above all else, coordinated sequential strikes. The only way to cope with all the possible threat combinations was to put as many fighters as possible aloft on CAP stations and distribute self-synchronized early-warning and FDO stations on ships. However, such a blanket of protection could not be established over all the forces at sea; the early-warning destroyers were often on their own. Given this fact, the Japanese could hit the radar pickets first and then go after the main targets—the carriers—through the holes created in radar coverage.

Further, even small kamikaze raids in 1945 conducted rudimentary electronic countermeasures (ECM), in the form of strips of metal foil ("window") that when dropped could produce big blips on the carriers' radars, hiding the exact location, movement, and composition of the raid. In one of the last such occasions, a little

group of four B7A2 Grace torpedo bombers, trying to hit a British task force, including the aircraft carrier HMS *Victorious,* was divided into two ECM aircraft and two attackers, carrying one 1,760-pound bomb each.

Of course, all or most of these tactical considerations were included in the Okha program, in which a shore-based medium bomber (G4M3 Betty) carried an MXY-7 glide bomb manned by a suicide pilot, powered by rocket engine, and armed with a huge, integrated warhead instead of regular bombs. Approaching the target, the kamikaze pilot climbed into his short-winged flying bomb and, when dropped from the Betty, directed it to a hit on the target ship. Although a viable concept, it was relatively unsuccessful in employment, owing to weakness of intelligence support, lack of fighter cover, low-quality assembly, and poor skills of the young, expendable pilots.[14]

Given the overall effectiveness of kamikaze units, however, it is not an exaggeration to claim that the most effective way to suppress them was to strike their airfields. Since the beginning of carrier aviation, the earliest possible attack on enemy carriers or airfields, aimed to deny the enemy the use of its aviation, had been the main priority of the carrier air group, at least in the U.S. Navy and IJN.[15] This doctrine reflected the 1920s and 1930s thinking that carrier-based fighter planes, even properly manned and directed, could not effectively fight bombers, primarily large, land-based ones but carrier-based ones too, and in that way defend their own carriers. Later in the war, when carrier fighters had proved their air-to-air capability and radar had been installed on virtually every type of ship, there was still the problem of effective fighter direction, and the more planes, friend and foe, that were in the air the worse the problem became.

But, as previously noted, all possible fighters had to be kept aloft on CAP stations ready to engage any Japanese plane, coming from any direction, that preliminary strikes on airfields had left able to take off and reach the task force. It was on the basis of this contradiction between the number of planes airborne and the complexity of their direction and control—a situation that more or less remains to this day—that the Soviet Navy built the aviation part of its "national anticarrier doctrine."

THE NAVAL AIR FORCE OF THE SOVIET NAVY: THE ADMIRALS' STEPCHILD

Despite the fact that Russian military aviation was born within the navy, since 1922—when the Union of Soviet Socialist Republics, the USSR, was created—until today the Naval Air Force has been essentially the representative office of the Soviet/Russian Air Force (Voyenno-Vozdushnie Sily, or VVS) in the navy realm. Russian naval aviation has not possessed two features that distinguish naval air forces from those of the army or "big" national air force counterpart:

- A system of development, design, and purchase of aircraft and weapons
- A system of education and training of flying personnel (from 1956 onward).[16]

All such systems were and are still mostly in the hands of the air force (during World War II, an army air force, known as the VVS-RKKA).

Technically, the Soviet Naval Air Force (SNAF) was the part of the navy. But in fact, SNAF fixed-wing planes, with a handful of exceptions—such as the vertical/short-takeoff-and-landing (VSTOL) light-attack Yak-38 and a small family of seaplanes of the Beriev Aircraft Company (the Be-6, Be-12, Be-200)—were, as they still are, ordered by and developed for the air force. All the huge long-range, heavy bombers, such as the Tu-16 (NATO Badger family), the Tu-95 (Bear), and the Tu-22 (Backfire), were developed under the orders and specifications of the Soviet Air Force's bomber command, the DA (Dal'naya Aviatsiya, or Long-Range Aviation). Moreover, the DA's heavy bomber units constituted an integral part of the anticarrier doctrine, representing nearly a third of the forces that would be involved in strikes. Those units could temporarily fall under operational control of the SNAF. Two-thirds of the rest were organized as the MRA (Morskaya Raketonosnaya Aviatsiya, or Naval Guided-Missile Aviation), permanently under the operational and administrative control of the navy.

But this administrative interconnection did not remove the curtain between the navy's philosophy and ethos and those of the VVS. Soviet naval aviators, all commissioned officers, held field rank instead of deck (naval) rank and were completely out of the chain of command of naval surface ships, units, and staffs, let alone submarines. Their areas of responsibility and service were almost exclusively aviation matters. Each of the four fleet staffs, typically headed by a full admiral (three stars) or a vice admiral (two stars), had a subordinate Staff of Naval Aviation of the *X* Fleet (where *X* would be Baltic, Northern, Black Sea, or Pacific), which commanded all the fleet's air units. For each fleet's commanding general of aviation, typically a major general or lieutenant general, to whom this staff reported, there was only one possible next career step within the navy: to become commanding general of Naval Aviation of the Soviet Navy in the Naval Main Staff in Moscow, as a colonel general.

Needless to say, then, almost all naval aviators and naval air navigators (roughly similar to American naval flight officers) from the beginning of their careers kept their eyes the other way—toward an interservice transfer to the VVS, where they could reach much higher command assignments, as air marshals.[17] Moreover, all of them had friends in the VVS, because the navy did not have its own system of pilot and navigator training courses, schools, or academies. All naval aviators, navigators, and aviation engineers were (and still are) graduates of VVS air military colleges or air military engineering colleges.[18] So not only

were they aware that they represented a marginal part of the annual alumni pool, having chosen the restricted SNAF path instead of the wide-open VVS, but their early military and flying experience, the four or five years spent in an air college, had filled them with VVS ethos and traditions instead of the navy's. It is worth noting that, contrary to U.S. military aviation training practice, Soviet/Russian VVS air colleges inserted cadets into the flying pipeline roughly in the middle of the course, two years before graduation and commissioning. All Soviet military pilots could fly the modern military aircraft in almost all circumstances months before the little stars of a second lieutenant were on their shoulders.[19] There are close parallels to British Royal Air Force (RAF) practice and ethos, and to those of the World War II Luftwaffe as well.[20]

From World War II to the beginning of the 1960s the SNAF had its own fighter, attack, reconnaissance, antisubmarine warfare (ASW), bomber, and mine-torpedo forces, organized in squadrons, air regiments (two to four squadrons), and air divisions (two to three regiments).[21] At that point fighter aviation was moved from the SNAF to the VVS. Since then the core of the SNAF of each of the four fleets has been represented by attack and mine-torpedo units. The former, with Il-28, Su-17, or Su-24 attack planes and light/medium bombers, maintained the sea frontiers in shallow waters and supported amphibious assaults within their combat range. The torpedo-bomber units, in turn—the last Soviet land-based torpedo bomber, the Tu-16T, was armed with RT-1 and RT-2 rocket-propelled torpedoes, in service until 1983—formed the basis for the new Naval Guided-Missile Aviation; in 1961 mine-torpedo aviation was absorbed into the MRA, in regiments and divisions, and given the heavy burden of carrying out the first stage of anticarrier doctrine. As mentioned above, the VVS DA contributed, but the primary agencies for the planning and coordinating of anticarrier strikes were SNAF staffs.

This semi-separation of the SNAF from the navy created, without doubt, neglect on the part of the "true" naval officer communities, surface and submarine. Given the rule that no naval aviator or navigator could attain flag rank in any of the fleet staffs and that the admirals and deck-grade officers of the Soviet Navy only occasionally flew on board naval aircraft, and then as passengers only, there was no serious trust in the SNAF in general or its anticarrier role in particular.[22] The SNAF, though its actions were coordinated with surface and submarine units in war plans and staff training, would attack on its own, whereas missile-firing surface units and submarines had to complement each other, depending on overall results. The actual training of SNAF units had no significant connection with surface or submarine units below the level of "type" staffs of the fleet. Communications between SNAF aircraft aloft and guided-missile cruisers at sea or even with shore radio stations maintaining submarine circuits often failed because of

mistakes in frequencies or call signs. So the "real" admirals' common attitude toward the MRA was essentially the same as that toward shore-based missiles: order them to take off, heading for the current target position, and forget them. No wonder that the kamikaze spirit was often remembered in the ready rooms of MRA units ashore.

The Soviet Navy had itself experienced the real thing once, in 1945, in the last month of the war. While supporting an amphibious landing on the Kurile Islands, a small group of Soviet ships was attacked by several B5N2 Kate torpedo bombers from the Kurile-based Hokuto Kokutai, an outfit normally devoted to patrol and ASW over the surrounding sea. According to Japanese records, at the time of the attacks only five Kates from that unit were flyable, and four of them participated in kamikaze attacks against the Soviet amphibious assaults, armed with two-hundred-kilogram depth charges or sixty-kilogram general-purpose bombs.[23] On 12 August two of these planes were shot down by AA fire from the minesweeper *T-525* (a U.S.-built AM type), and one crashed directly into the small motor minesweeper *KT-152* (a mobilized fishing boat), which immediately sank with all hands. This was the only successful kamikaze encounter in Soviet naval history.

WHY SHOULD WE ATTACK THE U.S. CARRIERS— AND FOR GOD'S SAKE, HOW?

Unable to create a symmetrical aircraft carrier fleet, for both economic and political reasons, the Soviet Navy had to create some system that could at least deter the U.S. Navy carrier task forces from conducting strikes against the naval, military, and civilian infrastructure and installations on the Kola and Kamchatka Peninsulas, Sakhalin Island, and the shoreline around the city of Vladivostok. The only reasonable way to do so was as old as carrier aviation doctrine itself: conduct the earliest possible strike to inflict such damage that the carrier will be unable to launch its air group, or at least the nuclear-armed bombers. Also, there was an important inclination to keep the SLOCs in Mediterranean waters under the threat of massive missile strikes. These plans, given the absence of a Soviet carrier fleet, definitely rode on the wings of land-based aviation. Riding also on the shoulders of air-minded military leaders, they reached out farther than the typical five-hundred-mile combat radius of regular medium bombers, by means of something much more clever than the iron, unguided bombs that had been the main weapon of Soviet bombers for a long time.

The origins of guided antiship missiles in military aviation are German. Hs293 missiles and FX1400 guided bombs were successfully employed in 1943–44 by Luftwaffe bomber units; one of only five battleships sunk at sea solely by aviation, the Italian battleship *Roma,* was sunk by FX1400s dropped and guided by Do-217

crews of Kampfgeschwader (Bomber Squadron) 100.[24] But those weapons, being radio controlled, could have been easily disabled by relatively simple ECM measures, such as jamming, had the ECM operator known the guidance frequency. A more promising method of guidance was active radar seekers, which made such weapons independent of the carrying platform after launch. The first air-to-surface missile with such guidance and targeting was created in Sweden in the early 1950s and entered service with the Swedish air force as the Rb04 family.[25]

Regardless of whether it had the help of intelligence information, the Soviet weapons industry managed to develop its own device at roughly the same time, but using semiactive targeting. The first such missile, the KS-1 Kometa (Comet), started development in 1951 and entered service two years later. From the beginning, and in contrast to all other such systems, Soviet antiship missiles were designed to kill carriers and other big ships by hitting pairs. The warhead of the KS-1 contained more than eight hundred kilograms of explosive, and the missile generally resembled a little unmanned MiG-15 fighter plane. The old Japanese Okha concept had clearly been adopted entirely, with the exception of a sacrificial pilot.

It is worth noting that the nuclear strike/deterrent role was exclusive to U.S. aircraft carriers for less than a single year, from the first assembly of a nuclear bomb on board a carrier in December 1951 to the successful trial launch of a Regulus nuclear cruise missile from a submarine in 1952.[26] The carriers' shared (i.e., with submarines) nuclear role lasted up to 1964, when *George Washington*–class ballistic-missile submarines went on patrol on a regular basis. From that time onward, as Adm. James Stockdale recalls, the primary role of the carrier air groups, even fighter squadrons, became the close support of land combat, as well as land interdiction.[27] The beginning of the Vietnam War featured this mode of employment. SNAF staffs found that the main skills of the carriers' attack squadrons (medium and light) changed twice. From 1964 to 1974, during the Vietnam War, it was mostly land targets that attack squadrons were intended to strike; from 1975 to the DESERT STORM operation in 1990 the carrier attack community shifted its focus to readiness to engage Soviet surface fleets at sea, developing the Harpoon guided-missile family.[28] During the first Iraq war the main effort switched again, to close air support and battlefield interdiction ashore. While it was not going to deal with the carrier attack planes directly, the SNAF was watching with interest the fluctuation in the U.S. Navy's fleet air-defense inventory and tactics, driven by changes in the targets between open sea and continental landscape. It was important to find the difference between the typical CAP tactics at sea and barrier CAP duty offshore, calculating the average times that F-4 and F-14 interceptors remained on station between aerial refueling and rotation of patrols.

During this time the Soviet Navy, sharing with the U.S. Navy the ballistic-missile path as the main one for deterrence, actively developed cruise missiles for launch from submarines, as well as from surface ships. The development of air-launched antiship missiles was given secondary priority and was constantly caught up under VVS control, with consequent delays. The submarine-launched missiles, in contrast, made great strides and could strike targets at ranges up to seven hundred kilometers. It was not until 1982, when the NORTHERN WEDDING naval exercise placed carrier battle groups near enough to the Kola Peninsula for fully loaded A-6E Intruders to reach the Severomorsk main naval base and return, that U.S. carriers showed how they really intended to hit Soviet land targets, with nuclear weapons or without them. But, as is usual for the militaries of autocratic political regimes or garrison states, the development of doctrines and weapon systems, once started, was hard to change, even in a clearly changed environment.

The U.S. carrier task force had first been considered a real threat to Soviet shore targets in 1954, when intelligence confirmed the presence of nuclear weapons (both bombs and Regulus missiles) on board the carriers, as well as planes that could deliver them (AJ-1s and A3Ds). The first anticarrier asset tested in the air at sea was of American origin—the Tu-4 heavy bomber, a detailed replica of the Boeing B-29 Superfortress. The missile-carrying model, the Tu-4KS, was introduced with the Black Sea Fleet Air Force in 1953. The plane was able to carry two KS missiles and was equipped with a K-1M targeting radar. Because of the need to guide the missile almost manually from the bomber, the aircraft had to penetrate the antiair-warfare killing zone of the task force to as close as forty kilometers from the carrier or even less. The kamikaze-like fate was abruptly switched from the single pilot of an Okha to the entire crew of a Tu-4KS. Subsequent efforts to develop autonomous active-radar missiles (the K-10, K-16, KSR-2, and finally KSR-5) were more or less unsuccessful. Though the semiactive KS placed the carrying plane under serious threat, it was considerably more reliable than the active-radar missiles.

The next generation of planes was represented by the series known to NATO as the Badger (the Tu-16KS, Tu-16K-10/16, Tu-16KSR, with reconnaissance performed by the Tu-16R, or Badger E). This plane was not the best choice for the job, but it was the only model available at the beginning of the 1960s. The service story of the Badger family is beyond the scope of this article, but it is noteworthy that the overall development of anticarrier strike doctrine grew on its wings.[29] The first and foremost issue that had to be considered by SNAF staffs was the approach to the target, which involved not only the best possible tactics but the weapon's abilities too. For a long time, prior to the adoption of antiradiation missiles, and given the torpedo-attack background of MRA units, there was

a strong inclination toward low-level attack. Such a tactic comported with the characteristics of the missiles' jet engines and the poor high-altitude (and low-temperature) capabilities of their electronic equipment. The typical altitude for launch was as low as two thousand meters; that altitude needed to accommodate the missile's four-to-six-hundred-meter drop after launch, which in turn was needed to achieve a proper start for its engine and systems. Although the SNAF experimented with high-altitude (up to ten thousand meters) and moderate-altitude approaches—and until it had been confirmed that the carrier's airborne early-warning (AEW) aircraft, the Grumman E-2 Hawkeye, could detect the sea-skimming bombers at twice the missile's range—the low-level approach was considered the main tactic, at least for half the strike strength.

FLYING THE BACKFIRE IN DISTANT-OCEAN COMBAT: A ONE-WAY TICKET

The MRA's aircraft, such as the Tu-16 missile-launching and the Tu-95 reconnaissance and targeting aircraft, were relatively slow, and they were evidently not difficult targets for U.S. fighters. They were large targets for the AIM-7 Sparrows shot from F-4 Phantoms. The problem for the aircraft was detection by AEW assets. If E-2 (or U.S. Air Force E-3) crews did their job well, even surface ships, such as the numerous *Oliver Hazard Perry*–class guided-missile frigates, could contribute to shattering a Soviet air raid. Despite the supersonic speed of the KSR-5 missiles, it was not a big problem to catch the bombers before they reached the launch point.

Those planes, by the way, had a very intricate system for the aircrew (of seven to eleven, depending on the model and mix of officers and enlisted personnel) to save themselves by bailing out. By comparison, the U.S. A3D's arrangements could be considered very effective. While the tail gunner and radio operator (enlisted or warrant officers), sitting in the small aft cockpit, could bail out by ejecting downward (which caused some casualties in accidents on takeoff and landing), the remainder had to leave the plane (by means of a belt transporter on the Tu-95, free-falling on the Tu-16) through a single emergency hatch in the main cockpit floor. If the plane lost stability, it was almost impossible. Losing stability was, in fact, quite possible, owing to the huge asymmetric wing drag caused by damaged propellers on the Tu-95 or the long, heavy wing itself of the Tu-16 (drag that could not be countered with thrust, because of the placement of the engine nacelles close to the fuselage). Ditching a Tu-16 was definitely much worse than bailing out from one: the main cockpit has only a narrow emergency hatch overhead, and the aft cockpit has none at all—the tail crew members had to escape through the two little "leaf"-type windows of the tail gunner's compartment, just above the gunhouse.[30] Inflight refueling, because of the complicated behavior of

these big birds at low speed and the primitive wing-to-wing technology used in the USSR, was almost as dangerous as a combat sortie with live ordnance. All this amounted to sufficient grounds for SNAF crews to consider themselves "suicide bombers" even without the enemy's presence.

The picture changed with the Tu-22M, Tu-22M-2, and Tu-22M-3—the Backfire family—which could reach almost Mach 2. (The pure Tu-22, with the engines mounted on the tail, was used as a photoreconnaissance plane only; now only the M-3 model is in service.) The bird has a crew of just four: pilot, copilot, and two navigators—the first *shturman* (the destination navigator) and second *shturman* (the weapons-system operator, or WSO). All of them are commissioned officers, males only, the crew commander (a pilot in the left seat, age twenty-six to thirty) being not less in rank than captain. All the seats eject upward, and the overall survivability of the plane in combat is increased, thanks not only to greater speed but also to chaff launchers, warning receivers, active ECM equipment, and a paired tail gun that is remotely controlled by the second navigator with the help of optical and radar targeting systems. This plane significantly improved the combat effectiveness of the MRA.

In theory and in occasional training, the plane could carry up to three Kh-22MA (or the MA-1 and MA-2 versions) antiship missiles, one under the belly and two more under the wings. But in anticipated real battle conditions, seasoned crews always insisted on just one missile per plane (at belly position), as the wing mounts caused an enormous increase in drag and significantly reduced speed and range.

The Kh-22 missile is not a sea skimmer. Moreover, it was designed from the outset as a dual-targeted missile, able to strike radar-significant shore targets, and the latest version can also be employed as an antiradar missile. The first and most numerous model of this missile, the Kh-22MA, had to see the target with its own active radar seeker while still positioned under the bomber's belly. But the speed, reliability, and power of its warhead are quite similar to those of the Soviet submarine-launched sea skimmers. The price for those capabilities is the usual one for a Soviet weapon—huge weight and dimensions. The Kh-22 is more than eleven meters long and weighs almost six tons, combat ready. The missile can travel at Mach 3 for four hundred kilometers. Usually it contains more than a ton of an explosive, but it could carry a twenty-to-two-hundred-kiloton nuclear warhead instead.

There is a pool of jokes within the Backfire community about the matter of who is more important in the Tu-22M's cockpit, pilots or navigators. The backseaters (both the navigators' compartments are behind the pilots') often claim that in a real flight the "front men" are usually doing nothing between takeoff and landing, while the *shturman*s are working hard, maintaining communications,

navigating, and targeting the weapon. In reality, the most important jobs are in the hands of the WSO, who runs the communication equipment and ECM sets as well.

The doctrine for direct attacks on the carrier task force (carrier battle group or carrier strike group) originally included one or two air regiments for each aircraft carrier—up to seventy Tu-16s. However, in the early 1980s a new, improved doctrine was developed to concentrate an entire MRA air division (two or three regiments) to attack the task force centered around one carrier. This time there would be a hundred Backfires and Badgers per carrier, between seventy and eighty of them carrying missiles. As the NORTHERN WEDDING and TEAM SPIRIT exercises usually involved up to three carrier battle groups, it was definitely necessary to have three combat-ready divisions both in northern Russia and on the Pacific coast of Siberia. But at the time, the MRA could provide only two-thirds of that strength—the 5th and 57th MR Air Divisions of the Northern Fleet and the 25th and 143rd MR Air Divisions of the Pacific Fleet. The rest of the divisions needed—that is, one for each region—were to be provided by the VVS DA. The two air force divisions had the same planes and roughly the same training, though according to memoirs of an experienced MRA flyer, Lieutenant General Victor Sokerin, during joint training DA crews were quite reluctant to fly as far out over the open ocean as the MRA crews did, not trusting enough in their own navigators' skills, and tried to stay in the relative vicinity of the shore.[31] Given the complexity of a coordinated strike at up to two thousand miles from the home airfield, navigation and communication had become the most important problems to solve.

Being latent admirers of the VVS ethos, MRA officers and generals always tried to use reconnaissance and targeting data provided by air assets, which was also most desired by their own command structure. Targeting data on the current position of the carrier sent by surface ships performing "direct tracking" (a ship, typically a destroyer or frigate, sailing within sight of the carrier formation to send targeting data to attack assets—what the Americans called a "tattletale"), were a secondary and less preferable source. No great trust was placed in reports from other sources (naval radio reconnaissance, satellites, etc.). Lieutenant General Sokerin, once an operational officer on the Northern Fleet NAF staff, always asked the fleet staff's admirals just to assign him a target, not to define the time of the attack force's departure; that could depend on many factors, such as the reliability of targeting data or the weather, that generate little attention in nonaviation naval staff work. The NAF staff had its own sources for improving the reconnaissance and targeting to help plan the sorties properly. Sokerin claims that "no Admirals grown as surface or submarine warriors can understand how military aviation works, either as whole or, needless to say, in details."[32]

As it was, the crews of the field-parked Backfires, in the best aviation tradition, had to accept the primary flight data during briefings in the regiments' ready rooms. Of course, they had the preliminary plans and knew roughly the location of the incoming air-sea battle and the abilities of the enemy—the task force's air defenses. In fact, the sorties were carefully planned, going in. But planning was very general for the way out. The following conversation in the ready room of the MRA's 183rd Air Regiment, Pacific Fleet NAF, which occurred in the mid-1980s, shows this very honestly. A young second lieutenant, a Backfire WSO fresh from the air college, asked the senior navigator of the regiment, an old major: "Sir, tell me why we have a detailed flight plan to the target over the vast ocean, but only a rough dot-and-dash line across Hokkaido Island on way back?" "Son," answered the major calmly, "if your crew manages to get the plane back out of the sky over the carrier by any means, on half a wing broken by a Phoenix and a screaming prayer, no matter whether it's somewhere over Hokkaido or directly through the moon, it'll be the greatest possible thing in your entire life!" There may have been silent laughter from the shade of a kamikaze in the corner of the room at that moment.

The home fields of MRA units were usually no more than three hundred kilometers from the nearest shoreline (usually much less). Each air regiment had at least two airstrips, each no less than two thousand meters long, preferably concrete ones, and the Engineering Airfield Service could support three fully loaded sorties of the entire regiment in thirty-six hours. The efforts of shore maintenance were important, as all the missiles, routinely stored in ordnance installations, had to be quickly fueled and prepared for attachment to the planes before takeoff.

The takeoff of the regiment usually took about half an hour. While in the air, the planes established the cruise formation, maintaining strict radio silence. Each crew had the targeting data that had been available at the moment of takeoff and kept the receivers of the targeting apparatus ready to get detailed targeting, either from the air reconnaissance by voice radio or from surface ships or submarines. The latter targeting came by high-frequency (HF) radio, a channel known as KTS Chayka (the Seagull short-message targeting communication system) that was usually filled with targeting data from the MRSC Uspekh (the Success maritime reconnaissance targeting system), built around the efforts of Tu-95RC reconnaissance planes. The Legenda (Legend) satellite targeting system receiver was turned on also, though not all planes had this device. The Backfire's own ECM equipment and radar-warning receivers had to be in service too. With two to four targeting channels on each plane, none of them radiating on electromagnetic wave bands, the crowd of the Backfires ran through the dark skies to the carrier task force.

WHERE ARE THOSE MAD RUSSIANS?

Generally, detailed data concerning the U.S. air-defense organization were not available to Soviet naval planners. What they knew was that F-4, and later F-14, planes could be directed from three kinds of control points: the Carrier Air Traffic Control Center on the carrier itself, an E-2 aloft, or the Air Defense Combat Center of one of the Aegis cruisers in formation. Eavesdropping on the fighter-direction VHF and ultrahigh-frequency radio circuits by reconnaissance vessels and planes gave Soviet analysts in 1973–74 roughly the same results as were subsequently noted by late Vice Admiral Arthur Cebrowski: "Exercise data indicated that sometimes a squadron of F-14s operating *without* a central air controller was more effective in intercepting and destroying attackers than what the algorithms said centralized control could provide."[33]

SNAF planners found that interceptor crews were quite dependent on the opinions of air controllers or FDOs, even in essence psychologically subordinate to them. So the task of the attackers could be boiled down to finding a way to fool those officers—either to overload their sensors or, to some degree, relax their sense of danger by posing what were to their minds easily recognizable decoys, which were in reality full, combat-ready strikes. By doing so the planners expected to slow the reactions of the whole air-defense system, directly producing the "golden time" needed to launch the missiles. Contrary to widespread opinion, no considerable belief was placed in the ability of launched missiles to resist ECM efforts, but the solid and partially armored airframe of the Kh-22 could sustain a significant number of the 20 mm shells of Close-In Weapon System (CIWS) guns. (Given the even more rigid airframe of the submarine-launched missiles of the Granit family —what NATO called the SS-N-19 Shipwreck—it would have been much better for the U.S. Navy to use a CIWS of at least 30 mm caliber.)

Things could become even worse for the carriers. In some plans, a whole VVS fighter air regiment of Su-15TM long-range interceptors would have escorted the MRA division, so that the F-14s over the task force might have been overwhelmed and crowded out by similar Soviet birds. Though the main targets for the Sukhois, which as pure interceptors were barely capable of dogfighting, were the E-2 Hawkeyes, it is possible that some F-14s could have become targets for their long-range air-to-air missiles with active radar seeker (such as R-33, similar to the AIM-54). Sure enough, no Sukhoi crews had been expected to return, mainly because of their relatively limited range and the fact that they, mostly unfamiliar with long flights over the high seas, depended on the bomber crews' navigation skills.

Long before reaching the target, at a "split" position approximately five hundred kilometers from the carrier task force, and if the target's current position had been somehow roughly confirmed, the air division's two regimental formations

would divide into two or three parts each. The WSO of each plane adopted his own battle course and altitude and a flight plan for each of his missiles. As we've seen, the early versions of Kh-22 had to acquire the target while on the plane's hard points, making this a terrible job very close to that of a World War II kamikaze, because between initial targeting of the carrier by the plane's radar and missile launch the Backfire itself was no more than a supersonic target for AIM-54s.

The more Phoenixes that could be carried by a single interceptor, the more Backfires that could be smashed from the sky prior to the launch of their Kh-22s. So if the Backfires were the only real danger to U.S. carriers up to the fall of the USSR, it would have been much better for the U.S. Navy to use the F-111B, a realization of the TFX concept, than the F-14. A Tomcat could evidently carry the same six Phoenixes as an F-111B, but there were the data that the "Turkey" could not bring all six back to the carrier, owing to landing-weight limitations. Imagine a fully loaded Tomcat with six AIM-54s reaching its "bingo point" (limit of fuel endurance) while on barrier CAP station, with air refueling unavailable. The plane has to land on the carrier, and two of its six missiles have to be jettisoned. Given the alternating sorts of approaches by Backfire waves, reducing the overall number of long-range missiles by dropping them into the sea to land F-14s safely seems silly. Admiral Thomas Connolly's claims in the 1960s that killed the F-111B in favor of the F-14 ("There isn't enough power in all Christendom to make that airplane what we want!") could quite possibly have cost the U.S. Navy a pair of carriers sunk.[34]

The transition of the U.S. Navy from the F-14 to the F/A-18 made the anti-Backfire matter worse. Yes, the Hornet, at least the "legacy" (early) Hornet, is very pleasant to fly and easy to maintain, but from the point of view of range and payload it is a far cry from the F-111B. How could it be otherwise for a jet fighter that grew directly from the lightweight F-5? Flying and maintaining naval airplanes are not always just for fun; sometimes it takes long hours of hard work to achieve good results, and it had always been at least to some degree harder for naval flyers than for their shore-based air force brethren doing the same thing. Enjoying the Hornet's flying qualities at the expense of the Phoenix's long-range-kill abilities is not a good trade-off. Also, the Hornet (strike fighter) community evidently has generally replaced its old fighter ethos with something similar to the "light attack," "earthmover" philosophy of the Vietnam-era A-4 (and later A-7) "day attack" squadrons; all the wars and battle operations since 1990 seem to prove it. It is really good for the present situation that the ethos of F/A-18 strike fighter pilots is not the self-confident bravado of the F-14 crews but comes out of more realistic views. Yet for the defense of carrier task forces, it was not clever to abandon the fast, heavy interceptor, able to launch long-range air-to-air missiles—at least to abandon it completely.

To fool the FDOs, the incoming Backfires had to be able to saturate the air with chaff. Moreover, knowing the position of the carrier task force is not the same as knowing the position of the carrier itself. There were at least two cases when in the center of the formation there was, instead of the carrier, a large fleet oiler or replenishment vessel with an enhanced radar signature (making it look as large on the Backfires' radar screens as a carrier) and a radiating tactical air navigation system. The carrier itself, contrary to routine procedures, was steaming completely alone, not even trailing the formation. To know for sure the carrier's position, it was desirable to observe it visually. To do that, a special recce-attack group (*razvedyvatel'no-udarnaya gruppa,* RUG) could be detached from the MRA division formation. The RUG consisted of a pair of the Tu-16R reconnaissance Badgers and a squadron of Tu-22M Backfires. The former flew ahead of the latter and extremely low (not higher than two hundred meters, for as long as 300–350 kilometers) to penetrate the radar screen field of the carrier task force, while the latter were as high as possible, launching several missiles from maximum range, even without proper targeting, just to catch the attention of AEW crews and barrier CAP fighters. Meanwhile, those two reconnaissance Badgers, presumably undetected, made the dash into the center of the task force formation and found the carrier visually, their only task to send its exact position to the entire division by radio. Of course, nobody in those Badgers' crews (six or seven officers and men per plane) counted on returning; it was 100 percent a suicide job.

After the RUG sent the position of the carrier and was shattered to debris, the main attack group (UG, *udarnaya gruppa*) launched the main missile salvo. The UG consisted of a demonstration group, an ECM group armed with antiradar missiles of the K-11 model, two to three strike groups, and a post-strike reconnaissance group. Different groups approached from different directions and at different altitudes, but the main salvo had to be made simultaneously by all of the strike groups' planes. The prescribed time slot for the entire salvo was just one minute for best results, no more than two minutes for satisfactory ones. If the timing became wider in an exercise, the entire main attack was considered unsuccessful.

Moreover, in plans, three to five planes in each regimental strike had to carry missiles with nuclear warheads. It was calculated that up to twelve hits by missiles with regular warheads would be needed to sink a carrier; by contrast, a single nuclear-armed missile hit could produce the same result. In any case, almost all Soviet anticarrier submarine assets had nuclear-armed anticarrier missiles and torpedoes on board for routine patrols.[35]

Having launched their missiles, it was up to the crews, as has been noted above, to find their way back. Because of the possibility of heavy battle damage,

it was reasonable to consider the use of intermediate airfields and strips for emergency or crash landings, mainly on the distant islands, even inhabited ones, in the Soviet or Warsaw Pact exclusive economic zones. The concept of using the Arctic ice fields for this purpose was adopted, by not only the MRA but the VVS (interceptors of the Su-15, Tu-128, and MiG-25/31 varieties) too. Though the concept of maintaining such temporary icing strips had been accepted, with the thought that planes could be refueled, rearmed, and even moderately repaired in such a setting, it was not a big feature of war plans. The VVS as a whole was eager to use captured airfields, particularly ones in northern Norway, but the MRA paid little attention to this possibility, because the complexity of aerodrome maintenance of its large planes, with their intricate weapons and systems, was considered unrealistic at hostile bases, which would quite possibly be severely damaged before or during their capture.

All in all, the expected loss rate was 50 percent of a full strike—meaning that the equivalent of an entire MRA air regiment could be lost in action to a carrier task force's air defenses, independent of the strike's outcome.

AN *UMI YUKABA* FOR THE SURFACE AND SUBMARINE COMMUNITIES

Although the first massive missile strikes on carrier task forces had to be performed by SNAF/DA forces, there were at least two other kinds of missile carriers in the Soviet Navy.[36] The first were guided-missile ships, mostly in the form of cruisers (CGs), those of Project 58 (the NATO Kynda class), Project 1144 (*Kirov* class), and Project 1164 (*Slava* class).[37] Moreover, all the "aircraft-carrying cruisers" of Project 1143 (the *Kiev* class, generally thought of as aircraft carriers in the West) had the same antiship cruise missiles as the CGs of Project 1164. Also, the destroyers of Project 956 (*Sovremenny* class) could be used in this role, as well as all the ships (the NATO Kresta and Kara classes) armed with ASW missiles of the Type 85R/RU/RUS (Rastrub/Metel, or Socket/Snowstorm) family, which could be used in an antiship mode. The main form of employment of guided-missile ships was the task force (*operativnoye soedinenie,* in Russian), as well as the above-noted direct-tracking ship or small tactical groups of ships with the same job (KNS or GKNS, respectively, in Russian).

The other anticarrier missile carriers were nuclear-powered guided-missile submarines (SSGNs), in a vast number of projects and types, using either surface or submerged launch. The most deadly of these were the Project 949A boats (NATO Oscar IIs), with P-700 Granit missiles. (The SSGN *Kursk,* recently lost to uncertain causes, was one of them.) The operational organization for the submarine forces performing the anticarrier mission was the PAD (*protivo-avianosnaya*

divisiya, anticarrier division), which included the SSGNs, two for each target carrier, and nuclear-powered attack submarines for support. In sum, up to fifteen nuclear submarines would deploy into the deep oceans to attack carrier task forces. One PAD was ready to be formed from the submarine units of the Northern Fleet, and one, similarly, was ready to assemble in the Pacific Fleet.

A detailed description of the tactics and technologies of all those various assets is beyond the aim of this article, but one needs an idea of how it worked as a whole. The core of national anticarrier doctrine was cooperative usage of all those reconnaissance and launch platforms. While they understood this fact, the staffs of the Soviet Navy had no definite order, manual, or handbook for planning anticarrier actions except the "Tactical Guidance for Task Forces" (known as TR OS-79), issued in 1979 and devoted mainly to operational questions of surface actions, until 1993, when "Tactical Guidance for Joint Multitype Forces" entered staff service. The latter document was the first and ultimate guidance for the combined efforts of the MRA, surface task forces, and submerged PADs, stating as the overall goal the sinking of the designated target carriers at sea with a probability of 85 percent.

It is no secret that the officers of the surface community who served on the guided-missile ships counted on surviving a battle against a U.S. Navy carrier air wing for twenty or thirty minutes and no more. In reality, the abilities of the surface-to-air missiles (SAMs) installed on the ships were far less impressive than the fear they drew from U.S. experts. For example, the bow launcher of the Storm SAM on the Kresta- and Kara-class ASW destroyers shared a fire-control system with the Metel ASW missile. It would be quite possible for U.S. aircraft to drop a false sound target (imitating a submarine) ahead of the Soviet formation to be sure that the bow fire-control radars would be busy with the guidance of ASW missiles for a while. The bow SAM launchers of the destroyers of these classes would be useless all this time, allowing air attacks from ahead. Even "iron" bombs could mark the targets.

SSGNs were evidently considered in the West to be the safest asset of the Soviet Navy during an attack, but it was not the case. The problem was hiding in the radio communications required: two hours prior to the launch, all the submarines of the PAD were forced to hold periscope depth and lift their high-frequency-radio and satellite communication antennas up into the air, just to get the detailed targeting data from reconnaissance assets directly (not via the staffs ashore or afloat); targeting via low- or very-low-frequency cable antennas took too much time and necessarily involved shore transmitting installations, which could be destroyed at any moment. There was little attention paid to buoy communication systems (because of the considerable time under Arctic ice usual for

Soviet submarines). Thus the telescoping antennas in a row with the periscopes at the top of the conning tower were the submarine's only communication means with the proper radio bandwidth. Having all ten or fifteen boats in a PAD at shallow depth long before the salvo was not the best way to keep them secure. Also, the salvo itself had to be carried out in close coordination with the surface fleet and MRA divisions.

However, the main problem was not the intricacy of coordination but targeting—that is, how to find the carrier task forces at sea and to maintain a solid, constant track of their current positions. Despite the existence of air reconnaissance systems such as Uspekh, satellite systems like Legenda, and other forms of intelligence and observation, the most reliable source of targeting of carriers at sea was the direct-tracking ship. Indeed, if you see a carrier in plain sight, the only problem to solve is how to radio reliably the reports and targeting data against the U.S. electronic countermeasures. Ironically, since the time lag of Soviet military communication systems compared to the NATO ones is quite clear, the old Morse wireless telegraph used by the Soviet ships was the long-established way to solve that problem. With properly trained operators, Morse keying is the only method able to resist active jamming in the HF band. For example, the Soviet diesel-electric, Whiskey-class submarine *S-363,* aground in the vicinity of the Swedish naval base at Karlskrona in 1981, managed to communicate with its staff solely by Morse, despite a Swedish ECM station in the line of sight. All the other radio channels were effectively jammed and suppressed. While obsolete, strictly speaking, and very limited in information flow, Morse wireless communication was long the most serviceable for the Soviet Navy, owing to its simplicity and reliability.[38]

But the direct tracker was definitely no more than another kind of kamikaze. It was extremely clear that if a war started, these ships would be sent to the bottom immediately. Given that, the commanding officer of each had orders to behave like a rat caught in a corner: at the moment of war declaration or when specifically ordered, after sending the carrier's position by radio, he would shell the carrier's flight deck with gunfire, just to break up the takeoff of prepared strikes, fresh CAP patrols, or anything else. Being usually within the arming zone of his own antiship missiles and having no time to prepare a proper torpedo salvo, the "D-tracker's" captain had to consider his ship's guns and rocket-propelled depth charges to be the best possible ways to interfere with flight-deck activity. He could even ram the carrier, and some trained their ship's companies to do so; the image of a "near miss," of the bow of a Soviet destroyer passing just clear of their own ship's quarter, is deeply impressed in the memory of some people who served on board U.S. aircraft carriers in those years.

CAREFUL ESTIMATION OF COST IS LIKE AN ICY SHOWER (OF COMMON SENSE)

In any case, there was a time when the U.S. Navy's aircraft carriers were the worst enemies of the whole Soviet Navy. That time is in the past now, but in spite of changed emotions, the "national anticarrier approach" as a model for other navies is still alive and could be applied to the current U.S. carrier fleet. The Chinese, for example, have added ballistic missiles to this general approach, in a way that has been effectively scaring U.S. naval staffs and analysts. While this is not the time to remember the blood and horror of Okinawa, let me state that such a campaign, being asymmetrical by nature, requires such huge human sacrifice that there is no great difference from the kamikaze conception, if scholars are objective about it.

One can imagine how strong would be the attempts of U.S. armed forces and their allies in the region to find and bomb DF-21D launchers, with enormous loss of lives, both young Westerners and Asians in uniform and collateral victims in the heavily populated mainland of China. Moreover, such a ballistic weapon cannot be deadly without active radar guidance, and since no properly reliable phased-array antenna can be stuffed into multiple, independently targetable reentry vehicles, it is doubtful that the use of those missiles against carriers makes sense without nuclear warheads. Also, unfortunately, while posing a great threat to U.S. carriers at sea, this kind of asymmetrical naval warfare is not a cent less expensive, proportionally, for the country with the balanced carrier fleet than for the challenger.

Last, but not least—this kind of naval warfare claims human blood. Wars inevitably end, but the people killed in action cannot return to life. The deaths of brave and skilled warriors make the nation bloodless and weak. We Russians have always won our wars by obligatory military drafts: our victories, being of the land-warfare kind every time, have been the victories of conscripts, without exception. Thus it is the greatest job for each of our career military officers, despite rank or service—as it should be for those of any country—to return these youngsters to their mothers and girls alive. People would probably feel much better if they could find ways to achieve unbreakable deterrence rather than to mount an irresistible strike. The strikes themselves are always defendable in this real world, but there is no invincible defense.

NOTES

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1. Y. Apushkin, *The Russo-Japanese War, 1904–1905* [in Russian] (Moscow: Russian Friendship, 1910).
2. Col. Miroslav Morozov, chief historian of the War History Institute of Russian Ministry of Defense, 2001–2009, e-mail conversations with the author, 2001–2012.
3. Friedrich Ruge, *Der Seekrieg 1939–1945* (Stuttgart, FRG: K. F. Koehler, 1954).
4. Cdr. Nigel "Sharkey" Ward, RN, "RAF Unsuitable for Carrier Operations," *Defence of Our Nation* (blog), 9 March 2013, sharkeysworld2.blogspot.com/.
5. Samuel P. Huntington, *The Soldier and the State* (Cambridge, Mass.: Belknap of Harvard Univ. Press, 1998).
6. Interestingly, the postwar efforts of the Midway hero (the fighter pilot, later an admiral) John S. Thach in the area of antisubmarine warfare, owing to the emerging Soviet submarine threat, were built around the same general principles—establishing a wide sensor field (this time acoustic instead of radar, using the sonars of helicopters and destroyers) and hanging the hitting power aloft (in carrier-borne antisubmarine aircraft) waiting to react to the contacts as quickly as possible. All-force VHF radio circuits were as vital here as in the previous antiair-warfare case.
7. "Damage Reports: Kyushu and Shikoku," *USS* Enterprise *CV-6,* n.d., cv6.org/.
8. O. Leyko, *Kamikaze Story* (Moscow: University Press, 1989).
9. The first use of skip-bombing as such was by Royal Air Force Bomber Command Blenheim medium-bomber units in the North Sea in 1940 against German shipping, with 250-pound bombs. Later the method was widely adopted in Soviet naval air forces, where mine-torpedo, attack, and fighter-bomber units employed high-explosive bombs of from a hundred to a thousand kilograms.
10. One of them was Night Torpedo Squadron (VT[N]) 90, on board USS *Enterprise* (CV 6) in 1944, flying solely night antishipping missions. None of the pilots of the squadron was happy about the small chances they had to score a bomb hit on a famous target. See Edward P. Stafford, *The Big E: The Story of the USS* Enterprise (New York: Random House, 1962).
11. For *Bismarck Sea,* see William T. Y'Blood, *The Little Giants: U.S. Escort Carriers against Japan* (Annapolis, Md.: Naval Institute Press, 1987). The *Twiggs* case is more interesting —the ship's battle report indicates that a B6N Jill bomber that crashed into its deck aft had dropped a torpedo that hit the bow a few seconds before; Theodore Roscoe, *United States Destroyer Operations in World War II* (Annapolis, Md.: Naval Institute Press, 1953), p. 262 (in Russian translation). However, the report notes that the torpedo was dropped no more than three hundred feet from the destroyer, almost dead ahead. It is hard to believe that a Type 91 torpedo could have armed itself in such a short run. It is more likely, considering the damage caused, that the weapon was a five-hundred-kilogram bomb dropped at low level.
12. The thin wooden flight decks of the main U.S. fleet carriers, the *Essex* class, did not do much to stop kamikazes' bombs from penetrating inside the ships, though they effectively stopped the crashing planes themselves.
13. For the bomb load, see discussions at *J-aircraft.com: Japanese Aircraft, Ships, & Historical Research,* j-aircraft.com.
14. Osamu Tagaya, *Mitsubishi Type 1 Rikko "Betty" Units of World War 2* (Oxford, U.K.: Osprey, 2001).
15. Thomas Hone, Norman Friedman, and Mark David Mandeles, *American and British Aircraft Carrier Development, 1919–1941* (Annapolis, Md.: Naval Institute Press, 1999).
16. Just before and during World War II, the Soviet Navy had had its own flying and air engineering training courses, which were partially disbanded and merged with VVS training pipelines up to 1955.
17. Even the small group of enthusiasts in the fixed-wings groups created for the aircraft-carrying cruisers of the *Kiev* class—initially two attack-air regiments, the 279th of the Northern Fleet and the 311th of the Pacific Fleet, flying Yak-38s—had served most of their military service in VVS, as test pilots of the Fighter Evaluation School or staff members. No more than a hundred pilots at any given time from 1973 till 1993 were qualified

for carrier VSTOL operations, and no fewer than ninety of them finally retired from the VVS rather than the navy.

18. Although often referred to as "trade schools," the Soviet military educational installations were closer to the U.S. service academies (the U.S. Military, Naval, Air Force, and Coast Guard Academies), as all were four to five years long and, aside from commissions, their graduates received college-level educations similar to those of civilian colleges or universities, with the same diplomas. So in the (rudimentary but obligatory) English course, the Soviet Kaliningrad naval educational installation was referred to as "Kaliningrad Naval College."

19. Of the ten VVS air colleges in the pilot pipeline prior to 1993, only one (the Balashov Higher Military Aviation College for Pilots, in central Russia) was meant to train pilots for big, multiengine planes. All the others produced fighter pilots, using L-29/39s and MiG-21s as "flying school tables." Thus, even on the big SNAF planes, of all the Tupolev models, an advancing number of pilots had fighter training in their backgrounds.

20. It is interesting to evaluate the differences between the RAF Harrier GR.3 unit and the Royal Navy Fleet Air Arm Sea Harrier FRS.1 unit on board HMS *Invincible* during the Falklands War of 1982. The RAF pilots claimed that the "ship exists for us and it should provide for us all the needed." See Ward, "RAF Unsuitable for Carrier Operations."

21. The planet's first spaceman, Yuri Gagarin, entered the space program for training as a first lieutenant, a jet fighter pilot in the Northern Fleet. In the VVS tradition, attack aircraft are not bombers, even formally. From their roots in the Il-2, attack aircraft in the USSR were primarily strafers, always armored and armed with guns, and might have no bombing equipment at all. The only real "attack" plane in the U.S. inventory, from that standpoint, is the A-10 Thunderbolt 2. Historically, bombing units of the SNAF had flown land-based, twin-engine dive-bombers, beginning with the Pe-2. Torpedo-bomber units of the SNAF had the secondary task of aerial minelaying.

22. A small number of the Naval College graduates with military occupational specialties in navigation or ASW were trapped in the crews of Tu-16 or Tu-142 units of the SNAF. They had no chance to return to the surface or submarine fleets, as they had changed their ranks at commissioning from deck (naval) to field (aviation) grade.

23. The website www.j-aircraft.org. Amazingly, Japanese sources state that in those flights the fighter escort for this Imperial Japanese Navy unit was provided by an army air force unit, flying a couple of sections of Ki-43 Oscars from the 54th IJAAF Fighter Regiment—a remarkable instance of cooperation between Japanese services not seen anywhere else during World War II.

24. In September 1943 the veteran British battleship *Warspite* and the U.S. cruiser *Savannah* (CL 42) were seriously damaged by FX1400 bombs. At 1,570 kg, the FX1400 was the heaviest aerial weapon ever to hit a U.S. Navy warship.

25. It was intended to stop a Soviet amphibious assault on the Swedish shoreline. The Royal Swedish Air Force planned to use the Rb04, and subsequently the Rbs15, against large surface combatants, such as *Sverdlov*-class cruisers.

26. Thomas C. Hone, Norman Friedman, and Mark D. Mandeles, *Innovation in Carrier Aviation,* Newport Paper 37 (Newport, R.I.: Naval War College Press, 2011), esp. p. 191, available at www.usnwc.edu/press/.

27. James B. Stockdale, *Thoughts of a Philosophical Fighter Pilot* (Stanford, Calif.: Hoover Institution Press, 1995).

28. As supposed by Soviet Navy staff experts, the AGM-84A Harpoon was created mostly for hitting surfaced SSGNs of Project 675 (i.e., what NATO called Echo IIs), which had to surface to launch their antiship missiles. Harpoon is subsonic and has a very complex and effective active radar seeker, an ideal combination against surfaced submarines. A French contemporary missile, the Aerospatiale AM-39 Exocet, intended to hit the surface combatants, has opposite, and deadly, features—supersonic speed and a relatively simple seeker.

29. Aside from missiles, from the beginning the Tu-16 (as well as Tu-95) was considered a potent weapon against U.S. carriers. One

of the most powerful unguided iron bombs in history was created for this task, namely, the nine-thousand-kilogram, high-explosive FAB-9000. Both the Tu-16 and Tu-95 could carry one such bomb.

30. In February 1988, a Pacific Fleet Air Force reconnaissance plane, Tu-16RM-1 side number 10, ditched off Kamchatka owing to engine failure. The aft cockpit crew drowned with the plane, as the tail gunner forgot to open the leaves before the ditching, so they became jammed. The copilot, First Lieutenant Kazimirov, who had safely escaped from the main cockpit's emergency hatch, attempted to save the two enlisted airmen aft. He swam in the icy water to the tail of the submerging plane and tried to break the bullet-proof glass of the aft cockpit by shooting it with his pistol, but in vain, and he too drowned. When a rubber raft with the three remaining crew members from the main cockpit was found by a submarine the next morning, seventeen hours after the ditching, only the plane commander, Captain Efremov, was alive; both navigators had frozen to death.

31. Lt. Gen. Victor N. Sokerin retired as commanding general of the Baltic Fleet Naval Air Force. Previously he had twelve years of service as a Tu-16 pilot and crew commander in the Northern Fleet and later a Naval Air Force staff officer.

32. V. N. Sokerin, e-mail conversation with author, 2009.

33. James Blaker, "Arthur K. Cebrowski: A Retrospective," *Naval War College Review* 59, no. 2 (Spring 2006), p. 133, available at www.usnwc.edu/press/ [emphasis original].

34. Tommy H. Thomason, *Grumman Navy F-111B Swing Wing,* Naval Fighters 41 (Simi Valley, Calif.: Ginter Books, 1998). The quotation is from "Tests & Testimony," *Time,* 22 March 1968. In fairness to the admiral, though, it does seem generally far from a wise decision to merge the two fighter concepts (daylight fighter and all-weather interceptor) in one airplane.

35. Diesel-electric submarines of Whiskey and Kilo classes usually had two Shkval rocket-powered torpedoes armed with nuclear warheads. The Project 685 (NATO Mike class) nuclear-powered attack submarine *Komsomolets,* sunk in 1989 in the Norwegian Sea, had two Shkvals and two 3M-10 Granat (similar to the NATO SS-N-21) cruise missiles, all four nuclear armed. Not less than 75 percent of the overall spending by the Soviet Navy in 1945–92 went to submarine design, building, arming, equipping, training, and maintenance—that is, for submarine-force affairs generally.

36. *Umi Yukaba* was a patriotic Japanese song often sung in World War II by suicide-attack pilots before takeoff: "If I go away to the sea / I shall be a corpse washed up. / If I go away to the mountain, / I shall be a corpse in the grass. / But if I die for the Emperor, / It will not be a regret."

37. Contrary to the U.S. Navy designation, the term "guided missile" in Russian means antiship, not antiair, missile.

38. In the author's own experience, ENIGMA-style crypto devices able to send secure messages letter by letter in Morse code automatically were in use in the Russian Navy as late as 1996.