Over the Horizon

NATO Joint Intelligence, Surveillance, and Reconnaissance in the Baltic Sea Region

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Cover Photo: Sunset comes early at this time of the year a member of the bridge crew of HMS Northumberland is outlined against the setting sun.

Exercise Trident Juncture 18 (TRJE18) is the flagship collective defense exercise for NATO and is the biggest in 2018. The Exercise will take place from 24th October until the 7th November. *Source: NATO https://www.flickr.com/photos/nato/45730562682/in/album-72157674623109598/*

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Members of the Atlantic Council Task Force for Baltic Sea Regional ISR

NATO Intelligence, Surveillance, and Reconnaissance in the Baltic Region

The three Baltic states—Estonia, Latvia, and Lithuania—today face the most direct threat of any of NATO's allies. Formerly part of the Union of Soviet Socialist Republics (USSR), they share borders with an aggressive and revanchist Russia intent on fracturing the Alliance. To deter Russian aggression in the Baltic region, NATO must deploy a credible and effective defense, grounded in a comprehensive understanding of Russian capabilities, actions, and intent. A critical element of deterrence and defense is NATO Joint Intelligence, Surveillance, and Reconnaissance (ISR)—a networked system of sensors, collectors, and analysts fielded by the Alliance and its member states to provide situational awareness, early warning, and if necessary, decision support for combat operations. In recent years, the Alliance has done much to identify shortfalls and enhance NATO's ISR capabilities. This effort must continue if NATO's twin goals of peace and security are to be realized, with the Baltic region as a priority focus.

Project Methodology. This study is informed by an in-depth review of open-source literature on the topic, including government, academic, research institution, and NATO sources, and by collaboration, workshops, and interviews with acknowledged subject-matter experts at NATO headquarters, US and allied military officials, industry specialists, and academics.

Baltic Security Threats. Since the Russian occupation of The Donbas and Crimea in 2014, NATO threat perceptions have greatly intensified, particularly with regard to the Baltic states. Baltic security experts take a cold and objective view of Russian intentions, based on daily contact and observation over many years:

Russia's ambitions and intentions are clear—to break up the post-Cold War security architecture, to undermine NATO and the EU, and to weaken the Transatlantic link—and these goals are not going to change for the foreseeable future.[1]

Indeed, Russian Chief of the General Staff Valery Gerasimov has gone so far as to note the "disappearance of the line between states at peace and their shifting to a state of war."[2] Russian behavior in the Baltic region supports his thesis. A constant stream of propaganda, subversion, disinformation, border provocations, airspace violations, and cyberattacks or cyber-intrusions—not to mention aggressive and unsupervised troop deployments and "snap" exercises—portrays a more or less continuous mode of confrontation just below the level of kinetic activity. Government-sponsored propaganda asserts the right of ethnic Russian communities within the Baltic region to declare independence in the same way Moscow has long encouraged ethnic Russians to secede from Ukraine.[3] The intention of these tactics, often referred to as "Russian malign activity," is clearly to pressurize the Baltic states and induce a degree of fear, uncertainty, and intimidation.

Should the West take all this seriously? In fact, there are sound and credible political, historical, and geographic reasons for Russia to covet the Baltics that are recognizable to any competent strategist or military planner.

For starters, the Baltic states represent exactly the kind of emerging, prosperous western democracies on

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1   Kalev Stoicescu and Henrik Praks, "*Strengthening the Strategic Balance in the Baltic Sea Area,*" Estonian International Center for Defense and Security, (March 2016), 4.

2   General of the Army Valery Gerasimov, "The Influence of the Contemporary Nature of Armed Struggle on the Focus of the Construction and Development of the Armed Forces of the Russian Federation," (lecture to the Voroshilov General Staff Academy, March 2018). Translated by Dr. Harold Orenstein and published in *Military Review Online* (January 2019), https://www.armyupress.army.mil/Journals/Military-Review/Online-Exclusive/2019-OLE/Jan/Gerasimov/.

3   Philip A. Petersen et al., *Baltic Security Net Assessment*, (Tartu: Potomac Foundation and Baltic Defense College, 2018), 78.

former Soviet territory Vladimir Putin is known to detest and fear.[4] The Baltic states each possess ethnic Russian minorities, especially Estonia and Latvia. They were, at different times, part of the Russian empire and the Soviet Union. They stand between Mother Russia and Kaliningrad, home of the Russian Baltic Fleet but isolated and separated by 300 km from the Russian border. Wrenching the Baltic states from NATO control would restore the strategic depth Russia lost in the 1990s, fracture the Alliance, and transform the European security environment in profound ways.[5] It would also sound the death knell for future NATO expansion for Ukraine and Georgia. These are tempting rewards.[6]

Under what circumstances would Putin contemplate aggression in the Baltics? A number of scenarios are plausible. Russian aggression might follow the deployment of additional US or NATO forces to the Baltic region designed to force Putin to choose between withdrawal or confrontation. A political or economic crisis threatening to destabilize Putin's regime (and thus suggesting a "patriotic" distraction); US involvement in a major crisis elsewhere, opening a window of opportunity; US or European internal disputes that might threaten a cohesive Alliance response; or political perturbations inside Estonia or Latvia (the largest Latvian political party, the ethnically Russian Harmony, has close ties to Putin's United Russia party): these and other scenarios represent opportunities to act that could occur with little warning. While Russian aggression in the Baltic states is not certain, the clear indicators suggest that strong steps should be taken now. The price of miscalculation will be far higher.[7]

Russia's actual capability to challenge NATO solidarity in the Baltic region is real. While lacking the strategic mobility and power-projection capabilities available to the United States, Russia is formidable along its periphery and especially in its Western Military District

Map of the Baltic Sea region.

(WMD), opposite NATO's eastern flank.[8] On the ground, the WMD includes the recently reconstituted 1st Guards Tank Army (1GTA) as well as the 6th and 20th Combined Arms Armies, along with the 11th Army Corps in Kaliningrad, with some 21 maneuver brigades.[9] Located in the WMD but under national control are three airborne divisions and three Spetsnaz Special Forces brigades.[10]

At sea, the Russian Baltic Fleet is equipped with 33 destroyers, frigates, and coastal corvettes and two diesel submarines, supported by an assortment of minesweepers and amphibious assault and logistics

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4   Lukas Milevski, "Prospective Strategy for Baltic Defense: The Russian Public and War Termination in the Baltic States," *Military Review* (January/February 2018).

5   "If Russia could engineer a situation to warrant military action against a NATO member, so that it was responding to a situation rather than provoking a crisis, the reward of weakening NATO and calling into question America's value as an ally would be extraordinary, as it would revise current European and global power balances ...." Martin Murphy and Gary Schaub, Jr., "Sea of Peace or Sea of War—Russian Maritime Hybrid Warfare in the Baltic Sea," *Naval War College Review*, Vol. 71, No. 2 (Spring 2018), 6.

6   See Ulrich Kühn, *Preventing Escalation in the Baltics*, Carnegie Endowment for International Peace, March 28, 2018, 13-23.

7   R.D. Hooker, Jr., *How to Defend the Baltic States*, Jamestown Foundation, October 2019.

8   The Western Military District and the "Western Operational Strategic Command" are distinct entities but commanded by the same four-star officer. The latter functions as a Joint Strategic Command in time of war. Lester Grau and Charles K. Bartles, *The Russian Way of War*, (Fort Leavenworth, Kansas: Foreign Military Studies Office, 2016), 29.

9   1GTA carries a famous designation dating back to the Great Patriotic War and is the only tank army in the Russian order of battle. "Endowing this newly re-established formation with such heritage can be seen as a clear political message intended to intimidate and to draw attention to its specific, overtly offensive operational role within the [Russian] military." Igor Sutyagin and Justin Bronk, "*Russia's New Ground Forces: Capabilities, Limitations, and Implications for International Security: Routledge Whitehall Papers*" (London: Routledge and RUSI, August 2017), 95.

10   Hooker, *How to Defend the Baltic States*, 2.

vessels.[11] Though not a blue-water force, the Baltic Fleet is substantial, particularly when supported by land- and sea-based anti-ship missiles like the Kalibr system. Kaliningrad, the fleet's home port, is the only major Russian port on the Baltic Sea that is ice-free year-round, while more than half of Russian large-ship construction and container traffic worldwide is centered on St. Petersburg—more evidence that having NATO right on its doorstep is deeply concerning to Russian leaders.[12]

In the air, the Russian Air Force fields almost 1,200 combat aircraft and just under 400 attack helicopters.[13] Perhaps 400 fighters and bombers and 150 helicopters could be made available for operations against the Baltic states, given operational readiness rates and the need to cover the rest of Russia's vast territory.[14] The Russian Air Force has no fifth-generation fighter aircraft in operational squadrons, but it has significant combat experience, most recently in Syria, where increased flying hours and the application of real-world joint operating concepts have undoubtedly increased confidence and proficiency.[15]

In the nuclear arena, Russia is well provided with air-, sea-, and ground-launched tactical nuclear weapons that give teeth to its "escalate to deescalate" narrative. Fielded weapons include nuclear-capable short-range ballistic missiles, and cruise missiles that can be launched by ship or aircraft. Experts disagree on whether Putin might contemplate a first use of nuclear weapons when the existence of the state is not at risk.[16] Western political leaders should respect Russia's capability, but the United States, the United Kingdom (UK), and France also possess nuclear arsenals that will surely give Putin pause.[17]

The Russian threat to the Baltic region in peacetime is already manifest in the day-to-day Russian malign activity touched on above. Actual violations of Baltic sovereignty are of course far more serious and could take the form of hybrid operations or conventional aggression. A typical hybrid scenario might be an insertion of Russian intelligence officers, paramilitary personnel, or special-operations troops to incite separatist movements among ethnic Russian populations in areas like Narva in Estonia.[18] Russian troops might then cross the border as "peacekeepers" or to provide "humanitarian" support.[19] A more conventional form of aggression would be spearheaded by Russian airborne and Spetsnaz troops (always kept at high readiness) on very short notice, followed by tank and motor rifle units. Both options would be supported by intense cyber activity and disinformation. Earlier operations in Georgia, Crimea, and The Donbas provide a template for these kinds of operations.

NATO has taken note of these developments in important ways, such as establishing the Very High Readiness Joint Task Force, emphasizing cyber defense, and deploying Enhanced Forward Presence battle groups to Poland and the Baltic states. In June 2018 NATO defense ministers agreed "in principle" to the US-proposed "30-30-30-30" initiative, obligating the Alliance to field 30 battalions, 30 warships, and 30 air squadrons within 30 days—if implemented, a major enhancement.[20] While conflict with Russia in the Baltic region is by no means certain, prudence dictates both a robust deterrence posture and a comprehensive understanding of the situation to inform Western decision makers. NATO Joint ISR (JISR) will be at the forefront of this effort.

NATO's JISR Architecture. NATO Joint ISR, or "JISR," is a combined operations and intelligence function that requires extensive coordination and interoperability at many levels. NATO JISR integrates capabilities, organizations, and procedures to provide timely information support to political and military leaders, from the tactical to the strategic level. It is both cross- and multi-domain, involving the tasking, collection, processing, exploitation, and dissemination of critical information from both NATO and national assets. Put simply, JISR is about getting the right information to the right person

11 *The Military Balance 2018*, (London: International Institute for Strategic Studies, 2018) 201.

12 Murphy and Schaub, 13.

13 *The Military Balance 2018*, 199.

14 Air Marshal Sir Christopher Harper et al., "*Air Defense of the Baltic States*," International Center for Defense and Security, May 2018, 6.

15 Michael Peck, "Welcome to Syria, the Russian Air Force's battle lab," *National Interest*, September 7, 2019, https://nationalinterest.org/blog/buzz/welcome-syria-russian-air-force%E2%80%99s-battle-lab-78671.

16 Kühn, *Preventing Escalation in the Baltics*, 19.

17 Dave Mujumdar, "Everything You Need to Know: Russia's Tactical Nuclear Weapons," *National Interest*, October 5, 2017.

18 Petersen et al., *Baltic Security Net Assessment*, 78.

19 NATO has yet to fully consider how to adjust ISR training to deal with hybrid scenarios. The "Find/Fix" function of hybrid target sets is particularly challenging, as seen in Afghanistan and Iraq/Syria.

20 See Ian Brzezinski, "Defining Success at NATO's Summit: Political Unity and Military Readiness," *New Atlanticist*, July 3, 2018, . https://www.atlanticcouncil.org/blogs/new-atlanticist/defining-success-at-nato-s-summit-political-unity-and-military-readiness/.
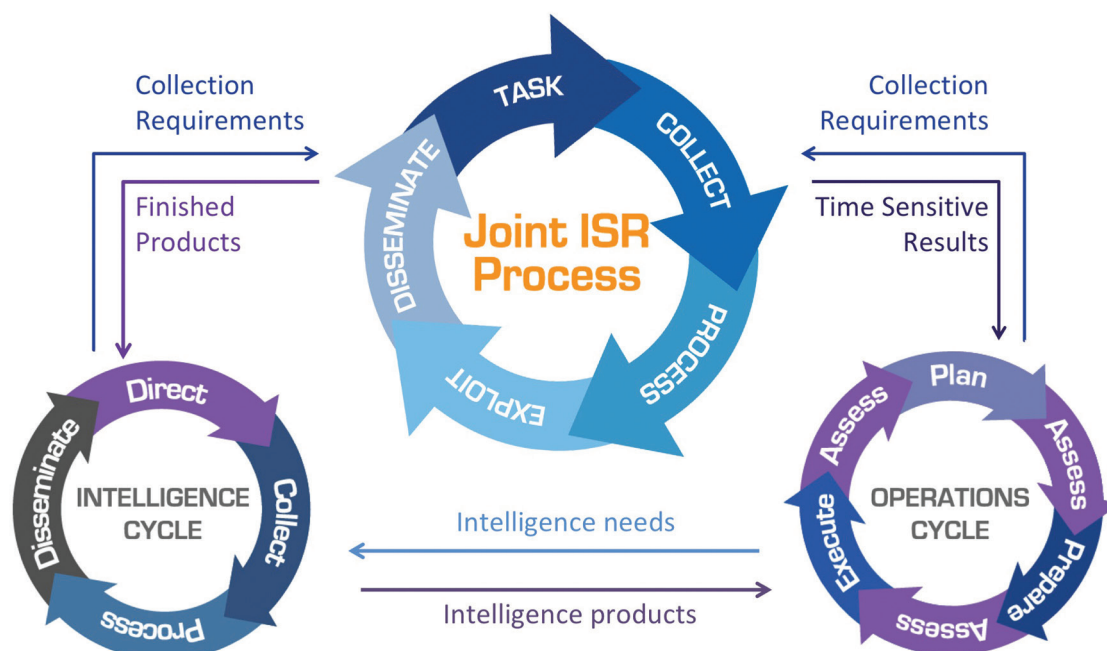
Multi-national, multi-service, multi-echelon process

Source: NATO Intelligence, Surveillance, and Reconnaissance, Defense Investment Division

at the right time in the right format. JISR is an operational sinew, or glue, that is fundamental to success in peace and war.[21]

NATO's JISR posture today is defined by organizations, systems, and trained operators. Building on the Lisbon (2010) and Chicago (2012) Summits, coupled with the lessons from both Libya and Afghanistan, the NATO Joint ISR Project Group was established to provide a governance role for overseeing the development and delivery of ISR across the Alliance. Supporting this effort was NATO's Joint Capability Group ISR, which leads the efforts to standardize and improve NATO's ISR interoperability. The Joint ISR Project Group is composed of national representatives with operational and technical support from key NATO entities.

One such entity is the NATO Communications and Information Agency and a nine-nation multinational effort known as MAJIIC2 (for Multi-sensor Aerospace

ground Joint ISR Interoperability Coalition) that combined with the Group in support of this effort.[22] At the Wales Summit (2014), heads of state confirmed ISR as one of NATO's key priorities.[23] A key result is the NATO ISR Interoperability Architecture, a series of standing agreements intended to align and rationalize ISR integration and interoperability. Managing all of these activities is NATO's Joint ISR Task Force, led by the Joint ISR Capability Area Manager. These groups, composed of allies, report to the North Atlantic Council through both NATO's Conference of National Armament Directors and, when required, NATO's Military Intelligence Committee. In addition to the interoperability efforts, NATO also possesses an advanced ISR analytical capability, found in its Intelligence Fusion Center (IFC) at RAF Molesworth in the UK but also residing in the intelligence staffs, data exploitation teams, and embedded analysts and linguists assigned to NATO Joint Force Commands, component commands (Air, Maritime, and Land),

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21   Kurt Veum, "Joint Intelligence, Surveillance and Reconnaissance in NATO," NATO Communications and Information Agency, September 9, 2016, https://fmv.se/Global/Dokument/Nyheter%20och%20Press/2016/Sensorsymposium%202016/2_Veum_NVIA_JISR%20 Initiative%20-%20Overview%20for%20SWE%20Sensors%20Conf%20(7%20Sep%202016)%20N-U.pdf.

22   Canada, France, Germany, Italy, the Netherlands, Norway, Spain, the UK, and the United States.

23   Philippe Vitel, *The Future of Allied Airborne Intelligence, Surveillance and Reconnaissance*, NATO Parliamentary Assembly, General Report, November 20, 2016, 7.

subordinate commands, national subordinate commands, and national organizations.[24] In some cases the availability of analysts is well below requirements.[25] For NATO airborne JISR, Allied Air Command (AIRCOM) in Ramstein, Germany, is the controlling headquarters. ISR data and information collected from airborne platforms are processed at a combination of national and NATO sites (including the US-manned Distributed Common Ground Station at Ramstein and NATO's advanced exploitation center at Sigonella, Italy).[26] These ISR products are then pushed to the designated Joint Force Commander and higher.[27]

NATO JISR Systems. At the Alliance level, NATO's Alliance Ground Surveillance (AGS) program will provide commanders with comprehensive land and maritime situational awareness.[28] Acquired by a consortium of 15 allies, AGS will consist of five RQ-4 Global Hawk unmanned, remotely piloted vehicles capable of all-weather, day/night, long-endurance missions. The RQ-4 can operate at altitudes of 65,000 feet with a range of 14,000 miles for up to 30 hours. Equipped with synthetic aperture radar and ground moving target indicator sensors, these platforms are supported by mobile ground control stations that are interoperable with a "wide range of NATO and national systems." (According to NATO officials, these platforms should be upgraded with signals intelligence [SIGINT], electro-optic, and infrared capabilities.) Based at Sigonella, AGS will fall under the operational control of Allied Air Command. AGS will receive its first RQ-4 platforms in 2019 and is expected to have initial operating capability in 2020.

While they offer a significant JISR enhancement, a total of five such aircraft is barely adequate for peacetime needs, and NATO should consider expanding this capability as soon as possible with additional upgraded platforms. This expansion will provide resiliency and redundancy, especially as not all AGS aircraft can be focused on the Baltic region. In time of crisis or conflict, NATO AGS should be reinforced with a full wing of heavy remotely piloted vehicles (RPVs), principally RQ-4s and MQ-9s, from the United States and key allies.[29] The MQ-9 reinforcements could have significant cost advantages that, when combined with increasingly

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24 The NATO IFC reports to the SACEUR in peacetime and to the designated Joint Force Commander in wartime, and it is co-located with USEUCOM's powerful Joint Analysis Center. Interview with Robert Murray, Head of the Office for ISR | Land | Maritime, Defense Investment Division, NATO International Staff, Brussels, Belgium, May 8, 2019.

25 For example, current estimates show a need for 700 additional analysts in the UK Ministry of Defense. See Joe Devanny et al., "Why the British Government Must Invest in the Next Generation of Intelligence Analysts," RUSI Journal, January 28, 2019.

26 A US Distributed Common Ground Station processes, exploits, and disseminates ISR inputs in a single collaborative environment, enhancing situational awareness and mission synchronization. Each US geographic combatant commander has one, all networked globally. See Eugene Haase, "Distributed Common Ground System—Future," Joint Force Quarterly 77, April 2015.

27 Unified Vision 2016, a major NATO exercise, demonstrated NATO's ability to fuse (also called "Process, Exploit, and Disseminate," or PED) AGS and AWACS inputs at multiple levels of command. Jay Vizcarra, "NATOE-3A and AGS Interoperability," Joint Airpower Competence Center Journal, Issue 25, March 2018.

28 Robert Murray, "How NATO Makes the Unknown Known," Joint Air Power Competence Center JournalCenter Journal, Issue 22, June 2016.

29 In peacetime, the US European Command and its air component, US Air Forces Europe, are allocated only small numbers of heavy UAVs/RPVs. In times of tension or crisis these priorities will change and the USEUCOM commander, who is dual-hatted as SACEUR, will likely be rapidly reinforced. Reinforcing ISR might consist of two squadrons of Global Hawks and four squadrons of Reapers, drawn from the United States, France, UK, Germany, and Italy.

Select ISR Platform Specifications[1]

Platform	RQ-4 Global Hawk	MQ-9A Reaper	E-3A Sentry	MQ-4C Triton
Manufacturer	Northrop Grumman	General Atomics	Boeing	Northrop Grumman
Wingspan	39.9 m	20 m	44.5 m	39.9 m
Ceiling	18.3 km	15.2 km	9.2+ km	17.22 km
Range	22,780 km	2500 km	9250 + km	15,186 km
Max Endurance	32+ hrs	27 hrs	10+ hrs*	24+ hrs
Payload	1360 kg	1747 kg	-	2451 kg
Crew	unmanned	unmanned	17-23	unmanned
Unit Cost^	$237 Million	$15.9 Million	$425 Million	$225 Million

*Endurance can be increased through air-to-air refueling and utilizing crew rest spaces.
^2019 US dollars.

1   Information in this chart was derived from the following sources:
"RQ-4 Block 40 Global Hawk," Northrop Grumman, https://www.northropgrumman.com/Capabilities/GlobalHawk/Documents/
Datasheet_GH_Block_40.pdf;
"MQ-9 Reaper/Predator B: Persistent Multi Mission ISR," General Atomics, http://www.ga-asi.com/Websites/gaasi/images/products/
aircraft_systems/pdf/MQ9%20Reaper_Predator_B_032515.pdf;
"E-3 Sentry (AWACS)," US Air Force, https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104504/e-3-sentry-awacs/;
"MQ-4C Triton," Northrop Grumman, https://www.northropgrumman.com/Capabilities/Triton/Documents/pageDocuments/
Triton_data_sheet.pdf; "Department of Defense Fiscal Year (FY) 2020 Budget Estimates: Aircraft Procurement, Air Force Vol-1," US
Department of Defense, March 2019, https://www.saffm.hq.af.mil/Portals/84/documents/FY20/PROCUREMENT/FY20_PB_3010_
Aircraft_Vol-1.pdf?ver=2019-03-18-152821-713, 179.
"MQ-9 Reaper," US Air Force, accessed https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104470/mq-9-reaper/;
Shelby S. Oakley, Weapon Systems Annual Assessment, Government Accountability Office, May 2019, https://www.gao.gov/
assets/700/698933.pdf.

creative operational concepts for the capability, might improve NATO's JISR crisis posture.

Situational awareness for the air domain is provided by NATO's Airborne Warning and Control System (AWACS), consisting of fourteen E3-A and six E-3D Sentry aircraft. Based at NATO Air Base Geilenkirchen in Germany and RAF Waddington in the UK, these platforms provide airborne surveillance, early warning, and command and control. Operating at altitudes up to 30,000 feet, the E-3 Sentry can track and monitor aircraft out to ranges of 400 km using onboard long-range radar and passive sensors. Three aircraft can cover up to 120,000 square miles, an area the size of Central Europe, for up to eight hours unrefueled. These aircraft will age and need replacement, probably around 2035; NATO has already launched its Alliance Future Surveillance and Control project to determine the system and capability requirements for the 2035 time frame. A system-of-systems approach is being considered with multiple, interconnected space-,

maritime-, land-, and air-based sensors providing the overall capability. The United Kingdom has already announced plans to replace its ageing fleet of six E3-D aircraft with five Boeing E-7 aircraft. The US Air National Guard also fields thirteen very capable MC-12 medium- to low-altitude ISR aircraft, some of which could be used in a Baltic scenario.

Maritime domain awareness in the Baltic region is enabled by a broad array of national platforms, including coastal radars, maritime patrol aircraft (both manned and unmanned), surface warships with their air defense radars and sonar arrays, submarines, acoustic and magnetic anomaly sensors, and coastal patrol craft. The United States European Command (USEUCOM) is normally supported by seven P-8 maritime patrol aircraft, while Germany and Norway field small numbers of the older P-3 Orions (the UK recently announced it will acquire nine P-8s beginning in 2020 while Norway will acquire five). Several NATO countries are looking at ways to lower costs and manpower needs for maritime

NATO's first Alliance Ground Surveillance aircraft arrived at Edwards Air Force Base, Calif., Dec. 19, 2015, completing its first flight. The aircraft took off from US Air Force Plant 42 in Palmdale, Calif., and arrived at Edwards AFB. The test flight marked the start of six months of ground and airborne testing at Edwards AFB before the aircraft is sent to its new home in Sigonella, Italy. NATO AGS is a derivative of the wide-area surveillance Global Hawk, with a few small changes in the communications software to meet certain criteria for operation in Europe. (*US Air Force photo/Chris Okula*)

domain awareness by evaluating other platforms as well. NATO is also considering a formal plan to make national maritime patrol assets available to the Alliance on a day-to-day basis until it can acquire its own maritime capabilities.[30]

Airborne ISR and unmanned underwater vehicles (UUVs) would augment the Alliance's antisubmarine warfare (ASW) capabilities in the Baltic region. Should circumstances warrant, NATO may also receive a complement of US P-8 maritime patrol aircraft and MQ-4 Tritons from USEUCOM to help with maritime domain awareness.[31] Like AIRCOM, the designated Maritime Component Command supporting the Joint Force Commander will collect, process, and disseminate these inputs.

NATO AGS and AWACS represent the core of NATO's owned and operated JISR collection platforms, but

national systems provided by allies significantly reinforce these capabilities in different and important ways. With thirty-one US Air Force (USAF) E-3 AWACS, thirty-two U-2 high-altitude strategic reconnaissance aircraft, twenty-two RC-135 Rivet Joint SIGINT (communications intelligence [COMINT] and electronic intelligence [ELINT]) aircraft in its inventory, and some 160 heavy unmanned aerial vehicles (UAVs; principally the RQ-4, MQ-4 and MQ-9), as well as several thousand smaller tactical UAVs, the United States far outmatches potential adversaries and would be the principal national provider of airborne JISR in a Baltic scenario.[32] US systems like the RQ-4 and E-3 are also in service with allies such as Germany and the UK, while the United States, UK, France, and Italy field the highly capable MQ-9 Reaper, with the UK and Belgium set to purchase the upgraded MQ-9B SkyGuardian. Moreover, USEUCOM is currently stationing unarmed Reapers out of Mirosławiec Air Base in Poland, having recently deployed them south to

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30 "Boeing is in exploratory talks with various allies to fill NATO's current gap in maritime surveillance and reconnaissance capabilities, according to company and allied officials. The idea would be to make the P-8 military multimission maritime version of Boeing's commercial 737 aircraft available to a core group of allies as a stopgap measure until the Alliance secures its own maritime capabilities by 2035." Brooks Tigner, *Jane's Defence Weekly*, April 3, 2019.

31 USEUCOM has seven P-8s in peacetime and would require another eight in a wartime scenario. Interview with NATO officials, June 12, 2019.

32 The Russian Federation fields many short- and medium-range drones but very few heavy UAVs. See The *Military Balance 2018*, 23.

Romania. Current plans call for basing an MQ-9 squadron in Poland as part of the recent bilateral agreement to increase US forces in country.[33] Other national systems, such as the UK's Sentinel R1 and Shadow R1 airborne ISR aircraft and Turkey's ANKA-S UAV, may also complement NATO JISR in peacetime, crisis, or conflict.

The Power of Jointness. Platforms and sensor systems are important, but the true strength of NATO's JISR is in jointness and cooperative security. The existing ISR architecture provides interoperability across all domains, enabling many different collection capabilities to contribute to multiple surveillance and reconnaissance activities. These include space-based imagery satellites, airborne signals and imagery intelligence aircraft (both manned and unmanned), land electronic warfare assets (ground surveillance and target acquisition radars), ground reconnaissance troops/special forces, naval radars, submarine platforms, sonars, and maritime patrol aircraft. These assets are further supported by air and missile defense radars, air defense control and reporting centers, electronic intelligence platforms, and commercial systems. All are leveraged by ISR analysts who can "fuse" this information and provide insight to decision makers. It is important to distinguish between tactical JISR systems, which feed directly into the tactical headquarters that are deploying them, and higher-level operational or strategic platforms and systems that require cross-cueing, data sequencing, and other sorting processes of much greater complexity.[34] Commercial platforms and services, such as communications and imagery satellites, ISR analysis, or space-launch services, will also play an increasingly important role.

NATO's JISR capabilities are significantly enhanced in peacetime with the addition of Swedish and Finnish systems. Both official NATO partners, Sweden and Finland have grown increasingly alarmed about Russian aggression and have experienced violations of their waters and airspace in recent years. Threatened by a dangerous and belligerent neighbor, both maintain a constant intelligence focus and detailed situational awareness of the Baltic region. Should Russia violate their territory or airspace in a time of crisis, both may decide to join or cooperate with the Alliance, adding valuable capacity and perspective to the JISR effort.[35]

The Baltic states themselves must also step up in the ISR arena. Although their defense budgets are small, they possess highly trained and well-educated technical experts who can make valuable contributions in ISR-related fields like cyber, air, and coastal defense radar and all forms of electronic intelligence. They also possess unique insights and understanding of the threat, based on their close proximity and almost daily engagement with Russian malign activity. Prioritizing their human capital in this way—perhaps through a Baltic JISR operations center linked to NATO structures—could leverage their unique strengths in ways that belie their small size and financial capacity. A Baltic ISR training "academy" might be another contribution that could add to this capability. Either, or preferably both, of these steps would provide tangible evidence of the Baltic states' willingness to "step up to the plate" in terms of their local and regional responsibilities. Moreover, it is possible that enhanced cooperation among the Baltic states—possibly with US Foreign Military Financing assistance—could allow them to pool resources in the service of purchasing and operating platforms that would contribute to JISR capability in the region. Alternatively, the Baltic states could consider acquiring a JISR capability through a contractor-owned/contractor-operated scenario, in which they pay for a JISR service rather than an acquisition. Such an arrangement could be more cost effective and provide greater operational flexibility.

The availability and capability of NATO JISR assets is important, but how their inputs are collected, processed, analyzed, prioritized, and disseminated to decision makers in real time is key. (NATO uses the acronym PED—for Process, Exploit, Disseminate—to describe these actions.[36]) This challenge is both multinational and

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33 The General Atomics MQ-9 Reaper has replaced the earlier MQ-1 Predator and can carry fifteen times the payload and fly three times faster than the MQ-1. With a service ceiling of 50,000 feet, a range in excess of 1,100 miles, and endurance of fourteen hours (fully loaded), the MQ-9 is the backbone of the US Air Force's ISR fleet and is also in use by the US Navy. According to NATO's International Staff, the United States currently fields ninety-three Reapers, the UK nine, France twelve, and Italy two. The Netherlands and Spain each have four on order, while the UK and Belgium are also purchasing significantly enhanced MQ-9B SkyGuardians. Source: NATO International Staff, ISR, Land and Maritime Division. Under current plans the UK will upgrade its current inventory with sixteen MQ-9B variants, called Protectors, by 2023. The Protector will feature an improved infrared targeting pod, better SIGINT capability, self-protection, and satellite communications redundancy.

34 Examples of tactical systems include the RQ-7 Shadow, RQ-5 Hunter, and RQ-11 Raven.

35 Sweden fields eight RQ-7 Shadow tactical UAVs with a service ceiling of 15,000 feet and endurance of six hours. Finland has eleven ADS-95 Ranger tactical UAVs with a service ceiling of 18,000 feet and endurance of nine hours, and a squadron of Learjet 35A fixed-wing ISR aircraft capable of operating up to 45,000 feet with a of 3,200 miles. The *Military Balance 2018*.

36 "PED is the transformation of raw collected data into usable information distributed for further analysis and/or use as combat information by commanders and staff." Eric Harclerode, "Modeling Intelligence PED With FOCUS: A Tactical-Level ISR Simulation," Defense Systems Information Analysis Center 2, Fall 2015, https://tinyurl.com/y2fhacaj

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A Russian S-400 Triumf air defense system. *Source: Wikimedia Commons*.

cross-domain, and it exists at the tactical, operational, and strategic levels of war. Here, effective solutions are both technical and organizational, underpinned by high levels of training for NATO's ISR professionals.

As we have seen, NATO and its member states possess impressive collection capabilities in all domains: space, cyber, maritime, air, and land. US space-based systems in particular are unmatched, providing global communications, navigation, focused surveillance, imagery (radar, infrared, and multi-spectral), electronic intelligence, area reconnaissance, measurement and signal intelligence, and many other capabilities. When reinforced by national systems, NATO's ISR backbone and capabilities can see, sense, and identify strategic indicators and intelligence targets, especially when sensible collection priorities have been established. This information must then be "sorted," analyzed, packaged, and disseminated to decision makers rapidly and accurately. The problem here will likely be too much, not too little, information. Adversary disinformation, deception plans, electronic warfare, and cyberattacks may all disrupt this vital activity. Ideally, analysts will collate many disparate inputs to rapidly produce an accurate Common Operating Picture, or COP, to support timely strategic decisions.

Although this may sound simple, in practice it is a daunting challenge. Inputs will flow in volume from many different nations, from all domains, and from tactical and operational as well as strategic sources. Strategic commanders will be forced to weigh operational security against the desire to share information as widely as possible. The need for Alliance consensus will militate against crisp intelligence support as nations may disagree on what adversary actions really mean. Here, NATO must strike a balance between operational security and the transparency required to ensure political consensus. In the future, machine learning and the application of data analytics will help analysts rapidly sift through the large amounts of collected data to best inform decision makers.

For the time being, however, it is imperative that these procedures be worked out and rehearsed in advance of any crisis situations, and that as much as possible they reflect standard peacetime processes. Wherever possible, authorities working to collect, analyze, and disseminate intelligence products based on JISR inputs should push their findings down to operational commanders based on command guidance. Intelligence and operations staffs must be thoroughly fused and exercised. Key billets must be manned with trained and

A multinational group takes part in NATO exercise Unified Vision, a major 'trial' managed by Allied Command Transformation and NATO Headquarters in the context of NATO's Joint Intelligence Surveillance and Reconnaissance, 14 – 29 June 2016. *Source: https://www.nato.int/nato_static_fl2014/assets/pictures/stock_2016/20160630_160629-uv16_rdax_775x440.jpg*

qualified personnel and stabilized to ensure continuity and mission performance. Collection plans and priorities must be rigorously prepared and regularly reviewed and updated in accordance with approved commanders' intelligence priorities—a baseline of awareness and understanding of the operational environment in peacetime is key. Duplication of effort between NATO and national operational headquarters and command posts should be avoided. To the maximum possible extent, procedures should be standardized across the Alliance and thoroughly understood. Given Russia's strong advantages in geographical proximity and demonstrated proficiency at snap exercises, time will be the most precious resource for Alliance leaders in a Baltic crisis. NATO cannot afford delay; JISR is the linchpin that holds together the Observe-Orient-Decide-Act cycle driving NATO planning and operations, particularly during any transition from a hybrid to an Article 5 scenario.

At the Joint Forces Command level, these fused ISR products will be continuously reviewed and updated to maintain an accurate COP. Soon, order-of-magnitude advances in computer processing power and "big

data" collection, coupled with advances in analytics automation, will improve NATO's ability to fuse huge volumes of data—currently a demanding challenge due to manpower limitations. Refining these requirements and bringing these new technologies and capabilities online should be a priority for NATO in the near term.

The Future of JISR. In the near term, future sensor, analytical, and platform technology will expand the capabilities of NATO JISR greatly. New systems and programs like the European High Atmosphere Airship Program, the Alliance Future Surveillance and Control Program, and the US Advanced Battle Management System[37] (intended to replace NATO AWACS as the E-3 platforms reach the end of their service lives) are planned, while next-generation UAV/RPVs, underwater unmanned systems, satellites, and more-sophisticated sensors and sensor packages expand the Alliance's capabilities. Open-source intelligence, biometric intelligence, artificial intelligence, social media, cognitive analytics, and more-capable active and passive sensor technologies will all transform JISR in coming years.[38]

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37   Air Marshal Sir Christopher Harper et al., *Air Defense of the Baltic States*, 12.
38   George Seffers, "From Eyes in the Sky to Sensors on the Ground," Signal, April 1, 2018.

In the longer term, advances in quantum sensing supported by quantum computing will propel a steep rise in JISR collection and analysis, providing ever more timely situational clarity to decision makers. Academic and government R&D efforts, combined with commercial innovation and competition, will be critical to seeing such concepts come to fruition. Here, the pace of technological advancement will often outstrip NATO's acquisition cycles, making "sensor refresh" a real challenge—perhaps best met by innovative leasing or other commercial arrangements.[39] Quantum and other such technologies will change the character of JISR in important and consequential ways, although its essential nature will endure.[40]

Rapidly evolving technology will increase JISR capabilities but also introduce vulnerabilities to cyber intrusion and attack. JISR systems and nodes will be prime targets that must be defended. In recent years the Alliance has made great strides in cyber defense, but the threat is real, advanced, and unremitting. Defense against Russian electronic warfare (EW) is also critical. At every step in the evolution and fielding of JISR systems in NATO, cyber and EW hardening, redundancy, and resiliency will be important and must be built in from the outset.

In the event of increased tension or crisis in the Baltic region, NATO decision makers and commanders will be focused on warnings and indicators of adversary intentions. In a hybrid or "gray zone" scenario, the JISR challenge is in many ways nontraditional and more demanding. Classical indicators like troop movements or railway and airfield activity may be reduced or absent altogether. Instead, JISR may take the form of intensive monitoring and analysis of propaganda and social media, open sources, atypical commercial ship and airline movements, stepped-up diplomatic activity, unusual financial transactions, increased volumes of cyber intrusion and denial-of-service attacks, and unrest in ethnic Russian areas and populations. The activity and movements of low-signature and specialized intervention units or "private contractor" formations like the Wagner Group[41] may also signal Russian intentions.

These indicators will be masked by sophisticated disinformation and deception efforts. Here, electronic intelligence and communications intercepts as well as imagery from airborne and space-based platforms and on-the-ground human intelligence will likely be more important than traditional moving-target indicators. In identifying and assessing these warnings, the Alliance should rely on the expertise of Baltic members who live and work in this environment on a daily basis, as well as the Poles, Swedes, Finns, and Norwegians living and operating on the Arctic border with Russia. In addition, surveillance and reconnaissance of financial movements in equity markets should also be factored in. Commercial entities are already providing ISR mission sets of financial markets as part of broader geopolitical indicators and warnings for areas of interest.

A Russian hybrid operation to destabilize or partition one or all of the Baltic states falls well within the calculus of Russian strategic thinkers as a way to fracture the Alliance. Assessing Russian intent before the fact will be extremely challenging, but NATO's ability to cope with hybrid threats is better than its ability to counter conventional Russian aggression in the Baltic region at the present time. In a period of heightened tension prior to such aggression, NATO JISR will likely pick up specific strategic indicators such as prepositioning of bulk fuel and ammunition supplies, airfield and ship operations and deployments, increased command-post activities, movement forward of field hospitals, marshaling of transport aircraft and railcars; unit recalls; intensified training evolutions; social media activity; deployment of large forces toward the border and into Belarus; deception operations in other theaters; and intensified information and cyber operations and border provocations. The Russian government will go to great lengths to deceive NATO about the likelihood, timing, direction, location, and nature of offensive operations.[42] Difficulties may arise in distinguishing between exercises and actual deployments, placing a premium on accurate assessments.

In this circumstance, and if kinetic operations commence, NATO can expect its JISR platforms and capabilities to be directly challenged. As one recent study notes, "highly contested and degraded information environments will be the norm in future warfare."[43] The most serious threat to airborne collection is the S-400, which can engage targets at altitudes far higher than

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39   Interview with Major General (Ret.) James Chiswell UK, former Director, UK Special Forces.

40   See Lt. Gen. Dash Jamieson, "Next Generation ISR Dominance Flight Plan," United States Air Force Office of Public Affairs, August 2, 2018, https://www.airuniversity.af.edu/Portals/10/ISR/Documents/HAF_A2/Next-Gen_ISR_Flight_Plan.pdf.

41   Nathaniel Reynolds, *Putin's Not-So-Secret Mercenaries: Patronage, Geopolitics, and the Wagner Group*, The Carnegie Endowment for International Peace, July 8, 2019, https://carnegieendowment.org/files/GlobalRussia_NateReynolds_Vagner.pdf.

42   Petersen et al., *Baltic Security Net Assessment*, 152.

43   Thomas G. Mahnken, "*Tightening the Chain: Implementing a Strategy of Maritime Pressure in the Western Pacific*," Center for Strategic and Budgetary Assessments, 2019, 37

the RQ-4's service ceiling of 60,000 feet at ranges out to 400 km. Heavy Russian air defense, electronic warfare, and cyber capabilities will challenge US and NATO systems like the RQ-4 and MQ-9 Reaper in a contested, highly lethal air defense environment. GPS navigation in particular may be impared. As one authoritative study notes, "adversaries will have the capability and intent to oppose or disrupt NATO air operations and will represent a serious threat to remotely piloted aircraft systems."[44] These threats can be mitigated by aggressive and creative use of manned and unmanned platforms working synergistically to degrade Russian air defense, particularly its targeting radars. Russian combat aviation and long-range fires (such as the SS-26 Iskander, SS-21 Tochka, SS-N-27 Kalibr, and SSC-8 Novator) might also target JISR airfields, ground control stations, and analytical sites at much greater distances before or after commencement of ground operations.[45] While Russian A2/AD systems in the Kaliningrad region are active, NATO must also rely on space-based systems and other intelligence collectors and systems not as vulnerable to Russian air defense. This dynamic suggests that current programs to develop high-performance, low-observable (or "stealthy") UAV/RPVs are well founded, although ultimately the cost of developing them should be weighed against the costs of attrition for current platforms.[46] Once Russian air defenses are neutralized or degraded, NATO JISR can be used to full effect for intelligence collection and dynamic targeting and will play an essential role in determining successful outcomes.

Conclusion. In peacetime, crisis, and conflict in the Baltic region and in the "gray zones" that separate them, NATO's Joint Intelligence, Surveillance, and Reconnaissance capabilities will be critical. Timely, high-quality JISR will be decisive in providing political and military leaders with the right tools to accurately assess the threat and to facilitate the decisions necessary for prompt and effective response. The Alliance currently fields a broad range of JISR capabilities that provide comprehensive situational awareness and decision support, and those capabilities can be reinforced by national capabilities as required. However, quantitative and qualitative enhancements in interoperability, cyber defense, manning, training and exercises, survivability, operational security, and authorities for employment can strengthen and improve the JISR effort. Given the pace of technological change, NATO and its member nations should continuously assess and plan to rapidly evolve new and more capable JISR solutions going forward. These steps will contribute to an effective deterrence posture on NATO's eastern flank well into the future. The following recommendations are intended to inform and advise NATO's senior leaders and may be usefully considered at upcoming NATO ministerials and summits.

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44   Major André Haider, LW, "*Remotely Piloted Aircraft Systems in Contested Environments: A Vulnerability Analysis*," NATO Joint Airpower Competence Center Journal, 2018.

45   Gen. Philip M. Breedlove, USAF (Ret.) *Toward Effective Air Defense in Northern Europe*, The Atlantic Council, February 2018, 1.

46   The USAF fields twenty RQ-170 Sentinel aircraft, designed as "stealth" UAVs, to operate against advanced air defense systems and is fielding the more advanced RQ-180 as a follow-on stealthy UAV. US Air Force Lt. Gen. Bob Otto first mentioned the RQ-180 publicly on June 9, 2014.

Key Recommendations

For NATO Strategic Leaders

◆ Russian aggression in either hybrid or conventional form should be seen as a genuine threat requiring robust deterrence and defense, with NATO JISR a critical component.

◆ To the maximum extent possible, the Alliance should push authorities to deploy and employ unarmed JISR systems down to the Supreme Allied Commander Europe (SACEUR) and operational commanders in peacetime, crisis, and conflict.

◆ As a critical priority, all NATO JISR billets should be fully manned with trained personnel on minimum tours of twelve months. Innovative approaches to manpower shortfalls should be considered.

For NATO Staffs

◆ NATO JISR collection priorities for different scenarios should be identified, approved, and disseminated in advance.

◆ JISR units, headquarters, and capabilities should be subjected regularly to interoperability evaluations to maximize operational effectiveness.

◆ Procedures for collection, evaluation, and secure and timely dissemination of key JISR products should be established in peacetime and regularly exercised.

For NATO Planners

◆ In periods of increased tension and when Indications and Warning "triggers" are met, NATO should be rapidly reinforced with a wing of heavy RPVs from the United States and key allies. US MQ-4 Tritons, P-8 maritime patrol aircraft, and MQ-9s should also be provided to augment maritime domain awareness.

◆ Before any sort of crisis begins, NATO should take lessons from the current United States Air Forces in Europe (USAFE) deployment of MQ-9s and evaluate the applicability of a larger and combined NATO force.

◆ Operational plans should be developed that take into consideration potential gaps in JISR coverage during conflict scenarios due to the serious threats to NATO AGS and AWACS from Russian air defense and long-range fires from the air, ground, and maritime domains, particularly those systems based in Kaliningrad.

◆ Well-considered procedures and organizational architecture should be developed to facilitate efficient and rapid transition of JISR derived information. Multiple competing organizations can delay, disrupt, and even defeat the JISR effort unless disciplined and clearly spelled-out processes for collection, analysis, and dissemination are in place.

For NATO Acquisition Officials

◆ NATO should consider augmenting its five AGS Global Hawks with an additional squadron of similar upgraded platforms for enhanced redundancy, capability, and continuity; the current platforms should be upgraded with SIGINT, electro-optic, and infrared capabilities.

◆ Programs currently under way to develop high-performance "stealthy" ISR platforms able to survive in high-threat environments should be supported, although development costs should be weighed against the costs of attrition for current platforms.

◆ NATO should move forward with plans currently under consideration to acquire or lease a number of maritime patrol aircraft as a long-term solution to requirements for maritime domain awareness. Moreover, other JISR platforms for maritime domain awareness should also be considered. Specifically, UUVs with advanced sensors should be considered to augment ASW capabilities.

◆ Fully interoperable communications and intelligence systems should be prioritized to enable timely and operationally secure flows of information across national boundaries and echelons of multinational command.

◆ Sensor technology will evolve much faster than NATO program acquisition cycles. NATO should

therefore consider innovative leasing or other commercial arrangements to keep pace.

◆ NATO allies should continue research and development as a follow-on from MAJIIC2 to deliver advanced machine learning capabilities to ISR analysts and organizations.

◆ Specific and focused cyber hardening and defense of NATO JISR assets should be implemented to defend against advanced Russian cyber and EW capabilities.

For NATO Nations and Partners

◆ Allied and partner nations, including the Baltic states, should routinely assess national JISR inventories in cooperation with NATO in order to ensure that national JISR priorities are met and that the ability to reinforce NATO in a crisis is certain.

For the Baltic States

◆ A Baltic JISR operations center linked to NATO structures could leverage the Baltic nations' unique strengths in ways that belie their small size and financial capacity. Similarly, a Baltic ISR training "academy" could add much-needed but affordable capability. Either, or preferably both, of these contributions would provide tangible evidence of the Baltic states' willingness to "step up to the plate" in terms of their local and regional responsibilities.

Appendix

Select Baltic Sea Regional Allied and Partner ISR Assets[1]			
COUNTRY	**AIRBORNE**	**MARITIME**	**LAND-BASED**
Denmark	6 Super Lynx Mk 90-B ASW helicopters 3 MH-60R Seahawk ASW helicopters RQ-11 Raven B small unmanned aircraft system 8 AS550 Fennec helicopters	[1] 6 Diana-class patrol vessels 3 Iver Huitfeldt-class FFGs 3 Knud Rasmussen-class patrol vessels	RAC 3D target acquisition and tracking radar
Estonia	!		Thales Raytheon Systems GM403 radar Lockheed Martin TPS-117 radar
Finland	1 C295M ELINT aircraft 11 ADS-95 Ranger UAVs 1 Learjet 35A 1 F-27-400M maritime patrol aircraft 2 Do-228 maritime surveillance aircraft (Border Guard) 5 AS332 Super Puma maritime surveillance helicopters (Border Guard) 1 Bell 412 Twin Huey maritime surveillance helicopter (Border Guard) 1 AW119KE Koala maritime surveillance helicopter (Border Guard)	4 *Hamina*-class guided-missile patrol craft 4 *Rauma*-class missile boats	GM400 radar system Sentinel X Band radar
Germany	8 P-3C Orion aircraft 22 Lynx ASW helicopters* 8 IAI Heron UAVs 44 Rheinmetall KZO target acquisition UAVs 40 EMT Luna X-2000 close reconnaissance UAVs 20 Panavia Tornadoes, electric combat/reconnaissance variant	6 Type 212 Submarines 5 Braunschweig-class corvettes 3 Sachsen-class air defense frigates	GM 400 radar system
Latvia	! 4 Mi-17 Hip H multi-role helicopters	5 Skrunda-class patrol boats	SAAB Giraffe 2D radar 4 Thales Raytheon Sentinel mobile radars TPS-77 Enterprise search radars
Lithuania	!	4 Zemaitis-class coastal patrol craft	SAAB Giraffe 2D radar Thales Raytheon Sentinel mobile radars

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1   Information presented in this chart was derived from the following sources: *The Military Balance 2019* (London: Institute for International and Strategic Studies, 2019), 100.; Andrew Metrick and Kathleen H. Hicks, *Contested Seas: Maritime Domain Awareness in Northern Europe*, Center for Strategic and International Studies, March 2018, https://csis-prod.s3.amazonaws.com/s3fs-public/publication/180328_MetrickHicks_ContestedSeas_Web.pdf.; "Estonia Accepts Lockheed Martin Radar for BALTNET Air Surveillance Program," Defense-Aerospace.com, accessed March 28, 2019, http://www.defense-aerospace.com/articles-view/release/3/17527/estonia-accepts-first-tps_117-radar.html.; Harper et al., *Air Defense of the Baltic States*, 13.; Petersen et al., *Baltic Security Net Assessment*, 227.

Poland	2 ISR helicopter squadrons with Mi-2URP 2 SH-2G Super Seasprite ASW helicopters 7 Mi-14PL Haze ASW helicopters 12 Su-22M Fitters (fighter/ground attack/ISR)	4 Kobben-class submarines 2 Pulaski-class (former Oliver Hazard Perry-class) frigates 1 Kaszub-class corvette 3 Orkan-class guided-missile fast patrol craft	3 RAT 31 radars
Sweden	8 RQ-7 Shadow UAVs 2 Gulfstream IV SRA-4 ELINT aircraft 3 S-100B/D AEW&C aircraft	3 Gotland-class submarines 2 Sondermanland-class submarines 5 Visby-class corvettes	ITT Exelis LCR-2020 coastal radar
	*Scheduled to be replaced by ASW Version of NH90		
	! While the three Baltic States possess limited domestic airborne surveillance capabilities, they are all covered by the NATO Baltic Air Policing mission which provides Allied aircraft on a rotating basis to patrol Baltic Airspace.		

About the Authors

Task Force Co-Chairs

Admiral Mark E. Ferguson, III, USN (Ret.)

Admiral Mark Ferguson was born in Newfoundland, Canada, and raised in Maryland. He graduated with distinction from the US Naval Academy in 1978 and completed nuclear power training prior to entering the fleet as a surface warfare officer. Over his career, he has operated in both the Atlantic and Pacific fleets in ships ranging from destroyers to aircraft carriers. His assignments include duty aboard USS South Carolina (CGN 37), USS Fife (DD 991) and USS Dwight D. Eisenhower (CVN 69), as well as command of USS Benfold (DDG 65) and Destroyer Squadron (DESRON) 18. In addition to various staff assignments focused on manpower and legislative affairs, he served as a special assistant to the Supreme Allied Commander, Europe during Operation Allied Force. His flag assignments include service as the Navy's chief of legislative affairs and chief of naval personnel. From August 2011 until July 2014, he served as the 37th vice chief of naval operations. He is a graduate of the Air Command and Staff College and holds a master's degree in computer science from the Naval Postgraduate School. He also completed a National Security Fellowship at the Harvard Kennedy School. Ferguson served as the commander of Allied Joint Force Command located in Naples, Italy from 2014 to 2016. In this capacity, he directed a combined NATO staff responsible for planning, preparing and conducting military operations throughout the Supreme Allied Commander Europe's area of responsibility. He concurrently served as Commander, US Naval Forces Europe and US Naval Forces Africa. His area of responsibility encompassed the waters bordering the coasts of Europe and Africa, including the Baltic, Mediterranean and Black Seas. He is a recipient of various personal and campaign awards, including the Distinguished Service Medal (three awards), the Defense Superior Service Medal and the Legion of Merit (three awards).

Air Marshal Sir Christopher Harper, RAF (Ret.)

Air Marshal Sir Christopher Harper joined the Royal Air Force as a pilot in 1976. He has flown numerous aircraft including the Jaguar, the CF-18 and, more recently, the Eurofighter Typhoon. He was involved in active operations over Iraq and in the Balkans and has commanded at all levels of the Royal Air Force including, from 2007 to 2009, as air officer commanding No 1 Group. In this role he was responsible for more than 15,000 personnel and all of the Royal Air Force's combat air power. Sir Chris has also held important staff appointments in the UK Ministry of Defense and at the RAF's Air Command headquarters. His last 7 years in the Royal Air Force saw him working in NATO. From 2009 to 2011, he was deputy commander of NATO's Joint Force Command at Brunssum in the Netherlands; following that, he was the UK's military representative to NATO and the EU in Brussels. More recently, from 2013 to 2016, he was director general of the HQ NATO International Military Staff. Sir Chris left the Royal Air Force in January 2017 and started a small independent company, CH4C Global Ltd, which offers bespoke consultancy services to organisations working in the international defense and security sector. He regularly speaks at key events such as the Munich and Berlin Security Conferences, Wilton Park, and the Lennart Meri Conference in Estonia. During early 2018 he worked with the Tallinn-based International Center for Defense and Security to lead an in-depth study of Baltic region air defence. Sir Chris is the Honorary Air Commodore of No 2620 'County of Norfolk' Squadron of the Royal Auxiliary Air Force and is the president of the Royal Air Force Flying Clubs Association. He is also a vice president of the Royal International Air Tattoo, a trustee of the Air League and a nonresident senior fellow with the Atlantic Council's Scowcroft Center for Strategy and Security.

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Dr. Richard D. Hooker, Jr. joined the faculty of the National War College in July 2018 after previous service as NDU's Director, Institute for National Strategic Studies (INSS). A career Army officer, his military service included combat tours in Grenada, Somalia, Kosovo, Iraq and Afghanistan, including command of a parachute brigade in Baghdad. His military service also included tours in the offices of the chairman of the Joint Chiefs, the secretary of the Army and the chief of staff of the Army. A veteran of three tours with the National Security Council, he previously served as assistant professor at West Point, as the Army chair at the National War College, and as dean of the NATO Defense College in Rome. Dr. Hooker graduated with a BS from the US Military Academy in 1981 and holds MA and PhD degrees in international relations from the University of Virginia. He is a distinguished graduate of the US National War College. His areas of expertise include defense policy and strategy, the Middle East, NATO/Europe and civil-military relations.

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