



ANALYSIS

# FIFTH GENERATION AIR POLICING

THE F-35 AND BALTIC AIR POLICING

| WILLIAM WATSON |

AUGUST 2021

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RAHVUSVAHELINE KAITSEUURINGUTE KESKUS  
INTERNATIONAL CENTRE FOR DEFENCE AND SECURITY  
EESTI • ESTONIA

Title: Fifth Generation Air Policing: The F-35 and Baltic Air Policing

Authors: Watson, William

Publication date: August 2021

Category: Analysis

Cover page photo: F-35 fighters of the Italian air force arrive in Estonia, 30 April 2021. Picture credit: [pildid.mil.ee](http://pildid.mil.ee).

Keywords: Baltic air policing, F-35, deterrence and defence, NATO

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ISSN 2228-2076

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63/4 Narva Rd., 10120 Tallinn, Estonia  
info@icds.ee, www.icds.ee

## ABOUT THE AUTHOR

### WILLIAM WATSON

William (Will) Watson is a joint-degree student at Texas A&M University and the Bush School of Government and Public Service studying international affairs with a focus on NATO and Russian foreign policy.

## INTRODUCTION

Baltic Air Policing (BAP), an enduring NATO mission, provides quick reaction alert capability to safeguard airspace over the Baltic states. As Estonia, Latvia and Lithuania do not have combat air assets, BAP operates through Allies volunteering aircrews and aircraft to undertake the mission on a rotational basis. In April 2021, Italy became the first country to use a 5<sup>th</sup> generation aircraft—the F-35—for this mission. The replacement of older combat aircraft by smaller numbers of their more expensive 5<sup>th</sup> generation successors may have implications for Allied contributions to BAP.

### 1. THE F-35

The development of the F-35 began with the US/UK Joint Strike Fighter project, which envisioned a new, multi-purpose combat aircraft to replace several existing models. Several other partners have since joined the project. The level of partnership, categorised into 3 tiers based on financial contribution to development costs, regulates the delivery schedule, amount of technology transfer, and subcontracting opportunities for partner states. The UK is the sole level 1 partner, with a contribution of \$2.2 billion. Italy and the

Netherlands are level 2 partners, having contributed about \$1 billion. Australia, Denmark, Norway, and Turkey each contributed \$100-\$200 million, making them level 3 partners.

The F-35's maiden flight was in 2006.<sup>1</sup> There are 3 variants: A, B, and C. The F-35A is a conventional take-off and landing aircraft, the F-35B is the short take-off and vertical landing version, and the F-35C is the carrier version.<sup>2</sup> The F-35A is the only variant to have been used for air policing missions so far.

Almost all JSF partner countries are acquiring F-35s to replace portions of, or the entirety of, their current 4<sup>th</sup> generation fleets. The cost per unit of an F-35 varies between countries as contracts may stipulate offsets for non-partner nations, the A/B/C variants differ in cost, and contracts may include different combinations of spare equipment and simulators. The initial unit acquisition cost of an F-35A varies from country to country due to differences in quantity and specification, but is about \$78 million; by comparison, an F-16, the world's most popular 4<sup>th</sup> generation fighter, costs about \$30 million to acquire.<sup>3</sup> The F-35 requires a substantial amount of software and supporting systems. Factors such as maintenance, facility upgrades, and training make the whole-life cost of an F-35 substantially higher than the initial acquisition cost—for example, it costs about \$10.1 million to train a pilot on an F-35 compared to \$5.6 million to train a pilot on an F-16.<sup>4</sup>

*The replacement of older combat aircraft by the F-35 may have implications for Allied contributions to Baltic Air Policing*

The F-35 is a 5<sup>th</sup> generation aircraft. While the term is not closely defined, 5<sup>th</sup> generation aircraft are considerably more capable than 4<sup>th</sup> generation aircraft such as the F-16, F-18, MiG-29, and Su-27 and have “thrust vectoring,

<sup>1</sup> Srdjan Vucetic and Kim Richard Nossal, “The International Politics of the F-35 Joint Strike Fighter,” *International Journal* 68, no. 1 (2012), 5.

<sup>2</sup> Jeremiah Gertler, “F-35 Joint Strike Fighter (JSF) Program,” *Congressional Research Service*, RL30563, 27 May 2020, 2-3.

<sup>3</sup> Valerie Insinna, “The Price of the F-35 has been falling, but it could hit a wall soon,” *DefenseNews*, 23 July 2020; Rich Smith,

“Lockheed Martin Scores \$62 Billion F-16 Sale,” *The Motley Fool*, 24 August 2020.

<sup>4</sup> Michael G. Mattock, Beth J. Asch, James Hosek and Michael Boito, *The Relative Cost-Effectiveness of Retaining Versus Accessing Air Force Pilots* (Santa Monica CA: The RAND Corporation, 2019), 16. It costs about \$9.4 million to convert a trained fighter pilot to the F-35.

composite materials, stealth technology, advanced radar and sensors, and integrated avionics.”<sup>5</sup> All 3 F-35 variants (A/B/C) are designed to operate in an anti-access environment through superior stealth technology. Additionally, 5<sup>th</sup> generation aircraft like the F-35 have advanced computers and sensors enabling them to serve as coordinators for other aircraft.<sup>6</sup> This may allow 5<sup>th</sup> generation aircraft to direct unmanned aerial vehicles in the future.<sup>7</sup> These abilities have led operators and analysts to describe the F-35 as a transformational capability that can act as a force multiplier and be a key part of a winning strategy.<sup>8</sup>

The F-35A is one of the most capable aircraft developed. It has advanced sensors that work together to improve detection range, enable advanced emitter location and enhanced geolocation, and support sophisticated threat identification to allow the F-35 to engage ground targets. Its enhanced stealth capability substantially reduces risk to the aircraft and pilot. The F-35 can pull from existing intelligence libraries to classify known threats such as surface-to-air-missiles and inform the pilot via a helmet mounted display. The F-35 has similar capabilities to previous fighter jets while maintaining air-to-ground capabilities, resulting in a proficient multirole aircraft. However, an inability to conduct high-G turns without lowering airspeed limits the F-35 in air-to-air combat when compared to an F-16. The F-35 is also vulnerable in close air-to-air combat with other stealth fighters, limiting its performance in visual range engagements.<sup>9</sup>

Furthermore, past problems with the software have prevented missions from taking-off as conflicting data grounded the jet. While there

are proposals to solve these issues, their success remains to be seen.<sup>10</sup> Lockheed Martin, the prime contractor, has however fixed issues with the active electronically scanned array that had been problematic in aerial engagements.

## 2. BALTIC AIR POLICING

As the Baltic states lack combat air forces, NATO countries volunteer to secure the integrity of their airspace through the NATO Air Policing mission. Air policing is an essential NATO mission to ensure “the integrity, safety and security of its airspace”.<sup>11</sup> Air policing aircraft also regularly intercept aircraft flying in NATO airspace without radio communication, flight plans, or a transponder signal, posing a risk to civilian aircraft.<sup>12</sup> Absent BAP, the Baltics would be more

*In 2020, across Europe, NATO scrambled aircraft about 400 times to intercept unknown aircraft, 90% of which were Russian*

vulnerable to Russian airspace aggression: in 2006, following a withdrawal of US air policing from Iceland, Russian aircraft began intruding into its airspace.<sup>13</sup>

Starting in 2004, BAP consisted of four aircraft provided on a 3-month rotational basis by Allies and was based at Šiauliai Air Base in Lithuania. Due to Russia’s aggression against Ukraine, in 2014 BAP surged to 16 fighters, then stabilised as an enhanced mission of eight fighters operating from Šiauliai Air Base and Ämari Air Base in Estonia.<sup>14</sup>

17 nations have participated in BAP as of May 2021 (see Figure 1). In 2020, across Europe, NATO scrambled aircraft about 400 times to intercept unknown aircraft, 90% of which were

<sup>5</sup> Gertler, “F-35 Joint Strike Fighter,” 1-2.

<sup>6</sup> Kyle Insinna, “[Air Force Chief Defends F-35A against Critics, Boasting Kills at Red Flag](#),” *Air Force Times*, 20 February 2019.

<sup>7</sup> Valerie Insinna, “[Under Skyborg program, F-35 and F-15EX jets could control drone sidekicks](#),” *DefenseNews*, 22 May 2019.

<sup>8</sup> Deborah Lee James and Daniel Gouré, *The Implications of Fifth-Generation Aircraft for Transatlantic Airpower* (Washington DC: Atlantic Council, 2019), 6.

<sup>9</sup> Stefano D’Urso, “[Sukhoi Begins Serial Production Of The Su-57, Meanwhile Let’s See What We Know About Russia’s 5th Generation Stealth Jet](#),” *The Aviationist*, 1 August 2019.

<sup>10</sup> John Venable, “[The F-35A Fighter Is the Most Dominant and Lethal Multi-Role Weapons System in the World: Now Is the Time to Ramp Up Production](#),” *The Heritage Foundation*, 14 May 2019.

<sup>11</sup> NATO, Allied Air Command, “[We Secure the Skies](#).”

<sup>12</sup> Andrew Whyte, “[Ministry: Over 200 Russian International Aviation violations in 2020](#),” *ERR*, 29 December 2020.

<sup>13</sup> Susan Cornwell, “[Condoleezza Rice Defends Guantanamo](#),” *Reuters*, 30 May 2008.

<sup>14</sup> Christopher S. Chivvis, Raphael S. Cohen, Bryan Frederick, Daniel S. Hamilton, F. Stephen Larrabee and Bonny Lin, *NATO’s Northeastern Flank. Emerging Opportunities for Engagement*, (Santa Monica CA: The RAND Corporation, 2017), 132.

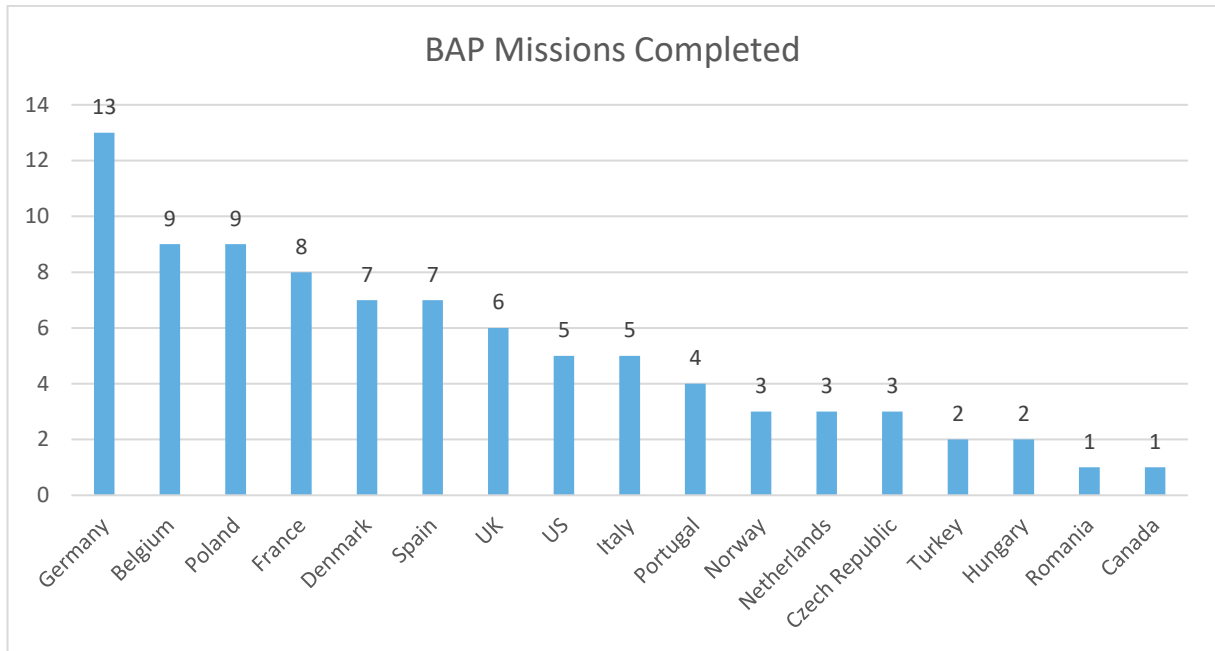


Figure 1. Participation in BAP

Russian.<sup>15</sup> Aircraft were scrambled from Ämari 48 times in the same year to perform intercept missions.<sup>16</sup> In May 2021, Italy became the first nation to bring F-35As to the Baltic air policing mission; however, Norway had earlier used the F-35A for Icelandic Air Policing.<sup>17</sup>

### 3. AIR POLICING WITH THE F-35

Deploying the F-35—arguably NATO’s most advanced capability—to a relatively benign mission in the Baltic states is certainly a demonstration of the seriousness with which other Allies treat Baltic security. The F-35’s value in any crisis-time transition from an air policing to an air defence mission also sends both deterrence and reassurance signals. But this should not be overstated: it is unlikely that 4-8 aircraft of any type have a significant impact on Russia’s deterrence calculations. Additionally,

deploying F-35s to eastern Europe may allow Russian air defence systems to gain valuable identification and targeting information—S-400 batteries located across the border in Russia or Kaliningrad can track NATO aircraft operating in the Baltic states.<sup>18</sup> Furthermore, the opportunity cost of using F-35s for BAP includes making aircraft and personnel unavailable for other uses for 4 months (although they could be redeployed in an emergency).

#### 3.1. OPERATING COSTS

Allies may also be reluctant to use the F-35 for air policing due to its higher operating costs. Operating an F-35 currently costs an estimated \$36 000 to \$44 000 per flight hour, while an F-16 costs only \$10 500 to \$22 500 per hour. Lockheed Martin expects that future F-35 hourly operating costs will fall to \$25 000.<sup>19</sup> This results

<sup>15</sup> NATO, “[NATO intercepts hundreds of Russian Military Jets in 2020](#),” 28 Dec 2020.

<sup>16</sup> Whyte, “[Ministry: Over 200 Russian international aviation violations in 2020](#),” *ERR*, 29 December 2020.

<sup>17</sup> Gareth Jennings, “[F-35 makes Baltic Air Policing Debut](#),” *Janes*, 4 May 2021.

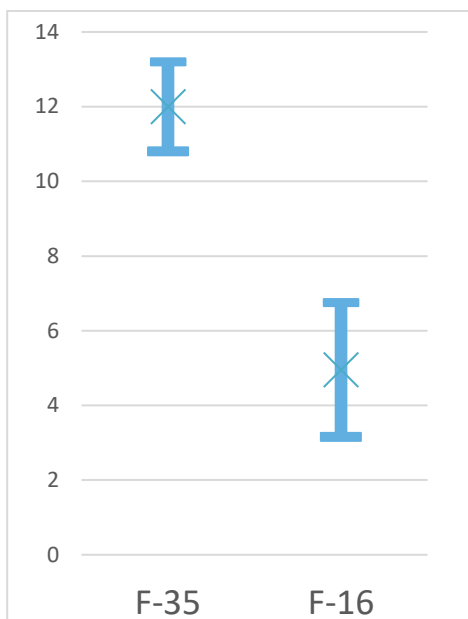
<sup>18</sup> Ralph Clem, “[Geopolitics and Planning for a High-End Fight](#),” *Air and Space Power Journal* 30 no.1 (Spring 2016), 80.

<sup>19</sup> Garrett Reim, “[Lockheed Martin confident F-35 operating cost will be reduced to \\$25,000 per hour](#),” *Flight Global*, 24 February 2021; Kyle Mizokami, “[The F-35 Is Cheap To Buy \(But Not To Fly\)](#),”

*Popular Mechanics*, 30 October 2019; Anne McAndrew to Assistant Secretary Of The Army (Financial Management And Comptroller), Assistant Secretary Of The Navy (Financial Management And Comptroller), Assistant Secretary Of The Air Force (Financial Management And Comptroller), Deputy Chief Management Officer, Director, Defense Finance And Accounting Service, Directors, Defense Agencies, 17 October 2020, Office of the Under Secretary of Defence, “[Fiscal Year \(FY\) 2021 Department of Defense \(DoD\) Fixed Wing and Helicopter Reimbursement Rates](#)”; Mark Thompson. “[Costly Flight Hours](#),” *Time*, 2 April 2013.

in substantially higher overall operating costs for F-35 BAP deployments (see Figure 2).

F-35 operations also need more deployed personnel than 4<sup>th</sup> generation operations. In 2021, Norway required about 32 people per F-35 for Icelandic Air Policing.<sup>20</sup> In 2015, Denmark needed only 15 people per F-16 for the same task.<sup>21</sup> This too raises the fiscal cost of the operation and demands more trained individuals, possibly straining Allies' resources.



**Figure 2. Estimated Operating Cost of BAP Deployment (USD million). (Sources: Flight Global, Popular Mechanics, Office for Under Secretary of Defense, Time. The figures assume 300 flight hours per BAP deployment.<sup>22</sup>)**

### 3.2. SHRINKING FLEETS

Analysts have raised concerns that there may be an association between acquisition of 5<sup>th</sup> generation aircraft and, due to a decline in total fleet size, an ability to contribute to BAP.<sup>23</sup> This problem may not be limited to the acquisition of 5<sup>th</sup> generation aircraft: modernisation through

the acquisition of newer variants of earlier generation aircraft may, for example, also lead to a reduced fleet size.

It is estimated that European Allies that have participated in BAP and have committed to acquire 5<sup>th</sup> generation aircraft will, in the next decade, see an average decrease of 31.5% in the size of their combat aircraft fleets (see Figure 3). In 2021, these Allies have approximately 570 4<sup>th</sup> generation aircraft and 71 5<sup>th</sup> generation aircraft (641 total). By 2030, they will have approximately 215 4<sup>th</sup> generation aircraft and 295 5<sup>th</sup> generation aircraft (510 total) available for BAP.

Precise figures for the retirement rates of 4<sup>th</sup> generation aircraft are frequently unavailable. Information publicly available includes:

- Italy will fully retire their AMX and Tornado fighters by 2025, decreasing their 4<sup>th</sup> generation fleet.<sup>24</sup>
- The UK is expected to purchase only 60- 70 F-35s, compared to the initial planned 138. It will likely retain many 4<sup>th</sup> generation Eurofighters.<sup>25</sup> The retirement of Tranche 1 Eurofighters and Tornados will decrease the fighter fleet to approximately 85 aircraft.<sup>26</sup>
- Belgium will replace its F-16s with F-35s starting around 2024; however, it is unclear at what rate they will do this.<sup>27</sup>
- Poland is set to replace its MiG-29s (of which it has 29) with F-35s. It has published a delivery schedule for the F-35s but not a retirement plan for the MiG-29s; however, it has suggested a gradual handover from 2025-2030.<sup>28</sup>
- Norway will use F-16s until the end of 2021.<sup>29</sup>

<sup>20</sup> Einarsdóttir Gréta Sigríður, "Four Norwegian Airforce F-35 Fighter Aircraft Deployed To Iceland," *Iceland Review*, 19 February 2021.

<sup>21</sup> "Four F-16 Fighter Jets Coming," *Iceland Review*, 28 August 2015.

<sup>22</sup> "RAF Lakenheath jets complete Baltic Air Policing Rotation," USAFE, 5 January, 2018.

<sup>23</sup> Martin Hurt, "The UK's Integrated Review Is Not Reassuring from a Baltic Perspective," *ICDS*, 16 March 2021.

<sup>24</sup> "Italian Air Force Plans To Phase Out AMX In Favor Of F-35," *Aviation Week*, 25 February 2019; "Despite Typhoons & Super Hornets, German Air Force To Keep Flying Tornado Jets Till 2030," *Eurasian Times*, 20 February 2021.

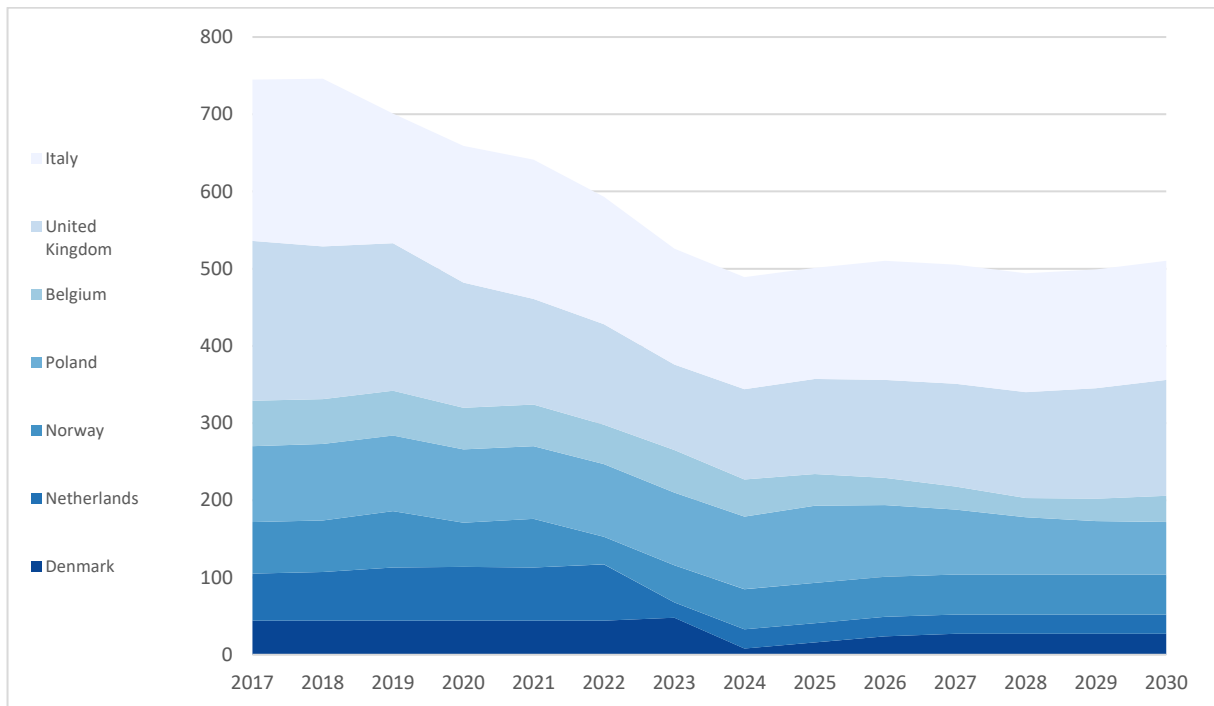
<sup>25</sup> Aaron Mehta, "New British plan looks to boost F-35 numbers, but is it still aiming for 138?," *Defense News*, 24 March 2021.

<sup>26</sup> RAF, "The end of an era: RAF Tornado returns from Operations for the last time," 2 May 2019; Gareth Jennings, "UK Defence Command Paper: RAF to axe older Typhoons," *Janes*, 22 March, 2021.

<sup>27</sup> Robin Emmott, "Belgium picks Lockheed's F-35 over Eurofighter on price," *Reuters*, 26 October 2018.

<sup>28</sup> Maciej Szopa, "Harpia Fighter Procurement Details," *Defence24*, 31 January 2020.

<sup>29</sup> Aaron Mehta, "As F-35 Comes Online, Norway to Scrap F-16 Fleet," *Defense News*, 8 August 2017; author's email correspondence with Defence Attaché.



**Figure 3. Combat Aircraft Fleet Size Projections.** (Sources: The IISS Military Balance 2017-2021 for historical data; Lockheed Martin’s F-35 [Lightning II website](#) and national press releases for F-35 acquisition numbers. Figures include only multirole and fighter aircraft that have historically been used for BAP, and training aircraft that the F-35 will replace.)

- The Netherlands is expected to gradually retire F-16s until 2024.<sup>30</sup>
- Denmark is expected to fully retire its F-16 fleet in 2024.<sup>31</sup> It will halt its international air engagements between 2022-24.<sup>32</sup>

With the introduction of the F-35, smaller nations will generally retire a larger percentage of their combat fleets at faster rates than larger nations, meaning that they will have relatively fewer aircraft available for deployment. The additional costs of participating in a mission with the F-35 will also be a larger percentage of the defence budgets of these nations. Availability and cost considerations could thus limit the frequency of participation in BAP of all Allies, but in particular those with smaller fleets. NATO defence planners have noticed this problem and asked some Allies to purchase additional F-35s.<sup>33</sup>

## CONCLUSIONS

The F-35 is an exceptional 5<sup>th</sup> generation aircraft, but it is not optimised for routine air policing missions. Given the small number of aircraft involved, its use in BAP, while a notable gesture, is unlikely to result in measurably increased deterrence or reassurance. Allies acquiring the F-35 will likely find it harder to make aircraft available for BAP and see higher operating costs on BAP missions. These challenges will be more acute for smaller Allies, possibly requiring larger Allies to take a more active role and thus raising burden-sharing questions in NATO. While there is no indication from any Ally of a weakening political commitment to BAP, the Baltic states should be aware of the implications of the introduction of the F-35 for this mission and be ready to take steps to enhance its attractiveness for contributing Allies.

<sup>30</sup> Daniel Darling, "[Netherlands to Buy Additional F-35s](#)," *Defense Security Monitor*, 29 June 2021.

<sup>31</sup> Aaron Mehta, "[As it takes on F-35, Denmark prepares to halt global operations](#)," *DefenseNews*, 14 July 2018.

<sup>32</sup> Mehta, "As it takes on F-35, Denmark prepares to halt global operations".

<sup>33</sup> Colin Clapson, "[Belgium asked to purchase 14 more F-35 fighter jets](#)," VRT, 19 February 2020.



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ISSN 2228-2076