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# Transferring Fighter Aircraft to Ukraine: Issues and Options for Congress

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SUMMARY

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# Transferring Fighter Aircraft to Ukraine: Issues and Options for Congress

Since Russia's renewed invasion of Ukraine began in February 2022, some defense analysts, U.S. defense officials, and Members of Congress have debated whether or not to enable the transfer of U.S. or NATO military aircraft, including fighter jets and unmanned aircraft, to Ukraine. In general, the debate has centered around two broad questions: (1) Is providing advanced military fighter jets to the Ukrainian air force necessary to helping Ukraine defend itself against Russian aggression, and (2) if so, how much and what kinds of assistance, ranging from aircraft to maintenance to training, should the United States and the North Atlantic Treaty Organization (NATO) provide?

On one side of the debate, some analysts note that combat aircraft have not yet played a decisive role in the conflict and are unlikely to do so based on current Ukrainian and Russian capabilities. Both sides have employed advanced air defense systems that have limited the combat effects of Russian and Ukrainian aircraft. As a result, the conflict in Ukraine has evolved into a ground-centric, air denial conflict featuring precision strike capabilities, such as the U.S. M142 High Mobility Artillery Rocket System (HIMARS). On the other side of the debate, proponents of transferring U.S. or NATO fighter jets to Ukraine claim that it may allow the Ukrainian military to address certain perceived gaps in operational capabilities, such as air superiority; suppression of enemy air defenses; intelligence, surveillance, and reconnaissance; and counter-land (air-to-ground) capabilities.

Congress may evaluate a proposed transfer of U.S. or NATO fighter aircraft to Ukraine applying an "air denial" (deny Russia ability to use airpower) versus "air superiority" (help Ukraine overcome Russian air defenses and air power) comparison to an analysis of selected military mission areas. From this perspective, the military operating environment of the conflict has resulted in both sides adopting an air denial strategy rather than seeking air superiority. A central tactical purpose of using advanced fighter aircraft, especially in U.S. military doctrine, has been to achieve air superiority. Congress may consider whether it is best for U.S. security assistance seek to continue to provide air denial capability to Ukraine, or whether it would further U.S. interests to support the Ukrainian Armed Forces seeking air superiority. The outcome of such decisions may affect other mission areas, such as suppression of enemy air defenses; intelligence, surveillance, and reconnaissance; and counter-land (air-to-ground) capabilities.

In evaluating whether it is in the U.S. interest to transfer U.S. or NATO military aircraft to Ukraine, Congress may consider several issues:

- What are the hurdles and potential implications to Ukraine's adaptation to fighting with advanced military aircraft? How long would it take Ukraine to fully adapt its security institutions to effectively fight with advanced military aircraft?
- How quickly can Ukrainian personnel be trained on new systems?
- Would Ukraine use a maintenance model where it trains its own personnel to do maintenance on advanced fighter aircraft, or a model where it uses international contract maintenance personnel? If the latter, for how long?
- What types of munitions would the United States likely provide? Would transferring munitions for Ukrainian fighter aircraft impact the U.S. military's ability to conduct air superiority operations elsewhere in the world?
- Should the United States pay to transfer U.S.-manufactured fighter jets to Ukraine? Congress may consider options for how to finance such aircraft and who should fund their purchase.
- If the United States or another NATO member chooses to transfer aircraft to Ukraine, should the aircraft be used, new, or a mix of both?
- Should Congress support the provision of such aircraft by NATO allies, in addition to or as an alternative to U.S. provision?

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Russia invaded Ukraine in 2014 and took control of the Crimea region, which it continues to control. Russia then renewed the invasion with a military offensive in February 2022. In response, Congress has authorized and appropriated funding, in particular for security assistance and security cooperation, to support Ukraine economically and militarily. In this context, some analysts, officials in the Biden Administration, and Members of Congress have discussed whether to provide Ukraine with military aviation capabilities, including fighter jets. In essence, such discussions start with a single military question: Are advanced military air capabilities in the Ukrainian Air Force necessary for Ukraine to defend against Russian aggression? If the answer is yes, a related policy question arises: What potential options are available for bolstering the capabilities of the Ukrainian Air Force? As part of its debate over the amount and types of assistance the United States should provide, Congress continues to consider whether and how to support the transfer of aircraft and aviation-related components to Ukraine. The debate endures even after Congress authorized the transfer of "Manned and unmanned aerial capabilities, including tactical surveillance systems and fixed and rotary-wing aircraft, such as attack, strike, airlift, and surveillance aircraft," as part of the Ukraine Security Assistance Initiative in the FY2023 James M. Inhofe National Defense Authorization Act (NDAA).[1]

This report provides an overview of the positions the Administration and Congress have taken regarding the provision of aircraft and aviation support to Ukraine, along with a description of the current military operating environment. In this context, the report highlights five issues Congress may consider and lays out three potential options for transferring military aircraft to Ukraine. **Appendix B** provides a detailed description of potential aircraft in each of these options.

# Background

This section summarizes the evolution of views in both the Administration and Congress regarding whether to transfer fighter jets to Ukraine. It then describes the current operating environment, highlighting four air warfare challenges for both Russia and Ukraine: (1) air superiority; (2) suppression of enemy air defenses; (3) intelligence, surveillance, and reconnaissance; and (4) counter-land.

## Statements from the Administration: Evolving Views Regarding Transferring Fighter Aircraft to Ukraine

The Biden Administration, after the renewed Russian invasion in 2022, initially did not support transferring aircraft to Ukraine. In March 2022, then-Department of Defense (DOD) Press Secretary John Kirby said, "We assess that adding aircraft to the Ukrainian inventory is not likely to significantly change the effectiveness of the Ukrainian Air Force relative to Russian capabilities. Therefore, we believe that the gain from transferring those MIG-29s is low. And finally, the intelligence community has assessed the transfer of MIG-29s to Ukraine may be mistaken as escalatory[,] and could result in significant Russian reaction that might increase the prospects of a military escalation with NATO."[2] Similarly, Secretary of the Air Force Frank Kendall and Chief of Staff of the Air Force General Charles Q. Brown stated in March 2022 that transferring retiring U.S. fighter jets—such as the A-10 Thunderbolt II and the F-16 Fighting Falcon—was not feasible because the timelines required to train Ukrainian

[1] P.L. 116-283, §1236, P.L. 117-263 §1241(b).

[2] U.S. Department of Defense (DOD), "Pentagon Press Secretary John F. Kirby Holds a Press Briefing, March 9, 2022," transcript, March 9, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/2961792/pentagon-press-secretary-john-f-kirby-holds-a-press-briefing-march-9-2022/.

personnel were too long, and because those aircraft are not likely "to significantly change the effectiveness of the Ukrainian Air Force relative to Russian capabilities."[3]

In light of changes in the military situation in Ukraine, the Administration's initial position has evolved to support increased assistance for military fighter capabilities in the Ukrainian Air Force. The first steps in that evolution involved third-country transfer of spare parts and aircraft to Ukraine. In April and May 2022, the United States facilitated the transfer of aircraft and spare parts from other countries[4] to support Ukraine's current aircraft fleet. Then-DOD Press Secretary Kirby said on April 19, 2022, that the Ukrainians had more operable fighter aircraft than they did two weeks prior, and that they had received platforms and parts from other nations to be able to increase their fleet size.[5]

By summer 2022, the Administration's position had evolved further and the United States started to provide the Ukrainian Air Force with more advanced aircraft munitions. On August 8, 2022, Colin Kahl, Under Secretary of Defense for Policy, said, "And then also, in recent PDA [Presidential Drawdown Authority] packages, we've included a number of anti-radiation missiles that can be fired off of Ukrainian aircraft that can have effects on Russia radars and other things. So there are also things that we're doing to try to make their existing capabilities more effective."[6] Kahl later stated that the United States had transferred these missiles, versions of the AGM-88 High-speed Anti-Radiation Missile (HARM), onto MiG-29 Fulcrums.[7] These anti-radiation missiles seek and destroy artillery and anti-aircraft radars. Kahl also discussed the United States' assistance in continuing to provide spare parts for Ukraine's air force.

In July 2022, Secretary of the Air Force Frank Kendall and Chief of Staff of the Air Force General C. Q. Brown publicly discussed the possibility of transferring fighter jets to Ukraine.[8] These officials said they were open to the possibility of transferring retiring U.S. fighter jets to Ukraine and were assessing Ukraine's long-term aviation needs.[9] Their comments raised the prospect that the United States might either sell or provide new aircraft, such as the F-16 Fighting Falcon and the F/A-18E/F Super Hornet, to Ukraine. In addition, both Secretary Kendall and General Brown said they were looking into potential options for aircraft that U.S. allies could

[3] Ibid. and Valerie Insinna, "No, the US Air Force isn't going to give Ukraine its A-10 Warthogs," *Breaking Defense*, March 3, 2022, https://breakingdefense.com/2022/03/no-the-us-air-force-isnt-going-to-give-ukraine-its-a-10-warthogs/.

[4] The specific nation(s) that provided spare aircraft parts to Ukraine was not specified, nor the details of the United States facilitating the transfer. It is reported that Poland may have been one provider. Clement Charpentreau, "Poland Reportedly Delivered MiG-29 Fighters to Ukraine as 'Spare Parts'," *Aerotime Hub*, January 27, 2023, https://www.aerotime.aero/articles/poland-reportedly-delivered-mig-29-fighters-to-ukraine-as-spare-parts.

[5] Department of Defense, "Pentagon Press Secretary John F. Kirby Holds a Press Briefing," press release, April 19, 2022, transcript, at https://www.defense.gov/News/Transcripts/Transcript/Article/3004347/pentagon-press-secretary-john-f-kirby-holds-a-press-briefing/.

[6] Department of Defense, "USD (Policy) Dr. Kahl Press Conference," press release, August 8, 2022, transcript, at https://www.defense.gov/News/Transcripts/Transcript/Article/3120707/usd-policy-dr-kahl-press-conference/.

[7] These missiles are used to seek and destroy an adversary's artillery and anti-aircraft radars, thus providing a "Suppression of Enemy Air Defenses," or SEAD, capability. Department of Defense, "Undersecretary of Defense for Policy Dr. Colin Kahl Holds a Press Briefing on Security Assistance in Support of Ukraine," press release, August 24, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3138872/undersecretary-of-defense-for-policy-dr-colin-kahl-holds-a-press-briefing-on-se/.

[8] Joseph Trevithick, "Giving A-10 Warthogs To Ukraine Isn't Off The Table," *The War Zone*, July 10, 2022, at https://www.thedrive.com/the-war-zone/giving-a-10-warthogs-to-ukraine-isnt-off-the-table.

[9] Stephen Losey, "Ukraine says air force needs western fighter jets, and the US is preparing to help," *Defense News*, July 21, 2022, at https://www.defensenews.com/air/2022/07/21/ukraine-says-its-air-force-needs-western-fighter-jets-and-the-us-is-preparing-to-help/.

provide.[10] Such options may include the French-made Rafale and the Swedish-made JAS 39 Gripen.[11]

## Congressional Debates and Actions Related to Transferring Fighter Aircraft to Ukraine

Congress first authorized the Ukraine Security Assistance Initiative (USAI) in the FY2016 National Defense Authorization Act (NDAA), following Russia's 2014 invasion of Ukraine.[12] This act authorized DOD to "provide appropriate security assistance and intelligence support, including training, equipment, and logistics support, supplies and services, to military and other security forces of the Government of Ukraine ... "[13] The act specifies three purposes for this assistance: (1) to enhance Ukrainian military and security force capabilities to defend against further aggression, (2) to assist Ukraine in developing the combat capability to defend its sovereignty and territorial integrity, and (3) to support Ukraine in defending itself against Russia and Russian-backed separatists.[14] It also authorizes DOD to provide real-time intelligence; lethal assistance;[15] counter-artillery radars; tactical unmanned aerial systems; cyber, electronic warfare, and counter-electronic warfare capabilities; training to maintain these capabilities; and training for critical combat operations.[16] Congress has modified USAI annually since FY2016, with expansions in authorities to include improving Ukraine's air defense capabilities.[17] The William M. (Mac) Thornberry FY2021 NDAA (P.L. 116-283) required DOD to provide "an assessment of the requirements of the Ukrainian air force to accomplish its assigned missions" by February 2022.[18] DOD has not publicized that assessment.

In March 2022, some Members introduced resolutions in their respective chambers related to transferring aircraft to Ukraine. For example, Representative Tom Cole introduced H.Res. 991, which would have expressed the sense of the House that the President should take steps to transfer requested fighter jets to Ukraine or other allies (and references a Polish fighter transfer proposal).[19] Senator Lindsey Graham introduced S.Res. 549, which would have encouraged the President to facilitate the transfer of MiG-29s and air defense systems to Ukraine.[20] Neither resolution was enacted before the 117th Congress adjourned, but the FY2023 NDAA (P.L. 117-

[10] Patrick Tucker and Jacqueline Feldscher, "Air Force Chief Hints Western Fighter Jets Could Go to Ukraine," *Defense One*, July 20, 2022, at https://www.defenseone.com/threats/2022/07/air-force-chief-hints-western-fighter-jets-could-go-ukraine/374721/.

[11] Although the JAS-39 Gripen is manufactured by Saab, this aircraft uses several U.S-developed subcomponents, including the General Electric 401 engine. The Rafale uses the French developed M88 engines. See Janes, "Saab JAS 39 Gripen," September 7, 2022, at https://customer.janes.com/Janes/DisplayFile/JAWA0989, and Janes, "Dassault Rafale," April 29, 2022, at https://customer.janes.com/Janes/Display/JAWA0257-JAWA.

[12] P.L. 114-92 §1250.

[13] Ibid.

[14] Ibid.

[15] Section 1250 specifically mentions anti-armor weapons, mortars, crew-served weapons and ammunition, grenade launchers, and small arms.

[16] Section 1250 defines *critical combat operations training* as planning command and control, small unit tactics, counter-artillery tactics, logistics, countering improvised explosive devices, battlefield first aid, post-combat treatment, and medical evacuation.

[17] P.L. 114-328, §1237; P.L. 115-91, §1234; P.L. 115-232, §1246; P.L. 116-92, §1244; P.L. 116-283, §1235; and P.L. 117-81, §1232.

[18] P.L. 116-283, §1236.

[19] 117th Congress, H.Res. 991.

[20] 117th Congress, S.Res. 549.

263), enacted in December 2022, amends the USAI to authorize assistance for "manned and unmanned aerial capabilities, including tactical surveillance systems and fixed and rotary-wing aircraft, such as attack, strike, airlift, and surveillance aircraft."[21]

Congressional debate regarding the dollar amount of military assistance the United States might provide to Ukraine may have potential implications for the type of weapons to be supplied. While some Members have expressed their commitment to sustaining military support for Ukraine,[22] other Members have expressed concern about the cost of such assistance.[23] As discussed in the "Financing" section of this report, the addition of military aviation to U.S. security assistance packages for Ukraine would be a significant increase in U.S. financial commitment.

## Selected Military Considerations Regarding Potential Transfer of Combat Aircraft to Ukraine

One aspect of how Congress may evaluate the effectiveness of a potential transfer of fighter aircraft to Ukraine, apart from the cost issue, is a look at how such aircraft may fit into the conflict's military operating environment in the zone of conflict. The operating environment for military forces in Ukraine illustrates a contrast between the effectiveness of air and ground operations. Russian and Ukrainian forces have relied on both ground-based offensive and defensive operations to meet their military objectives. Both sides have contested air operations by mounting strong air defenses, leading each to use its military air assets with restraint in order to avoid the risk of losing aircraft.[24] Both sides employ ground-based medium- and long-range surface-to-air missile systems, capable of targeting both high-performance aircraft (e.g., fighter aircraft such as Ukraine's MiG-29) and slower aircraft (e.g., Mi-8 helicopters and Ukrainian TB-2 Unmanned Aerial Vehicles, or UAVs).

At the start of the conflict, Russia employed offensive air operations, and Ukrainian air forces were able to impede Russian air operations through air defenses and fighter combat air patrols (CAPs), despite suffering losses.[25] Since then, air defenses have effectively deterred both sides from conducting significant offensive air operations, and therefore neither side has been able to leverage offensive air power.[26] Some analysts argue that Russian air power failed to effectively seize the offensive advantage, despite its technological superiority, because of high mechanical

[21] P.L. 117-263, §1241.

[22] Senator Roger Wicker, "Wicker Urges Continued Military Aid for Ukrainian Victory," press release, at https://www.wicker.senate.gov/2023/1/wicker-urges-continued-military-aid-for-ukrainian-victory For support of overall aid to Ukraine, see Sam Mednick, "US senators in Ukraine promise continued aid ahead of winter," *AP News*, November 3, 2022, at https://apnews.com/article/russia-ukraine-kyiv-travel-ohio-1ab7c7e32f4fbad58b0c71bde67ba66d.

[23] Dan De Luce et al., "With GOP skeptics of Ukraine aid poised to gain seats in Congress, lawmakers look to lock in a huge military assistance package," *NBC News*, October 20, 2022, at https://www.nbcnews.com/politics/congress/gop-ukraine-skeptics-poised-gain-congress-lawmakers-look-lock-billions-rcna53167.

[24] Rachel S. Cohen and Joe Gould, "With a mix of donated weapons, Ukraine's defenders adapt in war," *Air Force Times*, September 28, 2022, at https://www.airforcetimes.com/flashpoints/2022/09/28/with-a-mix-of-donated-weapons-ukraines-defenders-adapt-in-war/.

[25] Steve Trimble, "Bloody Day In Ukraine Ends With Russian Advances, Setbacks," *Aviation Week*, February 24, 2022, at https://aviationweek.com/defense-space/multi-mission-aircraft/bloody-day-ukraine-ends-russian-advances-setbacks.

[26] Rachel S. Cohen and Joe Gould, "With a mix of donated weapons, Ukraine's defenders adapt in war," *Air Force Times*, September 28, 2022, at https://www.airforcetimes.com/flashpoints/2022/09/28/with-a-mix-of-donated-weapons-ukraines-defenders-adapt-in-war/.

failure rates, poor intelligence and targeting, and insufficient capacity for the operation's scale.[27] Some analysts also argue that although Ukraine has successfully countered Russia with its air defenses, Ukrainian air forces are technologically and numerically unable to challenge Russia's air forces head-on.[28] These analysts say this is because the Russians have a higher number of fighter aircraft and because Russian air-to-air missiles can target Ukrainian aircraft at a much greater range.[29] The following discussion describes the mission areas that some analysts have identified as operational weaknesses for Ukraine and Russia: air superiority; suppression of enemy air defenses (SEAD); intelligence, surveillance, and reconnaissance (ISR); and counter-land (air-to-ground).[30]

## Air Superiority

The U.S. military defines air superiority as "that degree of control over the air by one force that permits the conduct of its operations at a given time and place without prohibitive interference from air and missile [air defense] threats."[31] This means having the freedom to attack from the air while preventing enemy air attacks.[32] Neither Russia nor Ukraine have established decisive control of the air, but both maintain effective ground-based air defenses.[33] From a U.S. Air Force perspective, gaining air superiority is generally desired before attempting other types of combat operations (e.g., ground operations); with air superiority in place, other types of missions can benefit from greater maneuverability.[34] Russia's initial efforts to achieve air superiority were unsuccessful. Based on Russia's lack of air superiority up to this point, Ukrainian leaders and some analysts argue that advanced fighter jets could allow Ukraine to close the technological gap against Russian fighters, help them defend military and civilian infrastructure, and deter future Russian air power aggression.[35]

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[27] Ian Williams, *Russia Doubles Down on Its Failed Air Campaign*, Center for Strategic and International Studies, October 13, 2022, at https://www.csis.org/analysis/russia-doubles-down-its-failed-air-campaign; CRS Insight IN11872, *Russia's Invasion of Ukraine: Military and Intelligence Issues and Aspects*, by Andrew S. Bowen.

[28] U.S. Air Force Colonel Maximilian Bremer and Kelly Grieco, "Success Denied: Finding Ground Truth in the Air War over Ukraine," *Defense News*, September 21, 2022, at https://www.defensenews.com/opinion/commentary/2022/09/21/success-denied-finding-ground-truth-in-the-air-war-over-ukraine/. Justin Bronk, Nick Reynolds, and Jack Watling, *The Russian Air War and Ukrainian Requirements for Air Defence*, Royal United Services Institute, Special Report, London, UK, November 7, 2022, pp. 1-2, p. 9, at https://static.rusi.org/SR-Russian-Air-War-Ukraine-web-final.pdf.

[29] Ibid.

[30] Some studies point to a number of causes for the air stalemate in these mission areas. See, for example, Justin Bronk, Nick Reynolds, and Jack Watling, *The Russian Air War and Ukrainian Requirements for Air Defence*, Royal United Services Institute, November 7, 2022, pp. 1-2, at https://static.rusi.org/SR-Russian-Air-War-Ukraine-web-final.pdf; David Axe, "The Russian Air Force is Back in the Fight in Ukraine. But It's Not Making Much of a Difference," *Forbes*, September 16, 2022, at https://www.forbes.com/sites/davidaxe/2022/09/16/the-russian-air-force-is-back-in-the-fight-in-ukraine-but-its-not-making-much-of-a-difference/?sh=474712c01235; CRS In Focus IF12150, *Ukrainian Military Performance and Outlook*, by Andrew S. Bowen.

[31] DOD, Chairman of the Joint Chiefs of Staff, "Joint Publication 3-01: Countering Air and Missile Threats," 2017, p. I-4, at https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_01.pdf.

[32] DOD, Department of the Air Force, "Air Force Doctrine Publication 3-0: Operations Planning," 2016, p. 34, at https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-0/3-0-AFDP-OPERATIONS-PLANNING.pdf.

[33] Rachel S. Cohen and Joe Gould, "With a mix of donated weapons, Ukraine's defenders adapt in war" *Air Force Times*, September 28, 2022, at https://www.airforcetimes.com/flashpoints/2022/09/28/with-a-mix-of-donated-weapons-ukraines-defenders-adapt-in-war/.

[34] DOD, Department of the Air Force, "Air Force Doctrine Publication 3-0: Operations Planning," 2016, p. 34, at https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-0/3-0-AFDP-OPERATIONS-PLANNING.pdf.

[35] DOD, Department of the Air Force, "Air Force Doctrine Publication 3-0: Operations Planning," 2016, at (continued...)

Some DOD officials and analysts have argued, especially early in the 2022 conflict, that Ukraine should avoid attempting to gain air superiority and focus on strengthening defensive capabilities.[36] In March, then-DOD Press Secretary Kirby said in responding negatively to a question on the desirability of transferring fighter jets to Ukraine, "We believe the best way to support Ukrainian defense is by providing them the weapons and the systems that they need most to defeat Russian aggression ... in particular, anti-armor, and air defense."[37] Russian has a total of 1,391 aircraft to Ukraine's 132, and in February 2023, U.S. Secretary of Defense Lloyd Austin reportedly stated that "Russia has substantial aircraft ... and a lot of capability left."[38] The crux of these arguments against strengthening Ukraine's air superiority capabilities are that Ukrainian air defenses—not fighter jets—have deterred and limited Russian air attacks, particularly in and around population centers like Kyiv.[39] Analysts making this case also have argued that Russian weakness (e.g., poor intelligence integration, lack of real-time targeting data and battle damage assessment) is largely to blame for Russia's lack of success in the air, and that Ukraine could succeed by continuing to exploit these weaknesses, especially by improving and resupplying Ukrainian air defense capabilities that can deny presence to Russia's manned and unmanned ISR aircraft.[40] Up to now, in transferring air defense systems before aircraft, the Administration has appeared to support a strategy of air denial for Ukraine.[41]

According to General James Hecker, Commander of U.S. Air Forces in Europe, Ukraine has lost 60 aircraft to Russian air defenses, but Ukrainian forces have successfully downed over 70 Russian aircraft.[42] U.S. defense officials have acknowledged Ukraine's success using Russian-made air defenses, while also noting that such air defense systems may experience maintenance issues and parts shortages as the conflict continues.[43] The United States and NATO allies have

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https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-0/3-0-AFDP-OPERATIONS-PLANNING.pdf. Michael Starr, "Zelensky: Western Warplanes Will Help Ukraine Achieve Air Superiority," November 1, 2022, https://www.jpost.com/international/article-721185, and Justin Bronk, Nick Reynolds, and Jack Watling, *The Russian Air War and Ukrainian Requirements for Air Defence*, Royal United Services Institute, Special Report, London, UK, November 7, 2022, pp. 1-2, https://static.rusi.org/SR-Russian-Air-War-Ukraine-web-final.pdf.

[36] U.S. Air Force Colonel Maximilian Bremer and Kelly Grieco, "Success Denied: Finding Ground Truth in the Air War over Ukraine," *Defense News*, September 21, 2022, at https://www.defensenews.com/opinion/commentary/2022/09/21/success-denied-finding-ground-truth-in-the-air-war-over-ukraine/.

[37] DOD, "Pentagon Press Secretary John F. Kirby Holds a Press Briefing, March 9, 2022," transcript, March 9, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/2961792/pentagon-press-secretary-john-f-kirby-holds-a-press-briefing-march-9-2022/.

[38] Angela Dewan, "Ukraine and Russia's Militaries are David and Goliath. Here's How They Compare," *CNN*, February 25, 2022, https://www.cnn.com/2022/02/25/europe/russia-ukraine-military-comparison-intl/index.html, and David Axe, Felicia Schwartz and Henry Foy, "Western Intelligence Shows Russians Amassing Aircraft on Ukraine Border," *Financial Times*, February 14, 2023, at https://www.ft.com/content/3fd6e91f-71e4-4c02-9360-be20a2a78763.

[39] U.S. Air Force Colonel Maximilian Bremer and Kelly Grieco, "Success Denied: Finding Ground Truth in the Air War over Ukraine," *Defense News*, September 21, 2022, at https://www.defensenews.com/opinion/commentary/2022/09/21/success-denied-finding-ground-truth-in-the-air-war-over-ukraine/.

[40] Justin Bronk, Nick Reynolds, and Jack Watling, *The Russian Air War and Ukrainian Requirements for Air Defence*, Royal United Services Institute, November 7, 2022, pp. 1-2, at https://static.rusi.org/SR-Russian-Air-War-Ukraine-web-final.pdf, and U.S. Air Force Colonel Maximilian Bremer and Kelly Grieco, "Success Denied: Finding Ground Truth in the Air War over Ukraine," *Defense News*, September 21, 2022, at https://www.defensenews.com/opinion/commentary/2022/09/21/success-denied-finding-ground-truth-in-the-air-war-over-ukraine/.

[41] CRS In Focus IF12230, *National Advanced Surface-to-Air Missile System (NASAMS)*, by Andrew Feickert.

[42] General Hecker's comments were made in the context of describing the air defense environment in the conflict. It is not specified what specific air defense systems downed these aircraft. Chris Gordon, "Ukraine Has Lost 60 Aircraft, Taken Down 70 in Russian Invasion, Hecker Says," *Air & Space Forces Magazine*, March 6, 2023, at https://www.airandspaceforces.com/ukraine-has-lost-60-aircraft-taken-down-70-in-russian-invasion-hecker-says/.

[43] DOD, "Senior Defense Official Holds a Background Briefing," transcript, July 1, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3082215/senior-defense-official-holds-a-background-briefing/.

provided additional air defense systems to Ukraine to strengthen its air defense network. Some analysts have credited Western systems (e.g., the German Gepard anti-aircraft system) with bolstering Ukraine's defenses, particularly in and around Ukrainian troop locations.[44] The United States has also provided National Advanced Surface to Air Missile System (NASAMS) to help combat Russian missile and aircraft threats.[45]

Fighter jets, while not the primary weapon system in an air denial strategy, may contribute to its execution, especially to counter adversary uncrewed aerial vehicles (UAVs). Ukrainian fighter jet operations, primarily near population centers like Kyiv, continue to assist the air defense effort.[46] In this role, Ukrainian fighters are conducting operations supporting an air denial strategy, rather than seeking air superiority. Russian missiles threaten military and civilian targets and since fall 2022 have targeted critical infrastructure (e.g., power plants and water treatment facilities). According to U.S. defense officials, Russia has used Iranian UAVs to target Ukrainian military and civilian targets.[47] Some analysts and U.S. military officials have argued that these UAVs offer Russia a cheaper way to cause greater harm, relative to manned aircraft, with the potential to overwhelm Ukraine's air defenses.[48] Russia reportedly ordered 2,400 UAVs from Iran.[49] During the first months of the renewed invasion, Ukrainian fighter aircraft conducted air defense missions to counter the increased cruise missile and UAV attacks launched on population centers.[50]

## Suppression of Enemy Air Defenses (SEAD)

Since both Ukraine and Russia have sophisticated air defenses, the ability to mitigate or defeat air defense systems may give the side who first obtains it a military advantage. SEAD consists of "activity to neutralize, destroy, or degrade enemy surface-based air defenses."[51] These effects can be accomplished by kinetic weapons (i.e., missiles and bombs) or by electronic warfare (EW).[52] Despite early offensive air operations, Russia has largely failed to neutralize or destroy Ukrainian

[44] David Axe, "The Russian Air Force is Back in the Fight in Ukraine. But It's Not Making Much of a Difference," *Forbes*, September 16, 2022, at https://www.forbes.com/sites/davidaxe/2022/09/16/the-russian-air-force-is-back-in-the-fight-in-ukraine-but-its-not-making-much-of-a-difference/?sh=474712c01235.

[45] See CRS In Focus IF12230, *National Advanced Surface-to-Air Missile System (NASAMS)*, by Andrew Feickert.

[46] "Western Air-Defense Systems Help Ukraine Shoot Down More Missiles," *The Economist*, November 6, 2022, at https://www.economist.com/europe/2022/11/06/western-air-defence-systems-help-ukraine-shoot-down-more-missiles.

[47] DOD, "Senior Military Official Holds a Background Briefing," transcript, October 24, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3197746/senior-military-official-holds-a-background-briefing/.

[48] Ibid.; Stephen Kalin and Michael R. Gordon, "Ukraine's Patchwork Air Defense Faces New Threat From Cheap Iranian Drones," *Wall Street Journal*, October 30, 2022, at https://www.wsj.com/articles/ukraines-patchwork-air-defense-faces-new-threat-from-cheap-iranian-drones-11667122204.

[49] Associated Press, "EXPLAINER: Killer Drones Vie for Supremacy Over Ukraine," October 18, 2022, at https://apnews.com/article/russia-ukraine-kyiv-business-government-and-politics-5a3e86a903ea5de028308f22f32a00c4. Also see CRS Insight IN12042, *Iran's Transfer of Weaponry to Russia for Use in Ukraine*, by Andrew S. Bowen, Carla E. Humud, and Clayton Thomas.

[50] Thomas Newdick, "Ukrainian MiG-29 Pilot's Front-Line Account of the Air War Against Russia," *The Drive*, April 2, 2022, at. https://www.thedrive.com/the-war-zone/45019/fighting-russia-in-the-sky-mig-29-pilots-in-depth-account-of-the-air-war-over-ukraine.

[51] DOD, Department of the Air Force, "Air Force Doctrine Publication (AFDP) 3-01: Counterair Operations," 2019, p. 8, at https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-01/3-01-AFDP-D02-AIR-Counterair-Operations.pdf.

[52] CRS Report R44572, *U.S. Airborne Electronic Attack Programs: Background and Issues for Congress*, by John R. Hoehn. For followup, congressional offices may contact Nathan J. Lucas.

air defenses.[53] Russia's Su-35S fighter jets can carry anti-radiation missiles capable of targeting artillery and anti-aircraft radars, but there is little evidence of their use or effectiveness in the conflict. The majority of documented Ukrainian air defense losses have been attributed to attacks that did not involve air power.[54]

At the start of the conflict, Ukraine had a limited inventory of Russian-made anti-radiation missiles, but there is little evidence of their use. DOD Under Secretary Kahl confirmed U.S. shipments of AGM-88 high-speed anti-radiation missiles (HARMs) to improve Ukraine's radar-targeting capabilities.[55] Ukrainian aircraft do not carry the associated targeting and EW capabilities that U.S. aircraft have, such as EW suppression and HARM targeting system (HTS) pods. Due to a lack of system integration between the weapon and the aircraft, HARMs may not be as effective when employed from Ukraine's Russian-made MiG-29s and Su-27s as they would be when used with U.S. fighter jets.[56] However, General David Hecker, United States Air Forces Europe Commander, argues that the presence of HARMs in Ukraine presents a threat to Russian air defense operators that may cause them to turn off their radars and prevent them from targeting Ukrainian aircraft.[57]

## Intelligence, Surveillance, and Reconnaissance (ISR)

A mission area where air superiority may be preferable to air denial is in the effectiveness of ISR. Air superiority enables information exploitation and can enhance freedom of movement on the battlefield by enabling timely and precise targeting of relevant military targets.[58] Battlefield targets (e.g., troops and tanks) are generally time-sensitive; therefore, efficient data transfer (from sensor to shooter) is often required to effectively engage targets. Both Russia and Ukraine have relied on UAVs for ISR, but both countries have experienced heavy losses of UAVs due to air defenses.[59] Russia's UAVs—such as the Orlan-10 UAV—have had high rates of attrition with limited ability to provide timely ISR. In addition, analysts have argued that Russia's space-based ISR satellite coverage is insufficient to provide timely targeting data.[60] These factors may have influenced Russia's decision to focus attacks on fixed infrastructure and civilian targets, for which it can more easily obtain accurate targeting data.

Ukraine has used low-altitude UAVs to locate targets on the battlefield, but open sources suggest that these UAVs have had limited success. According to U.S. defense officials, the United States and other nations have shared battlefield intelligence with Ukraine that has enabled military

[53] Justin Bronk, "Getting Serious About SEAD: European Air Forces Must Learn From the Failure of the Russian Air Force over Ukraine," *RUSI Defence Systems*, vol. 24 (April 6, 2022).

[54] Ibid.

[55] DOD, "USD (Policy) Dr. Kahl Press Conference," transcript, August 8, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3120707/usd-policy-dr-kahl-press-conference/.

[56] Rachel S. Cohen and Joe Gould, "With a mix of donated weapons, Ukraine's defenders adapt in war," *Air Force Times*, September 28, 2022, at https://www.airforcetimes.com/flashpoints/2022/09/28/with-a-mix-of-donated-weapons-ukraines-defenders-adapt-in-war/.

[57] Gen James B. Hecker, Lt. Gen James C. Slife, and Lt. Gen Alex Grynkewich, "Contering Russian Aggression," Panel at Air Force Association Air, Space, and Cyber Conference, National Harbor, MD, September 19, 2022, https://asc2022.us.chime.live/app/module?id=5&category=&filter=&quickFilterState=all.

[58] DOD, Department of the Air Force, "Air Force Doctrine Publication 3-0: Operations Planning," 2016, pp. 23, 55, at https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-0/3-0-AFDP-OPERATIONS-PLANNING.pdf.

[59] U.S. Air Force Colonel Maximilian Bremer and Kelly Grieco, "Success Denied: Finding Ground Truth in the Air War over Ukraine," *Defense News*, September 21, 2022, at https://www.defensenews.com/opinion/commentary/2022/09/21/success-denied-finding-ground-truth-in-the-air-war-over-ukraine/.

[60] Ibid.

operations to defend against Russian military operations.[61] The United States has also collaborated with commercial satellite companies to provide imagery, detect GPS jamming, and collect other forms of intelligence that Ukraine itself cannot gather or provide.[62]

Fighter jets can fill some ISR gaps by using their onboard sensors, such as radars and targeting pods.[63] Therefore, if either Ukraine or Russia had air superiority, their forces might be able to identify, track, and engage enemy targets more effectively, thereby mitigating adversary advantages in the ground domain.

## Counter-land (Air-to-Ground)

DOD officials have characterized the operational environment in Ukraine in 2022 as air denial, ground-centric warfare.[64] Russia's early offensive leveraged tanks and artillery to gain control of territory.[65] As Ukraine received more advanced military aid from the United States and other NATO countries, its ground forces were able to successfully conduct offensive operations. Artillery systems like the M777 howitzer and HIMARS enabled Ukraine to improve precision and mobility in its counter-offensives against Russia.[66] The United States and its allies have also provided intelligence and planning support, allowing Ukraine to perform strikes on fixed targets. Ukrainian forces also have demonstrated some ability to perform dynamic targeting (i.e., the ability to quickly identify a target and then strike it). With timely information and coordination, certain fighter and bomber aircraft can potentially provide effects on "targets of immediate concern to [friendly] ground forces when those forces cannot produce the desired effect with organic weapons alone."[67]

According to U.S. Air Force doctrine, counter-land operations support the ground war and "seek to destroy the enemy's fighting ability through focused attacks against key enemy targets."[68] Russia and Ukraine have executed limited counter-land strikes to assist ground forces, but air defenses have reportedly forced pilots to fly at low-altitude and minimize their time in enemy

[61] DOD, "Pentagon Press Secretary John F. Kirby Holds a Press Briefing," transcript, May 6, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3023614/pentagon-press-secretary-john-f-kirby-holds-a-press-briefing/; Olafimihan Oshin, "US has Helped Ukraine Target Russian Generals: Report," *The Hill*, May 4, 2022, at https://thehill.com/policy/defense/3477744-us-has-helped-ukraine-target-russian-generals-report/.

[62] Theresa Hitchens, "How US Intel Worked with Commercial Satellite Firms to Reveal Ukraine Info," *Breaking Defense*, April 7, 2022, at https://breakingdefense.com/2022/04/how-us-intel-worked-with-commercial-satellite-firms-to-reveal-ukraine-info/.

[63] Henry S. Kenyon, "Fighter Jets Provide Extra Eyes Over the Battlefield," *Signal* (magazine published by the Armed Forces Communications and Electronics Association, or AFCEA), February 2, 2010, at https://www.afcea.org/signal-media/fighter-jets-provide-extra-eyes-over-battlefield.

[64] U.S. Air Force General James B. Hecker, Lieutenant General James C. Slife, and Lieutenant General Alex Grynkewich, "Countering Russian Aggression," Panel at Air Force Association Air, Space, and Cyber Conference, National Harbor, MD, September 19, 2022, at https://asc2022.us.chime.live/app/module?id=5&category=&filter=&quickFilterState=all.

[65] CRS Report R47068, *Russia's War in Ukraine: Military and Intelligence Aspects*, by Andrew S. Bowen.

[66] Stephen Kalin and Daniel Michaels, "Himars Transform the Battle for Ukraine—and Modern Warfare," *Wall Street Journal*, October 8, 2022, at https://www.wsj.com/articles/himars-transform-battle-for-ukraine-modern-warfare-11665169716.

[67] DOD, Department of the Air Force, "Air Force Doctrine Publication (AFDP) 3-03: Counterland Operations," 2020, p. 37, at https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-03/3-03-AFDP-COUNTERLAND.pdf.

[68] DOD, Department of the Air Force, "Air Force Doctrine Publication (AFDP) 3-03: Counterland Operations," 2020, p. 3, at https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-03/3-03-AFDP-COUNTERLAND.pdf.

airspace.[69] These tactics effectively decrease the opportunities to identify dynamic or moving targets, and prevent the use of most precision-guided munitions. Without the ability to gain a degree of air superiority, counter-land strikes are difficult and present high risk to the limited number of Ukrainian aircraft and pilots.

# Potential Issues for Congress

In evaluating the advantages and disadvantages of transferring U.S. and NATO military aircraft to Ukraine, Congress may consider five potential issues: adapting Ukrainian security institutions, training pilots, maintaining and sustaining aircraft, providing munitions, and financing. The following section uses F-16s as an example to illustrate several points associated with these issues. (The F-16 is useful as an example because of the availability of data; its use does not represent an assumption that Ukraine would receive F-16s.)

## Adapting Ukrainian Security Institutions

As Congress evaluates the issues associated with transferring U.S. military aircraft to Ukraine, it may consider, as part of its oversight role, the extent to which the Ukrainian Armed Forces can effectively incorporate and employ advanced aircraft. Doing so would likely require Ukraine to change how it plans military operations and to increase its ability to leverage operational intelligence.

The military in Ukraine (a former Soviet republic) has traditionally relied on Soviet-style doctrine to plan and execute military operations.[70] This doctrine relies heavily on centralized control—meaning senior military officials exert a high level of detailed direction and approval for military forces and missions. Since the Russian invasion of Ukraine in 2014, the United States has provided assistance to improve Ukraine's security institutions, including a focus on transitioning Ukraine to a Western-style doctrine that focuses on mission command—allowing greater decisionmaking, within the parameters of the overall mission, at lower levels. USAI funding prior to 2022 focused on institution building, which would organizationally and doctrinally encourage greater decisionmaking freedom at lower levels.[71] This includes reducing corruption in the armed forces and improving programs like the State Partnership Program (SPP), which focused on providing experiences to enable Ukraine's military to transition to Western-style military doctrine.[72]

[69] David Axe, "The Russian Air Force is Back in the Fight in Ukraine. But It's Not Making Much of a Difference," *Forbes*, September 16, 2022, at https://www.forbes.com/sites/davidaxe/2022/09/16/the-russian-air-force-is-back-in-the-fight-in-ukraine-but-its-not-making-much-of-a-difference/?sh=474712c01235, and Justin Bronk, Nick Reynolds, and Jack Watling, *The Russian Air War and Ukrainian Requirements for Air Defence*, Royal United Services Institute, November 7, 2022, p. 16, at https://static.rusi.org/SR-Russian-Air-War-Ukraine-web-final.pdf.

[70] CRS In Focus IF11862, *Ukrainian Armed Forces*, by Andrew S. Bowen and Alex Hollings. For examples of how Russian air doctrine is not working in the Ukrainian context, see "How Russia's Warfare Doctrine is Failing in Ukraine," *Sandboxx News*, March 23, 2022, at https://www.sandboxx.us/blog/how-russias-warfare-doctrine-is-failing-in-ukraine/.

[71] U.S. Embassy Ukraine, "DOD Announces $250M to Ukraine," press release, June 11, 2020, at https://ua.usembassy.gov/dod-announces-250m-to-ukraine-2/.

[72] Stefano D'urso, "How California ANG Helped Ukrainian Air Force Improve And 'Counter Punch' Russian Aerospace Forces Over Ukraine," *The Aviationist*, May 24, 2022, at https://theaviationist.com/2022/05/24/california-ang-ukrainian-air-force/.

Some analysts have questioned whether Ukraine can shift from its prior Soviet-style doctrine[73] to Western-style doctrine that relies on decentralized control and flexibility in tactics, especially in a relatively short time frame. Ukraine's use of advanced munitions, such as HIMARS, transferred from the United States and NATO, could be cited as an example of Ukraine's overall successful shift to Western-style flexibility in tactics.[74] Using HIMARS, Ukraine has been able to collect intelligence and use that information to effectively target Russian fixed positions such as ammunition dumps and bridges. On the other hand, Ukraine has been unable to attack dynamic targets like mobile air defenses or aircraft using HIMARS. Western air forces have come to rely on decentralized control to be effective.[75] This Western-style approach maintains centralized command, but delegates mission control to lower echelons provided with real-time intelligence, who are then empowered to respond to changes in the operational environment during execution.[76] F-16 technical capabilities, some argue, would provide little advantage if pilots/local commanders do not have the authority and intelligence to quickly select and engage targets. Ukraine has demonstrated a limited ability to develop and execute these types of air operations.[77]

In considering potential military fighter transfers to Ukraine, Members may consider a number of oversight actions related to security institutions, including

- evaluate, as part of oversight, whether Title 10, Section 332 and 333 security cooperation programs and USAI have prepared the Ukrainian Air Force to effectively use advanced fighter jets in its war with Russia;[78]
- seek current assessments on whether or not the Ukrainian Air Force has shifted from Soviet-style doctrine to decentralized control and flexibility; and
- seek information from Inspector General sources within DOD and the Department of State on how well the Ukrainian Armed Forces have integrated U.S-provided security assistance into their military planning and execution.

## Training Pilots

The Ukrainian air force currently operates 1970s- and 1980s-era aircraft (e.g., Su-24, Su-25, Su-27 and MiG-29). These aircraft primarily use less sophisticated air-to-air and air-to-ground

[73] Prior to the 2022 renewal of the Russian invasion, the United States and military allies focused on facilitating Ukraine's move away from Soviet-era military doctrine, noting the periodic slow pace of those reforms. For example, see Andriy Zagorodnyuk, Alina Frolova, Hans Petter Midtunn, and Oleksii Pavliuchyk, "Is Ukraine's Reformed Military Ready to Repel a New Russian Invasion?," The Atlantic Council, December 23, 2021, at https://www.atlanticcouncil.org/blogs/ukrainealert/is-ukraines-reformed-military-ready-to-repel-a-new-russian-invasion/, andAndrew Salerno-Garthwaite, "Air denial over supremacy: lessons from Ukraine," *Airforce Technology*, September 8, 2022, at https://www.airforce-technology.com/analysis/air-enial-over-supremacy-lessons-from-ukraine/.

[74] Stavros Atlamzoglou, "HIMARS: How an Advanced US Artillery System is Winning for Ukraine," *Sandboxx News*, July 20, 2022, at https://www.sandboxx.us/blog/himars-how-an-advanced-us-artillery-system-is-winning-for-ukraine/.

[75] Clint Hinote, *Centralize Control and Decentralized Execution* (Montgomery, AL: Air University, 2009), at https://apps.dtic.mil/sti/pdfs/ADA550460.pdf.

[76] DOD, Department of the Air Force, "Air Force Doctrine Publication (AFDP) 1: The Air Force," 2021, p. 13, at https://www.doctrine.af.mil/Portals/61/documents/AFDP_1/AFDP-1.pdf.

[77] Justin Bronk, Nick Reynolds, and Jack Watling, *The Russian Air War and Ukrainian Requirements for Air Defence*, Royal United Services Institute, November 7, 2022, p. 38, at https://static.rusi.org/SR-Russian-Air-War-Ukraine-web-final.pdf. Benjamin Brimelow, "Neither Moscow nor Kyiv can control Ukraine's skies. These are the jets they're using to fight the air war," *Business Insider*, July 24, 2022, at https://www.businessinsider.com/combat-jets-russia-and-ukraine-are-using-in-ukraine-war-2022-7.

[78] 10 U.S.C. §332-333; P.L. 114-92 §1250, as amended.

munitions than do aircraft in western militaries.[79] *The Military Balance* notes that these aircraft have seen limited upgrades and do not incorporate the latest advances in military aviation,[80] including advanced radar technology, secure communications, and advanced munitions technologies.

Congress may consider the potential training required for Ukrainian pilots to use new munitions and aircraft. The transfer of new U.S. aircraft to Ukraine would require retraining the Ukrainian pilots to operate these systems. It can take several years to train a new fighter pilot in the U.S. military, but as little as several months to retrain an experienced pilot on a new aircraft. Some observers have argued that such retraining could happen relatively quickly.[81] In July 2022, Air Force Chief of Staff General Brown said experienced U.S. pilots could learn to fly a new aircraft within two to four months.[82] General Brown added, however, that pilots transitioning from Soviet-era aircraft to U.S. aircraft could face more difficulty and require more time.[83]

Congress, in its oversight role, may consider questions about the formal training necessary to transition Ukrainian pilots to new aircraft, taking into account aircraft type, experience level, and desired proficiency level. Potential oversight options might include, but are not limited to

- obtaining from DOD and the armed services plans for training Ukrainian pilots on U.S.-manufactured fighter jets; and
- conducting, or directing, a time and cost comparison between training Ukrainian pilots on advanced western fighter jets vis-a-vis former Soviet aircraft.

## Maintaining and Sustaining Aircraft

Another issue Congress might consider regarding the transfer of U.S. military aircraft to Ukraine is maintenance. The Ukrainian Air Force has only flown former Soviet fighter jets, which have different engineering standards and system components than advanced Western aircraft. A decision to transfer advanced Western fighter jets to Ukraine could further complicate Ukraine's ability to perform maintenance. Ukrainian air operations could use two potential sustainment models: one in which Ukrainian personnel perform maintenance, or one in which Ukraine's air force contracts out maintenance work. Using Ukrainian personnel to maintain aircraft may cost less over the long term and would reduce Ukraine's reliance on foreign countries. However, training maintenance personnel can take months or years, depending on the desired level of proficiency.[84]

According to the Government Accountability Office (GAO), a maintainer traditionally attends technical school to become an apprentice—training that lasts between 23 and 133 academic days,

[79] "Russia and Eurasia," in *The Military Balance 2022* (London, UK: International Institute for Strategic Studies, 2022), p. 213.

[80] Ibid.

[81] Dave Deptula, "Provide the Airpower Ukraine Needs to Win Now," *Forbes*, July 25, 2022, at https://www.forbes.com/sites/davedeptula/2022/07/25/provide-the-airpower-ukraine-needs-to-win-now/?sh=6190c9b53f72.

[82] Phil Stewart, "U.S., allies discuss possible training for Ukrainian air force," *Reuters*, July 20, 2022, at https://www.reuters.com/world/europe/us-allies-discuss-possible-training-ukrainian-air-force-2022-07-20/.

[83] Ibid.

[84] GAO, *Strategy Needed to Improve Retention of Experienced Air Force Aircraft Maintainers*, GAO-19-160, February 5, 2019, at https://www.gao.gov/assets/gao-19-160.pdf.

depending on the maintainer's specialty.[85] The maintainer is then eligible to become fully qualified after at least 12 months of on-the-job experience.[86] Because U.S. military maintenance training is normally conducted in English, foreign military personnel typically require extensive language training to gain sufficient language proficiency before they can start technical training.[87] Maintenance schooling also may be limited by student capacity. According to GAO, in FY2017, the Air Force trained 9,600 maintainers for all of its aircraft types.[88] It may be possible to train a smaller group of Ukrainian maintenance personnel that are proficient in English, and then allow them to train the rest. However, this may extend the timeline required to develop a sufficient maintenance cadre to support operations on the selected airframe. Some analysts have argued that Ukraine would likely have a difficult time maintaining U.S.-manufactured fighter aircraft due to both training and scale. They note that, for the U.S. Air Force, an F-16 requires about 16 man-hours of maintenance for every one hour flying, and that once trained, aircraft maintenance personnel rely on specialized equipment and a massive logistical enterprise to keep them supplied with materiel.[89]

Contract maintainers, on the other hand, could be available relatively quickly to support air operations. This maintenance model relies on previously trained personnel from other countries to maintain and sustain aircraft. One potential drawback of this approach is that because they are already trained and experienced, these maintainers can be expensive. As an example of how much a U.S.-manufactured fighter jet can cost to maintain, the U.S. Navy released a contract in September 2022 seeking proposals from companies to maintain a reported 26 F-16s for a value of $152.3 million over eight years, at a cost of approximately $19 million per year.[90] Another potential downside is that relying on contract maintenance for the long term poses a risk by relying on non-Ukrainian labor—most likely U.S. or European personnel, depending on the aircraft type. Should the political environment in Ukraine change, participating governments might decide to prevent this exchange of technical services.

As Congress evaluates the issues associated with transferring U.S. military aircraft to Ukraine, it may consider questions regarding its authorization and oversight roles in relation to these two potential maintenance approaches. For example, how long might Ukraine need to rely on contract maintenance before its own maintainers gained sufficient proficiency? How much might it cost either Ukraine or western aid donors to rely on contract maintenance until Ukrainian personnel are trained?

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[85] U.S. Government Accountability Office (GAO), *Strategy Needed to Improve Retention of Experienced Air Force Aircraft Maintainers*, GAO-19-160, February 5, 2019, p. 7, https://www.gao.gov/assets/gao-19-160.pdf.

[86] Ibid.

[87] For example, as of November 2022, Bulgarian Air Force pilots were enrolled in an advanced English course before beginning pilot training. Janes, "Bulgaria – Air Force," August 23, 2022, at https://customer.janes.com/Janes/Display/jwafa038-JWAF.

[88] GAO, *Strategy Needed to Improve Retention of Experienced Air Force Aircraft Maintainers*, GAO-19-160, February 5, 2019, at https://www.gao.gov/assets/gao-19-160.pdf.

[89] Alex Hollings, "Why Can't NATO Give Ukraine F-15s or F-16s? It's About More than Pilot Training," *Sandboxx*, April 4, 2022, at https://www.sandboxx.us/blog/why-cant-nato-give-ukraine-f-15s-or-f-16s-its-about-more-than-pilot-training/.

[90] Christine Thropp, "Navy Soliciting F-16 Aircraft Maintenance, Logistics Support Services," *GOVCON Wire*, September 9, 2022, at https://www.govconwire.com/2022/09/navy-soliciting-f-16-aircraft-maintenance-logistics-support-services/. The Navy reportedly operates 26 F-16s. For more information see Jamie Hunter, "The Navy Just Received Its First Surplus F-16s From The Air Force (Updated)," *The Warzone*, April 20, 2022, at https://www.thedrive.com/the-war-zone/the-navy-will-receive-its-first-surplus-f-16s-from-the-air-force-today.

In considering potential military fighter jet transfers to Ukraine, Members may consider whether or not to pursue the following potential oversight and legislative actions with respect to maintenance and sustainment:

- seek details on what DOD could provide Ukraine to maintain and sustain U.S.-manufactured aircraft, including training for Ukrainian aircraft maintenance personnel or contract maintenance;
- seek clarification from the Government of Ukraine on whether it intends to follow a model of maintaining and sustaining U.S.-manufactured fighter jets with their own personnel or follow a model of using contract maintenance providers; and
- explore amending USAI (P.L. 114-92, §1250) to authorize funding for Ukrainian aircraft maintenance training should U.S.-manufactured fighter jet transfers occur, if the plan is for Ukraine to use its own personnel.

## Providing Munitions

If Ukraine were to adopt a strategy of seeking air superiority with advanced western aircraft, it is likely that the Ukrainian Air Force would attempt to obtain significant numbers of advanced western-manufactured munitions. Currently most advanced western munitions require guidance and communications found only in advanced western aircraft, and munitions for current Ukrainian fighter jets that would put them in parity with Russian fighter jets would need to come mainly from Russia. Therefore, the advantages of transferring advanced western fighter jets in seeking air superiority are likely to be realized only if paired with large quantities of western-manufactured munitions.[91] Ukraine's ability to military operations has been limited because it does not have advanced munitions comparable to Russian aircraft.[92] DOD decided to transfer HARM missiles to Ukraine to improve its ability to conduct SEAD[93] (although the HARM missiles are not as fully capable on Ukrainian fighter jets as they would be on U.S. aircraft)[94], and to transfer Advanced Medium Range Air-to-Air Missiles (AMRAAMs) through the National Advanced Surface-to-Air Missile System (NASAMS) to conduct air defense.[95]

If the Administration were to propose a transfer of fighter aircraft to Ukraine, Congress could consider the cost, impact, and ability of munitions transfers on U.S. forces through its oversight and appropriations functions. Some Members may oppose the transfer of advanced missiles such as HARM and AMRAAM because they are relatively expensive and difficult to replace. For example, a single AMRAAM is budgeted at $1.181 million in FY2023 and scheduled for delivery

[91] See CRS Report R45996, *Precision-Guided Munitions: Background and Issues for Congress*. Almost all advanced munitions for U.S. fighter jets have guidance systems that need links to the avionics in the aircraft itself, which makes the munitions compatible only with specifically-designed aircraft.

[92] "Ukraine Has Momentum. What It Needs Now Are Munitions," *The Economist,* November 19, 2022, at https://www.economist.com/europe/2022/11/17/ukraine-has-momentum-what-it-needs-now-are-munitions. According to *The Military Balance,* Ukraine operates a series of Soviet-era anti-radiation and air-to-air missiles. See "Russia and Eurasia," in *The Military Balance 2022* (London, UK: International Institute for Strategic Studies, 2022), p. 213.

[93] DOD, "USD (Policy) Dr. Kahl Press Conference," transcript, August 8, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3120707/usd-policy-dr-kahl-press-conference/.

[94] Rachel S. Cohen and Joe Gould, "With a mix of donated weapons, Ukraine's defenders adapt in war," *Air Force Times,* September 28, 2022, at https://www.airforcetimes.com/flashpoints/2022/09/28/with-a-mix-of-donated-weapons-ukraines-defenders-adapt-in-war/.

[95] For more information on NASAMS, see CRS In Focus IF12230, *National Advanced Surface-to-Air Missile System (NASAMS),* by Andrew Feickert.

in April 2025—approximately two years after the contract award.[96] Other Members may opt to authorize DOD to buy the full complement of munitions if the United States transfers U.S.-manufactured fighter jets to Ukraine, to authorize instead less expensive munitions for other weapons systems, or to authorize purchase of a lesser number of fighter jet munitions and munitions for other weapons systems.

In the event of fighter aircraft transfer, the required munitions will depend on the airframe selected, but many NATO aircraft are capable of employing U.S.-made air and ground munitions. Recent announcements through the Ukraine Security Assistance Initiative for advanced munitions—for example, HIMARS, NASAMS air defenses, and GPS-guided artillery shells—have cost at least several hundreds of millions of dollars and will take years to manufacture, whether those munitions would go directly to Ukraine or replenish drawdowns from U.S. stockpiles.[97] However, supporters of transferring fighter jets to Ukraine may conclude that the capabilities provided to Ukraine justify the cost of providing these munitions, given the potential military advantages of Ukrainian air superiority.

In addition, some analysts have noted that the U.S. munitions industrial base is currently producing munitions at the maximum capacity that DOD funding is supporting.[98] These analysts have argued that transferring munitions to Ukraine poses a risk to U.S. military training and operations. The Administration has said it transferred older missiles to Ukraine and continues to evaluate DOD's inventory of munitions to ensure it can meet future requirements.[99] This strategy may apply to any future weapons transfers as well. The Administration has publicized the transfer of one type of advanced air-to-surface munition, HARM. Should a decision be made to transfer Western aircraft, it is unclear what impact transferring other advanced air combat munitions might have on U.S. military training and readiness. To speed replenishment of munitions, Congress authorized multi-year procurement contracts for both Army and Air Force munitions in the FY2023 NDAA (P.L. 117-263).[100] While authorizing multi-year procurement for AGM-179 Joint Air-to-Ground Missiles and AIM-120 Advanced Medium-Range Air-to-Air Missiles (AMRAAM), the FY2023 NDAA did not authorize multi-year procurement for HARM missiles.[101]

Congress, through its oversight and authorization roles, may consider questions regarding the impact of a potential jet transfer on munitions costs and supplies. For example, can the industrial base sustain both U.S. and Ukrainian munition demands? What is the cost of continuing to

[96] U.S. Air Force FY2023 Missile Procurement Budget Justification, pp. 73-75, at https://www.saffm.hq.af.mil/Portals/84/documents/FY23/PROCUREMENT_/FY23%20Air%20Force%20Missile%20Procurement.pdf?ver=QeRLpOSY7vcLmsKbr3C-Qw%3d%3d.

[97] CRS In Focus IF12040, *U.S. Security Assistance to Ukraine*, by Christina L. Arabia, Andrew S. Bowen, and Cory Welt.

[98] For example, see Mislav Tolusic, "Ukraine makes it obvious DoD has to change how it buys weapons," *Defense News*, October 13, 2022, at https://www.defensenews.com/opinion/commentary/2022/10/13/ukraine-makes-it-obvious-dod-has-to-change-how-it-buys-weapons/; and Maiya Clark and Jacob Montoya, "The War in Ukraine Continues; Can the U.S. Defense-Industrial Base Keep Up?," *The Heritage Institute*, May 5, 2022, at https://www.heritage.org/defense/commentary/the-war-ukraine-continues-can-the-us-defense-industrial-base-keep.

[99] DOD, "Undersecretary of Defense for Policy Dr. Colin Kahl Holds a Press Briefing on Security Assistance in Support of Ukraine," transcript, August 24, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3138872/undersecretary-of-defense-for-policy-dr-colin-kahl-holds-a-press-briefing-on-se/.

[100] See CRS Report R41909, *Multiyear Procurement (MYP) and Block Buy Contracting in Defense Acquisition: Background and Issues for Congress*, by Ronald O'Rourke.

[101] P.L. 117-263, §1244 (c).

transfer advanced munitions to Ukraine? How has the transfer of munitions affected U.S. defense stockpiles?

Members may consider the following potential oversight actions:

- seek to participate in war games, conducted by both DOD entities and think tanks, which analyze the rates which U.S.-manufactured fighter jets expend air-to-air and air-to-ground missiles in conflict; and
- obtain DOD plans to increase munitions production and evaluate them in light of a potential aircraft transfer to Ukraine.

## Financing

Ukraine would likely require U.S. security assistance grants to procure and sustain advanced aircraft for the foreseeable future. In general, aircraft procurement and sustainment represent a significant financial investment for militaries.[102] According to Janes, Ukraine spent approximately $1.1 billion, or approximately 30.2% of its defense budget, on its air force in 2021.[103] Within this budget, Ukraine dedicated approximately $228.6 million, or 21%, for procurement and $386.5 million, or 36%, for operations and maintenance.

Procuring advanced fighter aircraft can be costly, as demonstrated by recent foreign military sales (FMS) cases for F-16s in Slovakia and Bulgaria. In April 2018, DOD's Defense Security Cooperation Agency (DSCA) announced a proposed FMS case to sell Slovakia 14 F-16s—along with training, munitions, and aircraft sustainment—for a proposed value of $2.91 billion.[104] Similarly, DSCA announced a proposed FMS case in April 2022 to sell eight F-16s to Bulgaria—again including training, munitions, and aircraft sustainment—for $1.673 billion.[105] These FMS cases, on average, cost approximately $195 million per aircraft (including the additional munitions and support),[106] which is about 85% of the entire procurement budget of the Ukrainian air force.

Advanced aircraft like the F-15 and F-16 would likely cost more to operate than Ukraine's current aircraft inventory. DOD reports the reimbursement rate (the amount DOD charges a third party to pay for non-DOD use, roughly equivalent to the cost of operating an aircraft) of a single seat F-16 as $10,866 per hour.[107] Assuming this aircraft flies 250 hours per year, the annual operations and maintenance cost for a single aircraft would be $2.7 million. Replacing all of Ukraine's Su-27s and MiG-29s with 70 F-16s could increase annual O&M costs at least $190 million, or about half

[102] The U.S. military, for example, reports that it allocates $56.5 billion on aviation development and procurement, or approximately 20.5% of its total investment budget. For more information, see DOD, FY2023 Program Acquisition Costs by Weapon System, April 2022, p. i, at https://comptroller.defense.gov/Portals/45/Documents/defbudget/FY2023/FY2023_Weapons.pdf.

[103] Janes, "Defence Budget Tool: Ukraine Defence Budget by Activity, Air Force," accessed November 2, 2022, https://customer.janes.com/DefenceBudgets/Guided?view=chart&f=COUNTRY(Ukraine)%3Cand%3EFORCE(Air%20Force)&pg=1&template=.

[104] DSCA, Major Arms Sales, "Slovakia - F-16 Block 70/72 V Configuration Aircraft," press release, April 4, 2018, https://www.dsca.mil/press-media/major-arms-sales/slovakia-f-16-block-7072-v-configuration-aircraft.

[105] DSCA, Major Arms Sales, "Bulgaria - F-16 C/D Block 80 Aircraft," press release, April 4, 2022, https://www.dsca.mil/press-media/major-arms-sales/bulgaria-f-16-cd-block-70-aircraft.

[106] The Bulgaria FMS case on average costs $209 million per aircraft. The Slovakian FMS case on average costs $181 million per aircraft.

[107] DOD, Office of the Under Secretary of Defense (Comptroller), "FY2022 Reimbursable Rates – Tabs B and C," at https://comptroller.defense.gov/Portals/45/documents/rates/fy2022/2022_b_c.pdf.

of Ukraine's reported operations and maintenance budget.[108] Other aircraft options, such as the F-15 or the Typhoon, would likely cost more than that to operate. Some countries the United States has exported aircraft to have been unable to maintain them. For example, the United States sold 34 F-16s to Iraq to rebuild its air force.[109] Since the United States withdrew from Iraq and ended its contract maintenance assistance, Iraqi F-16s have experienced readiness issues.[110]

Congress may consider which legal authorities and funding streams would be the most appropriate and efficient to support the costs associated with U.S. training of Ukrainian personnel, the potential new procurement and transfer of significant military equipment such as aircraft and munitions, as well as maintenance, sustainment, and other logistics costs associated with the transfer of such equipment.

# Potential Policy Options for Congress

As Congress evaluates whether to transfer military aircraft to Ukraine or not, it may consider three potential legislative options: (1) maintaining the current policy (see below), (2) transferring used aircraft, and (3) procuring new aircraft. These options are not mutually exclusive, and Congress may choose none, any, or all of them. The options that involve transfer of aircraft do not prescribe a specific platform, and each available platform may fill different capability gaps. For a more detailed analysis of platforms and roles, see **Appendix B**, Overview of Selected Aircraft Options. The following discussion outlines each option and describes their respective advantages and disadvantages.

## Maintain the Status Quo

Congress may choose to maintain the Administration's current policy regarding the transfer of aircraft to Ukraine, which would require no congressional action. This option entails providing Ukraine with spare parts for its Soviet-era aircraft, along with systems engineering to integrate U.S.-developed munitions. In August 2022, when asked to respond to a question on what work the Administration had done to consider transferring western aircraft, DOD Under Secretary Kahl noted that, among critics of the Administration's preference at the time not to transfer fighter aircraft, "[n]ot very much has been noticed about the sheer amounts of spare parts and other things that 'we've done to help them [the Ukrainian Air Force] actually put more of their own MiG-29s in the air and keep those that are in the air flying for a longer period of time."[111] Under Secretary Kahl stated that DOD had transferred HARMs to Ukraine,[112] elaborating that these

[108] *The Military Balance 2022* reports that Ukraine had 36 MiG-29s and 34 Su-27s before the start of the 2022 invasion. See "Russia and Eurasia," in *The Military Balance 2022* (London, UK: International Institute for Strategic Studies, 2022), p. 213.

[109] CRS Report R44984, *Arms Sales in the Middle East: Trends and Analytical Perspectives for U.S. Policy*, coordinated by Clayton Thomas.

[110] Thomas Newdick, "The Iraqi Air Force's F-16 Fleet Is On The Brink Of Collapse Despite Showy Flybys," *The War Zone*, January 7, 2021, at https://www.thedrive.com/the-war-zone/38594/the-iraqi-air-forces-f-16-fleet-is-on-the-brink-of-collapse-despite-showy-flybys.

[111] DOD, "USD (Policy) Dr. Kahl Press Conference," transcript, August 8, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3120707/usd-policy-dr-kahl-press-conference/.

[112] Ibid. For more information about HARM, see CRS Report R45996, *Precision-Guided Munitions: Background and Issues for Congress*, by John R. Hoehn. Nathan J. Lucas is the current point of contact for congressional offices seeking any further information.

missiles "were not designed to fly off Russian equipment—they were designed to fly off our aircraft and the Ukrainians in recent weeks have been using the HARM missiles."[113]

This option would likely be the least expensive way to maintain the Ukrainian Air Force. It also raises several potential issues. First, a finite number of spare parts for former Soviet-era aircraft are available to sustain flight operations. News organizations have reported that Poland, the United States, and Germany have transferred their respective MiG-29 aircraft to Ukraine to be used for spare parts.[114] As other nations follow suit, fewer MiG-29 aircraft would be available to fly missions. In addition, Russia is not exporting aircraft or parts to enable Ukraine to sustain air operations. Second, munitions compatibility may limit the MiG-29 fighter's effectiveness. Although some U.S.-made munitions (e.g., a laser-guided bomb called the Paveway) could continue to be integrated into these aircraft, other more sophisticated munitions would be difficult to integrate. For example, the AIM-120 Advanced Medium Range Air-to-Air Missile (AMRAAM) would likely be unable to receive data from MiG-29s, thereby preventing these missiles from being used.[115] Similarly, global positioning system-guided bombs such as the Joint Direct Attack Munition (JDAM) need to interact with the aircraft to work as intended.[116]

## Transfer Used Aircraft

Another option would be to transfer used fighter jets to Ukraine, either by transferring U.S.-owned aircraft, or by brokering the transfer of inventory aircraft from an interested NATO or other partner nation.[117] Transferring used aircraft may benefit the Ukrainian Air Force by reducing the challenges of supporting Soviet-era aircraft (as described above) and by increasing the number, type, and sophistication of munitions the Ukrainian air force might use.[118] Congress could choose to act on this option by expanding or restricting the President's ability to transfer fighter aircraft to Ukraine in his exercise of Presidential Drawdown Authority (PDA), 22 U.S.C. §2318. Similarly, Congress could also act upon this option by funding or restricting U.S. support for transfer of foreign aircraft under the USAI or Foreign Military Funding (FMF).[119]

This approach has certain advantages. It would enable the United States (or its allies) to provide aircraft to Ukraine most quickly. Providing either U.S.-manufactured or NATO member-manufactured aircraft would improve the Ukrainian air force's capabilities, including its ability to perform air-to-air, air-to-ground, and suppression-of-air defense missions. Western aircraft, such as the F-16, the F-18 Hornet, or the JAS 39 Gripen, would be able to serve as a so-called "multi-

[113] DOD, "Undersecretary of Defense for Policy Dr. Colin Kahl Holds a Press Briefing on Security Assistance in Support of Ukraine," transcript, August 24, 2022, at https://www.defense.gov/News/Transcripts/Transcript/Article/3138872/undersecretary-of-defense-for-policy-dr-colin-kahl-holds-a-press-briefing-on-se/.

[114] Gaston Dubois, "U.S. to send MiG-29 aircraft to Ukraine, but as a source of spare parts," *Aviacionline*, April 19, 2022, at https://www.aviacionline.com/2022/04/u-s-to-send-mig-29-aircraft-to-ukraine-but-as-a-source-of-spare-parts/, and David Axe, "Ukraine Gets More MiG Parts. But Kyiv's Old Fighters Won't Last Forever," *Forbes*, June 22, 2022, at https://www.forbes.com/sites/davidaxe/2022/06/22/ukraine-gets-more-mig-parts-but-kyivs-old-fighters-wont-last-forever/?sh=868ba3e6d8eb.

[115] "AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM)," *Air Force Technology*, June 12, 2020, at https://www.airforce-technology.com/projects/aim-120-advanced-medium-range-air-to-air-missile-amraam/.

[116] DOD, Department of the Air Force, "Joint Direct Attack Munition GBU-31/32/38," press release, at https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104572/joint-direct-attack-munition-gbu-313238/.

[117] Valerie Insinna, "The US military now seems open to gifting Ukraine new fighter jets, but what type?," *Breaking Defense*, July 22, 2022, at https://breakingdefense.com/2022/07/the-us-military-now-seems-open-to-gifting-ukraine-new-fighter-jets-but-what-type/.

[118] Lara Seligman, "U.S. general calls on West to send fighter jets to Ukraine 'as soon as possible,'" *Politico*, June 3, 2022, at https://www.politico.com/news/2022/06/03/u-s-general-west-should-send-jets-to-ukraine-asap-00037173.

[119] See **Appendix A**.

role" fighter capable of performing many or all mission-sets. In addition, these aircraft would be able to use sophisticated munitions such as AMRAAM and JDAM.[120]

This approach has several limitations. Assuming the availability of these fighter jets, used or older aircraft have a limited service life. For example, older F-16s retiring from the Air Force may have a limited lifespan[121] and therefore might need to be replaced sooner than a newer aircraft. In addition, older aircraft tend to have higher operating costs,[122] potentially requiring additional U.S. financial assistance to maintain flight operations.

## Provide New Aircraft

A third potential option for Congress would be to authorize and appropriate Foreign Military Financing (FMF) for Ukraine to procure new aircraft under foreign military sales (FMS).[123] Compared with the status quo and used aircraft options, providing Ukraine with new aircraft could offer both a long-term sustainment option and an increase in capability due to technological advances.[124]

Congress may support the provision of such aircraft by NATO allies, in addition to or as an alternative to U.S. provision. Congress could support transferring allied fighter jets if the cost were lower, if the aircraft could be delivered more quickly, or if U.S. fighter jet production lines were filling U.S. military force structure. Should Congress choose to support the transfer of NATO fighter jets to Ukraine, FMF/FMS would likely not be an option, since the FMF structure under the Arms Export Control Act is intended for the transfer of U.S.-manufactured defense articles.[125]

Providing Ukraine with new aircraft offers several advantages. First, new aircraft incorporate the latest technological developments and use the most advanced munitions, thereby offering improved survivability against adversary aircraft and air defenses.[126] Second, because new aircraft are in production, spare parts are usually readily available, which improves the ability to maintain and sustain aircraft operations for the foreseeable future. Finally, new aircraft are typically designed to fly between 8,000 and 10,000 hours during their lifespan, providing capability for decades.[127]

There are several disadvantages to providing Ukraine with new aircraft. First, manufacturing a new aircraft can take several years—an issue that has been exacerbated by supply chain issues

[120] According to *2022 Military Balance*, Ukraine operates AA-8 and AA-11 air-to-air missiles, which it developed in the 1980s. Ukraine does not operate GPS-guided bombs such as the JDAM. For more information, see "Russia and Eurasia," in *The Military Balance 2022* (London, UK: International Institute for Strategic Studies, 2022), p. 213.

[121] Fighter jets are normally designed to fly between 8,000 and 10,000 hours. If the United States were to give Ukraine fighter jets with 7,000 hours (leaving only 1,000 left on the airframe), these aircraft would likely need to be replaced after approximately four years—assuming 250 hours per year.

[122] DOD, Office of the Under Secretary of Defense (Comptroller), "FY2022 Reimbursable Rates – Tabs B and C," at https://comptroller.defense.gov/Portals/45/documents/rates/fy2022/2022_b_c.pdf.

[123] For more information see **Appendix A**.

[124] For example, see Stefano D'urso, "First F-16V Block 72 Fighters Delivered To Greece," *The Aviationist*, September 14, 2022, at https://theaviationist.com/2022/09/14/first-f-16v-block-72-delivered-to-greece/.

[125] Defense Security Cooperation Agency, "Foreign Military Sales FAQ," at https://www.dsca.mil/foreign-military-sales-faq.

[126] Lockheed Martin, "F-16 Fighting Falcon," press release, at https://www.lockheedmartin.com/en-us/products/f-16.html.

[127] Saab, "A future-proof fighter jet," press release, May 1, 2020, at https://www.saab.com/newsroom/stories/2019/may/a-future-proof-fighter-jet.

associated with the COVID-19 pandemic and continuing consolidation and shrinkage of the defense supplier base.[128] Second, providing Ukraine with new aircraft would be more expensive than providing it with either spare parts or used aircraft. For example, in a recent FMS case, the United States sold eight F-16 Block 70s to Bulgaria for approximately $209 million per aircraft (which included a starting munitions and training package).[129] By comparison, the United States, through EDA authorities, transferred three used F-16s to Italy in 2015 for a total of $23.8 million.[130]

Each of the three general options warrants different mechanisms for the Administration to utilize. As previously mentioned, a potential transfer could include one or multiple options, offering various oversight considerations for Congress. More information on these options and the associated considerations can be found in **Appendix A**.

[128] Valerie Insinna, "COVID supply chain woes add yearlong delay to first F-16 rollout at new facility," *Breaking Defense*, November 17, 2021, at https://breakingdefense.com/2021/11/covid-supply-chain-woes-add-yearlong-delay-to-first-f-16-rollout-at-new-facility/; Ilene Wolff, "Can the Defense Industry Unkink Supply Chains to Meet Demands?" SME Media, November 21, 2022, at https://www.sme.org/technologies/articles/2022/november/can-the-defense-industry-unkink-supply-chains-to-meet-demands/.

[129] Defense Security Cooperation Agency (DSCA), Major Arms Sales, "Bulgaria – F-16 C/D Block 70 Aircraft," press release, April 4, 2022, at https://www.dsca.mil/press-media/major-arms-sales/bulgaria-f-16-cd-block-70-aircraft.

[130] The total value of FMS cases include equipment, sustainment, maintenance, and other logistics costs whereas the value of EDA includes just the equipment. DSCA, "Excess Defense Articles (EDA) Database Tool," accessed on October 21, 2022, at https://www.dsca.mil/programs/excess-defense-articles-eda.

# Appendix A. Overview of Foreign Assistance Programs and Authorities for Ukraine

The United States has used a variety of security assistance programs and authorities to help build the defensive capacity of the Ukrainian Armed Forces (UAF) through train, equip, and advise efforts across multiple spending accounts. These programs and authorities may assist the transfer of U.S.-manufactured fighter aircraft to Ukraine, should the United States decide to do so. Prior to the 2022 war, the two primary accounts were the State Department's Foreign Military Financing (FMF) and DOD's Ukraine Security Assistance Initiative (USAI).[131]

Congress funded FY2022 and FY2023 security assistance packages with more than $28 billion in regular and supplemental appropriations, including the Ukraine Supplemental Appropriations Act, 2022,[132] the Additional Ukraine Supplemental Appropriations Act, 2022,[133] and the Continuing Appropriations and Ukraine Supplemental Appropriations Act, 2023.[134] In total, FY2022 and FY2023 appropriations include $14.05 billion to replenish DOD equipment stocks sent to Ukraine via presidential drawdown authority (PDA); $9.3 billion for DOD's USAI; and $4.65 billion in FMF for Ukraine and "countries impacted by the situation in Ukraine."[135] USAI packages have included training, equipment, and advisory efforts to enhance Ukraine's defensive capabilities.[136] FY2022 appropriations also directed that USAI funds be provided for logistics support, supplies, and services; salaries and stipends; sustainment; weapons replacement; and intelligence support. Prior to FY2022, a portion of annual USAI funds was contingent on DOD and the State Department certifying Ukraine's progress on key defense reforms. The United States also has been providing defense items to Ukraine via PDA, by which the President can authorize the immediate transfer of articles and services from U.S. stocks without congressional approval in response to an "unforeseen emergency."[137] Since August 2021, the Biden Administration has authorized 30 drawdowns valued at over $18.3 billion, through January 19, 2023.[138]

The United States has also assisted Ukraine pursuant to DOD's security cooperation authorities, notably Building Partner Capacity and Defense Institution Building,[139] and International Military Education and Training (IMET), which has provided professional military education at U.S. defense institutions for Ukrainian military officers. Other State Department- and DOD-funded security assistance has supported conventional weapons destruction, border security, law enforcement training, and capabilities to counter weapons of mass destruction.

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[131] State Department FMF authorities are codified in 22 U.S.C. §2763. DOD's USAI was originally authorized in P.L. 114-92, §1250.

[132] P.L. 117-103, Division N.

[133] P.L. 117-128.

[134] P.L. 117-180.

[135] FY2022 supplemental appropriations also have included funds for additional U.S. troop deployments to Europe.

[136] CRS In Focus IF12040, *U.S. Security Assistance to Ukraine*, by Christina L. Arabia, Andrew S. Bowen, and Cory Welt.

[137] 22 U.S.C. §2318(a)(1).

[138] CRS In Focus IF12040, *U.S. Security Assistance to Ukraine*, by Christina L. Arabia, Andrew S. Bowen, and Cory Welt.

[139] Building Partner Capacity authorities are codified in 10 U.S.C. §333. Defense Institution Building authorities are codified in 10 U.S.C. §332.

## Authorities for Transferring Military Equipment

The Biden Administration could potentially use one or more of the following authorities to transfer fighter jets to Ukraine: Presidential Drawdown Authority (PDA), Excess Defense Articles (EDA), and Foreign Military Sales (FMS).[140] Both EDA and PDA would allow the Administration to transfer "used" or older aircraft to Ukraine, whereas FMS would allow for the procurement of new aircraft.

The President can authorize the immediate transfer of defense articles and services from U.S. stocks without congressional approval in response to an "unforeseen emergency" via PDA (22 U.S.C. §2318(a)(1)).[141] Under PDA, the President directs DOD to provide on-stock defense articles or military services to a foreign country or international organization. Prior to exercising PDA, the President must notify Congress, in accordance with 22 U.S.C. §2411, that an emergency exists which requires the immediate provision of U.S. military assistance, including a justification for the scope and value of the approved drawdown. The State Department must determine recipient country eligibility pursuant to 22 U.S.C. §2311 and obtain the necessary assurances from the proposed recipient country pursuant to 22 U.S.C. §2314.

The aggregate value of all drawdowns authorized in any fiscal year under 22 U.S.C. §2318(a)(1) may not exceed $100 million. Prior to and immediately following Russia's renewed invasion of Ukraine on February 24, 2022, Congress increased the PDA (22 U.S.C. §2318(a)(1)) funding cap for FY2022 from $100 million up to $200 million via P.L. 117-70; up to $300 million via P.L. 117-86; up to $3 billion via P.L. 117-103; and up to $11 billion via P.L. 117-128. Since August 2021, the Biden Administration has authorized 26 drawdowns totaling more than $11.7 billion in U.S. defense articles and services from DOD stocks.[142]

EDA refers to DOD and United States Coast Guard (USCG)-owned defense articles that are no longer needed and, as a result, have been declared excess by the U.S. Armed Forces. This excess equipment is offered at reduced or no cost to eligible foreign recipients on an "as is, where is" basis.[143] As such, EDA is a hybrid between sales and grant transfer programs. EDA, however, transfers equipment only and does not include support for sustainment, refurbishment, transportation, or training.[144] According to DOD, the EDA program works best in helping friends and allies augment current inventories of like items with a support structure already in place.[145] In some cases, EDA-eligible countries may use FMF to open a transportation case that enables them to receive the EDA.[146] EDA grants or sales that contain significant military equipment or have an

[140] CRS Report R46337, *Transfer of Defense Articles: Sale and Export of U.S.-Made Arms to Foreign Entities*, by Nathan J. Lucas and Michael J. Vassalotti.

[141] There are different types of drawdowns; however, this section only discusses the drawdown authorized by 22 U.S.C. §2318(a)(1). This section does not include drawdowns authorized under 22 U.S.C. §2318(a)(2) or 22 U.S.C. §2348a(c)(2).

[142] For more information, see CRS In Focus IF12040, *U.S. Security Assistance to Ukraine*, by Christina L. Arabia, Andrew S. Bowen, and Cory Welt.

[143] Defense Security Cooperation Agency (DSCA), "Security Assistance Management Manual (SAMM)." C11.3.1. Definition and Purpose. In practice, this means a recipient must pay all refurbishment costs and transportation costs. In some cases, recipients may use FMF to open a transportation case that enables them to receive the EDA. The cost of refurbishment is often a deterrent to seeking EDA transfer.

[144] DSCA, SAMM, C6.4. Case Execution - Logistics.

[145] Ibid.

[146] All FMS-eligible countries can request EDA. An EDA grant transfer to a country must be justified to Congress for the fiscal year in which the transfer is proposed as part of the annual congressional justification documents for military assistance programs. There is no guarantee that an EDA offer will be made on a grant basis; each EDA transfer is considered on a case-by-case basis. C11.3.2.2. Eligibility for EDA Grants. See also 22 U.S.C. §2321j.

original acquisition cost of $7 million or more require a 30-calendar day congressional notification.[147]

Foreign Military Sales (FMS) refers to government-to-government sales between the United States and eligible international purchasers, normally allies and international partners.[148] FMS is a Department of State program that is implemented by the Department of Defense (DOD) through the Defense Security Cooperation Agency (DSCA).[149] DSCA provides the rules and procedures for FMS, including for coordination with State, in the Security Assistance Management Manual.[150] There are three stages in the FMS process, which begins once a partner formally submits a Letter of Request (LOR) in the Pre-Case Development stage. In the Case Development stage, the DOD evaluates and validates the LOR and develops a proposed Letter of Offer and Acceptance (LOA) for response, which includes amendments and modifications. If the case value reaches a certain dollar threshold, Congress is then formally notified and has the opportunity to prohibit or modify the proposed sale. After the congressional review period, if applicable, is complete, DOD may present the LOA to the partner for acceptance and signing. The final and longest stage is Case Execution, in which the FMS case is implemented and eventually closed out. DOD uses what it refers to as a *Total Package Approach* (TPA) to ensure that FMS customers can operate and maintain their purchased items in the future and in a manner consistent with U.S. intent.[151] International purchasers must agree to pay in U.S. dollars, by converting their own national currency or, under limited circumstances, though reciprocal arrangements.[152] When the purchase cannot be financed by other means, credit financing or credit guarantees can be extended if allowed by U.S. law. FMS cases can also be directly funded by DOS using Foreign Military Financing appropriations.[153]

The Biden Administration also could potentially use the Ukraine Democracy Defense Lend-Lease Act of 2022 (P.L. 117-118), which modified provisions in the Foreign Assistance Act and Arms Export Control Act to bypass bureaucratic barriers for leasing or lending U.S. defense articles to Ukraine and neighboring countries. Additionally, the United States could broker the transfer of U.S.-origin aircraft from the inventories of NATO allies or other international partners to Ukraine through a Third Party Transfer (TPT).[154]

[147] 22 U.S.C. §2321j(f)(1).

[148] See 22 U.S.C. §2753 regarding provisions for eligibility for transfer of U.S. defense articles or services.

[149] FMS are authorized by Section 22 of the Arms Export Control Act [22 U.S.C. §2762(a)]. For more, see "Foreign Military Sales Process" in CRS Report R46337, *Transfer of Defense Articles: Sale and Export of U.S.-Made Arms to Foreign Entities*.

[150] Defense Security Cooperation Agency's (DSCA) Security Assistance Management Manual (SAMM). See, for example, Chapter 4 - Foreign Military Sales Program General Information; Chapter 5 - Foreign Military Sales Case Development; Chapter 6 - Foreign Military Sales Case Implementation and Execution (links in Chapter #).

[151] DSCA, SAMM, C4.3.2. Total Package Approach (TPA) and C15.2.4.6. Total Package Approach (TPA).

[152] DOD, SAMM, C9.3.2. Payment in U.S. Dollars. See also, 22 U.S.C. §2761 and 22 U.S.C. §2762.

[153] DOD, SAMM, C9.7. Methods Of Financing.

[154] For more information on TPT see Department of State, Bureau of Political-Military Affairs, "Third Party Transfer Process and Documentation," accessed December 7, 2022.

# Appendix B. Overview of Selected Aircraft Options

This appendix summarizes Ukraine's *current* air force capabilities (**Table B-1**) and selected *potential* aircraft capabilities (**Table B-2**). The aircraft types listed in **Table B-2** are based on Ukrainian requests and prominent policy discussions. To standardize aircraft comparisons, the tables are derived from Janes articles.

**Table B-1. Summary of Ukrainian Air Force Fighter Jets**

| Type | Manufacturer/ Country | Role | Performance Characteristics | Option(s) | Other Users |
|---|---|---|---|---|---|
| Su-24[a] | Aviatsionnyi Voyenno Promyshlennyi Komplex Sukhoi/Russian Federation | Air-to-Ground | 9 hardpoints<br>17,000 lb. ordnance<br>565 nautical miles | Status Quo | Algeria, Iran, Russia, Sudan, Syria, Libya, Uzbekistan, Kazakhstan |
| Su-25[b] | Aviatsionnyi Voyenno Promyshlennyi Komplex Sukhoi/Russian Federation | Air-to-Ground | 8 harpoints<br>9,700 lb. ordnance<br>radius not reported | Status Quo | Armenia, Azerbaijan, Belarus, Bulgaria, Chad, Democratic Republic of Congo, Equatorial Guinea, Georgia, Iraq, Kazakhstan, North Korea, Niger, Peru, Russian Federation, Sudan, Turkmenistan Uzbekistan |
| Su-27[c] | Aviatsionnyi Voyenno Promyshlennyi Komplex Sukhoi/Russian Federation | Air Superiority | 6 hardpoints<br>6,600 lb. ordnance<br>810 nautical miles | Status Quo | Angola, Belarus, China, Eritrea, Algeria, Ethiopia, India, Indonesia, Kazakhstan, Malaysia, Russian Federation, Uganda, Venezuela, Vietnam, Armenia, Uzbekistan, Myanmar |

| Type | Manufacturer/ Country | Role | Performance Characteristics | Option(s) | Other Users |
|---|---|---|---|---|---|
| MiG-29[d] | Inzhenirnyi Tsentr 'OKB imeni A I Mikoyana,' /Russian Federation | Air Superiority<br>Air-to-Ground | 8 hardpoints<br>9,900 lb. ordnance<br>radius not reported | Status Quo | Algeria, Azerbaijan, Bangladesh, Belarus, Bulgaria, Chad, Cuba, Egypt, Eritrea, India, Iran, Kazakhstan, North Korea, Mongolia, Myanmar, Peru, Poland, Russian Federation, Serbia, Slovakia, Sudan, Syria, Turkmenistan, Uzbekistan, Yemen, Libya, Malaysi |

**Sources:**

a. CRS analysis of Janes "Sukhoi Su-24 Fencer," March 4, 2022, https://customer.janes.com/Janes/Display/JAU_9127-JAU_; photo credit: https://customer.janes.com/Janes/Display/jau_9127-jau_?highlights=.

b. CRS analysis of Janes "Aircraft – Fixed-Wing – Military – Sukhoi Su-25 and Su-28," March 29, 2021, https://customer.janes.com/Janes/Display/JAU_9296-JAU_; photo credit: https://customer.janes.com/Janes/Display/jau_9296-jau_?highlights=.

c. CRS analysis of Janes "Sukhoi Su-27," June 3, 2022, https://customer.janes.com/Janes/Display/JAU_A212-JAU_; photo credit: https://customer.janes.com/Janes/Display/JAU_A212-JAU_.

d. CRS analysis of Janes "MiG-29," June 1, 2020, https://customer.janes.com/Janes/Display/jau_9123-jau_; photo credit: https://www.forbes.com/sites/davidaxe/2022/04/19/the-ukrainian-air-force-just-got-bigger-it-seems-someone-gave-kyiv-more-mig-29s/?sh=5d04335d3c8b.

**Notes:** This table includes the aircraft combat radius, if reported, to enable a comparison with the U.S. fighter combat radius figures in **Table B-2**.

**Table B-2. Summary of Selected Potential Aircraft**

| Type | Manufacturer/ Country | Role | Performance Characteristics | Option(s) | Other Users |
|---|---|---|---|---|---|
| A-10C[a] | Northrop Grumman/ United States | Air-to-Ground | 11 hardpoints,<br>16,000 lb. ordnance<br>540 nautical miles | Used aircraft | United States |
| F-15C/D[b] | Boeing/United States | Air Superiority | 8 hardpoints<br>2,680 lb. ordnance<br>radius not available | Used aircraft | Japan, United States |
| F-16A/B/C/D[c] | Lockheed Martin/United States | Air Superiority<br>Air-to-Ground<br>Suppression of Air Defenses | 6 hardpoints<br>12,000 lb. ordnance<br>500 nautical miles | Used aircraft<br>New aircraft | Bahrain, Belgium, Chile Denmark, Egypt, Greece, Indonesia, Iraq, Israel, South Korea, Morocco, Netherlands, Norway, Oman, Pakistan, Poland, Portugal, Singapore, Taiwan, Thailand, Turkey, United Arab Emirates, United States, Venezuela |
| F/A-18C/D[d] | Boeing/United States | Air Superiority<br>Air-to-Ground<br>Suppression of Air Defense | 9 hardpoints<br>15,500 lb. ordnance (est.)<br>290 nautical miles | Used aircraft | Finland, Kuwait, Malaysia, Spain, Switzerland, United States |
| F/A-18E/F[e] | Boeing/United States | Air Superiority<br>Air-to-Ground<br>Suppression of Air Defenses | 11 hardpoints<br>17,700 lb.<br>795 nautical miles | Used aircraft<br>New aircraft | Australia, Finland, United States |

| Type | Manufacturer/ Country | Role | Performance Characteristics | Option(s) | Other Users |
|---|---|---|---|---|---|
| JAS 39A/C/E Gripen[f] | Saab/Sweden | Air Superiority<br>Air-to-Ground | 6 hardpoints<br>11,840 lb. ordnance<br>432 nautical miles | Used aircraft<br>New aircraft | Brazil, Czech Republic, Hungary, South Africa, Sweden, Thailand |
| Rafale[g] | Dassault/France | Air Superiority<br>Air-to-Ground | 14 hardpoints<br>20,900 lb. ordnance<br>570 nautical miles | Used aircraft<br>New aircraft | Egypt, France, Greece, India |
| Typhoon[h] | Eurofighter Jagdflugzeug GmbH/Germany, Italy, Spain, United Kingdom | Air Superiority<br>Air-to-Ground | 13 hardpoints<br>14,330 lb. ordnance<br>325 nautical miles | Used aircraft<br>New aircraft | Austria, Germany, Italy, Kuwait, Oman, Qatar, Saudi Arabia, Spain, United Kingdom |

**Sources:**

a. CRS analysis of Janes, "Northrup Grumman (Fairchild) A-10 Thunderbolt II," September 28, 2022, https://customer.janes.com/Janes/Display/JAU_1667-JAU_; photo credit: https://www.military.com/equipment/a-10-thunderbolt-ii.

b. CRS analysis of Janes, "Boeing (McDonnell Douglas) F-15 Eagle," October 25, 2022, https://customer.janes.com/Janes/Display/JAU_1449-JAU_; photo credit: https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104501/f-15-eagle/.

c. CRS analysis of Janes, "Lockheed Martin (General Dynamics) F-16 Fighting Falcon," July 21, 2022, https://customer.janes.com/Janes/Display/JAU_1617-JAU_; photo credit: https://nationalinterest.org/blog/the-buzz/why-russia-china-still-fear-the-f-16-fighting-falcon-21976.

d. CRS analysis of Janes, "Boeing F/A-18 Hornet," November 4, 2022, https://customer.janes.com/Janes/Display/JAU_9146-JAU_; photo credit: https://www.homestead.afrc.af.mil/News/Photos/igphoto/2000645452/mediaid/982332/.

e. CRS analysis of Janes, "Boeing F/A-18 Super Hornet," February 23, 2022, https://customer.janes.com/Janes/Display/JAWA1185-JAWA; photo credit: https://www.homestead.afrc.af.mil/News/Photos/igphoto/2000645452/mediaid/9823320/.

f. CRS analysis of Janes, "Saab JAS 39 Gripen," September 7, 2022, https://customer.janes.com/Janes/Display/JAWA0989-JAWA; photo credit: https://www.19fortyfive.com/2022/07/pictures-the-jas-39-gripen-is-now-a-nato-warbird/.

g. CRS analysis of Janes, "Dassault Rafale," November 7, 2022, https://customer.janes.com/Janes/Display/JAWA0257-JAWA; photo credit: https://customer.janes.com/Janes/Display/JAWA0257-JAWA.

h. CRS analysis of Janes, "Eurofighter Typhoon," August 31, 2022, https://customer.janes.com/Janes/Display/JAWA0478-JAWA; photo credit: https://www.janes.com/defence-news/news-detail/uk-to-retire-tranche-1-typhoons-with-more-than-half-of-airframe-hours-remaining.

**Note:** This table includes the aircraft combat radius, if reported, to enable a comparison with the U.S. fighter combat radius figures in **Table B-1**.

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