




2022

F-16 & PROVEN
AIRCRAFT

OGDEN ECCLES CONFERENCE CENTER
SEPTEMBER 12-15, 2022
OGDEN, UTAH, U.S.A.

The Program Guide



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- NEW AND NOTEWORTHY EXHIBITORS AT THE SHOW
- ALPHABETIC LIST OF EXHIBITORS
- ROMANIA AND ITS AIR FORCE
- LEGACY WORLDWIDE FIGHTERS 2022



The Program Guide

2022 F-16 & PROVEN AIRCRAFT



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The Price of Freedom

At the time of this writing, the war in Ukraine is still raging, and I suspect that it will continue for some time to come. The one thing to remember about the Russian military leaders is that they have an unyielding determination to continue a chosen course of action for the long haul, no matter how deadly the results of such actions on both sides of the conflict.

"I Stand with Ukraine" is now a popular slogan here in America. But slogans do not stop armies, weapons do. And there are few weapon systems available that are as reliable and effective as the F-16 Fighting Falcon. At \$50 million per aircraft, this incredibly capable fighting machine is a bargain. Fifteen aircraft, with spare parts, support equipment, and training would cost under \$900 million and would help defend Ukraine against inevitable Soviet air strikes and future incursions.

Hopefully, the Ukrainian Air Force has been invited to attend this year's meeting here in Ogden. Even if they attended in civilian clothes, so as not to draw attention to their presence, the benefits to the Ukrainian military and our industry could be significant. I am sure that every supplier exhibiting at this conference would be happy to talk with representatives of the Ukrainian military about the many ways in which our industry repairs, upgrades and supplies parts for the F-16 Fighting Falcons.

The Ukrainian people seek the freedoms we take for granted here in the West, and they are willing to die for them, just as we would be too. Freedom of the press. Freedom of assembly. Freedom of speech. And justice, which comes with all being treated fairly.

The sad truth is even here, these rights, which we expect as U.S. citizens, can be denied to any one of us, at any time, without as much as a second thought. What has become apparent is how fragile our democracy is and how basic freedoms need to be defended, not just by the individual whose rights are in peril, but by everyone.

The United States began with a fight for the right of self-determination. Over the last 250 years, we have continued to support peoples throughout the world who also fought for the right to choose their own form of government. And yes, we always stand against unwarranted aggression, oppression and genocide. The time has come to support the Ukrainian Air Force, doing what we can to enable them to put planes in the air to support those beliefs.

I wish "Svoboda" (Freedom) and "Myr" (Peace) for the Ukrainian people.

Richard Greenwald

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(Photo courtesy of U.S. Air Force.)



NEW & NOTEWORTHY EXHIBITORS AT THE SHOW

By Hank Hogan

Among other reasons, professionals go to trade shows to learn about new technology and to locate new or back up suppliers. To help in that quest, as well as to save time and shoe leather, we talked with some of the exhibitors attending the 2022 F-16 & Proven Aircraft TCG Worldwide Review to discuss what they are doing and what is new and noteworthy for attendees of this year's event. Depending on your fleet's operating requirements and current needs, several or all of these vendors may be worth your attention.

IBC MATERIALS & TECHNOLOGIES

Booth: 20

Headquarters: Lebanon, IN
www.ibcmaterials.com



David Frix
Director of Operations & Development
(Photo courtesy IBC Materials & Technologies.)

COATINGS THAT ENHANCE PERFORMANCE

Based near Indianapolis, **IBC Materials & Technologies**

develops, and for a fee, applies coatings that protect and enhance the long-term performance of components found in the F-15 and F-16. Talking with David Frix, Director of Operations and Business Development, we discovered that there are a few special coatings worth highlighting.

The first is a specialized nanoceramic deposited in a plasma electrolytic process on lightweight alloys. The result can be a ten-fold or greater extension in life for some key components.

"It takes an aluminum, magnesium, or titanium alloy that is more prone to wear and makes it harder than steel," says Frix.

He adds that this coating was first deployed on the LAU 12XX missile rails found in the F-15 and F-16 in 2014. The initially coated components are still flying with no observable wear. Due to greater operational readiness as well as the high cost of replacement and maintenance of uncoated rails, the United States Air Force and Navy decided to replace worn out rails with ones coated with the nanoceramic.

The second IBC product is a diamond like carbon coating, dubbed DLC. It provides exceptional corrosion resistance as well as low coefficient of friction with high hardness for steel alloys and has replaced toxic chrome and cadmium plating. Both the Air Force and Navy specified this coating for critical LAU 12XX missile launcher components in 2017 with excellent results, according to Frix.

In addition to its other offerings, this innovative company continues research and development on other products, such as corrosion resistant, low temperature amorphous chromium carbide coatings and an ultrasonic-activated de-painting process that could replace toxic chemicals that have been banned. Named UADP, this last process is undergoing evaluation at Warner Robins AFB.

AEROSPACE & COMMERCIAL TECHNOLOGIES

Booth: 12, 13, 14

Headquarters: Ft. Worth, TX
www.aero-com-tech.com



AN OEM LICENSED BY AN OEM Aerospace and Commercial Technologies (ACT)

was founded in 2002 with the encouragement of Lockheed Martin Aeronautics Company (LM Aero) and the United States Air Force (USAF) for the specific purpose of providing sustainment products and services for the F-16 fleet. Located in Fort Worth, Texas, ACT is just minutes from LM Aero headquarters.

ACT was the first company to be licensed by LM Aero to provide Original Equipment Manufacturer (OEM) quality parts for the F-16s worldwide. The manufacturing/repair license allows ACT access to LM Aero engineering technical data and original production tooling, according to Chief Project Engineer Gary Fort. The F-16 was designed before computers and CAD systems became commonplace. These hand drawings were then interpreted into a vast array of production tooling of the various components. Access to this original tooling is essential in order to produce components that will fit as intended.

In 2015, HEICO Corporation, headquartered in Hollywood, Florida, purchased a majority interest in ACT. However, ACT continues to operate with the responsiveness and efficiency of a small business, Fort notes.

Today, ACT is the leading supplier of aftermarket structural and mechanical components and repair services in support of the F-16. ACT's international distribution is fulfilled by Blue Aerospace.

ACT has the knowledge, technical and managerial proficiency, and intimate knowledge of the F-16 to execute the manufacture or repair of a wide variety of F-16 structural components in accordance with all technical and manufacturing requirements.

"With the F-16 flying for decades to come, look for ACT to continue to provide OEM quality products for as long as the F-16 is flying," Fort says.



(Photo courtesy ACT.)

BLUE AEROSPACE

Booth: 12, 13, 14

Headquarters: Tamarac, FL

www.blueaero.com



LOCKHEED MARTIN LICENSED F-16 SUPPORT

Blue Aerospace is a Lockheed Martin Aeronautics licensed F-16 distributor. Together with "sister" company ACT, a Lockheed Martin Aeronautics licensed F-16 manufacturer, it provides comprehensive "nose to tail" support for most structures and sub systems for all blocks and type versions of the F-16, according to Paul Keffler, Director of Programs at the Tamarac, Florida-based company.

This complete maintenance coverage includes access to current Lockheed engineering support, guaranteeing that all products are manufactured and serviced according to the latest Lockheed drawings and master tooling.

"Blue Aerospace is dedicated to aerospace aftermarket sustainment and support, providing a high level of service to our customers—international military end users and maintainers—in partnership with many of the premier OEMs and repair facilities worldwide," Keffler says.



(Photo courtesy Blue Aerospace.)



MARVIN TEST SOLUTIONS

Booth: 162, 163, 164

Headquarters: Irvine, CA

www.marvintest.com



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POWERFUL ARMAMENT TEST

With products deployed in over thirty countries, **Marvin Test Solutions** of Irvine, California, supports armament testing from the factory to the flightline, as well as from the back shop to the depot. The Marvin Engineering Company along with Marvin Test Solutions designs and manufactures armament for 4th- and 5th-generation aircrafts. Both are part of the Marvin Group.

Asked about the latest company innovations, Marvin Test Solutions CEO Stephen Sargeant points to their SmartCan™ Universal O-Level Armament Test Set, which features comprehensive test capability. Handheld, it is easy to deploy, use and maintain.



SmartCan Kit (Photo courtesy of Marvin Test Solutions.)

Test Times	Test Time (min)			Setup (min)	Weight (lbs)
	Pylon with MIL-STD-1760 Umbilical	LAU-129 with AIM-120 and AIM-9			
MTS-3060A SmartCan	3	4	4	4.2	
Current F-16 Test Set	20	35	45	>80.0	
Improvement w/MTS-3060A SmartCan	85%	89%	91%	95%	

(Photo courtesy of Marvin Test Solutions.)

SmartCan offers about a 90% improvement in test and setup times compared to the current F-16 test sets. Additionally, SmartCan is capable of replacing every operational-level armament test set in use today across any air force. That performance is leading to changes in how testing is done.

"Some customers are loading all of their armament test profiles on every SmartCan, while others have removed numerous armament test sets from the flightline and replaced them with the SmartCan." Sargeant says.

Recently, Lockheed Martin and the F-16 System Program Office certified SmartCan for an overseas customer.

By supporting multiple armed aircraft platforms, SmartCan reduces the logistics footprint of essential armament testing. Sargeant points out that this, in turn, streamlines and speeds up both training and operations, and helps ensure mission readiness.

(Photo courtesy of Forjale Aeriens Române.)

VIAMI SOLUTIONS

Booth: 159

Headquarters: Chandler, AZ
www.viavisolutions.com/ALT-9000



A BETTER ALTIMETER TEST

Drawing on a background in avionics and other testing, **VIAMI Solutions** of Chandler, Arizona developed the ALT-9000 Radio Altimeter Test Set. This flightline test set allows testing and troubleshooting of the F-16's Radio Altimeter. It also can simulate static or dynamic altitudes to test other aircraft systems, while reducing the amount of work and time required for such testing.

"The supplied Antenna Couplers allow closed-loop testing of the Radio Altimeter system without needing to open any aircraft access panels, remove any screws from the aircraft, or disconnect any coaxes," said Terry Jarboe, Business Development Manager for Avionics Testing.

Confronted by an altimeter fault, service personnel can use the ALT-9000 to quickly determine if the problem is in the transmit or receive path, and then can isolate the issue to the faulty system component—all useful information to have when it comes to repairing an altimeter. What's more, being able to control the power level at the altimeter receiver antenna makes testing receiver sensitivity fast and easy, Jarboe notes.

Regular altimeter testing can pay dividends, he adds. It can help reduce scraped missions and training flights by ensuring that a system supplying critical information on an aircraft's altitude is working as it should. The ability to isolate faulty components can also translate into lower maintenance costs and improved mission readiness.



ALT 9000 Couplers (Photo courtesy Viavi Solutions.)

JBT DEFENSE

Booth: 51

Headquarters: Ogden, UT
www.jbtc.com/aerotech



A MORE CAPABLE SUPPORT CART

Being agile and mobile applies to everything connected to aircraft, even support equipment. That reality lies behind AgileAir, a multi-capable power and air product from **JBT Defense**, based in Ogden, Utah.

"AgileAir power carts are a great choice for tarmac, forward deployed, and mobile base operations in any environment," said JBT Director Scott Barber.

The air and power cart supplies conditioned air, bleed air, and 400 hertz of power for the F-15, F-16, F-18, and other fighter aircraft. A single cart replaces multiple legacy carts used on flightlines, by combining air conditioning and power needs. Significantly, it uses a diesel



AgileAir Shaw (Photo courtesy JBT Defense.)

engine rather than the turbines used in older carts. This creates several benefits, such as contributing to a smaller footprint, quieter operation, and improved reliability. The cart is readily air-transportable on a C-130, C-17, A-400M and other aircraft.

What's more, using a diesel powerplant reduces fuel consumption as much as sixfold, providing eight hours of operation on a single tank of fuel, so flightline personnel can spend more time on the job. A diesel powerplant also makes the AgileAir quieter than previous carts, while providing the reliability and uptime associated with diesel engines. It runs on various fuels, including the JP8 jet fuel widely used by the military and others usually available in an aviation setting.

S3 AERODEFENSE

Phone: 414-351-1506

Headquarters: Milwaukee, WI
www.s3aerodefense.com



A RELATIONSHIP DEEPENS

In 2016, Milwaukee-based **S3 AeroDefense** entered into an agreement with Honeywell, a leading supplier of lighting, power and other products to a wide range of aerospace platforms. That relationship has grown over the years, with S3 AeroDefense moving from the initial association to being an authorized repair facility, followed by an agreement to supply mechanical systems and components as well as generators for a host of aircraft using Honeywell products.

With the recent signing of a deal involving Honeywell (legacy Grimes) lighting, S3 AeroDefense's support for the F-16 further expanded, according to Yancy Everhart, Director of Strategic Marketing. "We are now Honeywell's exclusive lighting partner, working together to support the warfighter with a more comprehensive portfolio to ensure F-16 support."

Everhart adds that S3 AeroDefense also plays a role in supporting the F-16's Emergency Power Unit (EPU) by working closely with Honeywell's facility in Torrance, California to repair or overhaul each unit to Honeywell OEM standards. For its part, S3 AeroDefense plans, forecasts and manages the logistics of getting the EPUs to and from the repair site, handling export compliance requirements and other details. The goal is for the Honeywell/S3 AeroDefense combo to provide better lead time and improved service over alternative repair options, Everhart explains.

Considering the entire history of the affiliation between the two companies, Everhart said, "The trajectory is for closer collaboration with Honeywell." And that's good news for their customers.



(Photo courtesy Honeywell and S3.)



AEROKOOL AVIATION

Booth: 88

Headquarters: Miami, FL
www.aerokool.com



A BETTER WAY TO KEEP COOL

As its name implies, **AeroKool Aviation** is in the aircraft cooling business. Among other things, the Miami-based company repairs aircraft cooling turbines, doing so for more than 1,000 units a year. Some of these are for the U.S. Air Force as part of a contract to manufacture spare parts, which has been in place for more than 15 years.

According to Tom Wolfe, Vice President for Business Development, there is a modification that brings several benefits to the F-16 cooling turbines. First, AeroKool replaces steel ball bearings in F-16 AB cooling turbine with ceramic ball bearings. That change to ceramic bearings nearly doubles the average time between overhauls, lessening the maintenance workload, and helping to keep the fighter flying.

There is an additional benefit, Wolfe notes. "The redesign of the cooling turbine bearings offers a reduction in bearing preload and a reduced preload lowers the required start pressure and increases bearing tolerance to contamination." He adds that even with these advantages, the bearings maintain their load capacity and performance.

AeroKool has repaired, overhauled, and modified more than 1,265 F-16 cooling turbines since 2003. In addition to the U.S. Air Force, this company has worked with foreign military operators, training their technicians on how to service cooling turbines in the field.



(Photo courtesy AeroKool Aviation.)

MAC AEROSPACE CORP.

Booth: 41

Headquarters: Chantilly, VA
www.macaerospace.com



SUPPLYING PARTS OTHERWISE UNAVAILABLE

In business for over 32 years, **MAC Aerospace** of Chantilly, Virginia, is still younger than the F-16 or other legacy aircraft such as the F-4 and F-5. The age of those planes is

important because sourcing and supplying often hard to find parts to operators of those aircraft is what MAC Aerospace is all about.

The company specializes in helping secure obsolete and end-of-life, as well as hard-to-find components, for military aircraft, radar and weapon systems, according to Jay Rodriguez, President and CEO. "MAC Aerospace works with the applicable engineering design authorities to provide new designs for products that have become obsolete, where the manufacturer is no longer in business, or the costs have become prohibitive," he explains.

Once the designs are approved by the appropriate responsible authority, the company then becomes an alternate manufacturer. Its success is based on providing equivalent or even improved products at a substantially lower cost. Rodriguez notes that his company's service is a valuable tool for OEMs, government buyers and end users.

FRAZIER AVIATION, INC.

Booth: 44

Headquarters: San Fernando, CA
www.frazieraviation.com



EXTENSIVE EXPERIENCE

Frazier Aviation of San Fernando, California, is celebrating 70 years of maintaining legacy aircraft, according to President Robert Frazier. This support includes aircraft modifications, overhaul, manufactured components and a wide range of virtual stocking sustainment services.

The collaborative team of professionals at Frazier Aviation and FAI Defense and Space Group have always approached each customer with the primary idea of helping to solve challenges and to achieve a goal. With them, it is about solutions, not just about selling one part, Frazier notes.

The company's area of expertise is manufacturing, supply and overhaul/repair (FAA, EASA) of aerospace defense components across most platforms. This service is backed by extensive aerospace knowledge, broad capabilities and supply chain effectiveness in sustainment.



SIMTECH

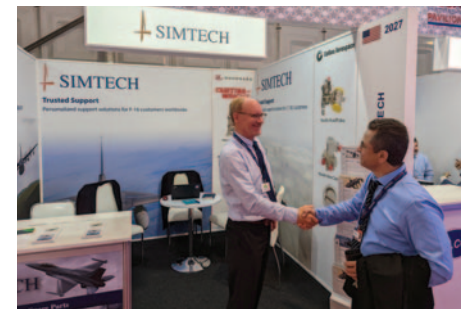
Booth: 179

Headquarters: East Granby, CT
www.simtech-inc.com



TIMELESS SUPPORT

Founded in 1988, **Simtech** of East Granby, Connecticut, distributes and exports military aircraft spares to foreign governments, companies and depots. Its foreign customers are in Europe, the Middle East, Latin America and



Richard Leite
President, Farnborough 2022
(Photo courtesy of Simtech.)

North America. Simtech also supplies spares directly to the U.S. government.

The company is responsive and dedicated to its customers, offering personal support, according to Richard Leite, President. It primarily focuses on three OEMs: Collins Aerospace, Curtis-Wright and Woodward. The supported airframes include fighters, transports, and rotorcraft.

The F-16 is on that list, with the aircraft and the company notably of similar vintage and staying power. As Leite notes, "Simtech has been in business for 34 years—almost as timeless as the F-16."



COMPANY INFORMATION

AeroKool Aviation
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www.aerokool.com
Booth: 88

Aerospace & Commercial Technologies
Headquarters: Ft. Worth, TX
www.aero-com-tech.com
Booth: 12, 13, 14

Blue Aerospace
Headquarters: Tamarac, FL
www.blueaero.com
Booth: 12, 13, 14

Frazier Aviation
Headquarters: San Fernando, California
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IBC Materials & Technologies
Headquarters: Lebanon, IN
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JBT Defense
Headquarters: Ogden, UT
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MAC Aerospace Corp.
Headquarters: Chantilly, VA
www.macaerospace.com
Booth: 41

Marvin Test Solutions
Headquarters: Irvine, CA
www.marvintest.com
Booth: 162

S3 AeroDefense
Headquarters: Milwaukee, WI
www.s3aerodefense.com
Phone: 414-351-1506

Simtech
Headquarters: East Granby, CT
www.simtech-inc.com
Booth: 179

VI/VI Solutions
Headquarters: Chandler, AZ
www.viavisolutions.com/ALT-9000
Booth: 159

THE F-16 SHOWDOWN

Just as every epic origin tale features a legendary confrontation, whose details grow in significance as years go by, the F-16 Fighting Falcon had its showdown moment in a precision-bombing competition, held at the U.K. Royal Air Force (RAF) base in Lossiemouth, Scotland, in June 1981.

The 388th Tactical Fighter Wing at Hill Air Force Base, Utah, received its first F-16 in January 1979, becoming the first U.S. Air Force squadron to achieve Initial Operational Capability for the F-16 later in 1980. For the event known as the Strike Command Tactical Bombing Competition, seven U.S. Air Force F-16As were deployed.

The Fighting Falcon would prove its worth against the RAF's Jaguar GR1, which had entered service in 1974. Equipped with tactical nuclear weapons, this attack jet had, by 1977, become a key part of Great Britain's nuclear deterrent capability during the Cold War.



F-16 Fighting Falcons from the 388th Tactical Fighter Wing (TFS) participate in the Strike Command Tactical Bombing Competition at Royal Air Force base Lossiemouth, Scotland in June 1981 (Image courtesy of the U.S. National Archives and Records Administration.)

At the end of the bombing competition—with the team scoring the most points on a scale of 0 to 8,000 declared the winner—the U.S. Air Force F-16 team had bested its RAF allies by a score of 7,831 to 6,401, setting a new record for highest score. Following the lead of U.S. Air Force Captains Roger Riggs and Wayne C. Edwards, who individually finished first and second in the bombing competition, the F-16 team also participated in a fighter demonstration exercise, in which it earned more than eighty simulated air-to-air kills, without a single loss.

As its proponents had hoped, this competition enabled the Fighting Falcon to demonstrate its capabilities. In the years since, the showdown at Lossiemouth has become a key event among those recounting how the F-16 won its place among the legendary fighters of the modern era.

Sources: Bjorkman, Eileen, "The Outrageous Adolescence of the F-16," *Smithsonian Air & Space magazine*, March, 2014.; F-16.net, www.f-16.net.; Grier, Peter, "The Viper Revolution," *Air Force magazine*, January 1, 2004.; Simmonds, Bertie, "Viper's Bite: The Evolution of the F-16," *Key Aero*, March 5, 2021.

TIDBITS

In August 2020, the Romanian Air Force received two Lockheed Martin F-16 (Block 15MLU) Fighting Falcons. The aircraft are operated by the 53rd Fighter Squadron at the Borcea-Fotești airbase in Romania's Călărași County. (Photo courtesy of the Romanian Ministry of National Defense, Adrian Sultănoiu.)

(Photo courtesy of Forțele Aeriene Române.)



U.S. Air Force airmen prepare to launch F-16Cs at Campia Turzii, Romania, in 2019, in support of Operation Atlantic Resolve. (Photo courtesy of Andrew Layton/U.S. Air Force.)

(Photo courtesy of Forțele Aeriene Române.)

In 2021, the Romanian Air Force received enhanced laser-guided training rounds for its F-16 combat aircraft via the NATO Support and Procurement Agency. (Photo courtesy of NSPA.)

In 2021, the last three F-16 MLU 5.2R fighters from the Portuguese Air Force is delivered to the Romanian Air Force at the Monte-Real airbase in Portugal. (Photo courtesy of the Ministry of Defense of Romania.)

ROMANIA FAST FACTS



(Photo courtesy of Forțele Aeriene Române.)

Romania

and its Air Force



By Tracy Martin

Located at the intersection of Central, Eastern and Southeastern Europe, Romania is the 12th-largest country in Europe and the 6th-most populous member of the European Union.

The nation was formed in 1859 through a union of the Danubian Principalities of Moldavia and Wallachia. It gained independence from the Ottoman Empire in 1877.

During World War I, Romania declared neutrality in 1914, but from 1916 on fought with the Allied forces. In 1941, the country entered World War II on the Axis side, fighting the Soviet Union until August 1944, when it again joined the Allies. After the war, Romania was occupied by the Red Army, becoming a socialist republic of

the Warsaw Pact. In 1989, a violent revolution began its transition toward democracy and a free market economy.

Today, Romania is a developing country, ranked as the 47th-largest world economy by nominal GDP. Experiencing rapid economic growth in the early 2000s, its economy is based predominantly on services and exports of machinery and electrical energy. It has been a member of the United Nations since 1955, the North Atlantic Treaty Organization (NATO) since 2004, and the European Union since 2007.

ROMANIAN ARMED FORCES

The Romanian Armed Forces are led by a commander-in-chief under the supervision of the

Ministry of National Defense; the president serves as the Supreme Commander during wartime. These military forces include around 15,000 civilians and 68,500 military personnel, broken down into land (45,800), air (13,250) and naval (6,800), with the remainder in other specialized fields.

In 2021, the Romanian Parliament approved strengthening the state military capabilities by increasing the defense budget to \$6 billion. The stated goal is to eventually reach the 2% of GDP benchmark established by the NATO Alliance.

In February 2022, Romania sent provisions and equipment, worth about \$3.02 million (U.S.), to Ukraine, and has offered to care for the wounded in military and civilian hospitals.

Provisions sent have included ammunition, bullet-proof vests, helmets, other military equipment, fuel, food and water.

ROMANIAN AIR FORCE

The Romanian Air Force (*Forțele Aeriene Române*, known as the *RoAF*) had its start during World War I. Romanian pilots flew 750 missions, totaling 11,000 hours, in 322 aircraft acquired from France and Great Britain.

Initially fighting alongside Nazi Germany in World War II, the RoAF's 621 aircraft included an indigenous platform. The Romanian-built fighter and ground-attack IAR 80 was an all-metal, low-wing monoplane that flew frontline missions from 1941–1945.

In 1949, the Romanian Aviation Command was established, based on Soviet command structures. The RoAF's fleet included new Soviet aircraft: the Ilyushin Il-10, Lavochkin La-9, Polikarpov Po-2, Tupolev Tu-2, and Yakovlev Yak-18.

The year 1952 saw the introduction of other aircraft, such as the Mikoyan-Gurevich MiG-15 and MiG-17. In 1958, the MiG-19, the first supersonic fighter, was added to the force's fleet. In 1962, it was followed by the MiG-21, one of the most effective fighters at that time. Just before the Romanian revolution against communism began in 1989, twenty-one MiG-29 fighters were delivered to the RoAF.

The Romanian Air Force reportedly still has 110 Soviet-designed MiG-21 LanceRs, which were

upgraded between 1993 and 2002 with help from Israel. However, only a portion of this fleet is said to be operational. The RoAF also operates the An-26, C-27J Spartan and C-130 Hercules transports, as well as IAR-330 Puma helicopters. The Romanian Air Force generally uses locally built IAR-99 Șoim jets for training.

ROMANIAN F-16 UPGRADE

In 2013, a contract was signed with Portugal for twelve F-16 A/B Block 15 MLU fighters—nine single-seat and three twin-seat configurations—to replace MiG-21s in Romanian service. This \$252.6 million (U.S.) deal included nine former Portuguese Air Force aircraft and three former U.S. Air Force aircraft supplied to Portugal for resale under the U.S. Excess Defense Article program. Portugal's portion of the sale was \$78.65 million (U.S.); the remainder of the contract commitment went toward acquiring and upgrading the U.S. surplus aircraft and associated equipment. The first F-16 achieved operational capability in 2017; the rest were delivered by early 2021.

In 2019, Romania made another deal with Portugal for five more F-16 A/B Block 15 MLU fighters. The last of the fighters in this order was delivered in March of 2021.

In December 2021, Romania announced a plan to acquire 32 F-16 A/B Block 20 fighters from Norway (a nation that is replacing its fleet of F-16s with F-35 Lighting IIs) at an estimated cost of \$514 million. Of

Capital:Bucharest

Official Language:Romanian

Population:19,000,000

Religion:Eastern Orthodox (81%),
.....Roman Catholicism (4.3%),
.....other (14.7%)

Literacy rate:98.8%

Urban population: ...10,451,921 (2020)

Romanian Armed Forces:
.....land, air and sea

Military Service:
.....Voluntary for men and
.....women 18 to 49 years of age

Active military personnel: ...68,500

Reserve military personnel: ..53,000

Nominal GDP:rank 47th (world)

Currency:Romanian leu
(Though this article notes international deals in euros, Romania will not officially adopt the Euro until 2024.)

Land area:92,046 square miles
(238,397 square kilometers)

Government:
.....Semi-Presidential Republic

Year of Independence:1877
Joined NATO in 2004

President:Klaus Iohannis

Minister of National Defense:
.....Vasile Dincu

(Photo courtesy of Forțele Aeriene Române.)



In addition to Romania, an estimated sixty other countries across four continents have flown the Soviet-built Mikoyan-Gurevich MiG-21 LanceR. This fighter holds the record of the most-produced supersonic jet aircraft in aviation history. (Photo courtesy of Cristian Ghe.)

AIRCRAFT	QUANTITY
COMBAT AIRCRAFT	
Lockheed Martin F-16 Fighting Falcon	.49
MiG-21	.11
RECONNAISSANCE	
Antonov An-30	.2
TRANSPORTS	
Antonov An-26	.1
C-27J Spartan	.7
C-130 Hercules	.6
HELICOPTERS	
IAR 330L/M	.35
IAR 330L SOCAT	.22
TRAINER AIRCRAFT	
F-16BM Fighting Falcon	.3
IAR 99	.19
IAR 316	.7
Yakovlev Yak-52	.14
UAV	
RQ-7 Shadow	.6

this total, \$356.95 million is slated for the purchase of the F-16s and \$100.8 million will go to logistics support and modernization work. The contract was signed in spring 2022, with delivery of the first three F-16s expected by the end of the year. Delivery dates for the balance of this order have not yet been determined.

While having served for 40 years, the Norwegian F-16s feature mid-life upgrade (MLU) modernization with the advanced M6.5.2 configuration, enabling the aircraft to carry and launch modern smart bombs, such as the Laser JDAM or AMRAAM-120D air-to-air long-range missiles. Plans also are in place to upgrade the entire RoAF F-16 fleet to the M6XR configuration, improving and implementing the avionics, software, sensors and delivery capabilities of modern precision-guided weapons.

In addition to the modernization, the Norwegian fighters are reportedly in fine shape. According to the Director General of the Norwegian Defense Materiel Agency, Mette Sørfondsen, "It is one of the best maintained

fighter aircraft in the world and, in general, they are in an excellent technical condition."

The RoAF anticipates its F-16MLU fleet to serve Romania for at least 10 years, with high expectations for safety and combat readiness capabilities.

In April 2022, the RoAF grounded its remaining fleet of military MiG-21 LanceR aircraft due to a high accident rate and announced plans to speed up the purchase of the F-16s from Norway. With the delivery of 17 F-16s from Portugal, and completion of the order for 32 from Norway, Romania should be flying a total of 49 F-16 Fighting Falcons in the near future.

Sources:
 Airforce Technology: www.airforce-technology.com
 Aviacionline: www.aviacionline.com
 F-16.net: www.f-16.net
 Janes: www.janes.com
 Reuters: www.reuters.com
 Romania Insider.com: www.romania-insider.com
 Wikipedia: en.wikipedia.org



(Photo courtesy of Bogdan PANTILIMON, Statul Major al Forțelor Aeriene / Forțele Aeriene Române.)

The Alenia C-27J Spartan is operated by the Romanian Air Force's 902nd Transport and Reconnaissance Squadron of the 90th Airlift Flotilla. (Photo courtesy of Eugen Mihai.)

Defending a country's air space is expensive, and acquiring and operating the latest stealth-capable fighters—such as the F-22 Raptor or F-35 Lightning II—is not within every country's budget. For many nations, 4th-generation and 4.5-generation fighters play an important role in maintaining an active national presence, providing a deterrent to adversaries, and otherwise protecting sovereign territory. Battle-proven, reliable, and low-cost fighters, including the McDonnell Douglas F-4 Phantom II, Northrop F-5 Freedom Fighter/Tiger II, and General Dynamics F-16 Fighting Falcon, continue to fly and serve many countries' needs for air defense.

F-4 PHANTOM

The F-4 Phantom entered service in 1960 and was used as a primary fighter throughout the Vietnam War by the U.S. Navy and U.S. Marine Corp. The two-seat fighter-bomber was designed as a carrier-based interceptor to fill aerial defense needs. It remains in service with several countries (see below), with current variants including the F-4E Peace Icarus 2000 and F-4E Terminator 2020.

While the F-4 was developed without an internal cannon, like other interceptors of its day, it does feature nine external hard mounting points and can carry up to 18,650 pounds of weapons. These armaments may include air-to-air and air-to-surface missiles and guided/unguided nuclear weapons. Even carrying its maximum takeoff load of more than 60,000 pounds, the F-4 can reach Mach 2.23, with an initial climb rate of over 41,000 feet/minute, and an operational ceiling of 60,000 feet.

Among those still flying this legacy fighter, Iran maintains an estimated fleet of 63 F-4 Phantoms, though the operational number is speculative. These aircraft remain among the most capable in Iranian inventories, though they are likely hampered by airframes with high flight hours and a lack of spare parts. The Iranian F-4 American-made vintage airframes (from the 1960s and 1970s) are not as technologically advanced as modern combat aircraft, making these older platforms more vulnerable to attack. Nevertheless, with the right missile arrangement, they still can deal a serious blow to adversaries, and thus continue to serve a valuable role within the Iranian Air Force.

The inventory of the Republic of Korea Air Force (RoKAF) has more than 60 F-4 Phantom IIs, which are headed for replacement, as obtaining parts and other logistics becomes increasingly uneconomical. In May 2022, a

LEGACY WORLDWIDE FIGHTERS 2022

By Tracy Martin

proposal was made during the Korea Security and Defense Forum to add to the fleet more Lockheed Martin F-35s and Korea Aerospace Industries (KAI) FA-50 and KF-21 fighters. The nation's goal is to accelerate the replacement of its F-4s and other older fighters, such as the F-5, by 3 to 5 years.

Turkey operates 48, F-4E Terminator 2020s that have been extensively upgraded to provide capabilities comparable to early variants of the F-15. In some ways, these improved fighters are considered more capable than the F-16 or F-35, despite the airframe's age.

F-5 FREEDOM FIGHTER/TIGER II

Northrop Grumman Corporation's F-5 tactical fighter, introduced in 1963, has served its customers for nearly 60 years. The F-5 was developed as a lightweight supersonic fighter, designed to be less expensive to acquire and simpler to maintain than the F-4 and other contemporary models. It can reach speeds of Mach 1.4, fly up to 50,000 feet, and has a combat range of 600 miles. Examples of the multiple variants are the F-5A/B Freedom Fighter, F-5C Skoshi Tiger, F-5E/F Tiger II, and F-5E Tiger 2000.

During the active years of the Cold War, the United States exported the cost-effective F-5 to friendly nations, under a military assistance program supporting air defense, earning the Freedom Fighter call name. The F-5 was sold to Canada, Greece, Iran, Norway, South Korea, Spain, Taiwan, Thailand, and Turkey.

About two-thirds of the countries that currently

have F-5s also operate F-15s, F-16s, F/A-18s, and/or Dassault Mirage supersonic jets and their F-5s have primarily shifted from fighter to trainer. To obtain a cost-effective lead-in, jet trainer, a number of these countries are considering (and some have committed to) basic structural life extension programs and avionics/subsystems upgrade packages for their F-5 fleet.

In 2022, U.S. Defense contractor Tactical Air selected L3Harris Technologies to upgrade their F-5 Advanced Tiger training aircraft. Tactical Air owns and operates a fleet of twenty-five F-5s, among which are twenty-one Jordanian F-5Es purchased in 2017. L3Harris will improve Tactical Air's legacy aircraft, adding GH-4001 Electronic Standby Instruments and Tactical Airborne Navigation Systems (TACAN+), enhancing pilot situational awareness and safety.

In other recent news, the F-5 revisited its "acting" role from *Top Gun* (1986) in this year's blockbuster sequel *Top Gun: Maverick*. As in the first movie, the MiG-28s flown by a fictitious adversarial nation are actually F-5F Tiger IIs, decked out with a sinister, dark paint job.

F-16 FIGHTING FALCON

The most widely used legacy fighter is the General Dynamics (Lockheed Martin) F-16 Fighting Falcon. In 2021, on behalf of five foreign military partners, the U.S. Air Force awarded Lockheed Martin approximately \$14 billion to build 128 F-16Vs Block 70/72 aircraft through 2026, with the first of these fighters produced this year. The aircraft will be delivered to multiple foreign military partners—

including Bahrain, Bulgaria, Slovakia, Taiwan, and other nations—with many having expressed interest beyond initial deliveries.

This advanced fighter has evolved from the original lightweight, daytime interceptor design to a multirole, all-weather, air-to-air and air-to-ground attack weapon system. The F-16V provides advanced combat capabilities in a scalable and affordable package, with a core configuration including a large-format, high-resolution display, Active Electronically Scanned Array (AESA) radar and a modern commercial off-the-shelf (COTS)-based avionics subsystem. Operational capabilities are enhanced by a high-speed data bus, Link-16 Theater Data Link, precision GPS navigation, Automatic Ground Collision Avoidance System (Auto GCAS), Sniper Advanced Targeting Pod and advanced weapons.

In 2018, Lockheed Martin signed a contract to supply fourteen F-16 Block 70/72 fighters to Slovakia. According to the Slovak Defense Ministry, delivery of the first aircraft will be in 2024, a year later than expected. Not surprisingly, the delay is due to supply chain issues, related to the Coronavirus pandemic and global chip shortage. As Slovakia is an eastern European Union nation bordering Ukraine, more than 165,000 refugees have fled to Slovakia since Russia invaded Ukraine in February, underscoring the need for defense readiness.

In November 2021, the first of Taiwan's upgraded Lockheed Martin F-16V Fighting Falcon multirole fighter jets officially entered service. The full F-16V upgrade program is expected to cost \$3.96 billion and will continue until 2023. Known as the Phoenix Rising program, it includes the installation of Northrop Grumman's AN/APG-83 scalable agile beam radar, a new mission computer, the Terma AN/ALQ-213 Electronic Warfare Management systems, an updated identification friend-or-foe system and the Rockwell Collins-Elbit Joint Helmet Mounted Cueing System. In addition to the upgrade program, Taiwan also is in the process of purchasing another 66 new F-16 Block 70/72 aircraft from the United States to replace its fleet of F-5E/F Tiger IIs.

■ "Air Force opens new F-16 production line for foreign military sales," May 2021, *Air Force*, www.af.mil.; "Delivery of Slovakia's F-16 Block 70/72 Fighting Falcon aircraft will be delayed by 12-14 months due to global chip shortage," March 2022, *The Aviation Geek Club*, www.theaviationgeekclub.com.; "F-5 Tiger Fighter Jet" *Northrop Grumman*, www.northropgrumman.com.; "L3Harris Selected for F-5 Fighter Upgrade," May 2022, *The Defense Post*, www.thedefensepost.com.; "Meet F-16V: The Most Technologically Advanced 4th Generation Fighter in the World," *Lockheed Martin*, www.lockheedmartin.com.; "Meet The Northrop F-5: The Real MiG-28 In Top Gun," June 2022, *1945 Corp*, www.1945corp.com.; "South Korea seeks to replace its aging F-4 and F-5 fighters as soon as possible," May 2022, *Aviationline*, www.aviationline.com.; "Why Does Iran Have U.S. F-4 Phantom Fighters?" June 2021, *The National Interest*, www.nationalinterest.org.

WORLD FIGHTER FLEETS

The following is a list of the total numbers of legacy fighter aircraft in worldwide fleets at the time of this writing. Quantities enclosed in parentheses indicate the number of aircraft (of the total inventory) principally used for training purposes.

MCDONNELL DOUGLAS F-4 PHANTOM II		
Iran	Islamic Republic of Iran Air Force	63 (16)
South Korea	Republic of Korea Air Force	69
Turkey	Turkish Air Force	48

NORTHROP F-5 FREEDOM FIGHTER/TIGER II		
Brazil	Brazilian Air Force	42
Chile	Chilean Air Force	10
Honduras	Honduran Air Force	3
Iran	Islamic Republic of Iran Air Force	35
Kenya	Kenya Air Force	17
Morocco	Royal Moroccan Air Force	22 (4)
South Korea	Republic of Korea Air Force	156
Switzerland	Swiss Air Force	27
Taiwan	Republic of China Air Force	27
Thailand	Royal Thai Air Force	31 (3)
Tunisia	Tunisian Air Force	11
United States	United States Marine Corps	(12)
United States	United States Navy	(31)
Yemen	Yemen Arab Republic Air Force	13

GENERAL DYNAMICS-LOCKHEED MARTIN F-16 FIGHTING FALCON		
Bahrain	Royal Bahraini Air Force	17
Belgium	Belgian Air Component	43 (8)
Chile	Chilean Air Force	35
Denmark	Royal Danish Air Force	33 (10)
Egypt	Egyptian Air Force	168 (50)
Greece	Hellenic Air Force	154
Indonesia	Indonesian Air Force	33
Iraq	Iraqi Air Force	26 (8)
Israel	Israel Air and Space Force	175 (49)
Jordan	Royal Jordanian Air Force	44 (15)
Morocco	Royal Moroccan Air Force	23 (8)
Netherlands	Royal Netherlands Air Force	36 (5)
Oman	Royal Air Force of Oman	23
Pakistan	Pakistan Air Force	75
Poland	Polish Air Force	48
Portugal	Portuguese Air Force	21 (4)
Romania	Romanian Air Force	14 (3)
Singapore	Republic of Singapore Air Force	60
South Korea	Republic of Korea Air Force	167 (49)
Taiwan	Republic of China Air Force	112
Thailand	Royal Thai Air Force	51 (14)
Turkey	Turkish Air Force	245
UAE	United Arab Emirates Air Force	78 (22)
United States	United States Air Force	930 (150)
United States	United States Navy	14
Venezuela	Venezuelan Military Aviation	20 (4)

EXHIBITOR PROFILES

The companies listed on the following pages are suppliers of parts, components, systems and repairs for the fighter aircraft aftermarket. Firms indicated in **BOLD** type with their logo and description have been vetted by the publishers as bona-fide sources of supply and are the best in the business, providing quality equipment and services at a price that reflects true value for the purchaser. We suggest you contact these businesses for all your supply and repair needs, since they are dedicated to your satisfaction as customers. If they do not have the exact part or repair you require, they can act on your behalf to locate a solution for you. For more information please contact Richard Greenwald at r.greenwald@abdonline.com.

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MORE THAN STEALTH: THE F-22 RAPTOR'S "SUPER" POWER

In a word association quiz about the most prominent capabilities of the Lockheed Martin F-22 Raptor, the term "stealth" seems a good bet to top the list of likely responses. But from the beginning, the Raptor's ability to achieve supercruise—that is, to cruise at supersonic speed for an extended period, with a useful weapons load, and without using afterburners—has been as equally defining as its well-known stealth characteristics.

When the U.S. Air Force requested proposals for its Advanced Tactical Fighter (ATF) program in the 1980s, incorporating supercruise into the next generation of U.S. Air Force fighters was a top priority. Just as advances in materials and techniques were enabling a new level of sophistication for stealth technology, similar advances in propulsion and flight control systems promised to enable supercruise.

To some degree, stealth and supercruise traits are intertwined, as the ability to supercruise contributes to an aircraft's stealthiness by eliminating the infrared footprint of afterburning. But the ability of the F-22 to consistently cruise at Mach 1.5 without afterburning while equipped with its usual complement of weapons also represents a major performance improvement compared to previous fighters. While some earlier models had achieved supersonic flight without afterburning for short periods or in non-combat configurations, most were limited to cruising at subsonic speeds when equipped for battle.

In addition to the F-22 and its ATF competitor, the Northrop YF-23 prototype, other aircraft recognized as being capable of achieving supercruise have included the French Dassault Rafale fighter, the multinational Eurofighter Typhoon fighter, the Swiss Saab Gripen NG fighter and the Concorde civilian airline.

Sources: "F-22 demonstrates 'supercruise' for first time," Federation of American Scientists, *Air Force News*, July 21, 1999, <https://man.fas.org>.; Lopez, C. Todd, "F-22 excels at establishing air dominance," U.S. Air Force press release, June 23, 2006, www.af.mil.

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A Portuguese Air Force F-16 prepares for refueling during a deployment in Europe in March, 1999. (Image courtesy of the U.S. National Archives and Records Administration.)

THE EXPORT F-16 EARNS ITS WINGS

In the years leading up to the 1975 U.S. Air Force announcement that it would acquire 650 F-16s, the Fighting Falcon found itself engaged in a fierce battle to become the next great NATO fighter aircraft—before it had even flown its maiden flight.

Competing designs vying to supplant the F-16 included several fighters that had already been introduced, including the French Dassault Mirage F1 (1973), the British-French SEPECAT Jaguar (France, 1973; Great Britain 1974), and the Swiss Saab 37 Viggen (1971). For the U.S. armed forces, the primary argument in favor of the F-16 was that it cost less to build and operate than the McDonnell Douglas F-15 Eagle; it also offered superior maneuverability.

The F-16 seemed an ideal complement to the F-15 for domestic purposes, and a suitable candidate for export to North Atlantic Treaty Organization (NATO) allies, seeking to upgrade their air arsenals during the Cold War standoff with Warsaw Pact nations. When the U.S. Air Force announced the F-16 as the winner of its Air Combat Fighter competition in January 1975, it made clear that the initial plan to purchase 650 Fighting Falcons likely would be augmented with further orders, clearly signaling U.S. commitment to this new airframe to potential buyers among its European allies.

The U.S. Air Force adoption of the F-16 all but ensured its success. By June 1975, the defense establishments of Belgium, Denmark, Norway and the Netherlands had agreed to acquire the versatile multirole F-16 as a replacement for aging Lockheed F-104 Starfighter fighter-bombers. Plans also were made to establish Continental production facilities for the airframe and its associated parts and equipment.

Sources: "Fact Sheet: F-16 Fighting Falcon," U.S. Air Force, www.af.mil.; "F-15 Eagle vs. F-16 Fighting Falcon: Comparing the USAF's Top Fourth Generation Fighters," *Military Watch* magazine, April 10, 2022.; Grier, Peter, "The Viper Revolution," *Air Force* magazine, January 1, 2004.; Hillaker, Harry, "John Boyd, USAF Retired, Father of the F-16," *Code One: An Airpower Projection Magazine*, April/July, 1997.; Lockheed Martin, www.lockheedmartin.com; Simmonds, Bertie, "Viper's Bite: The Evolution of the F-16," *Key Aero*, March 5, 2021.

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Simtech is a military aftermarket supplier of spares and logistics services. Our partnerships with OEMs, inventory of parts and more than three decades of experience allow Simtech to support our customers with unparalleled service. See our advertisement on page 32.



SNAP-ON INCORPORATED Booth #: 52
2801 80th Street
Kenosha, WI 53143 U.S.A.

SPARKCOGNITION GOVERNMENT SYSTEMS, INC. Booth #: 63
12708 Riata Vista Cir., Suite A-116
Austin, TX 78727 U.S.A.

SPECMAT TECHNOLOGIES, INC. Booth #: 50
215 Dunavant Drive
Rockford, TN 37853 U.S.A.

SRI INTERNATIONAL Booth #: 127
201 Washington Road
Princeton, NJ 08540 U.S.A.
609-734-2613
Contact: Jennifer Willette
geminfo@sri.com
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SUMMIT AEROSPACE Booth #: 16
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SURVITEC / RFD BEAUFORT, INC. Booth #: 6
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TACTICAL AIR SUPPORT INC. Booth #: 85
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TASK AEROSPACE, INC. Booth #: 128,129
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Mesa, AZ 85212 U.S.A.

TAT TECHNOLOGIES Booth #: 158
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TERMA NORTH AMERICA Booth #: 113,114
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TESTEK SOLUTIONS Booth #: 123
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TRANSHIELD, INC. Booth #: 143
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TRONAIR Booth #: 172
1 Air Cargo Pkwy East
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U.S. TURBINE & ACCESSORY, LLC Booth #: 39
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W L GORE & ASSOCIATES Booth #: 103
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WALL COLMONOY AEROBRAZE OKC Booth #: 21

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Oklahoma City, OK 73135 U.S.A.
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