

# C-130 TCG WWR



OCTOBER 24-28  
ORLANDO, FLORIDA

TECHNICAL COORDINATION GROUP WORLDWIDE REVIEW



## 2022 PROGRAM GUIDE

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Egypt & Its Air Force Spotlight | Worldwide C-130 Transport Aircraft | Exhibitor Profiles



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## From the Director



October 24, 2022

Welcome to Caribe Royale Hotel and Convention Center, the site of the 32nd Annual C-130 TCG Worldwide Review (WWR). We at the C-130 TCG, are

excited to have you here with us this week as we celebrate the 32nd year of gathering with our Partners. We look forward to providing you with world-class service and the latest technical information available to support your C-130 aircraft. If you have questions or need assistance at any time during your stay, please do not hesitate to contact me or another TCG representative.

The agenda is filled with topics our team has outlined as significant interest to you as a customer. I highly encourage your attendance and questions at the briefings. Copies of these presentations are on our website or available upon request.

We welcome your comments regarding the presentations; your valuable feedback helps us to identify and address current challenges and future requirements associated with maintaining and flying our Herc's. Likewise, your feedback, positive or negative, concerning the briefings, personnel, facilities and conference operations in general, will assist in our efforts to elevate the quality of this annual gathering.

I am excited and honored to host the 32nd annual C-130 TCG WWR here in Orlando. On behalf of the C-130 Program Office and the TCG team, we thank you in advance for your collaboration and participation in the 2022 WWR. I certainly hope your attendance will be enlightening, as well as enjoyable, and we look forward to seeing you at this event for many years to come.

### Kristopher K. Riddle

Chief, C-130 TCG

### C-130 TECHNICAL COORDINATION GROUP

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## C-130 Technical Coordination Group (TCG) World Wide Review (WWR)

October 24-28, 2022

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By Andrea Templeton			

Front image courtesy of U.S. Air Force. Photo by Staff Sgt. Kelly Goonan.



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C-130 Technical Coordination Group (TCG)  
World Wide Review (WWR)  
24-28 October  
Caribe Royale, 8101 World Center Drive, Orlando, Florida 32821

2022

(SCHEDULE SUBJECT TO CHANGE)

**SUNDAY OCT. 23**

09:00-17:00 **Exhibitor Set-up**

09:00-17:00 **Early Registration**

**WELCOME RECEPTION**  
**18:30-20:30**  
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**MONDAY OCT. 24: WWR OPENING, CONTRACTOR PRESENTATIONS AND TRADE SHOW**

06:00 **Registration Opens** - (Grand Sierra Registration South)

08:00 **WWR Opening** - (Grand Sierra Ballroom)

08:30 *Opening/Admin Remarks* Kristopher Riddle, Chief, C-130 TCG

09:00 *Keynote Speaker* Dr. Joseph "JP" Peloquin, Chief, C-130 Hercules Division

09:45 **Dismiss to View Trade Show/ Exhibit Hall Open** - (Palms Ballroom)

The Wright Prospector is a free service available to all C-130 TCG attendees. Show ambassadors will guide you to exhibitors with new technology and new sources of supply. Look for them in the registration area or request a tour at booth #308.

11:45 **LUNCH** - (Grand Sierra Ballroom)

13:00 **Contractor Presentations Begin** – (Grand Sierra Ballroom)  
*DISCLAIMER: THE PRESENTATION OF A BRIEFING BY A CONTRACTOR AT THIS REVIEW SHOULD NOT BE CONSIDERED USAF ENDORSEMENT OF THE PRODUCT OR SERVICE.*

13:00	<i>Blended C130H Aircrew Training System (ATS)</i>	Andy NG, Aviation Learn Pte Ltd
13:15	<i>Next Generation C-130 Interactive Technical Publications</i>	Bill Hackney, Lockheed Martin
13:30	<i>C130 sustainment solutions</i>	Michael Farmer, AllClear Aerospace & Defense
13:45	<i>The Sher-Flow® Inlet Barrier Filter</i>	Kevin Terrell, Sherwood Aviation
14:00	<i>Jet engine icing during testing and a new tool to help minimize its impact</i>	David Jamison, Jet Engine Tests Solutions
14:15	<i>T56 Series III Continued Support Options and C-130 Infrared Suppression</i>	Joe Daniel, Rolls-Royce
14:30	<b>BREAK</b> (Coffee/snacks in Exhibit Hall)	
15:00	<i>Recovery of Crash Damaged &amp; Disabled C-130 Aircraft</i>	Yudie Fishman, AMS Aircraft Recovery
15:15	<i>Enhancing the abilities of the C-130 thru Roll-On/Roll-Off Systems</i>	Michael Knight, Knight Aerospace
15:30	<i>Airborne Aerospace C-130 SABIR System Orientation and Operations</i>	Brennan Lewis, Airborne Aerospace, Inc.
15:45	<i>54H60 FMS Overhaul Contract</i>	Jared Flynn, Pacific Propeller International
16:00	<i>Technology for Energy Corp Aviation Systems</i>	Ken Todd, Technology for Energy Corporation
16:15	<i>Tech Talk: SAM MD302 Standby Attitude Module</i>	Tom Genovese, True Blue Power
16:30	<b>Dismiss for Visiting Exhibitor Booths / Side Meetings</b>	
17:00	<b>Exhibit Hall Closes/Exhibitor Tear-Down</b>	

**MONDAY EVENING SOCIAL**  
**IN THE EXHIBIT AREA**  
**18:30-20:30**  
**Come out, socialize and browse the displays.**

**TUESDAY OCT. 25: CONTRACTOR PRESENTATIONS AND TRADE SHOW**

07:00 **Registration Opens**

08:00 **Exhibit Hall Opens** – (Palms)

The Wright Prospector is a free service available to all C-130 TCG attendees. Show ambassadors will guide you to exhibitors with new technology and new sources of supply. Look for them in the registration area or request a tour at booth #308.

08:00 **Presentations Resume (Grand Sierra)**

08:00 *USAF Ramp to Ramp (R2R) and C-130 EDA Overview* Saina Grooters, Deputy Chief, C-130 Foreign Military Sales Branch

08:30 *54H60 Propeller Overhaul Presentation / Discussion* Peter Christiansen (USAF)  
John Fontaine (USN)  
Tom Corley (Collins)

*54H60 Propeller Overhaul Working Group Breakout Session* 09:45 - Hibiscus Conference Room

09:30 **BREAK** (Coffee/snacks in Exhibit Hall)

**Contractor Presentations Resume** – (Grand Sierra)  
*DISCLAIMER: THE PRESENTATION OF A BRIEFING BY A CONTRACTOR AT THIS REVIEW SHOULD NOT BE CONSIDERED USAF ENDORSEMENT OF THE PRODUCT OR SERVICE.*

10:00 *Increase Mission Readiness with ILSmart* John Angelbeck, Inventory Locator Service®

10:15 *GEM – A Solution for Obsolete Microcircuits* Jennifer Willette, SRI International

10:30 *Combating and Eliminating Hexavalent Chromate from your work center* Roger Wilbanks, VES

10:45 *Technology updates for the C-130 / C-130 Support Equipment* Derek Moffa, Howell Instruments, Inc.

11:00 *Turbopower- Redefining the T56 and 501D MRO Experience* Christopher Culp, Turbopower, LLC

11:15 *54H60 Propeller Overhaul Process* Alain Pages, Segers Aero Corporation

11:30 *VIAVI Avionics Test Solutions* Terry Jarboe, VIAVI Solutions

**LUNCH**

**Contractor Presentations Resume** – (Palms 3)

13:00 *IEE's C-130 Flight Displays* Ed Fulmer, IEE, Inc.

13:15 *C-130J preTOLD Takeoff and Landing Data (TOLD) Calculator for iPad* Kevin Halpin, Elite Electronic Engineering, Inc.

13:30 *C-130 Hercules Lightweight Armor* Gary Meakin, Marshall Aerospace

13:45 *General Capability Brief and C-130 EDA fleet Re-transfer* Paul Keffler, Blue Aerospace

14:00 *C-130 Hangar - Future Vision* Jose Salvada, AEROMECA

14:15 *AFMETCAL International Metrology Abilities and Concerns for C130* Dustin Bidwell & Steven Brown, AFMETCAL

14:30 *Parts and Repair Ordering System Overview* Lori McCullough, AFSAC/PROS

14:45 *KC-135 Retirements/EDA Opportunities* Michael Degman, KC-135 Program Office

15:00 **Dismiss for "Last Call" Visiting Exhibitor Booths / Side Meetings**

16:30 **Exhibit Hall Closes/Exhibitor Tear-Down**

**TUESDAY EVENING SOCIAL**  
**GRAND SIERRA BALLROOM**  
**18:00-20:00**  
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**WEDNESDAY OCT. 26th**

**THURSDAY OCT. 27th**

**FRIDAY OCT. 28th**

**GOV'T TO GOV'T SESSION BRIEFINGS**

08:00-17:30 Closed Gov't to Gov't Presentations (No Contractors)

**GOV'T TO GOV'T SIDE MEETINGS**

08:00-17:00 Closed Gov't to Gov't Side Meetings (Various locations) (No Contractors unless invited)

**GOV'T TO GOV'T SIDE MEETINGS**

08:00-17:00 Closed Gov't to Gov't Side Meetings as needed (Various locations)  
TCG Pack-up/Travel Day

# CARIBE ROYALE - PALMS BALLROOM

# CARIBE ROYALE - PALMS BALLROOM

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106 KWD Aircraft Support Equipment	107 Aereos Defense	206 MOHR Test and Measurement	207 G&S Test Solutions, LLC	306 Able Aerospace	307 Ancra International LLC	406 Knight Aerospace	407 VSE Corporation	506 Frazier Aviation, Inc.
104 Tactair Fluid Controls, Inc.	105 National Geospatial- Intelligence Agency	204 ST Engineering Defence Aviation Services Pte. Ltd.	205 G&S Test Solutions, LLC	304 F3 Solutions, LLC	305 Coastal Seat Cushions	404 Kearsley Airways Ltd	405 Wolverine Industries	504 Sierra Nevada Corporation
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100 Aeronix, Inc.	101 ARMS International	200 AMETEK MRO Defense	201 IMP Aerospace & Defence	300 IMP Aerospace & Defence	301 SCI Technology, Inc.	400 SCI Technology, Inc.	401 Defense Technology Equipment, Inc.	500 Defense Technology Equipment, Inc.

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521 Turbopower, LLC	620 Veteran Equipment Systems and Sales	621 Fatigue Technology	720 Teradyne, Inc.	721 Aero Engineering & Manufacturing	820 Air and Ground Aviation, Inc.	821 Aero Engineering Support Group, Inc.	920 Airdyne Aerospace, Inc.
519 Turbopower, LLC	618 Raptor Scientific	619 Astronautics Corporation of America	718 VHL Aircraft, Inc.	719 Engineering and Software System Solutions	818 AIRCAT International - MERC	819 David Clark Company Inc.	918 Airdyne Aerospace, Inc.
517 Aircraft Lighting International	616 Miami Aircraft Structures, Inc.	617 SkyOne Aerospace LLC	716 TAT Technologies	717 CTG (Crestwood Technology Group)	816 Autoflug GmbH	817 Leonardo Electronics	916 S&K Aerospace
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505 LSI, Inc.	604 DuraCoatings	605 Adventure Aviation	704 Elite Electronic Engineering, Inc.	705 MRO Aerospace, Inc.	804 Daniels Manufacturing Corporation	805 L3Harris Technologies	904 L3Harris Technologies
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# THE LEGENDARY HERCULES



## Supporting the U.S. Armed Services

By Andrea Templeton

**W**e often think of the C-130 in the United States as an Air Force platform. While the U.S. Air Force operates triple the number of C-130s flown by the U.S. Navy and U.S. Marine Corps combined, the aircraft is mission critical for all three services and predominately supported by the same supply chain.

Well known as one of the most versatile aircraft in military service, as well as the American defense forces' longest continually operated model, the C-130 entered service with the U.S. Air Force in 1956 and the U.S. Navy and U.S. Marine Corps in 1960. It since has served a crucial role in delivering troops and critical supplies to hostile areas, from Vietnam to Afghanistan, as well as dropping bombs,

conducting reconnaissance missions, fighting fires and serving in relief operations all over the world.

Heidi Fleming (Captain, U.S. Navy, Retired) currently is the director of Government Affairs for Navy and Marine Corps Programs with Lockheed Martin. She started her career flying C-130s.

Fleming recalls early missions back in the 1990s.

"I'll never forget my first time going tanking in the C-130. At that time, we were taking people and equipment into Egypt and Saudi Arabia for Desert Storm. And here I was, a young ensign, controlling fighters into our tanker—it was incredible. I thought, 'I can't believe I'm really doing this.'"

"We were very busy during Desert Storm," Fleming continues, "but we flew many cargo missions all over Europe out of Rota, Spain. I remember being lead navigator in a daybreak

exercise, leading four other Herc aircraft on a low-level exercise drop. We dropped 80 Spanish paratroopers on target, followed by the other four dropping the same number. It was quite a sight, seeing all of those paratroopers sitting in the back of our C-130F."

"The C-130 is a very versatile plane," Fleming notes. "We conducted logistics, aerial refueling, and even low-level airdrops. The logistical piece is so critical to the warfighter, and the Herc is just the reliable and sturdy platform to make it happen."

### VERSATILITY OF THE C-130

The C-130 is well known for being able to land on short dirt airstrips, making it particularly useful in forward operating theaters. It is perhaps less well-known that the C-130 also holds the record

U.S. Marine Corps KC-130J Super Hercules aircraft fly in formation above Japan in December 2021. (U.S. Marine Corps photo by Lance Corporal. Tyler Harmon.)



Serving as a tanker is one of the primary missions of the C-130. (Photo courtesy of Lockheed Martin)

for the largest and heaviest airframe to land on an aircraft carrier.

In October–November 1963, Lieutenant James Flatley III and Lieutenant Commander Walter W. Stovall of the U.S. Navy completed twenty-one unarrested landings and takeoffs on the USS Forrester supercarrier, including several test flights at full weight capacity for the aircraft. Despite the success of these naval trials, it was decided that the operation was too risky for standard carrier operations. The Hercules that completed these tests remained in use until 2005 and is now part of the collection at the National Naval Air Museum in Pensacola, Florida.

While carrier landings did not become an operational reality, the idea of a C-130 operating in littoral environments has been a long-standing dream of the U.S. armed services. In fact, U.S. Air Force Special Operations Command is currently working on making a MC-130J seaplane capable, addressing the engineering challenges of developing and installing removable floats to safely support this large transport and its substantial loads.

Yet this will not be the first time a C-130 has landed on water operationally. Technically,

C-130s have been equipped for landing on water for more than 60 years, though the water they have been landing on has been in the form of ice and snow.

The U.S. Air Force's LC-130 "Skibird" is the world's largest ski-equipped plane. The first C-130s factory equipped with ski-based landing gear for landing on frozen terrain were produced in 1959 to support U.S. Navy's Antarctic expeditions. These Hercules were flown by the Navy until 1998, when these missions were taken over by the 109th Airlift Wing, a unit of the New York Air National Guard. The 109th continues to operate LC-130 missions in the Antarctic and Arctic, supporting National Science Foundation research. The 109th also may be called on for domestic disaster and hurricane relief missions.

### EXPEDITIONARY AND LOGISTICAL MISSIONS

The U.S. Navy mission for KC-130T stretched troop and cargo carrier variants is known as the Navy Unique Fleet Essential Airlift, entailing the delivery of critical parts and supplies—such as a replacement engine needed by an F-35—the last tactical mile in theater. Currently, the Navy also is transitioning its Take Charge And Move Out (TACAMO) mission from C-130Es to stretched C-130J-30s. TACAMO supports Airborne Strategic Communications between the President and his deterrence forces, including Columbia-class submarines.

For the U.S. Marine Corps, the Hercules is critical to expeditionary missions. The Marine Corps has fully transitioned away from legacy C-130s. It now only flies KC-130Js, with the distinction of operating the largest such fleet. This variant of the Hercules is an expeditionary airlifter with the capability of in-flight refueling of other aircraft, ranging from helicopters to fighters. The Marine Corps also uses the KC-130J for forward refueling of ground vehicles.

In addition, the U.S. Marine Corps is the sole operator of a specialized KC-130J variant known as the Harvest HAWK, with some of this fleet modified to accept roll-on/roll-off special mission kits. These specialized aircraft provide support to expeditionary missions, as well as other Marine Corps missions, including armed intelligence, surveillance, and reconnaissance.

### FLEET READINESS

Being the longest continually run aircraft in use by the United States military creates a reliance on successful sustainment and readiness. As missions and air systems evolve, so do the partnerships needed to keep our fleet operational. Integrated teams include and rely on military personnel, as well as industry partners—Lockheed Martin as the original equipment manufacturer, various



Proving the resiliency of the C-130, this aircraft took off on January 10, 1988, after being buried in the snow for 17 years. It was dug out, repaired, and returned to service. (U.S. Navy photo.)

### SNOWBOUND

In 1988, a ski-equipped Hercules took off from Antarctica, after being buried in ice and snow for 17 years in a remote area of the southernmost continent. The LC-130, piloted by U.S. Navy Lieutenant Commander Ed Gabriel, had crashed shortly after takeoff on December 4, 1971.

No one was injured in the crash, however, the stranded crew had to camp out in survival shelters for 3 days due to bad weather. The snowbound Hercules was declared a loss, stripped of parts, and left where it landed, until the late 1980s, when a salvage mission was planned.

Recovered and restored enough for flight, the aircraft took off again from Antarctica on January 10, 1988—this time, successfully. After the U.S. Navy made additional repairs, the LC-130 was returned to active polar service.



The C-130 is one of the most versatile aircraft operated by the U.S. military. (Photo courtesy of Lockheed Martin.)



The U.S. Marine Corps uses the KC-130J for in-flight refueling of other aircraft, ranging from helicopters to fighters, as well as for forward refueling of ground vehicles. (U.S. Marine Corps photo by Corporal Jackson Ricker.)



The U.S. Marine Corps has completed its transition from legacy C-130s to the KC-130J and currently operates the largest fleet of KC-130Js in the world. (U.S. Marine Corps photo by Lance Corporal Tyler Harmon.)



Four F-35s tank off of a Marine Corps' KC-130J. (Photo courtesy of Lockheed Martin.)



C-130s from the 317th Airlift Wing, Dyess Air Force Base, Texas, and the 314th AW, Little Rock AFB, Ark., fly in formation over the beaches of Normandy, France, while participating in fly-over events June 4, 2019. (U.S. Air Force photo by Staff Sgt. Jeremy McGuffin).

subcontractors, and a wide range of aftermarket companies. Technology is also transforming the way the supply chain is managed and adding to the types of supplies needed to keep the fleet mission ready.

Supply chain success is critical throughout the life of an aircraft, from preproduction through decades on the flight line. Laura Sampsel, currently the Integration Sustainment Director for Air Mobility & Maritime Missions for Lockheed Martin, started her career as a Marine logistician and has been connected to the C-130 from day one of her professional career. According to Sampsel, "An aircraft's supply chain is its lifeline, and it's an essential ingredient in our sustainment practice."

Having been involved in the supply chain from all sides, Sampsel comments in particular on the way digital transformation is allowing military and industry partners to better manage the supply chain. "I've spent



The U.S. Navy Flight Demonstration Squadron Blue Angels team has used C-130s as their support aircraft since 1970. All told, ten C-130s known as "Fat Albert" or "Bert" have served the Blue Angels to date. (Photo courtesy of Lockheed Martin.)

#### THE BERTS

In addition to its agile fighter jets, the U.S. Navy Flight Demonstration Squadron "Blue Angels" team has long operated a C-130. Officially a U.S. Navy aircraft, it is known as "Fat Albert" or "Bert."

Hercules have been the Blue Angels' support workhorse since 1970. All told, ten C-130s have served as the squadron's "Berts" to date, with the first model being a KC-130F. It took over Bert duties from a C-121 Constellation, another versatile transport designed and developed by Lockheed.

An all-U.S. Marine Corps crew flies, maintains, and supports the Blue Angels' transport. The eleventh and newest Bert, a C-130J Super Hercules, came on board in 2020. This shorter body Bert formerly flew with the United Kingdom's Royal Air Force, from the late 1990s into the early 2000s.

my entire career in sustainment. And I am excited to be part of a time and place where we see the benefits of technology in the small and large aspects of our jobs."

"The supply chain can be a key vulnerability pulse point at all phases of an aircraft's lifespan," she explains. "Today's technology allows us to leverage the benefits of intelligent diagnostics and responsive fleet management to build a supply chain that, like our teammates, anticipates and prepares for, and not [just] reacts to, challenges."

Sampsel compares sustainment to an orchestra, where one piece of the sustainment capability directly complements another. As she points out, partnership is essential, "within our own sustainment organization, across different Lockheed Martin lines of business and business areas, among our many operators, and with our suppliers and industry partners. In sustainment, everyone's inputs and actions matter."

Fleming agrees. "The mission of the C-130 is incredibly important to the Navy and Marine Corps. I saw that as a C-130 operator, and I see it from the industry side as well. The teamwork that happens between Lockheed Martin, our industry partners, and the military is what makes the continued C-130 mission possible, and what allows us to effectively serve the warfighter."

About this close collaboration of military and industry, Sampsel says, "Excellence looks different across the multitude of operators we work with. By having a diversity in perspective, experience and outlook, we can exceed our customers' expectations and think outside the box to solve intensely critical challenges. It is very easy to just repeat what you know. It is only when you move outside your comfort zone that you enable greatness."

For Sampsel and the sustainment team at Lockheed, the ultimate motivation is based on who they ultimately serve: the military members in the air and on the ground. For Sampsel, whose son is a U.S. Marine, this motivation is personal.

"Every day, I know it may be this aircraft that provides him critical tactical support, fuel or a thousand other things. It must be there or be ready. No excuse."

As she aptly concludes, the synergy of efforts of all those involved in the C-130 ensures a successful mission for, "every Marine, airman, sailor, Coast Guard [service man and woman] and soldier who depends on our aircraft to complete a mission and come home safely."

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# Keeping Control of the **MIGHTY HERCULES**

## On the Ground

By Donna J. Kelly

**F**or fixed-wing aircraft like the Lockheed C-130 Hercules, each and every mission begins and ends with the use of the landing gear systems comprised of specially designed components.

Beginning with where the rubber hits the road, so to speak, we find rugged, bias tires. Typically supplied by Michelin of North America, headquartered in Greenville, South Carolina, these tires possess ideal features for transporting heavy loads and landing on rough airstrips. Inside are multiple layers of crisscrossed ply cords, running diagonally towards the center. Deep skid depths help extend life, while resisting cuts and abrasions. And an exclusive chemical compound applied to the tire's surfaces guards against the destructive rays of the sun.

But when landing a transport, with a normal landing weight exceeding 100,000 pounds, what good are even the best tires without an effective braking system? Stopping a large and often fully-loaded transport requires brakes that can handle high heat and withstand hundreds of landings.

### **PAST TO PRESENT**

Legacy brakes for the C-130 were made of heavy steel. They wore out quickly, and contained numerous parts, requiring extra time for maintenance, as well as increasing the possibility of inventory shortages.

More critical was how hot steel brakes became and how long it took them to cool down. For example, consider a heavily loaded C-130 coming in fast on a short runway. Steel

*Replacing the  
steel brakes  
with carbon  
went a  
long way...*

brakes working at full thermal capacity could reach temperatures exceeding 400 degrees Fahrenheit. When brakes are glowing that red hot, personnel cannot approach the aircraft, with the added danger of equipment fire—an all-too-common problem when steel brakes were used.

Replacing the steel brakes with carbon went a long way toward eliminating these problems but meant costly upgrades for C-130 fleets back in 2012 when the U.S. Air Force began flying them on operational aircraft. Initially, this high replacement cost was due to the extended process involved in making carbon brakes.

The good news is that more recent technologies have decreased this cost. In addition, new overhaul procedures were developed, allowing for optimal use of

This LC-130 is shown taking off from the North Greenland Icecore Project (NorthGRIP) camp. In addition to the engines, jet-assisted takeoff (JATO) rockets are used to propel the Hercules across and off the snowy surface. (Photo ©2005 Soren Wedel Nielsen and U.S. Air Force.)

### **THE INNER WORKINGS OF A CARBON BRAKE**

The outside frame of the brake is made up of housing for the pistons and torque tube. It is the piston housing that applies the squeeze force to the carbon brake stack, otherwise known as the heat sink. The heat sink is comprised of alternating rotating and stationary carbon disks. The rotating disks are driven by the aircraft's wheels, while the stationary disks are held in place by raised splines located within the torque tube.

As hydraulic pressure is applied to the heat sink, the rotating and stationary disks are squeezed together, resulting in the formation of abrasive particles. At first, these particles are relatively large, but they soon get broken down into smaller pieces. These, in turn, due to the high heat, break down further into particles that form a film, coating the rotor surfaces, increasing friction and decreasing wear of those surfaces.

Wear rapidly decreases when temperatures rise above 300 degrees Fahrenheit. The bulk of brake wear, 79%, occurs during the initial taxi out period, while landings account for 19% of total brake degradation.

In terms of performance, during a normal landing, brakes provide about 40% of the total braking energy. Aerodynamic braking accounts for 30%, rolling friction where the tires meet the tarmac provide 10%, and a varied amount is generated by reverse thrust from the engines.



Working the night shift, Staff Sergeant Toby Neal inspects the landing gear during a check on this C-130 Hercules at U.S. Air Force Ramstein Air Base in Germany. Sergeant Neal is a crew chief assigned to the 86th Aircraft Maintenance Squadron, which performs maintenance throughout the night to prepare aircraft to fly the next day. (U.S. Air Force photo by Master Sergeant John E. Lasky.)

Staff Sergeant Bruce Hegner slides a tire onto a C-130 Hercules wheel half, at the 86th Maintenance Squadron's wheel and tire centralized intermediate repair facility at U.S. Air Force Ramstein Air Base in Germany. Sergeant Hegner is the facility's noncommissioned officer in charge. (U.S. Air Force photo by Master Sergeant John E. Lasky.)

At an air base in Southwest Asia, Staff Sergeant Ruben Ramones tightens bolts on a C-130 Hercules wheel with a torque wrench. Sergeant Ramones is the wheel and tire shift lead for the U.S. Air Force's 379th Expeditionary Maintenance Squadron, which provides a full range of wheel and tire services. This 24-hour operation supports more than a dozen military locations and supplies hundreds of tires a month to various aircraft. (U.S. Air Force photo by Senior Airman Andrew Satran.)

refurbished carbon, making this material more cost effective. Such advances were the direct result of over a decade of testing, evaluation and use on the U.S. Air Force C-130 fleet.

Thanks to these efforts, the Duracarb brakes made by Collins Aerospace, of Charlotte, North Carolina, and used by the U.S. Air Force have proven to be a success. So much so that the U.S. Navy has been switching its C-130s to carbon brakes, with the first modified aircraft completed in May 2021.

These effective braking systems also are being used on other Hercules fleets worldwide. According to Collins, their Duracarb heat sink brakes currently are used on more than 600 C-130s around the globe. The company also is developing a new wheel and carbon brake system for the U.S. Air Force's B-52H Stratofortress fleet.

#### CLEAR ADVANTAGES

The U.S. Air Force began testing carbon heat sink brake



disk technology from UTC (now Collins Aerospace) in 2011, as part of its Wheel Brake System Improvement (WBSI) program. First to test the capabilities of the new brakes was the 418th Flight Test Squadron, at Edwards Air Force Base, in Kern County, California. Testing occurred under a range of operating conditions, including various cargo weights, landing on dry or wet runways, and applying "max-effort" braking (using maximum pressure in braking).

In this testing, real-time temperatures were obtained by drilling holes into the center stator and inserting thermal probes.

"The Duracarb brakes were able to reach temperatures of up to 500 degrees Fahrenheit without failing during an emergency runway stop," recalls Doug Hayes, Director of Carbon Operations for the Collins Wheel & Brake team in Pueblo, Colorado.

Longevity is another benefit of carbon brakes. A Duracarb brake will last for up to 2,000 landings between



After landing at Contingency Operating Base (COB) Speicher in Iraq, the brakes overheated on this Wyoming Air National Guard C-130. Crew members used water to cool the brakes and prevent a fire. (Image courtesy of the U.S. Air Force.)

The damaged tire of a C-130 Hercules, assigned to the 774th Expeditionary Airlift Squadron at Karshi-Khanabad Air Base, Uzbekistan, is shown after landing at Bagram Air Base in Afghanistan in April 2005 (Image courtesy of the U.S. Air Force.)

Airman 1st Class Christopher Griep (left) and Staff Sergeant James Christner disassemble a C-130 Hercules aircraft brake assembly carrier during an inspection at Yokota Air Base in Japan. (U.S. Air Force photo by Master Sergeant Val Gempis.)



#### ANTI-SKID SYSTEMS

Maximum braking efficiency exists when wheels are decelerating at the maximum rate achievable without skidding. The problem is that if a wheel slows too quickly, the brakes are likely to lock, resulting in a skid. And it can be difficult to achieve the precise speed needed to avoid this.

Anti-skid systems are designed to address and prevent dangerous skids. As a safeguard, monitors are placed at each wheel to detect whether the wheel is spinning at a different rate than the present rate of ground speed. If a mismatch in speed is detected, the connected unit signals an adjustment to the hydraulic pressure affecting the brake on that wheel.

Operationally, the pilot turns on the anti-skid system switch in the cockpit prior to taxiing. The system then operates automatically, until the aircraft reaches approximately 20 miles per hour. At that point, normal braking mode generally resumes for taxiing and turning.



A C-130 Hercules cargo plane, assigned to the North Carolina Air National Guard's 145th Wing, performs a tactical landing on a dirt strip at the Sicily Landing Zone at Fort Bragg, North Carolina, where paratroopers re-enacted a D-Day jump. (U.S. Air Force photo by Technical Sergeant Brian E. Christiansen.)

overhauls, an exponential improvement over the 250 landings typical for a steel brake.

Not only do technicians need to change brakes far less often, the actual brake-change time is decreased due to less connective hardware. A specialized two-piece lock ring allows for quick disconnect and re-installation, resulting in shorter turn times using fewer tools. With steel brakes, the change process took 4 hours and 15 minutes, while the carbon brakes can be changed in under an hour.

As an added safety measure, all brake pistons are totally sealed to prevent leaking of dangerous and corrosive hydraulic fluid. This also keeps contaminants from entering the brake body.

Finally, weight is a driving factor when deciding on materials for critical aircraft parts. Carbon brakes are

lighter than their steel counterparts by up to 60%, depending on the model. For example, 700 pounds can be saved on a Boeing 737 Next Gen by using carbon brakes. This means big savings in fuel consumption and a reduction in carbon dioxide (CO<sub>2</sub>) emissions.

#### SAVING MONEY AND THE ENVIRONMENT

Environmentally friendly practices have been implemented to find ways to reuse expended carbon. In partnership with the U.S. Air Force, Collins Aerospace devised a process that repurposes the carbon waste from used brakes.

Matthew Streeper, Chief of Strategic Acquisition Programs Directorate at DLA Aviation, a subordinate command of the Defense Logistics Agency, in Ogden, Utah, says, "Carbon reuse is a commercial best-practice

used by Collins Aerospace, and it has helped save the Air Force millions of dollars."

The process involves extracting useable carbon from spent brake heat stacks. The left-over carbon is inspected for its reusability. If the brake disks are found to be within specified limits, they are re-machined to make them thinner. Then two brake disks are joined together, with minimal use of hardware. This refurbished two-into-one disk, once certified, is sent to maintenance, repair and overall (MRO) sites for re-use for up to two additional overhaul cycles.

In addition, smaller, reclaimed carbon remnants are taken to local steel mills near the Collins facility in Pueblo, Colorado. There, these carbon pieces are used as a key ingredient in steel-making processes, such as manufacturing seamless pipes. Carbon dust also finds new life in the form of constituents for asphalt, industrial lubricants, fuel cells and specialized coatings.

#### STOPPING THE SKID

Upon landing, the pilot in the cockpit cannot immediately detect when one or more wheels have stopped turning and instead are skidding along on the surface, a dangerous condition that can result in tire blowouts, loss of control and damage to the aircraft. The solution has been development of anti-skid systems that detect and arrest the skidding of wheels.

For example, the Mark IV Digital Anti-Skid Brake Control Unit developed by Crane Aerospace of Burbank,



A C-130E from the 19th Airlift Wing at Little Rock Air Force Base, Arkansas, comes to a screeching halt during a Wheel Brake System Improvement test, held in May 2011, at Edwards Air Force Base, California. The C-130 was on loan to the 418th Flight Test Squadron to test new carbon brakes and the Mark IV Digital Antiskid Control Unit. (U.S. Air Force photo by Doug Spinks.)

California, can detect aircraft tire skids in progress; it also can predict and react to prevent imminent skids. The Mark IV unit automatically relieves pressure to the brake pistons, allowing the wheel to rotate and thus avoiding a skid. Lower pressure is then applied to the brake at a level that slows down the wheel, without skidding.

The Mark IV's speed transducer, a type of tachometer to measure wheel speed, includes a metering valve fault display unit that provides a visual indication to the pilot to alert him or her of the skid, whether in progress or impending. This feature also is available to ground maintainers as a trouble-shooting device. To ensure the aircraft stays put while on the ground, the control unit also includes a parking brake feature.

#### WHERE THE REAL WORK BEGINS

Landing gear systems contain far more components than just tires and brakes, with their hydraulic struts, limiting devices, gear door actuators and other parts extending several feet up into the aircraft body. But the parts touching the ground are the ones that get the aircraft to its takeoff point, and then safely support it during its transition back to terra firma. Interestingly, research continues into finding better ways to maintain these critical systems.

In 2021, the Southwest Research Institute, of San Antonio, Texas, and the University of Dayton, in Ohio, were the recipients of multiple year-long contracts from the U.S. Air Force, potentially totaling up to \$300 million, to further the science of landing gear sustainment. In this effort, each team will evaluate brake systems' service life to establish predictions of future operation and avoid potential problems, examine applicable technical data for integrity, explore the potential of 3D modeling and printing for recreating obsolete parts, and more.

This work and that of others in the industry—original equipment manufacturers, aftermarket parts manufacturers and suppliers, service maintainers, and fleet operators—all constantly contribute to improving and supporting these systems on C-130s and other in-service models. Together, they help make transport aircraft lighter, safer and ever easier to keep rolling and flying.

*As an added safety measure, all brake pistons are totally sealed to prevent leaking of dangerous and corrosive hydraulic fluid. This also keeps contaminants from entering the brake body.*

# EGYPT

## ITS AIR FORCE, INDUSTRY AND CULTURE

By Tracy Martin



An Egyptian Air Force K-8E Karakoram at the 2015 Malta International Airshow. (Photo Courtesy of Oren Rozen.)

### EGYPTIAN JET TRAINER

The Arab Organization for Industrialization (AOI) factory started producing the K-8E Karakoram basic fighter trainer in 2000, under an agreement with one of the Chinese state-owned aerospace manufacturers, with a plan to produce a total of sixty K-8s over 5 years. Initially, most of the parts were manufactured in China, and the aircraft were assembled in Egypt. But, by the end of the program, manufacturing was carried out entirely at the AOI factory.

The K-8E trainer is 38 feet in length, 13.8 feet tall, has a wingspan of 31.6 feet and an empty weight of 5,900 pounds. The maximum fuel capacity (in-flight tank) is 257 gallons, and the maximum take-off weight is 9,546 pounds. It is powered by the TFE731-2A turbofan engine, produced by U.S. manufacturer Garrett (now Honeywell) and has a maximum takeoff thrust of 3,600 pound-feet. This allows the K-8E to reach a maximum level flight speed of 497 miles per hour (at sea level) and a maximum range of 870 miles. The aircraft has a total of four pylons, which can mount bombs, rockets, missiles and auxiliary fuel tanks.

In June 2000, the K-8E trainer aircraft test flight was successfully completed in Nanchang, Jiangxi Province, China. The AOI Aircraft Factory began to assemble the aircraft in July 2000. The Egyptian company, contracted to manufacture Chinese-designed K-8E aircraft for the previous five years, completed the first Sino-Egyptian contract for eighty aircraft in December 2005. With AOI authorized to produce as much as 97.4% of components, the two companies signed a contract to produce another forty aircrafts in November 2004.

This relationship underscored China's use of sales of inexpensive, low-technology military hardware to shore up ties with developing nations. In May 2010, a ceremony was held in Cairo for the delivery of the 120th K-8E military trainer jointly manufactured by China and Egypt. Since 2021, the Egyptian Air Force has been looking to replace its aging K-8E fleet of trainer aircraft. Possible replacements include Germany's Grob G120TP turboprop, Italy's Leonardo M346 Master and the U.S. Sierra Nevada Corporation's (SNC's) A-29 Super Tucano.



Considered the cradle of civilization, Egypt has one of the longest recorded histories of any country, tracing its heritage along the Nile Delta back to the 4th millennia B.C.E. Evidenced by iconic monuments, such as the Pyramids of Giza and the Sphinx, and numerous other signs of a well-organized civilization, ancient Egypt saw some of the earliest developments of writing, organized religion, central government, urbanization, and agricultural development. Its historical record remains a significant focus of scientific and popular interest in the modern world.

In 1922, Egypt gained independence from the British Empire and formed a monarchy. England retained significant connections with the Kingdom of Egypt, and Britain used the country as a base of Allied operations during World War II. Throughout the war, regional priorities included control of the Eastern Mediterranean and the Suez Canal.

In 1952, a coup d'état was launched against the Kingdom of Egypt, and the country was declared a republic in June 1953. British forces withdrew from the occupied Suez Canal Zone in 1956, and the canal became nationalized. Egypt's hostile advances toward Israel prompted the beginning of the Second Arab-Israeli War, which U.S. and U.S.S.R diplomatic intervention helped bring to an end.

Through the second half of the 20th century, Egypt endured social and religious strife and political instability, with intermittent occupation of the Gaza Strip until 1967 and continued armed conflicts with Israel through 1973. In 1978, Egypt

In order from top to bottom:  
An Egyptian Air Force Lockheed C-130H Hercules. (Photo courtesy of Alan Lebeda.)

Airmen from the 436th Aerial Port Squadron load cargo onto an Egyptian Air Force C-130 Hercules, during a foreign military sales operation at the U.S. Dover Air Force Base in Delaware. (Photo courtesy of the U.S. Air Force, Senior Airman Faith Schaefer.)

An Egyptian C-130H Hercules (L-382) touches down at Lajes Terceira Island in Portugal. (Photo courtesy of Paulo Santos.)

Airmen from the 436th Aerial Port Squadron load cargo onto an Egyptian Air Force C-130 Hercules during a foreign military sales operation at the U.S. Dover Air Force Base in Delaware. (Photo courtesy of the U.S. Air Force, Senior Airman Faith Schaefer.)



### EGYPT FAST FACTS

**Capital:** .....Cairo  
**Official Language:** .....Literary Arabic  
**Population:** .....106,139,647  
**Religion:** .....Sunni Muslim (90%), Christianity and Judaism  
**Literacy rate:** .....17.5%  
**Urban population:** .....44,870,000 (as of 2021)  
**Military Branches:** .....Army, Navy, Air Force and Air Defense Forces  
**Military Service:** .....Compulsory conscription for men ages 19-34 (with qualifications)

**Active Military Personnel:** ... 438,500  
**Reserve Military Personnel:** .. 479,000  
**GDP:** .....\$340 U.S. billion  
**Currency:** .....Egyptian pound  
**Land area:** .....386,700 square miles  
**Government:** .....Republicanism with semi-presidential system of government  
**President:** .....Abdel Fattah Saeed Hussein Khalil el-Sisi  
**Armed Forces Chief of Staff:** .. Osama Askar

Following is a list of the total numbers of Egyptian aircraft at the time of this writing. Quantities enclosed in parentheses indicate the number of aircraft (of the total inventory) principally used for training purposes.

**AIRCRAFT ..... QUANTITY**

<b>Airborne Warning and Control System (AWACS)</b>	
E-2 Hawkeye .....	7
<b>Fighters</b>	
Alpha Jet .....	12 (27)
Dassault Rafale .....	24
F-16 Fighting Falcon .....	168 (50)
MiG-29 .....	38 (6)
Mirage 5 .....	75 (6)
Mirage 2000 .....	15 (4)
Sukhoi Su-35 .....	17
<b>Transport</b>	
Antonov An-74 .....	2
Beechcraft 1900 .....	8
CASA -295 .....	22
C-130 Hercules .....	21
DHC-5 Buffalo .....	8
Ilyushin Il-76 .....	2
<b>Helicopters</b>	
Aerospatiale Gazelle .....	89
AgustaWestland AW109 .....	3
AgustaWestland AW139 .....	3
AgustaWestland AW149 .....	8
AH-64 Apache .....	46
CH-47 Chinook .....	19
Kamov Ka-50 .....	39
Mil Mi-17 .....	62
Mil Mi-24 .....	6
Sh-2G Super Seasprite .....	10
Sikorsky S-70 .....	2
Westland Sea King .....	23
<b>Trainers</b>	
Aero L-39 .....	1
Embraer EMB-312 .....	54
Grob G 115 .....	74
K-8E Karakorum .....	119
<b>UAVs</b>	
ASN-209 .....	Not Available
CASC Rainbow .....	Not Available
CAIG Wing Loong .....	Not Available
CASIC WJ .....	Not Available
Lipán M3 .....	Not Available
Maggitt Banshee .....	Not Available
RQ-20 Puma .....	Not Available
324 Scarab .....	Not Available
Yabhon United 40 .....	Not Available



An Egyptian Air Force Lockheed C-130H Hercules. (Photo courtesy of Rick Ingham.)

signed the Camp David Accords, officially withdrawing from the Gaza Strip and recognizing Israel.

Today, Egypt's economy depends mainly on agriculture, natural gas and petroleum, along with media, tourism and revenues from the Suez Canal. Another notable influx of monies comes from Egyptian citizens working abroad. At the time of this writing, Egypt's 2022 Gross Domestic Product (GDP) was predicted to be around \$340 billion U.S., giving it a national rank of 152nd worldwide.

A rapidly growing population, limited arable land and dependence on the Nile, all continue to overtax resources and stress the nation's economy. Egypt has received U.S. foreign aid since 1979 (an average of \$2.2 billion per year). Today, it is the fourth-largest recipient of such funds, following Afghanistan, Israel, and Jordan.

**EGYPTIAN AIR FORCE HISTORY**

Initially a part of the Egyptian Army, the air service became the Egyptian Air Force (EAF) in 1937. In addition to the EAF, the Egyptian Air Defense

Forces (EADF), established in 1968, focuses on anti-aircraft warfare.

Despite the proximity of fighting in North Africa, the EAF had little involvement in World War II. From 1948 to 1973, the service took part in four separate conflicts with Israel. The service also supported the Egyptian Army during the North Yemen Civil War from 1962 to 1970 and the Libyan-Egyptian War of 1977.

Starting in 1992, the EAF has provided support for police and national security organizations engaged in the war against terrorism. Since 2011, this involvement has included the Sinai insurgency, an ongoing conflict in the Sinai Peninsula between Islamist militants and Egyptian security forces, with the latter's F-16 fighters and AH-64 Apache helicopters frequently bombing military targets. From 2014 to 2020, the EAF also participated in the Second Libyan Civil War, a multilateral conflict in the North African country of Libya.

Today, the Egyptian Air Force's primary role is defined as the air defense of the nation, with secondary tasks including strike and army support



A current Egyptian Air Force Hercules, VIP-configured VC-130H 1289/SU-BAV, visiting U.S. Dover Air Force Base in Delaware. The burden on Egypt's legacy Hercules fleet will be eased considerably with the planned acquisition of twelve new C-130J-30s in 2022. (Photo courtesy of U.S. Air Force Roland Balik.)

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operations. It also provides official government transport and carries out international search-and-rescue operations in the desert, Mediterranean Sea and the Red Sea.

Egypt boasts the largest air force in the Arab world, with over 550 aircraft, more than half of which are of Western origin. This fleet includes Chinese, Czechoslovak, Egyptian, French, Russian and U.S. aircraft.

**EGYPTIAN AIR FORCE TRANSPORTS**

The EAF currently operates twenty-two C-130Hs many of which were acquired during the late 1970s. Notably, the EAF received two EC-130H Compass Call aircraft in 2001. The EC-130H is an airborne tactical weapons system that relies on a heavily modified airframe. Its systems disrupt enemy command and control communications and limit adversary coordination essential for enemy force management.

In January 2022, the United States approved a potential sale to the EAF of twelve C-130J Super Hercules aircraft. These C-130Js are reportedly expected to cost about \$2.2 billion, with an estimated \$355 million for related equipment in support of the aircraft.

The proposed Lockheed Martin C-130Js will be powered by Rolls-Royce AE 2100D turboprop engines, and the deal will include a

dozen spare engines. Other features will include GPS navigation systems, identification transponders and advanced missile warning and countermeasure systems.

The related equipment package includes three, land-based SPS-48 air defense radar systems (with spares, motor generators, repeaters, randomes, and other parts). L3Harris Surveillance Systems, located in California is named as the principal contractor in this sale.

According to the U.S. State Department, selling Egypt this equipment will benefit the United States by helping a key ally in the Middle East improve its security and better detect air threats. Egypt already operates SPS-48 radar systems, so the State Department expects it will not have a problem adapting its armed forces to the new radars.

The twelve new C-130Js will increase Egypt's airlift capacity and facilitate transportation of equipment and people to better support its forces on such missions as border security and anti-terrorism, response to internal security threats, and humanitarian aid. These adaptable transports also will be used for maritime patrol, as well as search and rescue.

**EGYPTIAN AIRCRAFT INDUSTRY**

The Arab Organization for Industrialization (AOI) is an Egypt-based Arab military organization,

established in 1975 by Egypt, the Kingdom of Saudi Arabia, Qatar and the United Arab Emirates to support the collective development of the regional defense industry. Following a gradual deterioration in relations between AOI member-states, Egypt became sole owner of AOI in 1993. The wholly state-owned AOI is one of the largest industrial organizations in Egypt, with significant international relationships, both in the defense and civilian transport sectors.

The AOI Aircraft Factory was established in 1950 as Helwan Aircraft Factory, and it remains a key aerospace manufacturer in Egypt. The factory has manufactured and assembled various aircraft for the Egyptian Air Force, including the Helwan HA-200 Al Kahirah subsonic trainer, Helwan HA-300 supersonic fighter, Alpha Jet, Tucano turboprop trainer, and the K-8E Karakoram jet trainer, an Egyptian variant of the Chinese Hongdu JL-8 (see sidebar). The factory also manufactures aircraft parts for the Egyptian Civil Aviation Authority, Dassault Aviation, and SAGEM, and it has received certification from the Egyptian Civil Aviation Authority (ECAA) for its welding, painting, calibration and testing operations.

# WORLDWIDE C-130 HERCULES TRANSPORT AIRCRAFT

By Tracy Martin

The C-130 has the longest, continuous military aircraft production run in history, spanning a remarkable 68 years. In 2022, the Hercules celebrated 65 years of continuous service with the U.S. Air Force, its original primary customer.

Since its first flight in 1954, this capable transport has flown to both poles, landed or airdropped military supplies to hot spots from Vietnam to Afghanistan, and supported countless relief operations around the globe. In addition to transporting essential supplies, the C-130 has been used to conduct reconnaissance, fulfill aerial spray and firefighting duties, retrieve satellites in midair, drop bombs and attack ground targets with cannon-like armaments.

The large, unobstructed, fully-pressurized cargo hold can be rapidly reconfigured to accommodate personnel, passengers, stretchers, medical equipment or a wide range of goods and components. Its high-wing design places the cargo floor at truck-bed height above the ground for rapid loading, facilitated by its integral roll-on/roll-off rear-loading ramp. And with its back-opening hatch, it is ideal for airdrops of troops and/or equipment into battle fields.

The C-130 also can accommodate oversized cargo, ranging from massive generators and other large machines loaded on standardized pallets to six-wheeled armored vehicles and even



Image courtesy of U.S. Air Force. Photo by Airman 1st Class Rhett Isbell.

helicopters. In an aerial delivery role, it can airdrop loads up to 42,000 pounds or use its highly adaptable landing gear to deliver cargo on rough, dirt strips. And at maximum normal payload (35,000 pounds), depending on the variant, its operational range is from just under 1,500 miles to just over 2,400. The Hercules's tremendous lift capacity, ability to land on terrain that is less than ideal, and long range make it a true tactical airlifter.

To date, more than 2,500 Hercules have been delivered and/or ordered by 22 nations and 26 operators around the world. The latest C-130J model is a comprehensive update of the original, with new engines, flight deck and other upgraded systems. The C-130J has a truly integrated digital core that includes dual HUDs for situational awareness, Block 7.0/8.1 software, automated maintenance fault reporting and an integrated defensive suite. It also boasts a 250 knot-capable loading door and ramp. Overall, the C-130J is even smarter, faster, goes farther, and holds more, as compared to legacy platforms—all of which translates to enhanced performance and mission capabilities.

Lockheed Martin, with its global network and industry partners, effectively provides parts, upgrades, and support of all kinds to operators around the world, keeping both legacy and newer Hercules flying. In 1987, the C-130 Technical Coordination Group (TCG) was formed as a U.S. Air Force organization to provide a direct line of operational and logical assistance to foreign military users. The C-130 TCG currently supports 38 country partners.

## 2022 WORLDWIDE C-130 LIST

To give you an idea of the distribution of Hercules flown by nations worldwide, the list below estimates military-operated C-130s in service at the time of this writing. Note that these numbers change frequently and do not include operational variants in other government and nongovernment fleets.

Country	Air Force	C-130 Aircraft
Algeria	Algerian Air Force	15
Argentina	Argentine Air Force	4
Australia	Royal Australian Air Force	12
Austria	Austrian Air Force	3
Bahrain	Royal Bahraini Air Force	2
Bangladesh	Bangladesh Air Force	9
Bolivia	Bolivian Air Force	3
Botswana	Botswana Defense Force	3
Brazil	Brazilian Air Force	11
Cameroon	Cameroon Air Force	3
Canada	Royal Canadian Air Force	17
Chad	Chad Air Force	1

Country	Air Force	C-130 Aircraft
Chile	Chilean Air Force	4
Colombia	Colombia Air Force	6
Denmark	Royal Danish Air Force	4
Ecuador	Ecuadorian Air Force	3
Egypt	Egyptian Air Force	21
Ethiopia	Ethiopian Air Force	2
France	French Air Force	18
Gabon	Gabon Air Force	1
Germany	German Air Force	2
Greece	Hellenic Air Force	9
India	Indian Air Force	12
Indonesia	Indonesian Air Force	23

Country	Air Force	C-130 Aircraft
Iran	Islamic Republic of Iran Air Force	28
Iraq	Iraqi Air Force	9
Israel	Israel Air and Space Force	13
Italy	Italian Air Force	17
Japan	Japan Air Self-Defense Force	14
Japan	Japan Maritime Self-Defense Force	6
Jordan	Royal Jordanian Air Force	4
South Korea	South Korean Air Force	16
Libya	Libyan Air Force	1
Mexico	Mexican Air Force	3
Morocco	Royal Moroccan Air Force	14
Netherlands	Royal Netherlands Air Force	4
New Zealand	Royal New Zealand Air Force	5
Niger	Niger Armed Forces	1
Nigeria	Nigerian Air Force	3

Country	Air Force	C-130 Aircraft
Norway	Royal Norwegian Air Force	4
Oman	Royal Air Force of Oman	5
Pakistan	Pakistan Air Force	32
Philippines	Philippine Air Force	4
Poland	Polish Air Force	5
Portugal	Portuguese Air Force	4
Qatar	Qatar Emiri Air Force	4
Romania	Romanian Air Force	6
Saudi Arabia	Royal Saudi Air Force	33
Singapore	Republic of Singapore Air Force	5
South Africa	South African Air Force	6
Sri Lanka	Sri Lanka Air Force	2
Sudan	Sudanese Air Force	1
Sweden	Swedish Air Force	5

Country	Air Force	C-130 Aircraft
Taiwan	Republic of China Air Force	20
Thailand	Royal Thai Air Force	12
Tunisia	Tunisian Air Force	4
Turkey	Turkish Air Force	17
UAE	United Arab Emirates Air Force	8
United States	U.S. Air Force	326
United States	U.S. Coast Guard	27
United States	U.S. Marine Corps	60
United States	U.S. Navy	28
Uruguay	Uruguayan Air Force	2
Venezuela	Venezuelan Military Aviation	3

Sources: C-130.net, www.c-130.net; Lockheed Martin, www.lockheedmartin.com; Military Factory, militaryfactory.com; Technical Coordination Group (TCG), http://c130tcg.com; Wikipedia https://en.wikipedia.org.



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The companies listed on the following pages are suppliers of parts, components, systems and repairs for the C-130 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](mailto:r.greenwald@abdonline.com).

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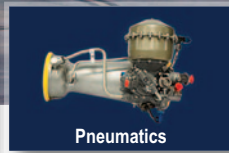
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A C-130 maintainer washes the fuselage of a C-130 Hercules — in just one of many regularly scheduled maintenance tasks. (National Archives and Records Administration.)

## MAINTENANCE INTERVAL CHALLENGES

To ensure the safety of its crews and the readiness and longevity of its fleet, the U.S. Air Force adheres to a strict maintenance regimen for every aircraft. To determine the appropriate intervals between scheduled service stops for various types of planes—maintenance identified within the service as Programmed Depot Maintenance (PDM)—U.S. Air Force engineers carefully consider an array of factors, including the Mission, Design and Series (MDS) of each airframe.

In the case of the Lockheed Martin C-130 Hercules, with hundreds of individual aircraft in service representing decades of innovative use and generations of design and development, the MDS covers a lot of ground. Each C-130's years of service and accumulated flight hours also play an important part in determining maintenance scheduling for the venerable airframe, as corrosion and airframe fatigue are two of the most pressing considerations in determining PDM. As a result, scheduled maintenance for different types of C-130s varies by as much as 21 months, depending on where each type is deployed and its primary use.

In general, C-130s used primarily for transport and cargo delivery are scheduled to receive depot maintenance at around 69-month intervals, while special-use versions of the venerable airframe tend to be scheduled for more frequent service. The AC-130H, for example, which is designed for use in combat conditions requiring long-duration flights and low-altitude operations, is assigned a PDM of 48 months. And most such service keeps an aircraft on the ground (AOG) for three months or more.

Added to the need to ensure every C-130 can continue to be safely flown, maintainer operations play a central role in the efficiency and readiness of the fleet as a whole, and represent a substantial investment. As of 2016, the annual maintenance cost for C-130s (excluding related support costs, such as unit operations and sustainment support) was estimated at about \$1.5 million per aircraft, and that number has risen in the years since.

Sources: Daniels, John A., "C-130 Programmed Depot Maintenance," Wright Flyer Papers No. 1, U.S. Air Force; Maxwell Air Force Base, Alabama, 1998.; U.S. Air Force, "C-130J Hercules Transport Aircraft (C-130J)," Washington, DC: Air Force Acquisition Executive (AFAE) Approved Acquisition Program Baseline (APB), 2018.; U.S. Air Force Technical Manual TO 00-25-4, *Depot Maintenance of Aerospace Vehicles and Training Equipment*. OH: Wright-Patterson Air Force Base, Ohio, 2016.

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A U.S. Air Force HC-130 outfitted with the AN/ARD-17. (Image courtesy of NASA.)

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From the start, the ability to adapt has been an advantage of the Lockheed Martin C-130 Hercules. And as the versatile airframe has moved from one role to another, its systems and equipment have been transformed to fit a wide array of missions.

The evolution of the HC-130H variant, for example, demonstrated the ability of specially modified C-130E aircraft to be deployed for combat search and rescue (CSAR) operations during the Vietnam War. Among the modifications made to the C-130E for such missions, one key component, the AN/ARD-17 aerial tracking system, had a unique lineage.

In its CSAR context, the job of the AN/ARD-17 was straightforward: it was used to locate beacons that downed aircrew deployed after they had reached the ground. Once the airman was located, CSAR forces, deployed in various aircraft, would take steps to suppress enemy fire, enter the contested terrain and complete the rescue.

By the time the HC-130H was deployed on its first CSAR mission in Vietnam in December 1965, the AN/ARD-17 device had been in development for several years, but not for use in combat. The system had its origins in the early years of the U.S. space program, where it was envisioned as a means of tracking and retrieving spacecraft returned to Earth.

During the final flights of the Mercury space program in 1962 and 1963, an early direction-finding device installed on a U.S. Air Force C-130B was able to successfully track the Mercury spacecraft in orbit. Buoyed by the successful test, Air Force officials and their counterparts at the National Aeronautics and Space Administration (NASA) made plans to acquire what would become the AN/ARD-17, with the intent of installing the system on as many as sixty HC-130s. The specially equipped aircraft could then be used to track and recover crewed spacecraft that veered off course from the intended return point.

As things worked out, NASA's ability to accurately predict where its pioneering astronauts would return to Earth mitigated the need for using the system to find wayward spacecraft during the manned Gemini and Apollo flights. But like the aircraft in which it was installed, the AN/ARD-17 system quickly adapted to its new role in the skies of Southeast Asia. Over the course of the war, it played a central part in the U.S. Air Force's CSAR capability, helping establish the Hercules's reputation for transforming its systems and equipment as it moves from role to role.

Sources: Chase, William R. and William A. Middleton, "Apollo Experience Report: The AN/ARD-17 Direction-Finding System," Washington, DC: NASA, March, 1975. Kaminski, Tom, "The Last Days of the King," Key Aero, July 4, 2019.

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 gary@skyoneaerospace.com  
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 All prizes will be drawn on Tuesday, Oct. 25 at 4:00 p.m. at the Wright Media booth (#308).

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thomas.innocenti@teledyne.com  
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120 West Court Square  
Ozark, AL 36360 U.S.A.

THE MODAL SHOP, INC. Booth #: 703  
10310 Aerohub Blvd.  
Cincinnati, OH 45215 U.S.A.

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9400 E. 34th St. N.  
Wichita, KS 67226 U.S.A.

TURBOPOWER, LLC Booth #: 519, 521  
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305-820-3225



Contact: Vlad Miskovic  
vlad.miskovic@turbopowerllc.com  
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Goldsboro, NC 27534 U.S.A.

VETERAN EQUIPMENT SYSTEMS AND SALES Booth #: 620  
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Fairfield, CA 94533 U.S.A.

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sales@volo-aero.com  
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# BACK PAGES

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*Orlando, Florida, is one of the top destinations in the United States. When thinking of this popular vacation area, three places might come to mind: Walt Disney World, Sea World, and Universal Studios. But there is much more to Orlando than Mickey Mouse, Shamu and the ET Adventure.*

*Read on for valuable information on how to have the best possible stay here while attending the 2022 C-130 TCG (WWR).*

## Major Attractions

**01 Walt Disney World**  
Walt Disney World Resort, Orlando, FL 32830  
407-939-7679, www.disneyworld.disney.go.com

**Important Information about Walt Disney World Resort COVID-19 guidelines**  
Please visit [disneyworld.disney.go.com/experience-updates](https://disneyworld.disney.go.com/experience-updates) for updated health and safety measures, face mask and operational guidelines. NOTE: To enter a park, both a park reservation and valid admission for the same park on the same date are required for guests ages 3 and up. Visit <https://disneyworld.disney.go.com/experience-updates/park-reservations> for tickets and reservations.

**NEW! Star Wars-Galaxy's Edge, an All New Land** (Open 9am-10pm)  
Magic Kingdom Park (Open 9am-10pm)  
Epcot-Future World (Open 9am-9pm)  
Disney's Hollywood Studios (Open 9am-9pm)  
Disney's Animal Kingdom Theme Park (Open 9am-9pm)  
Disney's Typhoon Lagoon Water Park (Open 10am-5pm)  
Disney's Blizzard Beach Water Park (Open 10am-5pm)  
Disney Springs (Open 10am-Midnight)

This internationally acclaimed theme park has something for everyone.  
Distance from Caribe Royale Hotel: 2.2 miles // approx. 4 min.







Lake Eola is actually a giant sinkhole.



**02 Universal Studios Florida**  
**Islands of Adventure/ Volcano Bay**  
 6000 Universal Blvd., Orlando, FL 32819  
 407-363-8000, www.universalorlando.com  
 Open daily: (Oct) 9am-7pm (hours fluctuate see website for accuracy) Make sure to check out the new Jurassic World VelociCoaster! Daily Admission: Starting at \$109  
 Offers a unique combination of rides, attractions, and show biz.  
*Distance from Caribe Royale Hotel: 9.3 miles // approx. 14 min.*



**03 SeaWorld Orlando**  
 7007 Sea World Dr., Orlando, FL 32821  
 407-545-5550; www.seaworld.com  
 Open Mon.-Fri.: (Oct.) 10am-6pm & Sat-Sun: 9am-7pm  
 Daily Admission: \$94.99  
 Experience one-of-a-kind attractions, thrilling coasters and up-close animal interactions.  
*Distance from Caribe Royale Hotel: 5.5 miles // approx. 12 min.*



**04 Capone's Dinner & Show**  
 4740 W. Irl Bronson Memorial Highway  
 Kissimmee, FL 34746  
 407-397-2378, www.alcapones.com; Open daily: 7:30pm Shows  
 Daily Admission: \$75.24 and half the price if purchased online! Transport back in time with the show's mobsters, dames and characters for a night of raucous fun.  
 The tickets include a delicious all-you-can-eat dinner buffet.  
*Distance from Caribe Royale Hotel: 3.2 miles // approx. 13 min.*



**05 Kennedy Space Center (Cape Canaveral)**  
 Kennedy Space Center Visitor Complex,  
 Space Commerce Way, Merritt Island, FL 32953  
 855-433-4210  
 www.kennedyspacecenter.com  
 Open daily: (Aug.12-Dec.18) 9am-6pm  
 Daily Admission: \$57  
 Learn about the U.S. national space center and programs.  
*Distance from Caribe Royale Hotel: 57 miles // approx. 53 min.*



**06 Orlando Farmers Market**  
 Lake Eola Park  
 20 N Eola Dr, Orlando, FL 32801  
 Open Sundays: 10:00am-4:00pm.  
 much more than just your average farmers market. Find seasonal fresh produce and more. Get yourself a taste of Florida-fresh produce, specialty foods, art, and entertainment.  
*Distance from Caribe Royale Hotel: 18.67 miles // approx. 33 min.*



**07 Screamin' Gator Zip Line at Gatorland**  
 14501 S. Orange Blossom Trail, Orlando, FL 32837  
 407-855-5496  
 www.gatorland.com  
 Open Daily: 10:00am-5:00pm (Rain or Shine)  
 Daily Admission: Zipline \$70.00. Soar through the air and defy gravity over some of the theme park's star attractions (including Cuban and Nile crocodiles) before heading over the Alligator Breeding Marsh, complete with 130 giant alligators watching from below!  
*Distance from Caribe Royale Hotel: 7.1 miles // approx. 11 min.*

Florida has the most golf courses of any state in America.

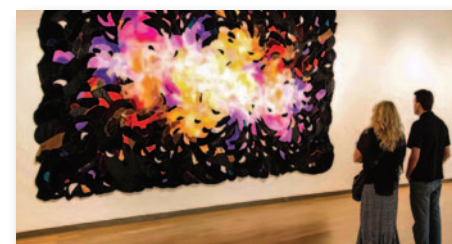


**08 iFly Orlando (indoor Skydiving)**  
 8969 International Dr, Orlando, FL 32819  
 407-337-4359, www.iflyworld.com/orlando  
 Open Mon-Thur: 9:00am-9:30pm, Fri-Sat: 8:30am-10:30pm & Sun: 8:30am-10:30pm  
 Daily Admission: From \$84.99;  
 Float in the air as if you were skydiving, but without having to jump out of an airplane.  
*Distance from Caribe Royale Hotel: 7.7 miles // approx. 11 min.*



**09 Winter Park**  
 Visit the town of Winter Park (only 30 minutes outside Orlando)  
 Central Park, an 11-acre park, lines the heart of the town's shopping district along Park Avenue. Enjoy a relaxing one-hour cruise through the lakes of historic Winter Park.  
*Distance from Caribe Royale Hotel: 7.2 miles // approx. 16 min.*

Take in some culture at...



**10 Orlando Museum of Art**  
 2416 North Mills Ave., Orlando, FL 32803  
 407-896-4231, www.omart.org  
 Tue.-Fri.: 10am-4pm & Sat.-Sun.: 12pm-4pm.  
 Among the best fine art museums in the South with world-class exhibits.  
*Distance from Caribe Royale Hotel: 19.4 miles // approx. 36 min.*

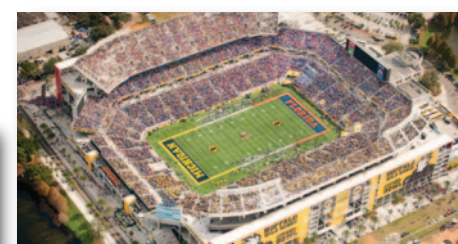
Do something really different...

**11 Blue Water Balloons**  
 1618 Norfolk Court  
 Clermont, FL 34714  
 407-894-5040; Open daily at sunrise.  
 www.adventuresinflorida.com  
 Hot air balloon ride. Daily Admission: \$175 (\$10 off per person with coupon on website.)  
*Distance from Caribe Royale Hotel: 14.8 miles // approx. 28 min.*

Other Sports and Activities



**12 Big Toho Airboat Rides**  
 2017 Neptune Rd., Kissimmee, FL 34744  
 321-624-2398; Open daily: 9am-5pm.  
 www.bigtohoairboatrides.com  
 "Airboat rides at the extreme Gators in the headwaters to the everglades.." Day or night airboat rides \$35 and up. Fishing is also an option.  
*Distance from Caribe Royale Hotel: 14.3 miles // approx. 18 min.*



**13 Florida Citrus Sports**  
 1 Citrus Bowl Pl.  
 Orlando, FL 32805  
 407-423-2476, www.fcsports.com  
 Open Mon.-Thurs.: 8:30am-5pm.; Fri.: 8:30-1pm.  
 Home of the Capital One Bowl, the University of Central Florida and Jones High School football teams, the organization's vision is to become the nation's premier venue for sports events.  
*Distance from Caribe Royale Hotel: 24.9 miles // approx. 27 min.*

Golf \$ - Under \$20, \$\$ - \$20-49, \$\$\$ - \$50-79

**Hawk's Landing Golf Club \$\$\$**  
 8701 World Center Dr., Orlando, FL 32821;  
 800-567-2623, www.hawkslandingcc.com;  
 Open 7am-6pm  
 This golf course offers 18 holes, 6,900 yards, and is par 72. Wrapping itself around the Marriot Hotel Convention Center, it is a "relatively flat" course that was redesigned in 2001. Come for the big Tidwarf greens, with water coming to play on 15 holes, rolling fairways, and native scenery.  
*Distance from Caribe Royale Hotel: 1 mile // approx. 4 min.*

**Eagle Creek Golf Club \$**  
 10350 Emerson Lake Blvd., Orlando FL, 32832  
 407-273-4653, www.eaglecreekorlando.com  
 Open Mon.-Fri. 8am-8pm  
 Designed by world-renowned golf course architects Ron Garl and Howard Swan, Eagle Creek is an extraordinary 18-hole, 7198-yard, Par 73 championship course with five sets of tees for golfers of all skill levels.  
*Distance from Caribe Royale Hotel: 18.9 miles // approx. 24 min.*

The Walt Disney World Resort in Orlando has some beautiful and unique courses that are open to the public, although they are a bit pricey. Golf carts include the latest GPS Technology, displaying images of greens, hazards, and fairways and even three-dimensional views of each hole. For information, call 407-939-4653 or visit www.golfwdw.com

**Disney's Magnolia/ Disney's Palm \$\$+**  
 1950 W. Magnolia Palm Dr.  
 Lake Buena Vista, FL 32830  
 Open Mon.-Thur.: 6:30am-8:30pm,  
 Fri.: 6am-8:30pm & Sat.-Sun.: 6am-9pm.  
 Choose from five color-coded tees up to 7,516 yards at par 72. Slope ratings range from 123 to 140. With a classic PGA style, this championship course has wide fairways and a Mickey Mouse sand trap on the 6th hole.  
*Distance from Caribe Royale Hotel: 8.2 miles // approx. 14 min.*

**Disney's Palm \$\$+**  
 The 18-hole championship course features shimmering lakes, tropical sands, palm trees and sloping greens. It is rated 4 stars by *Golf Digest* and includes 9 holes with water hazards and 59 bunkers.

**Disney's Lake Buena Vista \$\$+**  
 1960 Broadway, Lake Buena Vista, FL 32830;  
 Open Mon.-Thur.: 6:30am-8:30pm, Fri.: 6am-8:30pm & Sat.-Sun.: 6am-9pm.  
 The 18-hole course was certified by Audubon International as a Cooperative Wildlife Sanctuary and rated 4 stars by *Golf Digest*.  
*Distance from Caribe Royale Hotel: 4.6 miles // approx. 10 min.*



## Shopping

Shop Orlando!  
If you love to shop, Downtown Orlando, International Drive and the Outlets should be on your hot-spots-to-shop list. The Downtown area (Orange Ave., (Antique Row) Church Street, Pine Street, Magnolia Ave, Central Boulevard) is a great location for the random city shopper. You'll find antiques, art, books, gift shops, music, clothes, jewelry and more. If you cruise down International Drive, you're bound to find some place to spend your money, whether it's at a mall, a designer boutique or a lovely outdoor shopping center.

**14 Florida Mall**  
8001 S. Orange Blossom Trail  
Orlando, FL 32809; 407-851-7234  
www.simon.com/mall/the-florida-mall  
Open Mon.-Fri.: 10am-9pm, Sat.:10am-10pm;  
Sun.: 12pm-8pm.  
The largest shopping center in central Florida.

**15 The Mall at Millenia**  
4200 Conroy Rd.  
Orlando, FL 32839  
407-363-3555; www.mallatmillenia.com  
Open Mon.-Thur.: 11am-8pm; Fri. & Sat.:10am-9pm;  
Sun.: 11am-7pm  
The Mall at Millenia is the major upscale shopping destination in the Orlando area.

**16 Lake Buena Vista Factory Stores**  
15657 S. Apopka Vineland Rd.  
Orlando, FL 32821  
407-238-9301, www.lbvfs.com  
Open Mon.-Sat.: 10am-9pm; Sun: 10am-7pm.  
Designer and name brand shopping center.



## Night Life

**17** Downtown Orlando:  
**Mango's Tropical Café**  
8126 International Dr., Orlando, FL 32819  
407-673-4422; www.mangos.com/mangos-orlando  
Open Daily 11:45am-5am  
The best dinner show & nightclub in Orlando.

**18 Bösendorfer Lounge**  
325 S. Orange Ave.Orlando, FL 32801  
866-663-0024  
www.kesslercollection.com/bohemian-Orlando  
Open Sun.-Thur.: 11am-12:30am;  
Fri.-Sat.: 11am-1:30am. Jazz and blues lounge,  
serving great martinis; a little pricey, dressy casual.

**19 Bull and Bush**  
2408 E. Robinson St.,  
Orlando, FL 32803  
407-896-7546, www.bullandbushorlando.com  
Open Mon.-Thur.: 5pm-12am; Fri.-Sat. 5pm-2am.  
British pub, Scotch eggs and darts.

**20 Latitudes**  
33 W. Church St.  
Orlando, FL 32801  
407-649-4270; www.churchstreetbars.com  
Open Sun.-Mon 9pm-2am, Fri. 4pm-2am, Sat. 6pm-  
2am. Rooftop bar, a nice view and island ambiance.



## Restaurants

**21 Bahama Breeze**  
8849 International Drive  
Orlando, FL 32819  
Open everyday.: 11am-11pm  
407-248-2499; www.bahamabreeze.com  
Live reggae music and Caribbean cuisine.

**22 Old Hickory Steakhouse at Gaylord**  
Palms Hotel, 6000 W. Osceola Parkway  
Kissimmee, FL 34746  
407-586-1600  
Open Fri.-Sat. 5pm-10pm (only)  
Have a good meal in a steak house with an  
Everglades ambiance.

**23 The Venetian Chop House at Caribe**  
Royale Hotel  
Caribe Royale Hotel  
8101 World Center Drive, Orlando, FL 32821  
407-238-8060  
www.cariberoyale.com/dining-en.html  
Open Tues-Sat.: 6pm-10pm.  
A good choice for upscale fine dining.

*Make Sure Not  
to Miss!*

**24 2022 EPCOT International Food & Wine Festival**  
July 14-November 19, 2022  
Walt Disney World Resort; 407-939-5277  
A spectacular celebration of global cuisines, music & more! Explore international food kiosks, enjoy live performances and wet your appetite with all-new events, guest chefs and Marketplace additions.

## Beaches

Not too far Orlando (ranging from 45 minutes to about 1 hour away), there are some pretty nice beaches just waiting for you to dip your feet in their waters. Among them are Cocoa Beach, New Smyrna Beach and even Daytona Beach, up north on the eastern coast of Florida.

**Cocoa Beach**  
(321-868-3200)  
www.cityofcocoabeach.com  
This beach is the closest to Orlando. Plus, it's only 15 miles from Port Canaveral, near the John F. Kennedy Space Center.

**Daytona Beach**  
(386-255-0415)  
www.daytonabeach.com  
This "world's most famous beach" is about an hour from Orlando.

**Melbourne Beach**  
(321-724-5860)  
www.melbournebeachfl.org  
A little more than an hour away, off the mainland and over the Indian River Lagoon, lies this quiet beach.

**New Smyrna Beach**  
(386-410-2600)  
www.visitnsbfl.com  
An inviting white sandy beach, alongside the charming town of New Smyrna.

*It's claimed that the first sunblock was invented in Miami Beach, in 1944, by pharmacist Benjamin Green. Called Red Vet Pet (it was a red gel) it was used to protect American GIs from the sun in World War II. He later added cocoa butter to develop what eventually became suntan lotion.*



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**C130J TCG; Oct 24th – 28th** at the Caribe Royale Hotel and Convention Center in Orlando, FL.

