



INTRODUCING THE GREEN FRONT-LINE PROJECT



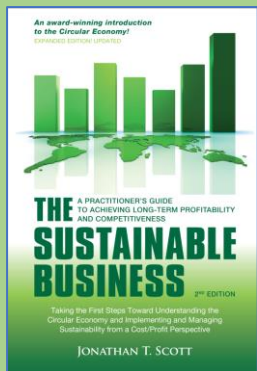
- A sustainable development initiative designed to:
- Increase productivity (e.g.: crop yields),
 - Eliminate waste and pollutants,
 - Generate revenue growth,
 - Create jobs (and a more diverse workforce), and
 - Increase the collection of data to help fight against climate change

Sustainability is defined as ‘the capacity to continue into the long-term.’

Waste is defined as ‘not achieving 100% of purchases and investments.’

...using local skills, local labor, and local infrastructure.

<https://www.efmdglobal.org/knowledge/sustainability-entrepreneurship/>



Background Information...

The **GREEN FRONT-LINE** project is guided by the following criteria:

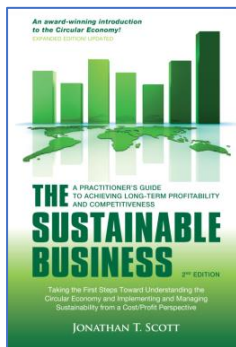
- **Affordability** - tools, equipment, and related costs (purchase price and operation costs) must be within the financial reach of intended users,
- **Availability** - equipment, tools, and parts must be easy to find and obtain,
- **Accessibility** - instruction or training must be easily accessible and easy to use *and* all equipment must be easy to maintain and repair.

Our Objectives:

Eliminate Waste and Pollutants | Reduce Resource Use | Increase Production (i.e.: crop yields)

Generate More Revenue | Job Creation and Inclusion

Create, Develop and Strengthen Cooperative Networks



Background information...



708 kilometers (440 miles)

As the profound effects of global weather pattern shifts (climate change) continue to unfold, collecting large amounts of data quickly and efficiently is an imperative to help prevent loss of life and property and to rapidly detect the onset of plant *diseases, moulds, pests, soil problems* and *fires* - each of which can wipe out crops or forests in 48-hours or less.



1,500 meters
(4,921 feet)



The main goal of the **Green Front-Line** project is to prove that it's possible to 'do more with less' in the field of aerial-imaging and observation. And the simplest way to begin collecting data over a large region is to position imaging cameras high enough to do that type of work.

For Example: a manned aircraft flying 90 kph and at 1,500 meters (4,920 feet) can collect data images from 30,000 acres (12,140 hectares) in about one hour.

Note that a drone needs six weeks or more to cover the same area!



500 meters
(1,640 feet)

120 meters
(400 feet)



This is how USDA* explains it... (*the United States Department of Agriculture)

“Every aerial-imaging platform has advantages and disadvantages. High-resolution commercial satellite, for example, can cover massive areas of land... but cost and availability are issues. For example, farmers may not be able to get images when they need them because satellites can’t collect images through clouds. Competition among customers can also be challenging, in that other people often compete for the same time. Additionally, most high-resolution satellite sensors have to be positioned correctly before they can focus on a particular target area.

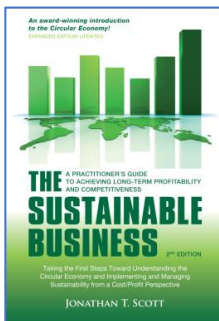
Drones can deliver very detailed, high-resolution images... and when flown low enough, each pixel may cover a 1-inch by 1-inch square area or even 1 cm by 1 cm. Also, because drones can fly very low, it’s possible to collect images of individual leaves or flowers on one plant. But from a practical standpoint, plant- or leaf-level details aren’t necessary for most field applications. Most farmers need images at the 1-foot (30.5 cm), 2-feet (61 cm), even 3-feet (91 cm) root-spacing width. Unfortunately, drones can’t do that. You have to fly very high to obtain foot-level to meter-level pixel resolution. Moreover, drones are constrained by technological and regulatory limitations that include a 400-foot (122 meter) flight-height ceiling, slow flight speeds, short battery life, and a smaller camera payload. In general, drones are best suited for covering smaller areas, such as a single field, and collecting images during early growth stages.

After years of research and testing different aerial imaging systems, (USDA) has determined that, more often than not, manned aircraft are the most practical way for farmers to obtain aerial images because manned aircraft can fly as low 100 feet to over 10,000 feet (30 meters to 3,000 meters) which enables images to be captured almost any time they’re needed.”

Chenghai Yang, PhD, Research Agricultural Engineer, United States Department of Agriculture (USDA), Agricultural Research Service (ARS), Aerial Application Technology Research Unit.

Source: 'Farmer's Eyes in the Sky' by Jay Calleja, *Agricultural Aviation* (Summer 2018)

https://www.agaviationmagazine.org/agriculturalaviation/summer_2018/MobilePagedArticle.action?articleId=1411364#articleId1411364



One More Time...

Aerial-Imaging Illustrated



708 kilometers (440 miles)

Satellites are suitable for imaging large geographic areas, but they are limited by *cloud cover* and *availability* (every 1-16 days due to their orbits) and booking time can be *expensive* (usually a minimum purchase limit of between 25-50 square kilometers at a cost of \$15-\$25 or more per square kilometer).

1,500 meters (4,921 feet)



Manned aircraft can do just about everything associated with imaging, but are prone to wind and weather conditions. Also, typical four-seat and six-seat aircraft are expensive to operate and maintain (particularly when they're used solely to carry cameras that only weigh a few pounds).

500 meters (1,600 feet)



Drones can cover small areas and produce high spatial resolution, but *height, weight* and *flight-distance restrictions* limit their range and abilities.

120 meters (400 feet)










Note that without a waiver or exemption, **drones cannot legally fly higher than 120 meters (400 feet)** over terrain or an object being observed.

Additionally, most drones can only stay aloft for 30-minutes or so at a time without changing batteries.

Many pilots of manned aircraft will not fly in areas where drones are being operated.

Note that **expense** is one of the greatest obstacles of aerial-imaging and aerial observation. Typical **expenses** include: purchase price, operation costs, storage (hangar) fees, and maintenance/repairs.

 DJI Agros T30 \$18,000	 SWT Agriculture UAV \$16,640	 Leica Aibot SX RTK \$50,000
 Freefly Alta X \$21,800	 SkyEye VTOL Modular \$42,000	 AVICUAV Petrol \$120,000
 Yuneec H850 RTK \$7,400	 VTOL UAV Fixed Wing \$70,000	
 DJI Phantom 4 Ag \$6,500		

 Cessna 172 \$100,000 (used) \$400,000+ (new)	 Magni Gyro M-16 \$65,000+ (new)
 Cessna 152 \$45,000 (used/repaired)	 Carbon Fiber Light Sport Aircraft (LSA) \$100,000+ (new)
 Magni M-24 Orion \$85,000 - \$90,000+ (new)	

Annual Operation and Maintenance Costs:

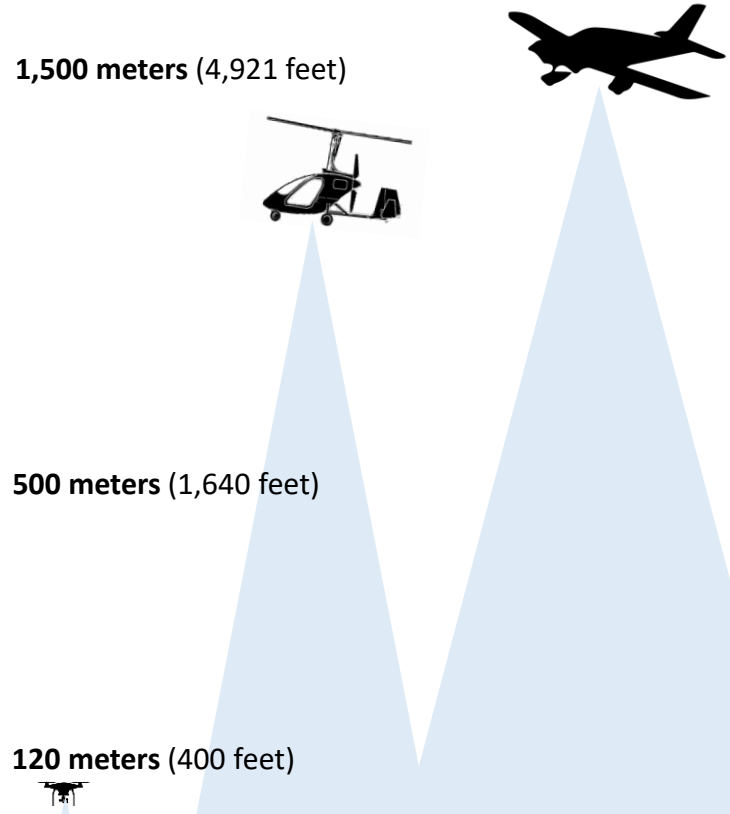
LSA/Gyroplane: **\$10,000+** Cessna: **\$15,000+**



Hey! It's not uncommon for work drones to cost more than small manned aircraft!
And some drones need 16 battery changes and 8-hours of flight time to cover 1,000 acres.

(A manned-aircraft can easily cover 1,000 acres in a few minutes)

The first phase of the **Green Front-Line** project was conducted at the *United State Department of Agriculture (USDA)* research facility in Bryan, Texas. It involved using smaller more fuel-efficient *Light Sport Aircraft (LSA's)* instead of the USDA's normal aerial-imaging aircraft. The following results were achieved (and published):



- **Leaded aviation fuel replaced** with **less-polluting** unleaded petrol,
- **Fuel consumption lowered** from 15-20 gallons per hour to 5-7 gallons per hour,
- **Hourly fuel costs cut** from approx. \$125 per hour to \$15 per hour (based on June 2021 fuel prices),
- **Reductions in GHG emissions** (70% or more),
- **Maintenance cost reductions** including no 50-hour oil changes or spark plug cleaning,
- **Purchase price decreases** (it was revealed that equipment costs of \$200,000 to \$1-million could be reduced to between \$20,000 and \$100,000),
- **Work/Time savings using small aircraft are identical compared to larger aircraft** small manned aircraft can cover 30,000 acres in one hour (drones need five-weeks or more to cover 30,000 acres),
- **Less hangar space** up to 60% less storage space is needed with smaller aircraft

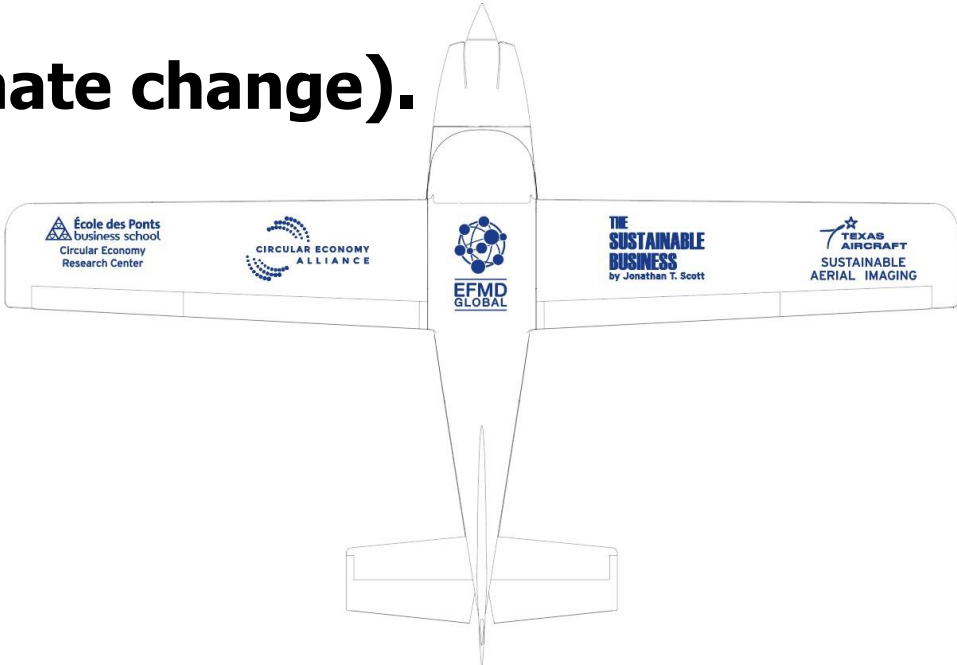
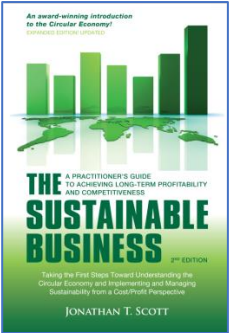


You can read about it here:

The Benefits of Collaborative Front-Line Research, *Global Focus*, Vol. 16 issue 01-2022

https://www.globalfocusmagazine.com/wp-content/uploads/2020/10/GF_1601_The-benefits-of-collaborative-front-line-research.pdf

Our time at the *United States Department of Agriculture* (USDA) was so productive, we've been invited back in 2023 so the *Aerial Technology Research Center* team can analyze several more of our pioneering concepts... all of which are designed to make aerial-imaging more affordable, available and accessible (and help fight against climate change).



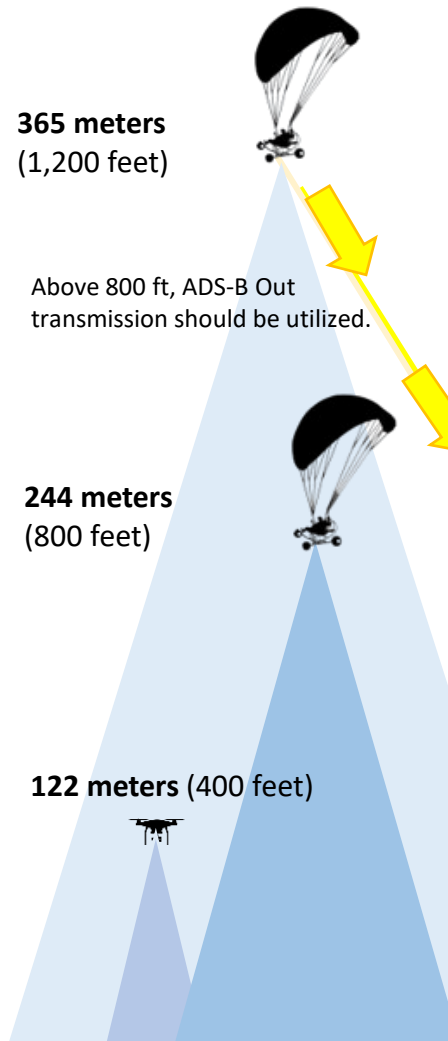
The first concept is called 'Bridging', which is named after *Ecole des Ponts* (School of Bridges), the world's first, and oldest, school of engineering:

1.3 kilometers
(4,300 feet)

Bridging involves removing the exterior camera on a manned aircraft and replacing it with a drone. Why? Because it produces *synergy* (i.e.: a greater total effect than each entity or device can produce on its own).

'Bridging' eliminates the height, weight, and distance limitations of the drone... while simultaneously enabling a manned aircraft to transmit live video to a ground crew!

Note that building a live-transmission system from scratch can cost over \$15,000... and would require the pilot to aim a directional antenna at a ground crew while flying, which is not practical!



Additional benefits of *Bridging*...

When not using its motors, a drone mounted on an aircraft can **transmit live video for as long as the aircraft is in the air (4-5 hours)**.

***Bridging* a drone** and an aircraft also enables the owner/operator to afford two different aerial platforms, which can be used **separately** or **together** to suit operational conditions. For example, if it's too windy to fly the aircraft, you can probably fly the drone.

Throughout 2023, we hope to explore **this concept more and provide answers to numerous questions.** Which affordable cameras/drones are the best? What flight-heights provide optimal results? How fast (or slow) should you fly to meet your needs? And so on...



Almost any small drone can be mounted onto an aircraft. In this photo, a *DJI Phantom 4* has been attached to a *Sky Kart*.

1,200 feet
(365 meters)

Note: Above 800 ft, ADS-B Out transmission should be utilized.

800 feet
(244 meters)

400 feet (122 meters)

And we would like to continue working on...

Wildfire Prevention and Detection

In 2022, we started designing a program that uses thermal cameras to detect 'hotspots' before they become wildfires. Unfortunately, thermal cameras are expensive, so funding is needed to carry this project over the finish line.

Our Objective:
Make wildfire detection
more efficient,
more effective, and less costly!

On average, **over the past 30 years, wildfires seasons have doubled** from 40 days to 80 days. Wildfires are also becoming larger, more frequent, more intense and more destructive.

Source: *Why are Forest Fires Becoming More Destructive?*, FireSafe Council, 16 March 2022.

Extreme **wildfires** are also predicted to become **more frequent**, with a **global increase of up to 14%** by 2030 (compared to the number recorded in 2010-2020). And if trends continue, extreme fires may **increase to 30%** by 2050 and **50%** by the end of the century.

Source: *Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires*, UNEP and GRID-Arendal, 23 Feb 2022.

Focus on Cause not Effect: Aerial-Imaging, Agriculture, and Job Creation

From: *University EARTH*

“In Costa Rica, a farm owner **increased his harvest by 33% and his profits by \$200 per hectare** using aerial-imaging to **decrease chemical use**. The results were so successful, he converted 300-hectares of his land into a pesticide-free operation and now only adds nutrients (such as phosphorous) when they're needed.”

Source: *University-EARTH* (6 April 2018) <https://www.earth.ac.cr/en/feature/making-precision-accessible/>

Note that increases in crop yields, revenues and profits, combined with decreases in costs, sets the stage for job creation!

From: *Agricultural Aviation*:

“The cost savings that aerial images can provide for land managers are significant. For example, if a grower only has to spray 30% of a 300-acre plot, and the spray product costs \$50 an acre, it would take \$15,000 of product to spray the entire field, versus \$4,500 to spray 90 acres, or 30% of the field.”

Source: 'Remote Sensing Platforms and Equipment' by Chenghai Yang, *Agricultural Aviation* (Summer 2018) https://www.agaviationmagazine.org/agriculturalaviation/summer_2018/MobilePagedReplica.action?pm=2&folio=30#pg32

From: *The Washington Post*

“*Homeland Security* officials in the United States have discovered that the cause of a puzzling increase in the number of Latin American families showing up at the U.S. border seeking asylum is not due to a spike in violence within their home regions, but a growing hunger crisis. According to the *U.S. Customs and Border Protection* (USCBP) agency, ‘food insecurity’ issues are being reported by the *United States Agency for International Development* (USAID) and USCBP intelligence assessments. Years of meager harvests, drought, and the devastating effects of “coffee rust” fungus in an industry that employs large numbers of rural farmers, is speeding up the exodus of families from villages bereft of jobs and food. ...analysis of current regional migration surges indicates that “the root causes of emigration could be alleviated by reducing hunger and creating jobs.”

Hunger Not Violence Fuels Guatemalan Migration Surge, US Says, *Washington Post*, Sept 22, 2018 https://www.washingtonpost.com/world/national-security/hunger-not-violence-fuels-guatemalan-migration-surge-us-says/2018/09/21/65c6a546-bdb3-11e8-be70-52bd11fe18af_story.html

The Green Front-Line (Proposed Final Stage – 2024/2025)

Objective: Introduce the concepts we've tested to regions of the world that need low cost aerial-imaging.

Proposed Location of the Pilot Project: **Panama**

Social media will be used to broadcast on-going methods and results:

Our co-op achieved a 26% increase in revenue thanks to larger crop yields, which enabled us to hire 1 full-time and 2 part-time workers...

Insert photo of local people

We are the Green Front-Line!

I now receive 10 times more data and can stop small problems from becoming big problems faster than ever before...

Insert photo of local farmer

I am the Green Front-Line!

We're operating a new program that has eliminated 34% of crop waste in our region...

Insert photos of local co-op administrators

We are the Green Front-Line!

My fuel expenses dropped from over \$200 per hour to \$5 per hour...

Insert photo of local participant

I am the Green Front-Line!

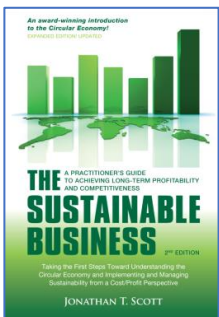
Location requirements:

- (1) **Stable growing season** (year-round is best),
- (2) **Political stability,**
- (3) **Government encouragement** (local, regional, and national)
- (4) **Local agricultural universities,**
- (5) **Research outcomes can be published,**
- (6) **Improvements in agriculture (crop yields) is desired by all involved,**
- (7) **Agricultural regions have relatively low annual wind speeds.**

Separate funding is needed to conduct the final stage!

The **waste elimination** and **waste prevention** concepts explained in *The Sustainable Business* are the bedrock on which much of the Green Front-Line is based (Note: these concepts can be applied in *any* business or industry).

<https://www.efmdglobal.org/knowledge/sustainability-entrepreneurship/>



Green Front-Line derivatives...

Additional aerial-imaging uses:

- Damage Control & Assessment
- Search & Rescue
- City Planning (mapping)
- Land Management & Forestry
- Safety & Security (incl. border patrol)
- Wildlife & Conservation Data Collection
- Water Detection
- Coastal Erosion
- Archaeology
- LiDAR... and more.



Our work was featured in the May 2002 edition of North America's premier aviation publication.

<https://www.flyingmag.com/will-mosaic-allow-lsas-to-do-more/>

**It's time to take
action, enable others,
and produce results!**



Project creator and director Jonathan T. Scott flying the Sky Kart.

Police, Fire Departments, Security Professionals, Land Managers, City Planning, Public Safety, etc...

Need Affordable, Available, and Accessible Aerial Observation!

From: **52par.com** (April 2019)

...As government agencies around the world look to reduce expenditures, many public departments are being forced to rethink their operations. Police forces are no exception... and aerial reconnaissance and assistance is a vital part of modern policing.

In Palm Bay, Florida, Police often get called to look for missing persons or stolen vehicles in the vast countryside surrounding the city. On foot, it takes an entire day for at least 20 officers to search a tiny area of densely vegetated countryside. PPG aircraft seemed an unlikely solution, but a very low purchase price and affordable operation costs prompted a rethink. Able to fly at low speeds and at low altitudes, with an excellent field of vision, paramotors proved to be an invaluable asset. Additionally, PPG's are easy to transport and can launch and land in minutes from most open spaces... and yet the total costs involved with owning and regularly using PPG units are less than a few day's use of a helicopter.

From: **Pensacola, Florida** (May 2021)

Law enforcement officials spent months trying to locate a meth lab that was hidden amongst thousands of acres of scrub brush, palmetto bushes and trees. Eventually, they asked the pilot of a small two-seater aircraft to slowly fly over the region (higher than a drone can legally operate) while a police officer scanned the area with a hand-held thermal monocular. The meth lab was located in less than ten minutes.

(This story was told to us by the pilot)

From: **SkiesMag.com** (Dec 7, 2021)

...“Oftentimes, police aviation units want the biggest, baddest equipment available” - typically a helicopter, which is expensive to buy, maintain, and fly. Yet only about 3% of all police forces actually conduct search-and-rescue operations where a helicopter is required. The fact is that too many police units buy expensive aircraft that then sit in a hangar because small town budgets can't afford the flight time.

From the archives: **The Los Angeles Times** (March 27, 1986)

For small cities... ultralights are a bargain, say police officials in Downey, Monterey Park and Tempe, Ariz., where ultralights are used successfully to apprehend burglars and car thieves...

A new police helicopter can cost as much as \$450,000, whereas an ultralight costs around \$13,000 and can, within minutes, reach any spot in the 12.8-square-mile city. From 1,000 feet, the pilot has a panorama of every street and alley in the city and can see a burglar hopping over a fence, distinguish makes and models of cars, and even determine the sex and clothing of people on the ground.

The ultralight has proved itself beyond a doubt, said a Downey police officer. Since February 1983, it has been useful in more than 100 felony and misdemeanor arrests. In 1985, the ultralight flew 300 hours and was used in 26 felony arrests for crimes such as burglary, armed robbery, grand theft, car theft, receiving stolen property and cultivation of marijuana.

We have an airfield, a hangar, pilots, aircraft, tools, and lots of experience at our disposal as well as a great team and a responsive network. But funding is needed to continue the **GREEN FRONT-LINE project.**

A reminder of our objectives:

(1) introduce measurable sustainability/circular actions into regions of the world where they're needed (in cooperation with local infrastructure), (2) reduce resource use, (3) eliminate waste, (4) boost work outputs and (4) increase revenues... ultimately leading to (5) job creation.

We're making difference and producing results!

We are the Circular Economy in action!

Would you like to join us?



The Green Front-Line works with

(but is not funded by)



The **Green Front-Line** consists solely of volunteer labor, but needs funding to help push 'Stage 2' over the finish line!

€25,000 - €30,000 funding will help pay for...

- Aircraft leasing
- Equipment purchases
- Hangar/Storage fees
- Maintenance/Parts
- Operation costs (fuel, etc)
- Travel expenses