New Developments in Aerospace Transportation Vehicles

Presented to: 14th Annual V&V Summit

By: Dr. Melchor Antuñano

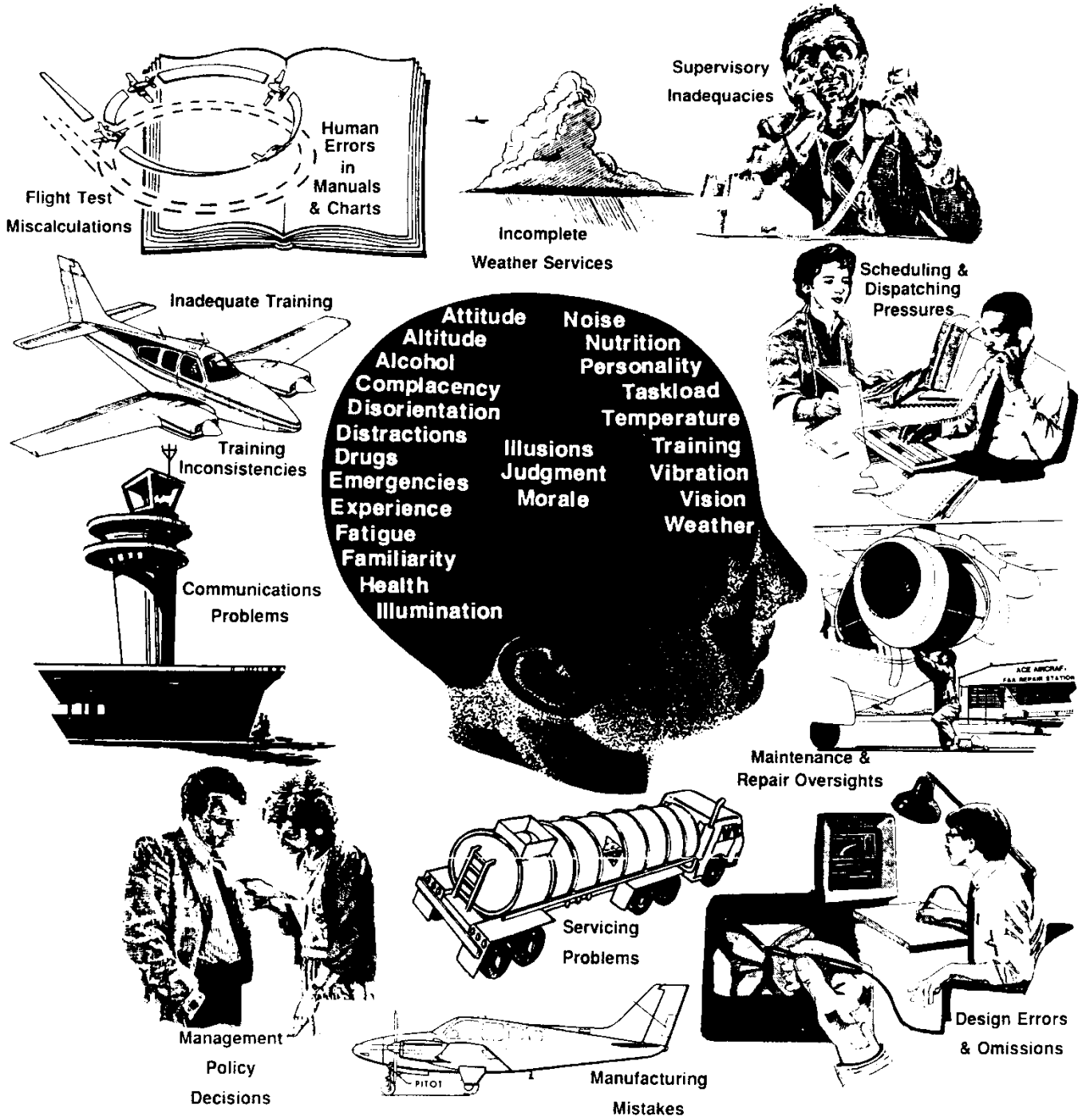
Date: September 25, 2019

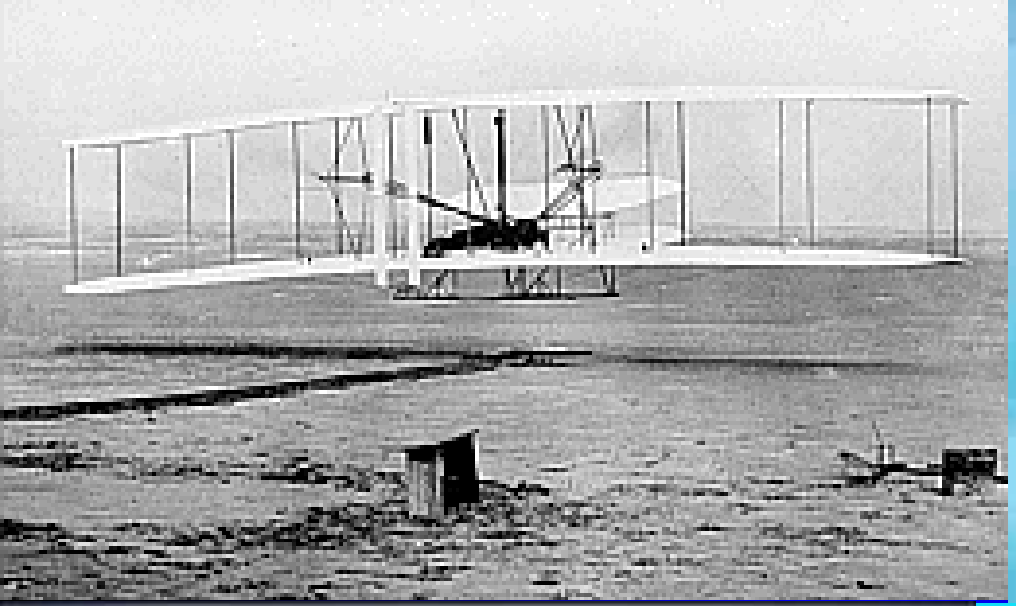

TECHNORAMA

HUMAN FACTORS
(ICAO Definition)

"Human Factors is about people; it is about people in their working and living environments, and it is about their relationship with equipment, procedures and the environment. Just as important, it is about their relationship with other people. Its twin objectives can be seen as safety and efficiency."

The Weak Link is the Human Being


Human Errors in Manuals & Charts
Flight Test Miscalculations
Supervisory Inadequacies
Incomplete Weather Services
Inadequate Training
Training Inconsistencies
Attitude
Altitude
Alcohol
Complacency
Disorientation
Distractions
Drugs
Emergencies
Experience
Fatigue
Familiarity
Health
Illumination
Noise
Nutrition
Personality
Taskload
Temperature
Illusions
Judgment
Morale
Training
Vibration
Vision
Weather
Scheduling & Dispatching Pressures
Communications Problems
Maintenance & Repair Oversights
Servicing Problems
Management Policy Decisions
Manufacturing Mistakes
Design Errors & Omissions



project Ornithopter

Dr. DeLaurier's Ornithopter – University of Toronto

Newest Wide Body Transport Aircraft

B-787


AIRBUS A350
A350


A-350
© AIRBUS S.A.S. 2013 - photo by e*m company / P. MASCLET
AIRBUS


AIRBUS
AIRBUS


A380
RBS
P
A380
only
Lufthansa
© Copyright Airbus - photo by exm company H.

SIMULATED EVACUATION

(03/27/2006)

853 passengers and 20 crew

Completed in 80 seconds

8 of 16 doors in operation

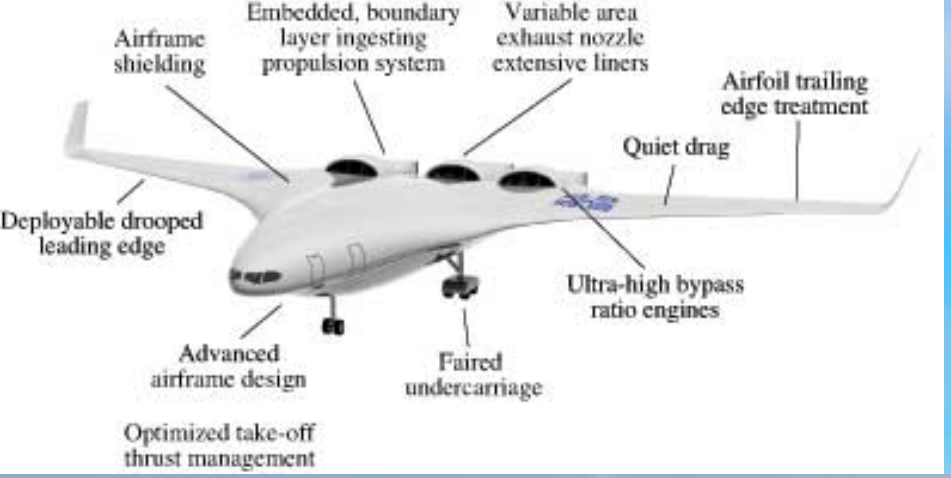
33 injuries (including 1 leg fracture)

The Future?

JOHN McMASTERS' SUPER CLIPPER

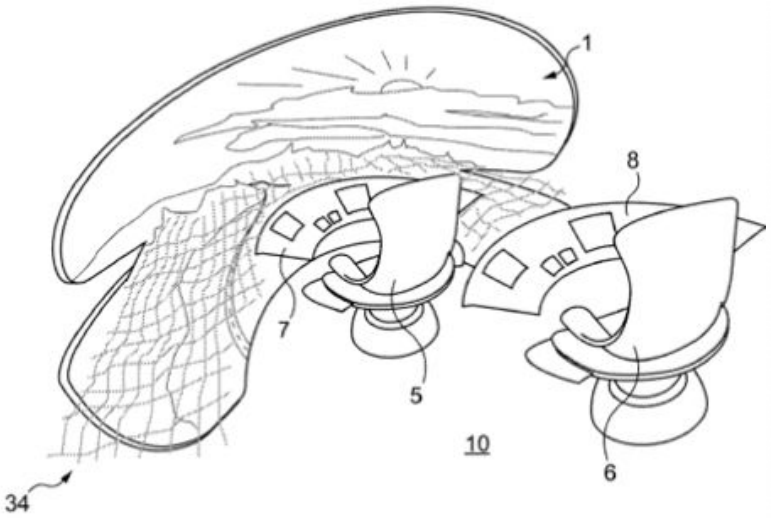
A supersized flying boat could pack passengers in wings, pontoons, and fuselage with room left over for play areas.

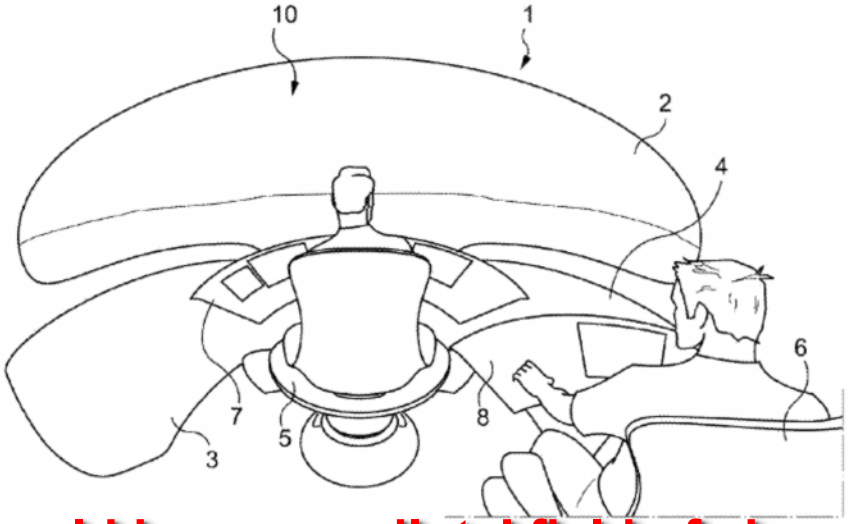
Future Silent Aircraft


Airframe shielding
Embedded, boundary layer ingesting propulsion system
Variable area exhaust nozzle extensive liners
Airfoil trailing edge treatment
Quiet drag
Deployable drooped leading edge
Ultra-high bypass ratio engines
Advanced airframe design
Faired undercarriage
Optimized take-off thrust management

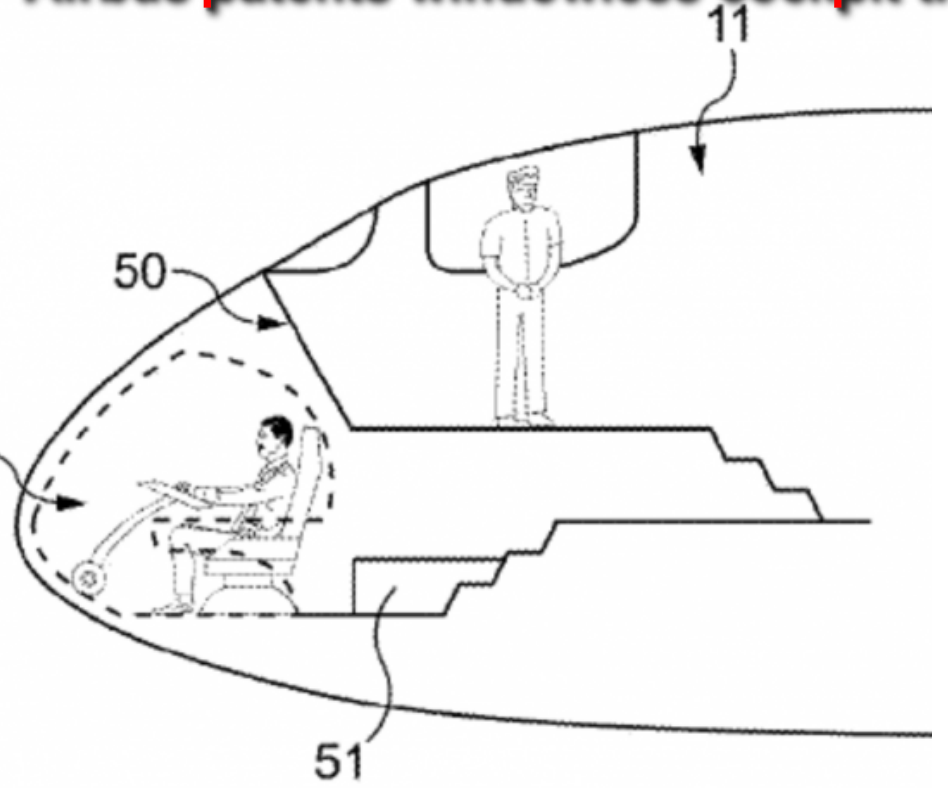

SAX-40
SAX-40

Future Occupant-Centered Aircraft Designs





Airbus patents windowless cockpit that would increase pilots' field of view



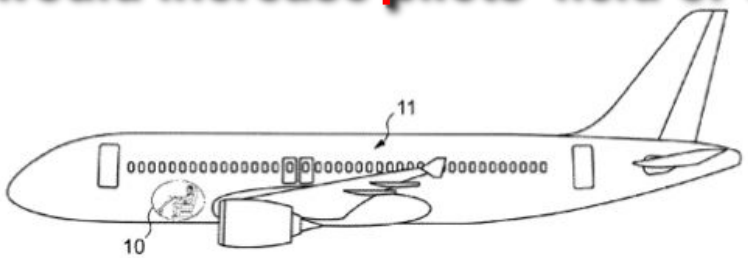


Fig. 5

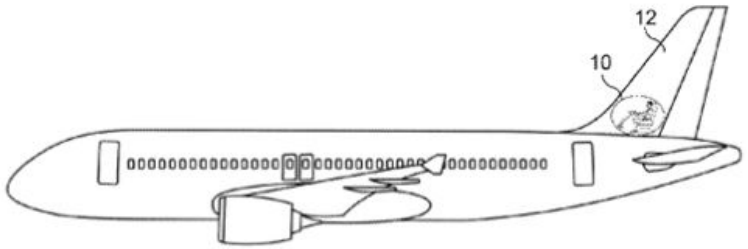
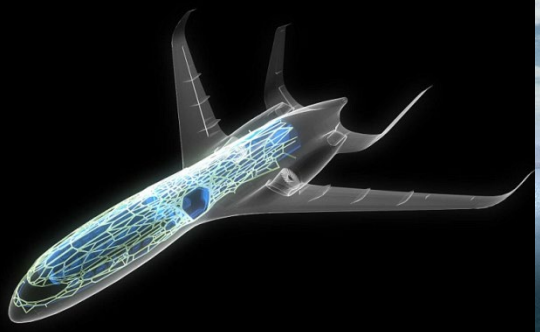
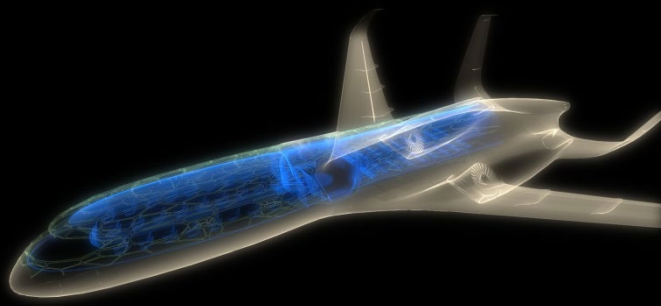


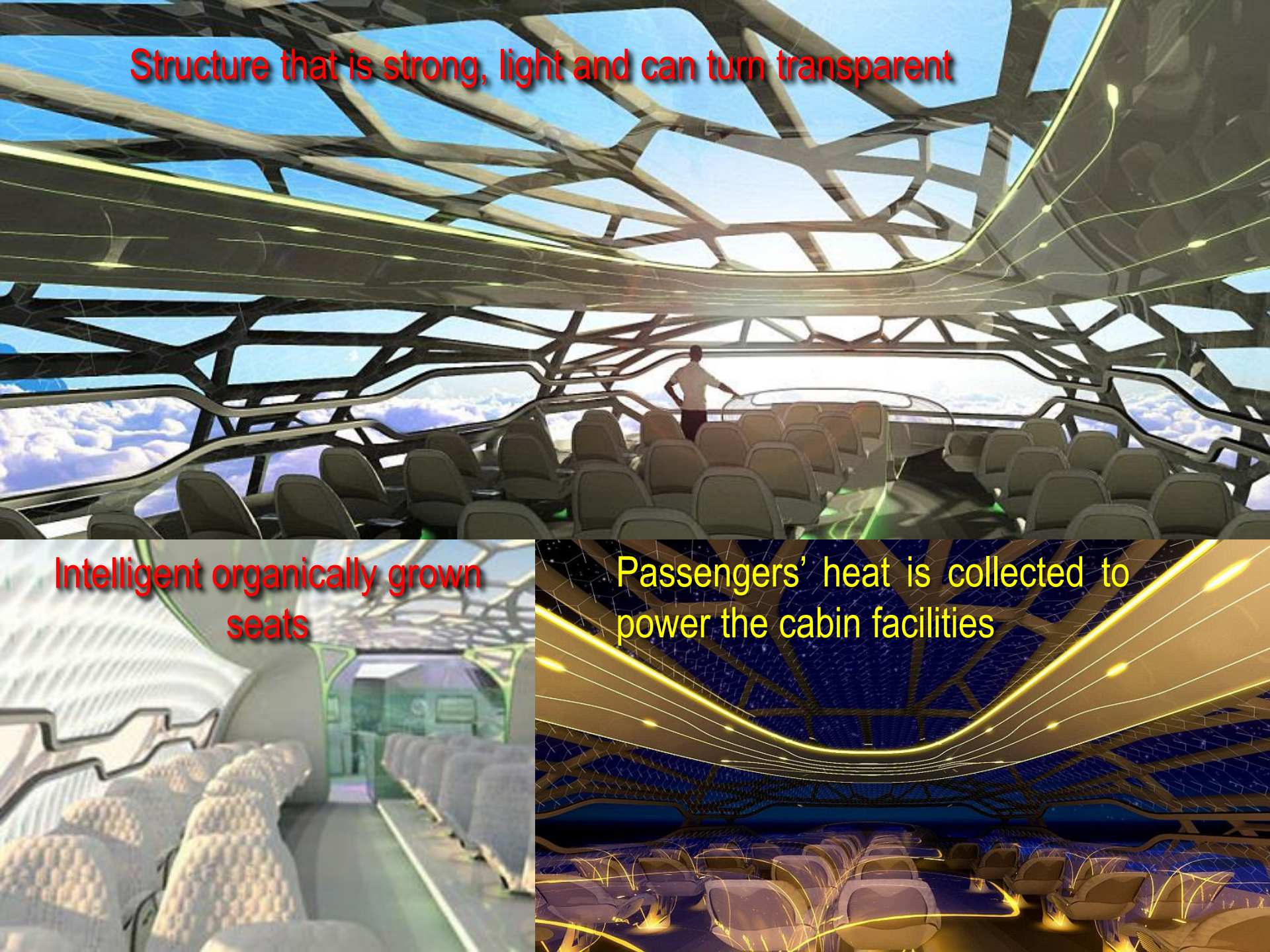
Fig. 6

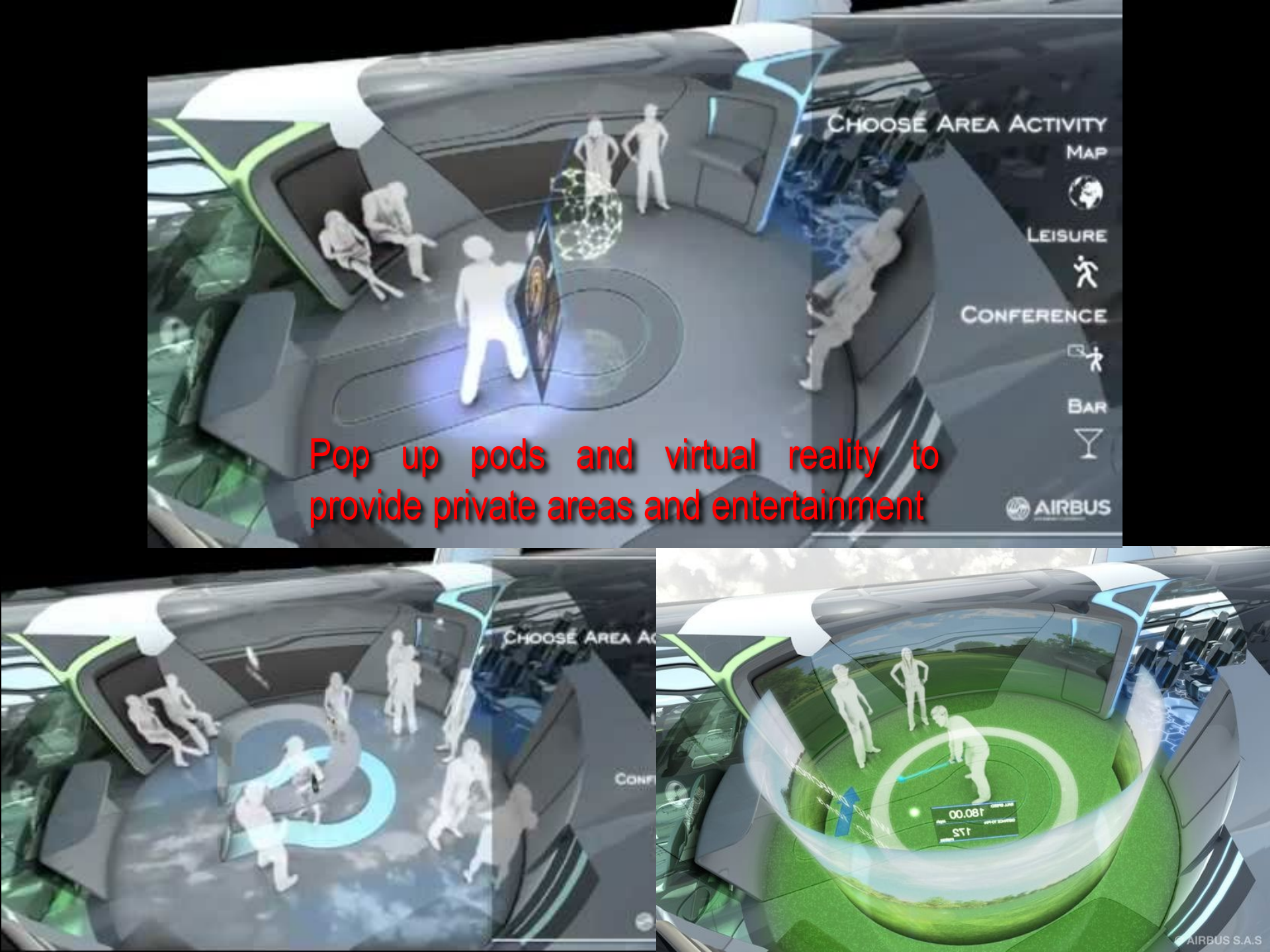

© Airbus




AIRBUS



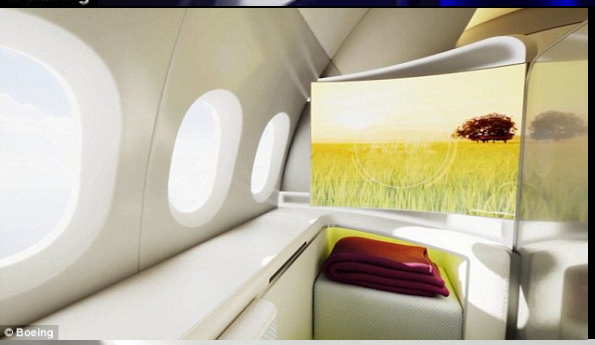

Structure that is strong, light and can turn transparent
Intelligent organically grown seats
Passengers' heat is collected to power the cabin facilities


Choose Area Activity
Map
Leisure
Conference
Bar
AIRBUS
Pop up pods and virtual reality to provide private areas and entertainment
Choose Area Ac
Conf
180.00
172
AIRBUS S.A.S

LG Display has developed an OLED panel that can be stuck to a wall like wall paper with magnets


© Boeing


© Boeing


© Boeing


© Boeing


© Boeing


WELCOME
© Boeing


© Boeing

Very Light Jets (VLJs)

Javelin

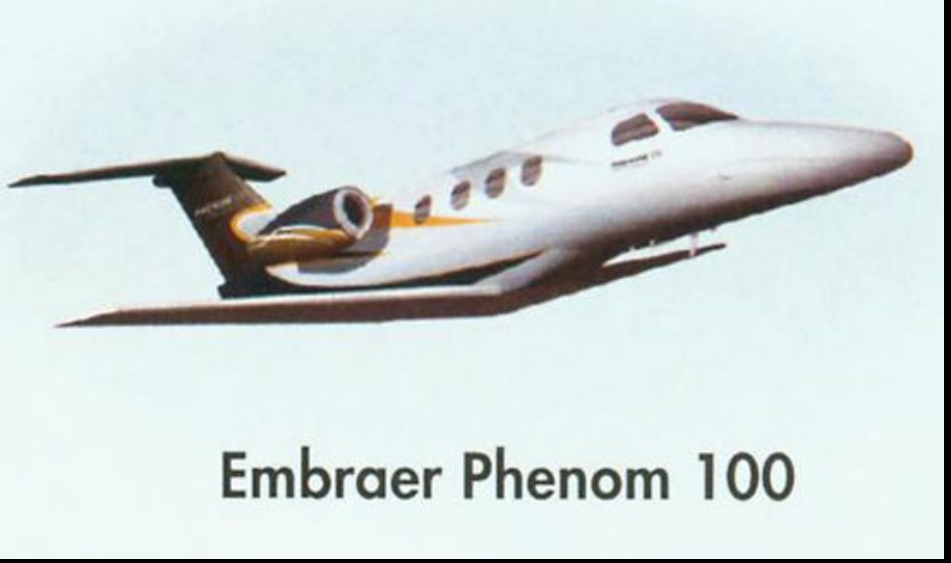
Viper

Eclipse 500

Adam Jet

Diamond

SJ30



Embraer Phenom 100

Citation Mustang

Epic

Cirrus

Hybrid Aircraft


05


BA609
N609TR
Tilt Rotor
Copyright Oscar Bernardi
AIRLINERS.NET


BA609
N609TR
Tilt Rotor

AW609 tiltrotor climbs towards 2018 certification

The Bell V-280 tilt-rotor aircraft went into cruise mode for the first time on May 11, 2018

Sikorsky X2 High-Speed Coaxial-Rotor Helicopter Demonstrator

Reached 258 mph

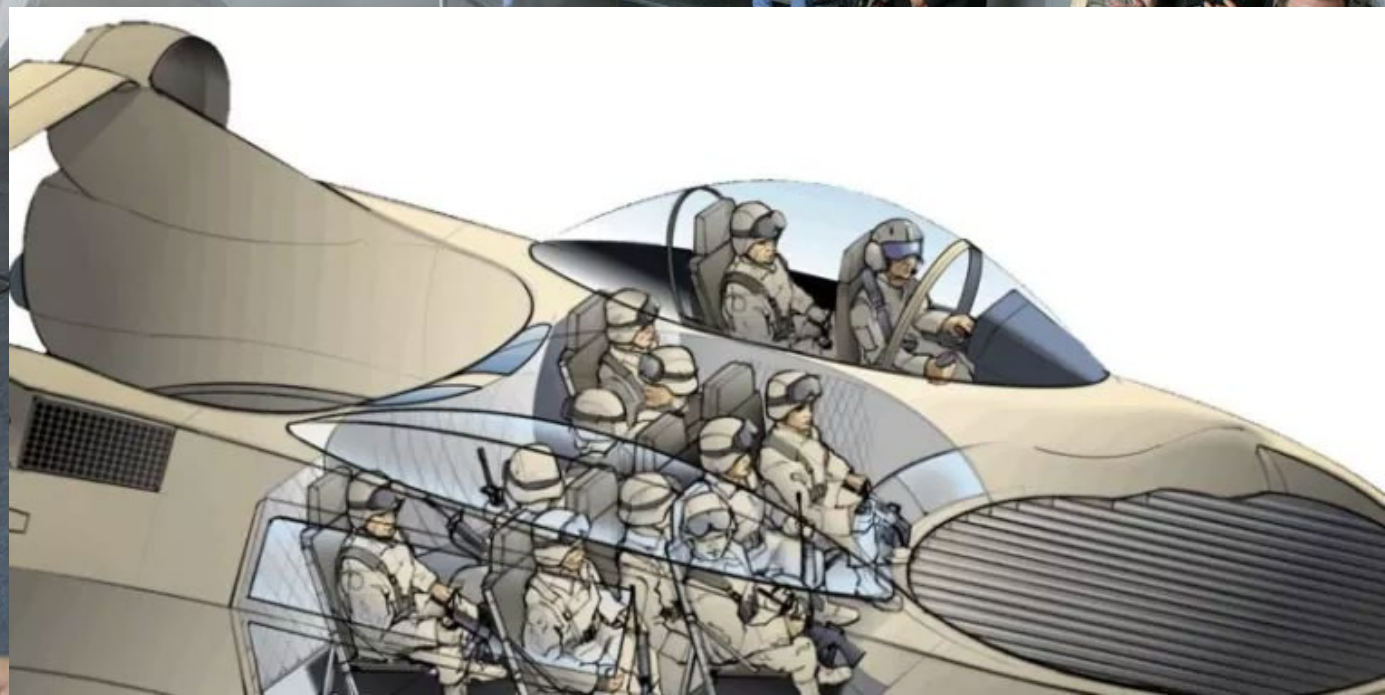
Target is 288 mph

20% Less lift needed from the main rotor

IT'S HERE

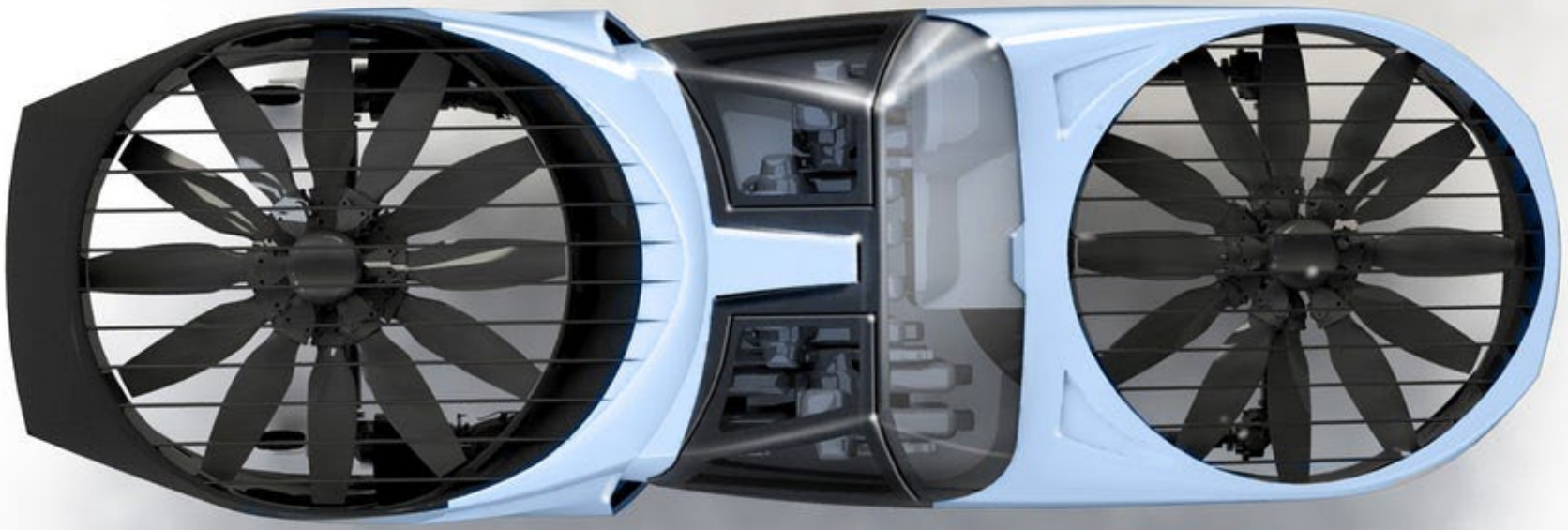
Israel Muse


X-HAWK
X-HAWK
X-HAWK



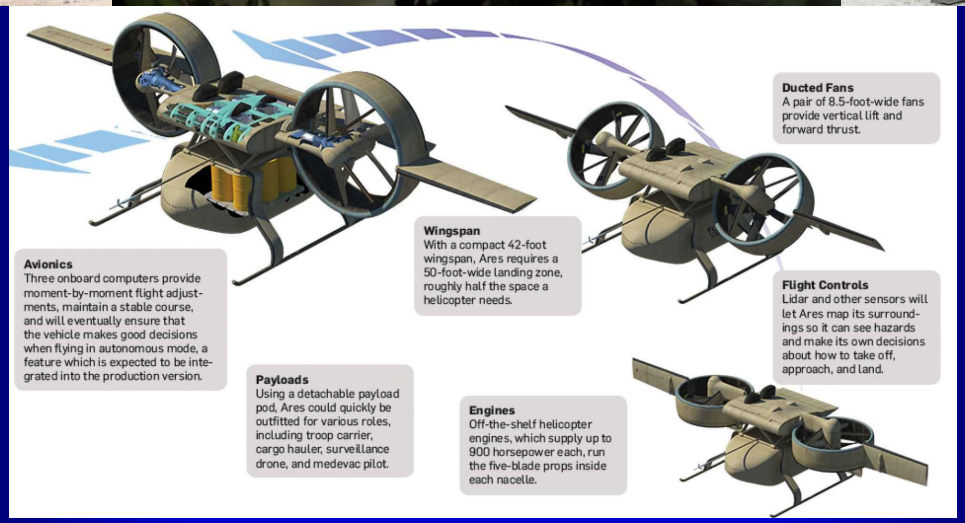
Designed by Israeli firm Tactical Robotics, the Cormorant is designed to fly either autonomously or by remote control, delivering troops, civilian passengers or other cargo within tight quarters

Urban Aeronautics is going into "full scale development" of its CityHawk flying car, an urban getabout vehicle with VTOL capabilities



Advanced Tactics Black Night Transformer

The DARPA TX has been moving on steadily and design elements have placed the cost at around $203,000 per unit



Lockheed Martin's Aerial Reconfigurable Embedded System (ARES) completed the third phase of DARPA's Transformer (TX) vehicle development program to demonstrate a four-person vehicle that provided enhanced logistics and mobility though hybrid flyable/roadable capabilities

Unique Aircraft Types


SKYCAR
MOLLER
200 X

Parajet SkyQuad


N356MV


Maverick Flying Car

The TERRAFUGIA Transition®

Performance Information*:

- The Transition® is being designed to be a factory certified Light Sport Aircraft (LSA).
- Two seats side-by-side & automotive-style entry.
- GTOW: 1,320 lbs (600 kg)
- Fuel Capacity: 20 gal (120 lbs / 54 kg)
- Fuel: Super-unleaded autogas
- Fuel Consumption: 4.5 gph
- Engine: 100 hp Rotax 912 S (four-stroke)
- Vs = 45 kts (51 mph, 83 km/hr)
- Vr = 70 kts (80 mph, 130 km/hr)
- Cruise Speed: 100 kts (115 mph, 185 km/hr)
- Range: 400 nm (460 mi, 740 km)
- Takeoff Distance over 50 ft obstacle: 1,700 ft (520 m)
- Wingspan: 27.5 ft (8.4 m)
- Length: 18.75 ft (5.7 m)
- Height: 6.75 ft (2.1 m)
- On-Road Width: 6.75 ft (2.1 m)
- Capable of highway speeds on the road.

Ordering Information*:

- Anticipated purchase price: $194,000
- Deposit amount: $10,000
- All deposits are held in individual accounts at Cambridge Trust Company and remain fully refundable until a Purchase Agreement is executed.
- Contact sales@terrafugia.com for more information or call +1-781-491-0812.

Development Schedule*:

- Drive testing: Fall 2008
- First flight: Late 2008
- First delivery: Late 2009

Production schedules are filling quickly. Reserve yours today!


TERRAFUGIA
DrivenToFly.com


TERRAFUGIA
DrivenToFly.com

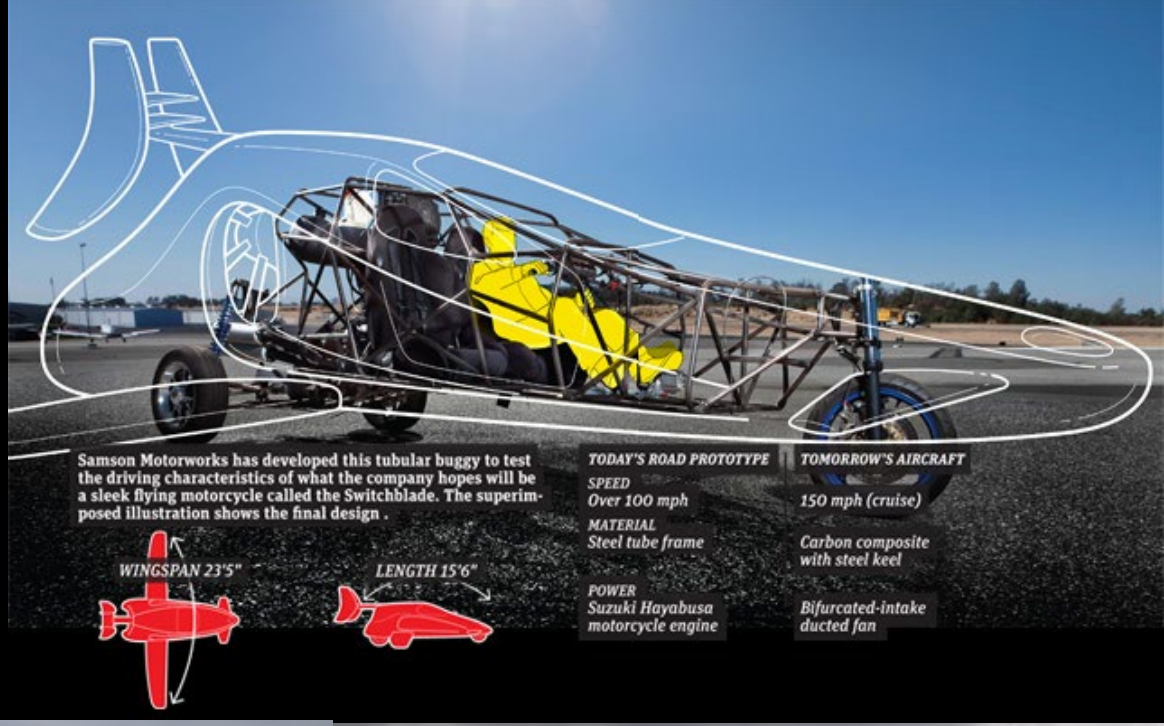
Woburn, MA – June 21, 2016: The FAA approved their 2014 Petition for Exemption, allowing a vehicle in the Transition® street-legal airplane configuration to be certified as a Light Sport Aircraft (LSA) with a maximum takeoff weight of 1,800 pounds.

This is a significant increase over the allowance received in 2010 which granted the Transition® a 1,430 pound weight limit, the same as currently imposed on amphibious LSA.

AeroMobile 3.0 - Certified by the Slovak Federation of Ultra-Light Flying in accordance with authorization issued by the Civil Aviation Authority of the Slovak Republic)

Molnar G2 Flying Motorcycle

Caravellair Flying Trike



Switchblade Flying Bike

Pipistrel Taurus G4

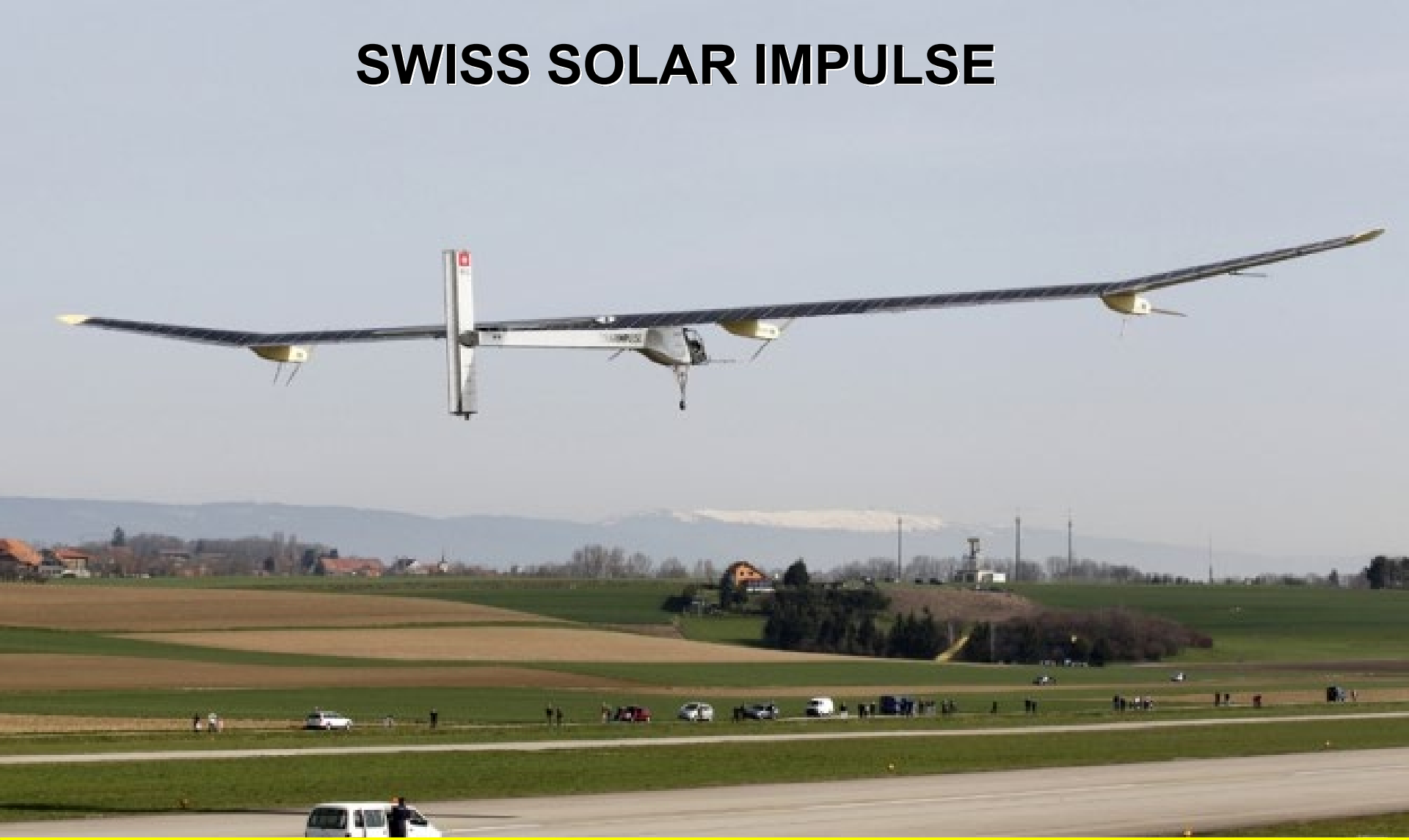
Pipistrel Panthera

The E430 is a two seat single engine LSA class aircraft designed to be easy to fly, economical, and quiet

It has a projected flight time of around two hours (not including reserves) and fast battery recharging

German eSpyder

SWISS SOLAR IMPULSE



Solar-powered plane to fly across U.S.

Solar Impulse, the solar-powered plane that made its first intercontinental flight from Switzerland to Morocco in 2012, is soon to fly coast-to-coast across the United States. A round-the-world flight is planned for 2015

Pilots: *André Borschberg (left)* and *Bertrand Piccard*

Wings: Covered with 12,000 solar cells

Propulsion: Four wing pods each contain 6kW motor and polymer lithium battery to power propeller

Cockpit: Non pressurized cockpit limits altitude to 8,500m

Wingspan: 63m – comparable to Airbus A340
Weight: 1,600kg
Cruising speed: 70km/h

Plane will make 7-10 day stopovers in each city to inspire engineers, students and aviation fans

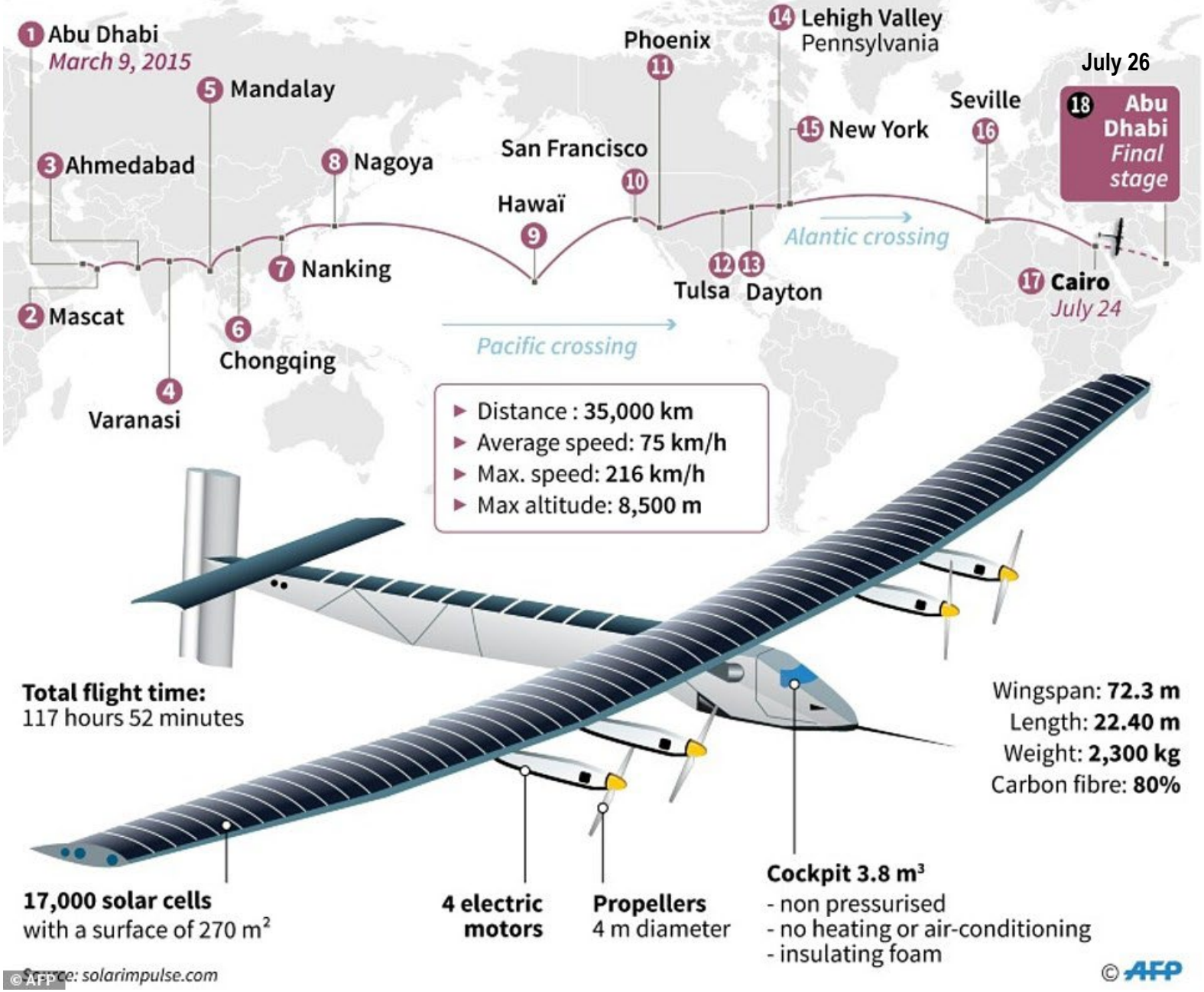
Source: Solar Impulse

Pictures: Associated Press, Getty Images © GRAPHIC NEWS

July 6, 2013
Solar Impulse lands at JFK

The journey around the world of Solar Impulse 2

The solar-powered plane begins the last stage of its historic flight



Source: solarimpulse.com

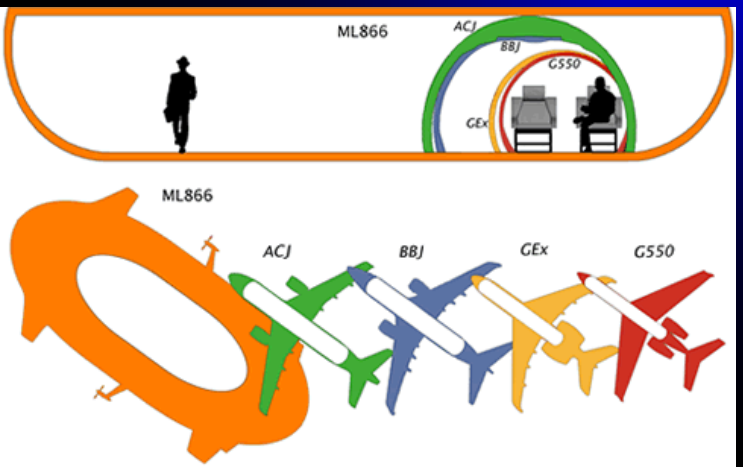
Next Generation Lighter-Than-Air Commercial Transports


GOODYEAR
N1DA


GOODYEAR

Aeroscraft

(Carry 250 passengers 6,000 miles at 174 mph)



Speed Range: 0-138 mph
Max Operating Altitude: 0-12,000 ft
Max Range: 3,100 miles
Overall Length: 210 ft
Overall Width: 118 ft
Overall Height: 56 ft
Cabin Area: 5,382 ft2

Lockheed Martin is working with the commercial market to bring the first generation commercial Hybrid Airship to the market

Lockheed Martin P-791 Hybrid Airship

Heavy lifter “Dragon Dream” passes Pentagon and NASA tests


DRAGON DREAM
aeroscraft


aeroscraft


N866ML
ML866

Sky Hook – JHL-40

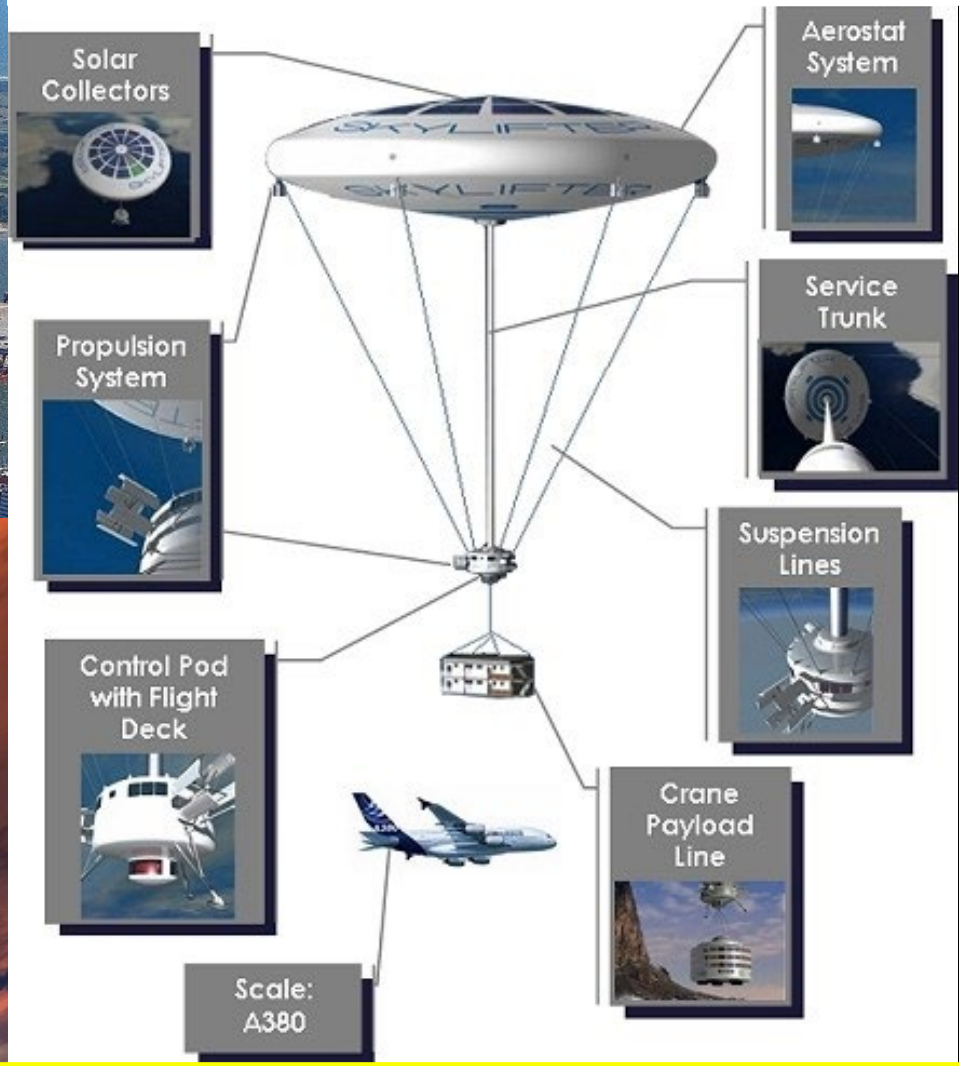
Lift 40 ton sling load and carry it 200 miles


SkyHook
SkyHook

SkyLifter

Flies up to 150,000 kg of oversize, fragile or indivisible payloads

A heavy-lifting aerial crane with genuine VTOL capability for hard-to-access areas

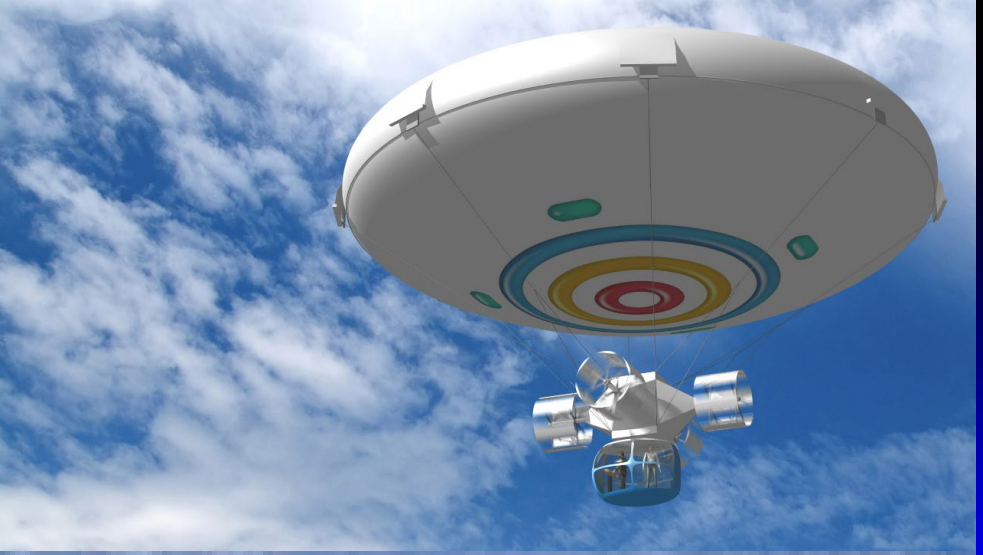


SkyLugger
Aerial Cargo

Ideal for lugging up to 5,000 kg of cargo from site to site, helicopter-style

Optimized for precision pick-up and delivery

High utilization and low operating costs with 24 hour capability



SkyRover
Aerial Canvasser

An endurance aircraft for news gathering, interdiction, and sporting

Easy, low-cost flying and sporting a very spacious flight deck

Good for commercial activities often done by UAVs

SkyPalace

Is a future concept for an aerial cruise liner floating over land at low altitude.

The planned habitable area of the SkyPalace features a 25 m diameter accommodation unit offering 2k m2 of configurable floor-space over five levels.

Includes an outdoor roof terrace

Personal Flying


Hosted On
LiveLeak


RedBull

Gryphon Flying Wing

Yves Rossy (Jet Man) Jet Propelled Wing

English Channel Crossing (10/26/08) – up to 120 mph

8-min crossing of the Grand Canyon (05/11/11)


© Alain Ernoult/Breitling/Barcroft Media


DUBAI

Gryphon SkyRay

Programmable High Altitude Single Soldier Transport (PHASST) used for "Die Another Day" James Bond movie

Gabriel Automatic Deployment System

UK Malloy Aeronautics Hoverbike

Maryland's Survice Engineering will work together with UK-based Malloy Aeronautics on the development of Hoverbike technology for the US Department of Defense, with the goal of the vehicle operating as a new class of Tactical Reconnaissance Vehicle (TRV)

Hoversurf Scorpion Hoverbike (Russia)


POLICE

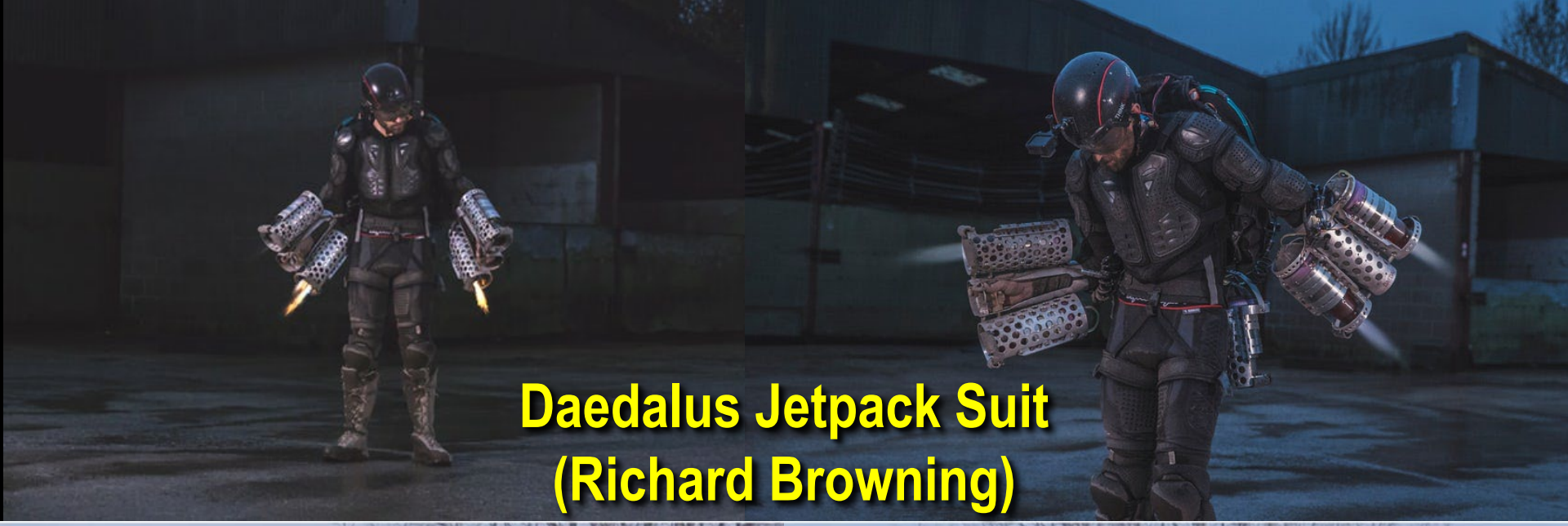
The Hungarian Flike flew a few meters off the ground in March 2015 and was able to demonstrate hovering and maneuvering capabilities while compensating for wind in a controlled flight lasting one and a half minutes

It has six rotors paired in a coaxial arrangement, directly driven by individual electric disc motors, powered by lithium polymer batteries, that allow for around 15 to 20 minutes of hover flight or 30 to 40 minutes of cruise flight

Canadian inventor Catalin Alexandru Duru traveled a distance of 275.9 m (905.2 ft) on a propeller-based hoverboard reaching an altitude of up to 5 m (16.4 ft)

Zapata Flying Board

Zapata Ezfly is a small platform with a series of jet thrusters, with two handgrips that come up from the base and steering is done with bodyweight



Daedalus Jetpack Suit
(Richard Browning)

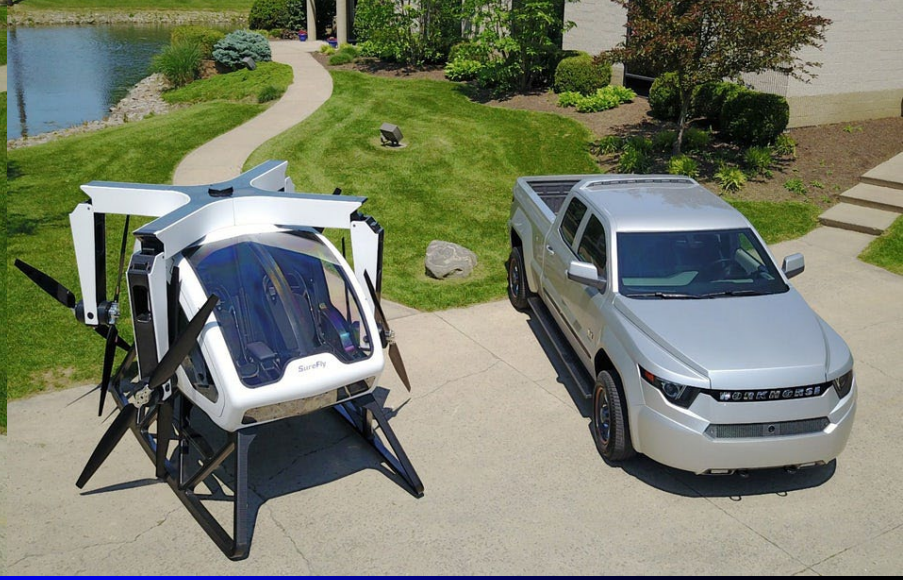

GRAVITY
GRAVITY

Super 54 Drones (UK)

Sky-Hopper
(Peter Dobber - Netherlands)

Swedish Alex Borg's Flying Carpet – Internal Combustion Engines

Swedish Alex Borg's Flying Carpet - Electric Engines



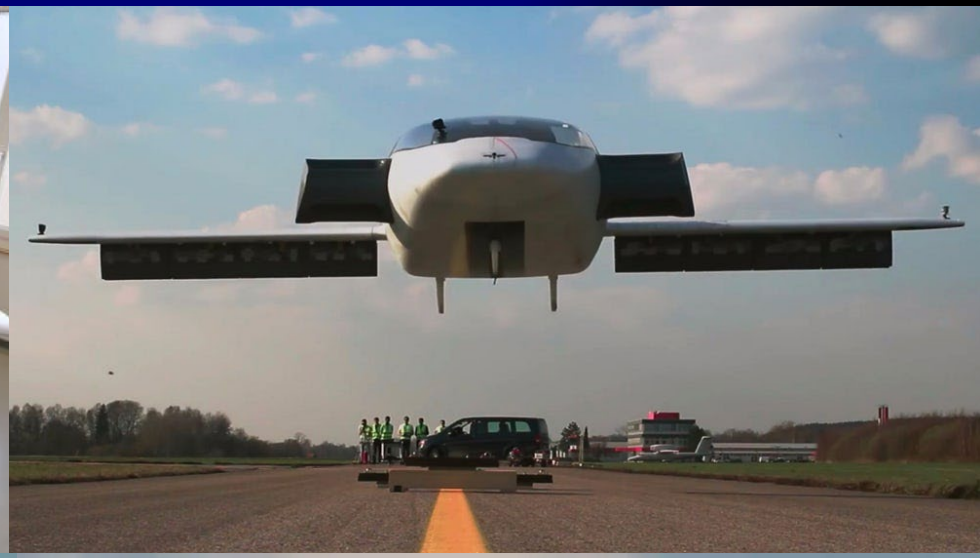
Workhorse first unveiled its Surefly flying car at the Paris Air Show in June 2017, and has now sent it into the air with a person inside for the first time

Ehang 184 for the first time carrying out test flights with people onboard

Canadian BlackFly is a single-seater ultralight electric VTOL aircraft


Flyer
KITTYHAWK
Flyer
Flyer

Lilium Aviation completed its first unmanned test flights of a two-seater version of its electric VTOL jet in early 2017 and is working on a five-seat production version and is targeting 2019 for its first manned flights



E-Bolo Prototype

Volocopter VC200


HIROBO
HIROBO
HIROBO
HIROBO
HIROBO
bit


MERLIN
ADX603N

universal hovercraft


19XRW-Hoverwing



Jet Pack H202

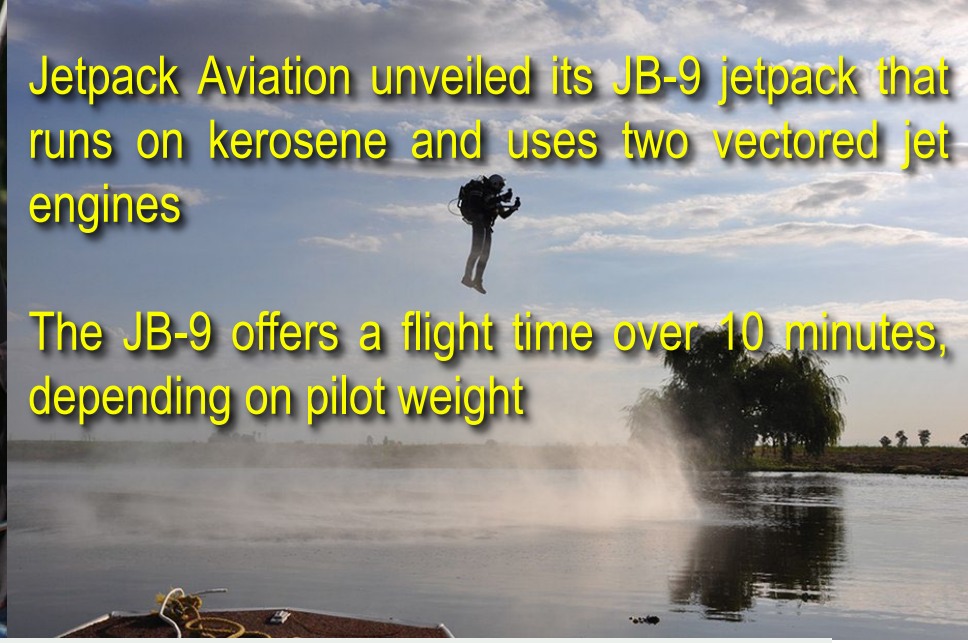
Max Flight Time: 33 seconds
Maximum Distance: 500 ft
Max Speed: 70 mph
Maximum Altitude: 120 ft
Max Pilot Weight: 180 lbs
Fuel: H202
Fuel Capacity: 5.8 gallons

Jet Pack H202-Z

Max Flight Time: 43 seconds
Maximum Distance: 1500 ft
Max Speed: 77 mph
Maximum Altitude: 250 ft
Max Pilot Weight: 180 lbs
Fuel: H202
Fuel Capacity: 8 gallons

Jet Pack T-73

Estimated Flight Time: 9 minutes
Estimated Distance: ~ 11 miles
Estimated Speed: 83 mph
Estimated Max Altitude: 250 ft
Max Pilot Weight: 180 lbs
Fuel: Jet-A fuel
Fuel Capacity: 5 gallons
Power Plant: T-73 turbine
Retail Price: $200,000



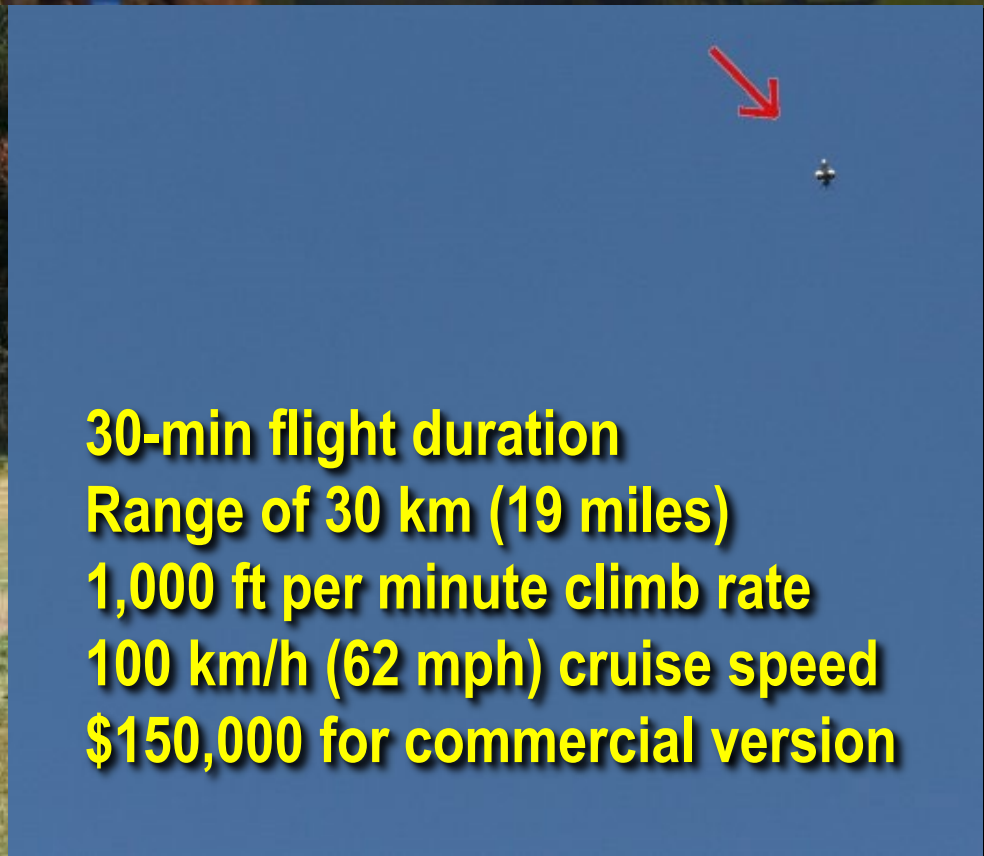
Jetpack Aviation unveiled its JB-9 jetpack that runs on kerosene and uses two vectored jet engines

The JB-9 offers a flight time over 10 minutes, depending on pilot weight

The JB-10 is some 7 percent more powerful than the JB-9

The JB-11 takes safety to the next level, as well as speed and power. Using three smaller turbojet engines per side instead of just one, JB-11 can hit speeds over 150 mph (240 km/h)

Martin Jet Pack



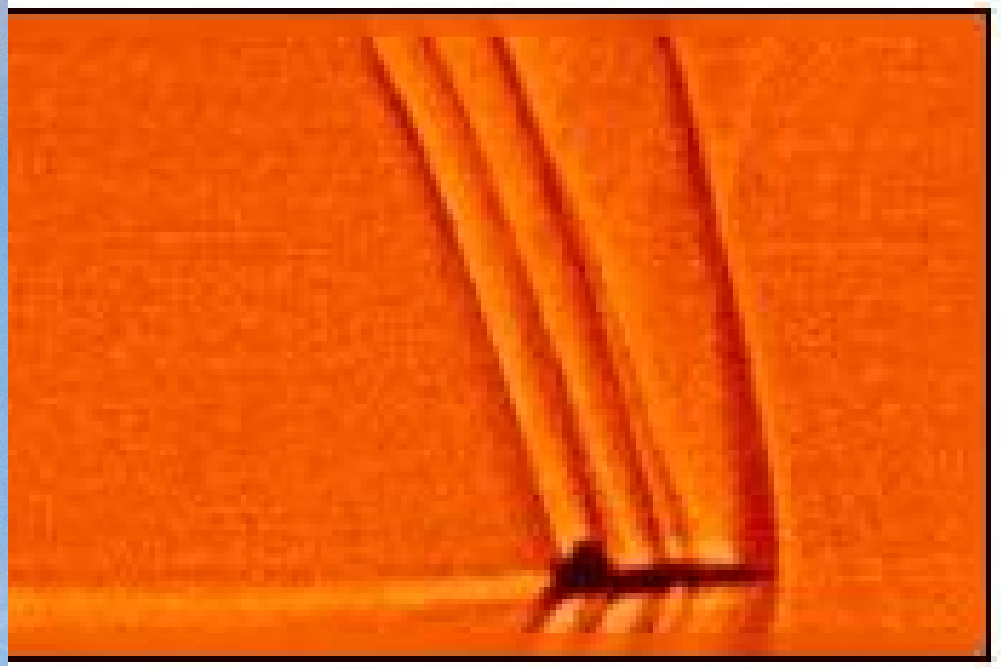
30-min flight duration
Range of 30 km (19 miles)
1,000 ft per minute climb rate
100 km/h (62 mph) cruise speed
$150,000 for commercial version

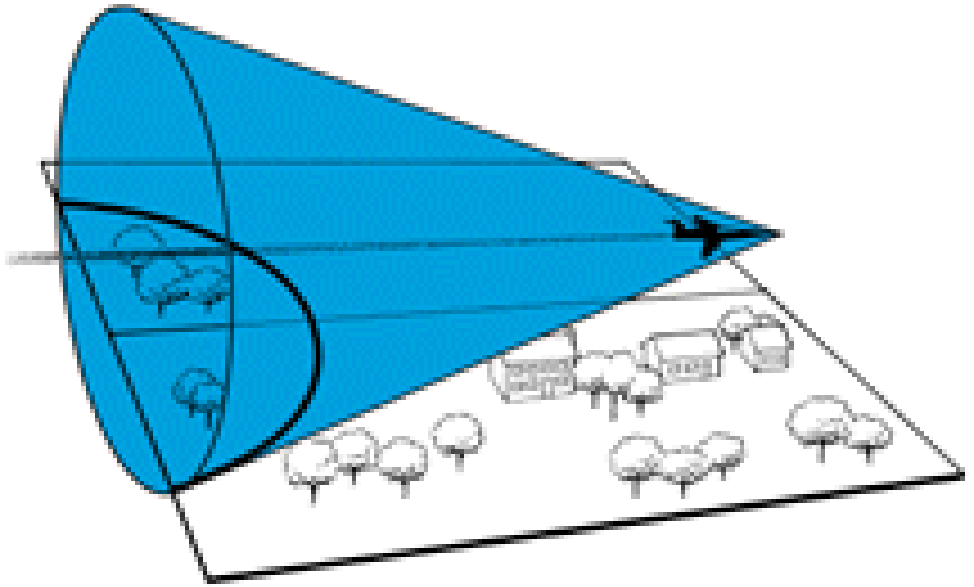

MARTIN
MARTIN

Supersonic Transportation

New Developments in Aerospace Transportation Vehicles

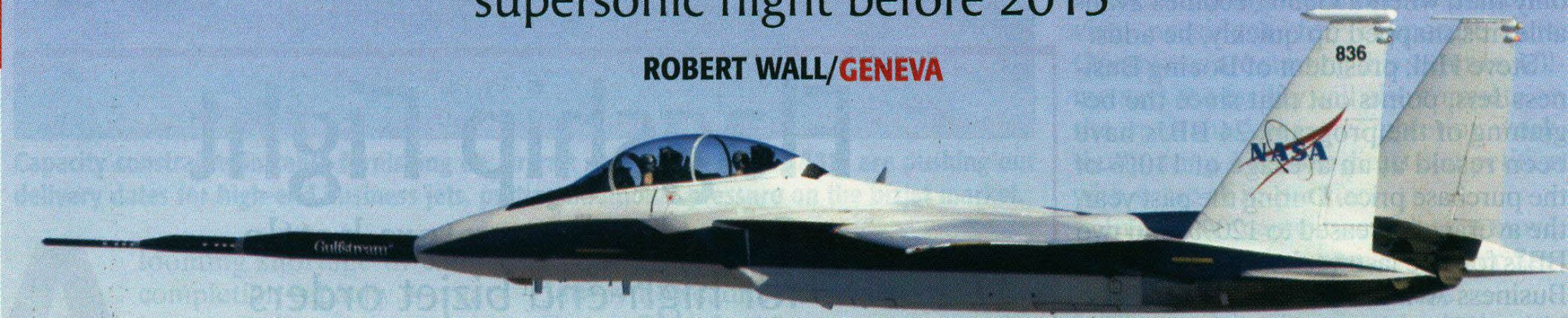
Federal Aviation Administration





Gulfstream sees need to demonstrate low-noise supersonic flight before 2013

ROBERT WALL/GENEVA



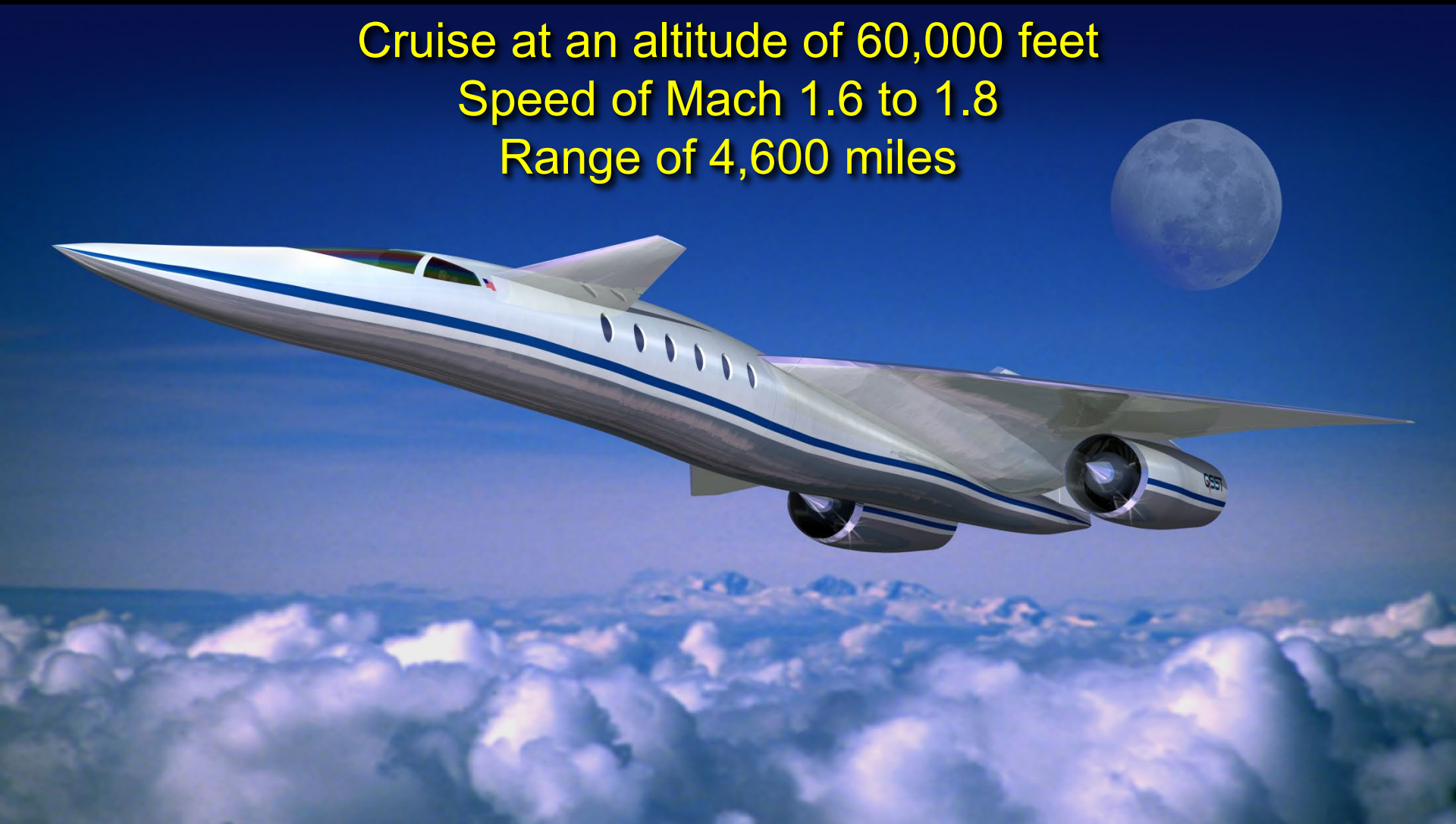
Gulfstream has completed a first test flight series of its telescopic spike. Results with the device fitted to an F-15 to reduce sonic boom were seen as encouraging and could allow for work on more complex demonstrator.


10
F
NORTHROP GRUMMAN
Integrated Systems
NASA
DARPA

Aerion/Lockheed Martin Supersonic Business Jet

Mach 1.6
4,000 Miles
8-12 Passengers
Launched in 2007 – First Flight Expected in 2023

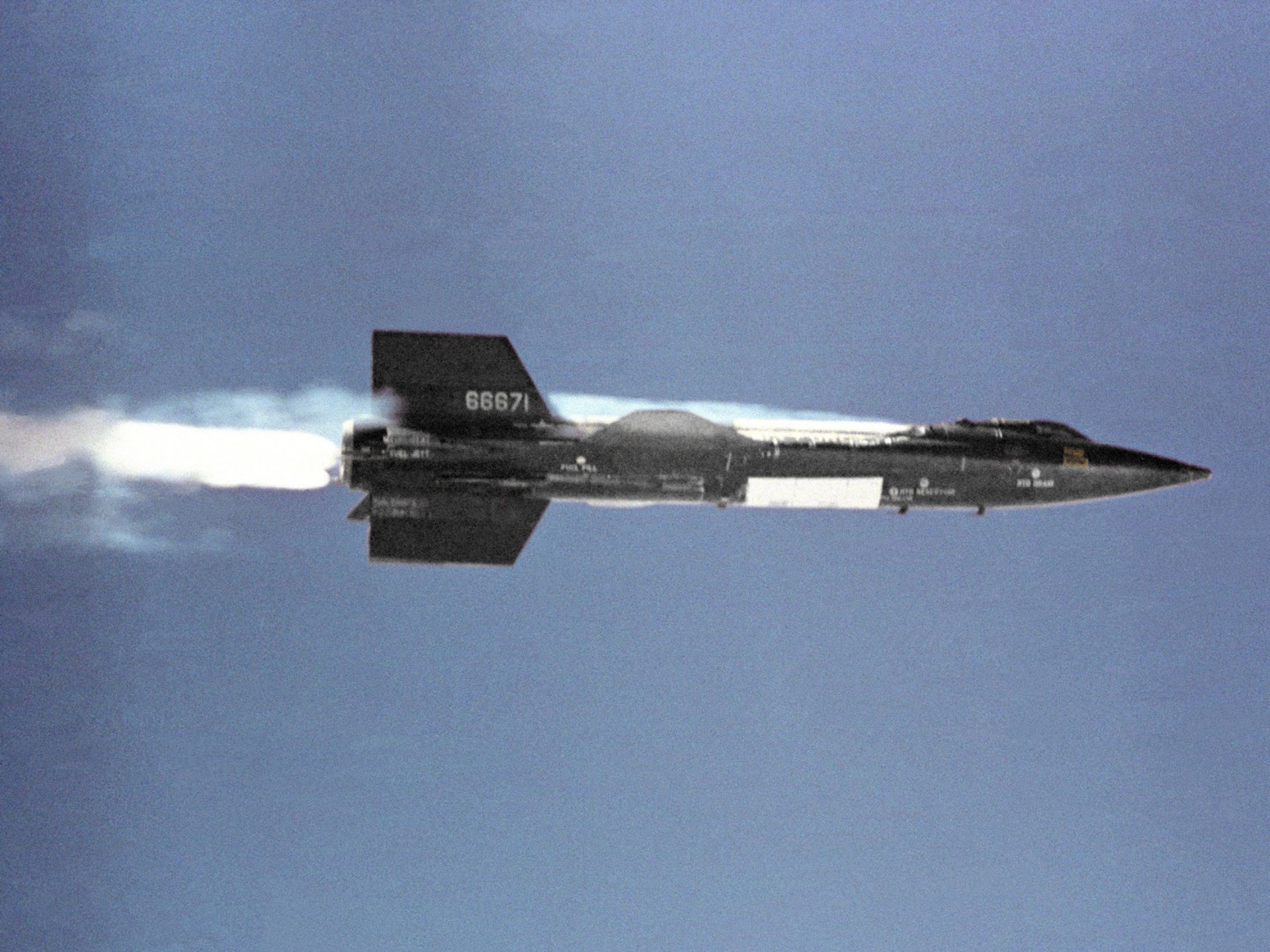
Supersonic Aerospace International Quiet Supersonic Transport (QSST)



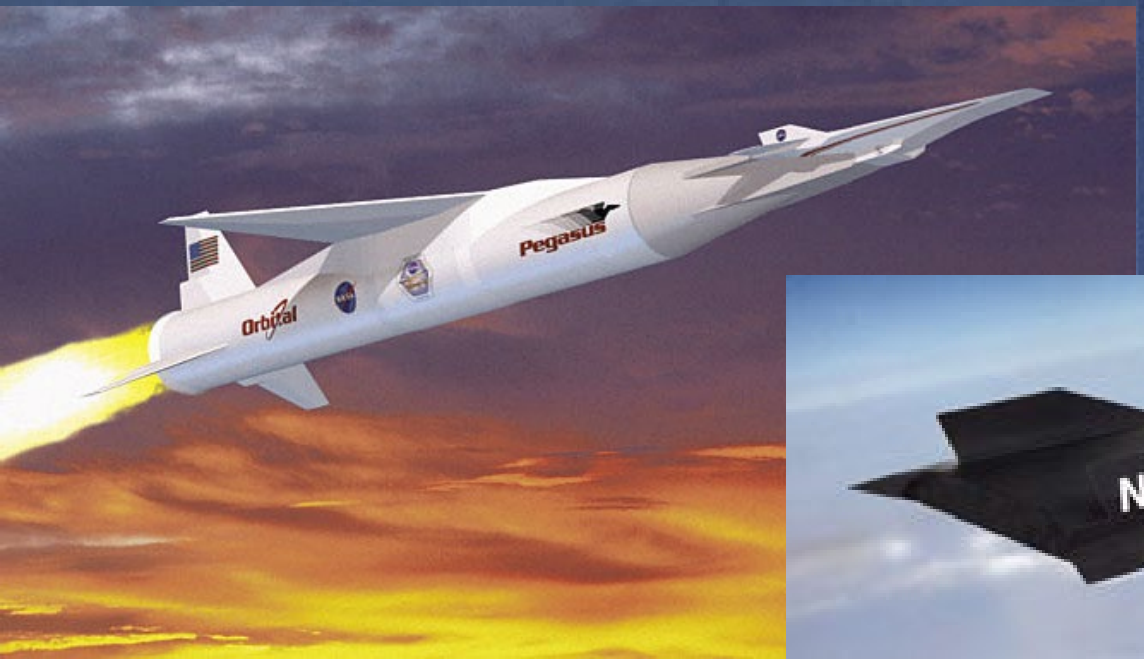
Spike S-512 Supersonic Jet

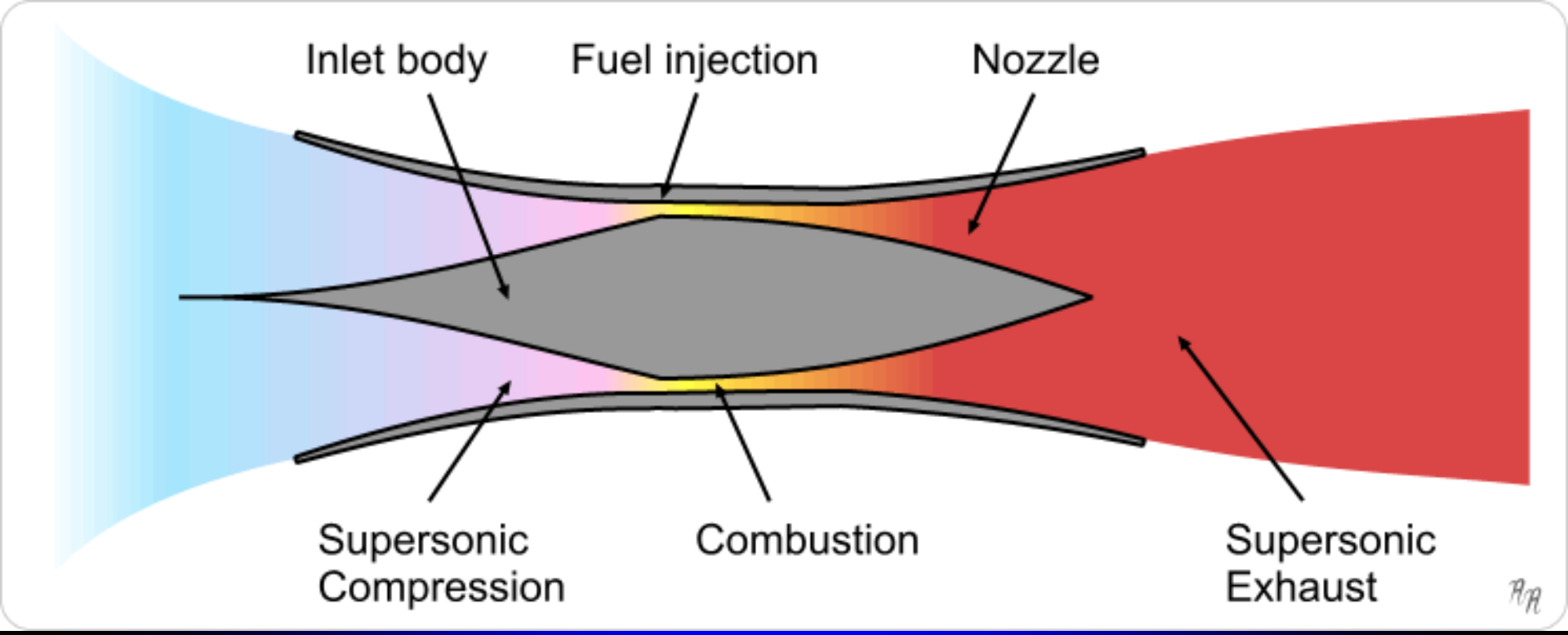
Is being developed with the assistance of Siemens, Quartus, Aernnova, Greenpoint, BRPH - Projected flight date of 2021 & first deliveries in 2023

Hypersonic Transportation


66671

X-43A Scramjet Demonstrator Flew at Mach 9.6 (7,000 mph) over the Pacific Ocean on November 16, 2004





A SCRAMJET (*supersonic combustion ramjet*) is a variant of a ramjet air breathing jet engine in which combustion takes place in supersonic airflow

X-51A


X-51A WaveRider
Flew at Mach 5.1 (>3K mph) at 50,000 feet for 143 seconds in May 2010
Demonstrated a hydrocarbon-fueled scramjet, high temperature materials, airframe/engine integration among other key technologies

Falcon Hypersonic Technology Vehicle 2 (HTV-2)

DARPA's Falcon Hypersonic Technology Vehicle HTV-2 was intended to fly at 13,000 mph (anywhere in the world in less than 60 minutes)

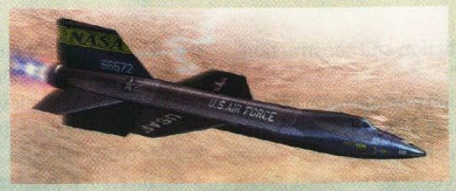
The second test flight of a prototype transitioned to Mach 20 aerodynamic flight (extreme hypersonics) on August 11, 2011

More than 9 minutes of data was collected before an anomaly caused loss of signal

Hypersonic Timeline

X-15
1959 - 1968
propulsion: rocket

Mach 6.7



Space Shuttle
1981 - 2010
propulsion: rocket

Mach 25

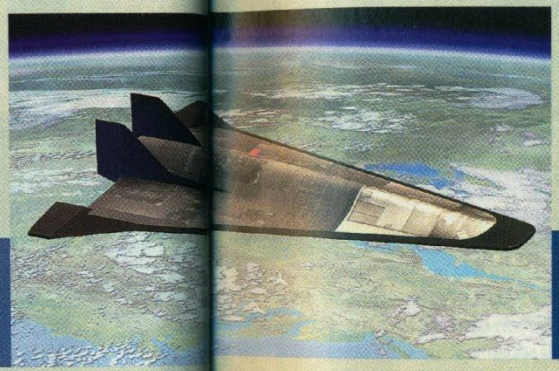
X-43
2004
propulsion: rocket + scramjet

Mach 9.8

X-51A
2009
propulsion: rocket + scramjet

Mach 7

FALCON
2025
propulsion: hybrid, including scramjet



Mach 20

The X-15 and space shuttle may not strictly count as hypersonic vehicles, since they didn't achieve sustained atmospheric flight above Mach 5. But their even-faster returns from the edge of space contributed valuable data to hypersonic research. NASA's X-43 was a milestone: the first scramjet-powered vehicle. Picking up where it left off, the X-51A will extend the flight time from seconds to minutes. The ultimate goal is the FALCON Hypersonic Cruise Vehicle, if thermal protection and other engineering challenges are solved.

Round-the-world racers

If the ability to reach the edge of space were not enough, hypersonic craft could also be used to slash journey times for globetrotters

NASA's X-15

Launched 1959

Speed:

Mach 6.7

- 1 hour, 45 minutes
- 1 hour, 23 minutes

NASA's X-43A

Launched 2001

Speed:

Mach 9.68

- 1 hour, 9 minutes
- 54 minutes

SpaceShipOne

Launched 2003

Speed:

Mach 3.09

- 3 hours, 40 minutes
- 2 hours, 54 minutes

Concorde

Launched 1969

Speed:

Mach 2.2

- 5 hours, 9 minutes
- 4 hours, 5 minutes

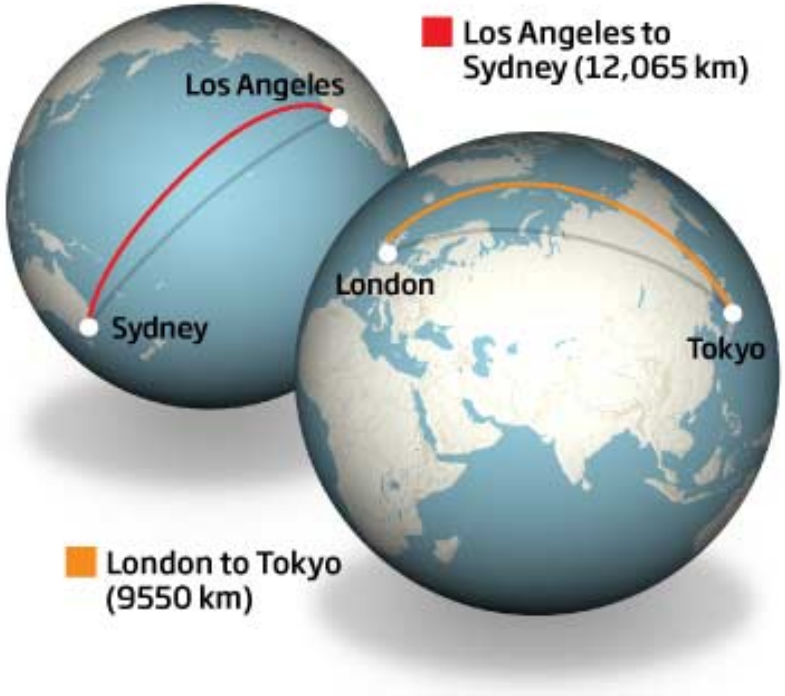
Boeing 747

Launched 1969

Speed:

Mach 0.89

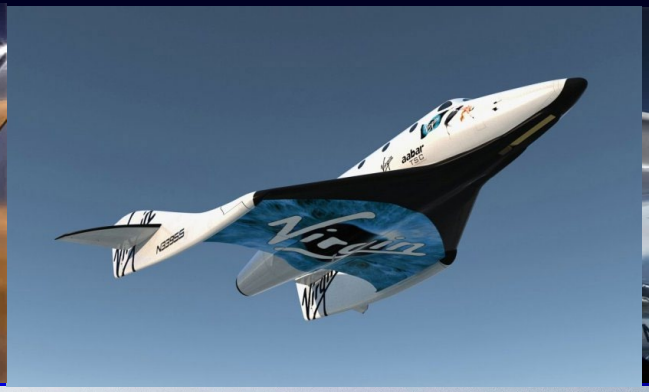
- 12 hours, 47 minutes
- 10 hours, 7 minutes



Assuming an altitude of 40,000 feet

Sub-Orbital Launch Vehicles Under Development for Commercial Use in the US

USA
New Shepard



USA - SpaceShipTwo

USA - Voyager

Orbital Launch Vehicles *Under* Development for *Commercial* Use in the US


Falcon
Heavy


COSMICGIRL


LauncherOne


BLUE ORIGIN


SpaceX


New Glenn
BLUE ORIGIN
Blue Origin

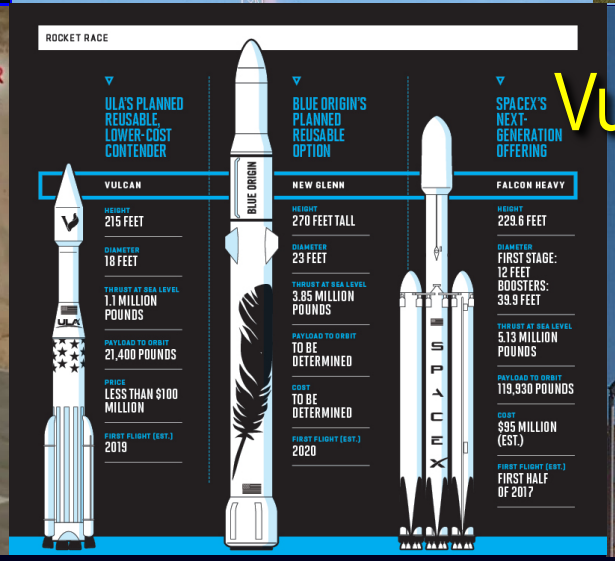

NASA


StratoLaunch


Vector R/H


VECTOR

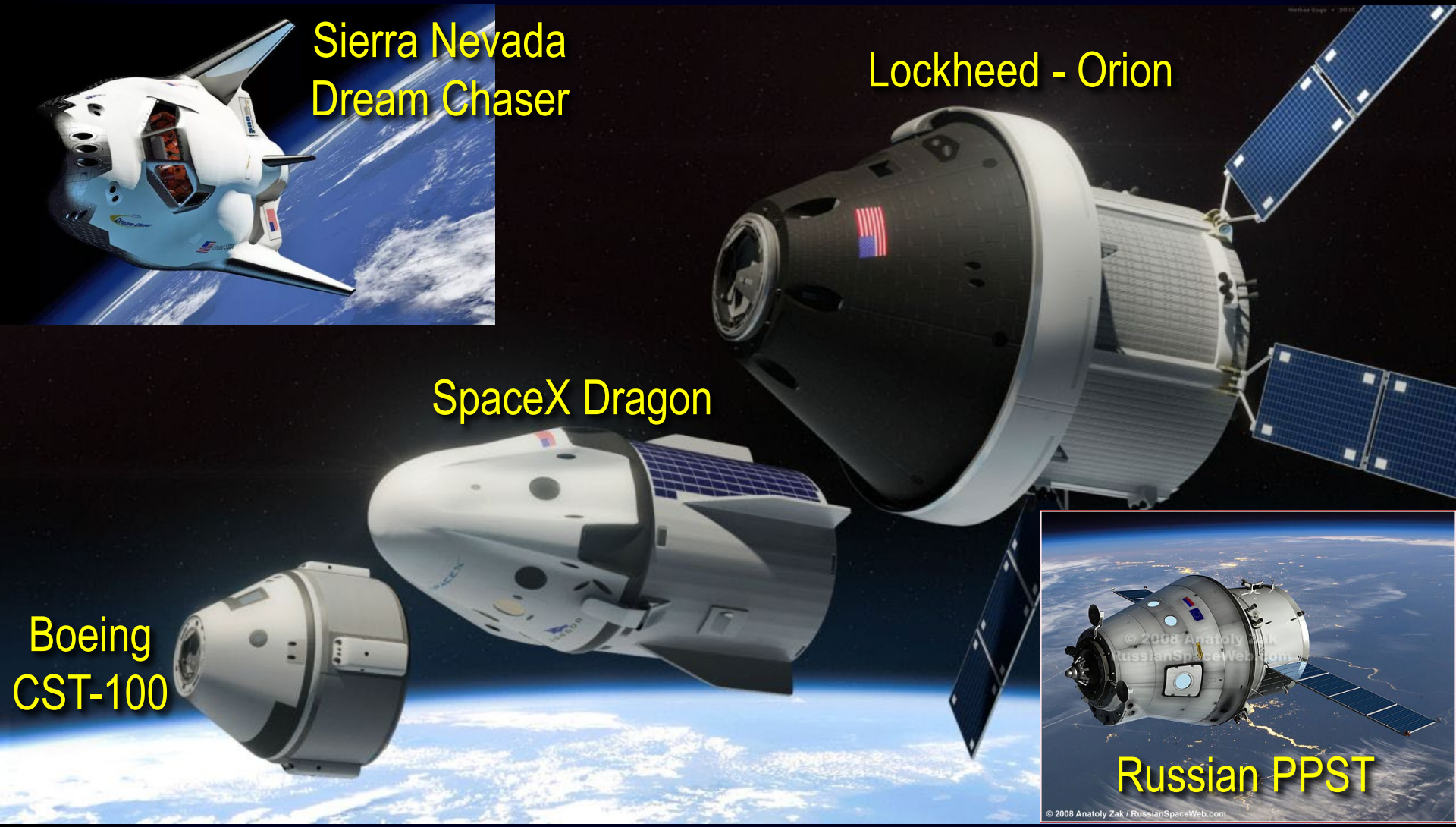

abc WORLD NEWS TONIGHT WITH DAVID MUIR

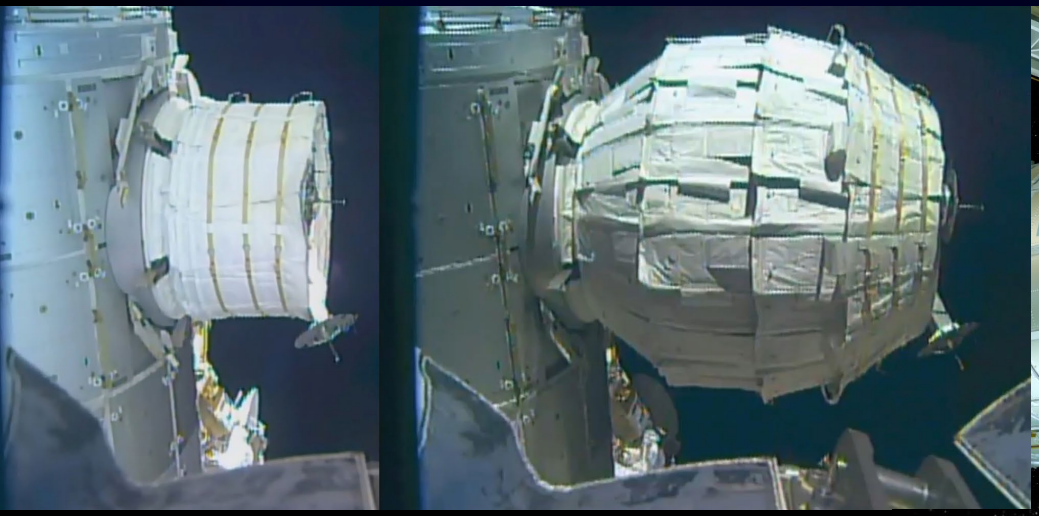

ROCKET RACE
ULA'S PLANNED REUSABLE, LOWER-COST CONTENDER
VULCAN
HEIGHT 215 FEET
DIAMETER 18 FEET
THRUST AT SEA LEVEL 1.1 MILLION POUNDS
PAYLOAD TO ORBIT 21,400 POUNDS
PRICE LESS THAN $100 MILLION
FIRST FLIGHT (EST.) 2019
BLUE ORIGIN'S PLANNED REUSABLE OPTION
NEW GLENN
HEIGHT 270 FEET TALL
DIAMETER 23 FEET
THRUST AT SEA LEVEL 3.85 MILLION POUNDS
PAYLOAD TO ORBIT TO BE DETERMINED
COST TO BE DETERMINED
FIRST FLIGHT (EST.) 2020
SPACEX'S NEXT-GENERATION OFFERING
FALCON HEAVY
HEIGHT 229.6 FEET
DIAMETER FIRST STAGE: 12 FEET BOOSTERS: 39.9 FEET
THRUST AT SEA LEVEL 5.13 MILLION POUNDS
PAYLOAD TO ORBIT 119,930 POUNDS
COST $95 MILLION (EST.)
FIRST FLIGHT (EST.) FIRST HALF OF 2017


Vulcan

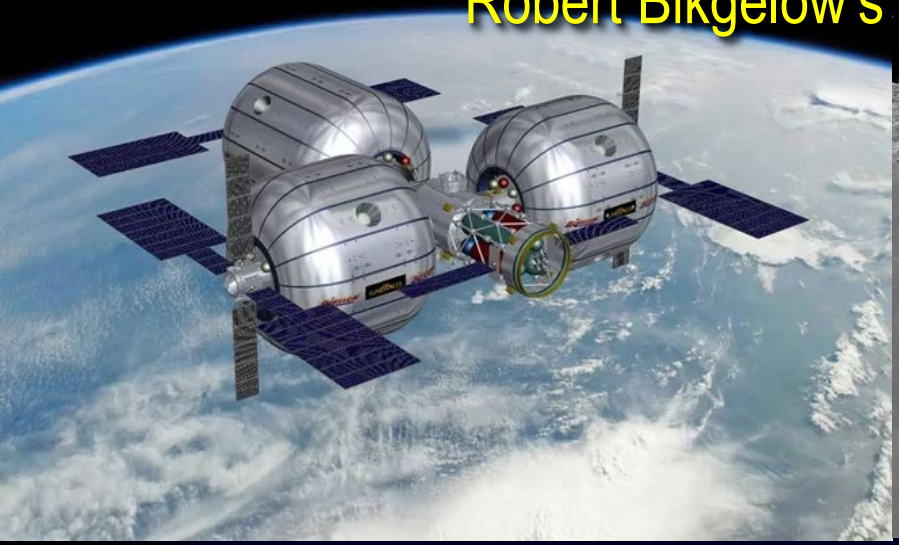
World's largest plane with a wingspan longer than a FOOTBALL FIELD taxis down the runway for the first time (Dec 2017) ahead of its 2019 test flight


Gulfstream
Aerospace
Corporation


Sierra Nevada
Dream Chaser
Lockheed - Orion
SpaceX Dragon
Boeing
CST-100
Russian PPST
© 2008 Anatoly Zak / RussianSpaceWeb.com



Robert Bikgelow's Inflatable Space Station



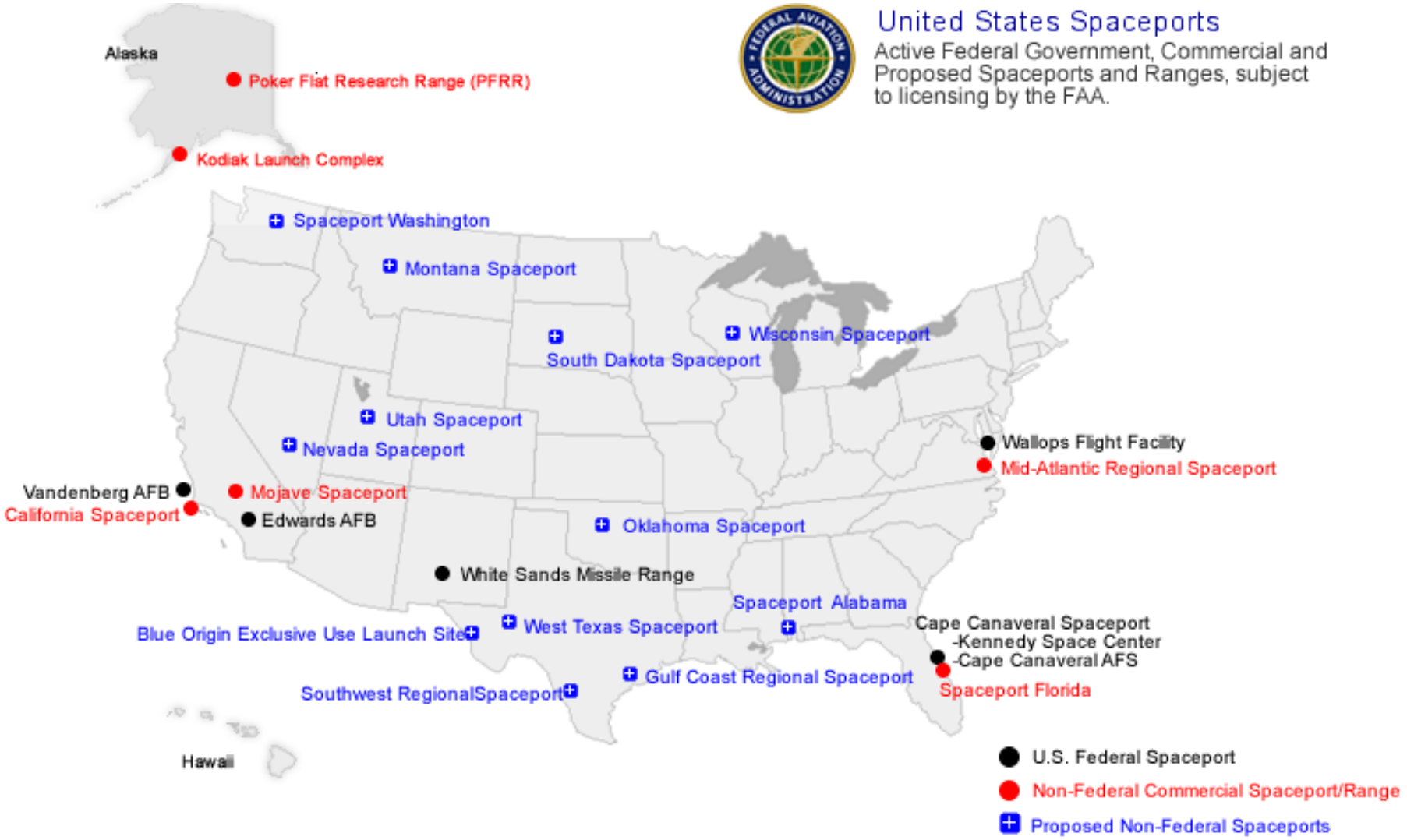
US-Based Launch & Reentry Sites

19 U.S. Government and Commercial Launch & Reentry Sites

- 8 Managed by US Government
- 10 Managed by State Agencies in partnership with Private Industry
- 1 Managed by a University

- 4 Orbital launches only
- 10 Suborbital launches only
- 5 Orbital & Suborbital launches

Launch Site	Operator	State or Country	Type of Launch Site	Type of Launches Supported	Currently Available for Commercial Operations?
California Spaceport	Harris Corporation	CA	Commercial	Orbital	Yes
Cape Canaveral Air Force Station	U.S. Air Force	FL	Government	Orbital	SLC-41 (Atlas V) SLC-37B (Delta IV) SLC-40 (Falcon 9) SLC-36 (Blue Origin) Landing Strip
Cecil Field Spaceport	Jacksonville Airport Authority	FL	Commercial	Suborbital	Yes
Edwards Air Force Base	U.S. Air Force	CA	Government	Suborbital	No
Ellington Airport	Houston Airport System	TX	Commercial	Suborbital	Yes
Florida Spaceport	Space Florida	FL	Commercial	Orbital/ Suborbital	Yes
Kennedy Space Center	NASA	FL	Government	Orbital	LC-39A (Falcon 9/Heavy) Shuttle Landing Facility
Mid-Atlantic Regional Spaceport	Virginia Commercial Space Flight Authority	VA	Commercial	Orbital	Yes
Midland International Air and Space Port	Midland International Airport	TX	Commercial	Suborbital	Yes
Mojave Air and Space Port	East Kern Airport District	CA	Commercial	Suborbital	Yes
Oklahoma Spaceport	Oklahoma Space Industry Development Authority	OK	Commercial	Suborbital	Yes
Pacific Missile Range Facility	U.S. Navy	HI	Government	Suborbital	No
Pacific Spaceport Complex Alaska	Alaska Aerospace Corporation	AK	Commercial	Orbital/ Suborbital	Yes
Poker Flat Research Range	University of Alaska Fairbanks Geophysical Authority	AK	Non-Profit	Suborbital	Five pads available for suborbital launches
Ronald Reagan Ballistic Missile Defense Test Site	U.S. Army	Republic of the Marshall Islands	Government	Orbital/ Suborbital	Omelek Island launch pad
Spaceport America	New Mexico Spaceport Authority	NM	Commercial	Suborbital	Yes
Vandenberg Air Force Base	U.S. Air Force	CA	Government	Orbital/ Suborbital	SLC-2 (Delta II) SLC-3E (Atlas V) SLC-4E (Falcon 9 and Falcon Heavy) SLC-6 (Delta IV) SLC-8 (Minotaur) SLC-576E (Minotaur-C)
Wallops Flight Facility	NASA	VA	Government	Orbital/ Suborbital	No
White Sands Missile Range	U.S. Army	NM	Government	Suborbital	No


United States Spaceports
Active Federal Government, Commercial and Proposed Spaceports and Ranges, subject to licensing by the FAA.
Alaska
Poker Flat Research Range (PFRR)
Kodiak Launch Complex
Spaceport Washington
Montana Spaceport
South Dakota Spaceport
Wisconsin Spaceport
Utah Spaceport
Nevada Spaceport
Wallops Flight Facility
Mid-Atlantic Regional Spaceport
Vandenberg AFB
Mojave Spaceport
California Spaceport
Edwards AFB
Oklahoma Spaceport
White Sands Missile Range
Spaceport Alabama
Blue Origin Exclusive Use Launch Site
West Texas Spaceport
Cape Canaveral Spaceport
-Kennedy Space Center
-Cape Canaveral AFS
Gulf Coast Regional Spaceport
Spaceport Florida
Southwest RegionalSpaceport
Hawaii
U.S. Federal Spaceport
Non-Federal Commercial Spaceport/Range
Proposed Non-Federal Spaceports

SpacePort America – New Mexico

New Developments in Aerospace Transportation Vehicles

Federal Aviation Administration


Virgin


20.11.2013


20.11.2013


20.11.2013


20.11.2013

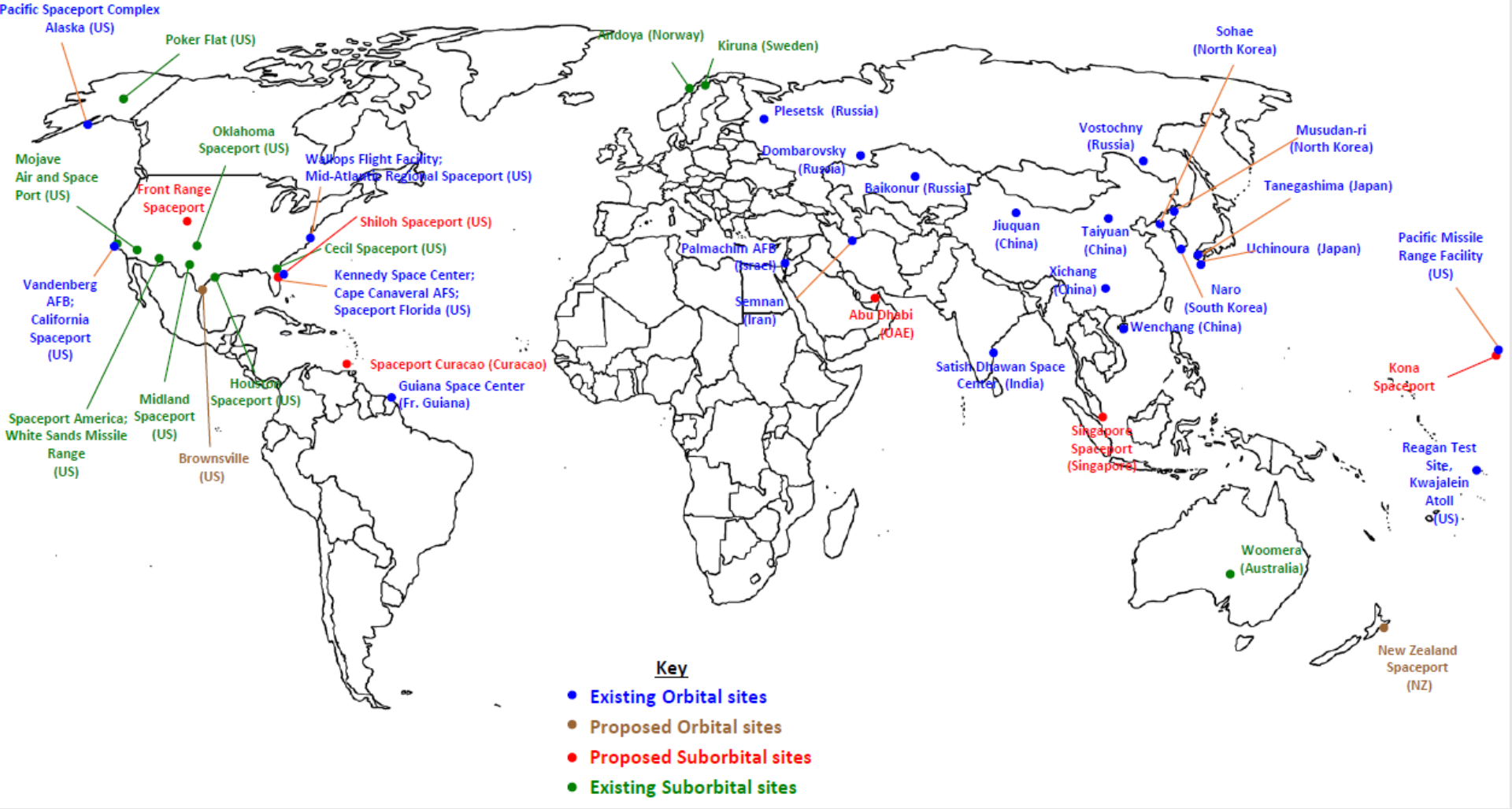

SPACEPORT
AMERICA
20.11.2013

Blue Origin Private Spaceport - Texas


OKLA.
ARK
Dallas
TEXAS
Austin
San Antonio
Houston
GULF OF MEXICO
MSNBC
BLUE ORIGIN

Non-US Launch & Reentry Sites

Existing and Proposed Global Launch Sites

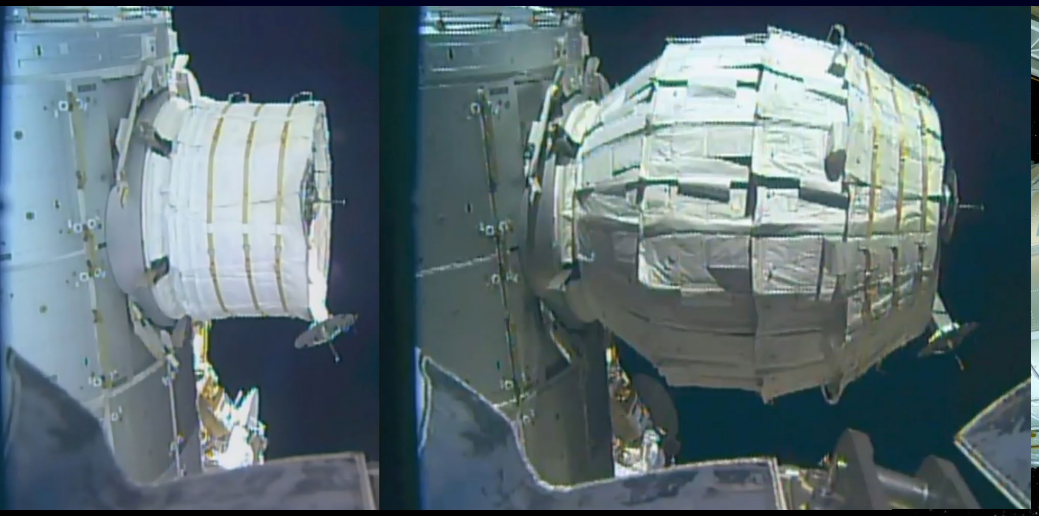


Commercial Space Stations

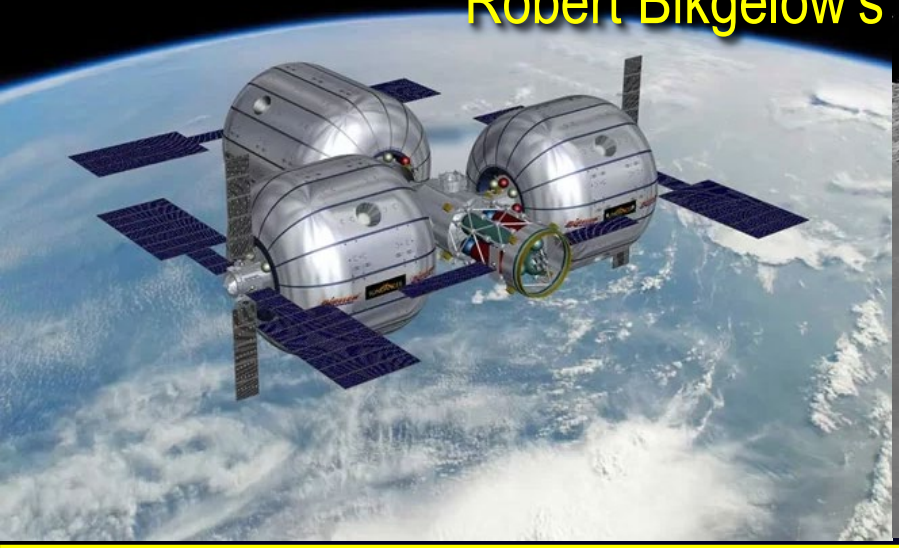
Robert Bigelow (founder of Bigelow Aerospace) announced his decision to sponsor a $50 million "America's Space Prize" competition to build and fly a private spacecraft capable of carrying no less than 5 people into orbit


RA 330

NASA awarded $17.8 M to Bigelow Aerospace to provide an Expandable Activity Module for ISS



Robert Bikgelow's Inflatable Space Station



Russian Commercial Space Station (CSS)

Design of the Commercial Space Station (CSS)

Russia has developed the design for a space hotel that could be in orbit as early as 2016

Design by Orbitalniye Tekhnologii and RKK Energia

Purpose of the station: recreation and scientific research

First module

Volume:
20 m³

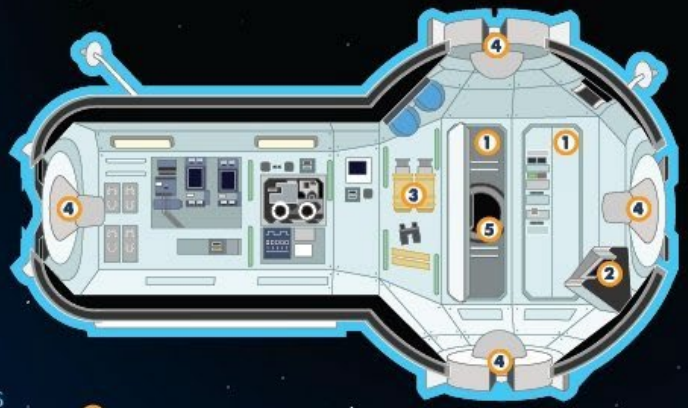
Number of berths:
4

Construction period:
2012-2013

Launch:
2015-2016

Crew:
Up to seven persons

Service life:
No less than 15 years



1. Berths
2. Controlling equipment
3. Oxygen generators
4. Docking assemblies
5. Viewport

The station will be built with reliable materials, that have already been tested in space

The CSS' orbit will be no further than 100 kilometers from the International Space Station's orbit, which will minimize costs and increase the potential for cooperation between the two stations

The Russian Soyuz and Progress spacecraft will serve the CSS, but the station will also be able to dock with all types of ships that will be used in the next decade (ATV, ARV, Shenzou, Dragon, etc.)

CSS with docked ships "Progress" and "Dragon"

 www.ria.ru


FOR
SALE

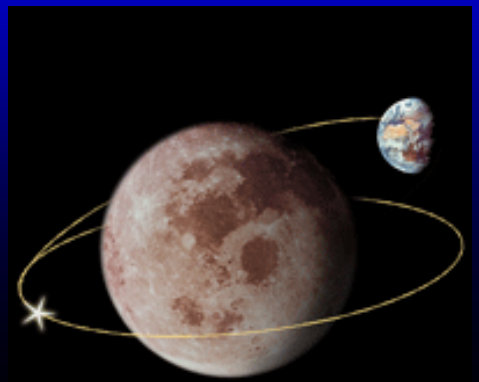
Celestis

Memorial Spaceflights

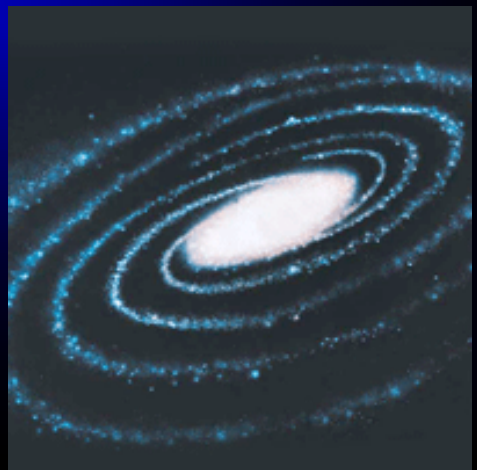
•EARTH RISE SERVICE launches a portion of cremated remains to space, and after experiencing the zero gravity environment, returns the individual flight capsules and modules back to Earth. After a successful flight, the payload, including flown flight capsules and modules, is recovered, validated as having reached space, and the capsule or module is returned to the family or loved one as a keepsake. ($695 – 1g)

EARTH ORBIT SERVICE ($2,495 1g)

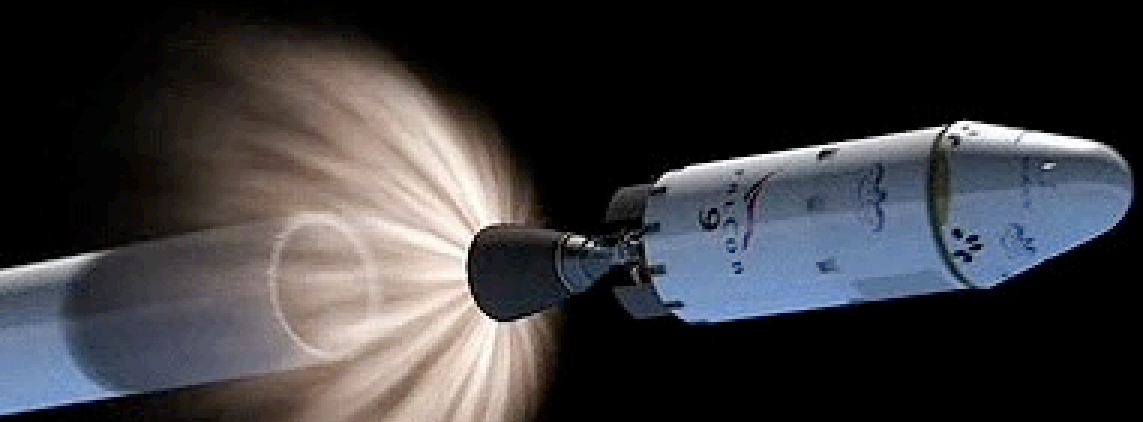
LUNA SERVICE – 2010 ($9,995 1g)



VOYAGER SERVICE – 2011 ($12,500 1g)

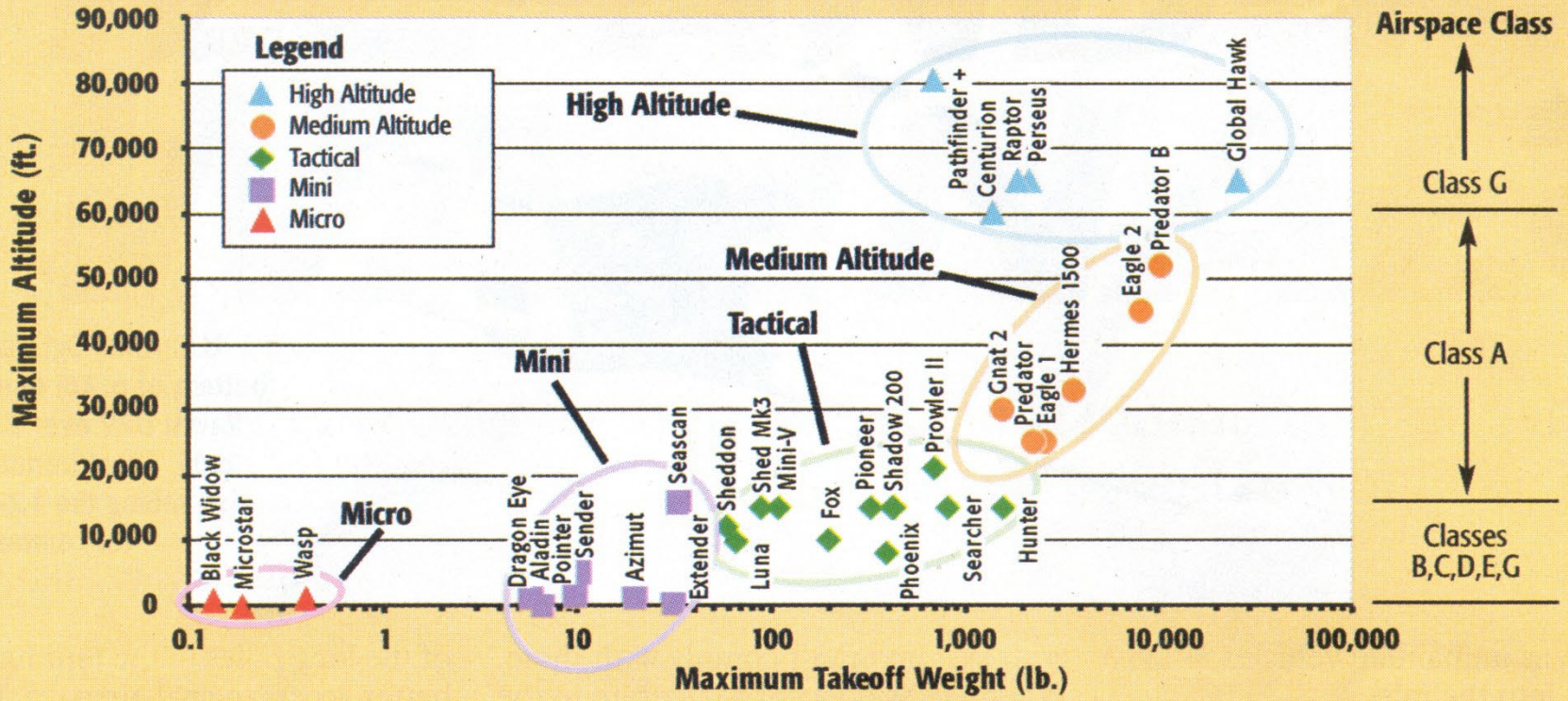


Falcon 9 second stage carried to orbit the ashes of 300 people including James Doohan (Scotty) and Gordon Cooper (Mercury Astronaut)



Unmanned Aerial Vehicles/Systems

MAXIMUM ALTITUDE OF UNMANNED AIRCRAFT SYSTEMS BY CATEGORY



Source: Roland E. Weibel, MIT Aero/Astro Ph.D. candidate, International Center for Air Transportation

UAS by the Numbers as of 09/26/2018

- 431,296 – Total downloads of the B4UFLY app
- 955,893 – Online hobby registrations under the FAA's Small UAS registration system
- 252,821 – Online commercial registrations
- 1,215,318 – Total UAS registrations

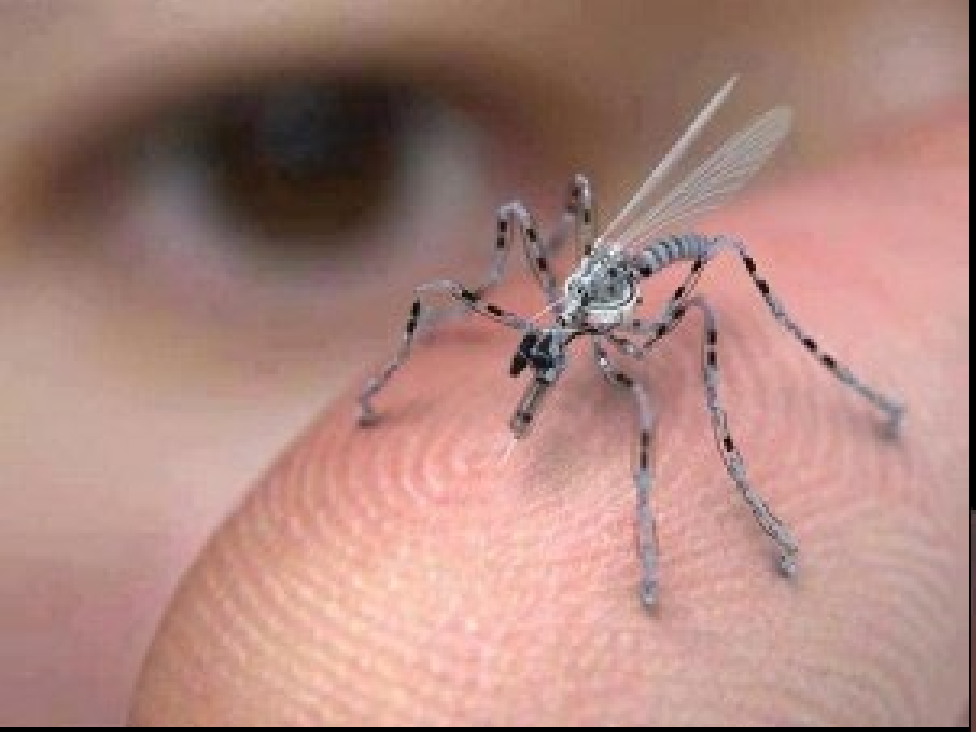
UAV/UAS vs Model Aircraft

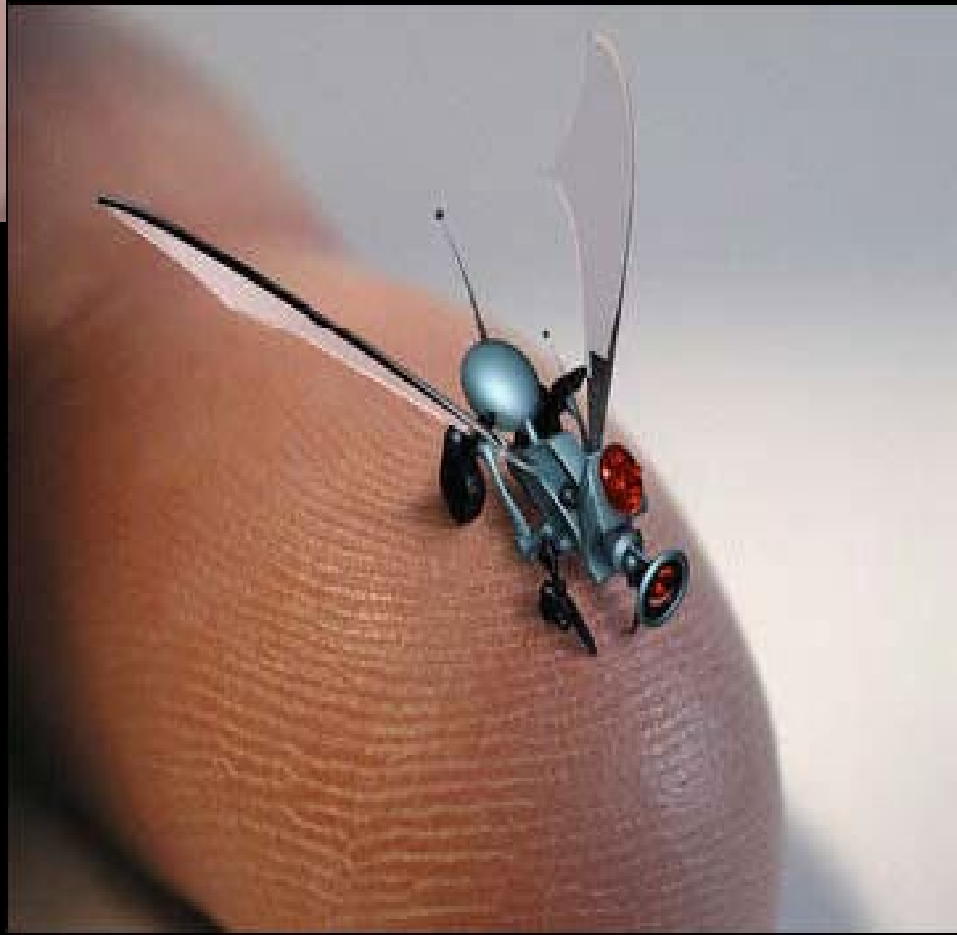
FAA Advisory Circular 91-57 limits recreational use of airspace by model aircraft to below 400 feet AGL and away from airports and air traffic

AC 91-97 only applies to aircraft modelers, and excludes individuals or companies flying model aircraft for business purposes


USAF

Model Aircraft for Hobbyist Activities





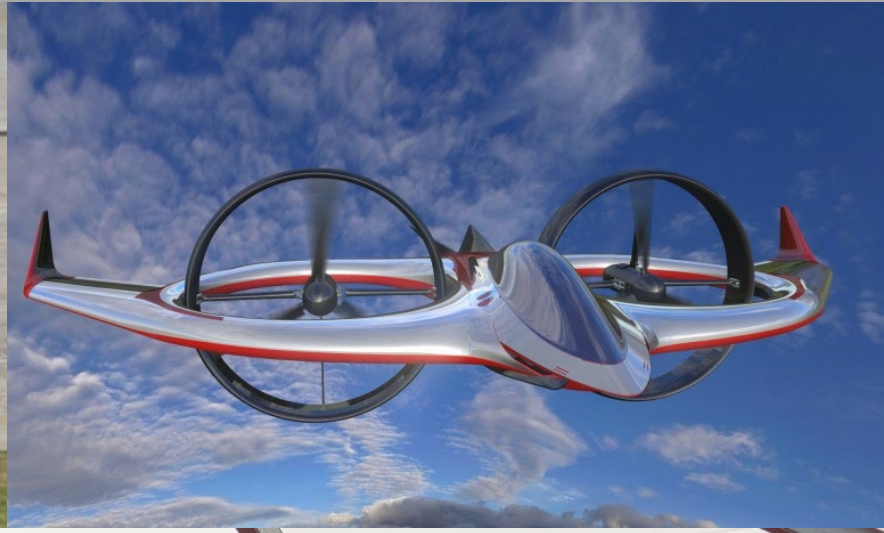

AP


WIFI
DRONE


WIFI
DRONE

FAA Aviation Safety Inspector Marcello Mirabelli with the Bell TR918. Vehicles like this are now called unmanned aircraft systems (UASs). The Bell TR918 was developed for commercial use and certified by FAA.


AgustaWestland




AgustaWestland
Eurofighter Typhoon

Greased Lightning or GL-10

A team at NASA's Langley Research Center is developing a concept of a battery-powered plane that has 10 engines and can take off like a helicopter and fly efficiently like an aircraft

Phantom Eye

Global Hawk

Heron 1

The Eitan is 79 feet long, has a wingspan of 86 feet — about the size of a Boeing 737 airliner

Real estate photography
Volcano monitoring
TV and news
Gas burn-off stack inspection
Fire scene inspection
Coastal zone studies
Meteorological research
Anti-piracy operations
Industrial terrain mapping
Climate monitoring
Algae proliferation detection
Coastal mapping
Forestry research
Wildlife census
Security and surveillance
Geophysical survey
Police applications
Archaeological site mapping
Forest fire detection and support
Perimeter surveillance

Perimeter surveillance
Agricultural surveillance
Border surveillance
Railway track bed inspection
Salt water infiltration detection
Marine mammal monitoring
Nuclear accident surveillance
Movies/Advertising/Events
Aerial terrain mapping
Photography/Video
Power line/Cable inspection
Agricultural operations support
Glacier and ice cap mapping
Tidal zone mapping
Traffic accident analysis
Monument Inspection
Disaster site monitoring
Disaster site operations
Tsunami, tidal surge mapping
Invasive species identification


madison


BIOHAZ
SN BAG


© Oceanic Preservation Society


Prime Air 30 Minute
Add to Cart
Add to Wish List
- $18.98
amazon PrimeAir


amazon
Prime Air
amazon


amazon
Prime Air
amazon


FROSTY WINTER LAGER
Lakemaid
BEER

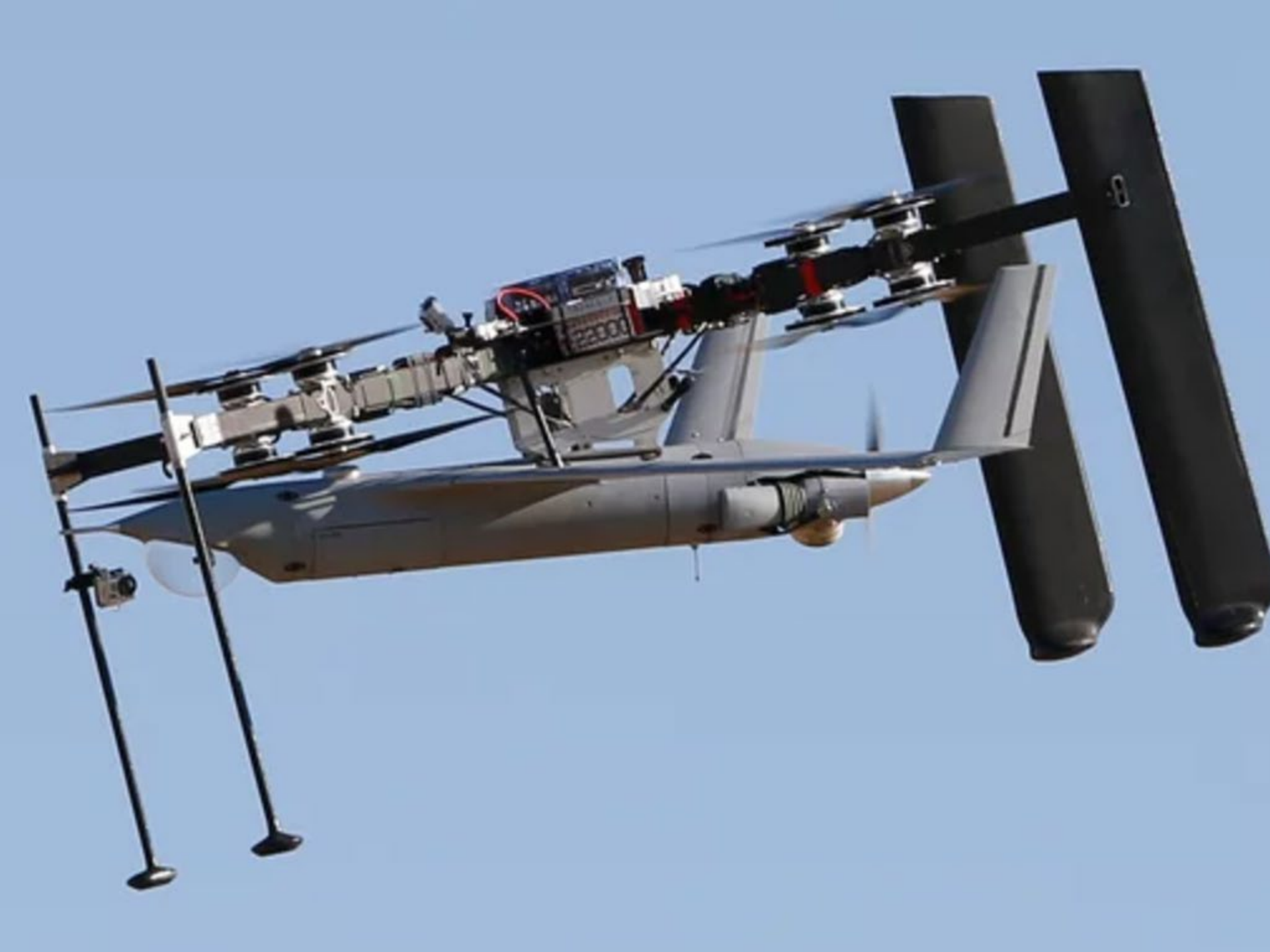

Lakemaid
BEER


Domino's

Chinese e-commerce giant Alibaba Group Holding Ltd began actual deliveries-by-UAV

The three-day, three-city test of the system began in Beijing, with deliveries being made from a single merchant operating through Alibaba's Amazon-like Taobao Marketplace website

UAV used by EasyJet for fuselage inspections



[Music]

Hazards Posed by UAS to Aviation Safety

- *Physical contact between UAS (fixed wing and rotary wing) and piloted aircraft*
- *Physical contact between UAS and humans*