

Global Forces in Vertical Flight Technology



Mike Hirschberg
Oct 21, 2015

AHS International
The Vertical Flight Technical Society

www.vtol.org



Overview

- Economic Outlook for Rotorcraft
- Global Competition
- Technologies for Vertical Flight
- Vision and Leadership

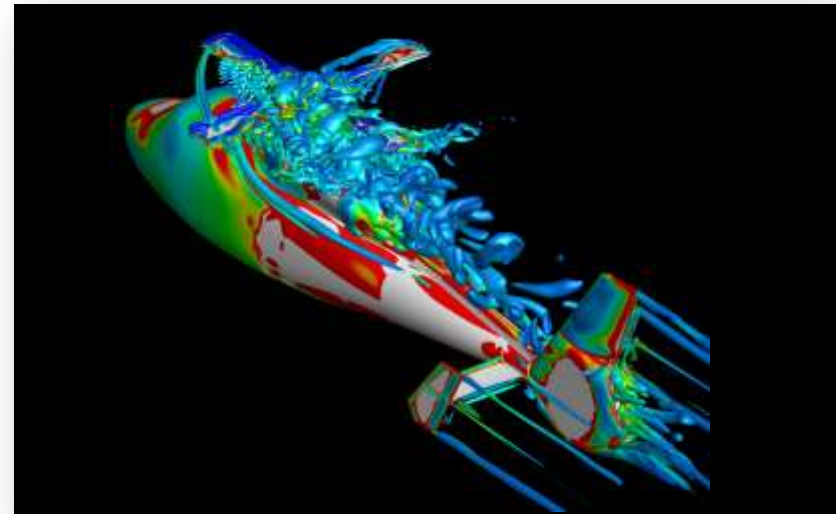




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What is AHS International?

- Founded in 1943 as the American Helicopter Society
 - Now the global vertical flight technical society
- **Expands knowledge** about vertical flight technology and **promotes its application** around the world
- Advances rotorcraft **safety and acceptability**
- Advocates for vertical flight **R&D funding**
- Helps **train the next generation** of vertical flight leaders



CFD simulation of Eurocopter Dauphin in forward flight
Courtesy of ONERA



VFF Scholarship Winners at AHS Forum 71, May 2015



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Transformative VTOL

- Many exciting VTOL concepts now being explored

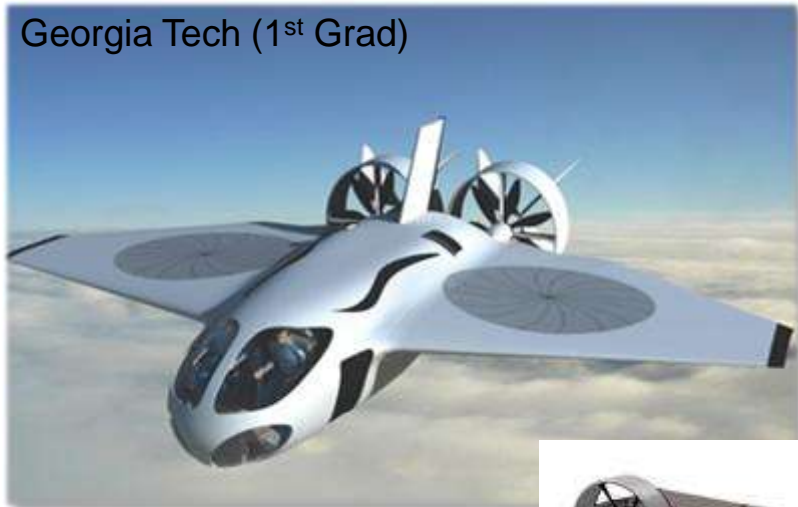




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2014 Student Design Competition: X-VTOL based on DARPA VTOL X-Plane

Georgia Tech (1st Grad)



Politecnico di Milano (2nd Grad)



St. Louis Univ. (1st Undergrad)



Georgia Tech (2nd Undergrad)



Rensselaer Polytechnic Institute (3rd Grad)



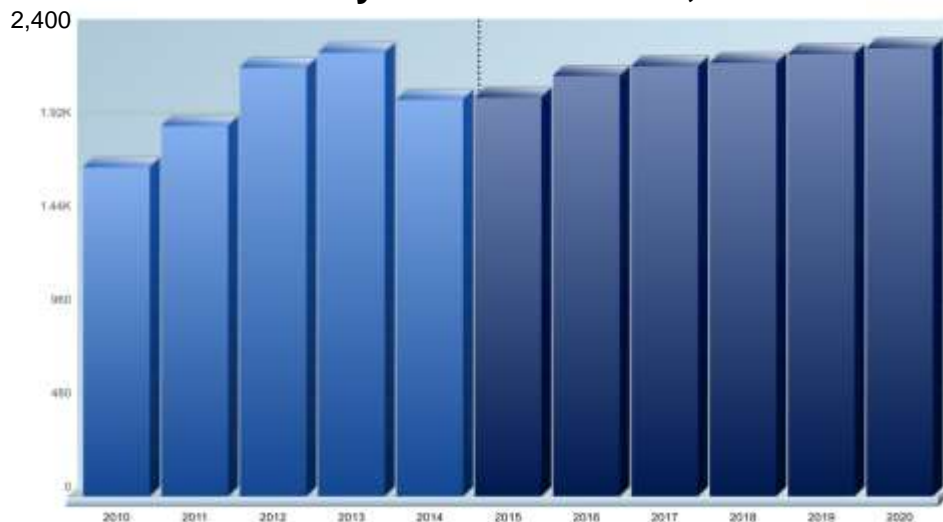
AgustaWestland
A Finmeccanica Company



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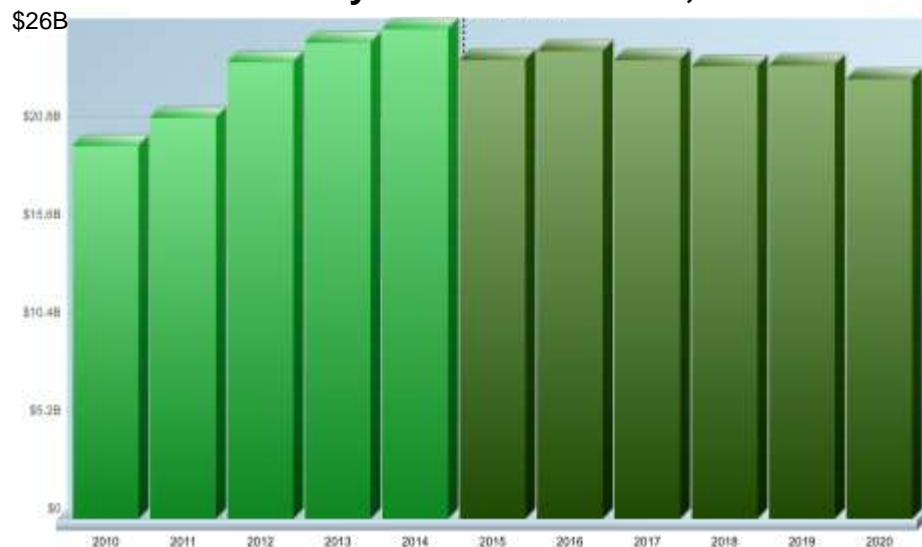
Industry Outlook: Overview

Civil & Military Production Units, 2010-2020



Robinson Helicopters at the factory

Civil & Military Production Value, 2010-2020



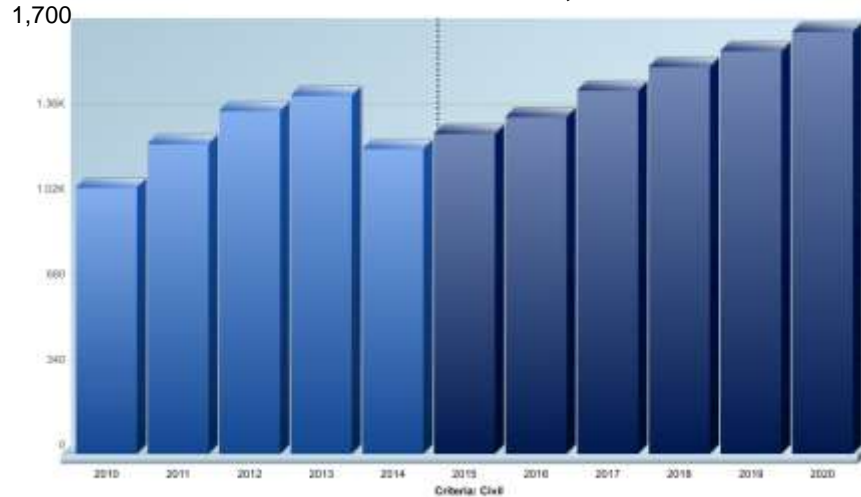
USMC MV-22 Osprey deployed on USS Wasp



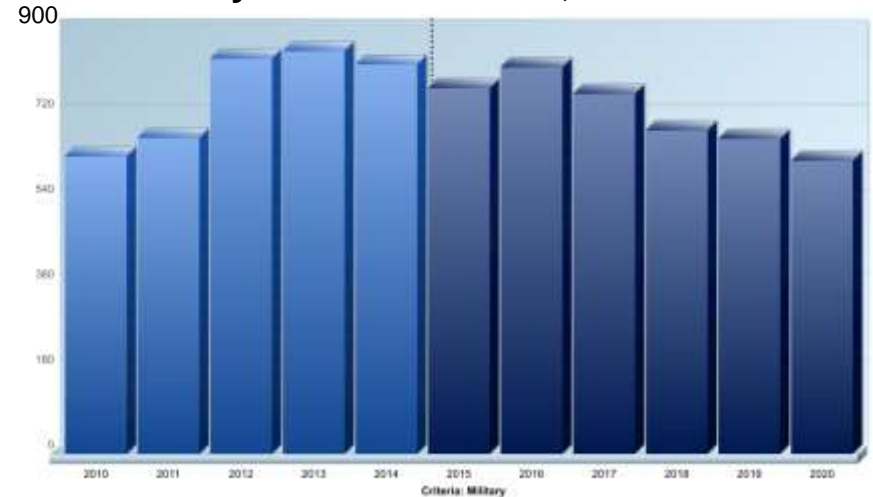
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Industry Outlook: Breakdown

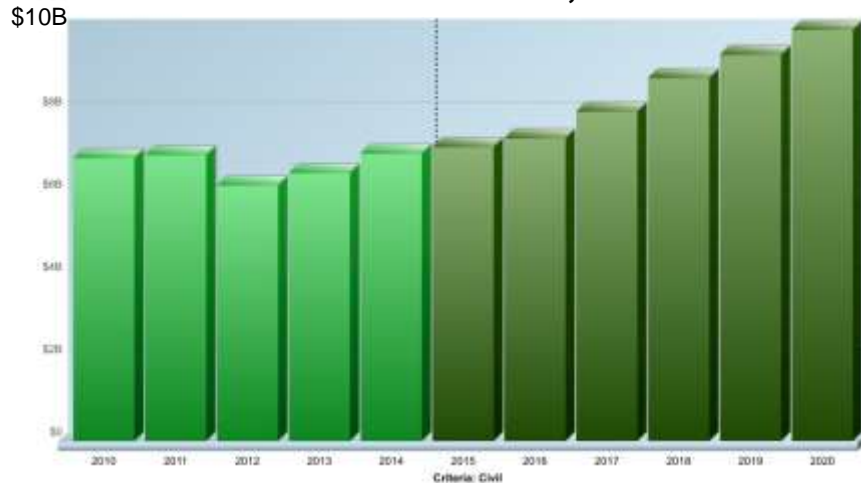
Civil Production Units, 2010-2020



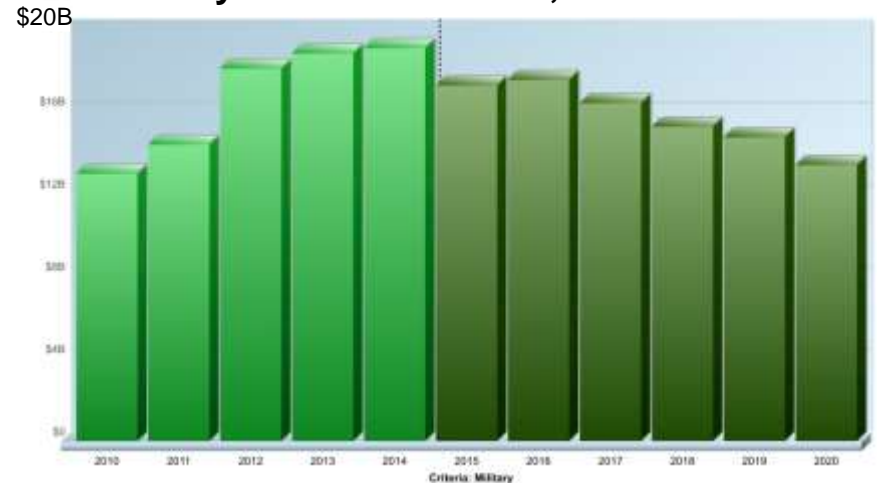
Military Production Units, 2010-2020



Civil Production Value, 2010-2020



Military Production Value, 2010-2020

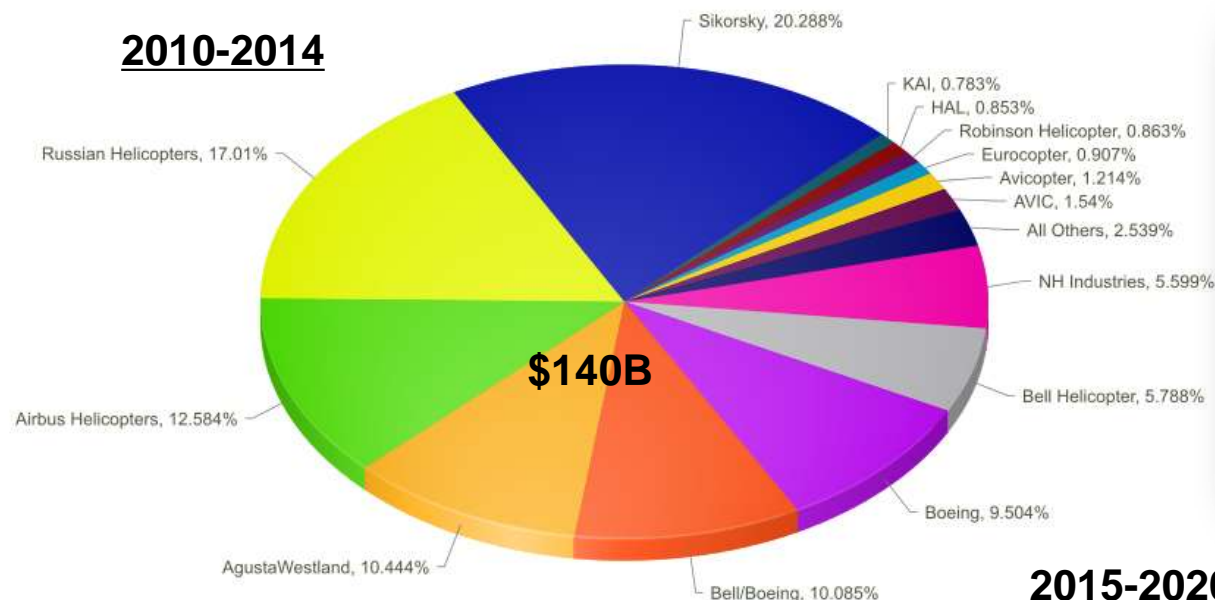




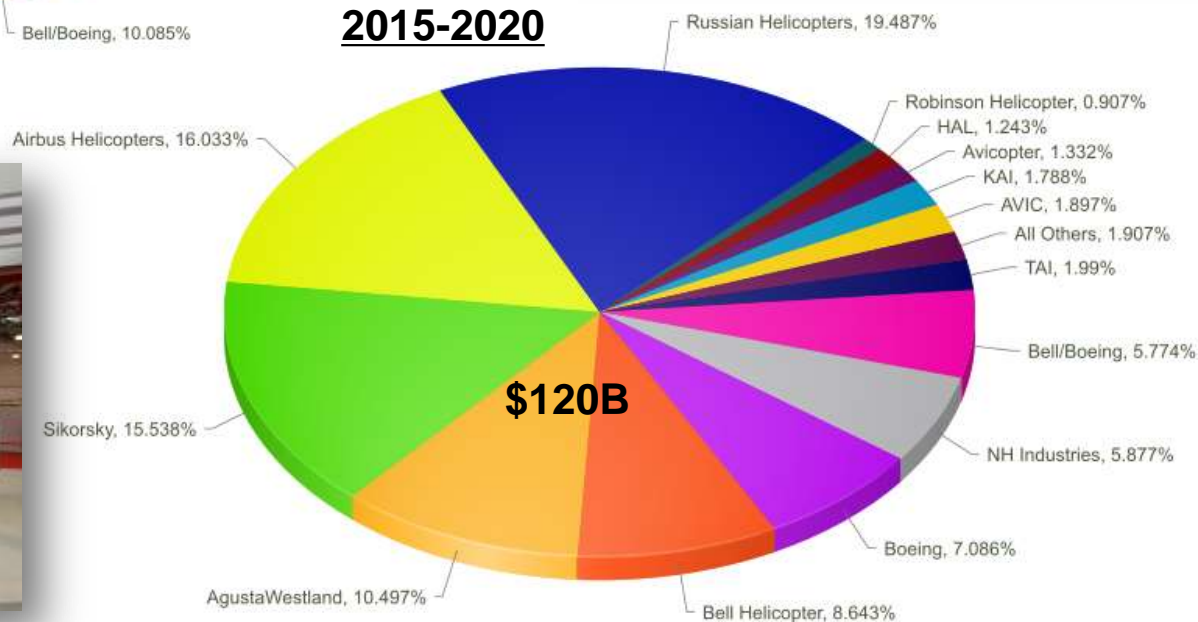
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US Losing Market Share

2010-2014



2015-2020





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All-New W. European Products



Reference: Vertiflite, Mar-Apr 2012



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Bell 525 Relentless

- 18,000 lb civil transport
- Announced February 2012
- Service entry early 2017
- ~70 orders
- First Flight July 1
- 3 in flight test by end of 2015





Bell 505 Jet Ranger X

- Announced June 2013
- Named February 2014
- First Flight November 2014
- 3 prototypes flying
- 350+ orders
- 5 seats
- Bell 206L-4 dynamics
- Turbomeca Arrius 2R (504 shp)
- Garmin G1000H glass avionics
- New “green field” factory in Louisiana



Joint Multi-Role (JMR) Preliminary Design Phase



Sikorsky/Boeing SB-1 Defiant



Karem TR-36



Bell V-280 Valor



AVX



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Bell JMR Demonstrator

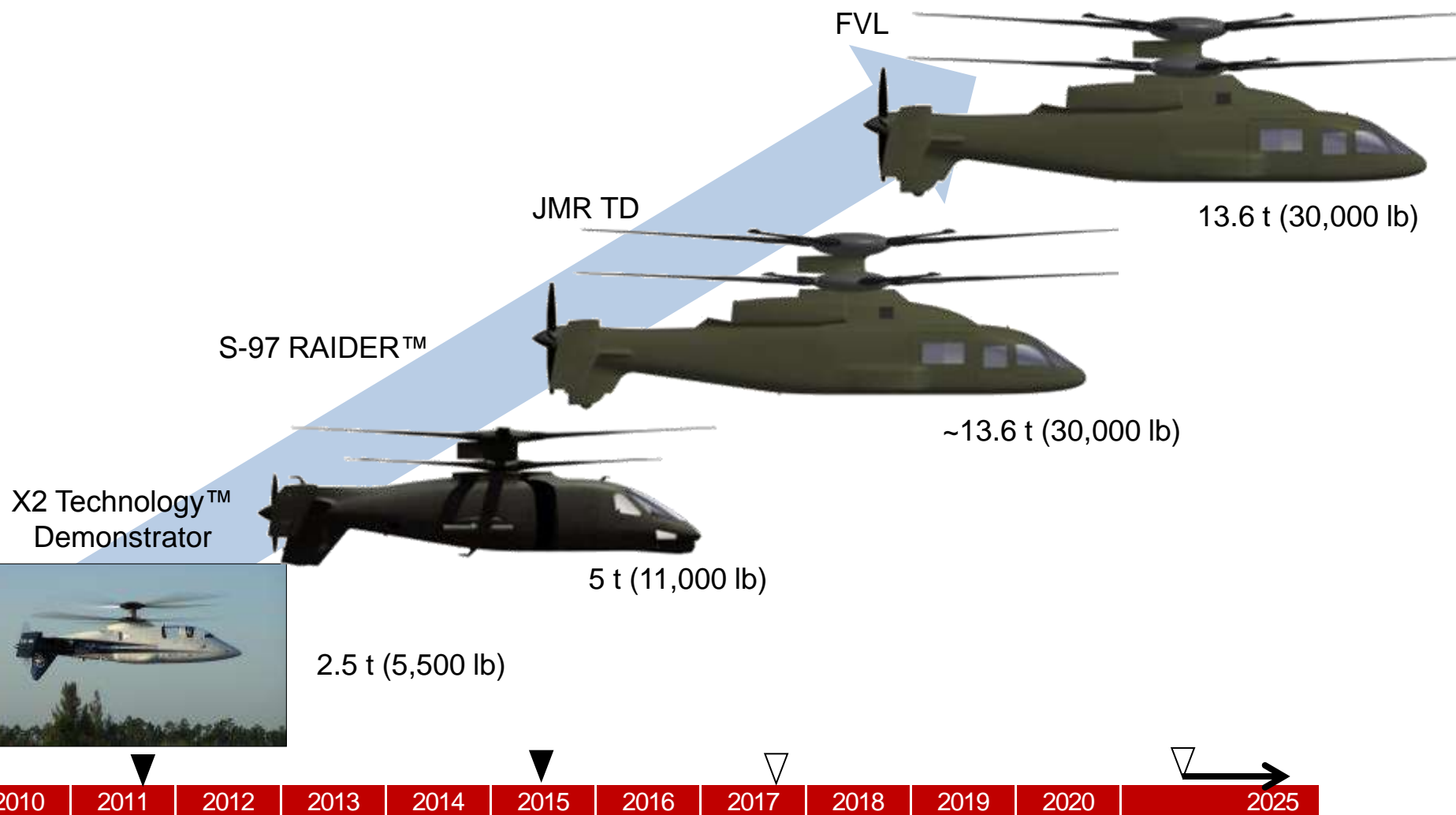
- V-280 Valor tiltrotor
- Fuselage assembly began in June
- Composite cabin, cockpit, fuselage built by Spirit AeroSystems
- Delivered September 22
- First flight expected in 2017





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Sikorsky High Speed Rotorcraft





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Sikorsky S-97 Raider



X6: Super Puma Replacement

Next Airbus Helicopters Product





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Airbus Helo Demonstrators

X3 High Speed Helicopter
260 kt



Blue Edge
Passive Noise Cancellation



Blue Pulse
Active Noise Cancellation



Bluecopter
Eco Demonstrator

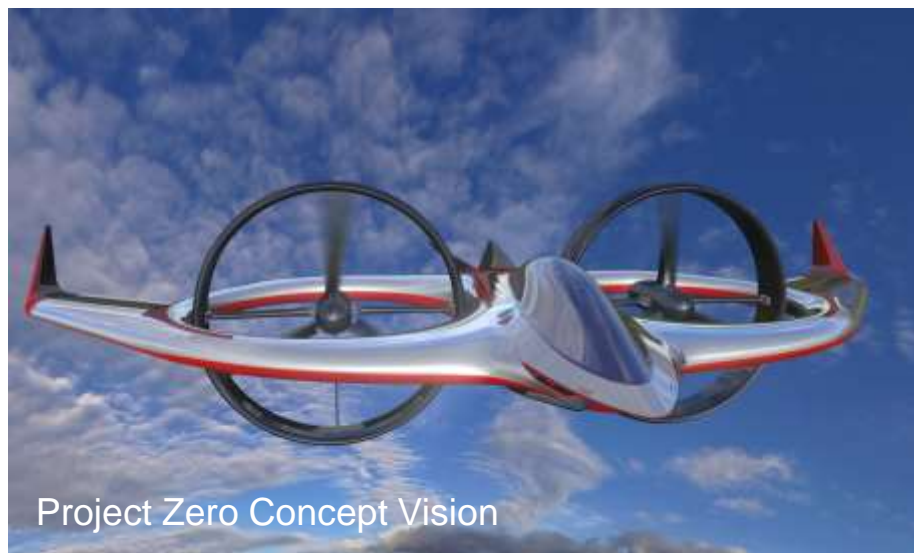


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AW High-Speed Rotorcraft



BA609 Civil Tiltrotor



Project Zero Concept Vision



Project Zero Full-Scale Demonstrator

Clean Sky 2



Airbus LifeRCraft

Flying Demonstrators in 2020

- Airbus Low Impact Fast & Efficient RotorCraft (LifeRCraft)
- AgustaWestland Next Gen Civil Tiltrotor (NGCTR)



AW NGCTR



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Safety and Noise



Technologies for the Future (1)

- New design tools (e.g. CFD/CSD)
- Advanced configurations
- Variable rotor speed
- Low noise blades
- High performance rotors
- Active/adaptive rotors
- Swashplateless hub
- FBW/FBL flight controls



Technologies for the Future (2)

- New manufacturing methods
 - Lean, Automation, RF ID Tracking
- Advanced composites
 - Unitized Composite Structures
 - Automated Fiber Placement
- Advanced engines
 - high P/W, low sfc, low emissions
- Advanced transmissions
 - high efficiency/low weight
- Biofuels/reduced carbon footprint

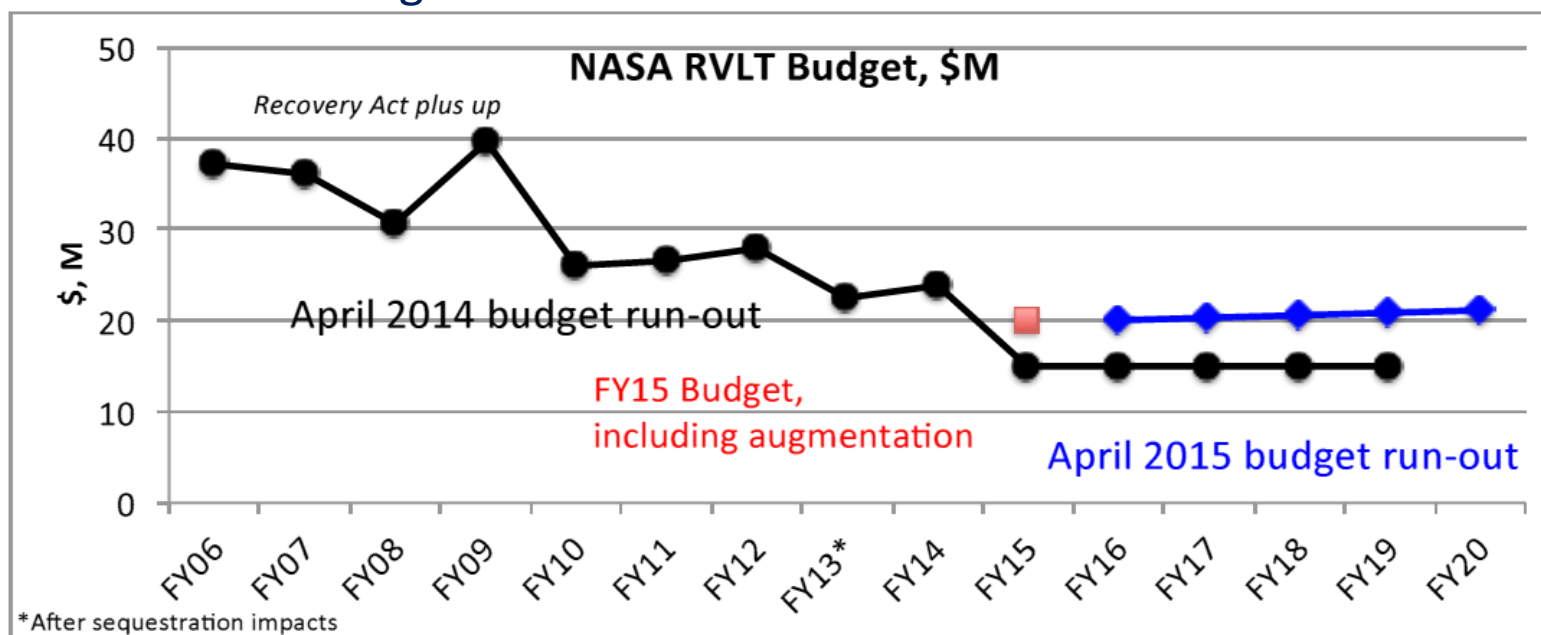


Many fertile areas being explored for potential



Aeronautics Vision

- “Vision without action is a daydream. Action without vision is a nightmare.”
 - Japanese Proverb
- “Vision without funding is a hallucination”
 - Major Mike Witteried, USAFR, Joint Staff (1995)
- “Leadership is just as important as funding, and funding is just as important as leadership.”
 - Mike Hirschberg



Recommendations for NASA

- Continue to support Blue Chip personnel and facilitates
- 2x increase in RVLT funding – back to historical levels
 - A well-thought out plan that is well-supported by industry and academia, and synergy with other government agencies where sensible
- Continue to increase the funding for Transformative concepts and look for synergies and cross-fertilization of tools, technologies and resources
- Work with the VTOL community to enable to future of vertical flight



Questions?



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New Light Civil Rotorcraft



Enstrom TH180*
First Flight 2015



Guimbal Cabri G2*
Certificated Dec 2007



Marengo Swisshelicopter: First Flight Oct 2014



Konner K1
First Flight April 2012

Chinese Rotorcraft

- China operates few civil helicopters, some police/paramilitary
- Recent purchase of Enstrom
- Military purchased or produced Russian or European models
- Cooperative developments with Eurocopter for civil and military
- Indigenous developments



Avicopter/Harbin Z-19: 5t Attack (2010)



Avicopter/Changhe Z-10: 7t Attack (2003)



Russian Helicopters

- World's largest helicopter producer (by value)
- Combines Kamov, Mil, Kazan, etc.
- Modernizing aircraft for civil and military customers



Mi-38



Mi-17V5



Mi-28N



Mi-26 and Ka-52

Indian Rotorcraft

- Hindustan Aeronautics Limited (HAL) licensed-production of Eurocopter designs began in 1960s
 - Developed indigenous variants (e.g. high altitude)
- HAL developed Dhruv Advanced Light Helicopter (ALH) – also civil and export
- HAL developed derivative Light Combat Helicopter (LCH)
- Tata Joint Ventures with AgustaWestland and Sikorsky for production

HAL Cheetah: 2t observation (1969)



HAL Dhruv : 5.5t light utility (1992)



HAL LCH: 5.8t light attack





Japanese Rotorcraft

- Primarily US produced or licensed helicopters for military
 - Fuji-Bell UH-1 Huey
 - Kawasaki-MD OH-6 Cayuse
- Kawasaki Heavy Industries (KHI) joint development with MBB/Eurocopter of BK117
- Kawasaki OH-1 Ninja Light Observation Helicopter (LOH)
- Kawasaki UH-X utility helicopter for Japan Ground Self Defence Forces
 - Development started March 2013
 - First flight 2018





Korean Rotorcraft

- Primarily US and European produced helicopters
- Indigenous development of Korea Aerospace Industries (KAI) Surion Korean Utility Helicopter (KUH)
 - Assisted by Eurocopter
- Full-scale production of 24 for the Army began in 2012
 - 40 Surions for Korean Marine Corps planned by 2023
- New co-development
 - Light Civil Helicopter (LCH): 2020
 - Light Armed Helicopter (LAH)



Turkish Rotorcraft

- Turkish Aerospace Industries (TAI)
- Licensed production of S-70 Black Hawk and key supplier
- TAI-AW developed T129 ATAK
- 5-6t Indigenous civil / Utility Helicopter



TUHP INDUSTRIALIZATION ESTABLISHES A PERMANENT FACTORY IN TURKEY

