

Design Features of P-180 *Avanti*

Mild Anhedral in Canards

Canard Incidence Angle > Wing Incidence Angle

Flaps in Canards

High AR Wings

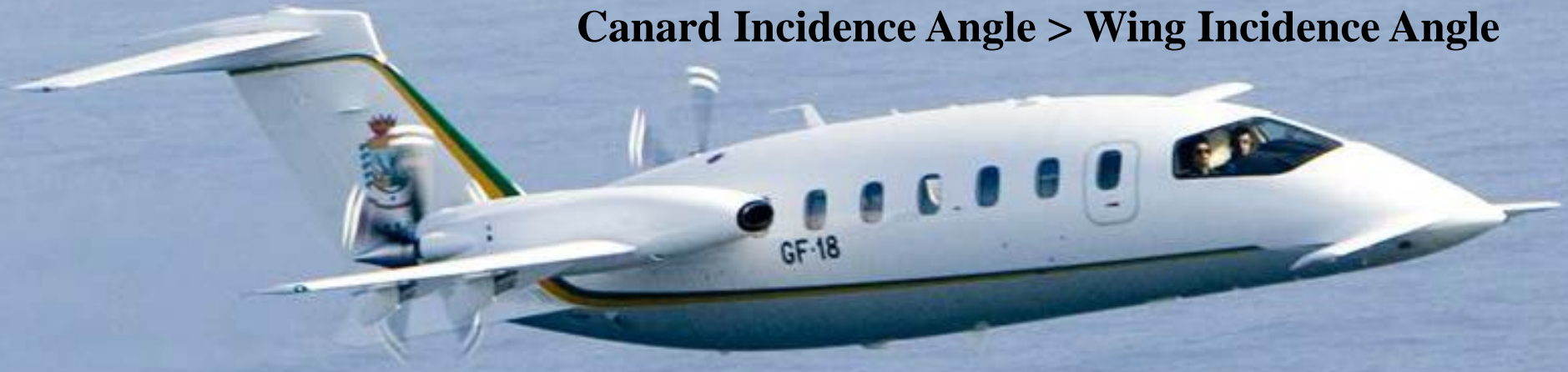
Delta Fins on Airframe Shaped Fuselage
Wings and Engine mounted behind Passenger Cabin



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Design Features of P-180 *Avanti*



Flaps in Canards

Design Features of P-180 *Avanti*

Delta Fins on Airfoil Shaped Fuselage



Design Features of P-180 *Avanti*



High AR Wings

Pusher Engines

Avanti *EVO*



P-180 Avanti

Avanti EVO



Why Winglets?



- Nearly equivalent to span extension *w/o* increased root bending moment
- Used where span limitations are important
- Good wingtip flow crucial to lower drag
- The local flow field is extremely non uniform:

Requires advanced computational aerodynamics methods to design.

Why Thrust Vectoring ?

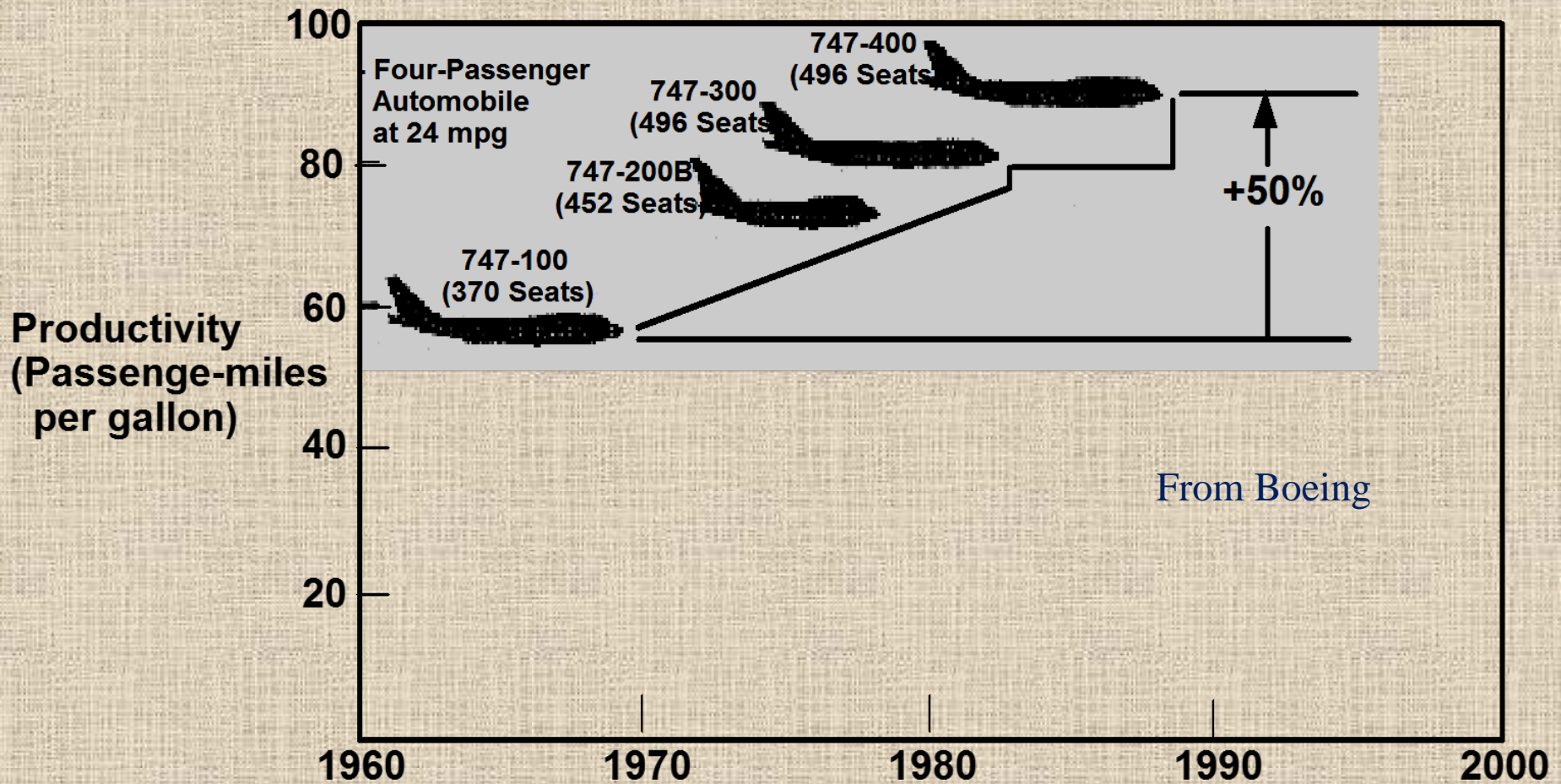
- ❑ Improved performance
- ❑ Vertical Takeoff and Landing Capability



F-35 Lightning-II
perhaps USA's last manned fighter aircraft ??

So Where Have We Come So Far?

747 Productivity improvement



FEW NOVEL CONCEPTS

Blended Wing Body

- Concept from Bob Liebeck (Douglas A/C)
- Less wetted area (no fuselage as such)
- Possibly more efficient structure
- This is now the X-48 series of planes



Oblique Wing Supersonic Transport

- Concept by R.T. Jones of NASA
- Fore-aft symmetry of lift
- Better area distribution
- Possibly only “practical” SST
- Flying wing version also



Mother-Daughter Configuration

Burt Rutan: Still imagineering!

SpaceShipOne

The White Knight

Pictures from the
Scaled Composites web site



Strut Braced Wing



- Werner Pfenninger's strut-braced wing concept from 1954
- The strut allows a thinner wing without a weight penalty
- Also a higher aspect ratio (span), less induced drag
- Reduced t/c allows less sweep without a wave drag penalty
- Reduced sweep leads to *even lower* wing weight
- Reduced sweep allows for some natural laminar flow
- Reduced skin friction drag
- Needs MDO to make it work

Lockheed, Virginia Tech, NASA Team



Compared to a conventional cantilever design:

- 12-15% less takeoff weight
- 20-29% less fuel
- less noise and emissions

Recent Configuration (2010)



Courtesy Ohad Gur

And Hope for Low-Sonic Boom Noise Flight

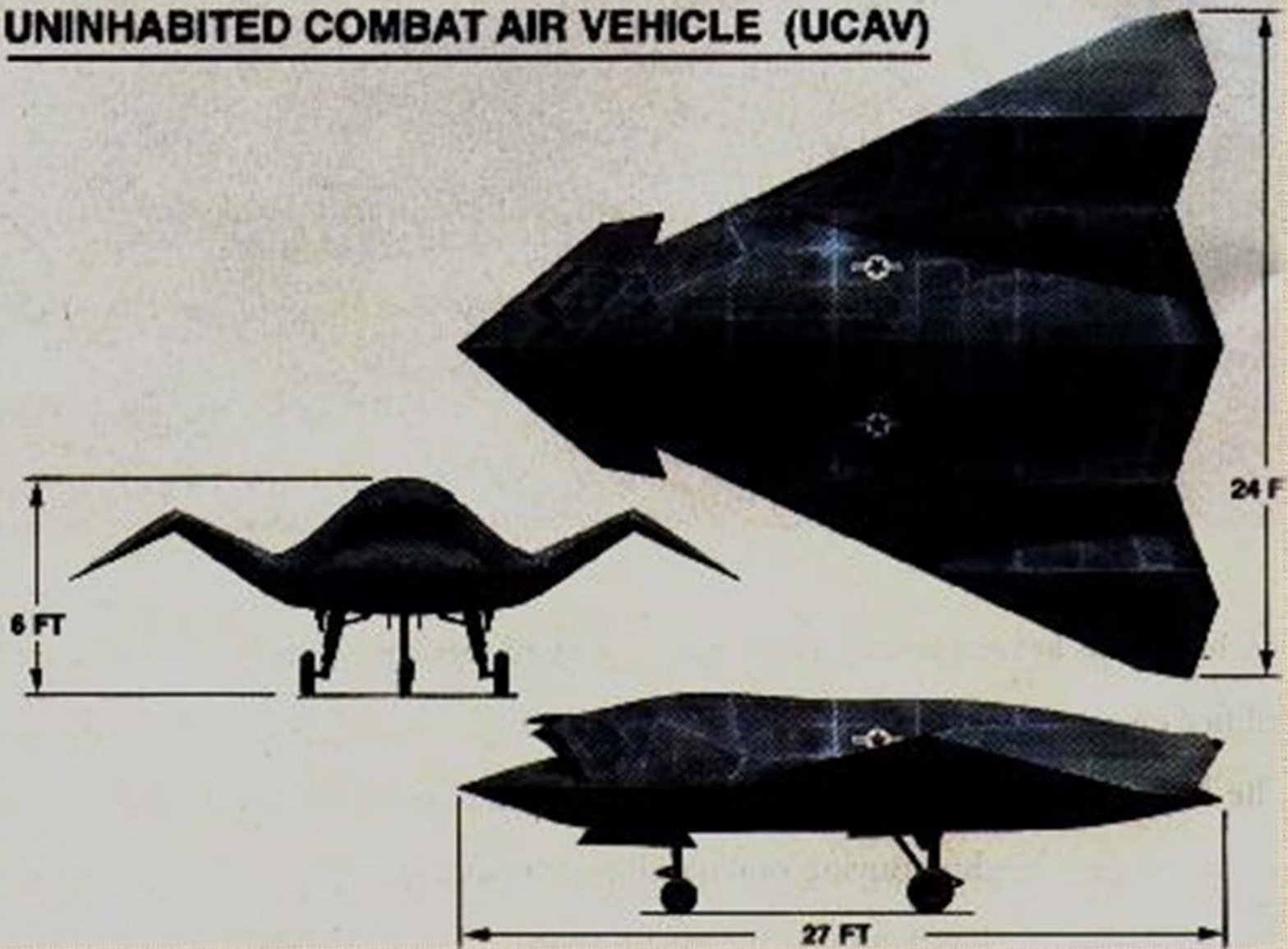
A modified F-5E demonstrated a low-noise boom on Aug. 27, 2003

So-called “boom shaping” can be used to reduce the part of the boom that hits the ground.

NASA Press Release, Sept. 4, 2003



UNINHABITED COMBAT AIR VEHICLE (UCAV)



Northrop Grumman Corporation, reprinted by *Aviation Week*, June 16, 1997

The vertical tail is eliminated for stealth, directional control comes from specially coordinated trailing edge deflections

Micro AVs

Black Widow

AeroVironment, Inc.

- 6-inch span fixed-wing aircraft
- Live video downlink
- Portable launch/control box
- Pneumatic launcher
- 60 gram mass
- 22-minute endurance
- Estimated 10 km range
- Electric propulsion



Achievements

- World MAV endurance record of 22 minutes
- Smallest video camera ever flown on a UAV: 2 grams
- Smallest live video downlink ever flown on a UAV
- World's smallest, lightest multi-function, fully proportional radio control system: 3 grams
- First aircraft to be flown "heads-down" indoors

To Learn More, Read These:

The Anatomy of the Airplane, by Darrol Stinton. Few equations and deceptively simple, but it's not. Lots of good information.

Design for Air Combat by Ray Whitford. Takes a deeper look at the details, again without equations and with lots of good graphics showing typical data to use deciding on design options. The title suggests a much narrower focus than the book has.

Aircraft Design: A Conceptual Approach, by Daniel Raymer. Chapter 8, "Special Considerations in Configuration Layout" and Chapter 22, "Design of Unique Aircraft Concepts" is good once you've read the first two references.

Airplane Design, Pt. II Preliminary Configuration Design etc., by Jan Roskam. Chapter 3, and 3.3 "Unusual Configurations", in particular.

There is Still Enough Room for Dreamers

We don't yet know what the ultimate airplane concept is.

Concerning the comments on configurations given above,

Remember:

there is a time and place for everything..

If you can justify it, you can have it !

Next Topic

LAYOUT & CONFIGURATION