

11.8 Subsystems

It has long been known that aircraft could be lighter and more efficient if engine bleed and hydraulic systems could be eliminated and replaced with electrically driven systems. This concept is known as the “all-electric airplane”. The Boeing 787 is moving in that direction, with the elimination of engine bleed, but retains hydraulic systems. In a study by Lockheed (Ref 11.8.1) for a 350 passenger, 4600 n.mi. aircraft using the GE/NASA Energy Efficient Engine, the elimination of bleed would produce a 1.5% reduction in SFC (Fig. 11.8.1).

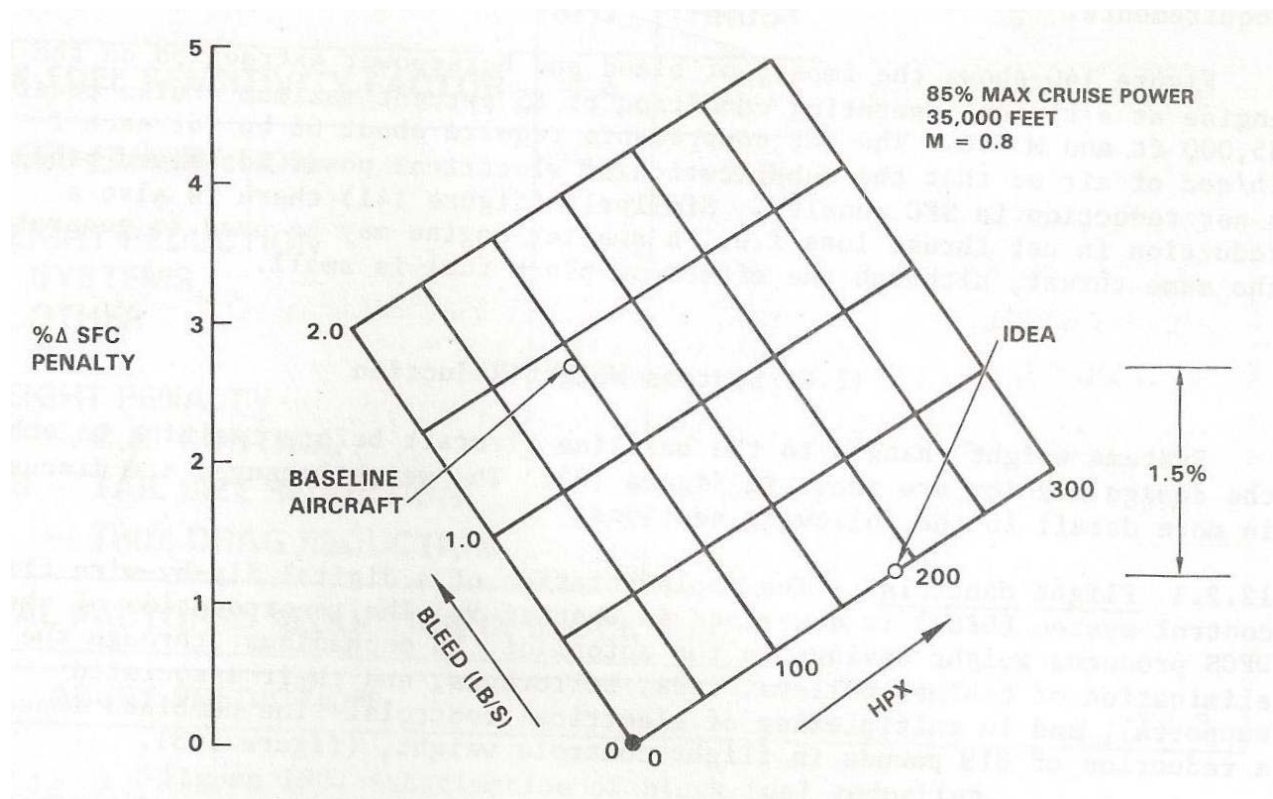


Fig. 11.8.1 Effect of Bleed and Horsepower Extraction on SFC

The Integrated Digital/Electric Aircraft (IDEA), would also achieve an approximately 2300 lb. or 1% saving in MWE, as shown in Fig. 11.8.2. The largest component of the weight reduction is due to the elimination of bleed air ducting from the engines to the environmental control system (ECS).

The complete substitution of hydraulic systems by electrical actuators has the potential of saving an additional 4700 lb, or 2% MWE, as summarized in Fig. 11.8.3. As yet, no commercial aircraft have achieved this goal.

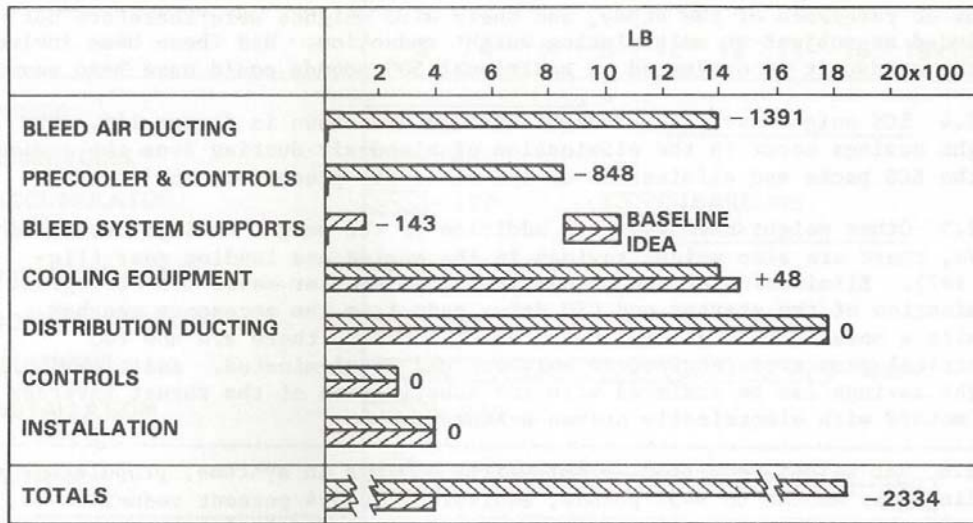


Fig. 11.8.2 Effect of Bleed Elimination on ECS Weight

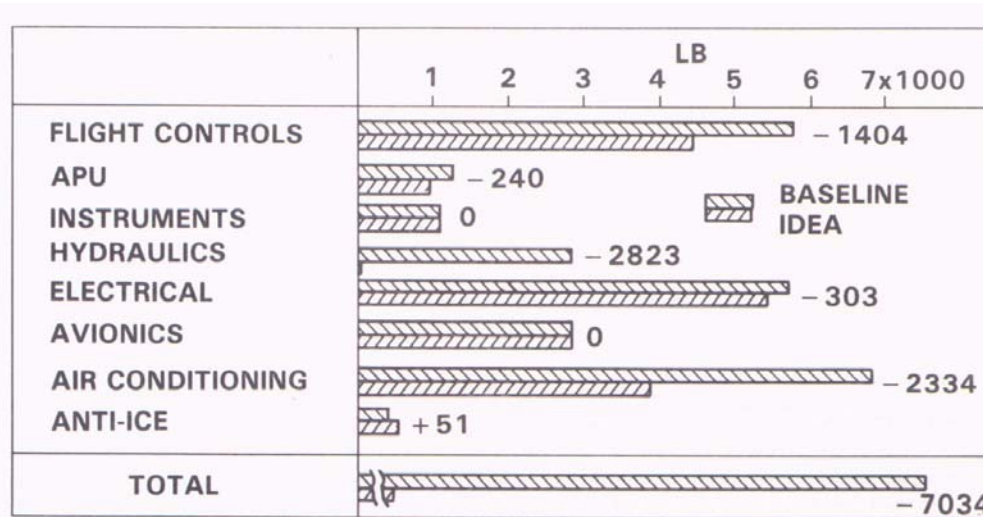


Fig. 11.8.3 System Weight Saving from Bleed and Hydraulic Systems Elimination

References

- 11.8.2.1 Cronin, M.J., et al., "Integrated Digital/Electric Aircraft Concepts Study", NASA CR 3841, January 1985.