AIRPORT/COMMUNITY ROUNDTABLE

San Francisco International Airport and
Local Governments in San Mateo County

Item #7.c

April 1, 2009

TO: Members of the Roundtable

FROM: Walter Gillfillan, Project Manager/Consultant

SUBJECT: **Agenda Item No.7.c for April 1, 2009: Work Program Item 3 – Review of New Technology, re: Aircraft Noise Reduction**

BACKGROUND

At the June 2008 Roundtable meeting, a summary of current aircraft noise mitigation research and study efforts was presented. That presentation included information on work being conducted by the FAA Center of Excellence (known as PARTNER), the Airport Cooperative Research Project (ACRP), and the Civil Aviation Organization (ICAO). Much of those efforts is focused on noise metrics, land use compatibility issues, noise mitigation methodology, and institutional interrelationships.

This memorandum is focused on two noise mitigation approaches that promise specific noise reduction at the source (jet engine and airframe noise). At the present stage of development, these efforts promise to provide noise levels well below those prescribed in the Stage 4 noise certification levels required by Federal Aviation Regulations FAR Part 36 for the certification of new commercial jet aircraft. The first of these mitigations is an engine redesign effort by Pratt &Whitney that is currently in a testing phase. The second mitigation involves a significant airframe design modification.

DISCUSSION

Jet Engine Redesign

Since 1998, Pratt & Whitney has been developing a jet engine redesign (PW1000G) for commercial aircraft. This engine is similar to a turbo-prop engine, except that the propeller is a large fan. As with the turbo-prop format, the turbine shaft revolutions per minute (rpm) is reduced through a gearbox to provide an acceptable fan rotation speed. As seen in Attachment A, there are fewer fan blades at the front of the engine. With fewer fan blades and a slower rotation, the engine produces less noise.

Pratt & Whitney has been working on this concept for the past 20 years. It was initially a test engine on a Boeing B-747 and is currently being tested on an Airbus A-340. Pratt & Whitney believes that this design will provide double-digit reductions in fuel consumption, CO2 and NOx emissions, engine noise, and operation costs. Unfortunately, the Pratt & Whitney information does not provide a numeric value or a

metric to the "double digit" noise reduction claim. However, a reduction of at least 10%, applied to Stage 4 levels, would be noticeable. It would be similar to a 10 dB change from Stage 3 to Stage 4 aircraft noise levels. An airframe manufacturer has an exclusive agreement to use the PW1000G engine on its Bombardier C Series, a 100-149 seat aircraft planned for commercial service in 2013.

Airframe Design Concept

NASA is currently working with Boeing on a new airframe design concept. First introduced in flight tests in the 1940s as a "flying wing", the concept diverts from the traditional tube/wing configuration to a blended wing/body (BW/B) format shown in Attachment B. Boeing is currently flying this un-manned, sub-scaled model in tests at Edwards AFB as a part of its research program.

NASA's research goals, as set in 2007, include design of a subsonic cargo aircraft to meet specified fuel burn, emissions, and noise reduction criteria. The objective for noise is a reduction of 42 dB below current Stage 4 certification limits. The principal contribution to noise reduction for people on the ground comes from the shielding effects provided by the wing/body configuration.

The cargo design version was selected as the first priority because it is a simpler design due to the lack of passenger windows and extensive cabin pressurization and cabin evacuation requirements. The cargo version availability date is targeted for service in 2020, with a passenger version available for service ten years later.

RELEVANCE TO THE ROUNDTABLE

The Airport Noise and Capacity Act (ANCA) of 1990 helped move the airline industry into an all Stage 3 commercial fleet (for aircraft weight above 75,000 pounds). Federal regulation resulted in significant aircraft noise reduction for surrounding communities. Current Stage 4 technology provides an additional noise reduction of 10 dB.

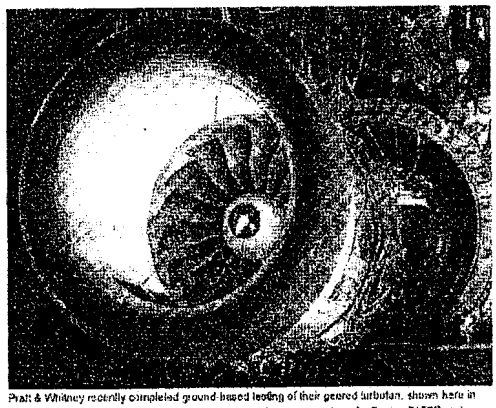
However, aircraft noise impacts in communities near the San Francisco International Airport continue to be an issue. The two technologies summarized in this memo may be ones that the Roundtable can follow to see if the expected aircraft noise impact reductions from those technologies are actually achieved.

Attachments:

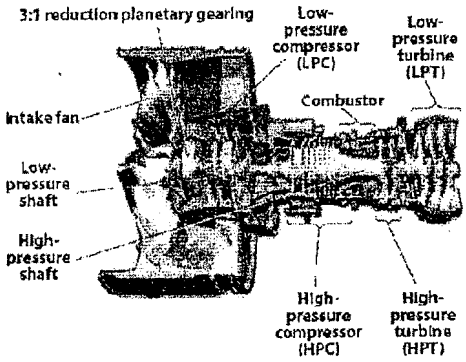
Attachment A: Diagrams of the Pratt & Whitney PW1000G Engine
Attachment B: Photo of the NASA/Boeing Blended Wing/Body Concept

WaltGRTmemonewnoisetechnologyforApril10309.doc

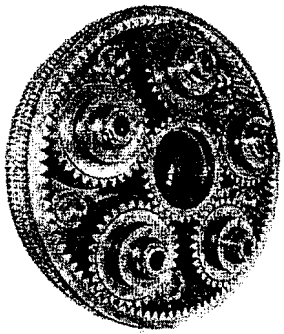
Volvo Aero, volvo.com/volvoaero/global/en-gb



Pratt & Whitney recently completed ground-based testing of their geared turbofan, shown here in the company's test rig at right. The next step is to fly the engines aboard a Boeing 747SP and an Airbus A340 to test flight qualities.



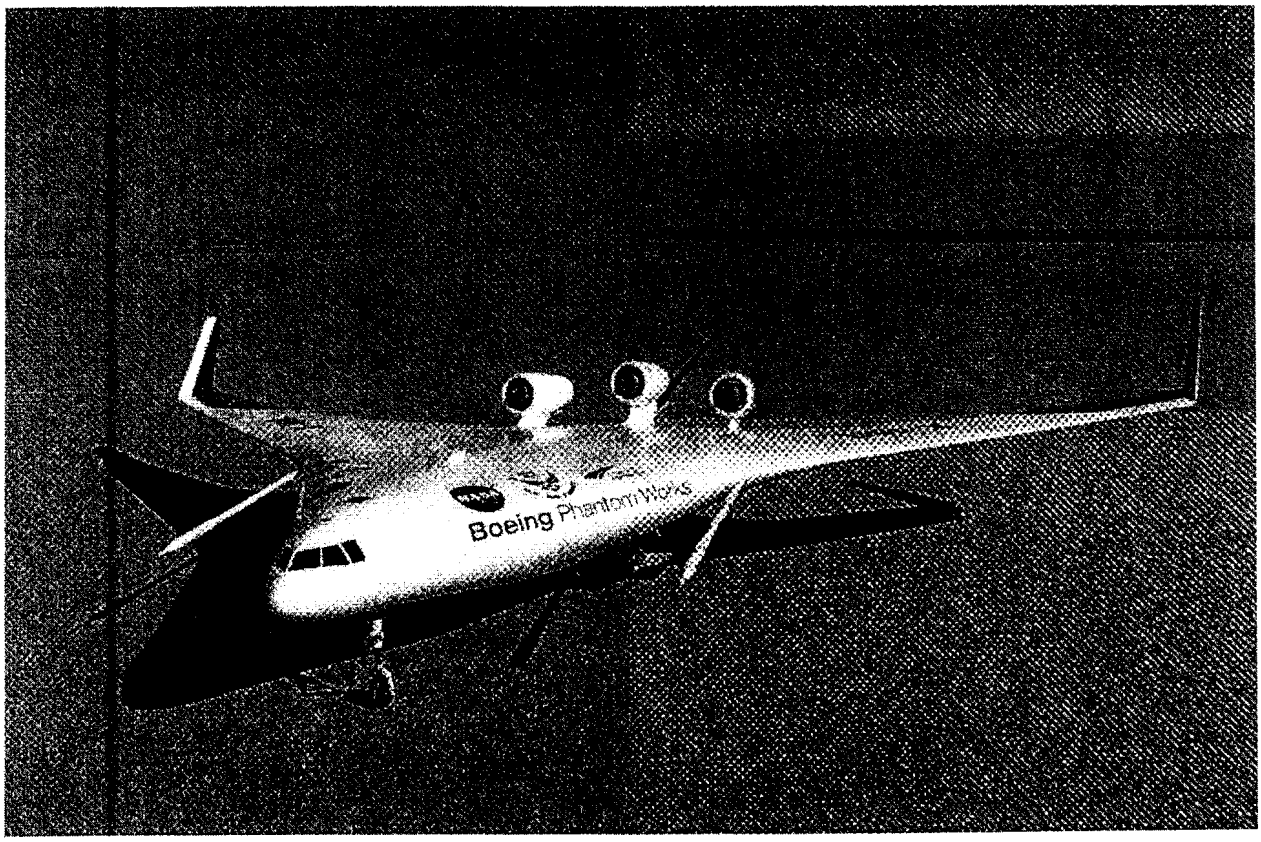
Pratt & Whitney's GTF schematic shows a large inlet fan decoupled from its low-pressure driveshaft by a 3:1 reduction planetary gearing system. This gearing lets the low-pressure compressor and turbine run about three times faster than conventional engines while slowing the fan for quieter operation and a bigger bypass ratio.



The enabling feature of the GTF is its 3:1 reduction gearing. The setup is similar to this planetary gear system, also produced by Italian aviation company, Avio.

ATTACHMENT A
Pratt & Whitney PW1000G Engine

Source
Machine Design Magazine
June 19,2008



ATTACHMENT B
Blended Wing/Body Concept

Source
Boeing Web Site