SUBMISSION FROM CFM INTERNATIONAL TO THE NATIONAL TRANSPORTATION SAFETY BOARD REGARDING THE US AIRWAYS FLIGHT 1549 ACCIDENT ON JANUARY 15th 2009 IN HUDSON RIVER, NEW YORK CITY. DCA09MA026.

This letter is submitted for the NTSB's consideration.

Summary
CFM fully supported and participated in many aspects of the NTSB-led investigation: on-site, engine investigative disassembly, public hearing, and technical review. We had participants on several of the NTSB teams including powerplants, DFDR, and CVR. We provided the secure facilities, tooling, and mechanics for the engine disassembly. We provided input to the powerplants group factual report and took advantage of the opportunity to review and comment upon that report prior to release. CFM also provided a technical witness and a presentation at the public hearing (available in the public docket) and sent a team of 4 people to support the hearing.

The CFM56-5B engines involved in the event experienced a simultaneous bird ingestion into both engines. One or more birds entered engine #1 and at least two birds entered engine #2 as verified by analysis of recovered bird remains. The analysis determined that the birds ingested were Canada geese. Canada geese typically average 8 pounds each, which is well beyond the certification requirements of the engine. Both engines showed evidence of ingestion into the core with consequent mechanical damage which led to thrust loss. The thrust decreased on both engines at the same time as evidenced by the DFDR data. The #1 engine continued operating at significantly reduced thrust but did provide electrical and hydraulic power. The #2 engine rolled back to sub-idle and safely shut down. Both engines reacted safely as required, remained intact, on-wing, did not release parts that could have damaged the aircraft, and could be safely shut down.

The DFDR data and CVR transcript were reviewed. The data shows that engine speed, fuel flow, and other related engine parameters reacted together following the bird ingestion. There was one minor anomaly related to the #2 engine high pressure shut-off valve (HPSOV) which, per the DFDR data, appeared to close prior to the flight crew closing the master lever. There was no corresponding master lever/HPSOV disagree fault recorded. This was not fully explained since relevant engine parts were lost in the river, however, it had no effect on the event. There were no other anomalies or unexpected readings observed.

Conclusions & Recommendations

The loss of airplane thrust following the ingestion of the geese is not unexpected given the severity of this event in terms of bird size and mass ingested into the core of both engines. As stated in the public hearing, CFM believes that current technology would not allow significant improvement for the modern high-bypass turbofan to withstand such ingestions at all conditions without compromising the current safety level when

considering all design requirements. The engine design must maintain a careful balance to operate both safely and efficiently.

In order to reduce the risk of a similar event in the future, there are several options that should be considered:

1) Ideally we should prevent the ingestion. One action that could be taken to help in this area is reducing resident large bird populations to acceptable levels in the vicinity of airports such that multiple engine ingestions would be much less likely. In January 2002 the TAEIG issued a letter from the ARAC-tasked Bird Ingestion Phase II Task Group with recommendations for management of large flocking bird populations, these should be re-emphasized.

2) Providing the crew with warnings of birds on the flight path would allow avoidance techniques to be used. Weather radar is now installed in all commercial aircraft and allows flight crews to avoid weather conditions which could pose a threat to safety of flight. TCAS systems give warnings of potential conflicts between aircraft. Current bird warning systems for airports are limited in capability (note this event occurred 5 miles from the airport), and the development of on-board radar should be pursued to give crews the chance to avoid bird flocks. This could also include consideration of new technologies which are being developed that can warn birds of an approaching aircraft (e.g. lasers) so that the birds can take evasive action, or physically deter them from the flight path (e.g. directed energy beams).

3) CFM supports an FAA/industry effort to update the bird ingestion database from 2000 through March 2009. This was initiated in 2009 and CFM is participating and providing data. Following completion of this update in 2010, review of the current and projected bird ingestion rates is appropriate to determine any potential need for further actions. In light of this event, this review should include an assessment of the medium bird ingestion conditions relative to both bird and engine speed to see if it accomplishes the original intent.

CFM believes that in order to successfully meet the threat of large flocking birds, all of the above factors should be addressed :

- Control populations of LFB's near airports.
- Provide crews with warnings to enable avoidance.
- Assess adequacy of current regulations for core ingestion.