Thank you for this opportunity to present what we have been working on to develop a long term and enduring strategy to you and get guidance.

4 years of steady steering into the new direction

Acknowledge ARMD & 4 research centers hard work

Challenge to cull it down to 3 hours but we did our best

BTW, the caption says NASA Aero is with you when you fly. That’s the message we have been communicating to the community and flying public → direct benefits to society and touching everyone’s life daily basis
NASA technologies are DNA of the modern aircraft.

Similar contributions to military aircraft, rotary wing, and general aviation.
NASA’s contributions did not stop 10 years ago. We are continuing to write our success stories. All four products on this chart came into the market in the last 2 years and NASA’s contributions to every one of them have been recognized by the manufacturers.

**B787**
20% more fuel efficient than B767 that is replacing GE GEnx and RR Trent 1000
Unit price: $200M

**B747-8**
Unit price: $350M
GE GEnx is the only engine
Collaboration with External Partners

Prior to 2008, Partnership with:

Universities was strong
OGA was not uniformly strong. DoD strong, but FAA openly criticized NASA for going back to fundamental research only
Industry pretty much broken altogether
International agencies was not on any priority list.

Today, we have very strong partnership with FAA evidenced by successful RTT activities, strong partnership with industry, and strategic partnership with several international agencies (ONERA, DLR, NLR, JAXA)
ARMD International Agreements

Agreements in force = 37 (out of 557 in agency)
Agreements/extensions in work = 12
mix of reimbursable and non-reimbursable agreements

as of 2013-02-13
Exploring Strategic Trends
Challenges Traditional Approaches

China & India Growing Economically at Historically Unprecedented Rates

They will have the Largest Middle-Class

The World will be Predominantly Urban

Technology Development & Adoption is Accelerating

Source: National Intelligence Council
Why are these trends important?
Challenges are multiplying and accelerating – technology is a key lever!

- It drives global demand growth for air travel...
- It drives expanding competition for high tech manufacturing...
- It enables “leapfrog” adoption of new technology/infrastructure...
- It drives resource use, costs, constraints and impacts...

COMAC (Commercial Aircraft Corporation of China) C919
- direct competition to B737 and A320
- serious challenger to the current duopoly
- 1st flight expect in 2014 – introduction in 2016 to mostly Chinese airlines (~380 orders to date)
- international competition expects to start around 2020.
  (Will used CFM LEAP engine)

Leapfrogging into next generation technologies
Not constrained by existing infrastructure
These Trends Create Aviation Mega-Drivers

Three critical vectors:

- Global Growth in Demand for High Speed Mobility
- Global Climate Change, Sustainability, & Energy Transition
- Technology Convergence
Even today, ARMD is working on all of the 6 thrusts.

This is the reason why external community told us that we are on the right track.

We need to think about the availability of funds vs. the speed of progress needed to make compelling impacts.