Foreign Comparative Test Program Samples Korea's Best

Col. Bob Mattes, USAF

The Republic of Korea's introduction of the T-50 Golden Eagle supersonic advanced jet trainer has raised the ante in the international military aviation market. I know this first-hand because I am the first U.S. military pilot to fly the T-50.

The author and Republic of Korea Air Force test pilot Maj. Cheol Kang before test flying the T-50 Golden Eagle. Photograph by Hui Man Kwon

The Foreign Comparative Test (FCT) Program under the Office of the Deputy Under Secretary of Defense for Advanced Systems and Concepts (AS&C) scours the world for the best equipment possible to meet our warfighters' requirements. AS&C partners with the Services and Special Operations Command, who test promising new technologies and equipment and procure those that meet their immediate warfighter requirements. Prominent examples of FCT successes include the Buffalo mine-clearing vehicle from South Africa and the M240 7.62 mm medium machine gun from Belgium, both used daily to save coalition lives in Iraq and Afghanistan. FCT remains a critical tool to support our troops in the war on terror. A close ally in the war on terror, the Republic of Korea has participated in the FCT program with nine projects over the years. I recently traveled to the Republic of Korea with an AS&C/multi-Service/Special Operations Command team to assess their current technology, engineering, and manufacturing level, with an eye toward garnering an expanded Republic of Korea involvement in the FCT program.

From literal devastation in 1953, the Korean people, industry base, and government have labored diligently, rising to a leading world economic power. In recent decades, the Korean government has emphasized and invested heavily in a handful of high-technology industries, including their aerospace industry. As a result, the overall economy of the Republic of Korea has grown to 18 times that of its neighbor to the north. Consumers can see the payoff in products from companies like Samsung, Hyundai, Daewoo, and many more.

Pinnacle of Achievement

Republic of Korea President Roh Moo-hyun highlighted the T-50 Golden Eagle supersonic advanced jet trainer as the pinnacle of Korean technical achievement at the recent Korean Aerospace and Defense Exposition 2005 opening ceremony. The president pointed out that the Republic of Korea stands as only the 12th country in the world to natively produce a supersonic aircraft. Korea Aerospace Industries (KAI), Ltd., designed, tested, and produces the T-50 in partnership with Lockheed Martin. The KAI and Republic of Korea Air Force leadership graciously extended me an invitation to fly the Golden Eagle during our FCT visit. Although the United States has no

Mattes *is a command pilot with over 3,700 flight hours. He now directs the Comparative Testing Office for the DUSD(AS&C), fielding critical capabilities to U.S. warfighters.*

requirement for a new trainer, what better way to assess a nation's technical and manufacturing capabilities than to taste the best they have to offer?

The indigenous defense aviation industry in the Republic of Korea started expanding by making parts and subassemblies for the F-5 Tiger II program. Their engineering and manufacturing expertise grew over time, and with the co-manufacturing arrangements in the Republic of Korea F-16 Fighting Falcon buy, they became more technologically sophisticated. Through targeted investment, partnering, and technology sharing with Lockheed Martin—and a phenomenal work ethic—Korea transitioned to assembling entire F-16s in country. The Republic of Korea T-50 program graphically exhibits the fruits of these efforts and alliances, as well as the power of carefully considered technology sharing.

Photograph courtesy of Lockheed Martin

Putting the T-50 Through its Paces

Maj. Cheol Kang, a Republic of Korea Air Force test pilot with over 400 hours in the T-50, conducted a thorough and professional briefing prior to the flight. He wisely took the front seat of the initial test aircraft, tail number 001, while I settled into the rear cockpit. The T-50 resembles an 80 percent scale, 2-seat F-16 on the outside; and the cockpit layout and advanced avionics are about the same as the F-16. It shares the F-16's relaxed longitudinal stability that enhances its agility. The overall design is thoroughly optimized for the training environment, to include reliability and maintainability. Examples of this mission-centered design include a control stick that duplicates its movement in both cockpits, larger control surfaces for enhanced low-speed handling, ability to start from its own battery and auxiliary power unit, and a raised rear seat for greatly improved instructor visibility.

KAI positioned the T-50 as an advanced trainer for fighter lead-in and transition training. It possesses all the advanced systems one encounters in front-line fighter/attack aircraft. This includes a hands-on throttle and sidestick control setup, electronic flight instruments, head-up display, up-front controls, two 5 by 5-inch color multifunction displays, integrated advanced avionics and sensors, GPS/INS navigation, embedded training features with in-flight recording and post-mission debriefing capability, and a Martin-Baker zero-zero ejection seat. The seatback angle is 17 degrees—similar to the F-35 Joint Strike Fighter and the F/A-22 seat angles. KAI estimates that transitioning Republic of Korea Air Force pilots from the T-50 to an F-16 would take just a few flights, saving over 40 of the training sorties now required to transition from the F-5E.

Once in the military operating area, Kang flawlessly demonstrated the T-50's roll rate, the 25-degree angle of attack limiter, and its enhanced pitch stability. The T-50's triple-redundant, fly-by-wire control system feeds back a term of one minus the cosine of the pitch angle, essentially eliminating the natural long-period, longitudinal oscillation (known to engineers as the phugoid) that is shared by all stable aircraft. The impressive result revealed itself in a 70-degree pitch angle climb held until the aircraft decelerated to about 70 knots (we crisply rolled it inverted at about 110 knots), while the aircraft tracked the pitch angle like a laser. A brisk pull on the stick brought the nose down crisply without a hint of buffet (airframe vibration from separated airflow). The T-50 demonstrated solid directional stability and ample control authority about all axes throughout the demonstrations.

Taking the Controls

I then flew some aerobatics and performed a tracking task to assess the ability to accurately position the aircraft under a variety of conditions and airspeeds. The Golden Eagle went where I pointed it without hesitation or complaint. The General Electric F404-GE-102 engine's dual-channel, full-authority digital electronic control provided instant thrust whenever asked, regardless of speed or

"Korea's Best" continued on page 15

into competition with more traditional processes, like forging and casting. The advent of emerging technologies either challenges those established businesses to improve their core technologies or to incorporate the new technology with their traditional processes to build new hybrid concepts that have unique system benefits.

Finally, MAI gives the technical community a place to discuss and develop technologies that best pay off when applied across the broad community. The best example of this type of pre-competitive technology is modeling and computational methods. The consortium has the ability to work collectively on models and tools and configure the tools such that they are applicable to a wide variety of issues and viable across a number of corporate technical architectures. The list of MAI technologies in the sidebar on the previous page includes modeling efforts that have been worked by and impact the majority of the consortium membership.

It might be argued that the benefits highlighted above resulting from MAI collaboration would occur naturally in the competitive free market anyway. Even if this supposition proved to be true, there is little doubt that the MAI consortium accelerates the advantages and allows them to take place in a forum that pays off directly for DoD.

Collaboration: Next Steps

The technology transitions of MAI have impacted a wide variety of fielded and in-acquisition systems. These transitions are noteworthy but have focused largely on Air Force systems. While this is the expected result of an AFRL-led initiative, it is clear that return on investment and transition opportunities will expand with the incorporation and the presence of program management from other Services and agencies. A logical next step for MAI will be for AFRL to invite government partnership in MAI. For example, if Army and Navy technical priorities are included in the long-term challenge workshop and then ultimately funded and managed by those Services with the added technical oversight of the consortium, then the domestic metals value stream is certain to be even further strengthened.

Clearly MAI provides a revolution in management, technology, and business practices; rewards innovation; and shares information. Continuing to utilize the consortium with the goal of expanding its impact fits within the strategic thrust of former Secretary Rumsfeld's vision. The DoD and the domestic metals infrastructure will both be beneficiaries of such action.

The authors welcome comments and questions. Contact them at mary.kinsella@wpafb.af.mil and daniel.evans@wpafb.af.mil.

"Korea's Best" continued from page 11.

The Foreign Comparative Test Program scours the world for the best equipment possible to meet our warfighters' requirements.

angle of attack—again without a hint of hesitation or complaint.

I returned to base, flying a precision radar instrument approach. Although I hadn't flown anything in five years (other than one T-50 simulator sortie the day before), I found the approach a breeze to accomplish. The T-50's directional and speed stability on approach proved impeccable, making even a rusty old aviator look like a hero.

After the flight, I engaged in a discussion of my T-50 experience with Hui Man "He-Man" Kwon—a U.S.Air Force Test Pilot School graduate and KAI's chief test pilot—and Kang. I asked Kwon about the lack of buffet at low speed/high angle of attack/high pitch rate conditions. He indicated that KAI had worked hard to eliminate any hint of buffet during the flight test program. He agreed with my assessment of the T-50's unassailable directional stability and enhanced control authority throughout its envelope, especially at low speed, stating that the larger control surfaces and vertical tail area keep the aircraft stable and yet responsive under all flight conditions.

The T-50 truly earns its title as a Golden Eagle. President Roh, KAI, and the Korean people may be rightly proud of this achievement. The Republic of Korea Air Force's gracious offer to me to be the first U.S. military pilot to fly the T-50 honors me beyond words. I found the design, manufacturing quality, assembly, performance, and handling qualities of the Golden Eagle to be world-class.

Given the demonstrated advanced state of the Republic of Korea's engineering and production capabilities, we in the Comparative Testing Office look forward to the Republic of Korea's industry proposals targeted at meeting our pressing warfighter requirements. And Korea's participation in the Dubai Air Show and active pursuit of contracts for the supersonic T-50 in Greece and the United Arab Emirates clearly demonstrate their intent to up the ante in the international defense aviation market.

The author welcomes comments and questions. Contact him at bob.mattes@osd.mil. For more information on the Foreign Comparative Test Program, visit <www.acq.osd.mil/cto/>.