ASC ENGINEERING FACT SHEET

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ACES-II Ejection Seat Upgrade

DESCRIPTION

The ACES II ejection seat has an excellent record in low airspeed ejections, but it has encountered a high major and fatal injury rate in ejections at high speed. These injuries can be reduced if the pilot's arms and legs are restrained. Arm and leg restraints have been developed for some versions of the ACES II ejection seat, but these have not been incorporated on the seats used in the F-15, F-16, B-2, and F-117. The limb restraints require modification before they can be integrated into these aircraft.

SUMMARY

PROBLEM:

- Experience with the ACES II ejection seat revealed that improvements were needed to protect pilots in high-speed ejections. Also, lightweight aircrew members were begininng to use the ejection seat. Simulations and sled testing have indicated an increased probability of injury in high-speed ejections from acceleration loads for these individuals. The seat's physical accommodation for smaller pilots also needs improvement. In addition, there was no funding for the projected cost of the modification program.

SOLUTION:

- The Japanese Air Force realized the same limitations in the seat and was trying to start its own upgrade program, but funding was a problem for the Japanese, as well. After two briefings by ASC/ENFC, the Japanese Air Force requested to SAF/IA that a cooperative development program be initiated to pool available resources. A Memorandum of Understanding (MOU) was signed in late March 1998. This is the first military cooperative development program between Japan and the United States.

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Air Force policy now allows smaller stature, lighter weight personnel to fly ACES II equipped aircraft. The expanded weight range for these pilots exceeds the qualification limits of the seat. Computer simulations of a lighter weight seat occupant indicate that there is an increased probably of acceleration-induced injuries. This was confirmed in high-speed sled track tests. Drogue chute induced "snap back" loads result in high lateral accelerations. To correct this, an improvement in seat stability is needed. Limb restraints will also help provide improved stability as well as reduce flail injury potential.

Another issue of concern is the seat's physical accommodation of the expanded flying population. This requires re-evaluation of the potential crew member's position in the seat for proper external vision, headrest support, and ability to reach seat controls.

Since the Japanese had these same concerns, both countries were trying to obtain funding for an upgrade program. ASC/ENFC briefed the Japanese regarding U.S. seat upgrade efforts in 1994 and 1995. After the second briefing, the Japanese approached SAF/IA requesting a cooperative effort, and initiated discussions for a new program.

At this point, the 311 Human Systems Wing (HSW) was brought in, placing the seat manufacturer, Boeing, under contract to determine the best methods for accomplishing the needed seat upgrades. The agreement is that each country is responsible for approximately half of the program, with Boeing as the program integrator. The upgrades consist of a U.S. developed, tractor rocket deployed, enhanced drogue system and Japanese developed arm and leg restraints based on the systems used in the B-1 and F-22. The Japanese also agreed to develop seat cushion inserts and headrest changes to improve the size range of personnel accommodated by the seat. The development program is scheduled for completion by September 30, 2001. Production and retrofit of the ejection seats will be conducted separately. ASC/ENFC continues to provide technical support to this program.

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