Payoff

The ejection seat of the F-22 accommodates 99% of the current Air Force pilot population and has excellent over-the-nose and over-the-side visibility. Its handle is centered for rapid initiation, canopy jettison, and catapult/rocket initiation. The high speed ejection capability has been increased to 600 knots, and a restraint system prevents arm flail during ejection. Other life support equipment in the cockpit includes a large-capacity emergency oxygen bottle for high altitude ejections, chemical biological equipment, cold water immersion equipment, anti-G garments, helmet (HGU-55/P), and oxygen mask (MBU-22/P).

Accomplishment

The living conditions within the environment of the aircraft cockpit were addressed by developing an on-board oxygen generation system (OBOGS) that continuously supplies breathable air to the pilot. Various components of the life-support system must simultaneously meet pilot protection requirements established by the Air Force in the areas of high altitude flight, acceleration, heat distress, cold water immersion, chemical and biological environments, fire, and high speed/high altitude ejection. Therefore, enriched oxygen is supplied to the pilot through the OBOGS. In order to ensure safe delivery of the oxygen to the pilot through the MBU-22P oxygen mask, an integrated breathing regulator/anti-g valve (BRAG) that controls flow and pressure to the mask and pressure garments was developed. The BRAG is fast-acting due to the maneuverability of the aircraft and compatible with the existing upper and lower G-garments, which keeps blood in the upper portions of the body during aircraft maneuvers. In addition, the currently used, tried and proven HGU-55P flying helmet, along with chemical biological (C/B) goggles and hood, are compatible in the new cockpit environment. The additional space in the cockpit has improved mobility and contributes to increased comfort when wearing the life support equipment.

The improved ejection seat has a center-mounted (between the pilot’s legs) ejection control for rapid initiation of ejection. High speed protection is provided during the escape environment with the addition of an active arm restraint system which retracts the seat’s arms as the seat ejects which prevents arm flail injuries. Safety and survivability during high speed ejections is further enhanced with an improved fast-acting seat stabilization drogue parachute system that provides increased seat stability in the yaw and pitch axis. The drogue is located behind the pilot’s head, rather than in the back of the seat, and is mortar-deployed for faster inflation and stabilization. The ejection seat includes a new electronic seat and aircraft sequencing system that improves the timing of the various events that have to happen in order for the pilot to eject. In the event of a high-altitude ejection, a larger oxygen bottle gives the ejecting pilot more breathing air to support ejection at higher altitudes.

Background

In order to fly high-performance military aircraft, there is a human-centered requirement to protect the pilot from the physiological stresses generated by the high speed, high altitude, and high maneuverability of the aircraft. The F-22 cockpit was developed with early consideration of the integration of human system domains. The F-22 life support system integrates all critical components of aircrew clothing, protective gear, and aircraft equipment necessary to sustain the pilot’s life while flying the aircraft. In the past, these components were designed and produced separately.

HSI Domains Addressed: Manpower, Personnel, Training, Human Factors, Environment, Safety, Occupational Health, Survivability, Habitability

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