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DEBRIEFING

Flight Safety is Everybody's Business

Improvised Mod to Equipment

The MND has a legal obligation under the Aeronautics Act to legislate on the airworthiness of aeronautical products including the vast majority of Aviation Life Support Equipment (ALSE). The requirement to follow a very rigid protocol when making modifications to aircraft, auxiliary kits and personal aircrew gear is not necessarily apparent to all of us but history has shown that a simple unapproved modification can result in a serious incident or worse, an accident. This Debriefing will provide an example of how a simple modification to an ejection seat configuration can have severe flight safety implications and succinctly explain in the last 2 paragraphs of the pamphlet the Airworthiness Program in place in the Department.

Is it has come to our attention, as an example, that fighter pilots use on occasion a locally procured seat cover foam to ease some of the physical discomfort that comes from long transit flights. This harmless looking modification to the seat configuration can have dire consequences as explained in the following paragraphs.

Designing ejection systems involves balancing the forces that must be imparted as rapidly as possible with standards for human tolerance to acceleration. Although this acceleration value may be used in the design calculations for the equipment, it is found that in practice, "G" forces experienced by the seat occupant may greatly exceed the stated limits. This is caused by the complex mechanical behavior of different parts of the body in relation to each other and of the body in relation to the seat. Mechanically, the body/seat combination is a multiple-mass system linked together by elastic elements, which temporarily absorb energy (later released), causing over-shoots in peak acceleration in parts of the system.

The selection of the type and thickness of the cushion between the occupant and the ejection seat is a practical application of this phenomenon. If a thick, easily compressible, elastic cushion is used, the body will compress the seat cushion as the seat begins to accelerate and the ejection seat will be well on its way toward peak velocity before the crewmember has moved at all. When the cushion reaches maximum compression, the body will experience greater acceleration than the seat in order to catch-up to it. The compressed energy of the elastic cushion and body tissues will provide additional acceleration to the body momentarily extending the individual in the restraint harness. Then, as the rocket ignites the seat will "catch up" to the body and produce very high acceleration rates which can be in the order of 500G per second. This phenomenon is commonly referred to as “seat slap”. To avoid this situation, cushions are non-elastic and individuals must ensure that

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restraint systems are tight and secure.

Another hazardous side effect of some of the seat cushions is the introduction of adverse flotation characteristics. Seat cushions that trap air will add a buoyancy component behind the hips and cause the body position to be more horizontal than desired. They may also contribute to a tendency to float face down. Seat packs can also contribute to this tendency, as their weight may be less than that for an equivalent volume of water.

Making improvised changes to our equipment can have serious outcomes that may have not been considered or even envisioned.

AIRWORTHINESS PROGRAM

The authoritative document for both civil and military aviation safety in Canada is the Aeronautics Act which aims to achieve an acceptable level of aviation safety for Canada's civil and military aviation activities. As a statute of Canada, the Act is a law that places upon the MND, for military aviation, the legal responsibility for the development, regulation and the supervision of all matters related to aeronautics. Under the provisions of the Aeronautics Act, the overall implementation of the airworthiness program and responsibility for the regulation of the program is normally delegated by the MND to the individual who is the Chief of the Air Staff as the Airworthiness Authority (AA). The AA is responsible for the development, promotion, supervision and management of an Airworthiness Program for the DND/CF. This includes the nomination of competent individuals to fill the roles of the Operational Airworthiness Authority (OAA) and the Airworthiness Investigative Authority and in consultation with National Defence Headquarters (NDHQ) Assistant Deputy Minister (Materiel) (ADM [Mat]) the nomination of a Technical Airworthiness Authority (TAA).

Aviation safety involves many areas including design, manufacture, maintenance and operation of aeronautical products. An aeronautical product is defined as any aircraft, aircraft engine, aircraft propeller or aircraft appliance, or the component parts of any of these things including computer systems and software. Aviation Life Support Equipment (ALSE) is defined as all flying related equipment and clothing, either managed within the Directorate of Technical Airworthiness or by other NDHQ Life Cycle Material Managers (LCMMs). ALSE is primarily intended for the preservation of life, prevention of injury and environmental protection of aircrew and passengers during flight emergency, air or ground egress, and the means to survive until such a time a rescue is effected. Some ALSE does not fall within the definition of Aeronautical Products and therefore would not normally come under the purview of the Airworthiness Program. However, since items of ALSE can have a major impact on the safe operation of a CF aircraft, the AA will oversee all regulatory aspects of ALSE, with the TAA being responsible for all regulatory aspects of ALSE that are aeronautical products and the OAA being responsible for all regulatory aspects of ALSE which are non-aeronautical products. In addition, the OAA is to be apprised of any plans to introduce or modify ALSE so that appropriate action can be initiated.