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ASSEMBLY — 38TH SESSION

EXECUTIVE COMMITTEE

Agenda Item 13: Aviation Security —Policy

LASER BASED DIRECTIONAL INFRA-RED COUNTERMEASURES SYSTEM (DIRCMS) INSTALLED ON ISRAEL REGISTERED COMMERCIAL FLEET

(Presented by Israel)

EXECUTIVE SUMMARY

The Government of Israel has decided to equip the Israeli civil air transport fleet with systems to protect aeroplanes from potential threats posed by Man-Portable Air Defense Missiles (MANPADS). The DIRCM system is currently undergoing a comprehensive Supplemental Type Certification (hereinafter – STC) process under the direction of the Civil Aviation Authority of Israel (CAAI) in order to demonstrate its compliance with ICAO standards and Israeli regulations. Starting early Q2/14, Israeli commercial air operators (El Al, Arkia and Israir) are expected to begin flying international and domestic routes with this equipment installed and operating.

This paper relates the CAAI's recent experience to apply the STC process to the approval of the Installation and Operation of a laser based DIRCMS on commercial transport category aeroplanes in Israeli air operators' service. Issues presented in this information paper include a general system description, determination of the Certification Basis, and the approach to system safety analysis, with special emphasis place on certification issues of the safe operation of aircraft mounted lasers projected into the navigable airspace.

Action: The Assembly is invited to note the contents of this paper.

Financial implications:	not applicable
References:	not applicable

1. INTRODUCTION

1.1 The Government of Israel has decided to equip civil transport category aeroplanes in Israeli airline service with systems to protect them from potential threats posed by Man Portable Air Defense missiles (MANPADs). The decision was made in response to the growing proliferation of these weapons and their known dispersal into the hands of non-state entities, some of which are engaged in attacks against civil aircraft such as the attack upon the Boeing 757 aircraft operated by Israeli air operator Arkia as the aeroplane took off from Moi International Airport, Mombasa, Kenya (HKMO) on November 28, 2002.

2. SELECTION OF THE DEFENSIVE SYSTEM

2.1 The Government of Israel reviewed the systems, both available and under development, capable of protecting large commercial aircraft from the MANPAD threats. Active and passive missile detection systems were considered, as were countermeasure systems using dispensable stores (flares) and those using electro optical countermeasures. It was eventually decided that the system that would provide the earliest availability, most efficient defensive shield, and would be most acceptable operationally within the commercial air traffic environment would be a system combining passive, optical missile-detectors and directed, infrared laser countermeasures.

3. AWARD OF THE PROGRAM CONTRACT

3.1 In June 2009, Israel's Ministry of Transportation awarded Elbit Systems a contract for the supply of DIRCMS. The systems will be installed on a variety of commercial passenger aeroplanes operated by Israeli air operators El-Al, Arkia and Israir, as part of the comprehensive 'Sky Shield' air transport defense plan.

3.2 The system selected for the program is the C-MUSIC (Commercial MUlti-Spectral Infrared Countermeasure) system, one of a growing family of similar MUSIC systems, each adapted for use on a particular type of aeroplane or helicopter platform. All are based on fiber-laser, directional infra-red countermeasure technology. The laser beam generated by the system disrupts missiles fired at aircraft and causes them to veer off course.

4. THE C-MUSIC SYSTEM

4.1 The main components comprising the C-MUSIC system are the passive, electro-optical Missile Warning System, the Jamming Turret/Laser Generator, and the system main Electronics Unit. All the main system units are housed in a conformal, externally mounted structure (the C-MUSIC Pod) fixed to the lower, aft fuselage of the platform aircraft. The C-MUSIC Pod is identical for all models of aeroplane to be equipped under the current program.

4.2 The system is designed to minimize its interface with aircraft systems and to operate automatically without inducing additional flight crew workload. Pods can be removed for servicing or repair and a replacement reinstalled in less than one hour. Aeroplanes may be dispatched with the Pod removed using a simply installed fairing.

5. THE C-MUSIC SYSTEM CERTIFICATION PROGRAM

5.1 Elbit Systems Electro-optics (Elop) applied for several STCs for models of transport aeroplanes on the Israeli register in July 2009. To date there are eight (8) STC applications, one for each of the following model aeroplanes: Boeing 737-800, 737-900ER, 757-300, 767-200, 747-400 and 777-200; AirBus A320-200; Embraer ERJ190-200ER (EMB 195). Each STC is a separate project within the CAAI Airworthiness Engineering Branch. The B737-800 model aeroplane is the first to undergo the certification process through award of the STC. The project is at an advanced stage of certification, with the first flight test with the C-MUSIC Pod installed having successfully taken place in June 2013.

5.2 Certification Program Concept

5.2.1 The C-MUSIC system is treated for certification as a “not required system” and is being certified on a “non-interference” basis. This means that the certification process will ensure that the installation and operation of the system comply with the applicable airworthiness regulations, but will not evaluate the issues of system performance and effectiveness. This issue is the responsibility of the Israeli Ministry of Defense. It will be substantiated during the certification process that installation and operation of the C-MUSIC System do not adversely affect aircraft safety including potential effects on aircraft systems, structures or handling qualities. Furthermore, safety assessments, including the C-MUSIC Functional Hazard Assessment and System Safety Assessment include potential effects of the system on **“persons outside the aircraft”,** as well as materials in the aircraft’s environment.

5.3 Certification Basis

5.3.1 The state of Israel has adopted the US 14 CFR Part 25 as the Airworthiness Standard for Transport Category Aeroplane certification. The applicable amendment status for parts significantly changed is determined by date of the STC application, with the initial group of models governed by Amdt. 25-128 and those most recently applied for by Amdt 25-134. Separate Certification Plan and Compliance Checklist documents are submitted for each model.

5.3.2 In addition to the general airworthiness standards, the CAAI has published several Issue Papers regarding the C-MUSIC certification project, covering such issues as structures, (aerodynamic) vibrations and buffeting, flight crew workload, external noise, and guidance development of safety related electronic programmable devices (DO-254).

5.4 Laser Safety as Part of the Certification Process

5.4.1 In the earliest stage of the certification project the CAAI determined that the issue of laser safety is central to the success of the certification process and the subsequent acceptability of the operation of the modified aeroplanes in international operation. Since the C-MUSIC system is intended to project laser energy into the navigable airspace and, potentially, into the immediate environment of civil aerodromes, the CAAI placed special emphasis on the issue of laser safety. The CAAI determined that the correct manner in which to bring this issue into focus was to direct the applicant, by means of an Issue Paper, to consider the potential effects of the laser on persons outside the aircraft, in addition to the passengers and crew normally considered in certification safety assessments. In response to the Issue Paper the applicant performed a thorough analysis of the C-MUSIC laser and its potential effects on persons and materials. The results of this report formed the basis of the categorization of the potential laser hazards within the Functional Hazard Assessment (FHA) that was approved by the CAAI. The FHA guided the design of the C-MUSIC system safety mitigations that prevent projection of laser energy while on ground. While airborne, the flight crew and passengers remain unaffected by the C-MUSIC laser because of the location of the system installation on the aircraft. Since the C-MUSIC laser operates in IR wavelengths that are not visible to the human eye, there are no issues of dazzling or blinding flight crew or other persons, both on ground and in the event of airborne operation.

5.4.2 In parallel to the safety analyses performed as part of the CAAI certification process, the C-MUSIC system was presented for evaluation by the Standards Institution of Israel (SII). After a thorough evaluation of the C-MUSIC system, including its safety mitigations, the SII issued a certificate declaring the C-MUSIC system to be a Class 1 Laser Product (safe under all conditions of normal use) in accordance with internationally recognized standards.

6. FUTURE PLANS

6.1 Starting early Q2/14 and pending successful completion of the STC project for the initial aeroplane models, Israeli commercial air operators (El Al, Arkia and Israir) are expected to begin flying international routes with this equipment installed and operating.

6.2 The CAAI engineering branch expects to successfully complete the STC process for all models of aeroplanes noted above within two years.

7. ACTION BY THE ASSEMBLY

7.1 The Assembly is invited to note the contents of this paper.

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