Hums system to the safety of flight

Many airlines operating fixed wing aircraft have adopted a pro active approach to improve operational safety by analyzing flight data on a routine basis to provide better visibility of their operation In flight operations quality Assurance (FAQ) programmer. A simple description of HUMS Is that It Is a system for monitoring the status of technical components, principally shafts, bearings, gears and other rotating components. The level of vibration Is recorded by accelerometers. The data is stored in a data card which is later taken out and brought too ground station for reading off at the end of each flight.

Operational information from the flight thus becomes available from the ground station via a terminal. The list thus printed also informs regarding any limit values that have been exceeded and description of failures in HUMS. Most of the information is analyses manually and this provides valuable additional information during trouble shooting. Advanced helicopter monitoring systems were Implemented In the early sass's following concern over the alarm worthiness of helicopters and, at the time, technical defects were the mall Issue.

The acronym HUMS, Healthand usage Monitoring Systems, was introduced for these systems. With the introduction of HUM systems, the number of incidents relating to the chemical malfunctions decreased and as a consequence the proportions of incident relating to the aircrew error increased. Thus later a need was envisaged of developing a system called HOMO. AIM accepted use in aviation and in context to India Air Force. WORKING The system consists of sensors, computers, software and analytical methods that, when taken together are able to record vibration and other parameters and thus deduce the health of the machine.

The HUMS information is received and processed by the Digital Acquisition and Processing Unit (ADAPT) before being stored on a magnetic card which is placed in the cockpit unit prior to flying. This card is taken out on leaving the helicopter after the flight and data are loaded into a ground station for further electronic processing. A HUMS is like adoctorapplying many stethoscopes to a patient continuously and keeping a constant check on his health. Helicopters having more rotating and moving parts, will fall part if not properly maintained, hence their mechanical health is critical to the safety of flight.

The deployment of HUMS as a life saving and cost effective equipment is a boon. There are number of sub systems in HUMS which determine parameters and determines he health of the helicopters. We will be dealing with the most important subsystems in the subsequent paragraphs. In HUMS the wear or damage to the components is identified while in service itself. Inevitably components wear out or fail unexpectedly. The traditional monitoring techniques such as oil debris and engine performances trending are aimed at identifying these problems before they become hazardous.

Techniques using conventional flight data can be used here, for example, engine performance trends can be calculated from engine parameters gathered in flight. Still the traditional Accident Data is usually inadequate for monitoring wear in rotating components and so a host of specialized techniques have been developed to measure the " health" of the rotors and transmission. These rely heavily upon vibration measurement and require special instrumentation and data acquisition systems. A PC based ground station provides the aircraft operator and maintain the simple diagnosis of the aircraft and required maintenance actions.

Advanced mechanical of aircraft monitoring superior to any other monitoring system available. THE SUB SYSTEMS As stated earlier there are number of sub systems which gather information in flight bout the health and usage and wear and tear off the components and can be read over a ground station. Major ones are:- (a) Rotor Track and Balance. Each helicopter main rotor blade should follow one in front and along the same path, and blades should be spaced at equal angles. This track is measured in terms of blade height past a fixed point and the angle between the successive blades.

Aphotosensitive device on the nose looks at the blade tips at two points on the either side of the nose. The leading and the trailing edges of the blades can be detected, and the timing of their passes gives the blade eight. The interval between one blade passing over the sensor and the following blades gives the system lead/lag information. Infrared techniques can be used if the helicopter is to be flown at night. (b) Engine Monitoring. Engine Monitoring parameters include vibration, gas temperatures and pressures, and shaft speeds. Engine Vibration can indicate excessive wear on ball bearings or races.

Small changes in the engine vibration signature must be recognized early. Two accelerometers are used to compile a good engine spectrum. The known frequencies of rotating components can first be used o detect simple imbalance. Then they are subtracted from the known spectrum. The remaining spectral lines are analyzed for more subtle defects. Gas temperatures are used to calculate thermal fatigue. High/Low temperature excursions, together with mean temperatures, are used to estimate damage caused by metal expansion and contraction. (c)Gear Box Vibrations.

The importance of gearbox vibration monitoring can not be over estimated. Cracks, broken gear teeth and excessive wear are critical areas that must be caught early. Gear vibrations are revealed by strategically positioned accelerometers. There might be 20 shafts in the gear box but fewer than half this number of accelerometers are needed to monitor them all. The problem is to separate very small signals caused by a single tooth defect from larger signals (d) Oil Debris Monitoring. Any moving metal surfaces in contact with one another will produce debris.

Most of it will end up in oil. Therefore, metal particle detection is a useful means of monitoring wear in the engine and gear box. Particles lesser than ten microns are the result of normal wear and are no cause of concern, unless they are being ground down from larger particles. The presence of metal flecks greater than hundred microns in size indicates a serious wear problem. Particles that size are large enough to cause further damage to other parts of the engine, which in turn leads to creation of more large particles.

Magnetic plugs were originally introduced to capture debris and prevent secondary damage. Today they have become an early warning device for heavy wear. A refinement of this is the quantitative debris monitor, which consists of an electronic metal particle detector used in the place of the magnetic plug. The monitor uses an electromagnetic to attract debris. The debris causes a flux disturbance in the drive coil, which in turn generates a voltage pulse that is proportional to particle size. A processor grades and counts the particles by size.