Presented at NDE2002, to predict. assure. improve. www.nde2002.org
National Seminar of ISNT, the Indian Society for Non Destructive Testing
Hotel Taj Connemara and Raja Muthiah Hall, Chennai, 05. – 07. 12. 2002

Application of Gamma Radiography for Liquid Propellant Engine of GSLV Rocket

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As an additional measure of reliability, there existed a need to inspect the plumbing lines of liquid propellant engine GS-2. Ways to inspect the engine lines had to be explored in the assembled condition, as the disassembly of GS2 for inspection was cumbersome and time consuming in a situation of tight flight schedule. Due to the presence of Electro-magnetically sensitive electronic packages in the vicinity of plumbing lines, high defect sensitive nondestructive testing (NDT) such as Kilo-Voltage X-ray radiography, Thermography (with heat loading option) were to be abandoned in favour of a non-electric tele-flex Iridium-192 isotope source based radiography for inspection. Constraints were many to begin with. (a) The difficulty to approach liquid lines through smaller openings on GS-2 case for source and film cassette. (b) The need to quickly design and fabricated film-manipulating device. (c)The challenging task of maneuvering the film manipulator without damaging nearby critical components. (d) The requirement to keep the total radiation dose to electronic components and hence the number of exposures at their barest minimum, and so on. Still the inspection was carried out successfully without affecting the flight schedule. The observations made during the inspection and data generated were used in a subsequent "hot test" of a stand-by GS-2 engine with simulated environment. The success of this test helped not only to accept the GS2 engine for flight and but also highlighted how a simple NDT method like gamma radiography could prove to be a valuable tool in such situations. The aim of this paper is to discuss the details of the approach evolved to face the time-critical situation and come out with success, the technique adopted for imaging the plumbing lines, the observations made and data generated and so on.