Infrared imaging

Technology

The Long-Range Navigation, LORAN-C system provides radio navigation coverage for maritime operations in US coastal areas. It provides position and precise timing services for military and civil air, land, and marine users. It is approved as a supplemental air navigation system and serves users that operate under visual flight rules. The system serves the 48 contiguous states, their coastal areas, the Great Lakes, and parts of Alaska. LORAN is a net work of land based radio transmitters and was developed to provide an accurate system for long range navigation.

LORAN Stations Operations are organized into sub-groups of four to six stations called Chain. One station in the Chain is designated the MASTER and others are called SLAVE Stations. The theory is to calculate the time between reception of the signals from the MASTER and SLAVE stations, which are emitted at different frequencies, at very low bands i?? 90kHz-110kHz and has power of 400-160kW. The master station emits its own signal first, when that signals reach the slave station; it emits its own signal after a predetermined delay.

When the master station's signal reaches the aircraft, its Navigation system counts the time until the slave station's signal arrives. The current position is found as the intersection of the line of two LORAN stations. Signal Processor receives the signals and measures the difference between the time of arrival of each secondary station pulse group and the master station pulse group. The time difference is depend on the location of the receiver on the aircraft in relation to the three or more transmitters. Each time difference value is measured to a precision of about 0. 1 microseconds.

As of the effectiveness of this method of navigating an aircraft, the U. S. has continued to operate the LORAN-C system beyond the previously planned termination date, December 31, 2000. During this time the U. S. will continue to evaluate the long-term need for continuation of the system. Users will be given reasonable notice if it is concluded that LORAN-C is not needed or is not cost effective, so that they will have the opportunity to transition to alternative navigation aids. The emergence of the Active Matrix Liquid Crystal Cockpit Displays, AMLCD technology represents a revolutionary improvement in flat panel displays.

Previously, most liquid crystal display applications, such as wrist watches, video games, automobile displays, and early generations of lap-top computers, relied on a multiplexing technology. Multiplexing causes some portion of the electronic signals used to activate target pixels to spill into surrounding picture elements, resulting in display images that have relatively poor contrast, speed, and brilliance. This shortcoming disqualifies conventional liquid crystal technologies from most military display applications, particularly in aircraft cockpits where full sunlight readability is critical to combat performance.

AMLCDs for cockpit displays offer significant performance advantages over other display technologies. Using AMLCD, each picture element on the display screen is connected to a small thin film transistor that can transfer and store enough voltage to switch a liquid crystal pixel from light to dark without " bleeding" voltage to the surrounding pixels. The resulting image exhibits superior speed, brightness, and contrast over other liquid crystal displays or cathode ray tubes (CRTs).

Boeing 777 cockpit instrumentation systems that utilize AMLCD In addition to performance advantages over other display technologies, AMLCDs weigh less and require less space than CRTs. The performance, weight, and space advantages offered by AMLCD technology are important considerations in aircraft and space vehicle applications. MH-60 Cockpit using Rockwell Collins Active Matrix Liquid Crystal Display Infrared (IR) radiation is electromagnetic radiation of a wavelength longer than visible light, but shorter than microwave radiation.

Infrared radiation spans three orders of magnitude and has wavelengths between 700 nm and 1 mm. Infrared Search and Track, IRST is a system that surveys its environment by analysing the natural infrared radiation emitted by targets compared to the background. Unlike radar, an IRST system does not transmit any energy. Its passiveness, together with Electronic Support Equipment (ESM), makes it the natural surveillance sensor on any platform with stealth characteristics or for anyone who wants to deploy stealth tactics.

IRST greatly enhances the ships' survivability in a harsh environment as well as extending the ships' capabilities during a greater variety of missions, such as those dictated by the United Nations. Sophisticated supersonic, and even hypersonic, missiles constitute a growing threat. The high infrared radiation of such high-velocity targets makes them an easy target for an IRST defence system, especially when taking the high scan rate of an IRST system into account. In such a lethal situation an IRST system provides precious additional time for taking the optimal decision.

The advantages of infrared systems are revealed best in combination with radar systems in which the strong points of both defence methods are complementary to each other. An IRST system is a tremendously versatile instrument that is highly valued by the crew on board. The Airborne Laser, ABL is a high energy laser weapon system for the destruction of tactical theatre ballistic missiles, which is carried on a modified Boeing 747-400F freighter aircraft. Boeing 747-400F with a modified ABL system

The ABL aircraft carries the COIL laser which generates the killer laser beam, an infrared surveillance and high speed target acquisition system and a high precision laser target tracking beam control system. The laser weapon uses three laser beam systems: the powerful killing laser beam or primary beam, a set of illuminating laser beams and a beacon laser. The ABL is designed to detect and destroy theatre ballistic missiles in the powered boost phase of flight immediately after missile launch. The aircraft loiters at an altitude of 40, 000 feet.

Missile launch is detected by a reconnaissance system such as satellite or Airborne Warning and Control System (AWACS) aircraft and threat data is transmitted to the ABL aircraft by Link 16 communications. A suite of infrared, wide-field telescopes installed along the length of the aircraft's fuselage detects the missile plume at ranges up to several hundred km. The pointing and tracking system tracks the missile and provides launch and predicted impact locations. The turret at the nose of the aircraft swivels towards the target and a 1.

5 metre telescope mirror system inside the nose focuses the laser beam onto the missile. The laser beam is locked onto the missile, which is destroyed near its launch area within seconds of lock-on. Where the missile carries liquid fuel, the laser can heat a spot on the missile's fuel tank, causing an increase in internal pressure resulting in catastrophic failure. Alternatively, the missile is heated in an arc around its circumference and crumples under atmospheric drag force or its own G-force.