A sophisticated border surveillance system for coastal and terrestrial supervision

**Introduction**

Indra designs, builds and integrates state-of-the-art border surveillance systems for coastal and terrestrial supervision. These systems are incorporated into the overall command and control network of the surveillance system. Indra’s SAR and SIVE BSS systems are amongst the most advanced in the market, fulfilling all the requirements of both the military and civil sector.

**The SIVE system**

The SIVE is a security surveillance system that integrates state-of-the-art technologies in radar and optronic systems. This system consists of a single or multiple Command and Control Centers (CCC) and a set of Sensor Stations (SS) forming a hierarchical architecture. The sensor stations are deployed across the surveillance area and can be adapted for ground or coastal surveillance and can incorporate fixed or mobile sensor stations.

**Command and Control Center**

The CCC centralizes all the information received from the different SS's. It processes, integrates and displays all the information in real-time. Among other features, the CCC does:

- Remote control and management of all SS's sensors
- Real-time reception and processing of radar tracks
- Fusion of radar tracks from different stations
- Display of radar tracks and patrol units on the system cartography
- Real-time display of IR and CCD images
- Tactical situation display on Videowall
- Security/alarm management of stations
- Interfaces with other communications networks (PSTN, ISDN, GSM…)

**Conclusion**

In security you cannot choose the second best option.
MARITIME SURVEILLANCE SYSTEM

In security you cannot choose the second best option

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**Applications**

- Detection of small boats
- Detection of moving people or vehicles
- Coordination of interception units
- 24h / 365d operation (day and night)

**Therefore, it is the ideal solution for:**

- Protect the country's borders against:
  - Terrorism / Piracy
  - Illegal immigration
  - Drug trafficking / Contraband
  - Illegal Fishing
- Guarantee sea traffic safety within its waters, coasts and ports
- Protect strategic off-shore installations – oil platforms especially
- Control its waters to prevent environmental disasters and act accordingly in case these take place

**Main system features**

- Integration with GIS
  - Radar tracks and interception units are represented over the cartography of the area
  - Measuring and analyzing tools are available for the operators
  - Blanking and alert areas can be defined and customized

- Digital video distribution
  - Use of MPEG-4 video coding
  - Distribution via IP multicast streaming
  - Digital video processing with a wide variety of processing algorithms

- Integration with tactical communication networks
  - Use of the IP protocol
  - Secured communications via encryption algorithms
  - Adjustable transmission bandwidth depending on system requirements
  - Flexible network communications architecture: microwave links, satcom links, leased lines…

**High system availability**

- 24h / 365d operation
- Minimum system life of 15 years
- System MTBF > 5000 hours
- Minimum availability of 95%

**Security system integration**

- Security system available at each SS
- Management and control of security centralized at the CCC
- Possibility to customize the type and number of sensors to be installed at each SS

**The main SIVE system features are:**

- Modular design
  - Scalability: the number of sensor stations can grow easily
  - Sensor independent design: any commercial type of radar/optronic sensor can be integrated

- Centralized operation
  - Hierarchical design of CCC: The information from several Regional CCC can be centralized in a National CCC
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- Graphic user interface
  - Organized GUI allowing access to different functionalities through graphic buttons and Pop-up menus
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  - Simultaneous display of visible and IR video

**Sensor station**

- The sensor station is the surveillance data capturing element in the SIVE system. It integrates the data from the different sensors and transmits it to the CCC.

  - **Radar sensor**
    - X Band radar
    - High resolution
    - Low probability of Intercept
    - FMCW
    - Automatic tracking
    - High gain antenna

  - **Optronic sensor**
    - CCD and IR cameras
    - High pointing accuracy
    - Gyro-stabilized
    - Video tracker
    - Different pointing modes:
      - Manual
      - To radar track
      - To multiple radar tracks

**Typical radar detection performance**

- 39 Km
- 57 Km
- 63 Km
- 66 Km

**Typical CCD performance**

- 20 Km
- 22 km
- 12 Km
- 15 km

**Typical IR performance**

- 13 Km
- 14 km
- 6 Km
- 7 km

**Sensor station architecture**

- **SS architecture**
  - SMR radar station
  - Pedestal controller
  - Antenna
  - Transmission link
  - Pressurizer dehydrator
  - Dual channel SMR rack
  - GPS antennas
  - Local control and monitoring system
  - Local display
  - Control center/tower
  - A-SMGCS system
  - Remote control and monitoring system
  - Operator's console

**Command and control center**
SIVE: Sistema de Vigilancia Económica y Eclesiástica

**Aplicaciones**

- **Detectores de pequeños barcos**
- **Detectores de personas o vehículos en movimiento**
- **Coordinación de unidades de interceptación**
- **Funcionamiento 24h/7 días (día y noche)**

Por lo tanto, es la solución ideal para:

- **Proteger los límites del país contra**:
  - Terrorismo / Piratería
  - Inmigración ilegal
  - Tráfico de drogas / Contrabando
  - Pesca ilegal
- **Garantizar la seguridad del tráfico marítimo** en sus aguas, costas y puertos
- **Proteger instalaciones estratégicas offshore**, especialmente plataformas petrolíferas
- **Controlar sus aguas para prevenir desastres ambientales** y actuar de acuerdo si estos ocurren

**Características del sistema SIVE**

- **Integración con GIS**
  - Radar, rastreamiento y unidades de interceptación representadas en el cartógrafo del área
  - Herramientas de medición y análisis disponibles para los operadores
  - Zonas de prescindencia y alerta definidas y personalizadas

- **Distribución de video digital**
  - Uso de codificación MPEG-4
  - Distribución por IP multicast streaming
  - Procesamiento de vídeo digital con una variedad de algoritmos de procesamiento

- **Integración con redes de comunicación táctica**
  - Uso del protocolo IP
  - Comunicaciones seguroas por algoritmos de cifrado
  - Transmisión ajustable de ancho de banda dependiendo de las necesidades del sistema
  - Arquitectura flexiblemente de redes comunicaciones: enlaces de micровaves, satélites, líneas dedicadas...

- **Alta disponibilidad del sistema**
  - Funcionamiento 24h/365 días
  - Vida mínima del sistema: 15 años
  - Tiempo promedio entre fallas (MTBF) > 5000 horas
  - Disponibilidad mínima del 95%

- **Integración de sistemas de seguridad**
  - Sistema de seguridad disponible en cada estación de seguridad
  - Gestión y control centralizado de seguridad en el CCC
  - Posibilidad de personalizar el tipo y número de sensores a instalar en cada estación de seguridad

**Sistema de sensoría SIVE**

- **Arquitectura del sistema**
  - **Estación de sensoría**: es el elemento de captura de datos en el sistema SIVE. Integra los datos de los diferentes sensores y los transmite al CCC.
  - Los elementos centrales de la estación de sensoría son:
    - **Sensor de radar**: X Band, alta resolución, baja probabilidad de interceptación, FMCW, seguimiento automático, antena de alta ganancia
    - **Sensor óptico**: cámaras CCD e infrarrojas, alta precisión de punto, estabilización con giroscopio, seguimiento con video, diferentes modos de punto:
      - Manual
      - Al radars
      - Al múltiples rastreos de radar

**Características del sistema SIVE**

- **Diseño modular**
  - Escalabilidad: el número de estaciones de sensoría puede crecer con facilidad
  - Diseño independiente de sensor: cualquier tipo comercial de radar o sensor óptico se puede integrar

**Centralización del sistema**

- **Diseño jerárquico del CCC**: la información de varios CCC regionales se puede centralizar en un CCC nacional
  - Control remoto de las estaciones de sensoría desde el CCC
  - Las estaciones de sensoría también pueden ser operadas localmente

**Interfaz gráfica del usuario**

- **Interfaz gráfica bien organizada**: permite acceder a diferentes funciones a través de botones gráficos y menús emergentes
  - Integración con GIS, visualización de toda la información en el cartógrafo
  - Muestra simultánea de video visible e infra roja

**Características técnicas del sistema SIVE**

- **PRODUCTOS INTEGRADOS**
  - **SMR Radar Station**
  - **Pedestal Controller**
  - **Antenna**
  - **Transmission Link**
  - **Pressurizer Dehydrator**
  - **Dual Channel SMR Rack**
  - **GPS Antennas**
  - **Local Control and Monitoring System**
  - **Local Display**
  - **Control Center/Tower**
  - **A-SMGCS System**
  - **Remote Control and Monitoring System**
  - **Operator's Console**

- **INTEGRACIÓN**
  - **Integración con GIS**: radar, rastreo de interceptación, visualización de todos los datos en el cartógrafo
  - **Integración con sistemas de comunicación local**: puede funcionar con diferentes estándares de comunicación

- **Características de radar**
  - **Resolución de imagen**: 39, 57, 63 y 66 km
  - **Identificación de objetos**: 12, 15 km

- **Características de cámara óptica**
  - **Resolución de imagen**: 20, 22 km
  - **Identificación de objetos**: 13, 14 km

- **Características de visión infrarroja**
  - **Resolución de imagen**: 6, 7 km
  - **Identificación de objetos**: 13, 14 km

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**Diagramas**

**Diagrama de arquitectura del sistema SIVE**

**Diagrama de flujo del sistema SIVE**

**Diagrama de integración del sistema SIVE**

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**Imagenes**

- **Panel de control del sistema SIVE**
- **Control Center/Tower**
- **Operator's Console**
- **SMR Radar Station**
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- 24h /365d operation (day and night)

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Medial architecture of the SIVE system

- Centralized operation
  - High redundancy
  - High availability
  - High performance

SS architecture

- Sensor station
  - Radar sensor
  - Optronic sensor
  - X Band radar
  - High resolution
  - Low probability of intercept
  - FMCW
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  - High gain antenna
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- Small ship: 66 Km

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