MEDAV

I3FS

Prevent · Protect · Respond · Recover

Signal and Information Technology in Service of Homeland Security

The implementation of **Fusion Centres** and **Intelligence Sharing** procedures are important initiatives to improve homeland security today. MEDAV offers a comprehensive spectrum of products and engineering services covering all needs to support **military forces**, **security agencies, police forces and intelligence services** with state of the art **radio and communication reconnaissance** and **information technology**.

The **collection**, **processing** and **analysis** of information from different sources are integrated functions. The fusion of raw intelligence, the content processing and analysis are essential part of the systems, delivered from one hand.

It's tough to make predictions, especially about the future.
(Yogi Berra)

The paper focuses on such solutions and systems which are deliverable within short time.

MEDAV is member in the ITSMIG e.V. association.

On May 14, 2008, the registered association ITSMIG e.V. (IT Security made in Germany) was founded at the Federal Ministry of Economics and Technology. The founding members consist of renowned companies from the German IT security industry.

Under the patronage of:

Bundesministerium des Innern

Bundesministerium für Wirtschaft und Technologie

1   Introduction

Obviously processes in law enforcement and government security agencies need to be supported by state of the art information technology systems which generate and provide the information needed for effective and efficient decisions and operations. The **right information** must be available at the **right time**, in the **right place** and translated into **intelligence** and **knowledge**, which is relevant to the job at hand.

MEDAV is covering a broad range of needs in these scenarios with off-the-shelf products:

- **Radio monitoring** sensors, processing and analysis solutions of different complexity

- **Information and Intelligence** processing, analysis and production systems.

COMINT and **Comms/ESM** Sensor and Acquisition Systems are dedicated for the search, identification, interception and localization of relevant radio emitters by means of innovative technical solutions. Additional information sources are relevant and of general interest. Analysis and work flow oriented **intelligence back office** systems are completing the full set of capabilities needed in the scope of responsibilities for handling information and intelligence.

Dr. Hans-Joachim Kolb, managing director and shareholder of the private owned company MEDAV GmbH, is willing to strengthen and deepen international cooperation and to improve the networking between users, partners and the company at the same time.

*"During more than 25 years MEDAV had the opportunity of delivering solutions and systems in the field of intelligence and government projects. Starting point had been products for signal analysis, processing, demodulation and decoding. The automation of detection, identification and recognition processes of relevant signals has been realized successfully by means of pattern recognition technology. Today we are supplying the **complete chain of information** processing from the information source to the intelligence back office, where the fusion of information and the reporting are the main tasks.*

Important issues of today are the need of flexibility, modularity and growth potential for the operational systems in order to create the capability of adapting and upgrading system features to meet current and future needs within short time. The consequent use of available COTS IT components helps to achieve the goals efficiently.

Single software modules are integrated into dedicated solutions meeting the needs and requirements of today starting with the sensor and ending with the intelligence back office. The consequent application of the design guideline helps to reduce product costs, risk and delivery time and increase quality in particular through the strategic use of the principle of software defined functionality.

We are cooperating with partners supplying special and dedicated technical sub systems especially for the interception of modern communication systems. We are also cooperating with partners having experience in the organization of security organizations and their operational efficiency. In an open, transparent and target oriented partnership we are supporting our customers not only with technical solutions but also with the consulting needed to develop efficient and effective organizations quickly.

No system can ever be better than its user. *This is why we make sure the operating and maintenance personnel receive comprehensive training, and we guarantee fast and efficient service. We are interested in a **long-term relationship** with our customers and guarantee continuous improvement to the system technology.*

We are offering the whole spectrum of products and services which are necessary and part of modern IT based security organizations. Our focuses are information and intelligence handling systems including the sensors for the collection of technical and communication signals and the interfaces for the acquisition of information from different sources, like human intelligence (HUMINT), open sources (OSINT) and others."

Please contact me directly if you have any questions, suggestions or if you are interested in the direct contact: Hans.Kolb@medav.de, Phone: ++49-9131-583-0

ARS-8000

Automatic Reconnaissance System

- 20 to some 1000 channels (HF, VUHF)
- Automatic production
- DF & localization support
- Modular and scalable
- Interactive operator intervention if necessary
- Role based system software
- Proven solution

The ARS-8000 system is a reconnaissance system to monitor, detect and produce a scalable number of narrow band channels automatically.

CRS-8000

Compact Reconnaissance System

- HF – VUHF
- Interferometer DF
- Compact antennas
- Wide band technology
- Acquisition – Processing – Recording
- ESM tracking mode
- Off-line analysis

CRS-8000 is a compact, fully integrated reconnaissance system dedicated for the use on mobile platforms as well as in stationary applications.

MIRA

MIRA Interception & Analysis

- ComCat tuner technology
- Comprehensive monitoring capabilities
- Comprehensive signal analysis including CCI-offline/online & OC-6040
- Client-server architecture

MIRA is a flexible, modular and scalable signal analyzer for HF, VHF and UHF. MIRA enables the online monitoring of a 16 MHz-broad band signal (optionally 24 MHz) in the frequency range between 100 kHz and 3 GHz. Wide band recording of an 8 MHz-band (16 MHz optional) is possible.

IFS-8000

Integrated Information and Intelligence Fusion System

- Middleware Design
- Multi sensor support
- Automatic content analysis
- Work flow support
- Diverse target oriented data bases
- GIS, I2, speech and text tools

IFS-8000 is a scalable, modular and high performance platform supporting all processes in the analysis and production of intelligence.

2 Company Overview

MEDAV GmbH - your Partner in the Markets Government and Test & Measurement

MEDAV GmbH is a modern and efficient company specialized in the application of signal processing, pattern recognition and information technology. MEDAV supplies the whole range, from a single stand-alone product to a complete system solution from single source. We guarantee our customers innovative product solutions of high quality. Our goals are continued success and customer satisfaction. By working together in trusted, long-term relationships with our business partners we achieve the positive growth we seek. Today, we design, develop, produce and implement solutions and engineering worldwide.

Centres of Competence

RMS   Radio Monitoring Solutions

CSS   Channel Sounding Solutions

BIS   Business & Intelligence Solutions

IAS   Industrial & Automotive Solutions

ERD   Engineering Research & Development

More than 25 Years of Experience

MEDAV Technology addresses customers worldwide who are on duty to protect their country, region and people from threats. Market leading solutions provide the technical support on the basis of innovative and proven technology.

MEDAV has the human and technology resources as well as a network of partners and specialists to provide the customer at the best.

Systems, Solutions and Devices are the keywords describing the structure and the size of products, services and projects we are providing.

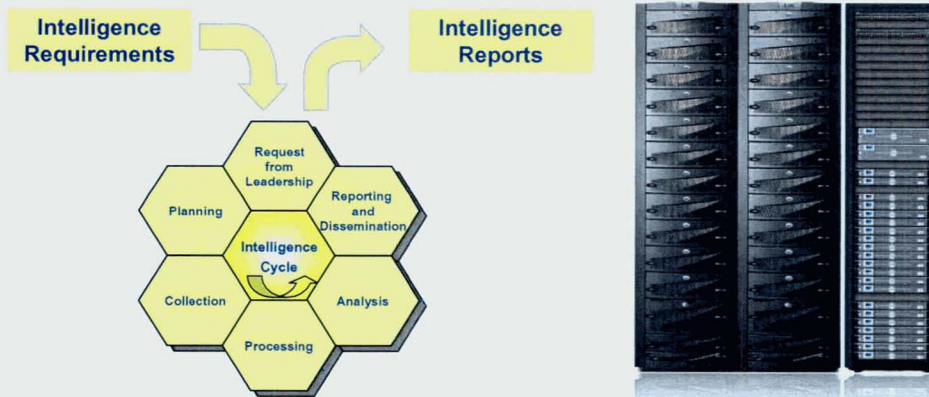| Systems | high complexity including engineering delivery time 6 – 18 months |
| Solutions | dedicated to the workplace delivery time 3 – 6 months |
| Devices | ready to use modules for OEM customers off-the-shelf |

Since 1982 **MEDAV** delivers worldwide turnkey solutions and systems for radio monitoring and surveillance applications from the antenna to the intelligence back office.

- Ground-Based COMINT – Comms/ESM – COTS & Customer specific

  - o Fixed Location HF / VUHF

  - o Networks of distributed HF – DF Systems

  - o Mobile solutions HF / VUHF

- Shipborne COMINT – Comms/ESM – COTS & Customer specific

  - o Submarine

  - o Above Water Ship COMINT / Comms/ESM systems

- Airborne COMINT – Customer specific.

Sensors like radio monitoring systems (COMINT) are producing raw intelligence by means of collecting signals, performing measurement procedures and classifying the information and the content. The collection of information and the localization of the emitters provide information which is directly relevant for improving the situation awareness of command and control units.

MEDAV additionally supports the following steps in the **C4I** (command, control, communication, computer, intelligence) process by suitable IT-systems. Processing, content and relationship analysis of fused information from different sources, work flow support and reporting are major tasks of the integrated information and intelligence fusion system IFS-8000.

From technical point of view MEDAV is following the principle of "software defined intelligence architecture" which is a unique approach today. The **SDIA** approach also allows MEDAV today to speak about VAR-business. VAR (value added reseller) relations are of growing importance as many of our customers and their home countries are discussing the aspects **offset** and **technology transfer**. We are open for such kind of discussion and accept these requests as a reasonable concern.

3 Issues of Today

3.1 Current Discussions in the Security Community

"Intelligence, Surveillance, and Reconnaissance (ISR) systems are integral components of both national policymaking and military operations - including counterterrorism operations, but they are costly and complicated and they must be linked in order to provide users with a comprehensive understanding of issues based on information from all sources."

Information, Knowledge and Intelligence are key factors in the successful planning and performing of operations. **Sharing information** can help prevent crime and terrorism before it occurs. Proactive law enforcement requires putting together many pieces of a puzzle. While there is no guarantee that information sharing will prevent all attacks or crimes, failure to do so will almost certainly guarantee future attacks and crime.

[1]*"In the wake of the September 11, 2001 terror attacks there has been a call for more and better intelligence to preserve domestic security. Much of the focus has been on improving and expanding existing federal mechanisms for ensuring national security. Equally important, however, is the need for more and better intelligence for and by state, local, and tribal law enforcement agencies.*

The intelligence function can serve two broad purposes within law enforcement agencies:

Prevention (Tactical Intelligence): *This includes gaining or developing information related to threats of terrorism or crime and using this information to apprehend offenders, harden targets, and/or employ strategies that will eliminate or mitigate the threat.*

Planning and Resource Allocation (Strategic Intelligence): *This includes generating information to decision-makers about the changing nature of threats, the characteristics and methodologies of threats, and emerging threat idiosyncrasies for the purpose of developing response strategies and reallocating resources, as necessary, to accomplish effective prevention.*

The tragedies of 9/11 do not change the fact that LEI (law enforcement intelligence) has the capacity to support many functions within a police organization. In many communities, LEI that supports local criminal investigations and improved management decision making may be as valuable as LEI that supports matters of homeland security."

3.2 Consequence: No Operation Without Information!

Beyond any dispute collection of information from different sources is recognized to be the basis for all following steps in the work flow of intelligence organizations observing their duty to support the deciders and the leadership.

Operation - Intelligence

> **MEDAV** supplies with the products ARS-8000, CRS-8000 and MIRA all kind of communication intelligence systems, especially radio monitoring solutions. Additional sensor systems are offered on request using a network of cooperation partners.

The fusion of information is a necessary step to produce intelligence and knowledge which is reported to the leadership. Strategic and tactical scenarios are part of the daily tasks and determine the way how to handle the special intelligence requirements.

> **MEDAV** supplies the IFS-8000 system which is designed as a modular, flexible and scalable IT platform for the organization of work flows in the intelligence back office including many dedicated support, processing and analysis tools.

I3FS integrates sensors, signal processing and analysis with the following processing and analysis of intelligence.
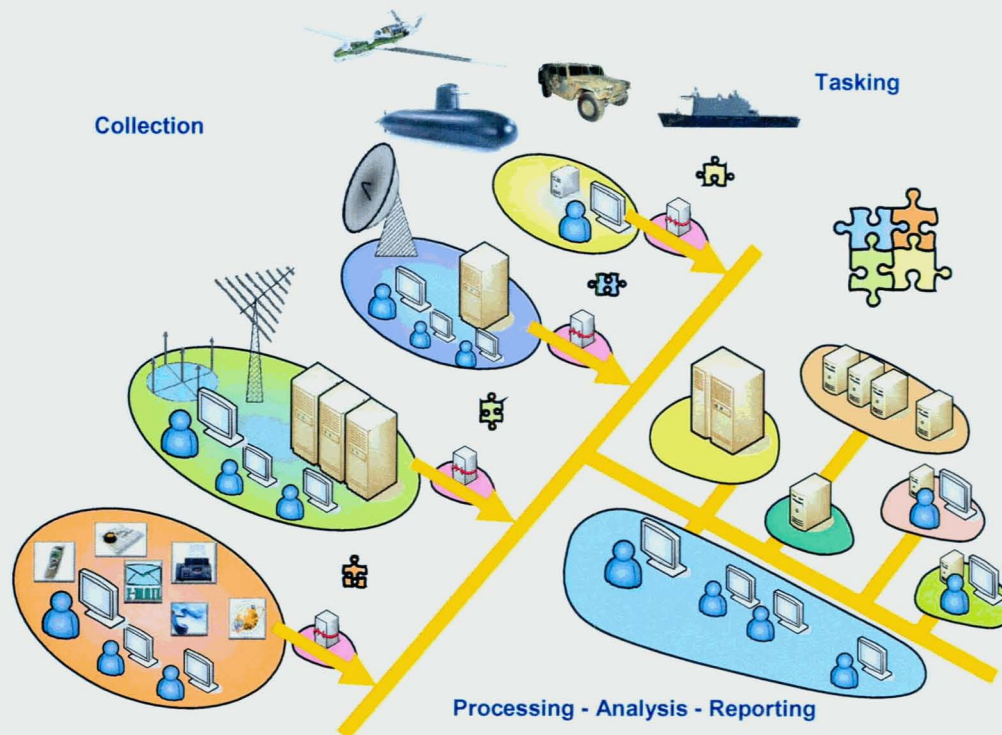
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[1] Published by the Futures Working Group (FWG), collaboration between the FBI and the Society of Police Futurists International (PFI). Its purpose is to develop and encourage others to develop forecasts and strategies to ethically maximize the effectiveness of local, state, federal, and international law enforcement bodies as they strive to maintain peace and security in the 21st century. "The Future of Law Enforcement Intelligence, Joseph A. Schafer & David L. Carter"

3.3 Integrated Information Intelligence Fusion System (I3FS)

I3FS is MEDAV´s answer to the current challenges in law enforcement and national security agencies worldwide. I3FS **collects** information from different sources and provides the agency with all tools to **process** and **analyze** information efficiently. The puzzle, consisting of single pieces of intelligence, is merged into the **report** and gives a complete picture supporting best **situation awareness**. The work flow is organized in a closed loop and allows **tasking** of the collection sensors.
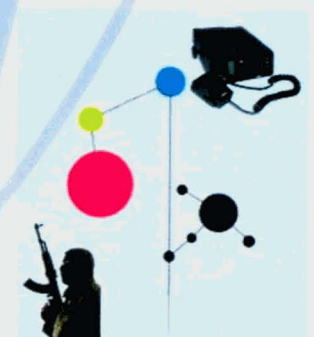

IFS-8000 is the modular IT platform which enables MEDAV and the end users to adapt the functionality of the I3FS system to the dedicated needs and requirements easily and target oriented. Diverse powerful analysis tools provide functionality in the field of relationship, geographic location, technical and speech signal analysis.

MIRA, CRS-8000 and ARS-8000 are radio monitoring sensors allowing the collection of signals and their processing, analysis localization and content production. Special communication collection systems, dedicated for different communication services, complement the scope of sensors and the availability of acquisition and interception capabilities.
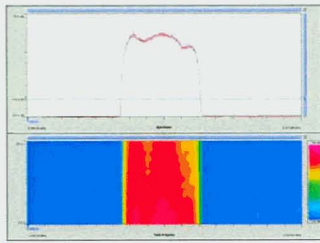
The following areas of applications are covered by the product family:

- Radio Monitoring and COMINT in strategic and tactical scenarios
- Radio Monitoring for civil regulation authorities
- Equipment for mobile platforms with radio monitoring and COMINT solutions:
  - special emergency vehicles for police and special task forces
  - ships for the coast guard
  - airborne platforms.
- Signal and speech analysis labs and work places
- Support of strategic oriented security services and agencies under the leadership of the **Minister of Defence** or the **Minister of Interior** with Surveillance and Information Processing solutions
- Command – Control – Communication – Computer and Intelligence applications (**C4I**)
- Compact solutions to support special task forces with dedicated IT solutions for the mobile use.

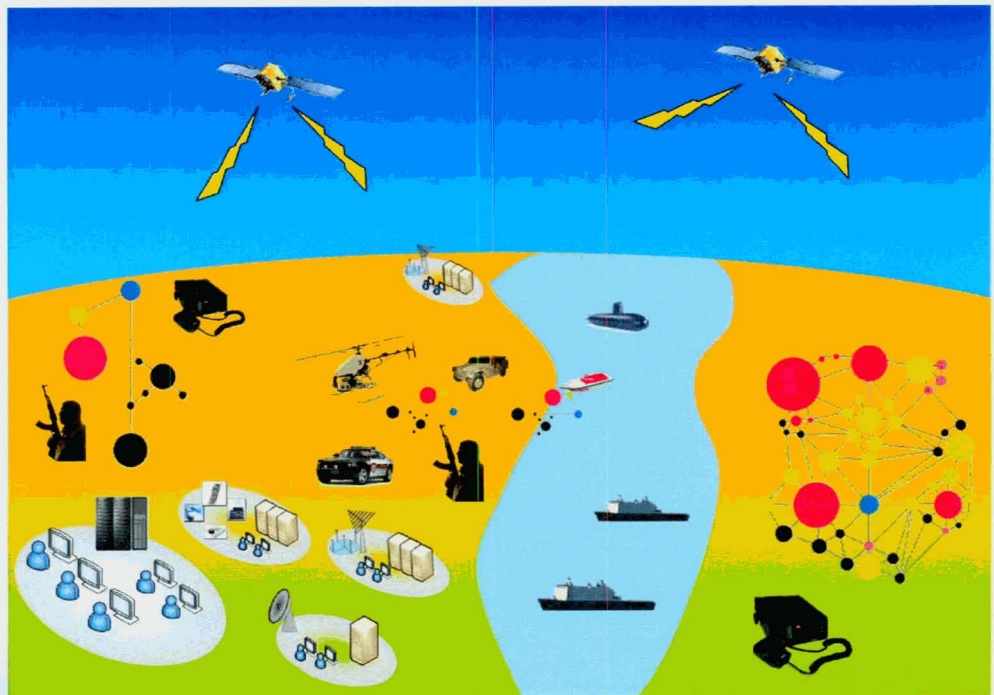# 4 Radio Monitoring – OSINT, COMINT, SIGINT, HUMINT & MASINT

4.1 Introduction

Systems for radio monitoring can contribute significantly to the success of the work within law enforcement and intelligence agencies. The central idea is that the bad guys are using communication systems during their operation leaving their marks and electronic fingerprints in the air. The detection and identification of the electro magnetic emissions and signals indicate behaviour, deployment and movement of threatening task forces, terrorists or criminals. Those signals can be captured and analysed in different way by means of signal processing and analysis methods. Content is another important issue in analysing the intercepts.

The process usually generates information and intelligence in several steps:

- Detection
- Identification
- Classification
- Localization
- Interception
- Content production and analysis
- OSINT, COMINT, SIGINT, HUMINT and MASINT.

The complete set of collected transmissions are fused and analysed in order to give an enhanced picture of the current situation and situation awareness. Situation awareness, or SA, is the perception of environmental elements within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future.

A Fully Automatic Acquisition and Production System

Applicable in HF / VUHF Scenarios

Scalable from 50 to more than 1000 channels

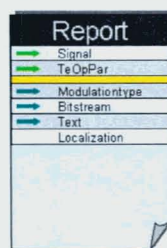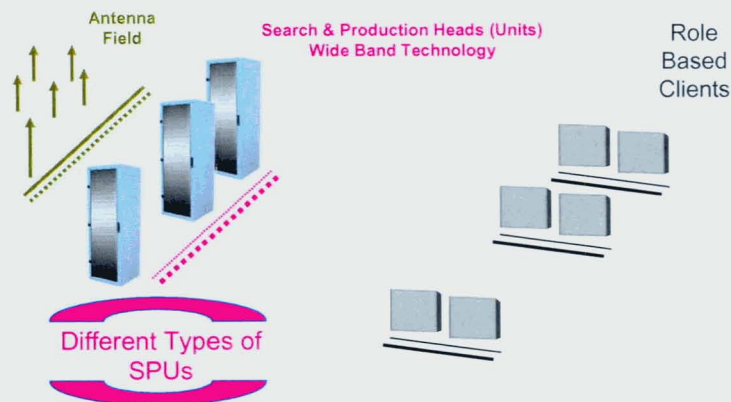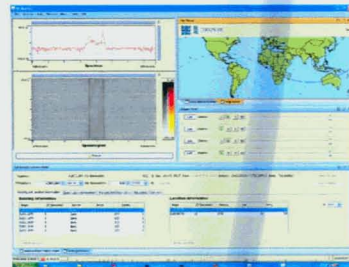|	
Development:	completed, systems delivered and in operation
Application:	Strategic, COMINT, mobile, fixed location, remote controlled
Delivery time:	for standard solutions: 8-10 weeks

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One operator controls 10-200 production channels

- modular
- scalable
- flexible

ARS-8000 is an automatic reconnaissance system providing functionality to increase efficiency and throughput in the detection, acquisition, processing and analysis of radio emissions. The system design is modular, scalable and flexible and allows configurations from 20 to more than 1000 processing channels.

The pressure of work for the operators is reduced by delegating routine processes to the machine and giving the human operators the possibility to focus their manpower on signals of special interest.

ARS-8000 significantly increases efficiency, quality and saves cost in modern RF acquisition applications.
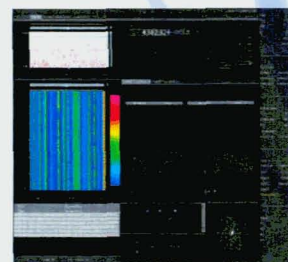
Antenna Field

Search & Production Heads (Units)
Wide Band Technology

Role Based Clients

Different Types of SPUs

Acquisition → **Added value** → **Report** →

Report	Report	Report
Signal	Signal	Signal
TeOpPar	TeOpPar	TeOpPar
	Modulationtype	Modulationtype
	Bitstream	Bitstream
	Text	Text
	Localization	Localization
		Analysis
		Identification
		Comment ..

A Compact Solution with full functionality

Searching – Monitoring – Analysis – Interception – Warning

Example: Version CRS-8010

Development:	**completed, systems delivered and in operation**
Application:	**Tactical, COMINT, Comms/ESM, DF, mobile, fixed location**
Delivery time:	**for standard solutions: 10-12 weeks**

CRS-8010 is a compact COMINT - Comms/ESM solution based on the CRS-8000 technology. All system components, especially the antenna, have been adapted to the needs and the conditions on an above water ship. Other mobile platforms as well as the operation at fixed locations are possible.

- COMINT & ESM solution for vessels based on the CRS-8000 design
- HF/VUHF interferometric direction finding
- Radio emitter detection by automated classification and analysis
- Automated scan
- Narrow band production, demodulation, decoding
- Wideband and narrow band recording
- Radio emitter tracking (COMMS-ESM)
- Operator role concept – work flow oriented
- Compact system design, inclusive antennas
- Powerful tools for offline processing

A fully integrated solution

- Frequency range: HF / VHF / UHF - 100 kHz – 3 GHz
- Wide band technology
- Integrated antenna for DF and interception
- DF and signal detection
- Signal interception, demodulation, decoding, production
- Signal recording - comprehensive offline analysis

Modular design and scalable functionality

- Different configurations according customers needs

Dedicated solutions for special requirements

- Submarine version available
- Ruggedized versions for mobile operation

4.4 MIRA – Wideband Signal Monitoring & Analysis

RF Signal Surveillance System

Signal Intercept, collection, identification, demodulation

Technical Signal Analysis in the lab and in the mission

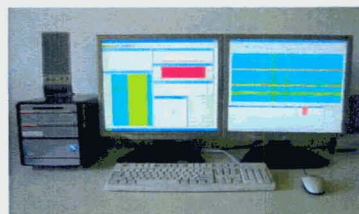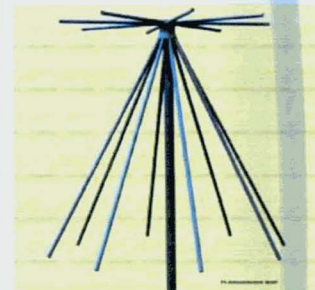|	
Development:	**completed, systems delivered and in operation**
Application:	**Tactical, COMINT, Comms/ESM, mobile, fixed location**
Delivery time:	**for standard solutions: 4-6 weeks**

MIRA is a one channel flexible, modular and scalable signal analyzer for HF, VHF and UHF.

MIRA enables the online monitoring of a 16 MHz-broad band signal (optionally 24 MHz) in the frequency range between 100 kHz and 3 GHz.

Wide band recording of an 8 MHz-band (optionally 16 MHz) is possible.

- ComCat tuner technology
- Comprehensive monitoring capabilities
- Comprehensive signal analysis (offline/online)
- Client-server architecture
- Option: Additional analysis stations

- Online broadband monitoring of a 16 MHz-band (opt. 24 MHz) for HF/VHF/UHF with a display of the broadband spectrum and panorama display (spectrograph)
- Fixed setting of the 16 MHz-band (opt. 24 MHz) and scan operation over the complete HF/VHF/UHF-range
- Broadband recording of an 8 MHz-broad band (opt. 16 MHz) in the HF/VHF/UHF-range on the hard disk server, whereby the recording band lies within the monitoring band.
- Narrow-band recording of complex and demodulated data.
- ComCat tuner for supporting two antennas with internal channel switch-over and raw data processing
- Innovative client-server-architecture for network-oriented analysis workstations
- Offline-analysis of broadband and narrow-band signals
- Automatic and interactive demodulation & decoding
- Use of standard modules for capturing (CC-IO), recording (RePros) and offline analysis (CCI-Offline)
- Simple system extension for analysis through plug-ins, e.g. universal analyzer OC-6040
- Example of an antenna configuration: Active monopole-antenna for extended HF-band (0.1 – 50 MHz) and standard-discone-antenna-S13036/201- for VHF/UHF-bands (30 – 3.000 MHz)
- Robust device design of the capturing part, standard-PCs, standard network components.

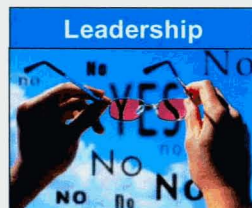# 5 IFS-8000 – Information and Intelligence Fusion

5.1 Overview

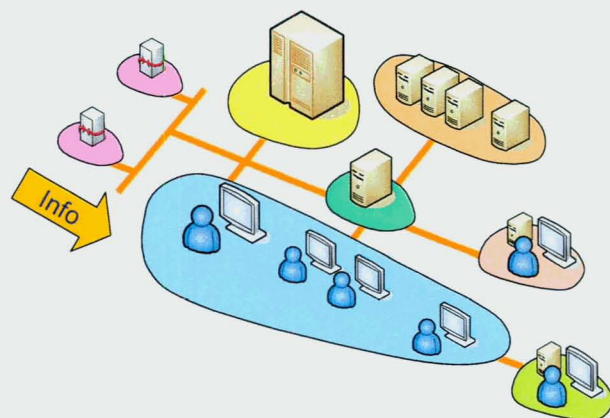|	
Development:	**in progress based on available framework**
Application:	**Analysis, intelligence fusion**
Delivery time:	**depending on complexity**

The aggregation and analysis of information for supporting decision makers and the management in the analysis and fusion centre is a central task. IFS-8000 is a flexible, modular and scalable family of IT solutions, based on an open architecture, to support and organize the work flow in modern and state of the art analysis centres of intelligence organizations:

- support of different sensor and acquisition systems
- online pre processing to reduce data early and efficiently
- suitable indexing of large, long-term oriented data bases
- Support of suitable retrieval of archived information
- automatic classification of raw messages
- diverse voice, text and image processing capabilities for the specific generation of added value (meta data and content)
- support of relationship and network analysis
- included geographical information system (GIS)
- work flow and organizational support in the analysis centre
- Comprehensive use of commercial off-the-shelf modules including options for the adaptation by the administration of the operating agency.

- IFS-8000 is designed as a **modular**, **scalable** IT-platform to support all processes in the production of intelligence from different sources to be used in:
  - tactical operation (x workplaces)
  - strategic operation (x00 workplaces)

- Different acquisition systems and sensors are supported
- Processing and analysis procedures are based on **modern** and **innovative**:
  - information technology
  - signal processing technology
  - pattern recognition technology

IFS-8000 is an open framework – not a Black Box solution

5.2 Modularity – Scalability – Flexibility & Data Bases

IFS-8000 includes diverse scalable data bases storing and handling raw structured and unstructured information as well as finished intelligence based on **Oracle** technology:

- **UC DB**   Unified Collection Data Base

- **TR DB**   Training Data Base for the adaptation of trainable classifiers

- **E DB**   Event Data Base for the handling of: Events – Entities – Relations

- **I DB**   Intelligence Data Base for finished intelligence
             and document management

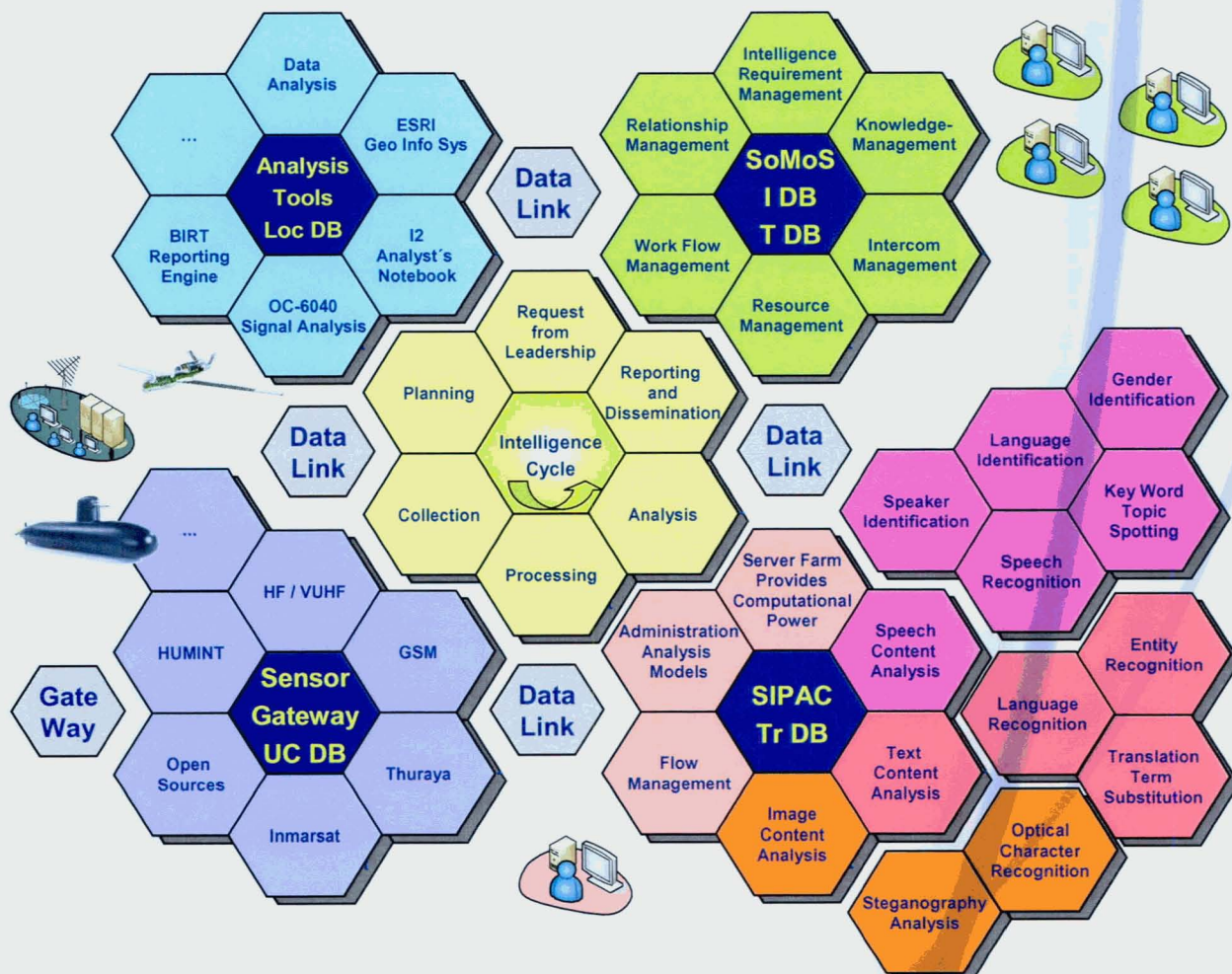- **Loc-DB** Dedicated Local Data Bases at the work places.

Analysis and reporting tools have well defined access to the data bases which enable the end user to adapt the analysis procedures to individual and dedicated needs. These tools are handling especially the **structured information** automatically by pre-defined and implemented analysis and reporting functions:

- **ESRI**   Geographic Information System

- **I2**   Analyst's Notebook via iBridge

- **BIRT**   Business Intelligence Reporting Tool.

The work flow in the organization is defined, monitored and controlled with a standard commercially available and supported tool:
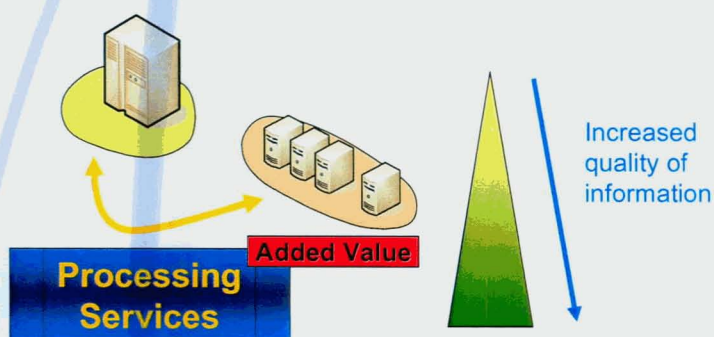
- **BPMS**   Intalio´s Business Process Management System.

The performance of the overall system is determined by the performance of the work place computers and the performance of the diverse integrated servers.

5.3 Catalogue of Automated SIPAC Functions

IFS-8000 is designed to handle raw intelligence and content not just by human processing and analysis but especially also by using automatic services based on state-of-the-art processing and pattern recognition technology. These services are an essential part of the SIPAC Server. SIPAC is handling **non structured content information** automatically by dedicated computer software.

Processing Services

Added Value

Increased quality of information

SIPAC is a server, offering processing, analysis and classification services which are implemented as automatic working modules. A SIPAC service can be understood as the automation of a complex procedure or process, traditionally performed by the **human process operator**, the **linguist** or the **traffic analyst**. SIPAC services are generating **added value** as the human operator does by analysing the content of information. SIPAC services are controlled by the BPMS system similar to services performed by the human staff in the intelligence back office.

Also **SIPAC** is modular, flexible and scalable and can be updated with diverse services, replacing the work of the human operators easily in case the software solution offers sufficient performance. Step by step human activities can be replaced by automated SIPAC services, increasing efficiency, quality and reproducibility following the progress in proven information and pattern recognition R&D results.

SIPAC can be used in a broad range of applications to improve the quality of services and efficiency of the whole intelligence production system. SIPAC also supports the process by offering such services which are not covered by the operators as a result of a lack of knowledge in special disciplines. Today the following services are covered.

Audio Speech Signal Processing and Classification

- **SSD**   Speech Signal Detection
- **ENH**   Speech Signal Enhancement
- **LID**   Language Identification (scenario based, training)
- **GID**   Gender Identification
- **SID**   Speaker Identification (scenario based, training)
- **TID**   Topic Identification (scenario based, training)
- **KWS**   Keyword Spotting (scenario based, training)
- **TCR**   Transcription – Speech to text

Technical Signal Processing

- **WBA**   Access on Wideband Signals
- **DDT**   Digital data (Identification, Demodulation, Decoding)

Text Processing

- **OCR**   Optical Character Recognition - Fax to text
- **Trans**   Translation (different methods, different languages)
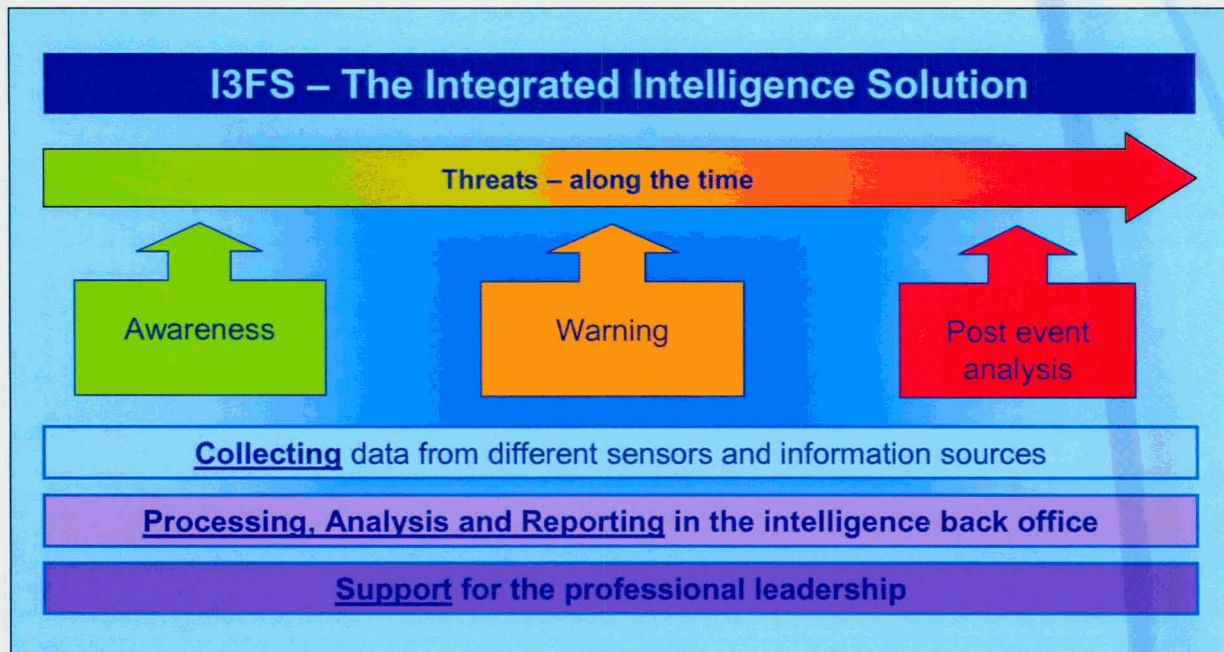- **TDiv**   Diverse Text Analysis (Language, Entity, Topic)

Image Processing

- **STG**   Steganography Analysis.

The performance of the SIPAC system is determined by the performance of the algorithms and the performance of the computer platform.

6 Conclusion

Today's world of law enforcement, investigations and intelligence services is focused on the **identification** and the **prevention** of threats.

Necessary requirements for success are well designed and implemented processes for handling information and the generation of relevant intelligence:

- generate relevant and appropriate reports
- answering the questions from the leadership
    - in an efficient way
    - at the right time
- speeding up the process
- increasing quality of information
- reducing the cost
    - on a high quality level
    - using IT support and automation wherever possible.

MEDAV I3FS solutions provide the tools, technologies, trainings and consulting needed to supply decision-makers with the information they need at the right time and help them to control situations through global situation awareness at all levels.

"A genuine expert can always foretell a thing that is 500 years away easier than he can a thing that's only 500 seconds off"

(Mark Twain)

Sensors

Signals

Classification

Content

Information

Intelligence

Corporate Policy

Technology

… in the products, development and in the company management is state-of-the-art and represents a top level.

Quality

... in all divisions of our company is considered as the indispensable prerequisite for a risk-free and successful cooperation with our customers and business partners.

Position in the market

… is affected by extensive experience gained from signal and information processing. We are prepared best to face competition.

Product and engineering spectrum

… are comprehensive, complete and tailored to meet all requirements.
As a single source supplier of solutions, we offer standard devices, systems and services.

Employees

… form the roots of the company and render the services necessary for maintaining and expanding the technical basis and a trustful and fair cooperation.

Growth

... on a stable technical and economical basis at home and abroad is our declared long-term goal.

Trust and fairness

… vis-à-vis our business partners and within the company are the basis of our business.

Compliance

... with excessive sensibility and compliance with German and international export regulations we act on a worldwide basis.

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