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A MODULAR AUTOMATIC ESM SENSOR FOR HELICOPTER

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A MODULAR AUTOMATIC ESM SENSOR FOR HELICOPTER

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A B S T R A C T S : The paper describes a modular, automatic ESM ELINT sensor, the RQH-5, originally designed by SELENIA for helicopter installation.

The RQH-5 system design criteria integrate over ten years of experience of SELENIA in this field and the results of extensive trials, performed on other operational systems.

The paper explains in broad terms the criteria adopted for system architecture, pulse selection and deinterleaving, radar sequences reconstruction, identification and handling, short and long term data integration, file organization for display and other forms of exploitation.

All the ESM information may be categorized and correlated with other sensor and composite display presentation.

No operator or display is required.

A system description details the following:

A system description details the following:

— system functions
— system composition and block diagram
— main characteristics
— options
— RQH-5 integration with other helicopter systems
— integrability with ECM modules
— growth capability of the system in terms of extension to higher frequencies.

1. REQUIRED OPERATION CAPABILITIES FOR AN ESM/ELINT HELICOPTER SYSTEM

In the last ten years the helicopter has played an ever increasing role as a credible airborne combat platform.

The helicopter's operational versatility, its ability to go anywhere and do virtually anything, makes it essential for all kinds of military support missions.

Modern airframe technology, improved engines, lightweight and high reliable avionics, plus increased payload capability have extended the roles of modern light, medium and heavy-lift helicopters.

Avionic and weapon systems have so greatly improved that they make rotary wing vehicles ideal for such missions as ASW, Maritime Patrol, ASV, ESM, ECM etc.

In particular the Electronic Support Measurements (ESM) have beem slowly emerging into mission essential roles in all aspect of warfare. This emergence has been achieved using Passive electromagnetic sensor systems in different configuration and applications.

With the increasing importance of the avionic systems in integrating sensors, weapons and display, the role of the ESM is becoming preminent in overall weapon systems for its inherent capability of being passive, thus having the possibility, for example, of directing a missile against an identified threat.

Early applications operated in a less severe Electromagnetic environment, but as the complexity and density of the scenario increased, analog passive sensor frequently exibited both false alarms and operator overload (too much decision making and signal interference to ensure correct operator interpretation).

These problems and low cost digital technology directed development towards Automatic ESM systems which have the processing and filtering capabilities needed for a correct deinterleaving of the signals, leaving the operator the role of decision making rather than the role of a final interpretation of a stream of data.

Tactical helicopters, equipped with an automatic ESM system and operating in mid-high intensity combat environments, are employed essentially in the following roles:

- operation planning support
- combat operation support
- post operations assessment support

As a consequence, it is possible to distinguish the following typical actions:

- detect, locate, record, analyze and observe electromagnetic radiation activity associated with hostile operation in order to
- sort out, identify and disseminate information that would be significant or critical in supporting the planning, conduct and assessment of tactical operations.

Table I indicates the purpose of some of the ESM activity associated with the support roles already indicated.

TAB.1

ESM ACTIVITY	PURPOSE OF ACTIVITY
OPERATION PLANNING SUPPORT	— SIGNAL DETECTION — DIRECTION FINDING — ANALYSIS — IDENTIFY EMITTERS — UPDATE ELECTRONIC ORDER OF BATTLE (EOB) — SUPPORT ECM, ECCM PLANNING — SUPPORT TARGETING PLANNING
COMBAT OPERATION SUPPORT	— DETECT HOSTILE FORCE — DETERMINE HOSTILE FORCE COMPOSITION — PROVIDE EARLY WARNING — PROVIDE TERMINAL THREAT WARNING — SUPPORT ECM, ECCM ACTIONS — SUPPORT TARGETING ACTIONS — DETERMINE EMITTER FUNCTION — SUPPORT FRIENDLY FORCE ACTIONS — SUPPORT SEARCH AND RESCUE
POST-OPERATION ASSESSMENT SUPPORT	— IDENTIFY EMITTERS — REVISE ELECTRONIC ORDER OF BATTLE (EOB) — SUPPORT TARGETING EFFECTIVENESS ESTIMATES

The expected capabilities includes CW and pulsed radar with PRF of $2,5x10^5$ to $1x10^6$ pulses per second, frequency range from 0,5 GHz to 18 GHz plus the pulse characteristics can be stable on each recurring pulse of an emitted pulse train, or they can be changing with each pulse transmitted. A further complications are the atmosperic noise, dropout of the pulses, and reflections of the pulses.

The problem of an automatic ESM system is, without any partecipation from an operator, to detect, to extract, to analyze, to list and to track all the received emitters known and unknown, scanning or tracking, stable or agile in frequency and/or in pulse repetition frequency, even if they radiate only few pulses, to keep in the memory all the data of the electromagnetic environment, and, finally, to transfer it, on the base of preprogrammed criteria or operator decision, to the display subsystem.

In conclusion the required operation capabilities of the ESM system or subsystem installed on board a military helicopter are the following:

— to detect by means of high sensitivity and high probability receivers operating in the whole frequency range (1 to 18 GHz) in which modern radars operate;

— to perform REAL TIME AUTOMATIC and tracking of a large number of radars by advanced data processing by automatic warning and identification of preprogrammed radars, or by data collection;

— to perform the analysis of a designated radar to have the capability of being integrated with on board electronic subsystems (radar, missile guidance, data link, etc.).

2. ESM EQUIPMENT DESIGN REQUIREMENTS

In order to cover the above described functions, the ESM equipment is designed to provide the following:

— cover the EOB frequency spectrum

— istantaneous signal detection

— signal resolution

- signal band indication
- signal frequency measurement
- signal bearing measurement
- signal pulse/PRF measurement
- signal scan period measurement
- antenna scan type indication
- signal amplitude measurement
- automatic signal processing
- permanent threat library
- signal identification
- automatic warning channels
- automatic signal analysis
- audio/video data recording
- time and navigation data correlation.

3. THE SELENIA ESM/ELINT RQH-5 AIRBORNE SYSTEM

The RQH-5 system, designed by SELENIA in the years 1975-1980, and now fully operational, is capable of fully AUTOMATIC ESM performance. That means that the RQH-5 system can rapidly capture new emissions in multiple bands, identify radar type, and measure DF bearings without operator interaction.

The RQH-5 system layout is shown in fig. 1 and is composed, essentially, of the following units:

- Antenna System (one omnidirectional plus 8 Direction Finding antennae)
- Istantaneous Frequency Measurement (IFM) Receiver
- Video Receiver
- Automatic Extractor Processor
- ELINT Processor
- Multifunction Control Unit (KEYBOARD)
- System Display.

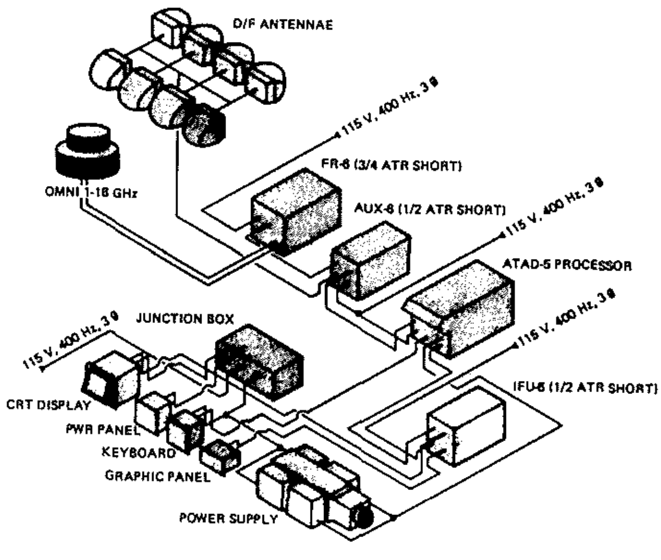

Fig. 1 · RQH-5 SYSTEM GENERAL LAYOUT

The RQH-5 originated on the basis of a specific customer requirement for an airborne ESM system capable of providing automatic ESM performance in very dense environment and very high data acquisition speed. Omnidirectional, istantaneous, wide-open coverage over the fully frequency range was considered mandatory, as well as instantaneous measuring of Radio Frequency and Direction of Arrival (F and DOA), with special emphasis given to the ability to «capture», analyze and keep in memory a short-duration signal, and to provide a clear analysis of the electromagnetic environment: all received signals (known and unknown, scanning or tracking) are to be analyzed and tracked.

Automatic operation, as already stated, is of basic importance, as well as automatic identification and warning of pre-programmed radar types.

3.1 ANTENNA SYSTEM

3.1.1 GONIO ANTENNA SYSTEM (DIRECTION FINDER)

The requirement of the RQH-5 is for an instantaneous and omnidirectional measurement of the DOA for each detected pulse.

The solution adopted is an 8 antennae array with amplitude monopulse receiver.

The eight directional antennas are disposed at 45 degrees one to the other on the horizontal plane in order to provide istantaneous coverage over 360 degrees. The outline of a single element is shown in fig. 2.

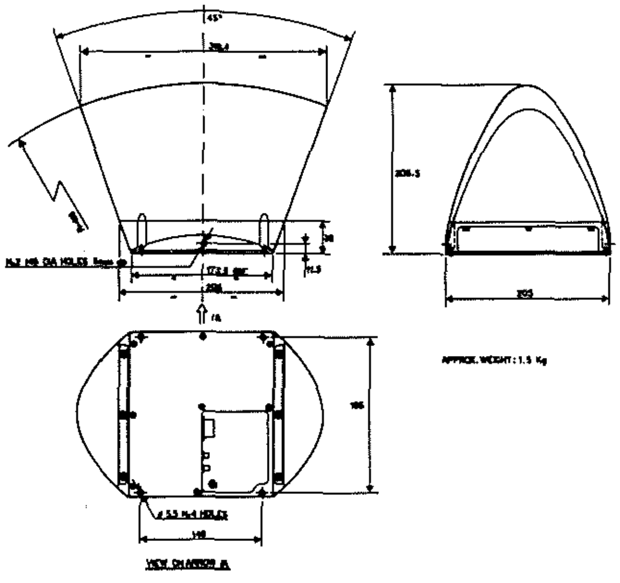

Fig. 2 - SINGLE GONIO ANTENNA LAYOUT

Two basic arrangements can be adopted:

a) a «drum» configuration, on which the eight antennas are all connected to a central support;

b) a «deployed» configuration, consisting of four subgroups, positioned as desired around the helicopter body, and each composed of a selectable number of antennae.

Fig. 3 shows detail of a typical installation on an helicopter.

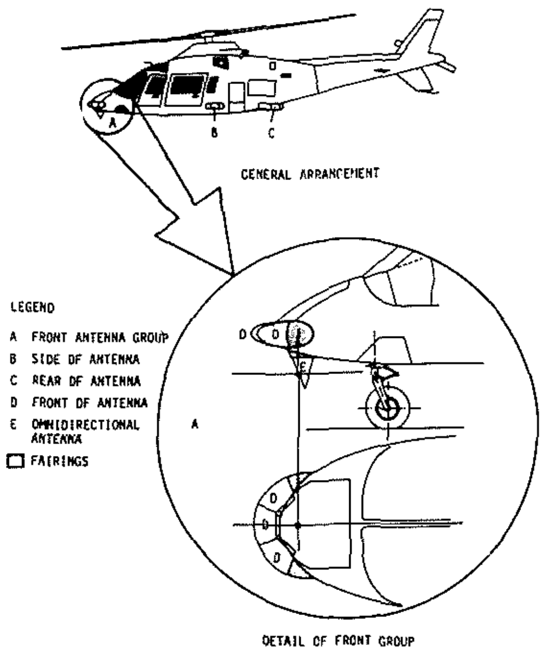

Fig. 3 - EXAMPLE OF GONIO ANTENNAE INSTALLATION

3.1.2 OMNI ANTENNA UNIT

Most of today's airborne ESM system cover the band from 2.5 to 18 GHz. However, in the last ten years many radar manifacturers in the world have designed and delivered new radars in the range 1 to 2 GHz. In addition radars in the band from 0.5 to 1 GHz are still in operation.

We have to consider that in the range from 0.5 to 1 GHz there are many types of non-radar signals, mainly consisting of modulated CW.

For this reason it has been decided to cut at 1 GHz the frequency coverage of the RQH-5. The selected band is 1-18 GHz.

The OMNI antenna unit is a biconical type omnidirectional antenna to be generally located under the aircraft body.

Fig. 4 shows the outline of the omni antenna.

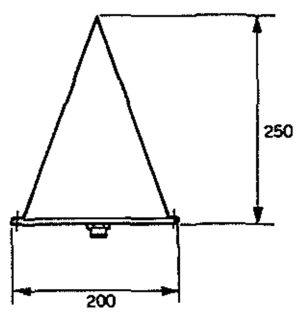

Fig. 4 - OMNIDIRECTIONAL ANTENNA LAYOUT

3.2 *THE RADIO FREQUENCY AND VIDEO RECEIVERS*

The new Radio Frequency and Video receivers for ESM and ELINT applications: are wide-open, with instantaneous F, DOA, Amplitude and PW measurements capable of providing real-time digital output for any incoming pulse and CW radar signals.

3.2.1 IFM RECEIVER

The IFM receiver amplifies the RF signals coming from the OMNI antenna and performs an istantaneous high sensitivity measurement (IFM) in all the RF band from 1 to 18 GHz.

The need for real time response requires the selection of an *IFM* (Istantaneous Frequency Measurement) receiver. Two version of the IFM receiver are available: one which provides ten bits resolution and the other providing 14 bits resolution.

The output of the two version are compatible with the video receiver unit. The mechanical size is a STANDARD 3/4 ATR SHORT for one version and 1 ATR SHORT for the other version.

The outline is shown if fig. 5.

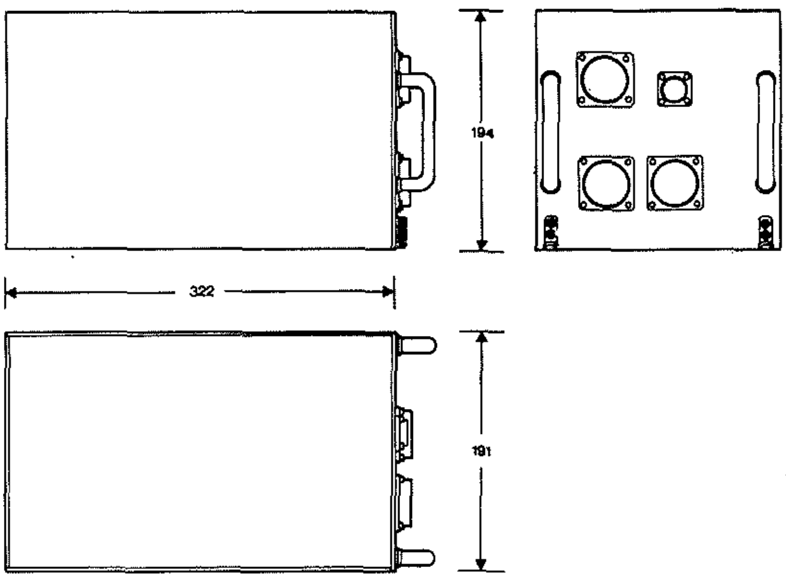

Fig. 5 - FREQUENCY RECEIVER LAYOUT

3.2.2 THE VIDEO RECEIVER UNIT

This unit receives the video signals from the Gonio Antenna system and from the Frequency Receiver, and provides amplification, correlation and digitization of the said signals so that each received pulse is associated in real time to a group of digital words representing his parameters (frequency, bearing, PW, amplitude).

The unit mechanical size is a STANDARD 1/2 ATR SHORT and is shown in Fig. 6.

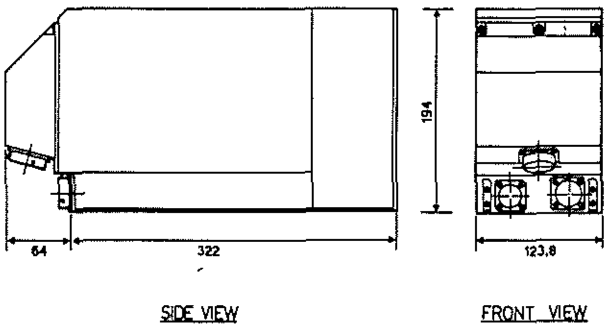

Fig. 6 - VIDEO RECEIVER LAYOUT

3.3 *THE AUTOMATIC EXTRACTOR*

The Automatic Extractor was designed to fulfill the automatic operation requirements.

It is a high speed digital processing unit designed by SELENIA for REAL-TIME ESM PROCESSING applications and is capable of tracking the Video Receiver output data, classifying and correlating it, in order to compile and update a «file» of the active emitters.

The computing node of the Automatic Extractor is on the MARA airborne computer.

The MARA architecture selected for this application is a «hierarchich node» with one «master processor» and three «I/O slave processors».
The master processor is capable to perform a large set of general purpose tasks and the I/O slave processors are included for the execution of all the I/O dedicated tasks in order to decongest the master.

The modularity of the architecture has allowed the development of a very flexible system when the configuration is a run time software choice and all the peripheral interfaces are used as logical channels with the same exchange protocol.

The major benefits offered from the basic and operational software are:

- Automatic acquisition of hardware configuration in the start-up phase and consequent software self configuration.
- High level performance of the on-line auto-diagnosys and automatic reconfiguration in case of fault.
- Minimum reaction time for exception handling.
- Operational parameters hamdling (for example: levels, thresholds, etc.) also during the operational phase.

3.3.1 THE ESM DATA AUTOMATIC EXTRACTION FUNCTION

Considering that the amount of data coming out from the receiver may exceed 250000x48 bits word per second, it is important to note that the automatic processor must be suitable to handling in «real time», this amount of data. In addition it is important to remember that this requirement is very different from that of a Radar Warning Receivers, mainly designed for locked-on radars. Infact even the more advanced types of RWRs available today are capable of selective warning function on preprogrammed threats, locked or not on the helicopter, but cannot provide the analysis of unknow radar. As a consequence such RWRs are an ideal instrument for fighter pilots, whose main problem is to avoid the engagement from the anti-aircraft system, but are completely inadeguate for the type of identification and location capabilities on either programmed or unprogrammed radars. The Selenia automatic extractor has been refined, implemented, tested in factory and patended.

Field tests were conducted in 1980 and is now in operation.

The receiver output consists of a digital message, one for each pulse detected and describes the following pulse parameters:

- Band (B)
- Frequency (F)
- Direction of Arrival (DOA)
- Pulse Width (PW)
- Amplitude (A)

The task of the automatic extractor is to correlate these data, and establish how many emitters have been received, and their parameters.

The input section of the extractor must be able to store and correlate each pulse message and be matched with the time on target of the received radar.

The SELENIA approach for the input section of the automatic extractor is, so called «SELECTED BEFORE LOADING» technique.

It consists in the real time evalutation of the information content of each incoming pulse ad a subsequent decision whether to store it or not.

The input section consists of two memory areas containing the input pulse parameter. The two memories areas are filled alternatively thus permitting the receiver to remain continuously «open», filling one of the two buffers at any one time and processing the data previously stored in the other.

Each input buffer is multiple channelled and can store a sample of pulses per each time frame. Each pulse family (channel) is characterized by the same band B and same pulse-width PW.

Storage (or not) is based on the parameters of the pulse and the previous pulse history within the time frame.

Following the input section the data is stored and ready for further processing.

The basic extraction algorithm performed by MARA stores each emitter in an «active radar file» and compares it with the previous stored data and associates a «track number». If the present emitter data is not already in the active file, it is added to the file as a «new track» and is characterized by a new «track number».

At the predetermined refresh rate, the active radar file is sent to the presentation file. The capability of the presentation file is up to a maximum of 64 emitters under track (warning and not warning emitters).

In Figg. 7.8 are shown, respectively the preprocessing unit and the complete automatic extractor architecture.

PRE-PROCESSOR STRUCTURE

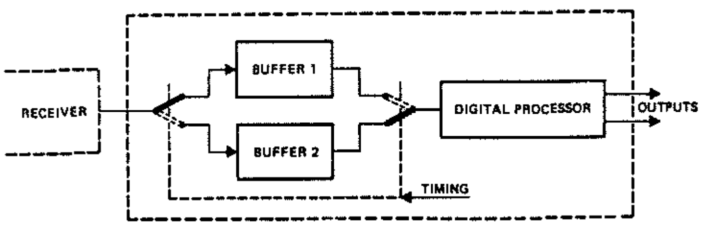

Fig. 7 - PRE-PROCESSOR STRUCTURE

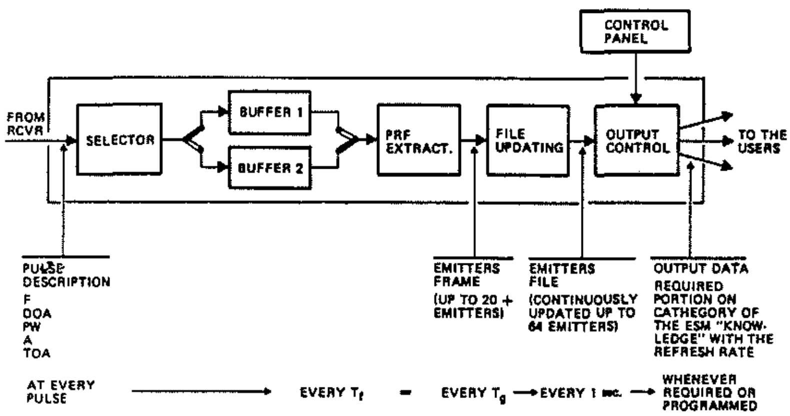

Fig. 8 - AUTOMATIC EXTRACTOR STRUCTURE

The unit mechanical outline is shown in fig. 9.

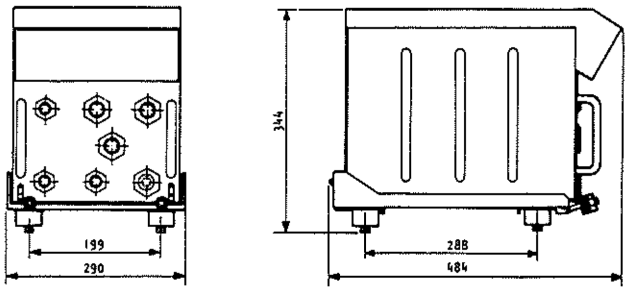

Fig. 9 - PROCESSOR LAYOUT

3.3.2 WARNING CHANNEL FUNCTION

The RQH-5 has an automatic warning capability for fast recognition and of emissions whose parameters have been pre-stored by the user into «WARNING MEMORY», consisting of small, solid-state, interchangeable module, mechanically inserted on the front of the keyboard unit.

The recognition of those emissions is made on the basis of the frequency, pulse repetition and pulse width.

No manual interventions are required and the relevant message can be sent to the users of the EW data, e.g., via a data link, and at the same time, display in special form (negative labelled).

Parameters acceptance windows and real time software modifications are provided by using numerical keyboard, which is the only interface between the operator and the automatic extractor computer.

3.3.3 IDENTIFICATION FUNCTION

On operator request, the RQH-5 system has the capability for fast recognition of the non-dangerous (friends emitter) and dangerous (foe emitters) whose parameters have been pre-stored in a special permanent library of the processor.

Following a designation from the operator, by the system keyboard, the identification function consists of a comparison between the parameters of the designated emitter and its own radar library. All the radars contained in the identification library and within a certain confidence level defined by the operator, are displayed and ordered as a function of threat or confidence level.

3.3.4 AZIMUTH GATE FUNCTION

One additional facility is the AZIMUTH GATE function, which allows the directional selection (in steps of 10 degrees) of ESM.

Signals arriving from directions outside of this sector are automatically discarded and the ATAD-5 Processor extracts only the pulses having a Gonio measurement and within the presetted angular sector.

The keyboard unit loads the Azimuth Gate sectors and activate (or not) the facility, while the sector limits remain visible in a display integrated into the same keyboard. Limit changes simply requires only to key in the new angular sector limits.

3.4 ESM PRESENTATION DATA ORGANIZATION

The presentation of the emitters parameters is obtained automatically and is continuously update by the extractor processor.

It is very important to note that the operator, in this case is not a part of the ESM machine. Infact the ESM INFORMATION are displayed on the display system, without any operator intervention. This is very important where, in general, the operator dedicated at the same time, to different subsystems (radar, sonar, navigation, data-link etc.).

In this case the RQH-5 system must be considered as an automatic ESM sensor, transferring his output file to a tactical computer capable of generating tactical pictures in which a portion of interest of the ESM information is automatically displayed and correlated with other elements of the tactical picture.

The integrated display modes make possible a simultaneous control of the helicopter subsystem by the single operator.

3.4.1 ESM DISPLAY MODES

There are four display modes:

— Standard ESM mode
— Warning Channels mode
— Identification mode
— Frequency/Direction of Arrival mode.

In the Standard mode the following information is displayed:

— TRACK NUMBER (NT)
— BAND (B)
— IDENTITY (IDENT) (in the case of an identified emission or a warning emission).
— THREAT LEVEL (in the case of an identified or warning emission) (T)
— MINIMUM FREQUENCY (F-MIN)
— MAXIMUM FREQUENCY (displayed only if the radar is a frequency agile radar) (F-MAX)
— PULSE REPETITION FREQUENCY (PRF)
— PULSE WIDTH (PW)
— ANTENNA SCAN PERIOD (ASP)
— ANTENNA SCAN TYPE (AST)

In the WARNING CHANNEL mode the following prestored data are displayed:

— RADAR NUMBER (NR)
— IDENTITY (IDENT)
— BAND (B)
— FREQUENCY (FREQ)
— FREQUENCY ACCEPTANCE WINDOW (R)
— PRF (PRF)
— PRF ACCEPTANCE WINDOW (R)

— PW (PW)

— PW ACCEPTANCE WINDOW (R)

— JAMMING PROGRAM (if available) (JPR)

— THREAT LEVEL (T)

In the IDENTIFICATION Mode the following data are displayed:

— RADAR NUMBER (NR)

— IDENTITY (IDENT)

— CONFIDENCE LEVEL (CONF)

— OPERATIVE PLATFORM (naval, ground, airborne) (PLA)

— THREAT LEVEL (T)

— OPERATION ROLE (OPR)

— JAMMING PROGRAM (JPR)

In the Frequency/Direction Of Arrival mode a reduced ESM standard presentation is displayed combined with a frequency versus azimuth graphic presentation while detailed ESM analysis is selectively obtained in the lower part of the screen.

The figs. 10, 11 and 12 a typical ESM presentation, the Warning channels page and the Identification list.

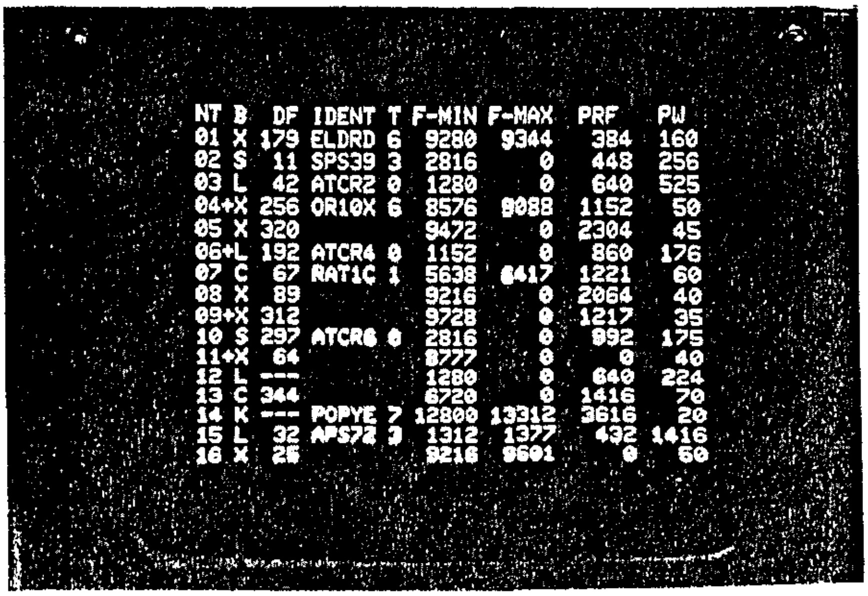

Fig. 10 - EXAMPLE OF ESM PRESENTATION

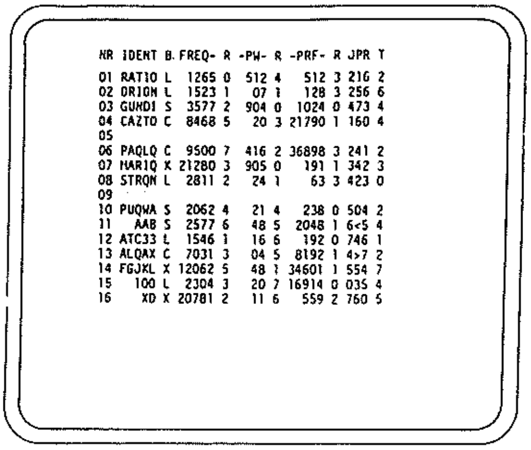

Fig. 11 - EXAMPLE OF WARNING PAGE PRESENTATION

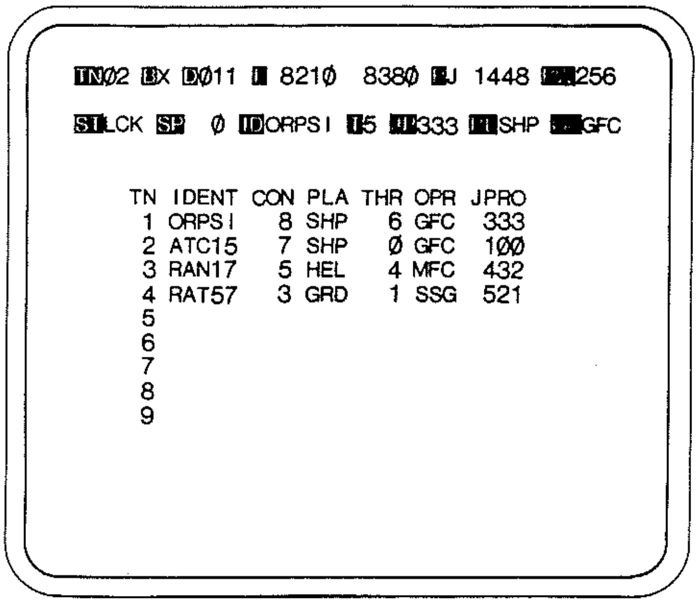

Fig. 12 - EXAMPLE OF IDENTIFICATION LIST

3.5 ELECTRONIC INTELLIGENCE (ELINT) PROCESSOR IFU-6

The RQH-5 system has the capability to process and observe a signal transmitted by radar systems and so obtain information about their capabilities. This function is performed, on operator's request, by another subsystem which includes another MARA computer node with the same hierarchical architecture of the above mentioned node.

Obviously this second MARA node offers the same performances and architectural benefits of the first one.

The operator, by the system keyboard, can performs the following functions:

- Selective signal loading and analysis (one emitter at a time).
- Pulses pattern recognition.
- PRI calculation.
- Amplitude pattern presentation.
- Antenna scan analysis.
- Pulse repetition interval (PRI) analysis.
- PRF stagger analysis and calculation.
- PRF jitter analysis and calculation.
- Frequency pattern presentation.
- Direction Of Arrival (DOA) evolution during the flight.
- Statistical evaluation and histograms presentation.
- Interfacing with other on board systems for multifunction display management.
- Data recording on magnetic tape (optional).
- Data link management (optional).

Results of analysis can be displayed and/or recorded, at operator selection, either in memory (the same used for the warning channels) on the system keyboard or on an optional tape recorder or send it to an ELINT center by a data link.

For this purposes the ELINT processor architecture comprises, in addition to the input buffer and the MARA processor unit, a video graphic interface unit and 5 off standard serial input/output channels EIA RS 422, and than the capability to interface a TV monitor and other subsystem on board.

The implemented architecture consists of two MARA nodes linked with a very fast serial line for data and command communication.

The unit mechanical size is a STANDARD 1/2 ATR SHORT and an outline is shown in fig. 13.

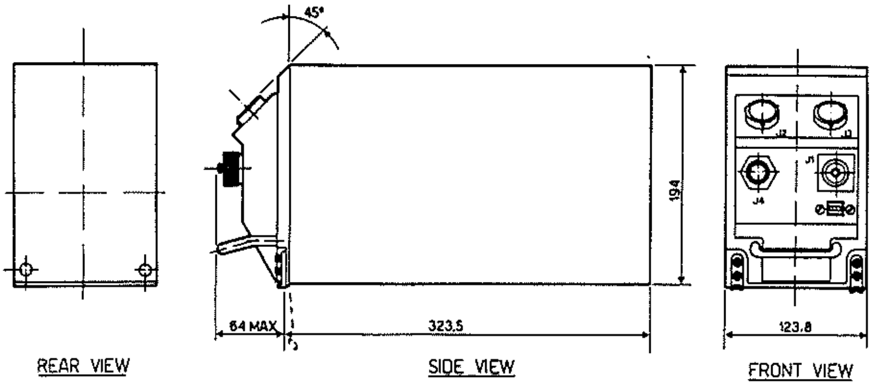

Fig. 13 - ELINT PROCESSOR LAYOUT

3.5.1 ELINT DATA PRESENTATION MODES

There are, basically, the following modes:

- Amplitude pattern, allowing the evaluation of radar antenna characteristics and scanning mode.
- Frequency pattern, allowing the evaluation of frequency agility mode and measurement of related parameters.
- PRI pattern, allowing the evaluation of PRI agility mode and the measurement of related parameters.

Fig. 14 shows a typical display presentation of a received amplitude pattern.

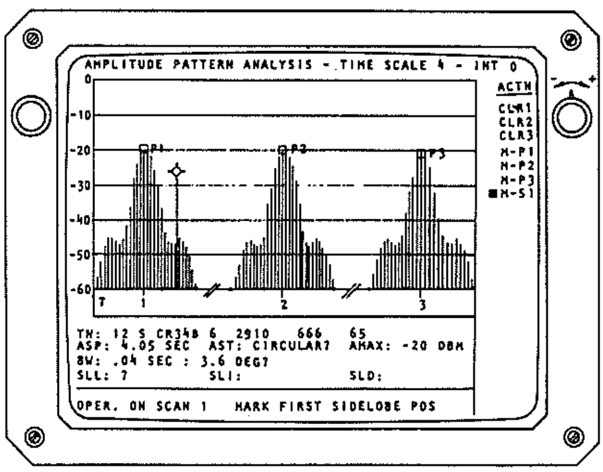

Fig. 14 - EXAMPLE OF AMPLITUDE PATTERN PRESENTATION

4.0 INTEGRATION CAPABILITY WITH OTHER SUBSYSTEMS

The RQH-5 system can be easily interfaced with a variety of other subsystems on board the helicopter, by using the standard RS 422 serial lines.

For example, when the system is interfaced with a navigation system and the on board radar, it is possible to correlate the ESM information with the radar target. In this case a special presentation mode is required in addition of the above described presentation modes, so called «PPI mode». It consists of presentation, showing the geographical position of the ESM helicopter in true motion over a net of coordinated and through non-real-time triangulation for the geographical location of the received emitters is achieved. Fig. 15 shows an example of this type of presentation in case of integration with a radar sensor at display level, while a ESM/ELINT presentation is shown in fig. 16, where navigation symbology/functions are also shown.

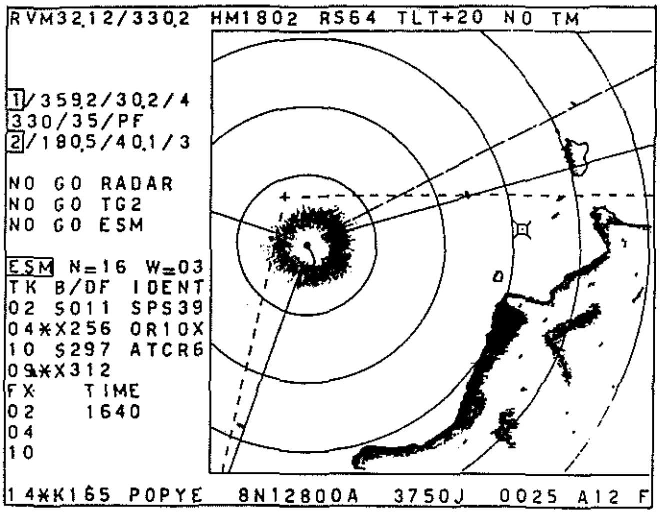

Fig. 15 - EXAMPLE OF ESM/RADAR COMBINED PRESENTATION

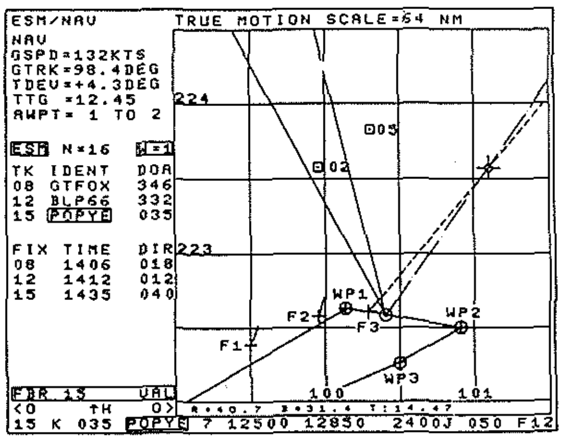

Fig. 16 - EXAMPLE OF ESM ELINT COMBINED PRESENTATION

5. INTEGRABILITY WITH THE ECM PACKAGE

The RQH-5 system has been dsigned to facilitate integration with active jammers. The reaction time for activation of the jammers is extremely short and the operation is higly automated.

This performance is achieved by means of the modularity of the MARA hardware and software architecture, and its associated very fact real-time capabilities.

Stand-off jamming operation is possible with jammers of SELENIA TQN-2 family, operating today in bands ranging from 1 to 16 GHz, with extension to the higher frequencies in the near future.

Interfacing and control of the TQN-2 jammers is provided by an additional 1/2 Standard ATR unit.

A typical arrangement for ESM/ECM helicopters consists of an RQH-5 permanently fitted on board, and of one of four bands (1-2 GHz, 2-4 GHz, 4-8 GHz and 8-16 GHz) of the ECM suites available installed as required.

6. GROWTH CAPABILITY

The evolution of the radar threat is continuous and expantion the frequency performance of the RQH-5 is envisaged Frequency band extension to 40 GHz is now in study.

The growth is expected to be obtained by the substitution of modules at Radio Frequency receiver FR-6/7 level, changing the OMNI and GONIO antenna system and modifing the software packages.

High language programming and structured designed modules allow s/w modifications at minimum cost.

7. CONCLUSIONS

As already described, the RQH-5 system mainly comprises of the following functions:

1. Wide frequency coverage.
2. Real time automatic extraction, analysis and tracking of all incoming radar signals (scanning or not, known or unknown).
3. Full capability on frequency agile and PRF agile signals.
4. Automatic CW measurements capability.
5. Automatic warning on pre-programmed signal types.
6. Computer assisted identification of low priority radars, within very wide identification library.
7. High probability of extraction and high learning speed.
8. ELINT capabilities.
9. Computer generated interactive display modes.
10. Integrability with other on board combat subsystems.
11. High accuracy DOA measurement with the optional FINE Bearing Receiver unit.
12. High frequency resolution and accuracy with the optional subassembly at Frequency Receiver unit level.
13. Standard serial/parallel input/output interface lines.
14. Man-machine computer assisted interface.
15. Storage capability, during a mission, of the ESM and of digital words representing his parameters (frequency, bearing, PW, amplitude).

The RQH-5 ESM/ELINT system fulfils the operational requirements above mentioned, either for its particular ESM performance and for its modular configuration which allows an easy effective integration with the on-board subsystems of the helicopter.

As a result of this integration, in small helicopters like AGUSTA A-109 the copilot directly operates passive sensors with a multipurpose display and transfers to the ship or to a ground centre the ESM/ELINT data.

The same configuration is applicable for medium size helicopters where the operator is not a copilot and a second operator is foreseen for separate systems (air to surface missile, etc.).

The very high density of today's electromagnetic scenario implies the need of a completely automatic extraction of the ESM data.

The automatic ESM system can operate even without any a priori knoledge of the electromagnetic scene without significant reduction in performance. On the other hand, the ELINT capability completely characterizes the radar signals and keeps record of them.

The RQH-5 system described in this paper, is a direct consequence of the evolution of the operational requirements for the ESM/ELINT airborne equipments. Its outstanding features and performance herein described, make it suitable for many types of operational missions.