

ATM international

MODE S MONOPULSE SURVEILLANCE RADAR

September-2017



indra

INDRA SOLUTION FOR MSSR MODE S

OVERVIEW

- New generation of Monopulse Secondary Surveillance Radar (MSSR)
- More than 40 years of experience
- Contrasted functionality, improving reliability, maintainability
- Worldwide installed (more than 200 installations)
- Complies with all international standards
- Faces future needs



INDRA SOLUTION FOR MSSR MODE S

CONFIGURATIONS AVAILABLE

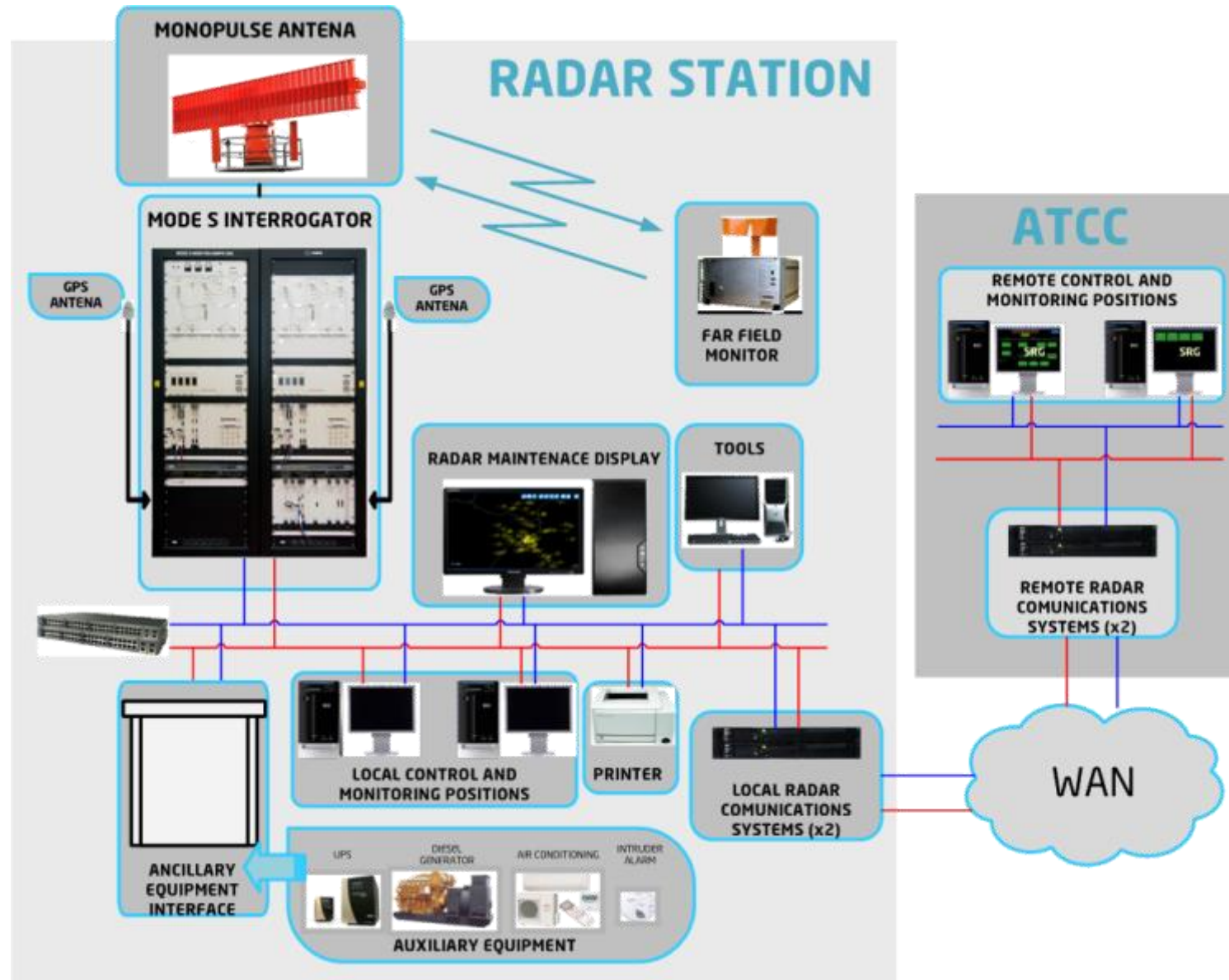
- Co-mounted
- Stand-alone (both transportable or fixed)

INTEGRAL SOLUTIONS PROPOSED

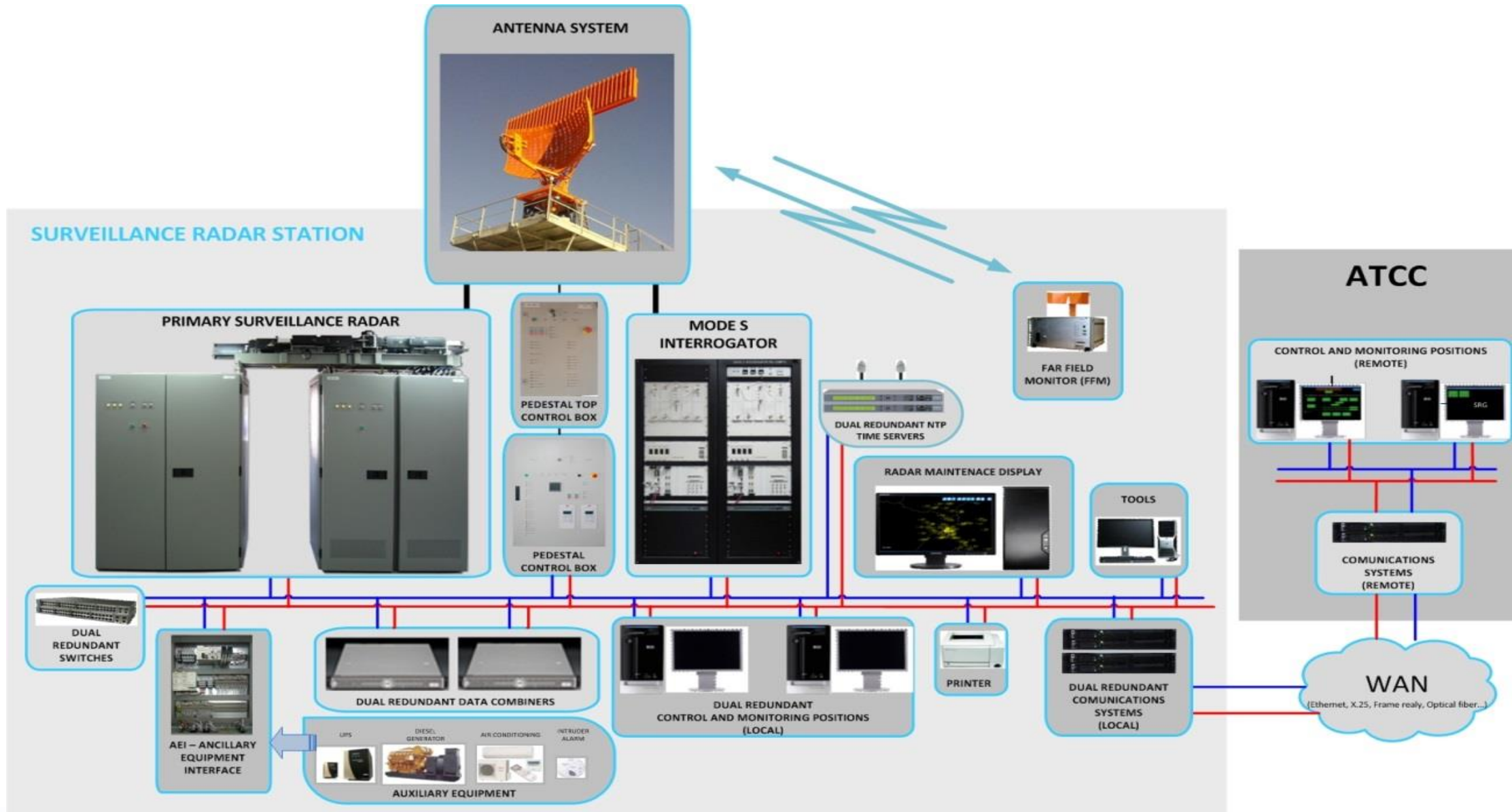
- Analysis of the necessities
- Coverage and site analysis
- Requirements definition
- Sensors manufacturing
- Project management
- Installation & Civil works
- Commissioning & Optimization
- Maintenance



INDRA SOLUTION FOR MSSR MODE S



INDRA SOLUTION FOR PSR S-BAND + MSSR MODE S



INDRA SOLUTION FOR MSSR MODE S

Stand-alone configuration



INDRA SOLUTION FOR MSSR MODE S

Co-mounted with 3D L-Band PSR



INDRA SOLUTION FOR MSSR MODE S

Co-mounted with S-Band PSR



MSSR MODE S - BENEFITS OF INDRA SOLUTION

HIGH DUTY CYCLE MODE S TRANSMITTER

HIGHEST DUTY CYCLE SOLID STATE MODE S TRANSMITTER :

- Peaks of 65% over 2.4 ms periods (Eurocontrol requires 63.7%)
- More than 6.57% continuously (Eurocontrol requires 5%)

EARLY ACQUISITION OF TARGETS

TARGETS ARE ACQUIRED AND REPORTED TO ATC IN THE FIRST SCAN

- Digital Video Processing based on very high density FPGA
- Powerful in airport areas (for departures)

TEST AND SUPERVISION UNIT

TEST AND SUPERVISION UNIT ABLE TO PERFORM TESTS REMOTELY

- Replies and target generation in RF level
- Measurement of interrogator signals.
- Continuous Wave generation.
- Maintenance costs reduction

MSSR MODE S - BENEFITS OF INDRA SOLUTION

HIGHEST TARGET CAPACITY

HIGH DENSITY TRAFFIC SUPPORTED

- More than 1080 targets per scan (Eurocontrol requires 900)

HIGHEST COVERAGE ACHIEVED

HIGHEST RANGE IN THE MARKET WORKING IN ENHANCED MODE S

- Adaptive mode S Interrogation schedule
- Allowing the highest range (256 NM) working at 15 rpm

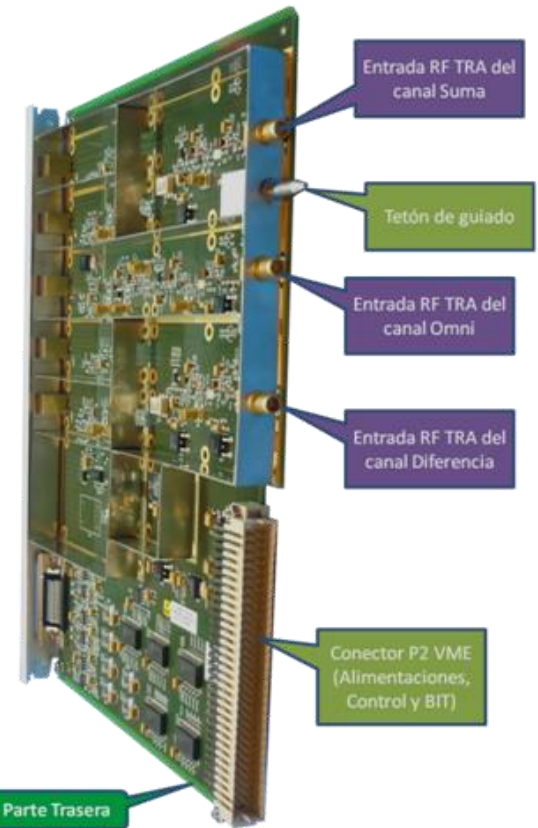
ADS-B INTEGRATED

MSSR-S SYSTEM WITH ADS-B RECEPTION AND PROCESSING CAPABILITIES

- Delivers ASTERIX 021 dataflow
- Improved performances and benefits in MSSR operation

MSSR MODE S - BENEFITS OF INDRA SOLUTION

FULLY DIGITAL RECEIVER



MSSR MODE S - BENEFITS OF INDRA SOLUTION

FULLY DIGITAL RECEIVER

**MOST
ACCURATE**

**DIGITAL RX
CHAIN**

**DIRECT
1090MHz
SAMPLING**

**BETTER
COVERAGE**

SUBSTANTIAL IMPROVEMENTS

- Sensitivity and accuracy of the monopulse detector
- Fully digital process is achieved
- No down-conversions adding noise to the signal
- No intermediate frequency losing information

BETTER DETECTION PERFORMANCE AND ACCURACY OVER LONG DISTANCES (>200NM)

- Substantial improvement in the signal / noise ratio
- Higher sensibility of the unit
- Extended dynamical range

MSSR MODE S - BENEFITS OF INDRA SOLUTION

FULLY DIGITAL RECEIVER

**NO ANALOG
COMPONENTS**

**RELIABILITY &
ROBUSTNESS**

**ENHANCED
PROCESSING
CAPABILITIES**

**SIMPLIFYING
MAINTENANCE
ACTIVITIES**

INCREASED RELIABILITY AND ROBUSTNESS

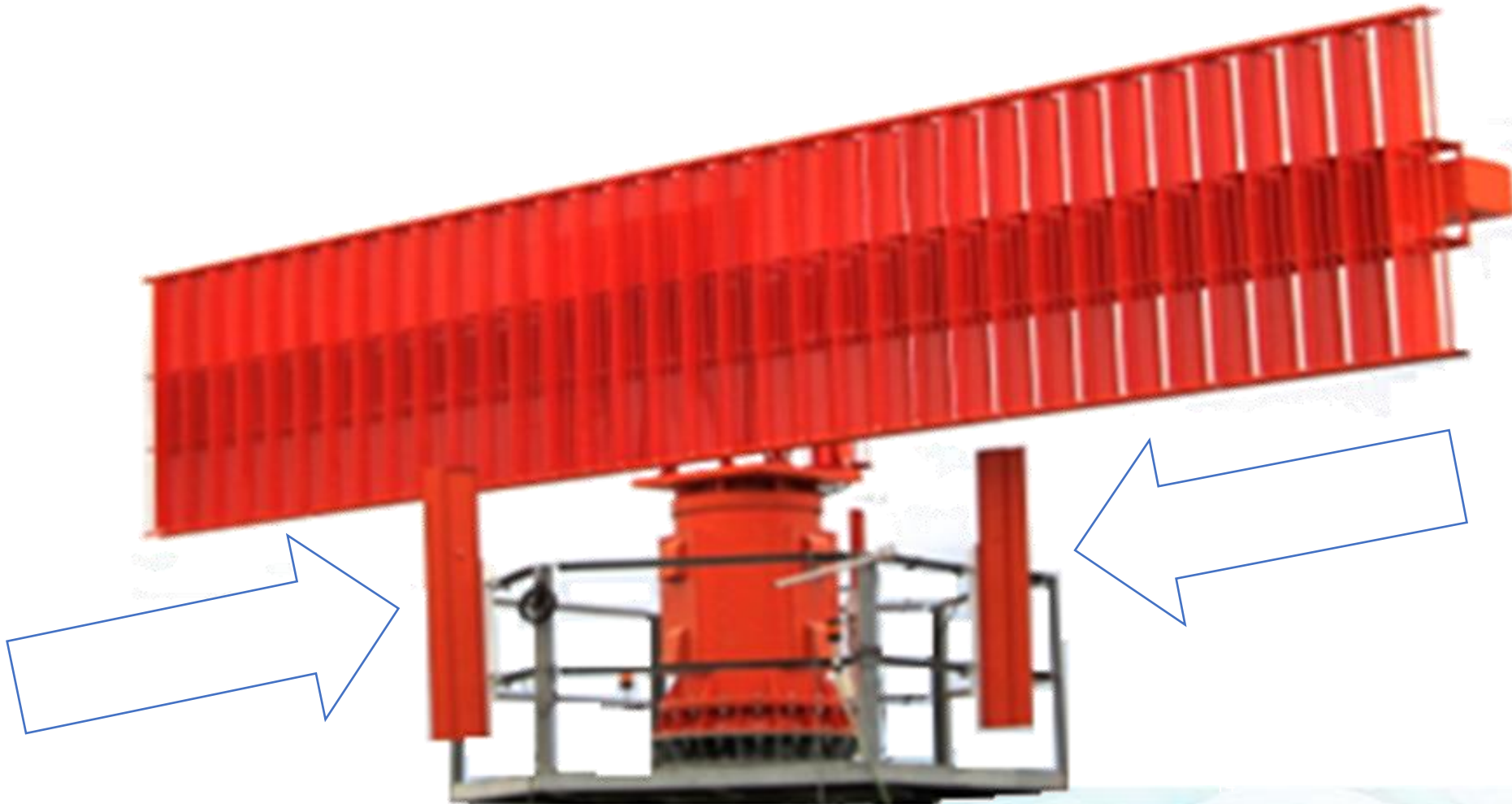
- Whole digital Rx chain (no analog components)
- Free spare capability for future upgrade
- Improved BIT mechanisms (noise floor, channels matching)

LESS MAINTENANCE, LOWER OPERATING COSTS

- Complete supervision and adjustments by means of CMS
- Automatic detection & solving of installation troubles
- Amplitude and phase mismatches in the RF cables

MSSR MODE S - BENEFITS OF INDRA SOLUTION

**ADS-B integrated in the MSSR
(SMART INTEGRATION)**



MSSR MODE S - BENEFITS OF INDRA SOLUTION

**ADS-B integrated in the MSSR
(SMART INTEGRATION)**

**SECTORIZED
ANTENNAS**

- SECTORIZED ANTENNA CONFIGURATION**
- Better gain and coverage
 - Sectorized antennas for 360° coverage

**MORE IN THE
SAME**

- SAME INFRASTRUCTURE TO PROVIDE ADS-B AND RADAR DATA**
- Different or same dataflow for reports (AST CAT021)
 - Sharing energy system, communications and other infrastructures
 - Implementation costs are reduced significantly

**EASY
INSTALLATION**

THE DESIGN ALLOWS THE SYSTEM TO BE EASILY INSTALLED IN ALL THE CONFIGURATIONS

MSSR MODE S - BENEFITS OF INDRA SOLUTION

**ADS-B integrated in the MSSR
(SMART INTEGRATION)**

**BEST ADS-B
COVERAGE**

BEST ADS-B DETECTION PERFORMANCES IN VERY LONG DISTANCES (>250NM)

**ADS-B &
MSSR
SINERGIES**

ADS-B INFORMATION TO ENHANCE THE PERFORMANCES OF MSSR SYSTEM

- Reduction of cone of silence
- Mode S target detection on-ground (passive acquisition)
- Supports surveillance while MSSR maintenance tasks
- Reflection process improvement

**CONE OF
SILENCE
REDUCTION**

**MODE S
DETECTION
ON-GROUND**

**REFLECTION
PROCESS
IMPROVEMENT**

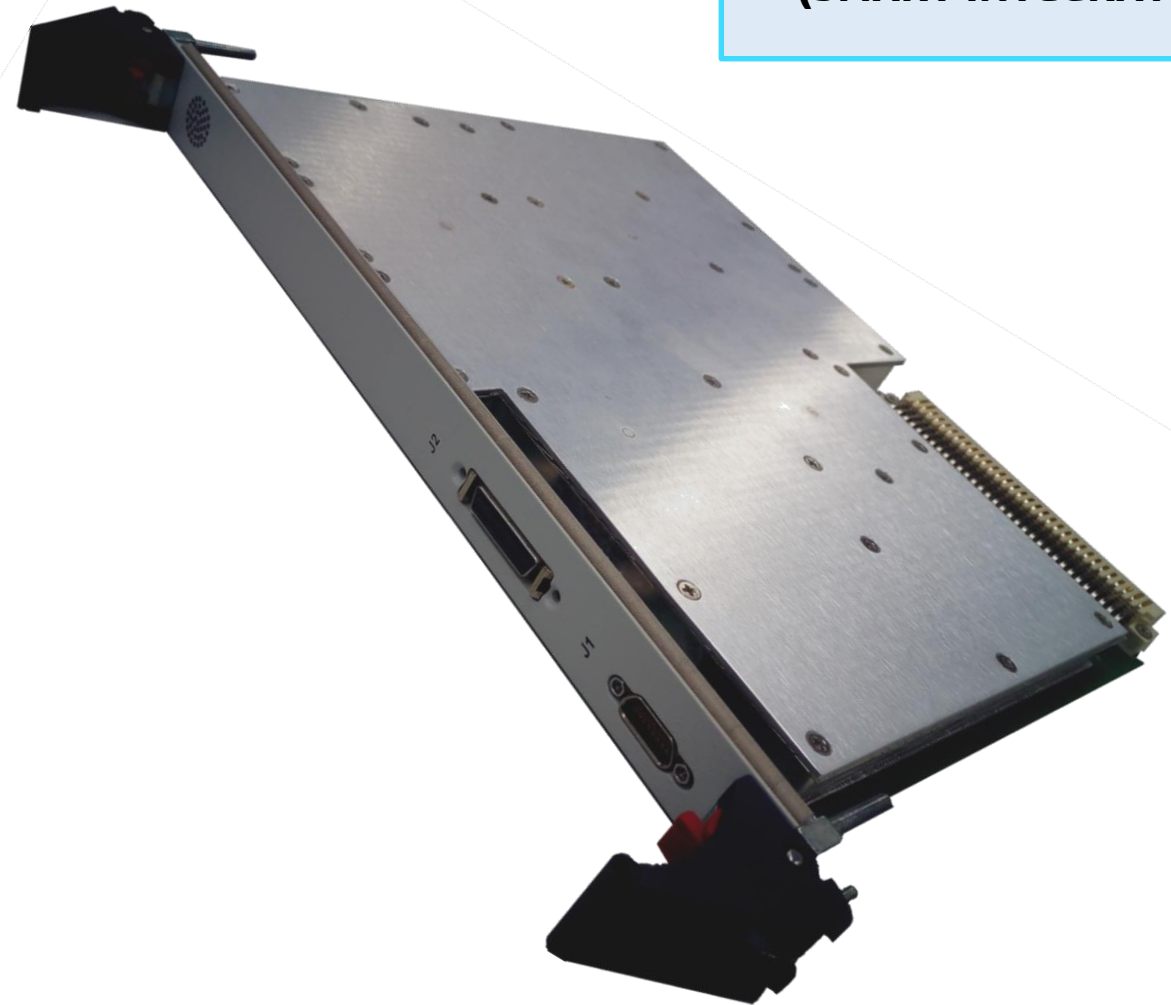
**SUPPORTS
MAINTENANCE
ACTIVITIES ON
LVA**

**II/SI
CONFLICTS
DETECTION &
MITIGATION**

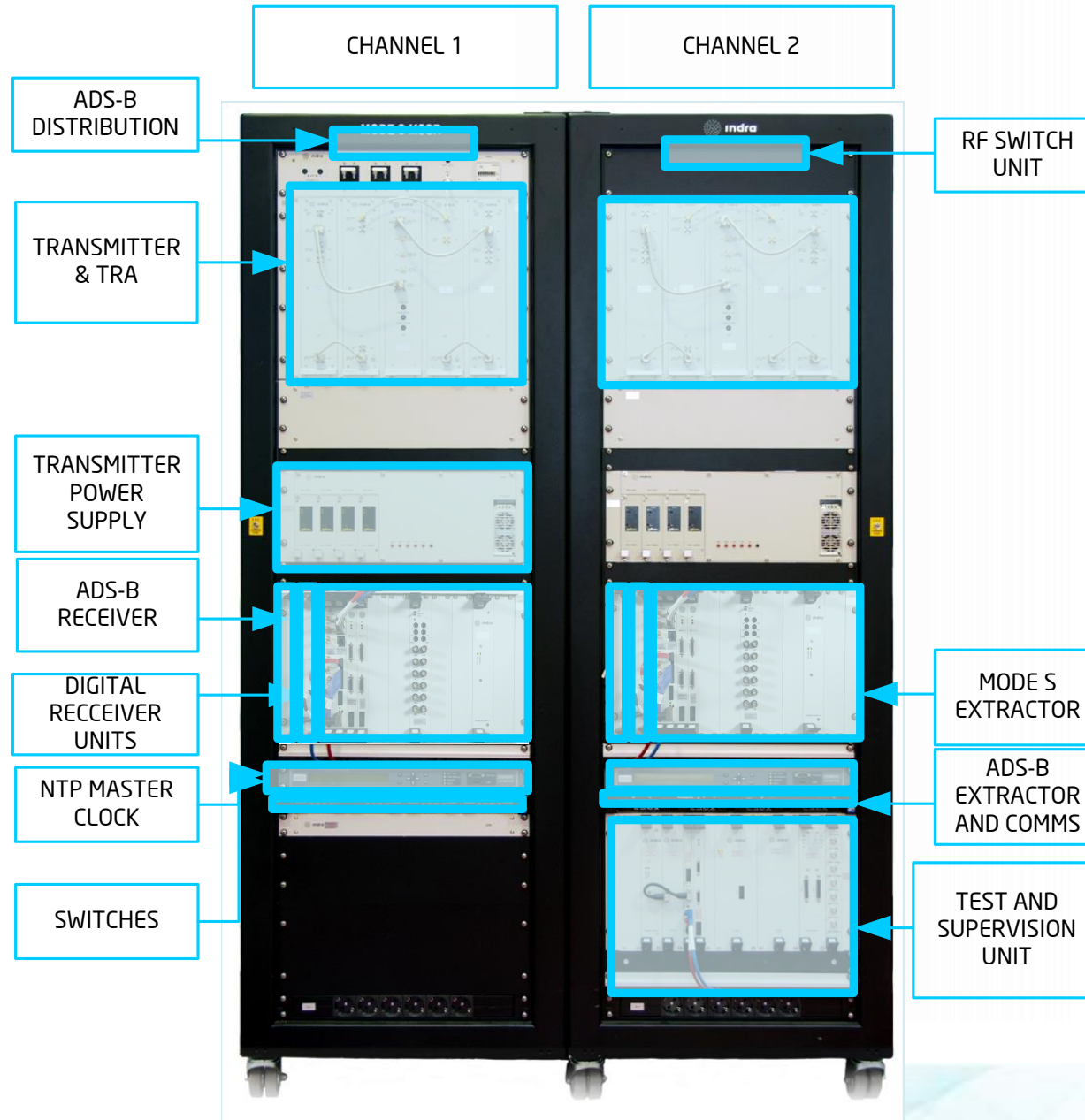
AND MORE...

MSSR MODE S - ADS-B COMPONENTS INTEGRATED

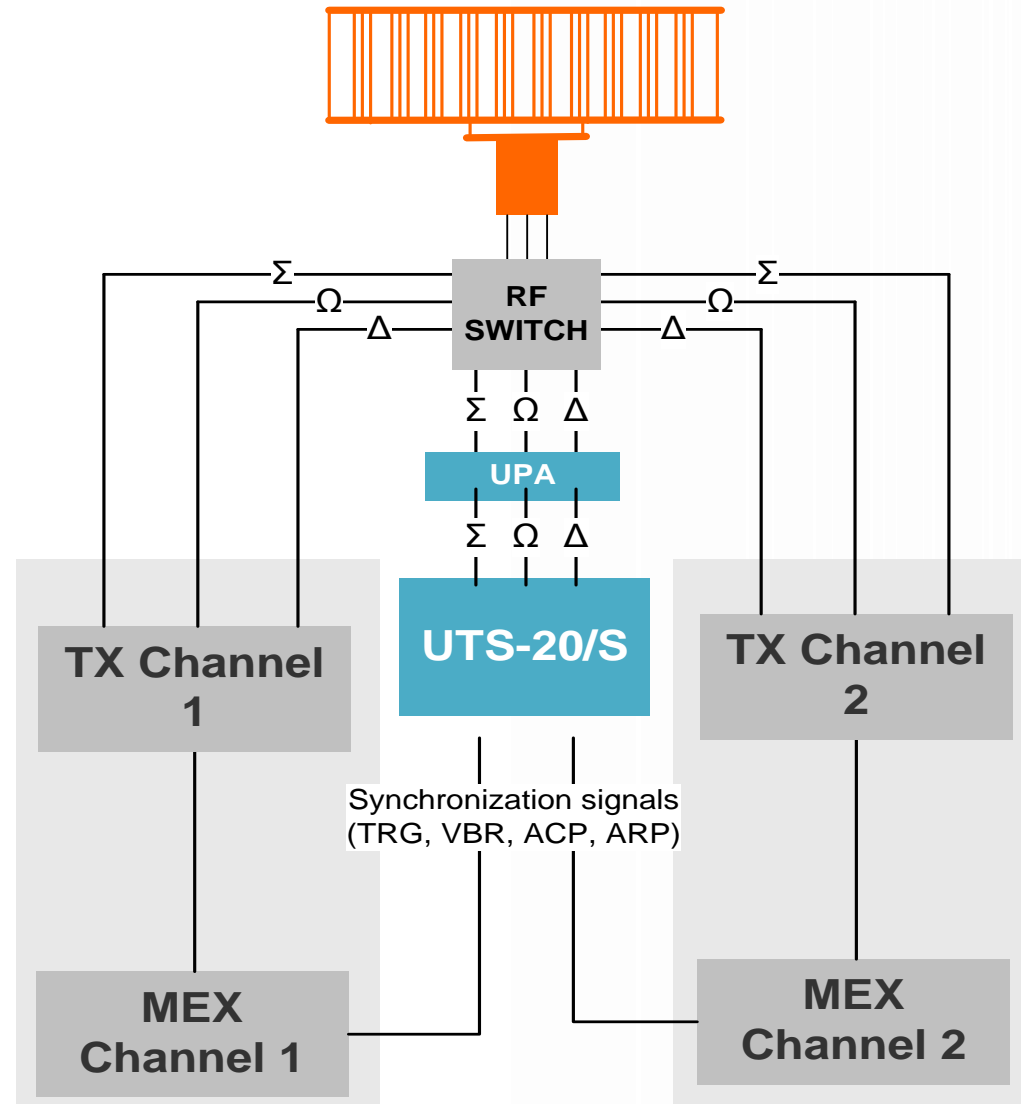
**ADS-B integrated in the MSSR
(SMART INTEGRATION)**



MSSR MODE S - TEST AND SUPERVISION UNIT (UTS)



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MSSR MODE S - TEST AND SUPERVISION UNIT (UTS)

**LOCAL &
REMOTE**

TEST AND SUPERVISION UNIT (UTS) IS **DESIGNED TO CHECK** THE CORRECT OPERATION OF THE INTERROGATOR IN MAINTENANCE STATE

LOCAL AND REMOTE SUPERVISION OF MODE S STATION PERFORMANCES

- By means of CMS
- Minimizes works, manpower, travels...

TEST AND MEASURES ARE PERFORMED IN AN AUTOMATIC WAY

- Minimal intervention from operator

SIMPLIFIES MAINTENANCE ACTIVITIES

- Minimizing human errors

ENHANCES THE MAINTENANCE ACTIVITIES

- More tests available
- Repetition

AUTOMATIC

**SIMPLIFIES
ACTIVITIES**

**ENHANCE
MAINTENANCE**

MSSR MODE S - TEST AND SUPERVISION UNIT (UTS)

TEST AND SUPERVISION UNIT (UTS) IS **SPECIFICALLY DESIGNED FOR MSSR**

INTEGRATED

FULLY INTEGRATED

- With both interrogator channels
- In the Control and monitoring (Local and remote)

**COST
REDUCTION**

COST REDUCTION IN TERMS OF

- Number of test equipments required
- Manpower

**WHOLE
VERIFICATION**

WHOLE TRANSMISSION AND RECEPTION CHAINS ARE VERIFIED

- Interrogations analysis
- Replies injection

MSSR MODE S - TEST AND SUPERVISION UNIT (UTS)

UTS PERFORMS TESTS IN SEVERAL WAYS

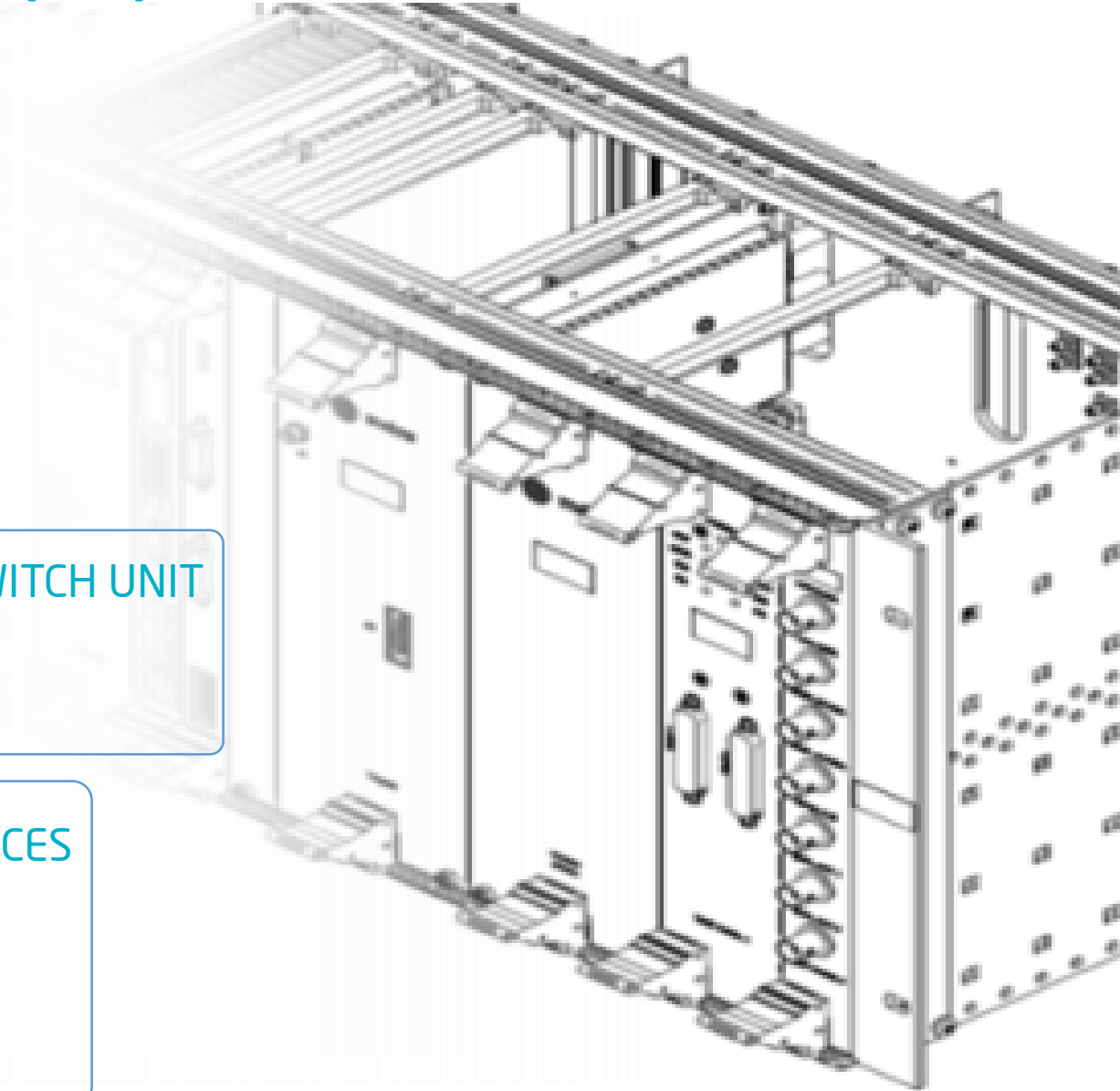
- Reply Generation.
- Target Generation.
- Target Pattern Generation.
- Measures.
- Continuous Wave.

RECEIVES AND INJECTS SIGNALS IN RF THROUGH THE SWITCH UNIT

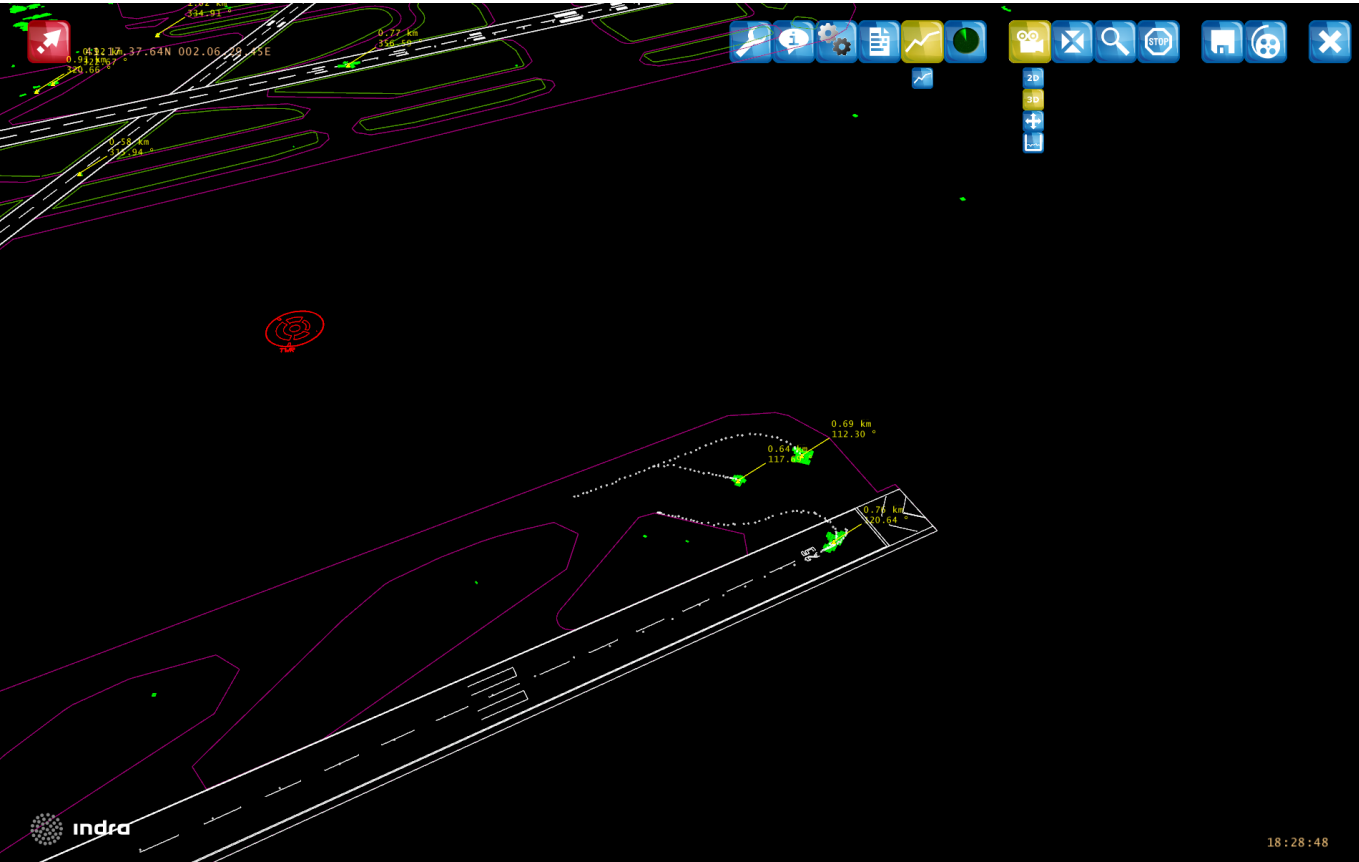
- Main channel is connected to antenna
- Maintenance channel is tested

REMOTE SUPERVISION OF MODE S STATION PERFORMANCES

- From remote locations (by means of CMS)
- Minimizes maintenance activities
- Reduces maintenance costs.



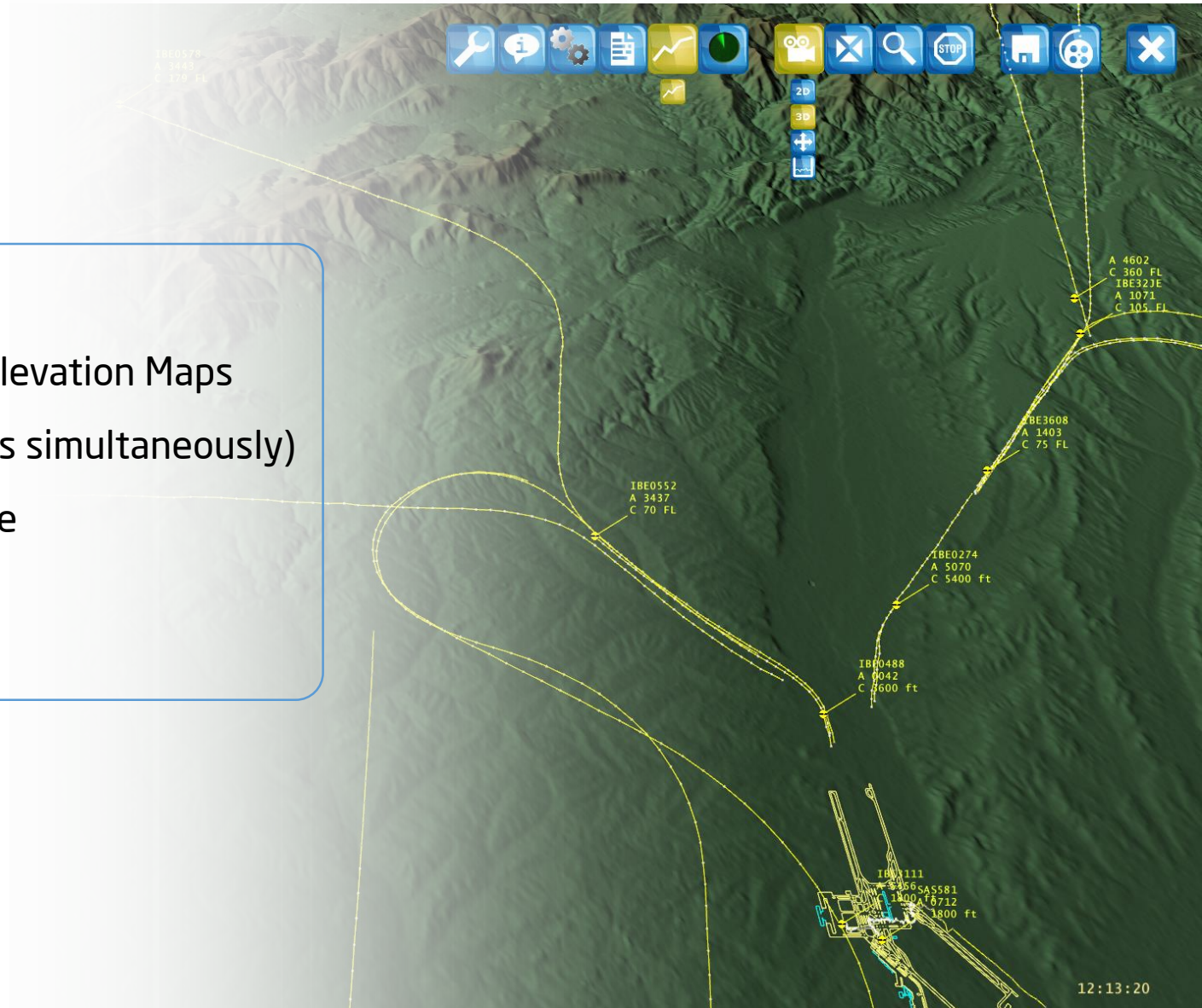
RADAR DISPLAY MONITOR



RADAR DISPLAY MONITOR

ADVANCED GRAPHICS PROCESSING UNIT

- Full Earth terrain coverage by NASA SRTM Elevation Maps
- High plot tracking capacity (up to 3000 plots simultaneously)
- List of the Mode S aircraft under surveillance
- ASTERIX Multicategory support
- Recording and playback capabilities



CONTROL AND MONITORING SYSTEM (CMS)

ALL SENSORS INTEGRATED IN THE SAME APPLICATION

STATION IS FULLY CONTROLLED FROM BOTH LOCAL AND REMOTE POSITIONS

- Switch between operational states and modes
- (Re-) configure the equipment
- Obtain the current system status.
- Perform diagnostics, tests and other maintenance tasks.
- Retrieve logged data
- Access protection (user and passwords)



CONTROL AND MONITORING SYSTEM (CMS)



PRESENTED IN A GRAPHICAL USER INTERFACE

- User-friendly and intuitive interface
- Synoptic and physical diagrams in real time
- Color-code for status summary

CONTROL AND MONITORING SYSTEM (CMS)

The screenshot displays the Indra RMMS CMS interface. The top navigation bar includes 'Overview', 'Maintenance', 'Alarms 4', and 'Global Status'. The breadcrumb trail shows the path: Spain / Indra-Torrejón / ModeS / Mode-S Interrogator / Channel1 / Targets Process (Digital Rx). The main area is titled 'Configuration' and contains numerous input fields and dropdown menus for various parameters such as 'Targets Bocking in Silence Cone', 'Angle for No AST Send', 'MS/SSR Combination Range Window', and 'Treatment of Invalid Code A'. A left sidebar shows 'Device status: Critical Failure' and 'Modules status' for CTT and MEX units. A right sidebar displays a list of active alarms, including 'ID: UTSEVENT_IHO_INFORMATION', 'ID: SYSTEM.EVENT.DEVICEREADERROR', and 'ID: MODE-S SENSOREVENT_CRITICAL_FAILURE'.

The screenshot shows the 'Device Information' page for an Indra RMMS device. It includes the Indra logo and the text 'RMMS' with a stylized 'M'. The page title is 'Device' and the date is 'Thursday 05 February 2015'. The 'Main information' section lists: Device name: dvor, Node type: DVOR, Order weight, and Device part number: 1.0.9-5068M. The 'Location' section provides: Latitude: 40.536486, Longitude: -3.567638, and Altitude: 0. The 'Time zone' is Europe/Lisbon and the 'Status' is active.

The screenshot displays the 'Current alarms' page, showing a total of 11 active alarms as of Thursday 05 February 2015. The table below lists the details for each alarm:

Path	Device	Name	Status	Started	Acknowledged	User
Test	Test Device	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:04		
Barajas / Runway2	NM7000	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:04		
Barajas / Runway1	ModeS	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:04		
Barajas / Runway1	dvor	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:04		
Barajas / Runway2	ILS	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:04		
Barajas / Runway1	NTP	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:06		
Barajas / Runway2	dvor1	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:04	Thu, 05/02/2015 16:17:10	factory
Barajas / Runway1	dme	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:04	Thu, 05/02/2015 16:17:12	factory
Barajas / Runway1	Switch	Adapter Lost	ALARM	Thu, 05/02/2015 15:43:05	Thu, 05/02/2015 16:17:14	factory
Barajas / Runway1 / ModeS / Status	ModeS	sensorEvent	ALARM	Thu, 05/02/2015 15:54:51		
Barajas / Runway1	ModeS	Device Read Error Event	ALARM	Thu, 05/02/2015 15:54:52		

**MORE THAN 200 MSSR MODE S SYSTEMS
CONTRACTED WORLDWIDE**











RADAR REFERENCES

Spain







indra

www.indracompany.com

