AIR TRAFFIC MANAGEMENT

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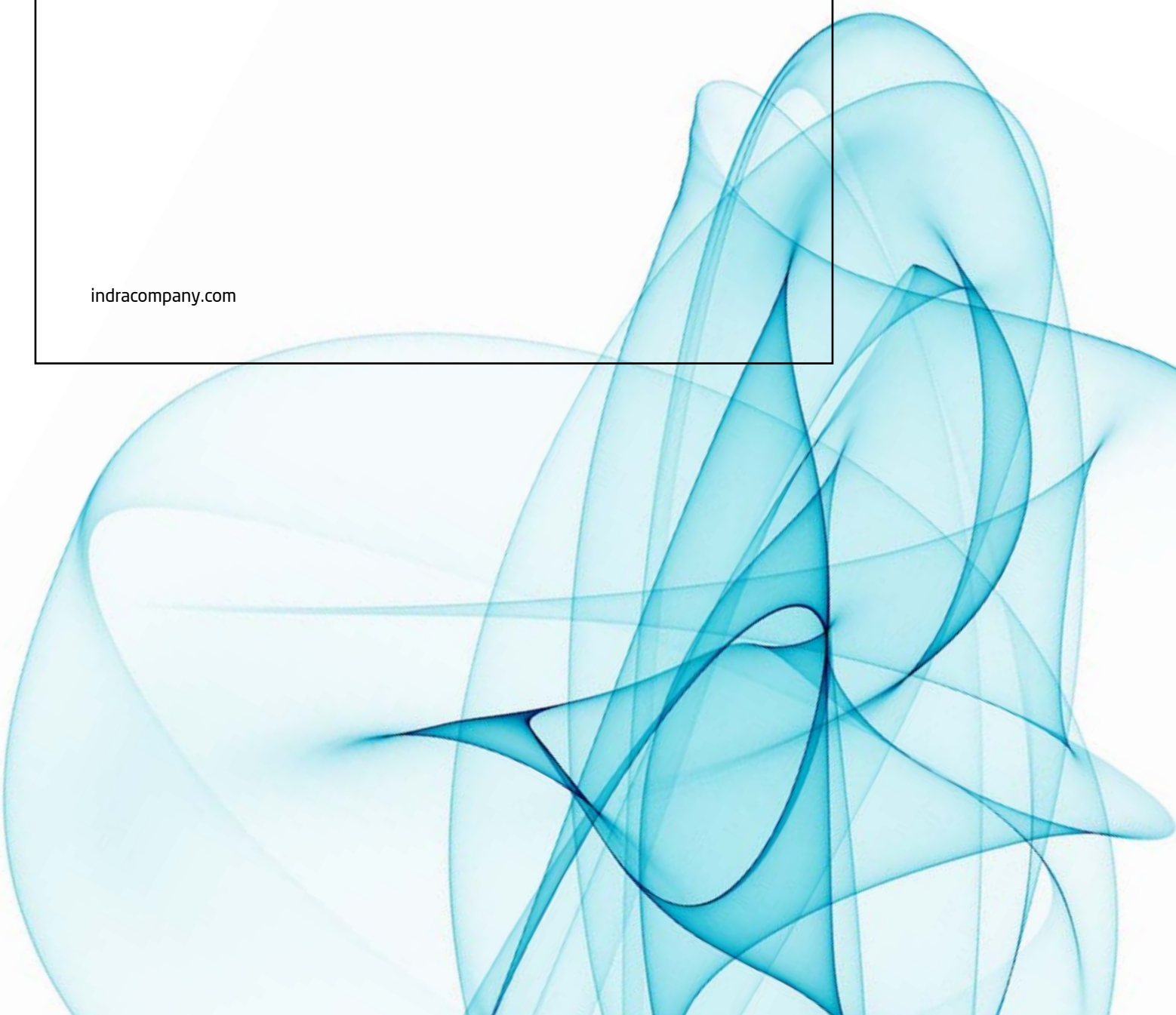
Supplying ATM systems around the world for more than 95 years

indracompany.com



AIR TRAFFIC MANAGEMENT

Performance-Driven Excellence in Project Management at the service of the customer

Indra Air Traffic Management experience

Indra is a leading company in the international market in Air Traffic Management and Control Systems. Indra has been supplying Air Traffic Management systems around the world for more than 95 years, having supplied over 4000 Air Traffic Management installations in over 160 countries.

Particularly, Indra is recognised as a world ATM leader having supplied installation worldwide and being trusted to manage the most busiest and complex airspaces as for example in Europe.

In December 2008, Indra supplied Eurocontrol with the new next-generation interoperable Flight Data Processing System at Maastricht Upper Area Control Centre.

The implementation of this FDPS is a technological breakthrough aimed at improving the safety, capacity, efficiency and environmental performance of Air Traffic management in Europe, while actively contributing to achieve the European's Commission Single European Sky objectives.

Additionally Indra has been selected by the most advanced European Air Navigation Service Providers to develop the future Air Traffic Management systems following the Single Sky Concept, through the iTEC Program (Interoperability Through European Collaboration), which is currently composed of ENAIRE (Spain), DFS (Germany), and NATS (United Kingdom), and LVNL (Netherlands) with Indra as industrial partner.

With the aim to provide our Customers with comprehensive, full and turnkey solutions, Indra product range covers the whole range of Air Traffic Management Systems, including Surveillance, Automation, Communications, Simulators and Navaids.

Indra has the extensive experience and technological know-how necessary to successfully carry out any Air Traffic Management program, with both a proven international management approach and a history of responsible program execution.

This experience, together with a solid technology base, permanent innovation and quality in processes and projects is the pillar sustaining Indra's leading position in Air Traffic Management, completely oriented to Customer needs and aimed at providing our Customers with the highest level of service.

Air Traffic Management references

Afghanistan
Albania
Algeria
Angola
Anguilla
Antarctica
Argentina
Australia
Austria
Azerbaijan
Bahamas
Bahrain
Belgium
Belize
Benin
Bhutan
Bolivia
Bosnia Herzegovina
Botswana
Brazil
Brunei
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroun
Canada
Cape Verde
Cayman Islands
Central African Rep.
Chad
Chile
China
Colombia
Comoros
Congo
Cook Islands
Costa Rica
Croatia
Cyprus
Czech Republic
Denmark
Dominican Republic
East Timor
Ecuador
Egypt
El Salvador
Equatorial Guinea
Ethiopia
Faroe Islands
Fiji
Finland
France
Gabon
Georgia
Germany
Ghana
Greece
Greenland
Guatemala
Guinea Bissau
Guyana
Honduras
Hungary
Iceland
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Ivory Coast
Jamaica
Japan
Jordan
Kazakhstan
Kenya
Kosovo
Kuwait
Kyrghyzstan
Latvia
Lebanon
Lesotho
Liberia
Libya
Lithuania
Macedonia
Madagascar
Malawi
Malaysia
Maldives
Mali
Martinique
Mauritania
Mauritius
Mexico
Mongolia
Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nauru
Nepal
Netherlands
New Caledonia
New Zealand
Nicaragua
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Niue
Norway
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Pakistan
Palestine
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Papua New Guinea
Paraguay
Peru
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Qatar
Romania
Russia
Rwanda
Saudi Arabia
Senegal
Serbia
Seychelles
Singapore
Slovak Republic
Slovenia
Solomon Islands
South Africa
South Korea
Spain
Sri Lanka
St. Vincent and Grenadines
St.Kitts
Sudan
Swaziland
Sweden
Switzerland
Syria
Tahiti
Tajikistan
Thailand
Togo
Tonga
Tunisia
Turkey
Tuvalu
Uganda
Ukraine
United Arab Emirates
United Kingdom
Uruguay
USA
Vanuatu
Venezuela
Vietnam
Western Samoa
Zambia
Zimbabwe

More than 4000 installations in 160 countries

References at Jan-2015

Communication and Navigation

Garex-220

Digital Voice Communications Control System

The Indra's Digital Voice Communications Control Systems are specially developed for Civil and Military Air Traffic Control applications, either in real or simulated environments.

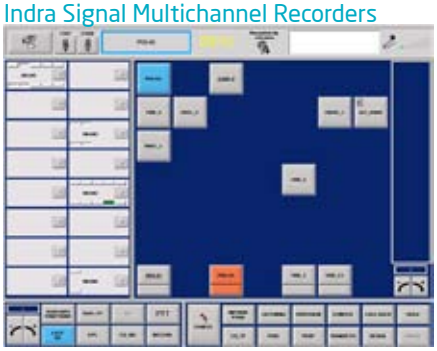
Indra's Voice Communication System architecture is designed to be easily adaptable to the requirements of every Customer in any Air Traffic System environment and efficiently respond to any network change while maintaining constant high network performance.

This adaptability and efficiency, together with the most modern, innovative, well-proven and state-of-the-art technologies converge into Indra Voice Communication System to achieve the most existent goals in terms of availability and reliability. Its high reliability is supported by the use of Hot/Standby concepts of critical elements and great modularity.

The equipment, designed under PCM and ISDN technologies, uses HMI based either with touch type TFT screens or panels with push buttons and associated displays giving the operator, in a very intuitive way, and easy access to radio and telephone services with a wide range of possibilities.

DVCCS Screen

Indra Signal Multichannel Recorders



DVCCS Screen

Neptuno is an Indra recording solution for Air Traffic Management (ATM). It records and replays the communications of the control centers and operator's consoles with accuracy and full availability. It has successfully proved its highest availability in more than 200 sites on five continents where it has been installed.

Neptuno is a modular recording solution that fulfills specific requirements of each user : AR (Audio Recording) and CR (Console Recording). Indra is developer and manufacturer of Neptuno system what makes possible to perform changes and add any functionality requested by the user.

Voice Recorder

NORMARC NAVAIDS

State-of-the-art NavAids

Indra's NORMARC Doppler VOR Ground Beacon from Indra is one of the primary navigational aids for a nation's airways system. It is a ground based, radio navigation aid, transmitting an omni-directional signal that enables an aircraft to determine its bearing relative to the location of the beacon. Designed to exceed all ICAO requirements, it is the ideal complement to the DME.

NORMARC Distance Measuring Equipment (DME) is a ground based navigational aid for use by aircraft. Signals transmitted between an aircraft and a DME ground beacon enable the aircraft to accurately determine its distance from the beacon. The NORMARC DME is used at an airport or en-route, and is one of the primary navigation aids in an airways system.

The NORMARC ILS (Instrument Landing System) is a ground based precision approach aid to assist aircraft approach to runways. The system enables the aircraft to be maneuvered along a precise, predetermined, final approach path. The NORMARC ILS is configured for either Category I, II or III as per requirements of ICAO Annex 10.

The NORMARC ILS system comprises a Glide Slope (GS) system and a Localiser (LOC) system for vertical and horizontal course information on approach, and transmits coded signals to determine the amount of deviation from the optimum approach path.

DVOR-DME Antenna

Automation and Simulation

Integrated ATC Automation System

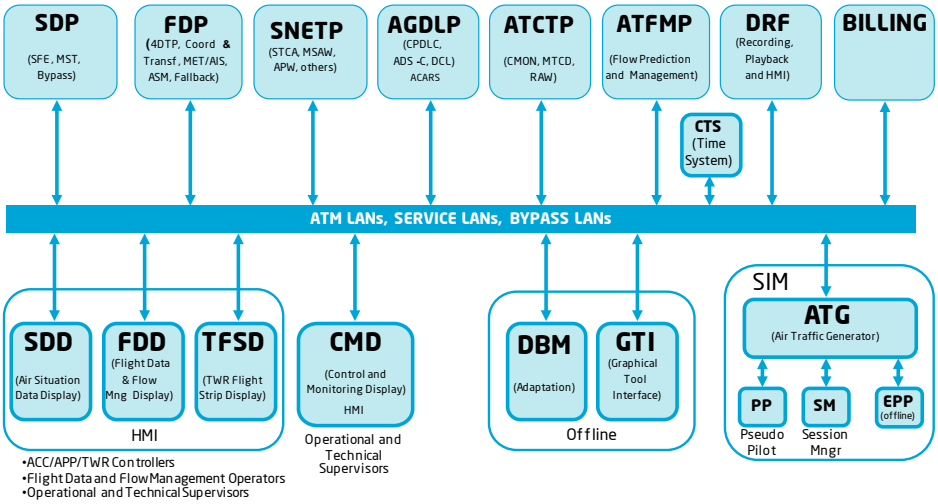
Advanced ATM Systems for ACC, APP and TWR ATC Centres

Indra's Advance Air Control Automation System offers one of the most advanced automated air traffic control systems which meets International Civil Aviation Organization (ICAO) standards and recommended practices in air traffic management.

The strong requirements concerning air traffic safety and high reliability of the equipment are met by the innovative use of state-of the-art technology.

Having safety and reliability as the comes true of Indra's Automation System has served to make a user-friendly, easy to mantain system.

It represents the best tradeoff for ATC systems ranging from highly competitive COTS solutions to full-performance semi-custom systems.



Automation System Overview

Components

- Flight Data Processing (FDP)
- Surveillance Data Processing (SDP)
- Radar Data Compressor Unit (RDCU)
- Data Link Server (DLS)
- Situation and Flight Data Displays (SDD/FDD)
- Data Recording Facility (DRF)
- Control & Monitoring Display (CMD)
- Data Base Management (DBM)
- Simulation Subsystem (SIM)
- Safety Nets (SNET)
- Flow Management (ATFM)
- Electronic Flight Data Display (EFSD)
- Arrival Manager (AMAN)
- Data Analyzing Tool (AAT)

APP ACC & TWR SIMULATORS

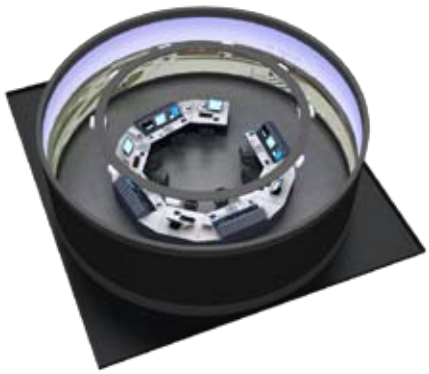
Indra has an extensive experience in the provision of turnkey ATC training solutions, providing integrated APP/ACC and Tower simulation systems, either standing alone or with a real ATC replica system in back-up and contingency modes.

Indra has designed, developed and installed En-Route/Approach and Tower Simulation Systems in Europe, Latin America, Africa, Middle East and Asia. Our experience includes all phases, from design to commissioning, in addition to performing all developments and required Air Control Centre integrations when necessary.

Focused on its exhaustive didactical purposes, Indra's En-Route/Approach and TWR simulation system provides simultaneously a multi-exercise and multi-level of difficulty environment, in which the students/controllers receive their evaluation reports automatically, including infringements and workload. Voice, data and 2D/3D-images are recorded, synchronized with given instructions, that will be analyzed during exercise evaluation.

The Spanish Centre for Training of Air Traffic Controllers (SENASA) is a worldwide reference of integration of Indra's Simulators in a "Total Training Solution". Since SENASA centre was born in 1990, Indra has been continuously updating its systems and functionalities.

Nowadays, this centre contains three Enroute/Approach ATC simulators, six control tower simulators with 180º (three with 360º) environment, and CBT and Brief/Debriefing Rooms. More that one hundred students can simultaneously practice in different positions.



Surveillance

Surface Movement Radar

Indra's SMR is a continuous wave radar, state-of-the-art due to it is fully manufactured in solid-state technology which offers great flexibility to adapt to customer needs.

The radar is designed to detect and locate stationary, moving, individual and multiple targets located in airport manoeuvre and ramp areas at extended range even in low visibility conditions caused by fog or rain. Its solid-state low power design allows highly reliable operation with very simple maintenance.

Indra's SMR system provides a high resolution compared with other SMR. The continuous wave waveform together to the system processing techniques allows the system obtaining excellent performances.

This SMR is characterised by the high level of integration. The modular dual channel system composed by redundant transmitters, receivers and Radar Data Processor (RANC) system fully integrated in a single 19" rack.

SMR Antenna

Monopulse Secondary Surveillance Radar

Enhanced mode S Surveillance Performance

Indra 40 years experience and knowledge in surveillance solutions, installing and putting into operation radar networks world-wide, has resulted in our fourth generation of secondary radars in Indra. It complies with the requirements stated by the International Civil Aviation Organization (ICAO) and with the performance demanded by EUROCONTROL to the surveillance and navigation mode S systems.

This Mode S system means a low cost and outstanding radar performance solution which provides the best accuracy performance in azimuth and range, the highest target capacity and range resolution in the market, and a superior availability and reliability. A very open and flexible architecture ensure highest performances and configurability either co-mounted with Primary Surveillance Radar or stand-alone.

MSSR Antenna

Primary Surveillance Radar & 3D Radar

Best Performance with the newest technology

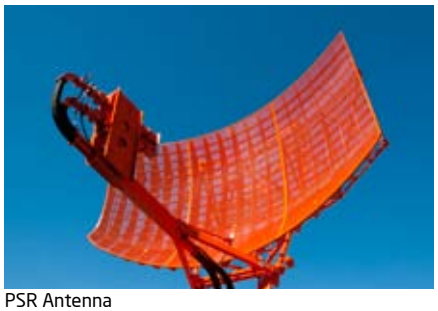
Indra has more than 40 years experience in Surveillance Solutions design, manufacture, operation and integration, with a wide range of products covering any customer necessities. Indra Primary Surveillance Radar is a fully solid-state radar system that incorporates the latest technologies into a surveillance radar systems to provide outstanding features in terms of range resolution, minimun detection range, reliability and availability.

Additionally, Indra's PSR solution incorporates the AMTA-IV procesing algorithm and the use of synchronous clutter map which improves tangential detection and visibility in heavy clutter environments. Thus, this system allows the air traffic controller to monitor all the aircraft in the airspace, clearly, simultaneously and without interference.

Medium and Long Range 3D Radar Latest technologies for Airport & Air Route Surveillance

It provides accurate aircraft position information, including flight height. These detection and 3D position estimation capabilities are achieved even under extreme conditions of weather, ground clutter and natural or man-made interference, and both with cooperative and non-cooperative aircrafts.

Besides aircraft detection and tracking, the radar includes a weather processor that provides the controller with the weather information required for safe air traffic control management.



PSR Antenna

3D Radar and MSSR-S Antenna

ADS-B

The Indra's ADS-B ground station is an equipment which brings the benefits of the Automatic Dependent Surveillance Broadcast with the best cost-performance ratio in the market. This system has been entirely developed and manufactured by Indra complying with the most exigent and recognized standards.

The equipment is designed to fulfil and/or exceeds the requirements, inputs and recommendations developed by FAA/RTCA ICAO, EUROCONTROL, and EUROCAE for the ADS-B systems as part of an air traffic control system, and can be adapted easily to meet the increased air traffic requirements that will occur in the future.

ADS-B Antenna

A-SMGCS

Integration of all sensors data for the safety of the airport movements

The main functions of an Advanced Surface Movement Guidance and Control System are: Surveillance, Control, Routing and Guidance.

The Indra Advanced Surface Movement Guidance and Control System is based on an open and flexible architecture offering high performances.

The system can integrate data from different surveillance sensors: Primary Surveillance Radar, Secondary Surveillance Radar, Surface Movement Radar, Automatic Dependent Surveillance Broadcast, Wide Area Multilateration, Multilateration and the airport sensors.

The integration of all these data ensures an accurate traffic picture and the safety of the movements in the airport area under all circumstances.

A-SMGCS

MLAT & WAM

Airport deployment

For surface surveillance porpouses the WAM/MLAT system consists on a distribution of receiving and transmitting stations inside an airport that receive the squitters and replies from the targets and a redundant Central process station. This Central process station correlates all the replies received and with the timestamp information calculates the position of the targets.

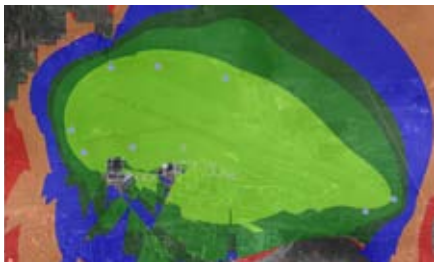
The WAM/MLAT system is distributed, in this way and not as rotating radars, the system is receiving data all the time, so the update of the information is much faster than traditional surveillance systems. In addition, the effect of the shadows produced by the buildings can be reduced to the minimum in the design phase and the service is provided in all parts of the aerodrome.

Wide Area deployment

For Wide Area coverages WAM/MLAT system will be provided with receiving and transmitting stations deployed around the desired coverage volume. A Central process station correlates all the replies received and with the timestamp information calculates the position of the targets. When necessary the ECP orders the transmitting stations to interrogate in order to obtain the required information for targets.

The system includes BITE which allows for diagnostic and supervision. All this data is sent to the Control and Monitoring System, and the user has a real time picture of the situation of the system.

This CMS stores all relevant data and when necessary will create reports or report events defined by the user. As required on ED-142, CMS communication is based on SNMP protocol.



Multilateration Accuracy

ADS-B coverage in Europe

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