Contents

1. INTRODUCTION

As repeatedly stated by the World Meteorological Organisation (WMO), meteorology has taken a growing importance in modern societies in the past decades. Climate change, growth of population, increasing toll of natural disasters, droughts and related competition for water, pollution, economic impact on increasing sectors of economy, make meteorology more and more central in life.

All National Meteorological and Hydrological Services (NMHSs) among which Islamic Republic of Iran Meteorological Organization (IRIMO), are facing the above challenges. As public entities they are also committed to play a significant role not only in warning the population against natural disasters, but also, beyond this core mission of protection of life and property, in contributing to the socio-economic development of their country.

As members of the WMO they also contribute to the world scientific cooperation which is needed for an optimum management of atmospheric and oceanographic related risk management.

Efficient contribution of NMHSs to the daily fight against natural elements requires strong policy in observation network design and management, training in modern forecasting techniques, and rapid development of powerful ICT (Information and Communication Techniques) to a specific field where the value of information vanishes every day.

In the recent past, IRIMO has managed to underline the importance of meteorology in the country and therefore plays a increasing role in the Ministry of Roads and Transportation, and more widely, in the Government.

After several natural disasters hit the country in the past years, IRIMO have got an agreement from the Government, enabling major Modernization actions. In 2003, IRIMO launched a vast and ambitious project called **MITD (Modernization and Information Technology Development)** aiming the modernization of all technical and human components of the Organization up to highest world standards, and a better service to the user community including governmental authorities, general public, agriculture and industry.

IRIMO decided to request a full cooperation from Meteo France International (MFI). In this appendix the present statute of IRIMO and the MITD project as a challerge for the future will be discussed.

This project aims a significant upgrade of IRIMO's facilities in all fields: **Observation, Telecommunications and Information Systems, Forecasting & climatology, Services to end-users** and main sectors of activity (agriculture & fishing, road & transportation, industry), **Research & training** with special emphasis on Numerical weather Prediction (NWP), oceanographic modelling and pollution. The project covers nearly all fields mentioned in the IRIMO Strategic Guidelines.

The project aims a **high level of integration**, thanks to implementation of latest information technologies and telecommunication facilities, and also thanks to a deep understanding of all interactions between project components, before optimum design of the overall solution.

The key-words of this major project are:

Risk management, as the project should enable significant improvement in warnings and mitigation of all natural & accidental atmospheric or oceanic disasters in Iran.

Information Technology, as no progress can be made nowadays in meteorology and related service capability to the increasing user community without efficient & reliable telecommunications, and a strong data management and processing capabilities.

Technology transfer, as modern techniques in critical fields such as data management, forecasting, numerical weather prediction can be implemented through efficient technology and know-how transfer.

Quality insurance, as the project should lead to an updated organization together with efficiency index in

several critical fields.

2. PRESENT STATUS of IRIMO

IRIMO is a significant National Meteorological Service in the world, with more than 1200 people, including 300 working at HQ level.

In the past years IRIMO has been focussing on 4 major missions : data collection and management, forecasting & warning, Research & training, and Telecommunications.

However, despite long term plans (LTP) available at each department level, IRIMO is aware of insufficient system integration and integrated strategic view for the future.

On a territorial plan, IRIMO is sticking to the 28 provinces with a specific centre in each province, in charge of operational (and also R&D) activities and service to local end-users and province authorities. IRIMO aims an optimized early warning system, as expected by country authorities after a set of natural disasters hit many places of the country in a recent past.

IRIMO has also motivated and trained people, able to manage major modernization actions in the future, and Quality Insurance is somehow already an implicit quality to be found in operations at all levels in IRIMO.

2.1. IRIMO Guidelines

IRIMO, as an active National Meteorological Service in the world, has a clear vision of its future. This vision has been translated into Guidelines that have been representing an effective reference up to now.

The main objectives of IRIMO have been expressed as follows :

- ***Development of effectivity and flexibility of IRIMO's performance*** *to respond the needs of community and create new opportunities by using innovative technologies*
- ***Development and Optimization of Observational network and data collection*** *by use of appropriate systems such as AWS, Radar network and Satellite Systems*
- ***Modernization and development of Information Technology*** *through the use of high speed telecommunication systems (incl. satellite based systems), specific software, and implementation of international telecommunication equipment*
- ***Enhancement of the accuracy of atmospheric predictions, warnings*** *and timely climatic and disaster relief services to the public for immediate decision making at the time of emergencies, and reduction of the impacts of the natural disasters*
- ***Development of meteorological operational models*** *for present and future weather, climate and physical oceanography which are used in climate change studies, environmental predictions and air pollution services*
- ***Optimization of meteorological and climatological services*** *to contribute to infrastructural activities*
- ***Development of applied research activities*** *and providing short and long-range forecasts for national and international users in the fields of aviation, marine, road, air pollution, agricultural, hydrological meteorology and climate studies*
- ***Encouragement of cooperation*** *among National Meteorological and Hydrological Services*
- ***Establishment of effective cooperation between Meteorological services and Universities*** *as well as private/governmental research Institutes*

- ***Optimizing organizational structure**, especially for facilitating making the responsibilities transparent in cooperation with other Organizations, Ministries and Research Institutes*
- ***Developing human resources** through encouraging continued scientific and specialized enhancement of experts*
- ***Legislating new income/expenses economic mechanisms** and use of privatization and partnership methods to initiate economic activities*
- ***Applying the index of efficiency** in meteorological activities for monitoring and controlling purposes*

2.2. Detailed description of existing situation

IRIMO is composed of ten divisions namely:

- Research and Scientific Investigation;
- Administration;
- Technical Services (laboratories, technical supervision, telecommunication services, electronic and engineering services);
- Network (climatological observation, agricultural observation);
- Operation (forecasting, synoptic observation, aeronautical control, marine meteorology, agrometeorological);
- Information and Data-processing (data-processing, data bank, publication);
- Training Department (training of Class I, II, III and IV meteorological personnel); and
- A Bureau in charge of the international meteorological affairs.
- Regional Meteorological Training Centre (RMTC) - Tehran
- Research Institutes

The country has been divided into 28 provinces, in each of which, IRIMO has established meteorological offices.

2.3. Basic observing networks

The total number of rainfall stations of IRIMO is 2420. In addition, the Ministry of Energy has its network of precipitation stations consisting of approximately 1619 stations.

The agrometeorological stations are equipped as climatological stations. In addition, they include measurements of crop growth and soil-moisture conditions. Soil-moisture is measured by gravimetric methods for four to five sets of samples of 10 cm each down to the depth of 100 cm. These measurements are performed approximately 70 times a year, usually before and after irrigation and after rainfall events.

Most instruments are calibrated at IRIMO and the different types of stations are standardized according to international recommendations. Both recording and ordinary raingauges are used at the synoptic weather stations. They are not equipped with wind shields and data are not corrected for errors due to high wind speeds, etc. The rainfall stations are equipped with ordinary and Data loggers raingauges.

Twelve automatic weather stations are in operation and 10 of these were placed at each one of the regional centres. Data collected are transmitted directly to a microcomputer at the regional centres.

A meteorological satellite receiving equipment was installed at IRIMO in February 1992. This system receives METEOSAT low- and high-resolution images and NOAA high- resolution images. We upgraded

the system in 1998 and now we have MDD and DCP RS receiver system. A time-lapse animation consisting of up to 60 pictures can be produced and a user can configure up to four separate animations. The system is used half-hourly to aid forecasters. Since it is a new system, much effort is being given to train local forecasters for its most efficient use.

Type of station	No. of station	Remarks
Synoptic	155	The network gives an average density of a synoptic station per 12,200 km².
• RBSN-SYNOP	74	
• RBSN-CLIMAT	74	
• RBSN-TEMP	9	
Upper-air	13	
• Radiosonde	11	
• Pilot balloon	2	
• Two obs. daily	1	
• One obs daily	12	
Weather radar	1	One 3 cm analogue radar in Tehran Rainfall estimation is not possible.
AWS	12	
Agrometeorology sta	22	
Climatology station	261	
Rainfall station	2420	
Aeronautical station	47	(Aeronautical Station+Synoptic Station lies in Airport)
Evaporation station	220	
Marine met. station		
• VOS	1	
• Buoy	2	Purchased under UNDP project
• Ship	-	
• Coastal station	13	
Satellite receiving sta.	1	Located in Tehran-Mehrabad and installed in 1992
GAW		
• BAPMoN	1	
• Ozone	1	
Others		
• Radiation station	28	66 Actiongraph
• Mountain station	1	

* RBSN: Regional Basic Synoptic Network
* AWS Automatic Weather Station
* VOS Voluntary Observing Ship
* GAW Global Atmospheric Watch
* BAPMoN Background Air Pollution Monitoring Network

2.4. Automation of telecommunication system

Tehran is an Asian centre for collecting synoptic data and also the Regional Telecommunication Hub (RTH) Centre. RTH Tehran is automated. A level of automation of telecommunication system is as follows:

Computer system for telecommunication

- Main computer
  - DEC 3000-700 (installed in 1993), front end: DEC Server 3000
- Specification
  - Main memory size: 128 MB, Hard disk size: 381 MB
  - Operating system: VMS
  - Source of GTS application s/w: Vendor
  - No. of local terminals: 64
  - No. of telecommunication circuits: 44 (low speed of 50-600 bauds; 26 circuits, high speed of 1200-9600 bps; 18 circuits)
  - Capability for handling messages in bit-oriented form: yes, 4 MB/sec
  - Number and type of connections with other computers: 2 (Ethermet, Decmet)

RTH Tehran collects observational data from 155 synoptic, 11 upper air, 2 pilot wind finding, 9 automatic, 1 marine and 1ozone meteorological stations using single sideband (SSB) and telegraph. Microwave communication is used for digital transfer of data from regional centres to the main centre in Tehran. There are 28 regional sub-centres which communicate through microwave transfer to their regional centre. RTH Teheran has an Automated Data Transmission System for the collection and dissemination of all observational data in accordance with the established schedules.

RTH Tehran is linked to Jeddah and New Delhi as the main regional circuits and with Karachi as the regional circuit.

2.5. DATA PROCESSING

In the Computer Center of IR. of IRIMO an ES 9000 computer system with OS/390 Operating System and more than 180Gb memory is used for operating raw data processing and setting up Meteorological database. The processing rate of this system is 82 MIP.

All collected data of meteorological stations which are quality controlled will be included to the IRIMO computerized data base.

IRIMO database contains of 20,000,000 data records since 1951, providing requested information for different end users, and support research projects in national and global level.

The archive of these data is available on a cartridge.

In addition of existing Mainframe, more than 220 Microcomputers are used for data decentralized processing.

About 200 Meteorological Applied Programs are provided in this center and used for data processing

operations. Most of these programs have been written in FORTRAN language.

In addition to weekly, monthly and seasonal publications, precipitation analysis are issued in this center and provided to applicants.

- **Mainframe & Climate Data Bank**
- **ICT centre**
- **Quality Control Office**
- **Publications**

2.6. Forecasting Department

- **Numerical Weather Prediction and specific models**
- **Operational Forecasting at Central Forecasting Office**
- **Forecasting tools at central office**
- **Severe weather events**
- **Provincial offices**
- **Airports**
- **Public weather services & media**

2.7. Electronic Department

This Department is in charge of the equipment of the stations.

- **Upper Air stations**
  - 11 existing stations + 11 planned new stations
- **Automatic Weather stations** (existing - under construction – planned)
  - Airport systems 0 5 20
  - Synoptic stations 12 (Lambrecht) 25 200
  - Compl. Syn. Stations 0
  - Climatological st. 5 15 300
  - Pollution station 2 (Campbell) 0 0
  - Marine stations 1 (Seba) 1 18
  - Road stations 5 (Boschung) 3 16
  - Buoys 1 2 6
- **3 Existing Radars**
  - Tehran C-band + dual pol. Klystron
  - Khuzestan S-band Klystron
  - East Azerbaïdjan C-band Klystron
- **Plan for radar network**

2.8. Research & training at IRIMO

Atmospheric Science & Meteorological Research Centre (ASMERC)

This Research Centre located out of IRIMO HQ also reports to the Deputy in charge of Research & Training at IRIMO. The AMERSC is described as the main research centre in charge of the overall coordination of all Research Centers throughout the country. AMERSC addresses 9 subdomains: Climatology, Dynamic & Synoptic meteorology, Physical Meteorology and Weather modification, Marine meteorology and Physical Oceanography, aeronauticalo meteorology, Agrometeorology, Hydrometeorology, Atmospheric Chemistry & Air Pollution, and New Technologies & concepts

Climatological Research Institute (CRI)

In regard to the role of climate in human activities, lack of an institution to deal with this vital and important aspect was felt. Therefore, an initiative was put forward to establish such a center in an area of the country with the most diverse climatic conditions. The authorities approved this proposal and Climatological Research Institute (CRI) was founded in 1996, which potentially could appear as a Regional Climate Center in Center and West Asia. The main goal of CRI is scientific activities on climatology in parallel to WMO objectives:

-To conduct research and carry other academic activities on climatology,

-To guide and land scientific activities on climatology,

-To collaborate with international organizations and participate in their activities such as Climate Change Convention and CCl commission,

-To centralize climatic forecasting and monitoring activities in the country and regions,

-To develop and extend applied services of climatology to the public.

The CRI has been received the Institute grade from Ministry of Science, Research and Technology with three research groups, that have been organized as follows:

Climatology of Natural Disasters, Climate Change, Applied Climatology.

Oceanographic & Atmospheric Science Centre (OASC)

This Research Centre located out of IRIMO HQ reports to the Deputy in charge of Research & Training at IRIMO. OASC deals with many topics related to Oceanography, including **Theoretical and Applied Research**

2.9. IRIMO International role

IRIMO hosts an RMTC (Regional Meteorological training Centre in Tehran) and IRIMO President, Dr A. M. Noorian, has recently been elected 1st Vice President of World Meteorological Organization.

The MITD Project should be a unique opportunity to IRIMO to play a major role in Middle East and Central Asia in the next years.

3. Modernization and Information Technology Development Project

In 2003, IRIMO has launched a major Modernization Project called **IRIMO Modernization and Information Technology Development (MITD)**. This project addresses all components of the Organization, and aims a significant upgrade of IRIMO's facilities in all fields :

- **Observation,**

- **Telecommunications and Information Systems,**
- **Forecasting & climatology,**
- **Services to end-users** and main sectors of activity (agriculture & fishing, industry)
- **Research & training** with special emphasis on Numerical weather Prediction (NWP) emphasis, oceanographic modelling and pollution

The key-words of this major project are :

- **Risk management**, as the project should enable significant improvement in warnings and mitigation in all natural & accidental atmospheric or oceanic disasters in Iran.
- **Information Technology**, as no progress can be made nowadays in meteorology and related service capability to the increasing user community without efficient & reliable telecommunications, and a strong data management and processing capabilities.
- **Technology transfer**, as modern techniques in critical fields such as data management, forecasting, numerical weather prediction can be implemented through efficient technology and know-how transfer
- **Quality insurance**, as the project should lead to an updated organization together with efficiency index in several critical fields.

The scope of the MITD Project covers nearly all fields mentioned in the IRIMO Guidelines.

3.1. Scope of the MITD Project

The MITD Project has the following twelve technical components, according to three main categories (observation, core data processing activities, and operational modeling):

- **01 – Surface Observation Network enhancement**
  - Global Data Collection and Management Systems
  - Synoptic stations (AWS and Data Collection Platforms)
  - AgroClim stations
  - Road meteorology
  - Environment stations
  - Marine stations (coastal, ships, buoys)
- **02 – Implementation of Integrated Airport Weather Systems**
  - Automated Weather Observing Systems
  - Flight Plan Briefing System
- **03 – Upgrade of Upper-air sounding network**
- **04 – Introduction of Wind Profilers complementarily to upper air sounding systems**
- **05 – Implementation of a nationwide Radar network**
  - Additional radar network (on top of the initial radar project led by IRIMO)
  - Integration of the whole resulting network and setting up of fitted calibration procedures
- **06 – Modernization of Telecommunications**

- Automatic Message Switching systems (HQ and provinces)
- Wide Area Network connecting the major IRIMO centres in the country
- LAN in HQ and Provinces

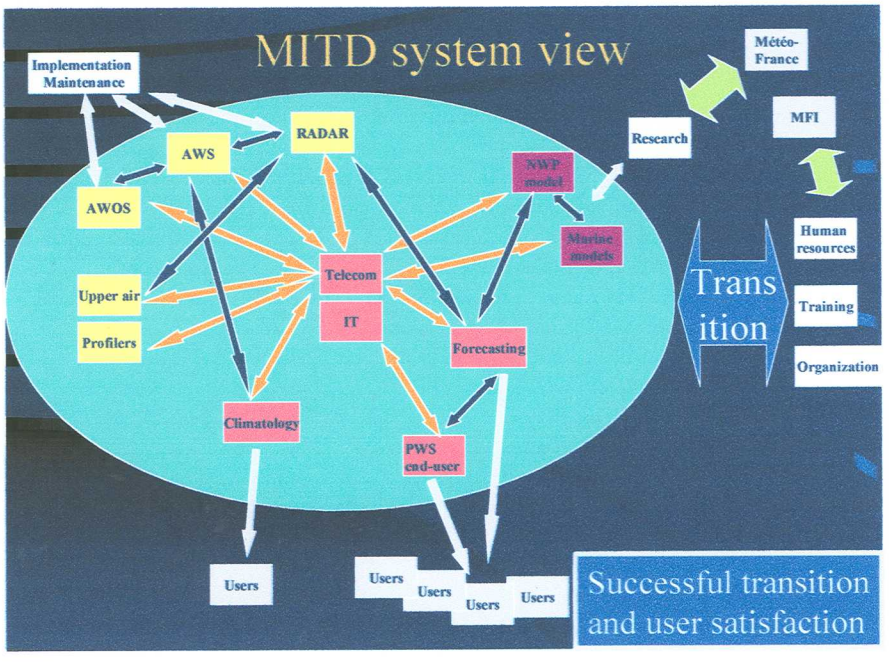
- **07 – Setting up of a comprehensive Meteorological Information System**
  - National Information System (Central data management system, archival & back-up system, computing power)
  - Provincial Information System
- **08 – Development and modernization of Forecasting and early warning**
  - Organisation
  - Forecasting tools at HQ, training centre and Provinces
- **09 – Modernization of Climatology**
  - Organization
  - Full data management systems at HQ & Mashhad NCRI
- **10 – Extension and upgrading of Services to end-users**
  - Public Weather Services (incl. TV systems)
  - Web based systems enabling production to different user categories
- **11 – Setting up an operational capability in Numerical Weather Prediction**
  - Atmospheric model configuration over Iran and larger area
- **12 – Setting up an operational capability in Marine modelling**
  - Seastate modelling over Caspian, Persian Gulf and Oman sea
  - Oil slick prediction in case of accidental pollution
- **13 – Setting up an operational capability in Environmental Prediction**
  - Pollution model over Iran

3.2. *Transversal components*

Beyond the technical components are other main transversal components such as :

- **System Integration** and **Consultancy**
- **Organizational matters** & transition issues
- **Technical assistance and support**
- **Training**
- **Project management**

Those transversal components are described in §5.



Typical view of the MITD system, with interactions, integration, and immediate environment.

3.3. General overview and quantities

Over the project period (5 years), the MITD project should complement IRIMO existing facilities and the country with :

1. **A modernized real time and denser surface observation network** (totalling more than 200 modernised or new observing stations), with new sub networks dedicated to road, marine and environment
2. **Airport integrated meteorological systems** including full runway observing systems and flight preparation systems for pilot, for 12 airports minimum, in order to get to highest safety ICAO standard
3. **Upgraded upper air sounding network** through update of the existing stations (switch to digital systems) and additional stations (<2)
4. **Wind profilers** (>3) at main international airports and sensitive airports for better detection of wind shears
5. **A comprehensive nation wide meteorological radar network** (> 7 new radars) covering most sensitive and populated part of the country, with real time collection, composite product capability at HQ, and real time calibration by automatic stations.

6. **A full telecommunication solution** enabling high speed connexion of all critical sites in IRIMO (HQ, >28 provincial centres, >12 airports, >12 radars sites, + other specialized sites), for real time observational data collection and added value data dissemination to provinces and surrounding countries.
7. **A Central Information System** with up to date subsystems and data management systems, for tight interconnexion of all core systems, supervised production, and computing capability to run atmospheric and marine models (*see 11-12*). Reduced Information systems to be implemented in all Provincial centres as well.
8. **A modernized Forecasting function**, with specialized working positions (Marine, aviation, …), 24h weather watch, and efficient warning capability. More than 60 powerful forecasting workstations to be implemented in HQ and provincial centres for close weather watch, investigation in new amount of available data from observation and numerical weather prediction data, regular production, and timely warnings.