Erciyes University 13-m Single Dish Antenna and Radio Astronomy in Turkey

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EFFORTS FOR A RADIO TELESCOPE in TURKEY (1990-1995)

(NATIONAL FUNDING by TUBITAK-MAM)
- CONCEPTUAL CONSIDERATIONS
  (joint radio astronomy + satellite remote sensing images reception)
- SITE SELECTION (A summary in the Evaluation Report)
- OTHER PROCESSES & PROCEDURES
  (logistics, administrative structure, man-power planning, ...)
- INTERNATIONAL BIDDING for a multipurpose terminal
  (2 Proposals)
  (1) Krupp-MAN consortium, (2) ESSCO Massachusetts
- CANCELLATION OF BIDDING by TUBITAK HQ!! (1993)
Previous attempts-2

- EFFORTS FOR A RADIO TELESCOPE in TURKEY (2000-2005)
  - Physics and Astronomy Dept’s with Radio Astronomy as one of its main research areas:
    - Erciyes University Astronomy Dept, Kayseri –Turkey (5 PhD staff, 3 assistants)
    - Çanakkale Onsekiz Mart University Physics Dept, Çanakkale, Turkey, (2 PhD staff, 1 graduate student)
    - Other PhD radio astronomers from Turkey (1 in USA, 1 in Canada, 2 Great Britain)
Current Situation

- **1990-1997 TUBITAK-MRC**
  - 2-m dish antenna
- **2007 – 2009 Erciyes University**
  - Two 5-m dishes and 12.8-m antenna
- **2 SPO(DPT) Projects (5-6 years)**
  - National Radio Astronomy Observatory of Turkey.
    - Site selection studies
      - Started in 2008
      - Aim: 30 – 40 m class antenna and observatory establishment
    - Erciyes University Radio Astronomy Observatory (ERAO).
      - Establishment and calibration works
        - Aim: Radio Astronomer growing and education for future
Erciyes University Astronomy and Space Sciences Department

- **Instrumentation:**
  - a 13 m Cassegrain focus antenna with radome is being converted to a radio telescope
  - a 25 cm LX200 GPS Meade telescope
  - a 40 cm LX200 GPS Meade telescope

- **Research fields**
  - Radio Astronomy
  - Eclipsing binary stars
  - Stellar Evolution
  - Open Cluster photometry
Mounting process
The antenna
The reflector system consists of a main reflector, a sub-reflector, and feed equipments, arranged in the Cassegrain configuration, but with the surface profiles modified to produce optimum antenna gain. The main reflector is a 12-8 m quasi-paraboloid with a focal length of approximately 4.1 m.

The sub-reflector is a quasi-hyperboloid machined aluminium casting of approximately 1.37 m diameter and 0.31 m depth.

It is supported on a tetrapod, which is attached to the main reflector. The tetrapod legs are elliptical in section to minimize shadowing.
Antenna pattern-Azimuth
Antenna pattern - Elevation

Relative Gain (dB)

Angle (Degrees) From Axis

-30

-20

-15

-16

0

-40

-9 -8 -7 -6 -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5 +6 +7 +8 +9
ERT-5_1 & ERT-5_2 RADIO TELESCOPES
(during setup)
The radio astronomy studies in Turkey was started with a State Planning Organization Project by TUBITAK National Observatory (TUG) in April 2007.

“National Radio Astronomy Observatory Site Selection Committee” started to work in 04 May 2007 and the task has completed in 31 December 2008.
Site selection project

- Suitable meteorological conditions,
- Suitable geographical construction;
- Preserved from RFI
- a "RQZ" selection.

Things done and will be done:
- Meteorological, geographical, topographical features analyzed and interpreted for all Turkey.
- Suitable regions are decided
- In these regions some RF measurements are done
Site determination criterias for Radio Observatory

1. Conditions for Radio Observatory
2. Parameters for site selection
3. Instruments that will be used
4. Instruments expensive
5. Technical requirements
1. Conditions for Radio Observatory

- Frequency effects
- Ionospherical and tropospherical effects
- Topology
- Interference
- Climate
- Sysmical and techtonical activities
- Infrastructure and logistic needs
2. Conditions for site selection

- Atmosphere
  - Water vapour (IPWV - Integrated Precipitable Water Vapor)
  - radio refractivity (N units)
  - Elevation
  - Rain fall (rain & snow)
  - Temperature
  - Pressure
  - Wind speed
  - Cloudness and fog
  - Oxygen
  - Atmospherical features
- Flight routes
- Radars
- Power lines
- Security
3. Needs (Data & Maps)

- Parameters for climate
  State Meteorological Affairs
- Radio Interference detection for whole country
  GSM, Radar, and other sources
  Telecommunication Institution
- Flight Routes
- Topographical Maps
  Military and remote sensing
Earthquake map
Ready to go...

**TRRS:** Portable Monitoring Station
Mechanism

LPDA 20-1000MHz

RG-8 Kablo

RF Kablo

spektrum analizör

15 V DC

130 V to 32 VDC supply

Power strip

AC adapter

Power filter

USB

kontrol kablosu

PRA 1-40 GHz
Test measurements
8 Jan 2008 - BTK – Ankara
## Antenna types for measurements.

<table>
<thead>
<tr>
<th>Angular Coverage</th>
<th>Polarization</th>
<th>Bandwidth</th>
<th>Antenna Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>360° azimuth</td>
<td>Linear</td>
<td>Narrow</td>
<td>Whip, Dipole, or Loop</td>
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<td></td>
<td></td>
<td>Wide</td>
<td>Bi-conical or Swastika</td>
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<tr>
<td></td>
<td>Circular</td>
<td>Narrow</td>
<td>Normal mode Helix</td>
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<tr>
<td></td>
<td></td>
<td>Wide</td>
<td>Lindenblad or Four-arm conical spiral</td>
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<tr>
<td>Directional</td>
<td>Linear</td>
<td>Narrow</td>
<td>Yagi, Array with dipole elements, or Dish with horn feed</td>
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<tr>
<td></td>
<td></td>
<td>Wide</td>
<td>Log periodic or Horn</td>
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<tr>
<td></td>
<td>Circular</td>
<td>Narrow</td>
<td>Axial mode helix, Horn with polarizer, or dish with crossed dipole feed</td>
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<td></td>
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<td>Wide</td>
<td>Cavity-backed spiral, Conical spiral, or Dish with spiral feed</td>
</tr>
</tbody>
</table>
The antennas used in measurements

- 18GHz – 26GHz
- 1GHz – 26GHz
- 400MHz – 30GHz
- 20MHz – 7500MHz
- 1GHz – 18GHz
- 9KHz – 20MHz
- 9KHz – 20MHz
Karaman – Akçaşehir Pelitli Plateau
<table>
<thead>
<tr>
<th>°-δ</th>
<th>ANTENNA</th>
<th>Frequency</th>
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<tr>
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<tr>
<td>270-0</td>
<td>HL50</td>
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<tr>
<td>0-45</td>
<td>HL50</td>
<td>1GHz-26GHz</td>
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<td>90-45</td>
<td>HL50</td>
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<td>Pelitli</td>
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Measurements below 1GHz

For $90^0$ polarization
800MHz - 1GHz

For $180^0$ polarization
800MHz - 1GHz
Measurements between 1GHz - 30GHz

90° polarization
1-2GHz

45° polarization
1-2GHz
Special frequencies

OH

Su Buharı

CH

KARAMAN - Yazılı
THANKS