



## Current Status of Eastern Anatolia Observatory (DAG) Project

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### ABSTRACT

Eastern Anatolia Observatory (DAG) is the new observatory of Turkey with the optical and near-infrared largest telescope (4 m class) and its robust observing site infrastructure. This national project consists of three phases with DAG (Telescope, Enclosure, Buildings and Infrastructures), FPI (Focal Plane Instruments and Adaptive Optics) and MCP (Mirror Coating Plant) and is supported by the Ministry of Development of Turkey. Almost all the infrastructure (roads, geological and atmospherical surveys, electricity, fiber optics, cable car, water, generator, etc.) of DAG site (Erzurum/Turkey; 3,170 m altitude) have been completed.

**Keywords:** DAG, Telescope, IR

## 1 PROJECT

Project Name and Institute: Eastern Anatolia Observatory (DAG), Atatürk University (ATAUNI); Financial Resources: Ministry of Development (DPT), Atatürk University (ATAUNI); Project Executive Unit: ATAUNI – ATASAM (Application and Research Center for Astrophysics); Project Timeline and Budget: 2012 – 2019, ~25 M€; Feature of Project: Turkey's Largest and First IR Telescope; End of Project: First Light in 2019.

Project Phases: Eastern Anatolia Observatory (DAG); Focal Plane Instruments (DAG-FPI, 2016-2019); Mirror Coating System (DAG – MCS, 2020-2022)

## 2 TELESCOPE

Diameter: 4 m; Focal Length: 56 m; Primary F#: 1.8; Observational Waveband: Visual + Near IR ( $< 3.0 \mu\text{m}$ ); FoV:  $30'$  (*Large - unvignetted*),  $10'$  (*Narrow - vignetted*); Focal Platforms: 2 Nasmyth (N1: Adaptive Optics, N2: Seeing Limited); Instrument Capacity: 6 Instruments (VIS: 3 + NIR:3); Mounting: Altitude – Azimuth; Optical Performance: Ritchey-Chretien (RC), Active Optics (aO), Adaptive Optics (AO), Deratator + Field Corrector, Diffraction Limited with aO+AO, Long Focal Length (56 m) + Large Field of View ( $30'$ ) (Higher performance than other 4 m class telescope); Mirror Type: Zerodur (Schott); Pointing-Tracking Accuracy:  $<2''$  -  $<0.1''$  (rms); Manufacturers: AMOS + EIE (Telescope), EIE (Enclosure).

### 3 SITE

Region: Erzurum – Eastern Anatolia –Turkey; Location: Karakaya Tepeleri - Konaklı – Erzurum; Terrain: High altitude plato - 5 km long mountain range; Altitude: 3170 m (*the 3<sup>rd</sup> highest observing site*); Geographic Coordinates: 39° 47' N - 41° 14' E; Distance from City/University: ~35 km/35' (*by road*); Position: Filling the longitude gap in Northern Hemisphere; Acreage: 2500 decars (*suitable land for various telescopes*); Weather Conditions: Many clear nights (*>250 d, Clear*), Low humidity (*up to 2-10%, Dry*), Certain prevailing wind direction (*N-E, Stable*), Low wind speeds (*Calm*), Low temperature values (*up to -35°C for winter, Cold*), Low atmospheric inversion layer (*~2600 m, Ideal*), Iced thin snow cover (*<100 cm, Dust-free*), Snow season (*November - April, Consistent*).

### 4 INFRASTRUCTURE

Building: ATASAM Building in ATAUNI Campus (*1000 m<sup>2</sup>, Tech.-Obs.-Guest Rooms, Labs., Fiber, 60KW UPS*), Service Prefab Building-1 in DAG Site (*100 m<sup>2</sup>, Temporary, Tech.-Obs. Rooms, Fiber, 30KW UPS*), Service Prefab Building -2 in DAG Site (*40 m<sup>2</sup>, Temporary, Tech. Rooms, Fiber*), Atmospheric Systems + DIMM Tower in DAG Site (*7 m height, Fiber, 10 KW UPS, Atm.-Ast. Systems*), Energy + Snow Vehicles Garage near DAG Site (*300 m<sup>2</sup>, Garage, 20 Tons Gasoline Tank, Generators, Transformers*); Electricity: 3 Phases Medium Voltage Lines in DAG Site (*Underground, 3.6 km line, Redundant line, Active*); Power: 30 KW + 10 KW UPS in DAG Site (*Now, 3 Phases, Temporary*), 10 KW Mobile UPS in DAG Site (*Now, 3 Phases, Temporary*), 2 x 250 KW UPS in DAG Site (*2017*) (*3 Phases, Redundant, Permanent*), 110 KW Generator near DAG Site (*2016*) (*3 Phases, Temporary*), 2 x 400 KW Generators near DAG Site (*2017*) (*3 Phases, Redundant, Permanent*), 2 x 630 KW Transformers near DAG Site (*2016*) (*3 Phases, Redundant, Permanent*); Lightning Safety: 3 Rods in DAG Site (*Active, R <1 Ω, Permanent*); Internet: 48 Cores - 100 Gbits Transmission Fiber Line (*Underground, 26 km line ATASAM to DAG Summit, Active*), 24 Mbits RadioLink (RL) System (*Redundant, RL from ATASAM to DAG Summit, Active*); Transportation: 12 km Asphalt Road (*Erzurum Airport to ATAUNI Campus, Open in Winter*), 25 km Asphalt Road (*ATAUNI Campus to Konaklı Ski Center, Open in Winter*), 7 km Stabilizing Road (*Konaklı Ski Center to DAG Summit, Close in Winter*); Cable Car/Lift: 2 Cable Cars (*Konaklı Ski Center to 2 different DAG Summits, Active*); Vehicles: 2 Pickup (*4x4, 2500cc*), 1 ATV (*4x4, 800cc*), 1 Snow Track (*500cc*), 1 Snow Cabin Track (*5000cc*); Seismic System: 5 Seismographs (*Active, Connected, Spread around DAG Site*); Geological Analysis: Geological-Geophysical Analysis (*Basalt Ground, 20 Drills up to 10-50 m, Water after 250 m depth*); Water: 2 Natural Water Supplies (*Distance from Summit: 1 and 1.5 km, Altitude: 3000 - 2800 m*), Artificial Lake in Konaklı Ski Center (*Pumped up to DAG summit, Altitude: 2200 m*), Water Tank in DAG Site (*Filtered, 30 Tons, Underground, Heat System, Altitude: 3000 m*);

### 5 ATMOSPHERICAL –ASTRONOMICAL SYSTEMS

All are mounted on the DIMM Tower in DAG Site

#### 5.1 Atmospheric systems

AWOS (*Automatic Weather Observing System, Fiber, Active*); 1 DAVIS Meteorology Station (*Wireless, Active*); 1 Boltwood Cloud Sensor; 1 Meteosat Meteorological System (*12 Channels, mounted on ATASAM Building, Active*)

#### 5.2 Astronomical systems

1 All Sky Camera (ASC); 1 Seeing Monitor (*SM-SBIG*); 4 Rotating Sky Quality Meters (*SQM*) (*Developed by DAG Technical Team, Automatic, Active*); 1 MASS - DIMM System (*2016*) (*Multi Aperture Scintillation Sensor - Diff. Image Motion Monitor*) (*Collaboration with SAI - Moscova State Univ., Prof. V. Kornilov*)

## **6 ENCLOSURE**

Type: Rotating – Large Slit Door; Basic Specifications: ~16 m (Diameter), Active Environment Control + Cooling System, Louvers and Wind Screen + Bridge Crane

## **7 ACKNOWLEDGEMENTS**

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