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EASTERN ANATOLIA OBSERVATORY (DAG): RECENT DEVELOPMENTS AND A PROSPECTIVE OBSERVING SITE FOR ROBOTIC TELESCOPES

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RESUMEN

El Observatorio del Este de Anatolia (DAG) es el nuevo observatorio de Turquía que incluye un nuevo telescopio óptico e IR (de la clase de 4m) en un robusto emplazamiento. Este proyecto nacional consiste de 3 fases: DAG (telescopio, habitáculo, edificios e infraestructuras), FPI (instrumentos de plano focal y óptica adaptativa) y MCP (planta de recubrimiento de espejos) y está apoyado por el Ministerio de Desarrollo de Turquía. La solicitudes de oferta tanto por el telescopio como por la cúpula ya se han realizado y casi toda la infraestructura (carreteras, estudios geológicos y meteorológicos, electricidad, fibra óptica, teleférico, agua, generador, etc.) en el emplazamiento DAG (Erzurum/Turquía, a 3.170 m de altura) ya ha sido completada. Son bienvenidas futuras colaboraciones para este sitio.

ABSTRACT

This document (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. The tenders of telescope and enclosure have been made and 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. This poster is about the recent developments of DAG and about the future possible collaborations for various robotic telescopes which can be set up in DAG site.

Key Words: site testing — telescopes

1. INTRODUCTION

DAG (Eastern Anatolia Observatory in Turkish) Project is about contruction of the newest and largest observatory of Turkey with its robust observatory site. The project which is supported by the Ministry of Development of Turkey and awarded to Atatürk University, consists of three main phases: DAG, FPI (Focal Plane Instruments and Adaptive Optics) and MCP (Mirror Coating Plant).

2. PROJECT

The specifications of DAG Project are given in Table 1.

TABLE 1. Project Specifications

Name	Eastern Anatolia Observatory (DAG)
Institute	Atatürk University (ATAUNI)
Financial Resources	Ministry of Development (DPT), Atatürk University (ATAUNI)
Project Executive Unit	ATAUNI - ATASAM
Project Timeline	2012 - 2019
DAG Project Final Budget	$\sim$ 28M Euro (2015)
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)

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Project Support Units - Team	Dept. of Astronomy and Astrophysics (ASA), ATASAM - 50 cm Telescope (ATA50), International and National Advisory Board, Project Technical Team
Project Managers	Dr. Lorenzo Zago (HEIG-VD, Switzerland), Dr. Onur Keskin (FMV Işık Univ., Turkey)
Current Status of Project	Establishment of a Research Center (ATASAM), Erection of ATA50 Telescope in ATAUNI Campus, Establishment of a Department (ASA), Land Allocation for DAG Site, Land Master Planning, Technical Specifications, Telescope Tender, Telescope Preliminary Design Review, Enclosure Tender, Mirrors Order, Observatory Building Design, Focal Plane Instruments Project Submission, infrastructure (almost ready, 80%)

3. SITE

The geographic place of the DAG site is given in Table 2.

TABLE 2. Geographic Specifications

Region	Erzurum - Eastern Anatolia - Turkey
Location	Karakaya Tepeleri - Konaklı - Erzurum
Terrain	High altitude plato, 5 km long mountain range
Altitude	3170 m (the 3^{rd} highest observing site)
Geographic Coordinates	39° 47′ N 41° 14′ E
Distance from City	$\sim 35km/35'$ (by road)
Position	Filling the longitude, gap in northern hemisphere
Acreage	2500 decares, 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 -35oC for winter, Cold), Low atmospheric inversion layer ($\sim 2600m$, Ideal), Iced thin snow cover (¡100 cm, Dust-free), Snow season (November - April, Consistent)

4. INFRASTRUCTURE

The infrastructure specifications of DAG project are given in Table 3.

TABLE 3. Infrastructure Specifications

Buildings	ATASAM Building in ATAUNI Campus, (1000 m2, Tech.-Obs.-Guest Rooms, Labs., Fiber, 60KW UPS), Service Prefab Building -1 in DAG Site, (100 m2, Temporary, Tech.-Obs. Rooms, Fiber, 30KW UPS), Service Prefab Building -2 in DAG Site, (40 m2, 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 (2015), (300 m2, Garage, 20 Tons Gasoline Tank,Generators, Transformers)
Lightning Safety	3 Rods in DAG Site, (Active, R < 1Ω, 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)
Cable Car/Lift	2 Cable Cars, (Konaklı Ski Center to 2 different DAG Summits, 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

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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, (3 Phases, Redundant, Permanent), 110 KW Generator near DAG Site,(3 Phases, Temporary), 2 x 400 KW Generators near DAG Site, (3 Phases, Redundant, Permanent), 2 x 630 KW Transformers near DAG Site (2015), (3 Phases, Redundant, Permanent)
Vehicles	1 Pickup (4x4, 2500cc), 1 ATV (4x4, 800cc), 1 Snow Track (500cc), 1 Snow Cabin Track (5000cc) + 1 Pickup (4x4)
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. TELESCOPE

The specifications of DAG Telescope is given in Table 4.

TABLE 4. Telescope Specifications

Diameter	4m, Focal Length: 56m, Primary F#: 1.8m
FoV	$30'$ (Large - unvignetted), $10'$ (Narrow - vignetted)
Optical Design	Dr. Laurent Jolissaint (HEIG-VD, Switzerland)
Mounting	Altitude - Azimuth
Mirror Type	Zerodur (Schott)
Pointing - Tracking Accuracy	$< 2" - < 0.1"$ (rms)
Optical Performance	Ritchey - Chrétien (RC), Active Optics (aO), Adaptive Optics (AO), Derotator + 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)
Focal Platforms	2 Nasmyth, (N1: Adaptive Optics, N2: Seeing Limited), Instrument Capacity 6 Instruments (VIS: 3 + NIR: 3)
AO Types	Narrow Field + Ground Layer AO ($3" - 5'$)
AO Design	Dr. L. Jolissaint + Dr. O. Keskin, Manufacturers, AMOS (Advanced Mechanical and Optical Systems, Main Manuf., Belgium), EIE, (European Industrial Engineering, Sub-Manuf., Italy)

6. CONCLUSIONS

The DAG project welcomes all kinds of scientific and technical collaborations. The DAG site with its robust and powerful infrastructure on the Anatolian peak is ready to accommodate different size of telescope and various instrumentations.

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