



ESSTI
Ethiopian Space Science and Technology Institute

Overview of Ethiopian Space Program Development: Challenges & Prospects

Yeshurun Alemayehu ADDE(PhD)

Deputy Director General

Ethiopian Space Science & Technology Institute

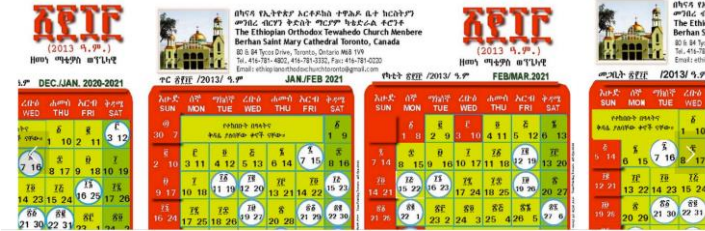
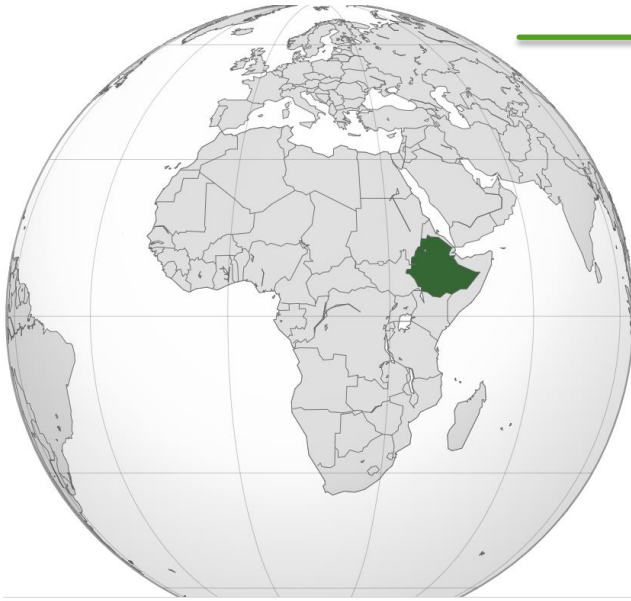
Contents

- ▶ Introduction
- ▶ History of Space Program Development
- ▶ Overview of Ethiopian Space Program Development
- ▶ What Has Been Done So far?
- ▶ International Relations/ Collaborations
- ▶ Challenges and Prospects
- ▶ Summary



Introduction

Overview About Ethiopia



Ethiopia has a total area of 1,100,000 sq.kms and over 117 million inhabitants and is the 12th-most populous country in the world the 2nd-most populous in Africa.

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Ethiopian national identity is grounded in the long history of Christianity and Islam in the region, and independence from foreign rule since antiquity.

During the late 19th-century Scramble for Africa, Ethiopia was the only African nation to defend against colonization.

Ethiopia was the first independent African member of the League of Nations and the United Nations.

Ethiopia is a multiethnic state with 80 different ethnic groups.

It is also the **source of the Blue Nile**, the great river whose power and fertility nurtured the **origin of civilization** itself.

And it is the origin of one of life's greatest pleasures – **coffee**, Ethiopia's gift to the world.

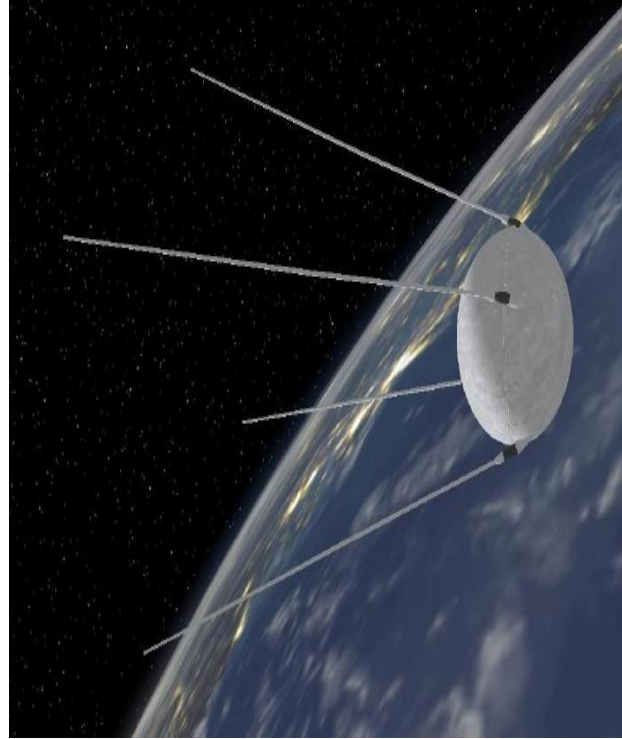
For more information **#VisitEthiopia**



History of Space Technology

History ...

1957: Sputnik



History ...

1957: Sputnik

1958: Explorer

**JUPITER-C
EXPLORER I**

EXPLORER MAIN CHARACTERISTICS	
LENGTH	80 IN.
DIAMETER	6 IN.
WEIGHT	30.8 LB.
VELOCITY (APPROX.)	18,000 MPH
APOGEE ALTITUDE	1,594 MI
PERIGEE ALTITUDE	225 MI
PERIOD	114.78 MIN
MAXIMUM LATITUDE	33.3 DEG.

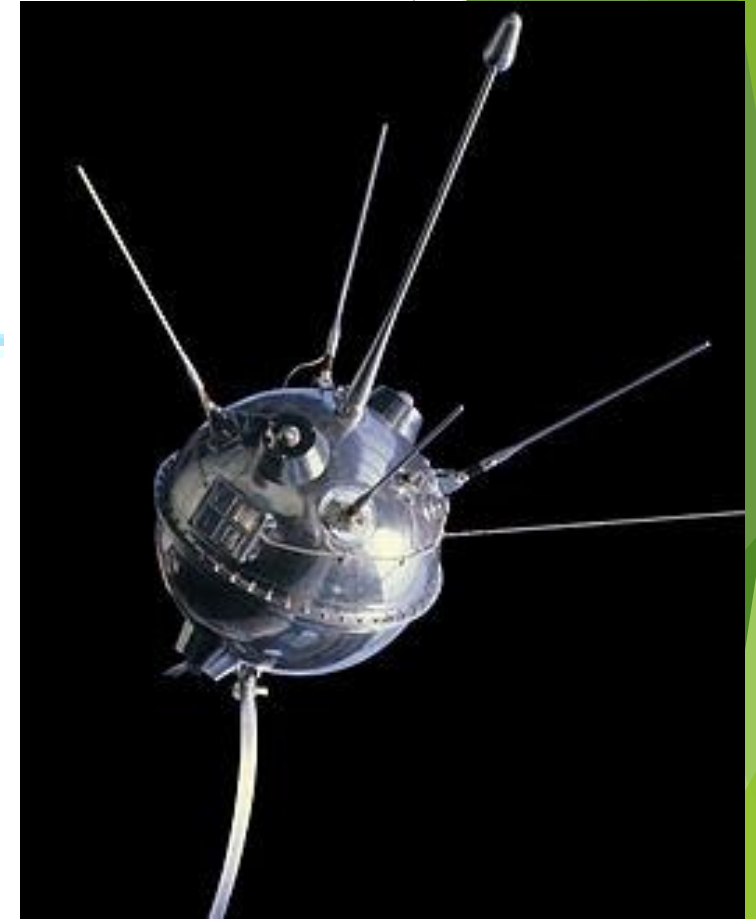
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History ...

1957: Sputnik

1958: Explorer

1959: Soviets launch Luna 1, the first spaceship on the moon

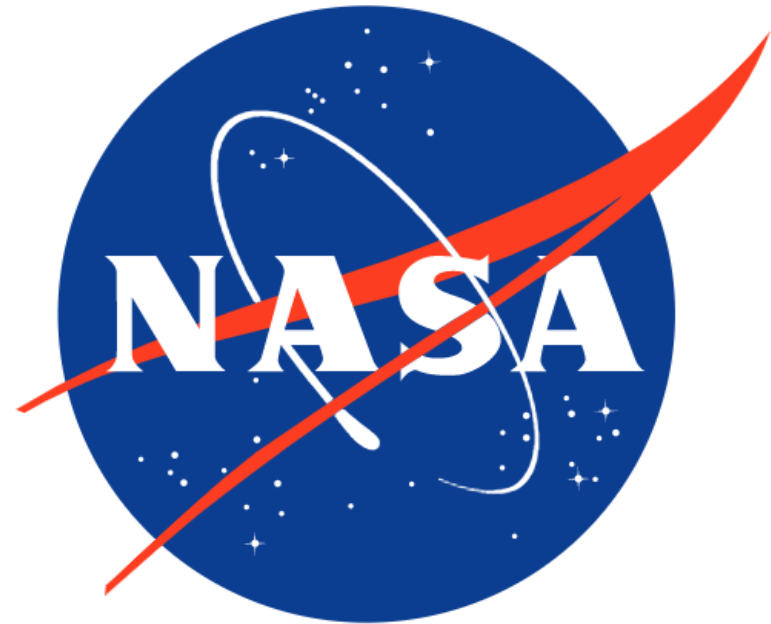


History ...

1957: Sputnik

1958: Explorer

**1959: Spaceship on the moon
NASA is formed**



History ...

1957: Sputnik

1958: Explorer

1959: Spaceship on the moon

NASA is formed

1961: Yuri Gagarin - a Russian Soviet pilot and cosmonaut was the first human to journey into outer space, when his Vostok spacecraft completed an orbit of the Earth on April 12



History ...

1957: Sputnik

1958: Explorer

1959: Spaceship on the moon

NASA is formed

1961: Yuri Gagarin

**Alan Shepard - became
the second person and
the first American to
travel into space**



History ...

1957: Sputnik

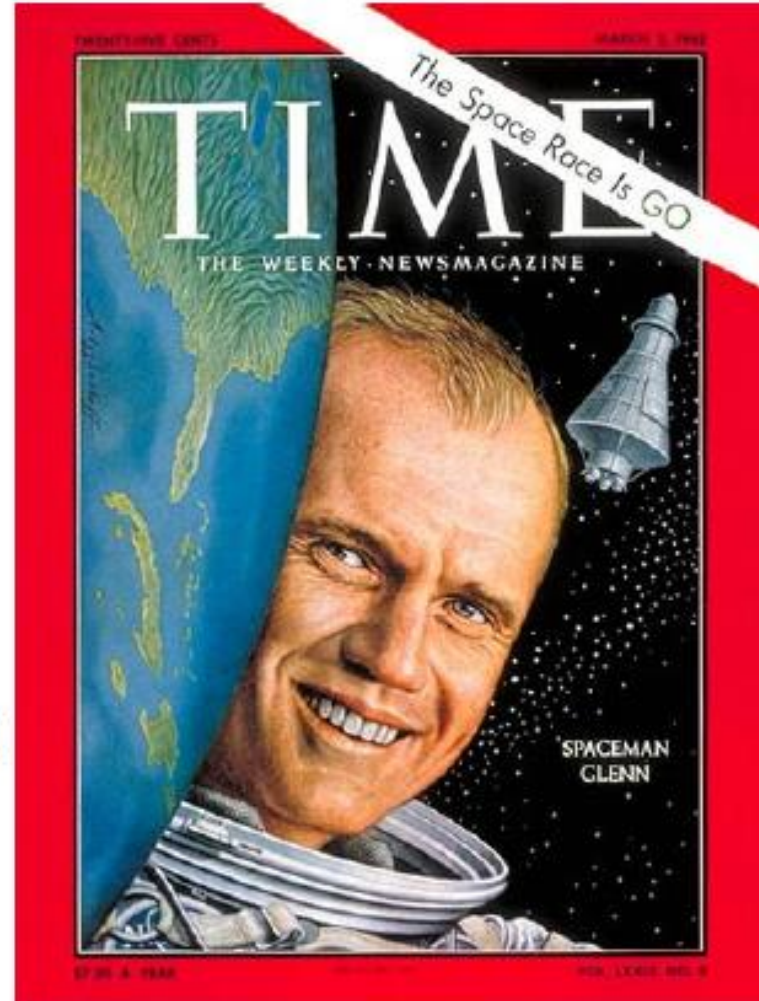
1958: Explorer

1959: Spaceship on the moon
NASA is formed

1961: Yuri Gagarin

Alan Shepard

1962: John Glenn piloted the Mercury-Atlas 6 "Friendship 7" spacecraft on the first manned orbital mission of the United States. He completed a successful three-orbit mission around the earth in 4 hours, 55 minutes, and 23 seconds.



History ...

1957: Sputnik

1958: Explorer

1959: Spaceship on the moon
NASA is formed

1961: Yuri Gagarin
Alan Shepard

1962: John Glenn

1963: Valentina Tereshkova becomes the first woman to have flown in space, having been selected from more than four hundred applicants and five finalists to pilot Vostok 6.



History ...

1957: Sputnik

1958: Explorer

1959: Spaceship on the moon
NASA is formed

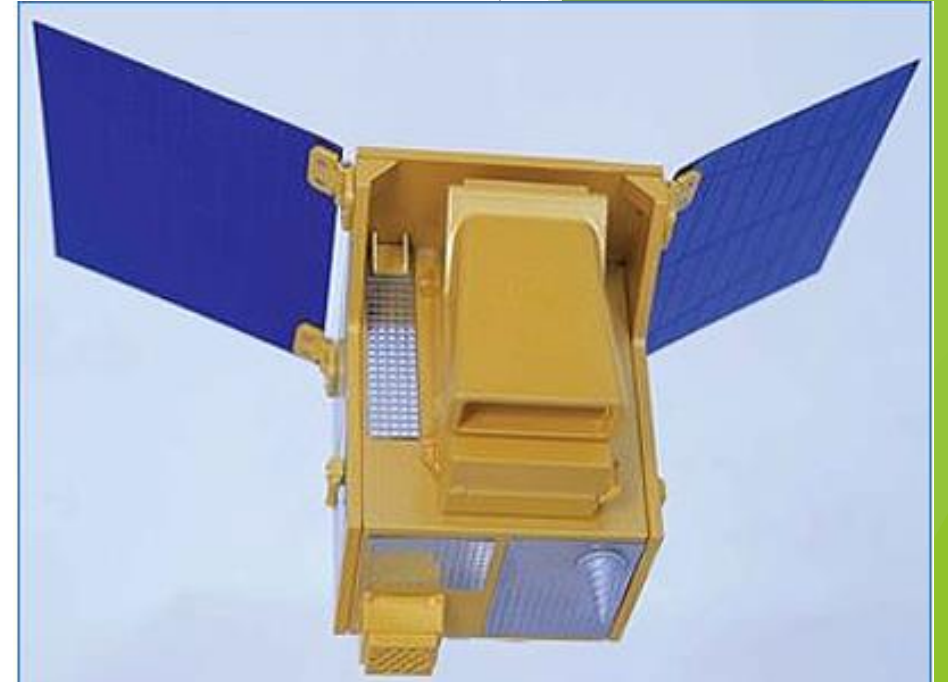
1961: Yuri Gagarin
Alan Shepard

1962: John Glenn

1963: Valentina Tereshkova

.....

2019: On December 2019 Ethiopia put its First Satellite into Orbit.





Overview of Ethiopian Space Program Development

Historical Overview



Three Phases for Ethiopian Space Program Development

- Preliminary Stage (1957-1975)
- Dormant Stage (1975 – 2004)
- Accelerated Stage (Since 2004)

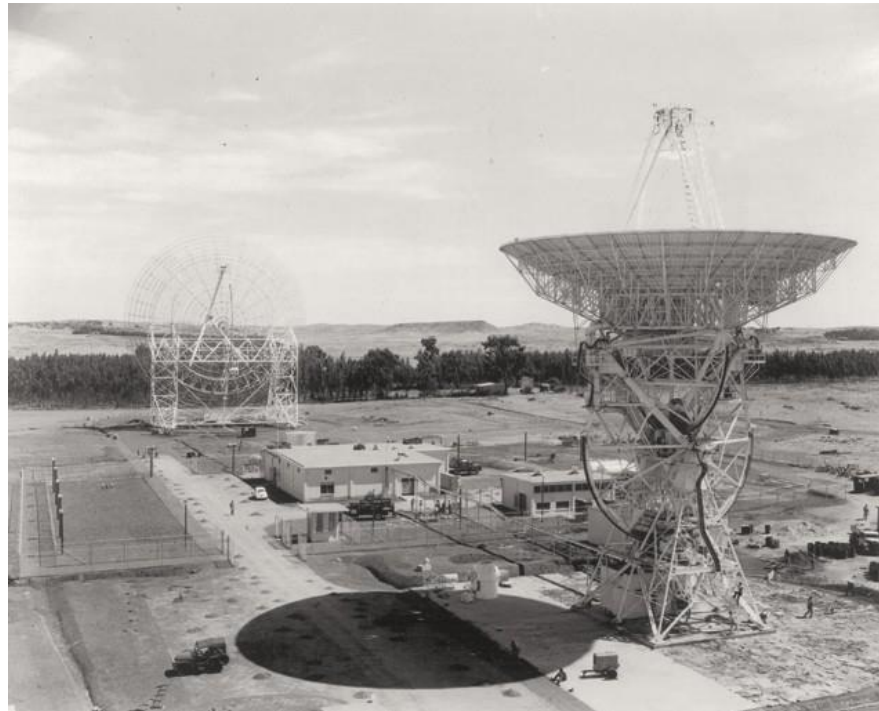
Stage I: Preliminary Stage: **1957 - 1975**

- ❖ 1957, Sputnik 1.
- ❖ In 1957, Haile Selassie I University installed the first 4 inch optical telescope.
- ❖ In 1957, the first geomagnetic observatory to characterize geospace magnetism in the deep equatorial region.
- ❖ In 1966, the establishment of the first Satellite Laser Ranging (SLR) tracking station at Bishoftu.



Historical Overview

- ❖ Since 1965, NASA established deep space communication antenna at Kagnew (Asmera region). The station named STONEHOUSE has provided space surveillance and intelligence operation from 1965-1975.



Historical Overview

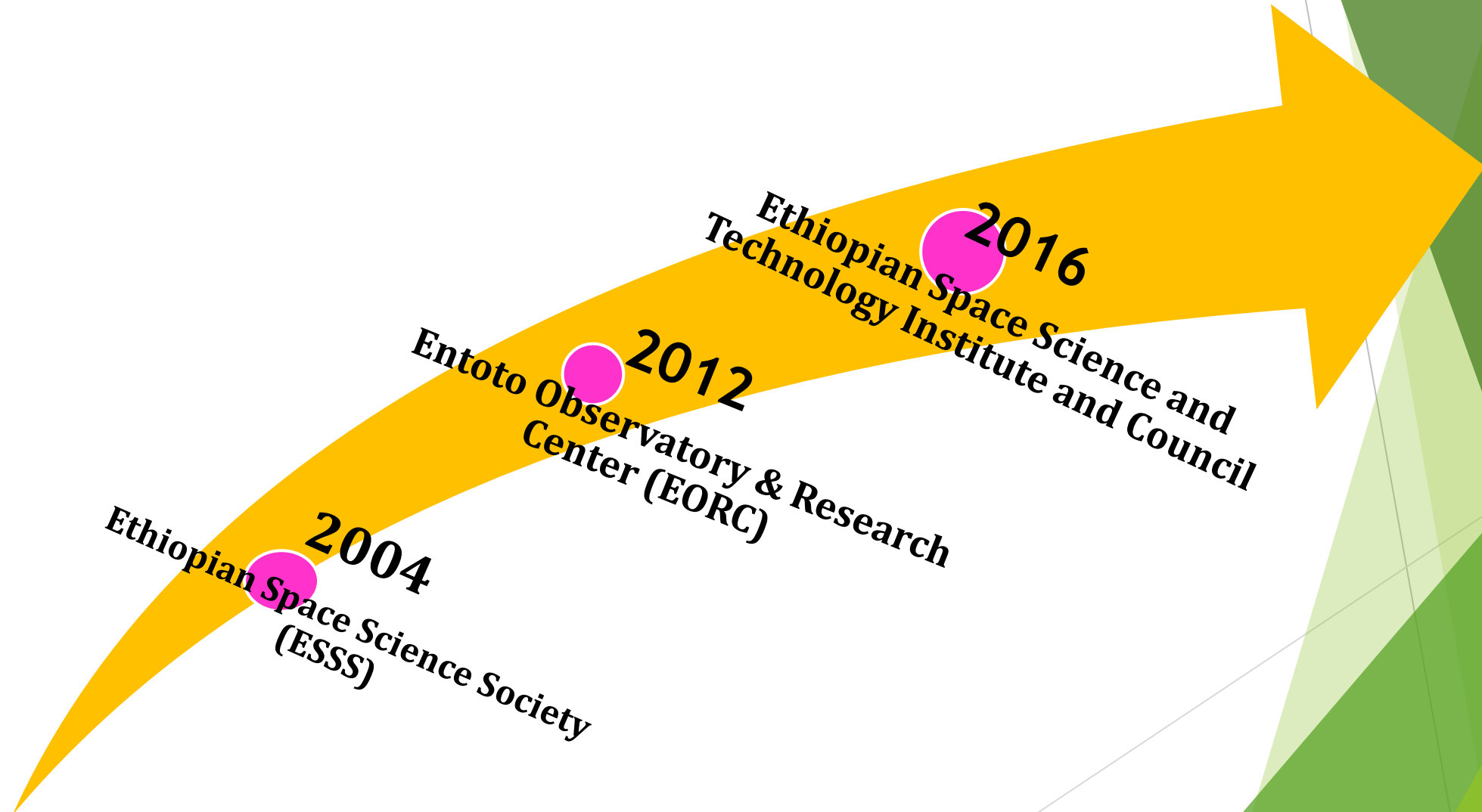


1975 - 2004

- ❖ Except the development of some new curricula in astrophysics and space physics at Addis Ababa University.
- ❖ Only few efforts have been made in upgrading research facilities needed for studying seismology and geomagnetic field of the Earth.



Since 2004 to the present



2004
Ethiopian Space Science Society
(ESSS)

2012
Entoto Observatory & Research
Center (EORC)

2016
Ethiopian Space Science and
Technology Institute and Council

Since 2004 to the present



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OF THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA	
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23 rd Year No. 5 ADDIS ABABA 1 st November 2016	
ግዴታ	CONTENT
ደንብ ቁጥር ፻፶፯/፳፯ የኢትዮጵያ ስፔስ ሳይንስና ቴክኖሎጂ ምክር ቤት እና ኢንስቲትዩት ማዕቀቢያ የሚኒስትሮች ምክር ቤት ደንብ.....7 ጽ ህ ሺ ፪ ፻ ፲ ፮	Regulation No. 393/2016 Ethiopian Space Science and Technology Council and Institute Establishment Council of Ministers Regulation 9416page 9416
የሚኒስትሮች ምክር ቤት ደንብ ቁጥር ፻፶፯/፳፯ የኢትዮጵያ የስፔስ ሳይንስና ቴክኖሎጂ ምክር ቤትን እና ኢንስቲትዩትን ለማዕቀቢያ የወጣ የሚኒስትሮች ምክር ቤት ደንብ	COUNCIL OF MINISTERS REGULATION No. 393/2016 COUNCIL OF MINISTERS REGULATION TO PROVIDE FOR THE ESTABLISHMENT OF THE ETHIOPIAN SPACE SCIENCE AND TECHNOLOGY COUNCIL AND INSTITUTE
የሚኒስትሮች ምክር ቤት የኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፐብሊክ የአስፈጻሚ አካላትን ሥልጣንና ተግባር ለመወሰን በወጣው አዋጅ ቁጥር ፱፻፲፮/፳፯ አንቀጽ ፭ እና ፴፱ መሠረት ይህንን ደንብ አውጥቷል።	This Regulation is issued by the Council of Ministers pursuant to Article 5 and 39 of the Definition of Powers and Duties of the Executive Organs of the Federal Democratic Republic of Ethiopia Proclamation No. 916/2015.
ክፍል አንድ	PART ONE
ጠቅላላ	GENERAL
፩. አጭር ርዕስ	1. Short Title
ይህ ደንብ "የኢትዮጵያ ስፔስ ሳይንስና ቴክኖሎጂ ምክር ቤት እና ኢንስቲትዩት ማዕቀቢያ የሚኒስትሮች ምክር ቤት ደንብ ቁጥር ፻፶፯/፳፯" ተብሎ ሊጠቀስ ይችላል።	This Regulation may be cited as the "Ethiopian Space Science and Technology Council and Institute Establishment Council of Ministers Regulation No. 393/2016".
፪. ትርጓሜ	2. Definition
በዚህ ደንብ ውስጥ የታሉ አገላለጽ ሌላ ትርጉም የሚያሰጠው ካልሆነ በስተቀር፦ ፩/ "ስፔስ" ማለት ከመሬት ከባቢያዊ አየር ውጭ	In this Regulation unless the context otherwise requires: 1/ "space" means an area encompasses all natural bodies found above earth's atmosphere;
የገዢ ዋጋ Unit Price	ነጋሪት ጋዜጣ ሥራ ህንፃ Negarit G. P.O.Box 80001

www.chilot.me

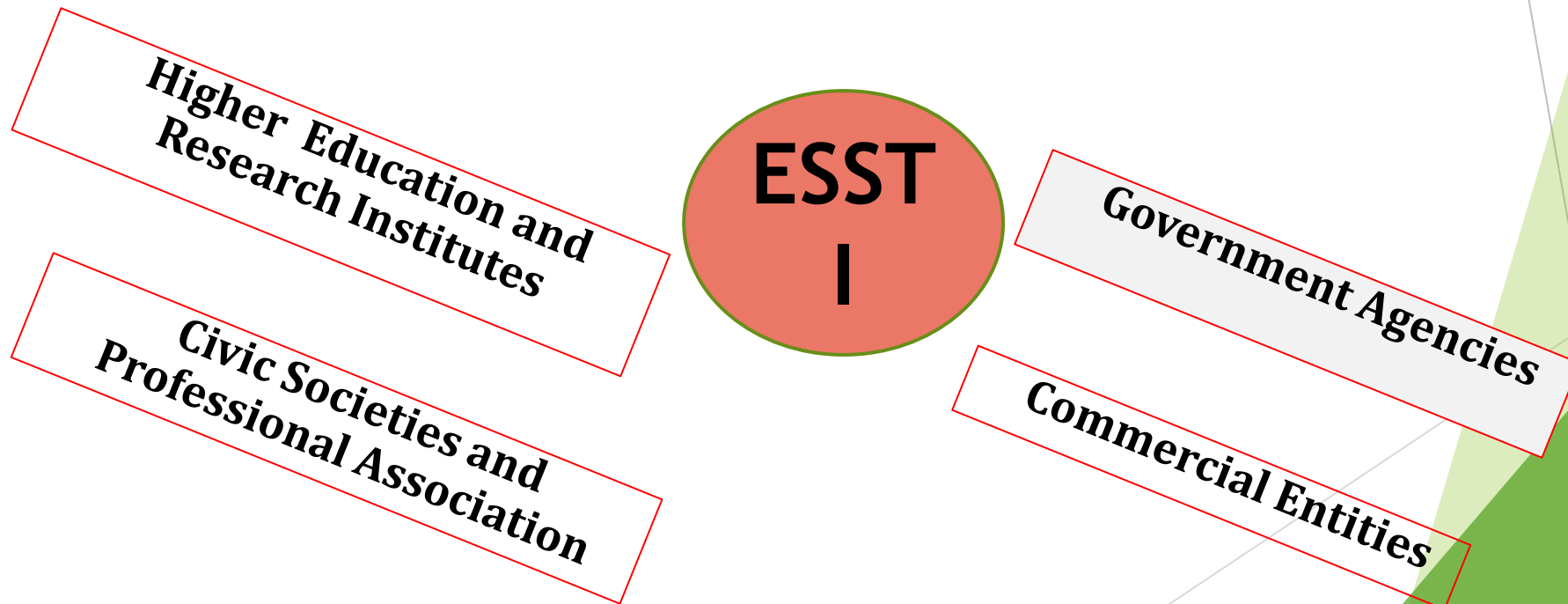


Since 2004 to the present



National Space Council

Ministry of Innovation and Technology





What Has Been Done So Far?



Infrastructure Development

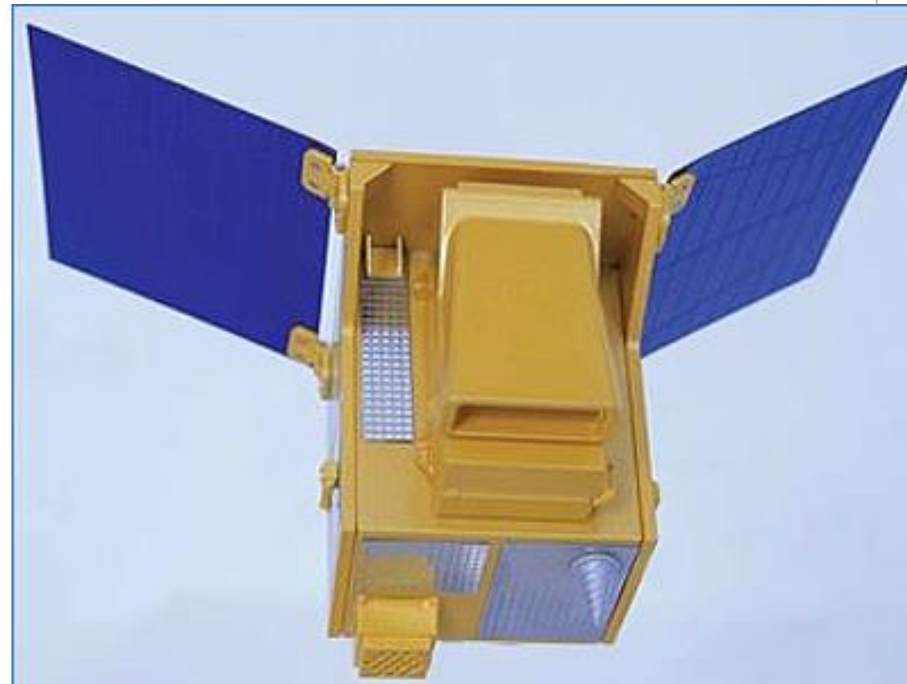
Twin Optical Telescopes at EORC

Entoto Observatory and Research Center is engaged in:

- Taking observations (two identical 1 m telescopes)
- Site-testing projects in the highlands of northern part of Ethiopia (close to Lalibela) to put bigger-size telescopes
- ESSS and Entoto observatory to realize International Astronomical Observatory in the highland of Lalibela.
- Launch MSc and Ph.D. programs: in collaboration with AAU; study programs in the fields of astronomy and astrophysics, space science, remote sensing and geodesy



ETRSS-1 (First Satellite & It's Ground Station)



- 4.5m Antenna
- ETRSS-1 Satellite: Resolution 13.75m
- Earth Observation

Ethiopian Multisatellite Ground Receiving Station



- 7.3m Antenna
- ETRSS-1 Satellite: Resolution up to 0.5m
- Earth Observation
- Receives data from 5 different satellites
 - CBERS-4
 - GAOFEN-1
 - GAOFEN-3
 - GAOFEN-5
 - SuperView-1
- Can be enabled to receive from other & more satellites



Human Capacity Development

Human Capacity Development

Old/Existing Programs

MSc Programs in

1. Remote Sensing
2. Space Science
3. Astronomy & Astrophysics
4. Geodesy & Geodynamics

PhD Programs in

1. Remote Sensing
2. Space Science
3. Astronomy & Astrophysics
4. Geodesy & Geodynamics



Graduate students have been admitted from Ethiopia and other East African Countries: Kenya, Uganda, Tanzania, Nigeria, etc.

New Programs

MSc Programs in

1. Space Engineering
2. Aeronautical Engineering

PhD Programs in

1. Aerospace Engineering

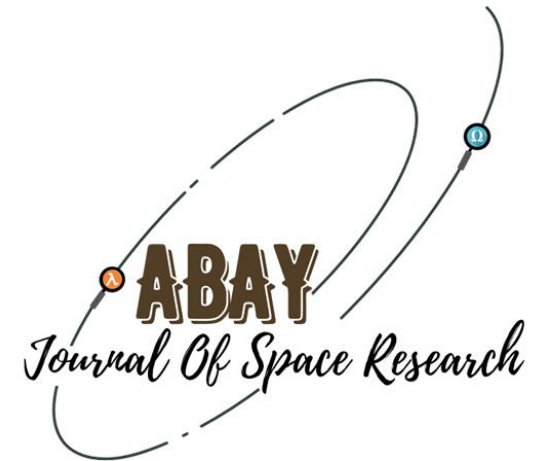
Research & Technology Development

11/3/2021

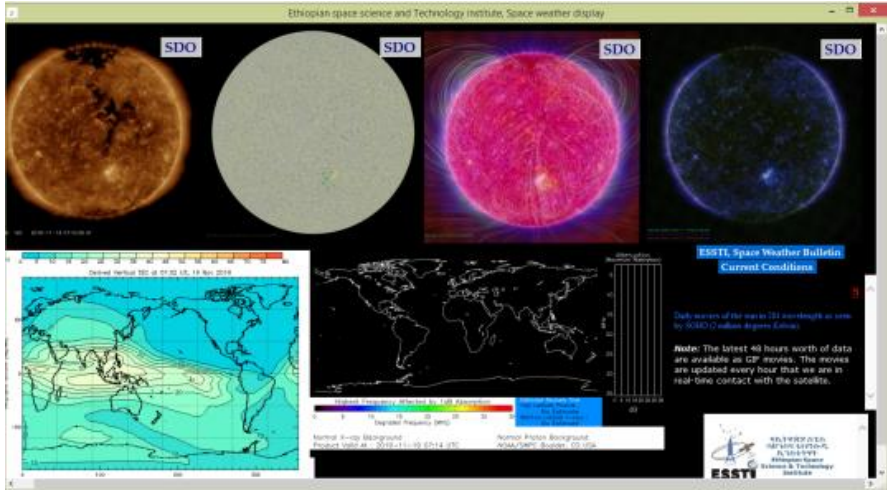
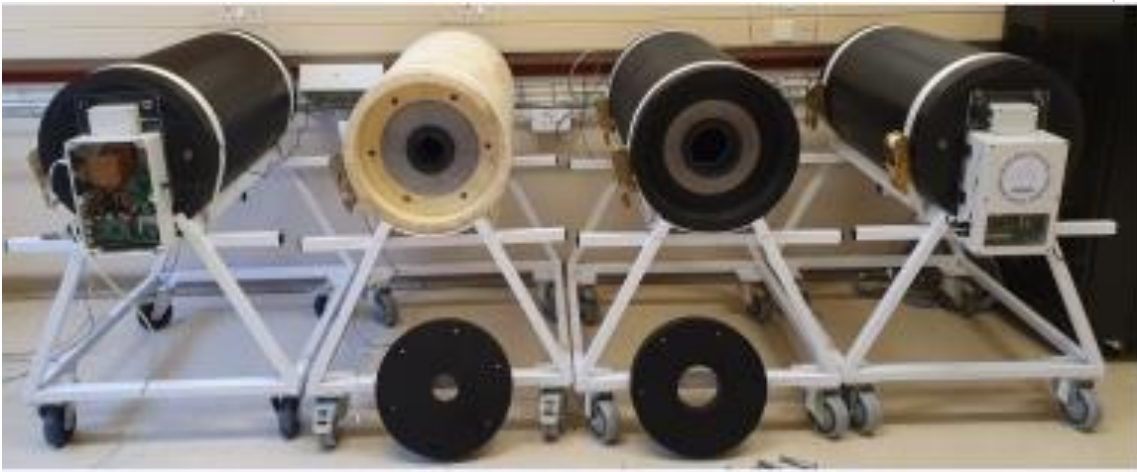
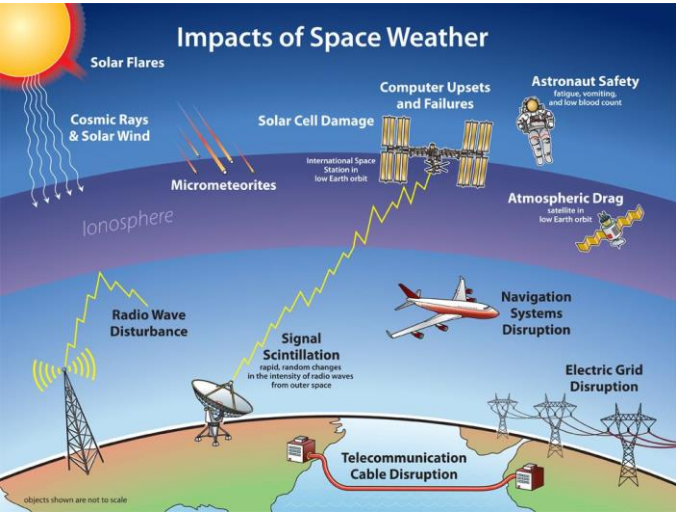
29

Research Activities

- ▶ **More than 100** research projects are undergoing
 - ▶ Focusing on Remote Sensing, Geodesy, Space Science, Astronomy & Astrophysics
 - ▶ Working with universities, research institutions, privates,
 - ▶ To solve societal problems interms of food security, climate change, disaster management, etc



Research Activities

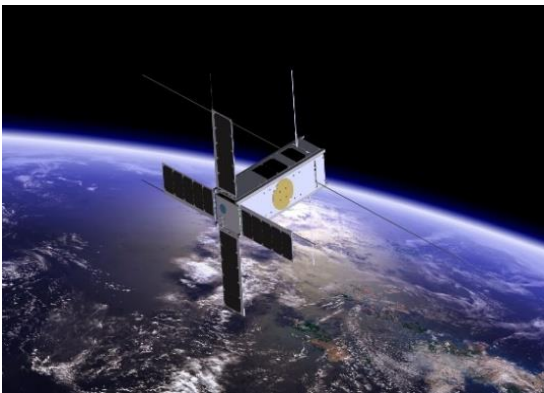


Technology Development Activities

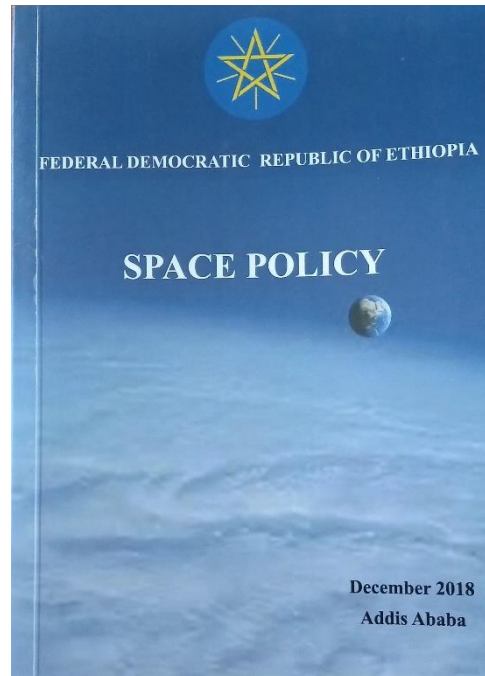
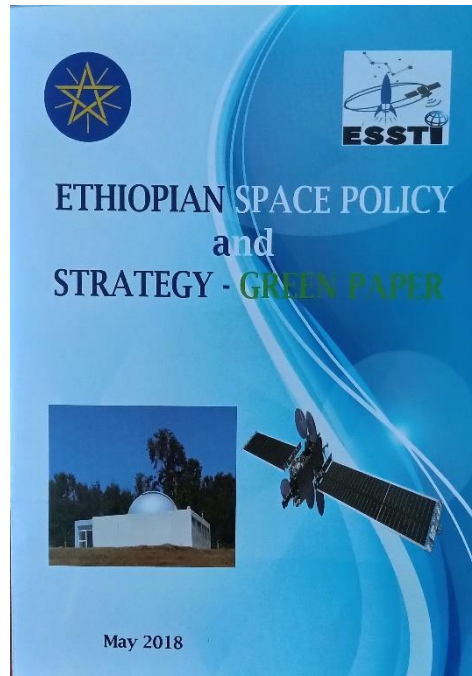
- ▶ Development of Small Telescopes



- ▶ Development of Small Satellites (CubeSats, CanSats, etc)



Approval of Space Policy

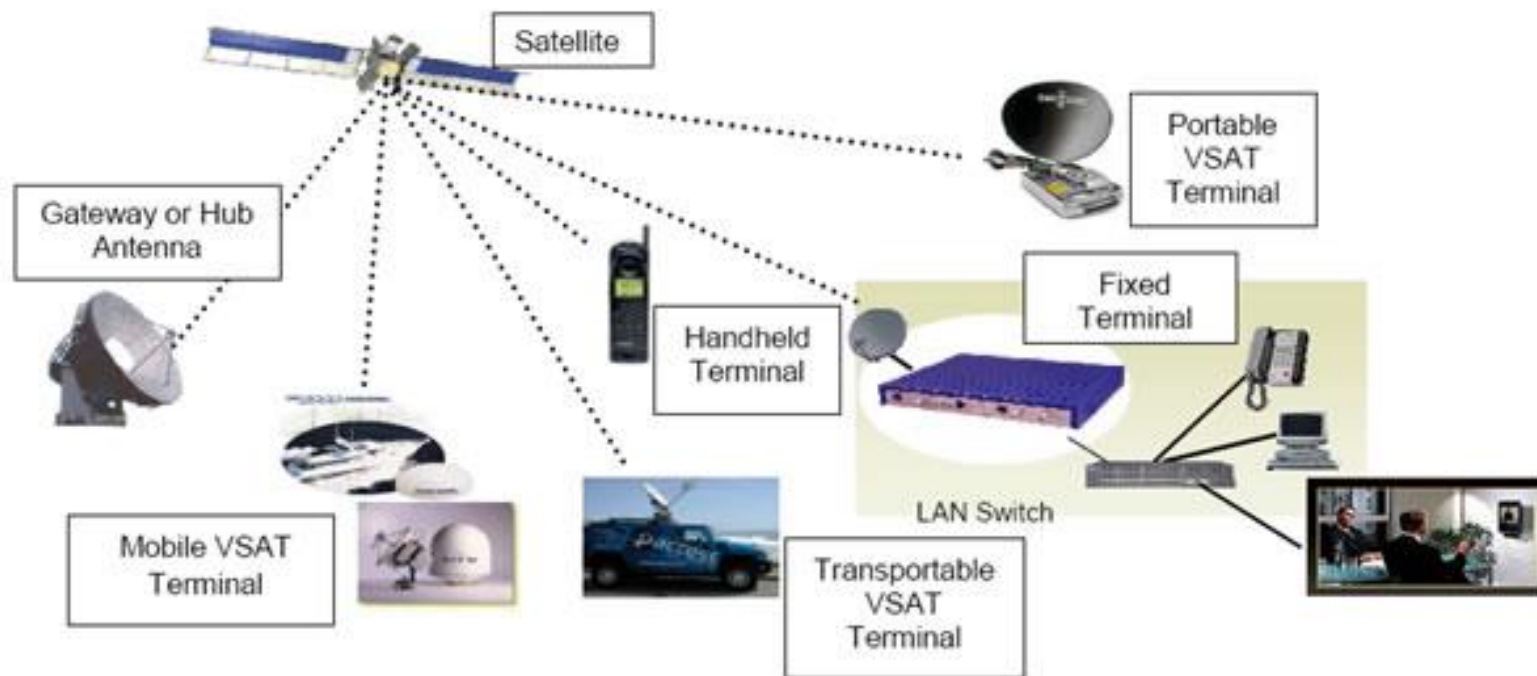




Planned Projects

Communication Satellite

- ▶ We have prepared a feasibility study
- ▶ Looking for vendors: through open international bid or may be another form of modality



Satellite Manufacturing, Assembling, Integration & Testing Facility

- ▶ We have done a feasibility study
- ▶ Looking for vendors: through open international bid or may be another form of modality



High Resolution Earth Observation Satellite

- ▶ We have done a feasibility study
- ▶ Looking for vendors: through open international bid or may be another form of modality



International Relation Activities of ESSTI



- MOU with The National Centre for Space Studies (**CNES**), France
- MOU with The South African National Space Agency (**SANSA**), South Africa
- MOU with China National Space Administration (CNSA), China
- MOU with The Keldysh Institute of Applied Mathematics of The Russian Academy Of Sciences (**KAIM – RAS**), Russia



MEMBERSHIP

- UN Committee on the Peaceful Uses of Outer Space (COPUOS)

(since 2018)

- International Astronomical Union (IAU)

(since 2012)



UNITED NATIONS

Committee on the Peaceful Uses of Outer Space

The logo of the International Astronomical Union (IAU), consisting of the letters 'I', 'A', and 'U' in a stylized, white, outlined font on a black background.

- **Hosted Office**
- East Africa Regional Office of Astronomy for Development (IAU-EA-ROAD)



International and Regional Collaboration and Networks on Research, Training and Education

- **EAARN** , East African Astrophysics Research Network
- **DARA**, Development in Africa with Radio Astronomy
- **NASSP**, National Astrophysics and Space Science Program
- **ISP**, International Science Program, , Uppsala University

- **IAU-OAD** , Office of Astronomy for development
- **NASA**, National Aeronautic and Space Administration
- **ESA**, European Space Agency
- **Oversea Universities and collaborators**



III. MAIN COLLABORATIONS

- Spanish Research Council (CSIC)
- Instituto de Astrofísica de Andalucía (Spain)
 - IRAM, Spain/France
 - ESO, Chile
 - IAC, Spain
 - ESAC, EU
- SAAO/UCT, South Africa
- University of Moscow, Russia
 - NASA, USA
- Univ. of Padova, /INAF/Univ. of Rome, Italy
 - Tel Aviv Univ., Israel
 - Univ. of Rwanda, Rwanda
 - MUST, Uganda
- Dodoma Univ., Open Univ., Tanzania



Plus participation in international long-term collaborations:

ALHAMBRA - Advanced Large Homogeneous Area Medium Band Redshift Astronomical Survey

GLACE - GaLAXy Cluster Evolution Survey

BASS - BAT AGN Spectroscopic Survey






Challenges & Prospects

Challenges

- Cost and high level of skill required in the sector
- Access to data is insufficient, and both the infrastructure development and its utilization require a high degree of skill.
- Access to facilities for scientific experimentation is difficult
- Inadequate awareness for the sector
- Government/ policy makers priority issues

Prospects

- Late comers advantage
- As the sector is inspiring, youth and children are very eager to get to know it.
- Collaborations
- COTS products availability to customize our own
- Government gave attention to STEM and developed STI policy & Strategy
- Additional graduate programs launched to solve HR skill problems

Summary

- ▶ Ethiopia passed three stages in the development of its space program.
- ▶ We strongly believe collaboration in terms of a win-win principle helps to grow faster
- ▶ We are open to time-sharing scheme to jointly use our 7.3m satellite tracking and ground receiving station
- ▶ We highly appreciate to jointly work in human capacity development through strengthening the already available graduate programs

yeshurun818@gmail.com

Or

yeshuruna@essti.gov.et

yeshurun818@gmail.com

Or

yeshuruna@essti.gov.et



Thank you