April 17th, 2020

BUSINESS CONCEPT OF CREATING HEROUNI UNITED SPACE CENTER

ARGUMENT Consulting Bureau

Annexes

1. Annexes

1.1 Annex 1

The list of reference complexes of antenna measurements created in 1971-80 in the all-Union research Institute of radio-physical measurements and stored in the scientific center of Aragats.

1. SSRS [1]-0.25
2. SSRS -1
3. SSRS -0.5
4. SSRS -2
5. SSRS-16/18
6. SSSS [2]-0.2
7. SSSS-0.5
8. SSPSA -1
9. SSPSA -2
10. SSPSA -3
11. SSPSA-4

These reference systems for measuring antennas were the first in the world and were recognized as **state standards of the USSR**, then as **national standards** of the Republic of Armenia.

[1] SSRS – State standard of the radition sphere;
[2] SSSS – State standard o the scattering sphere, SSPSA – State standard of the phase shift angle

1.2 Annex 2

Decision XXVI of the General conference of weights and measures

Since May 20, 2019, the platinum and iridium ingot stored in the International Bureau of weights and measures has ceased to designate a kilogram. It turned out that the ingot, stored under three sealed caps, still changed, losing about 50 micrograms per 100 year.

Since the standard was unstable, the XXVI General conference of weights and measures, which was held in November 2018, decided to use the Planck constant for determining the kilogram, not a material object. This physical constant determines the relationship between the energy of radiation quanta and frequency.

Now, this unit of mass will be determined using the Planck constant, using the existing reference values of length and time. Now the kilogram should be such that the Planck constant is $6.626069 * 10^{-34}$ joules per second. Joules are output in kilograms, meters, and seconds. For seconds and meters, the standard is already there — a second, this is the time equal to 9 192,631,770 periods of radiation of a cooled cesium atom, and light passes for a second 299,792,458 meters. To measure the Planck constant, metrologists use the so-called Kibble scale. This device determines what current is needed to create an electromagnetic field that can balance the bowl with the sample.

1.3 Annex 3

as of February 21, 2020

“JURISDICTION ARMENIA FOUNDATION”
THE PROJECT “HEROUNI UNITED SPACE CENTER”

Jurisdiction Armenia Foundation (hereinafter - JAF) in September 2017 initiated the project to create the “Herouni United Space Center” (hereinafter – The Center) and rebooting the VVS-54/2.6 telescope. The project aims to form and develop an ecosystem of the scientific, industrial and educational significance of the Herouni united space center" based on the Aragats scientific center, including the rod-54/2.6 radio-optical telescope.

The process in chronological order:

Since 2018, the issue of forming a separate structural unit of state property has been actively discussed with the Ministry of economic development of the Republic of Armenia. The Foundation has established a stable relationship with well-known international scientists and structures, interested organizations and donors of the sphere, signed memoranda of understanding, letters of support for the program to launch cooperation in the framework of rehabilitation and application of radiofrequency astrophysics, as well as to achieve comparability of the international radio interferometric network EVN.

On February 19, 2019, Deputy Prime Minister Tigran Avinyan instructed the RA Ministry of economic development and investment to submit to the RA government a draft decision on the establishment of the center as a separate structural unit, which was distributed in several ministries and other departments. According to the project, the Aragats research center should be separated from the National Institute of Metrology (NIM) CJSC and transferred to the state Service, which should transfer these assets to the Jurisdiction Armenia Foundation for free use for 25 years. JAF proposes to create a separate legal unit in state ownership and is ready to form an independent structure with an effective management mechanism within a year, transferring assets to the balance of this structure.
JAF presented a business plan for infrastructure and industry development, which will create a developed research center.
On July 26, 2009, within the framework of the “Herouni United space center" project, a meeting was held in the office of the RA Deputy Prime Minister Tigran Avinyan with the RA Minister of economy Tigran Khachatryan, the management of the Foundation and the head of the "USC Herouni" project, Professor Arevik Sargsyan, during which a package of the RA government's decision to create a separate state institution based on consolidated assets was discussed.

On September 07, 2009, Deputy Prime Minister Tigran Avinyan also instructed to get the opinion of the Armenian National Interests Fund (ANIF) for this project Fund in which ANIF received the

following conclusion: JSC "Fund of the state interests of Armenia" "has no objections to "Herouni United Space Center", at the same time, part of ANIF the program does not consider it appropriate".

With the assistance of the RA Ministry of economy, JAF has currently provided scientific and technical expertise on the current technical condition of the ROT-54/2. 6 telescope at the European research consortium's (JIVE) ultra-high bases, its restoration and further applicability, and a business concept for the project is being developed.

1.4 Annex 4

About "Jurisdiction Armenia" Foundation

COMPANY DESCRIPTION

"Jurisdiction Armenia" Foundation was established on December 8, 2016 By the government of the Republic of Armenia. Decision n 1377-N.
Number of the certificate of state registration of the organization: 222.160.941924.

1.1 Company objectives and issues

Jurisdiction Armenia Foundation objectives (according to company regulation):

1. creating opportunities for the country's globalization ... diversification of the economy of the Republic of Armenia,..., developing projects of legislative and Bylaw changes, promoting reforms within the framework of their powers,
2. creating an attractive environment based on the best international experience for organizations that use the solutions of the "jurisdiction of Armenia" program, and their employees and participants, contributing to development ... educational, ... telecommunications, environmental, ... security, and other humanitarian, infrastructure projects ... improving the international rating of Armenia as an attractive and competitive jurisdiction,
3. Stimulating the development of the economy and human capital of Armenia,..., ensuring high economic freedom, the rapid growth of financial flows and a new source of anti-crisis buffer resources, counterbalancing internal and external risk factors by attracting financial resources, technologies, professional opportunities..., increasing the country's investment capabilities and attracting investment, etc.
4. All activities of the "Jurisdiction Armenia" Foundation will be aimed at attracting attractive foreign legal entities and individuals to Armenia, attracting leading companies and qualified/unique specialists to Armenia.

"Herouni United Space Center" is an institution created to implement the dedicated program activities of the "Jurisdiction Armenia" Foundation.

1.2 Legal basis of the organization's activity

Jurisdiction Armenia Foundation is guided by the Constitution of the Republic of Armenia, the Civil code of the Republic of Armenia, The law of the Republic of Armenia "on foundations", the Charter of the "Jurisdiction Armenia" Foundation and other legal acts. Relations between employees of the "Jurisdiction Armenia" Foundation are regulated by the legislation of the Republic of Armenia.

1.5 Annex 5

Dr. Arevik Sargsyan

Arevik Sargsyan was born in 1965 in Armenia.

Arevik Sargsyan is multi professional, has three specialties: Radio Engineer, Business Trainer and Consultant, Adult Education (Andragogy) Professional.

She is Doctor of Engineering, has more than 170 printed scientific and methodological articles, 5 books, 2 patents. She was a supervizor of 87 Bachalor Degree, 30 Master Degree and 7 Ph.D. Degree Students.
The main occupation is National Polytechnic University of Armenia (NPUA) – 31 years' experience, Professor. She is owning and managing ARLIAN consulting and Training Company for 26 years, and was elected many times during last 15 years as a President of Youth and Adult Education and Lifelong Learning Association (NGO, Armenia). Arevik Sargsyan is a Member of Council of the Ministry of Education and Science of RA.

As a National Expert and Trainer she was engaged in projects of World Bank, USAID, UNDP, ETF, SME DNC, NC VETD, ANQA, State Employment Agency and others. She was invited as a Speaker, International Expert, Trainer to Russia, USA, Germany, Greece, Norway, India, Sweden, Denmark, Great Britain, Brazil, Spain, Italy, Kirgizstan, Belarus, Moldova, Georgia.

Arevik Sargsyan was awarded by RA Prime-minister Prize "Best Business woman in 2013 year" for the nomination of Innovation and Initiative. She has one Son 29 years old.

1.6 ANNEX 6

project

GOVERNMENT OF THE REPUBLIC OF ARMENIA

D E C I S I O N

N ..... –N, as of ___ March, 2019

ABOUT CREATION OF «HEROUNI UNITED SPACE CENTER»

Given the provisions of the program of the Government of the Republic of Armenia On the development of science and education in the Republic of Armenia, stimulating the implementation of important projects and programs in the Republic of Armenia, guided by article 605 of the Civil code of the Republic of Armenia, taking into account the provisions of the law "On approval of the Program eligibility of Armenia" from 08.12.2016 G. Protocol decision No. 49- the government of the Republic of Armenia decides:

1. In order to implement the program of industrial and infrastructure development within the framework of public - private partnership, to create the "Herouni United Space Center" in accordance with paragraphs 2, 3, 4 of this decision, combining the property owned by the Republic of Armenia, state bodies and organizations in accordance with Annex 1 to this decision;
2. After the entry of this decision into force together to ensure that the Ministry of economic development and investments of the Republic of Armenia and the head of state property management under the Government of the Republic of Armenia the transfer of property allocated to create a "Herouni United Space Center", Jurisdiction Armenia Foundation and the design documents provided by the law;
3. The Executive Director of the "Jurisdiction Armenia" Foundation should ensure the formation of the "Herouni United Space Center" as a separate institution within the Foundation in accordance with the proposal submitted by the Foundation to the Ministry of economic development and investment of the Republic of Armenia within two months after this decision comes into force;
4. Within one month after the entry into force of this decision, the Minister of justice of the Republic of Armenia shall ensure the state registration of the geruni national space center institution within the procedure established by the legislation of the Republic of Armenia;
5. Alienation of the transferred consolidated property or complexes that are part of it in favor of third parties is prohibited without the permission of the government of the Republic of Armenia;
6. Grant the right to the "Jurisdiction Armenia" Foundation to organize fundraising and capital raising events (including crowdfunding, preliminary dram offer, securities offer, etc.), attract partner organizations within the framework of public-private partnership, and obtain loans and loans. The "Jurisdiction Armenia" Foundation can attract and trade both in Armenian Drams and in foreign currencies that are not prohibited by law, including cryptocurrencies, for the purpose of development;
7. Grants allocated, subsidized, appropriated or otherwise provided for the maintenance, service or development of the property specified in Annex 1, including the allocation of AMD 45 million annually provided by the state budget for the "preservation and development of the reference system", should be

consolidated and transferred to the "Herouni United Space Center" for the purpose of organizing a minimum amount of scientific work;

8. Within one month after this decision comes into force, the Minister of economic development and investment of the Republic of Armenia should submit a proposal aimed at ensuring the maintenance of the national space center geruni for 25 years;
9. In order to ensure uninterrupted, accurate and unhindered operation of the VVS-54 instrument and other antennas located on the territory of the "Heruni United Space Center", the Executive Director of the "Jurisdiction Armenia" Foundation will submit the necessary technical conditions to the government of Armenia within ten days after the decision comes into force;
10. To provide the head of the real estate cadastre Committee of the government of the Republic of Armenia with functions related to the implementation of this decision concerning its scope, free of charge;
11. Within a month after the completion of the work specified in this decision, but no later than may 31, 2019, ensure the Head of the state property management Department under the Government of the Republic of Armenia, Minister of economic development and investment, Director of the "National Institute of Metrology", heads of other involved state bodies and organizations that all the necessary wording, work on the delivery and acceptance of the specified property, and the conclusion of contracts with the Fund, establishing that the costs associated with the registration, ratification and state registration of rights arising from the contracts are subject to implementation at the expense of the state budget;
12. This decision shall enter into force on the day following its official publication.

PRIME-MINISTER OF THE REPUBLIC OF ARMENIA N. PASHINYAN

Annex
to decision of the Government of RD
N ..... –N, as of ___ March, 2019

ABOUT CREATION OF «HEROUNI UNITED SPACE CENTER»

LIST

of the property subject to consolidation in the frames of the decision of the Government of RA

Aragatsotn region, office address located next to the community of Orgov; 2 street no. 27 -a square with a fence, a radio-optical telescope on this territory, other equipment, antennas, residential and non-residential buildings, structures, unfinished structures, roads, other infrastructure units, and other property in accordance with the inventory,

Office space in Yerevan-49 Komitas Ave. standards Department of "National Institute of Metrology" CJSC buildings 49/4 and rooms of 6-7 floors with property and equipment, including laboratory rooms of "National Institute of Metrology" CJSC, antennas installed on the roof of the building,

With the right of gratuitous use of the entrance and exit to the roof of the antenna located on the roof of the building 49/4 on Komitas street, Yerevan,

"Alik" experimental plant-office address; Yerevan, 25/1 Lepsius street, with plant substructures, adjacent buildings, territories provided for its operation and maintenance,

At the height of mount Aragats with adjacent buildings and a land plot with a diameter of 3.2 m.

1.7. ANNEX 7

Professional reference on the technical data of the ROT-54/2.6 radio-optical telescope
Basic Data

1. General

Diameter of the main stationary spherical radio reflector	54m	Current state	Without changes
Working diameter (for the given direction of the antenna beam)	32m		Without changes
Diameter of the small radio reflector	5m		Without changes
Overall error of the radio reflector (RMS error)	83 mcm		1mm (rough estimation)
Diameter of optical reflector	2.6m		Without changes
The angle of inclination of the entire system to the south	15˚		Without changes
The geographical longitude of the place (East)	40˚		Without changes
The geographical latitude of the place (North)	44˚		Without changes

2.Radio-technical

Minimal length of the wave		1 mm
Maximal length of the wave		1m
Beam width	on the wave 2 mm	14″
	on the wave 8 mm	1′
	on the wave 20 cm	27′
Temperature of the self-noise	on the wave 3 mm and 8 mm (incl. background noise)	3K
	on the wave 3 cm	9K
	on the wave 20 cm	12K
Geometric surface of the aperture used		800 m^2
Antenna aperture efficiency	on the wave 1 mm (expected)	0.4
	on the wave 2 mm	0.6
	on the wave 8 mm	0.7
Useful surface	on the wave 2 mm	480 m^2
	on the wave 8 mm	550 m^2
Gain factor	on the wave 2 mm	$1.5*10^9$
	on the wave 8 mm	$1.1*10^8$
Aperture angle of the feed		141˚
Shading of the used aperture by the small reflector		2.4%

3. Optical

Diffraction-limited resolution	0.2″

Actual resolution	2″
Field angle	40′x 40′
Undistorted field angle	10′x 10′
Collecting surface	5.3m^2
The image sizes of point objects	2″ - 3″

4. Guidance

Apical angle of the conical view		120°
The declinations of the observed sources	from	-35°
	to	+85°
Guidance rate, maximal		40°/min
Acceleration, maximal		1.3°/sec^2
Guidance error	Manual mode (digit. dialling)	3″
	Automatic mode by computer	3″
	Fine manual correction	1″
Support errors	Automatic mode by computer	2″
	Adjusted fine manual correction	1″
Video-guide №1	Field angle	2°x 2°
	Diameter of the lens	30 mm
	Apparent star magnitude	4
Video-guide №2	Field angle	2.5°x 2.5°
	Diameter of the lens	250 mm
	Apparent star magnitude	12

5. Main radio reflector of the antenna

Diameter of the reflector	54m
Shape of the reflector	hemisphere
Curve radius	27m
Inclination of the entire dish to the south	15°
Number of reflector panels	3800
Panel material	Alloy of allum. and zinc
Panel technology	Casting and mechanical treatment
Average weight of the panel	80 kg
Average size of the panel	1m x 1m
Number of the panels sizes	36

Accuracy of the panel surface (RMS error)	10 mcm
Accuracy of the reciprocal array of the panels	±100 mcm
Width of the gaps between panels (aver.)	2 mm
Total error of the main reflector surface (RMS error)	58 mcm
Distance of the panels from the concrete bowl	1.8 m
Length of the panel mounting legs	1.8 m
Diameter of the concrete hemispheric bowl	60 m
Thickness of the concrete bowl	1.5 m
Total weight of the concrete	15,000 t
Total weight of reinforcement	500 t
Total weight of aluminium	360 t
Total volume of excavation	70,000 m^3
Total volume of backfill	57,000 m^3

6. Small radio-reflector of the antenna

Diameter of the reflector	≈5m
Depth of the reflector	≈ 2.5m
Shape of the reflector	special
Distance of the centre of the main reflector from the top of the small reflector	13.5m
Distance of the small reflector top from the focus	3.4m
Surface of the small reflector's aperture	19.6 m^2
Frame	Steel, hard
Number of reflector panels	170
Panel material	titanium
Panel technology	Mechanical treatment
Average sizes of the panels	70 x 40 cm
Accuracy of the panel surface	15 mcm
Reciprocal array of the panels	By the copier
RMS error of the small reflector's surface	60 mcm
Total weight of the small reflector	15 t

7. Optical telescope

Diameter of the main reflector	2.6 m
Shape of the reflector's surface	parabolic
Primary focal length	10 m
Material of the main reflector	Glass ceramics

Ratio of the focal length to the diameter	3.85
Light-gathering power	0.26
Weight of the main reflector	4.2 t
Number of unloading mechanisms	28
Diameter of the secondary reflector	0.4 m
Shape of the secondary reflector's surface	hyperbolical
Total weight of the optical telescope	12 t

8. Support tripod

Length of the supports		≈ 27 m
Size of the cross section of the supports		1.2 x 0.8 m
Weight of each support		12 t
Load on the supports	on the southern	70 t
	on the eastern and western	each 30 t
Diameter of the ring bearer		6 m
Weight of the bearer		20 t
Weight of the turning frame		7.5 t
Total length of the turning structure		30 m
Total weight of the counterweights of the small radio reflector		6 t
Total weight of the turning structure together with the small radio reflector and optical telescope		70 t
Total weight of the support tripod with the turning system		130 t

9. Settings

Panels of the main radio reflector	Number of regulating bolts on each panel	4
	Limits of adjustments (course)	±25 mm
	Pitch (10° turn of the screw)	14 mcm
Panels of the small reflector	Number of regulating bolts on each panel	4
	Limits of adjustments (course)	±15 mm
	Pitch (10° turn of the screw)	14 mcm
Support tripod (3 mechanisms)	Limits of the manual regulation of the leg length	±250 mm
	Pitch of the screw	10 mm
Limits of the automated regulation of the leg length	Pitch (1 turn of the motor)	0.5 mm
	Accuracy of autostabilization of the lengths of the legs	20 mcm
Hanger of the small reflector (3	Limits of the length regulation	±60 mm
	Step (1 step of the step motor)	10 mcm

mechanisms)	Limits of regulation of the angular position	±6˚
	Step (1 step of the step motor)	10″
Mechanisms of radio-focus	Limits of travel in the X and Y axes	±75 mm
	Step (1 step of the step motor)	10 mcm
	Limits of travel in the Z axis	±50 mm
	Step (1 step of the step motor)	10 mcm
	Limits of turning round the axis Z	360˚
	Turning step	1˚
Mechanisms of optical focus	Limits of travel in the X and Y axes	±35 mm
	Step (1 step of the step motor)	10 mcm
	Limits of travel in the Z axis	±50 mm
	Step (1 step of the step motor)	10 mcm
	Limits of turning round the axis Z	360˚
	Turning step	1˚

10. Automatic control system

Error of guidance and support		1″- 3″
Total number of electric drives		28
Including:	digital	4
	laser	9
	servo- systems	7
Number of digital sensors angle-code		4
Error of sensors angle-code		2″
Number of control panels		3
Number of observation panels		2

The central control unit carries out in the manual and automatic (computer) modes:	guidance, support, scanning, applications, adjustments, control and indication, communication
Control panel Radio-1 carries out:	scanning, adjustments, control and indication, control of servicing systems
Control panel Optica-1 carries out:	fine correction, adjustments, control and indication, control of servicing systems
Observation panels Radio-2 and Optica-2 carry out:	registration of signals, indication, selection of the signal processing modes in the computer, control

11. Radio receiving equipment

Radiometers of ROT	Wave length, mm/ Frequency, GHz					
	2/138	3/94	8/34	30/10	100/3	200/1.5

Self-noise, K	6400	1900	2300	100	260	200
Sensitivity K (at τ =1 sec, $T_{ш}$=300K)	0.3	0.1	0.06	0.02	0.16	0.2
Free transmission range, MHz	1000	1000	3800	800	25	14
Path length to the focus, mm	164	241	221	250	250	250
Stream sensitivity, $(W/m^2*Hz)*10^{-27}$ (at S_{eff}=500 m^2)	16.5	5.5	3.3	1.1	8.8	11
Nonlinearity in the dynamic range 25 dB, dB	0.03	0.03	0.03	0.03	0.03	0.03
Input VSWR	1.3	1.2	1.15	1.1	1.1	1.1

These conventional, uncooled radiometers were manufactured in the All-union Scientific Research Institute of Radio-physical measurements under the leadership of Paris Herouni.

12. Storage of time

Frequency and time standard Ч1-69	
Nominal value of the output signal frequency	5 MHz, 1 MHz, 100 kHz
Relative error of output signals by frequency within the limits	$\pm 2*10^{-11}$
Relative systematic change in frequency in a day within the limits	$\pm 1*10^{-12}$

13. Servicing systems

Underground pipe to drain water from the bowl:	
diameter	1m
length	120m
Snow removing system:	
number of heaters with fans (under the main reflector)	60
total power	1 MW
average number of snowing days in a year	20
Number of lifts	3
Folding platform to the radio focus	1
List of other servicing systems:	lighting, washing of the main reflector, communication and messaging, cryogenics, measurements, control of covers of the optical telescope, photo guides, and cameras of optical focus, blinds, etc., waterworks, weather station, geodesic points, etc.

14. The ranges of view and the time of observations

The critical aspect angle $\propto_{м}$ is determined by the touch-down of the used and geometric apertures. However, in practice, certain losses of the area (up to 10%) may be acceptable for the sake of increasing that angle.

Calculations show that the increase of the critical angle in degrees is numerically equal to the approximate loss of the area in percentage terms.
The possibility of observing these or those celestial sources with the given tool is determined by the view ranges of the antenna, the width of the installation site φ, the source declination, the angle of the possible inclination of the tool towards the south on the whole from Zenith in the plane of the local meridian ψ.
The useful time of observation of the given source depends on the same factors, considering that it is not accepted to work at low dispositions of the source over the horizon as in the thick of the atmosphere with strong gradients, a substantial absorption of the signal and distortions because of the refraction take place. That is why, the sources are usually observed at angles 10-20˚ (and even 30˚) above the horizon.
The mentioned facts refer to both the radio-range and the optical range of the electromagnetic radiation.
In case of ROT-54/2.6, $\varphi = 40°, \psi = 15°, 2 \propto_{м} = 120°$, i.e. there is an effective possibility for observing the sources with declinations from δ=-35˚to δ=+85˚. The sources located "lower" than the pole, towards the north horizon in the zone "inaccessible" to observation by ROT, after some time, rotating around the polar axis, will enter the zone of the ROT-54/2.6 observation themselves. Besides, having a gimbal, but not the azimuthal mounting system, ROT does not have a "dead" ("blind") zone around the Zenith point as its axes look at the points on the horizon line, and these points are outside the observation zone.
The observation time for the sources with declinations from δ=-34˚ to δ=+84˚ ranges from 3 to 11 hours a day.

The current state of the systems ROT-54/2.6

Electromechanics:
The state of the mechanical systems of the radio-telescope is satisfactory. It is necessary to maintain some irregularities in cardan system.
The accuracy of the surface of the small reflector has remained unchanged (RMS error = 60 mcm).
The accuracy of the panel surface of the antenna's main radio-reflector and the accuracy of the reciprocal array of the panels have deteriorated, thus alignment and adjustment works are required.
The motors of the gimbal mounting system installed on the antenna operate normally. The small motion motors at the bases of the tripod legs, the radio-focus and optical focus corrections are in the working state.

Control systems:
Most electric drives, digital sensors, and servo-systems are out of order. All the control and observation panels need to be replaced. Many cables, connecting the units of the antenna with the controlling building are lacking. The computer system needs to be updated. It is necessary to develop new software products.

Radio equipment:
At present, the radiometers are inoperative. In case of further application, it is necessary to reconstruct and repair the entire radio-receiving system.
Electronic digital acquisition system:
Digital acquisition system is lacking. There is a device of analogue acquisition (recorder).

Stabilization systems:
The ruby frequency standard is in an operating state. However, it is necessary to renew the cable system and to develop up-to-date transformation devices. The hydrogen standard is out of order.

Optical telescope:

The cables connecting the control systems of the reflector cover, video-guides, and the video-camera with the control board are lost.

Because of the impossibility of opening the telescope cover mechanically (it is opened only by an automatic command from the control board), it is not possible to estimate the surface of the reflector.

The cooler of the reflector is lacking.

1.8. Annex 8

Արձանագրություն
ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի վերազինման վերաբերյալ հանդիպման

Երևան, ՀՀ
06-07 մարտի, 2018թ.

Minutes
of the meeting on the development of the ROT-54/2.6

Yerevan, Armenia
06-07 March 2018

Ներկաներ՝

անուն	պաշտոն	հաստատություն
Սուրեն Կարայան	Նախարար	ՀՀ տնտեսական զարգացման և ներդրումների նախարարություն
ստորև անունները ներկայացված են հայկական այբուբենական կարգով		
Աշոտ Ասլանյան	Քարտուղար	ՀՀ Նախագահին առընթեր Հայաստանի իրավազորություն խորհուրդ
Արևիկ Սարգսյան	Դոցենտ	Հայաստանի Ազգային Պոլիտեխնիկական Համալսարան (ՀԱՊՀ)
Էմիլ Տարասյան	Փոխնախարար	ՀՀ տնտեսական զարգացման և ներդրումների նախարարություն
Լեոնիդ Գուրվից	Բաժնի ղեկավար	Եվրոպական հետազոտական կոնսորցիումի գերերկար բազաներով ռադիոինտերֆերոմետրիայի ինստիտուտ
Կարինե Դարբինյան	Գործառնական տնօրեն (COO)	«Հայաստանի իրավազորություն» հիմնադրամ

Attendance

Name	Position	Affiliation
Suren Karayan	Minister	Ministry of Economic Development and Investments of RA
names below are listed in a latin alphabetical way		
Arevik Sargsyan	Associate Professor	National Polytechnic University of Armenia (NPUA)
Ashot Aslanyan	Secretary	Jurisdiction Armenia Board adjunct to the President of RA
Emil Tarasyan	Deputy Minister	Ministry of Economic Development and Investments of RA
Karine Darbinyan	Chief Operating Officer (COO)	"Jurisdiction Armenia" Foundation
Leonid Gurvits	Head of Department	Joint Institute for VLBI ERIC

Հանդիպումը կազմակերպված է ՀՀ տնտեսական զարգացման և ներդրումների նախարարությունում **«Հայաստանի իրավազորություն» հիմնադրամի և Եվրոպական հետազոտական կոնսորցիումի գերերկար բազաներով ռադիոինտերֆերոմետրիայի ինստիտուտի (VLBI ERIC (JIVE))** մասնակցությամբ՝ համաձայն Չափագիտության ազգային ինստիտուտի (ՉԱԻ) Արագածի գիտական կենտրոնում տեղադրված ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի վերազինման և բարելավման վերաբերյալ նախնական խորհրդատվությունների: Սարքավորման մասնագիրը 2017 թ-ի դեկտեմբեր ամսին տրամադրվել է JIVE-ին Արևիկ Սարգսյանի կողմից՝ Եվրոպական VLBI ցանցի (EVN) տեխնիկական և

The meeting was organised at the Ministry of Economic Development and Investments of RA by the **"Jurisdiction Armenia" Foundation** and **Joint Institute for VLBI ERIC (JIVE)** after preliminary consultations on the reconstruction and development of the radio-optical telescope ROT-54/2.6 of located at Aragats Scientific Center of National Institute of Metrology. The specification of the facility have been provided by Arevik Sargsyan to JIVE in December 2017 for evaluation involving the European VLBI Network (EVN) Technical and Operations Group (TOG).

շահագործման խմբի (TOG) ներգրավմամբ գնահատում կատարելու նպատակով:

Հանդիպման նպատակն է ուսումնասիրել ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի և տեղանքի վիճակը, նախագծել և կազմակերպել հետագա համատեղ աշխատանքներ՝ ուղղված ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի EVN ռադիոինտերֆերոմետրական միջազգային ցանցի համադրելիությանը հասնելուն:

The aim of the meeting was to inspect the current state of the ROT-54/2.6 facility and of the site, and to design and organize further joint work in achieving by the ROT-54/2.6 technical capabilities compatible with the EVN operations.

2018թ-ի մարտի 7-ին Հայաստանի Ազգային Պոլիտեխնիկական Համալսարանում Լեոնիդ Գուրվիցի կողմից ներկայացվել է պրեզենտացիա՝ նվիրված EVN-ին և JIVE-ին: Նույն օրը տեղազննման նպատակով հանդիպման մասնակիցները այցելել էին ՌՕԴ-54/2.6-ի տեղանքը:

Leonid Gurvits gave a presentation on the EVN and JIVE at the National Polytechnic University of Armenia on 7 March 2018. On the same day, a group of the meeting's participants visited the ROT-54/2.6 site for an in situ inspection.

Տնտեսական զարգացման և ներդրումների նախարարությունը հաստատում է ազգային նախագիծ նախաձեռնելու մտադրությունը: Կողմերը նպատակ ունեն հասնել ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի EVN ռադիոինտերֆերոմետրական միջազգային ցանցի համադրելիությանը: Մասնավորապես, նրանք ընդգծեցին՝

- վերազինել ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակը և հասցնել դրա մակարդակը միջազգայինի՝ գերերկար բազայով ինտերֆերոմետրերում (VLBI) ռադիոաստղագիտական համատեղ կիրառման նպատակների համար EVN՝ համաձայն այն ցուցանիշների, որոնք կմշակվեն հայկական կողմի և EVN-JIVE-ի ներկայացուցիչների կողմից համատեղ;
- հիմնել Հերունու Կենտրոն;
- ցուցաբերել և ստանալ ՌՕԴ-54/2.6- վերազինման ծրագրի շուրջ աջակցություն JIVE և EVN TOG-ի կողմից խորհրդատվության տեսքով;
- ցուցաբերել և ստանալ աջակցություն Հայաստանում EVN նախաձեռնողների խումբ ստեղծելու համար;
- ցուցաբերել և ստանալ աջակցություն ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի EVN ռադիոինտերֆերոմետրական միջազգային ցանցի համադրելիության գործընթացի շրջանակներում անձնակազմի վերապատրաստման համար:

The representatives of the Ministry of the Economic Development and Investments confirmed the intention to undertake a national project. The parties are aiming to achieve operational compatibility of the ROT-54/2.6 facility with the EVN. In particular, they stressed their intention to:

- reconstruct the ROT-54/2.6 to the level compatible with joint radio astronomy (Very Long Baseline Interferometry, VLBI) operations with the EVN based on the specifications worked out jointly with the representatives of EVN and JIVE;
- establish Herouni Center;
- render and obtain assistance in a form of consultancy on the ROT-54/2.6 reconstruction project from JIVE and/or EVN TOG;
- render and get assistance in establishing a seed EVN user group in Armenia;
- render and get assistance in training of personnel which will be involved in EVN-compatible operations of the ROT-54/2.6 facility.

Լեոնիդ Գուրվիցը հանդիպման մասնակիցներին փոխանցեց EVN-ի և JIVE-ի բարձր հետաքրքրվածությունը ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի հետ կապված վերոնշյալ նպատակներին հասնելու հարցում: Մասնավորապես, նա ընդգծեց JIVE-ի պատրաստակամությունը

- ապահովել վերոնշյալ նախագծում միջազգային խորհրդատվության կազմակերպումը;
- հիմնվելով վերջին 5 տարիների ընթացքում EVN-ին միացած աստղադիտարաններում նմանատիպ

Leonid Gurvits conveyed to the participants of the meeting the high interest of the EVN and JIVE in achieving the goals of the ROT-54/2.6 as described above. In particular, he stressed the JIVE's readiness to:

- assist in organising international consultancy to the project described above;
- assist in evaluating the cost of the project-related VLBI-specific instrumentation

ձեռնարկումների փորձի վրա և (կամ) EC H-2020-ի JUMPING JIVE նախագծի փաթեթների շրջանակներում համապատասխան աշխատանքի համատեղ գործողությունների օբյեկտ հանդիսացող հեռանկարային նոր EVN-սարքավորումների նմանատիպ ձեռնարկումների փորձի վրա աջակցել նախագծի VLBI-ին հատուկ գործիքավորման ներդրման ծախսերի գնահատման գործընթացում;

- աջակցել EVN TOG և EVN Կոնսորցիումի Տնօրենների խորհրդի (EVN Consortium Board of Directors (CBD)) համաձայնությամբ գնահատելու ՌՕԴ-54/2.6 սարքավորման՝ վերը ներկայացված ծրագրի իրականացումից հետո ի հայտ եկող գործառնական ծախսերը;
- ապահովել EVN-ի ենթակառուցվածքի օժանդակությունը եւ հասանելիությունը՝ EVN-ի կողմից ստեղծված գործառնական մեխանիզմների եւ պրակտիկաների միջոցով:

investment based on the experience of similar undertakings at observatories that have joined EVN over the past 5 years and/or prospective new EVN facilities-subjects of the joint activities under relevant work packages of the EC H-2020 JUMPING JIVE project;

- assist in evaluating in concurrence with the EVN TOG and EVN Consortium Board of Directors (CBD) the operational cost of the ROT-54/2.6 facility after completion of the project described above;
- provide support and access to the EVN observational infrastructure through the operational mechanisms and practices established by the EVN.

Հանդիպման մասնակիցները համաձայնել են ընդունել որպես ելակետային արժեքներ և ծրագրի ներդրման գնահատման մեկնարկային կետ 500 000 եվրոյից ոչ բարձր շեմը:

The meeting's participants agreed to accept as benchmark values and a starting-point of the evaluation of the project investment at the level of up to 500 kEuro.

Լեոնիդ Գուրվիցը նշեց, որ սովորաբար ռադիոաստղադիտակի տարեկան շահագործման ծախսն իր գործողության առաջին տասնամյակում որպես կանոն կազմում է սարքավորման մեջ ընդհանուր կապիտալ ներդրման արժեքի 10%-ը:

Leonid Gurvits noted that a "rule of tomb" for annual operational cost of a radio astronomy facility during the first decade of its operations is at the level of 10% of the total capital investment cost of the facility.

Այնուամենայնիվ, նա զգուշացրեց, որ սա ոչ ավելին է, քան նախագնահատում. փաստացի արժեքը պետք է հիմնված լինի օբյեկտի փաստացի գնահատման վրա և կարող է տատանվել երկու ուղղություններով:

However, he warned that this is no more than an estimate; the actual value should be based on factual assessment of the facility and might vary in both directions.

Լեոնիդ Գուրվիցն ընդգծեց, որ VLBI- ի օպերացիոն համակարգի ստեղծման փորձը անխուսափելիորեն հանգեցնում է ազգային բազմամասնագիտական գիտության և կրթական գործունեության զարգացման համար բարենպաստ միջավայր ստեղծելուն՝ ֆունդամենտալ աստղաֆիզիկայից մինչև մոլորակային գիտություն և տիեզերական հետազոտությունից մինչև ՏՏ, էլեկտրոնիկայի, բնապահպանական ուսումնասիրությունների բնագավառներում համապատասխան տեխնոլոգիական ձեռքբերումների, և այլն:

Leonid Gurvits stressed that the experience of establishing an operational VLBI facility invariably leads to creating a favourable environment for development of national multi-disciplinary science and educational activities ranging from fundamental astrophysics to planetary science and space exploration to relevant technology spin-offs in IT, electronics, environmental studies, etc.

Հետագա գործողություններ՝

1) Մինչև 2018թ-ի ապրիլի 1-ը Արևիկ Սարգսյանը JIVE-ի միջոցով տրամադրի EVN CBD-ին փոփոխված փաստաթուղթը, որը նկարագրում է ՌՕԴ-54/2.6

Action items:

1). Arevik Sargsyan to provide to EVN CBD via JIVE the modified document describing the current state of the ROT-54/2.6 facility by 1

սարքավորման ընթացիկ վիճակը:

April, 2018.

2) JIVE-ը (Լեոնիդ Գուրվիցը) 2018թ-ի մայիս ամսին կայանալիք EVN CBD հաջորդ հանդիպմանը ներկայացնի «Հայաստանի իրավազորություն» հիմնադրամի հարցումը՝ արծարծելով ծրագրի իրականացման վերոնշյալ կետերը:

2). JIVE (Leonid Gurvits) to present to the next EVN CBD meeting in May 2018 a request of the "Jurisdiction Armenia" Foundation for addressing project implementation items described above.

3) Հետագա հանդիպումներ, կոնտակտներ, տեղեկատվության փոխանակում, և այլն:

3). Further meetings, contacts, exchange of information, etc.

Հայաստանի Հանրապետության Տնտեսական զարգացման և ներդրումների նախարարություն
«Հայաստանի իրավազորություն»

For the Ministry of the Economic Development and Investments of the Republic of Armenia
"Jurisdiction Armenia" Foundation

Աշոտ Ասլանյան, տնօրեն
By Ashot Aslanyan, CEO

Ամսաթիվ՝ 2018թ-ի մարտի 7

Date: 2018.03.7

Եվրոպական հետազոտական կոնսորցիումի ռադիոինտերֆերոմետրիայի համաեվրոպական ինստիտուտ – JIVE

For Joint Institute for VLBI ERIC - JIVE

Լեոնիդ Գուրվից, բաժնի ղեկավար
By Leonid Gurvits, Head of Department

Վայր՝ Երևան, ՀՀ

Place: Yerevan, Armenia

Date April 13th, 2018
Our reference PV/18.0005
Contact person Prof.dr.ir. P.N.A.M. Visser
Telephone/fax +31 (0)15 272595
E-mail p.n.a.m.visser@tudelft.nl
Subject radio-optical telescope ROT-54/2.6

TU Delft
Delft University of Technology

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Dear Mr. Aslanyan,

It gives me great pleasure to express our support to the developments related to the scientific and technological legacy of Academician Paris Herouni. In particular, we are very encouraged by the intention to resurrect the radio-optical telescope ROT-54/2.6. As we have learned recently, there is intention to establish a new entity, the Herouni Center as a research and educational organization. We find this intention timely and very promising. Based on the information made available to Prof. Leonid Gurvits during his recent visit in Armenia, the ROT-54/2.6 facility is in the state that makes its upgrade to an operational state very feasible, especially its radio segment. Such the operational facility with a 54-m radio reflector could play an important role in advanced radio astronomy studies, in Very Long Baseline Interferometry (VLBI) regime in particular. The near-field modification of VLBI known as Planetary Radio Interferometry and Doppler Experiment (PRIDE) would benefit significantly from involvement of ROT-54/2.6 in VLBI observations in the interests of planetary and space science.

I would like to also stress the educational potential of the ROT-54/2.6 facility. Space science and astronomy are among most fascinating and attractive science disciplines for young people. A modern operational facility offering unique opportunities in both radio and optical domains of the spectrum would serve as a very efficient seed for developing creativity spreading above and beyond the immediate area of astronomy and space science research. It will be a natural advanced addition to the well established in Armenia and accomplished educational facilities, such as the Ayb Educational Foundation and Tumo Center for Creative Technologies.

I would like to wish every success in establishing the Herouni Center and upgrading the ROT-54/2.6 facility, and look forward for prospective collaborative opportunities in the near future.

Yours sincerely,

Prof.dr.ir. P.N.A.M. Visser
Head Astrodynamics & Space Missions

NATIONAL INSTRUMENTS

ՀՀ տնտեսական զարգացման և ներդրումների
Նախարարությունում
«Հայաստանի իրավազորություն» հիմնադրամ
հասցե՝ ՀՀ, ք. Երևան, Մհեր Մկրտչյան փողոց 5
շենք. 5-րդ հարկ, 515 աշխատասենյակ,

№ _____ 17 մայիսի 2018թ.

«Նեյշնլ Ինստրումենտս Էյէմ» ՍՊԸ-ն ի աջակցություն ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի վերազինման և բարելավման գաղափարի՝ դիտակի միջազգային համապատասխան գործիքազգի մակարդակին հասնելու և EVN ռադիոինտերֆերոմետրական միջազգային ցանցին համադրելիության նպատակով, հայտնում է իր պատրաստակամությունը կատարել հետևյալ գործողությունները.

- Տեխնիկական զննում;
- Խորհրդատվության տրամադրում;
- Այլ աջակցության և ներուժի տրամադրում ըստ անհրաժեշտության:

Համագործակցության ձևաչափը քննարկման և համաձայնեցման փուլում է:

«Նեյշնլ Ինսթրումենթս ԷՅԷՄ» ՍՊԸ

Ստորեն,
Արամ Սալաթյան

123 Hovsep Emin • Yerevan, 0051, Armenia
Tel: (+374-10) 21 97 10 • Fax: (+374-10) 21 97 82 • www.ni.com/armenia
www.ni.com

Memorandum of Understanding

This MOU is made with effect on May 17th, 2018 in Armenia and entered into between:

Acronis International GmbH, a limited liability company (Gesellschaft mit beschränkter Haftung) organized and existing under the laws of Switzerland with its registered office in Neuhausen am Rheinfall, with its domicile at Rheinweg 9, 8200 Schaffhausen, Switzerland, registered under company number CHE-113.666.835 (hereinafter to as "Acronis")

and

"JURISDICTION ARMENIA" FOUNDATION, a company duly incorporated under the laws of Republic of Armenia, whose registered office is at 5 Mher Mkrtchyan str., Ministry of economic development and investments of RA, 514-517 offices (hereinafter to as "JA Foundation"),

Acronis and JA Foundation are each hereinafter also referred to as the "Party" and, collectively, as the "Parties".

WHEREAS, Acronis is a leading backup software, disaster recovery, and secure data access provider to consumers, small-medium businesses, and enterprises. Acronis solutions include physical, virtual, and cloud server backup software, software-defined storage, secure file sharing, and system deployment. Powered by the Acronis AnyData Engine, Acronis products provide easy, complete, and safe solutions for data in local, remote, cloud, and mobile devices.

WHEREAS, JA Foundation specialized in strengthening of economic relations between Switzerland and Armenia and in attracting investments in the development of high-technology sectors of the Armenian economy.

WHEREAS, the Parties hereto desire to line up some key activity principles and procedures for the performance of such joint activities,

NOW THEREFORE, the Parties make the following declarations of their intentions with respect to the Herouni's Radiotelescope project:

Section 1 - Purpose of the MOU

To point up the mutual interest in joint project in high technology sector, specifically in the sphere of ICT, on the basis of a separate specialized legal entity (Herouni Space Center) in Armenia ("Space Center Entity").

Section 2 – Roles and commitments of the Parties

JA Foundation intends to initiate the process of establishing of a separate specialized legal entity (Herouni Space Center) in Armenia.

Subject to a separate agreement to be executed by the Parties, **Acronis** intends to invest in the Herouni's Radiotelescope investment project (hereinafter "Project") as follows:

a. For up to ten (10) years Acronis will provide a software-defined cloud storage solution with a storage limit of up to two (2) TB per day valued at approximately Ten Million USD ($10,000,000.00);
b. Acronis may invest in the infrastructure required for the implementation of the Project; and
c. Acronis' investment in the Project may be conditioned on the JA Foundation or Space Center Entity making a certain independent investment in the Project, or purchasing certain support and maintenance services from Acronis, or buying certain professional services from Acronis, or making payments for Acronis' software defined cloud storage solution, or any combination of the foregoing.

The Partners acknowledge that notwithstanding anything to the contrary no contractual relationship is created between them by this Memorandum. The Parties intend to work together in the true spirit of partnership to ensure that there is a united visible and responsive leadership of the Project and to demonstrate financial, administrative and managerial commitment to the Project.

Section 3 – Exclusivity on Project Basis

Neither Party may assign or transfer the responsibilities or agreement made herein to any party other than the assignor's affiliates and subsidiaries without the prior written consent of the non-assigning Party, which approval shall not be unreasonably withheld.

Section 4 - Legal effect of

If any provision of this Memorandum is found to be invalid or unenforceable for any reason, the remaining provisions will continue to be valid and enforceable. If a court finds that any provision of this Memorandum is invalid or unenforceable, but that by limiting such provision it would become valid and enforceable, then such provision will be deemed to be written, construed, and enforced as so limited.

This Memorandum may be amended or supplemented in writing, if the writing is signed by the party obligated under this Memorandum.

This Memorandum constitutes the entire Memorandum between the parties relating to this subject matter and supersedes all prior or simultaneous representations, discussions, negotiations, and Memorandums, whether written or oral.

Section 5 - Development, Preparation, and Submission of proposals

It is mutually agreed upon and understood by and among the Partners of this Memorandum that:

a. To the extent determined by a separate written agreement between the Parties, Each Partner will work together in a coordinated fashion for the fulfillment of the Project.
b. To the extent determined by a separate written agreement between the Parties, each Partner will participate in the development of the Project.
c. Nothing in this Memorandum shall obligate any Partner to the transfer of funds. Any endeavor involving reimbursement or contribution of funds between the Partners of this Memorandum will be handled in accordance with applicable laws, regulations, and procedures. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the Partners involved and shall be independently authorized by appropriate statutory authority. This Memorandum does not provide such authority.
d. Notwithstanding anything to the contrary, this Memorandum is not intended to and does not create any right, benefit, or trust responsibility.
e. This Memorandum will be effective upon the signature of both Partners.
f. Any Partner may terminate its participation in this Memorandum without liability by providing written notice to other Partner.

Section 6 - Negotiation of contracts

After the pre-initial phase of the preparation and the preliminary design of the Project, negotiations on the contract are expected to be started.

Section 7 - Proprietary Information - Confidentiality

In order to ensure the most favorable conditions for the implementation of the joint Project, the Parties are determined to conclude a separate Non-Disclosure Agreement (NDA) in accordance with the established procedure.

The Parties undertake to respect the confidentiality of all information transmitted as confidential information or as information that in nature should be considered confidential.

Section 8 - Term and Termination/Extension

The arrangements made by the Partners by this Memorandum shall remain in place from May 14, 2018 until May 14, 2028. The term can be extended only by agreement of all of the Partners.

Section 9 - Representations and Warranties

Contact person on behalf of Acronis
Name: Robert Schlegel
Title: Director of strategic project and operation
Address: 3, Dolgoprudnenskoe sh., PhystechPark, Moscow, Russia
Phone: +7 (495) 648-1427, (075376)
Email: rob@acronis.com

Contact person on behalf of "JURISDICTION ARMENIA" FOUNDATION
Name: Karine Darbinyan
Title: Chief operating officer (COO)
Address: 5a, Mher Mkrtchyan str., 5th floor, 514-517 offices, building of Ministry of economic development and investment of RA
Phone: +374 (11) 597 160
Email: k.darbinyan@jurisdiction.am or info@ jurisdiction.am

The Parties undertake not to disclose any information relating to the provisions of this Agreement without the prior consent of the other Party, unless such disclosure is required by virtue of the requirement of the applicable law or judicial decision, as well as the disclosure of confidential information to the subsidiaries and affiliates of the Parties.

The Parties take into account the sovereignty of the national law of each of the Parties and act in accordance with the applicable jurisdiction in the specific territory for the implementation of projects arising from this Agreement.

Section 10 - Limitation of Liability

Notwithstanding anything to the contrary, no liability will arise or be assumed between the Partners as a result of this Memorandum.

Section 11 - Governing Law

This Memorandum shall be construed in accordance with the laws of the Republic of Armenia.

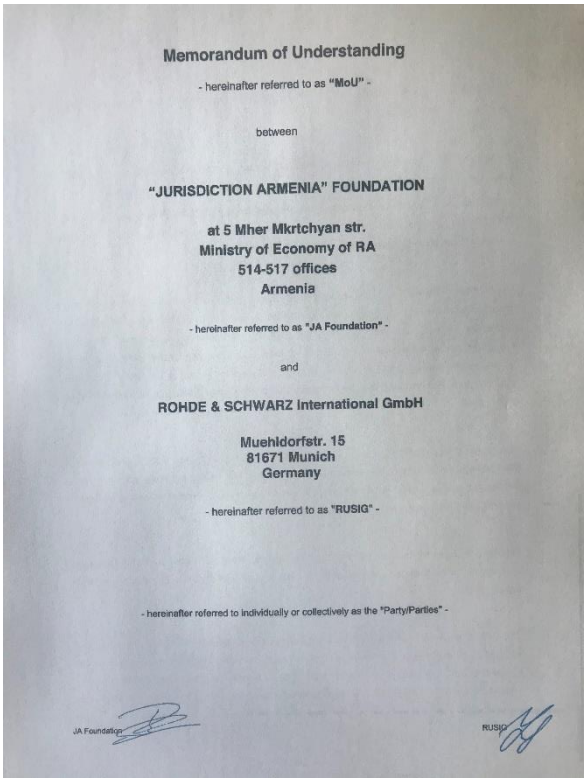
Section 12 - Notices

Any notice or communication required or permitted under this Memorandum shall be sufficiently given if delivered in person or by certified mail, return receipt requested, to the address set forth in the opening paragraph or to such other address as one party may have furnished to the other in writing.

IN WITNESS WHEREOF, the Parties hereto have, through their duly authorized representatives, executed this MOU effective as of the date indicated on the first page.

Acronis International GmbH
Signature: _____
Printed: SERGUEI BELOUSSOV
Title: Director
Date: May 17th, 2018

"JURISDICTION ARMENIA" FOUNDATION
Signature: _____
Printed: ASHOT ASLANYAN
Title: Executive director
Date: May 17th, 2018



Memorandum of Understanding

- hereinafter referred to as **"MoU"** -

between

"JURISDICTION ARMENIA" FOUNDATION

at 5 Mher Mkrtchyan str.
Ministry of Economy of RA
514-517 offices
Armenia

- hereinafter referred to as **"JA Foundation"** -

and

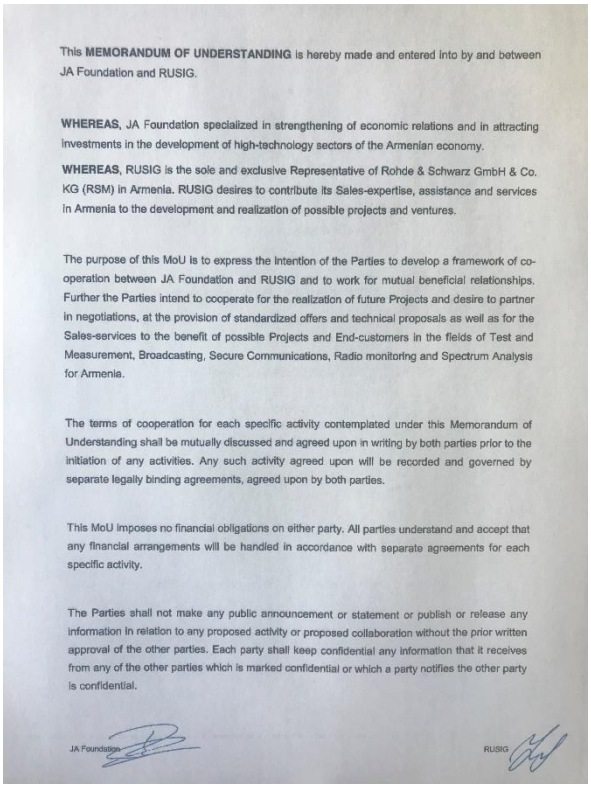
ROHDE & SCHWARZ International GmbH

Muehldorfstr. 15
81671 Munich
Germany

- hereinafter referred to as **"RUSIG"** -

- hereinafter referred to individually or collectively as the "Party/Parties" -

JA Foundation RUSIG



This **MEMORANDUM OF UNDERSTANDING** is hereby made and entered into by and between JA Foundation and RUSIG.

WHEREAS, JA Foundation specialized in strengthening of economic relations and in attracting investments in the development of high-technology sectors of the Armenian economy.

WHEREAS, RUSIG is the sole and exclusive Representative of Rohde & Schwarz GmbH & Co. KG (RSM) in Armenia. RUSIG desires to contribute its Sales-expertise, assistance and services in Armenia to the development and realization of possible projects and ventures.

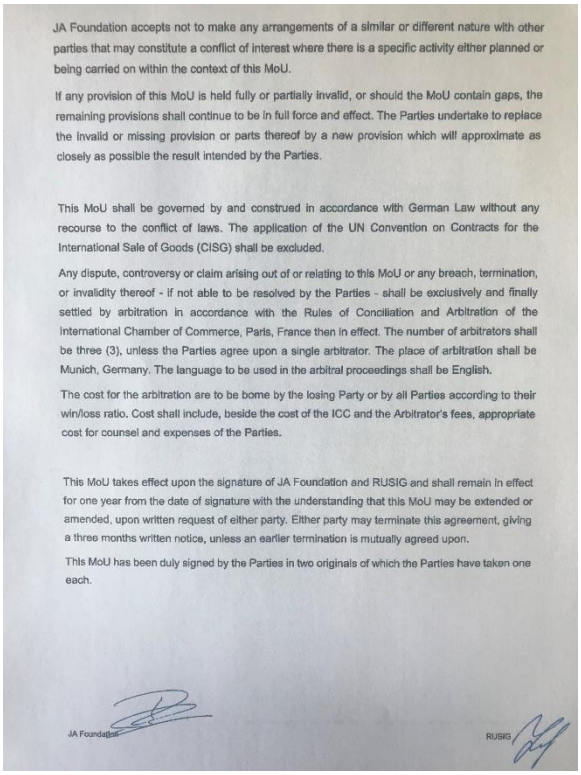
The purpose of this MoU is to express the intention of the Parties to develop a framework of co-operation between JA Foundation and RUSIG and to work for mutual beneficial relationships. Further the Parties intend to cooperate for the realization of future Projects and desire to partner in negotiations, at the provision of standardized offers and technical proposals as well as for the Sales-services to the benefit of possible Projects and End-customers in the fields of Test and Measurement, Broadcasting, Secure Communications, Radio monitoring and Spectrum Analysis for Armenia.

The terms of cooperation for each specific activity contemplated under this Memorandum of Understanding shall be mutually discussed and agreed upon in writing by both parties prior to the initiation of any activities. Any such activity agreed upon will be recorded and governed by separate legally binding agreements, agreed upon by both parties.

This MoU imposes no financial obligations on either party. All parties understand and accept that any financial arrangements will be handled in accordance with separate agreements for each specific activity.

The Parties shall not make any public announcement or statement or publish or release any information in relation to any proposed activity or proposed collaboration without the prior written approval of the other parties. Each party shall keep confidential any information that it receives from any of the other parties which is marked confidential or which a party notifies the other party is confidential.

JA Foundation RUSIG



JA Foundation accepts not to make any arrangements of a similar or different nature with other parties that may constitute a conflict of interest where there is a specific activity either planned or being carried on within the context of this MoU.

If any provision of this MoU is held fully or partially invalid, or should the MoU contain gaps, the remaining provisions shall continue to be in full force and effect. The Parties undertake to replace the invalid or missing provision or parts thereof by a new provision which will approximate as closely as possible the result intended by the Parties.

This MoU shall be governed by and construed in accordance with German Law without any recourse to the conflict of laws. The application of the UN Convention on Contracts for the International Sale of Goods (CISG) shall be excluded.

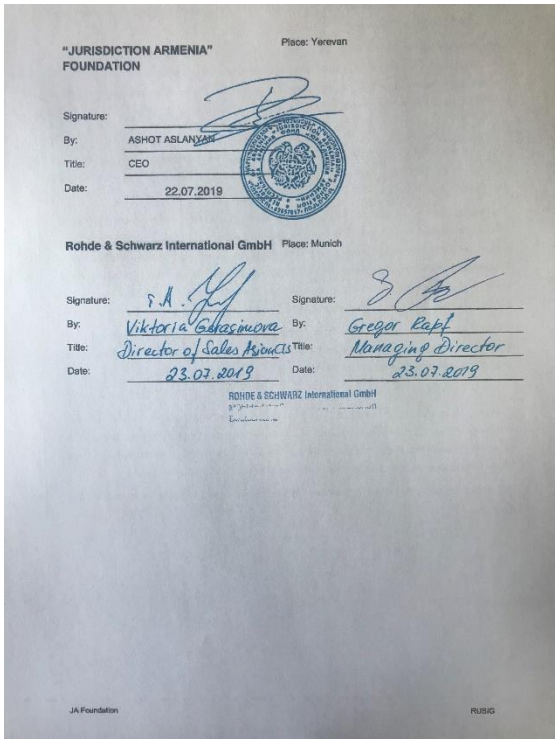
Any dispute, controversy or claim arising out of or relating to this MoU or any breach, termination, or invalidity thereof - if not able to be resolved by the Parties - shall be exclusively and finally settled by arbitration in accordance with the Rules of Conciliation and Arbitration of the International Chamber of Commerce, Paris, France then in effect. The number of arbitrators shall be three (3), unless the Parties agree upon a single arbitrator. The place of arbitration shall be Munich, Germany. The language to be used in the arbitral proceedings shall be English.

The cost for the arbitration are to be borne by the losing Party or by all Parties according to their win/loss ratio. Cost shall include, beside the cost of the ICC and the Arbitrator's fees, appropriate cost for counsel and expenses of the Parties.

This MoU takes effect upon the signature of JA Foundation and RUSIG and shall remain in effect for one year from the date of signature with the understanding that this MoU may be extended or amended, upon written request of either party. Either party may terminate this agreement, giving a three months written notice, unless an earlier termination is mutually agreed upon.

This MoU has been duly signed by the Parties in two originals of which the Parties have taken one each.

JA Foundation RUSIG



"JURISDICTION ARMENIA" FOUNDATION Place: Yerevan

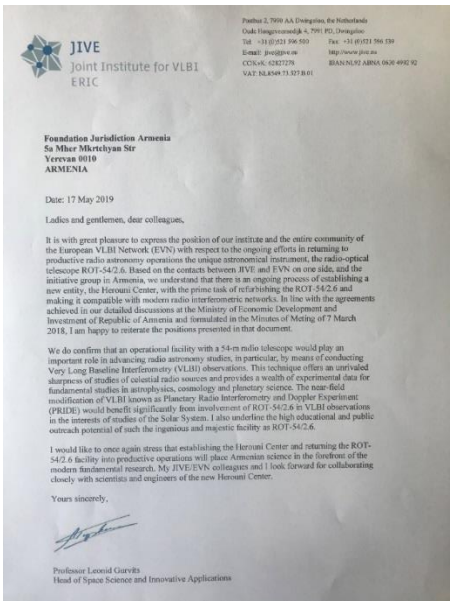
Signature:
By: ASHOT ASLANYAN
Title: CEO
Date: 22.07.2019

Rohde & Schwarz International GmbH Place: Munich

Signature:	p.A.	
By:	Viktoria Gekasimova	Gregor Rapf
Title:	Director of Sales Services	Managing Director
Date:	23.07.2019	23.07.2019

ROHDE & SCHWARZ International GmbH

JA Foundation RUSIG



JIVE
Joint Institute for VLBI ERIC

Foundation Jurisdiction Armenia
Sa Mher Mkrtchyan Str
Yerevan 0010
ARMENIA

Date: 17 May 2019

Ladies and gentlemen, dear colleagues,

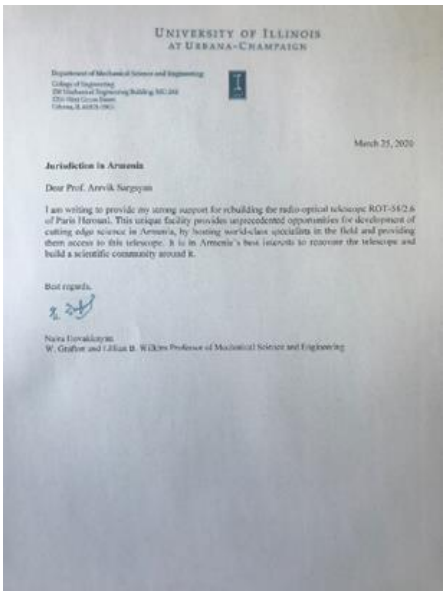
It is with great pleasure to express the position of our institute and the entire community of the European VLBI Network (EVN) with respect to the ongoing efforts in returning to productive radio astronomy operations the unique astronomical instrument, the radio-optical telescope ROT-54/2.6. Based on the contacts between JIVE and EVN on one side, and the initiative group in Armenia, we understand that there is an ongoing process of establishing a new entity, the Herouni Center, with the prime task of refurbishing the ROT-54/2.6 and making it compatible with modern radio interferometric networks. In line with the agreements achieved in our detailed discussions at the Ministry of Economic Development and Investment of Republic of Armenia and formulated in the Minutes of Meting of 7 March 2018, I am happy to reiterate the positions presented in that document.

We do confirm that an operational facility with a 54-m radio telescope would play an important role in advancing radio astronomy studies, in particular, by means of conducting Very Long Baseline Interferometry (VLBI) observations. This technique offers an unrivaled sharpness of studies of celestial radio sources and provides a wealth of experimental data for fundamental studies in astrophysics, cosmology and planetary science. The near-field modification of VLBI known as Planetary Radio Interferometry and Doppler Experiment (PRIDE) would benefit significantly from involvement of ROT-54/2.6 in VLBI observations in the interests of studies of the Solar System. I also underline the high educational and public outreach potential of such the ingenious and majestic facility as ROT-54/2.6.

I would like to once again stress that establishing the Herouni Center and returning the ROT-54/2.6 facility into productive operations will place Armenian science in the forefront of the modern fundamental research. My JIVE/EVN colleagues and I look forward for collaborating closely with scientists and engineers of the new Herouni Center.

Yours sincerely,

Professor Leonid Gurvits
Head of Space Science and Innovative Applications



UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

March 25, 2020

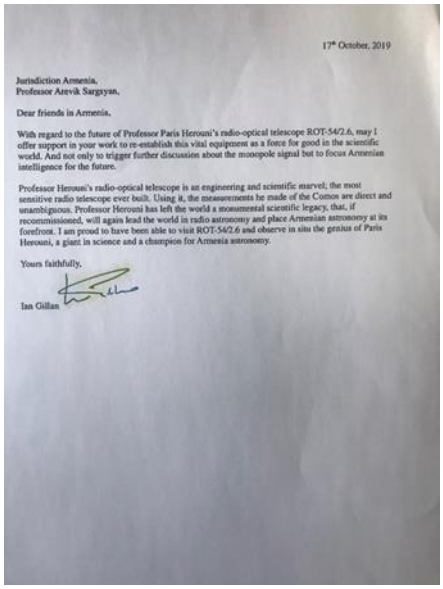
Jurisdiction in Armenia

Dear Prof. Arevik Sargsyan

I am writing to provide my strong support for rebuilding the radio-optical telescope ROT-54/2.6 of Paris Herouni. This unique facility provides unprecedented opportunities for development of cutting edge science in Armenia, by hosting world-class specialists in the field and providing them access to this telescope. It is in Armenia's best interests to renovate the telescope and build a scientific community around it.

Best regards,

Naira Hovakimyan
W. Grafton and Lillian B. Wilkins Professor of Mechanical Science and Engineering



17th October, 2019

Jurisdiction Armenia,
Professor Arevik Sargsyan,

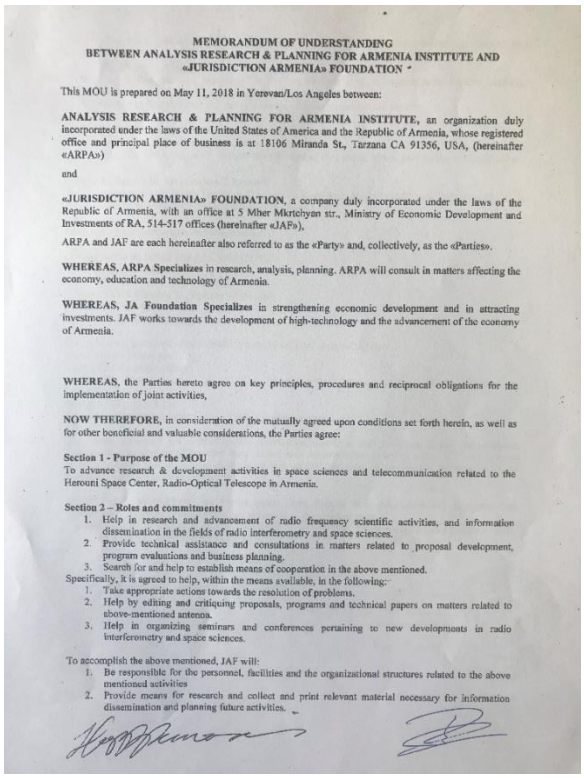
Dear friends in Armenia,

With regard to the future of Professor Paris Herouni's radio-optical telescope ROT-54/2.6, may I offer support in your work to re-establish this vital equipment as a force for good in the scientific world. And not only to trigger further discussion about the monopole signal but to focus Armenian intelligence for the future.

Professor Herouni's radio-optical telescope is an engineering and scientific marvel; the most sensitive radio telescope ever built. Using it, the measurements he made of the Cosmos are direct and unambiguous. Professor Herouni has left the world a monumental scientific legacy, that, if recommissioned, will again lead the world in radio astronomy and place Armenian astronomy at its forefront. I am proud to have been able to visit ROT-54/2.6 and observe in situ the genius of Paris Herouni, a giant in science and a champion for Armenia astronomy.

Yours faithfully,

Ian Gillan



MEMORANDUM OF UNDERSTANDING
BETWEEN ANALYSIS RESEARCH & PLANNING FOR ARMENIA INSTITUTE AND «JURISDICTION ARMENIA» FOUNDATION

This MOU is prepared on May 11, 2018 in Yerevan/Los Angeles between:

ANALYSIS RESEARCH & PLANNING FOR ARMENIA INSTITUTE, an organization duly incorporated under the laws of the United States of America and the Republic of Armenia, whose registered office and principal place of business is at 18106 Miranda St., Tarzana CA 91356, USA, (hereinafter «ARPA»)

and

«JURISDICTION ARMENIA» FOUNDATION, a company duly incorporated under the laws of the Republic of Armenia, with an office at 5 Mher Mkrtchyan str., Ministry of Economic Development and Investments of RA, 514-517 offices (hereinafter «JAF»),

ARPA and JAF are each hereinafter also referred to as the «Party» and, collectively, as the «Parties».

WHEREAS, ARPA Specializes in research, analysis, planning. ARPA will consult in matters affecting the economy, education and technology of Armenia.

WHEREAS, JA Foundation Specializes in strengthening economic development and in attracting investments. JAF works towards the development of high-technology and the advancement of the economy of Armenia.

WHEREAS, the Parties hereto agree on key principles, procedures and reciprocal obligations for the implementation of joint activities,

NOW THEREFORE, in consideration of the mutually agreed upon conditions set forth herein, as well as for other beneficial and valuable considerations, the Parties agree:

Section 1 - Purpose of the MOU
To advance research & development activities in space sciences and telecommunication related to the Herouni Space Center, Radio-Optical Telescope in Armenia.

Section 2 – Roles and commitments

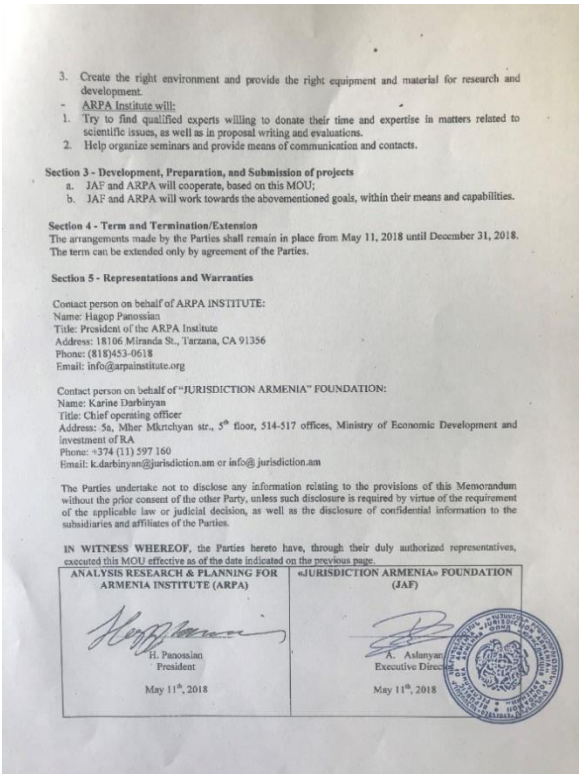
1. Help in research and advancement of radio frequency scientific activities, and information dissemination in the fields of radio interferometry and space sciences.
2. Provide technical assistance and consultations in matters related to proposal development, program evaluations and business planning.
3. Search for and help to establish means of cooperation in the above mentioned.

Specifically, it is agreed to help, within the means available, in the following:

1. Take appropriate actions towards the resolution of problems.
2. Help by editing and critiquing proposals, programs and technical papers on matters related to above-mentioned antenna.
3. Help in organizing seminars and conferences pertaining to new developments in radio interferometry and space sciences.

To accomplish the above mentioned, JAF will:

1. Be responsible for the personnel, facilities and the organizational structures related to the above mentioned activities
2. Provide means for research and collect and print relevant material necessary for information dissemination and planning future activities.



3. Create the right environment and provide the right equipment and material for research and development.

ARPA Institute will:

1. Try to find qualified experts willing to donate their time and expertise in matters related to scientific issues, as well as in proposal writing and evaluations.
2. Help organize seminars and provide means of communication and contacts.

Section 3 - Development, Preparation, and Submission of projects

a. JAF and ARPA will cooperate, based on this MOU;
b. JAF and ARPA will work towards the abovementioned goals, within their means and capabilities.

Section 4 - Term and Termination/Extension
The arrangements made by the Parties shall remain in place from May 11, 2018 until December 31, 2018. The term can be extended only by agreement of the Parties.

Section 5 - Representations and Warranties

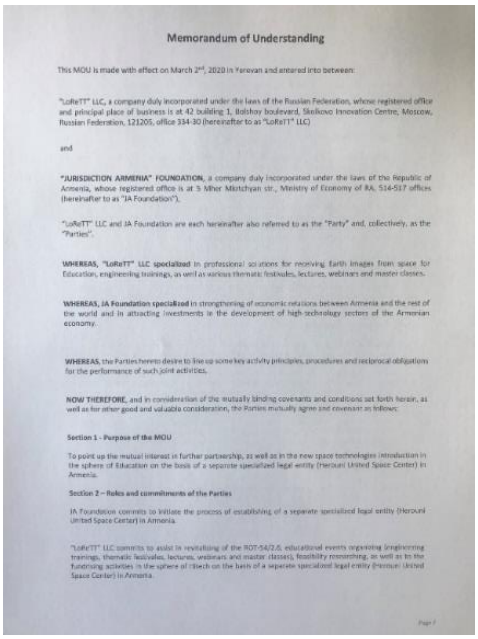
Contact person on behalf of ARPA INSTITUTE:
Name: Hagop Panossian
Title: President of the ARPA Institute
Address: 18106 Miranda St., Tarzana, CA 91356
Phone: (818)453-0618
Email: info@arpainstitute.org

Contact person on behalf of "JURISDICTION ARMENIA" FOUNDATION:
Name: Karine Darbinyan
Title: Chief operating officer
Address: 5a, Mher Mkrtchyan str., 5th floor, 514-517 offices, Ministry of Economic Development and Investment of RA
Phone: +374 (11) 597 160
Email: k.darbinyan@jurisdiction.am or info@ jurisdiction.am

The Parties undertake not to disclose any information relating to the provisions of this Memorandum without the prior consent of the other Party, unless such disclosure is required by virtue of the requirement of the applicable law or judicial decision, as well as the disclosure of confidential information to the subsidiaries and affiliates of the Parties.

IN WITNESS WHEREOF, the Parties hereto have, through their duly authorized representatives, executed this MOU effective as of the date indicated on the previous page.

ANALYSIS RESEARCH & PLANNING FOR ARMENIA INSTITUTE (ARPA)	**«JURISDICTION ARMENIA» FOUNDATION (JAF)**
H. Panossian President May 11th, 2018	A. Aslanyan Executive Direc May 11th, 2018



Memorandum of Understanding

This MOU is made with effect on March 2nd, 2020 in Yerevan and entered into between:

"LoReTT" LLC, a company duly incorporated under the laws of the Russian Federation, whose registered office and principal place of business is at 42 building 1, Bolshoy boulevard, Skolkovo Innovation Centre, Moscow, Russian Federation, 121205, office 334-30 (hereinafter to as "LoReTT" LLC)

and

"JURISDICTION ARMENIA" FOUNDATION, a company duly incorporated under the laws of the Republic of Armenia, whose registered office is at 5 Mher Mkrtchyan str., Ministry of Economy of RA, 514-517 offices (hereinafter to as "JA Foundation").

"LoReTT" LLC and JA Foundation are each hereinafter also referred to as the "Party" and, collectively, as the "Parties".

WHEREAS, "LoReTT" LLC specialized in professional solutions for receiving Earth images from space for Education, engineering trainings, as well as various thematic festivales, lectures, webinars and master classes.

WHEREAS, JA Foundation specialized in strengthening of economic relations between Armenia and the rest of the world and in attracting investments in the development of high technology sectors of the Armenian economy.

WHEREAS, the Parties hereto desire to line up some key activity principles, procedures and reciprocal obligations for the performance of such joint activities.

NOW THEREFORE, and in consideration of the mutually binding covenants and conditions set forth herein, as well as for other good and valuable consideration, the Parties mutually agree and covenant as follows:

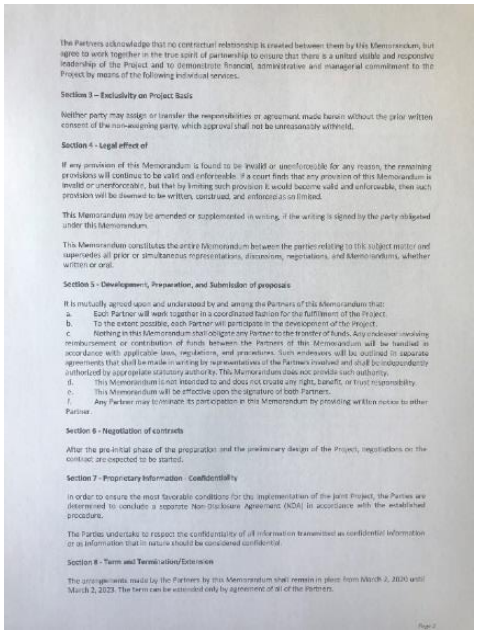
Section 1 - Purpose of the MOU

To point up the mutual interest in further partnership, as well as in the new space technologies introduction in the sphere of Education on the basis of a separate specialized legal entity (Hereuni United Space Center) in Armenia.

Section 2 – Roles and commitments of the Parties

JA Foundation commits to initiate the process of establishing of a separate specialized legal entity (Hereuni United Space Center) in Armenia.

"LoReTT" LLC commits to assist in revitalizing of the ROT-54/2.6 educational events organizing (engineering trainings, thematic festivales, lectures, webinars and master classes), feasibility researching, as well as to the fundraising activities in the sphere of Hitech on the basis of a separate specialized legal entity (Hereuni United Space Center) in Armenia.



The Partners acknowledge that no contractual relationship is created between them by this Memorandum, but agree to work together in the true spirit of partnership to ensure that there is a united visible and responsive leadership of the Project and to demonstrate financial, administrative and managerial commitment to the Project by means of the following individual services.

Section 3 – Exclusivity on Project Basis

Neither party may assign or transfer the responsibilities or agreement made herein without the prior written consent of the non-assigning party, which approval shall not be unreasonably withheld.

Section 4 - Legal effect of

If any provision of this Memorandum is found to be invalid or unenforceable for any reason, the remaining provisions will continue to be valid and enforceable. If a court finds that any provision of this Memorandum is invalid or unenforceable, but that by limiting such provision it would become valid and enforceable, then such provision will be deemed to be written, construed, and enforced as so limited.

This Memorandum may be amended or supplemented in writing, if the writing is signed by the party obligated under this Memorandum.

This Memorandum constitutes the entire Memorandum between the parties relating to this subject matter and supersedes all prior or simultaneous representations, discussions, negotiations, and Memorandums, whether written or oral.

Section 5 - Development, Preparation, and Submission of proposals

It is mutually agreed upon and understood by and among the Partners of this Memorandum that:

a. Each Partner will work together in a coordinated fashion for the fulfillment of the Project.
b. To the extent possible, each Partner will participate in the development of the Project.
c. Nothing in this Memorandum shall obligate any Partner to the transfer of funds. Any endeavor involving reimbursement or contribution of funds between the Partners of this Memorandum will be handled in accordance with applicable laws, regulations, and procedures. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the Partners involved and shall be independently authorized by appropriate statutory authority. This Memorandum does not provide such authority.
d. This Memorandum is not intended to and does not create any right, benefit, or trust responsibility.
e. This Memorandum will be effective upon the signature of both Partners.
f. Any Partner may terminate its participation in this Memorandum by providing written notice to other Partner.

Section 6 - Negotiation of contracts

After the pre-initial phase of the preparation and the preliminary design of the Project, negotiations on the contract are expected to be started.

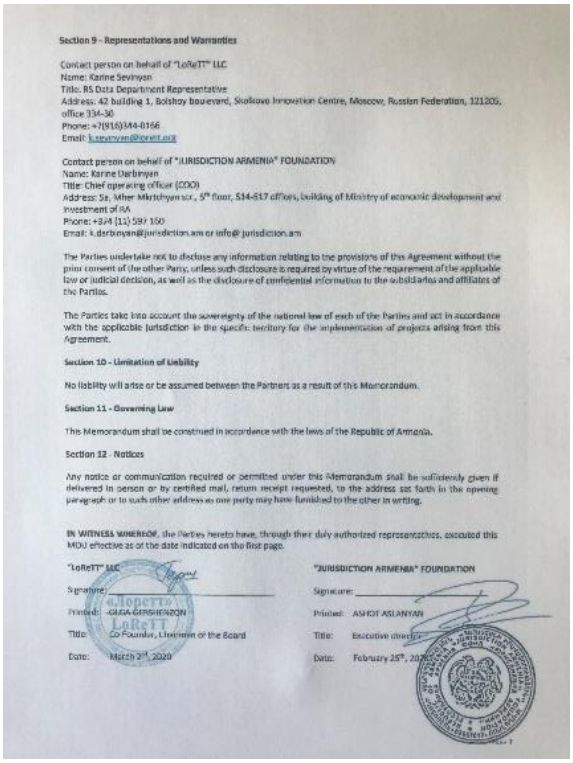
Section 7 - Proprietary Information - Confidentiality

In order to ensure the most favorable conditions for the implementation of the joint Project, the Parties are determined to conclude a separate Non-Disclosure Agreement (NDA) in accordance with the established procedure.

The Parties undertake to respect the confidentiality of all information transmitted as confidential information or as information that in nature should be considered confidential.

Section 8 - Term and Termination/Extension

The arrangements made by the Partners by this Memorandum shall remain in place from March 2, 2020 until March 2, 2023. The term can be extended only by agreement of all of the Partners.



Section 9 - Representations and Warranties

Contact person on behalf of "LoReTT" LLC
Name: Karine Sevinyan
Title: BS Data Department Representative
Address: 42 building 1, Bolshoy boulevard, Skolkovo Innovation Centre, Moscow, Russian Federation, 121205, office 334-30
Phone: +7(916)344-0166
Email: k.sevinyan@loretT.org

Contact person on behalf of "JURISDICTION ARMENIA" FOUNDATION
Name: Karine Darbinyan
Title: Chief operating officer (COO)
Address: 5a, Mher Mkrtchyan str., 5th floor, 514-517 offices, building of Ministry of economic development and investment of RA
Phone: +374 (11) 599 160
Email: k.darbinyan@jurisdiction.am or info@ jurisdiction.am

The Parties undertake not to disclose any information relating to the provisions of this Agreement without the prior consent of the other Party, unless such disclosure is required by virtue of the requirement of the applicable law or judicial decision, as well as the disclosure of confidential information to the subsidiaries and affiliates of the Parties.

The Parties take into account the sovereignty of the national law of each of the Parties and act in accordance with the applicable jurisdiction in the specific territory for the implementation of projects arising from this Agreement.

Section 10 - Limitation of Liability

No liability will arise or be assumed between the Partners as a result of this Memorandum.

Section 11 - Governing Law

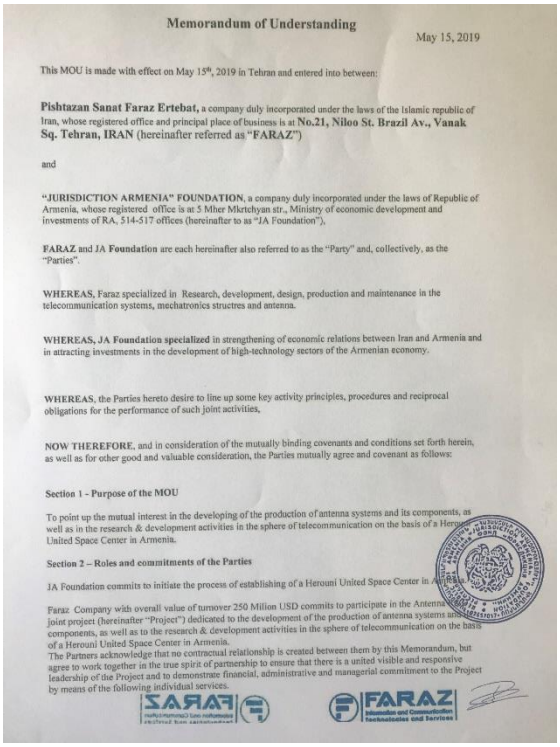
This Memorandum shall be construed in accordance with the laws of the Republic of Armenia.

Section 12 - Notices

Any notice or communication required or permitted under this Memorandum shall be sufficiently given if delivered in person or by certified mail, return receipt requested, to the address set forth in the opening paragraph or to such other address as one party may have furnished to the other in writing.

IN WITNESS WHEREOF, the Parties hereto have, through their duly authorized representatives, executed this MOU effective as of the date indicated on the first page.

"LoReTT" LLC	"JURISDICTION ARMENIA" FOUNDATION
Signature:	Signature:
Printed: GIGA GERSHENZON	Printed: ASHOT ASLANYAN
Title: Co-Founder, Chairman of the Board	Title: Executive director
Date: March 2nd, 2020	Date: February 25th, 2020



Memorandum of Understanding

May 15, 2019

This MOU is made with effect on May 15th, 2019 in Tehran and entered into between:

Pishtazan Sanat Faraz Ertebat, a company duly incorporated under the laws of the Islamic republic of Iran, whose registered office and principal place of business is at **No.21, Niloo St. Brazil Av., Vanak Sq. Tehran, IRAN** (hereinafter referred as **"FARAZ"**)

and

"JURISDICTION ARMENIA" FOUNDATION, a company duly incorporated under the laws of Republic of Armenia, whose registered office is at 5 Mher Mkrtchyan str., Ministry of economic development and investments of RA, 514-517 offices (hereinafter to as "JA Foundation"),

FARAZ and JA **Foundation** are each hereinafter also referred to as the "Party" and, collectively, as the "Parties".

WHEREAS, Faraz specialized in Research, development, design, production and maintenance in the telecommunication systems, mechatronics structres and antenna.

WHEREAS, JA Foundation specialized in strengthening of economic relations between Iran and Armenia and in attracting investments in the development of high-technology sectors of the Armenian economy.

WHEREAS, the Parties hereto desire to line up some key activity principles, procedures and reciprocal obligations for the performance of such joint activities,

NOW THEREFORE, and in consideration of the mutually binding covenants and conditions set forth herein, as well as for other good and valuable consideration, the Parties mutually agree and covenant as follows:

Section 1 - Purpose of the MOU

To point up the mutual interest in the developing of the production of antenna systems and its components, as well as in the research & development activities in the sphere of telecommunication on the basis of a Herou... United Space Center in Armenia.

Section 2 – Roles and commitments of the Parties

JA Foundation commits to initiate the process of establishing of a Herouni United Space Center in Ar...

Faraz Company with overall value of turnover 250 Milion USD commits to participate in the Antenna ... joint project (hereinafter "Project") dedicated to the development of the production of antenna systems and its components, as well as to the research & development activities in the sphere of telecommunication on the basis of a Herouni United Space Center in Armenia.
The Partners acknowledge that no contractual relationship is created between them by this Memorandum, but agree to work together in the true spirit of partnership to ensure that there is a united visible and responsive leadership of the Project and to demonstrate financial, administrative and managerial commitment to the Project by means of the following individual services.

Section 3 – Exclusivity on Project Basis

Neither party may assign or transfer the responsibilities or agreement made herein without the prior written consent of the non-assigning party, which approval shall not be unreasonably withheld.

Section 4 - Legal effect of

If any provision of this Memorandum is found to be invalid or unenforceable for any reason, the remaining provisions will continue to be valid and enforceable. If a court finds that any provision of this Memorandum is invalid or unenforceable, but that by limiting such provision it would become valid and enforceable, then such provision will be deemed to be written, construed, and enforced as so limited.

This Memorandum may be amended or supplemented in writing, if the writing is signed by the party obligated under this Memorandum.

This Memorandum constitutes the entire Memorandum between the parties relating to this subject matter and supersedes all prior or simultaneous representations, discussions, negotiations, and Memorandums, whether written or oral.

Section 5 - Development, Preparation, and Submission of proposals

It is mutually agreed upon and understood by and among the Partners of this Memorandum that:
a. Each Partner will work together in a coordinated fashion for the fulfillment of the Project.
b. To the extent possible, each Partner will participate in the development of the Project.
c. Nothing in this Memorandum shall obligate any Partner to the transfer of funds. Any endeavor involving reimbursement or contribution of funds between the Partners of this Memorandum will be handled in accordance with applicable laws, regulations, and procedures. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the Partners involved and shall be independently authorized by appropriate statutory authority. This Memorandum does not provide such authority.
d. This Memorandum is not intended to and does not create any right, benefit, or trust responsibility.
e. This Memorandum will be effective upon the signature of both Partners.
f. Any Partner may terminate its participation in this Memorandum by providing written notice to other Partner.

Section 6 - Negotiation of contracts

After the pre-initial phase of the preparation and the preliminary design of the Project, negotiations on the contract are expected to be started.

Section 7 - Proprietary Information - Confidentiality

In order to ensure the most favorable conditions for the implementation of the joint Project, the Parties are determined to conclude a separate Non-Disclosure Agreement (NDA) in accordance with the established procedure.

The Parties undertake to respect the confidentiality of all information transmitted as confidential information or as information that in nature should be considered confidential.

Section 8 - Term and Termination/Extension

The arrangements made by the Partners by this Memorandum shall remain in place from March 15, 2019 until December 31, 2019. The term can be extended only by agreement of all of the Partners.3

Section 9 - Representations and Warranties

Contact person on behalf of Faraz
Name:Karim Mohammadpour -Aghdam
Title: Managing Director
Address: No. 2., Houman Ave., Brazil St., Vanak Sq., Tehran-Iran.
Phone: +98(0)2188878651-3
Email: int.affairs@farazcomm.com

Contact person on behalf of "JURISDICTION ARMENIA" FOUNDATION
Name: Karine Darbinyan
Title: Chief operating officer (COO)
Address: 5a, Mher Mkrtchyan str., 5th floor, 514-517 offices, building of Ministry of economic development and investment of RA
Phone: +374 (11) 597 160
Email: k.darbinyan@jurisdiction.am or info@ jurisdiction.am

The Parties undertake not to disclose any information relating to the provisions of this Agreement without the prior consent of the other Party, unless such disclosure is required by virtue of the requirement of the applicable law or judicial decision, as well as the disclosure of confidential information to the subsidiaries and affiliates of the Parties.

The Parties take into account the sovereignty of the national law of each of the Parties and act in accordance with the applicable jurisdiction in the specific territory for the implementation of projects arising from this Agreement.

Section 10 - Limitation of Liability

No liability will arise or be assumed between the Partners as a result of this Memorandum.

Section 11 - Governing Law

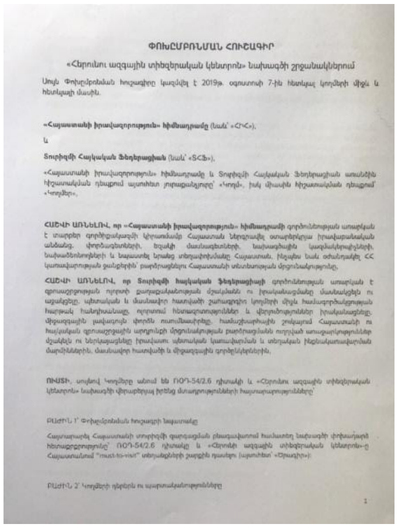
This Memorandum shall be construed in accordance with the laws of the State of Republic of Armenia.

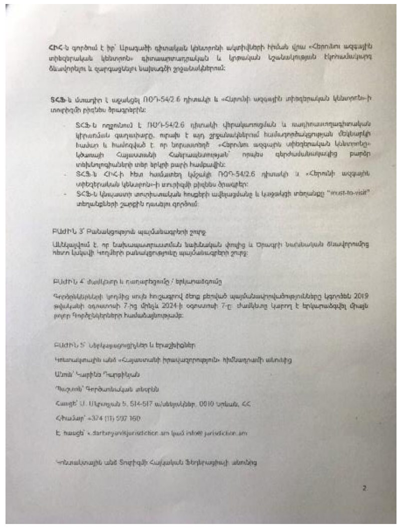
Section 12 - Notices

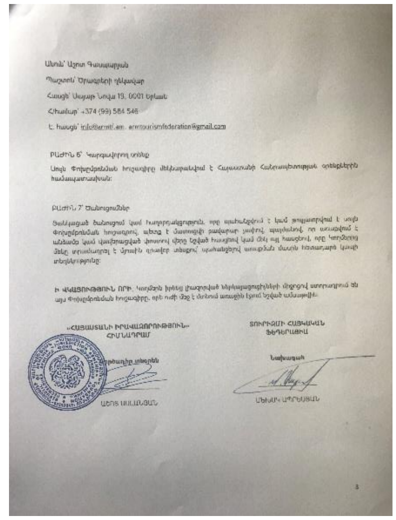
Any notice or communication required or permitted under this Memorandum shall be sufficiently given if delivered in person or by certified mail, return receipt requested, to the address set forth in the opening paragraph or to such other address as one party may have furnished to the other in writing.

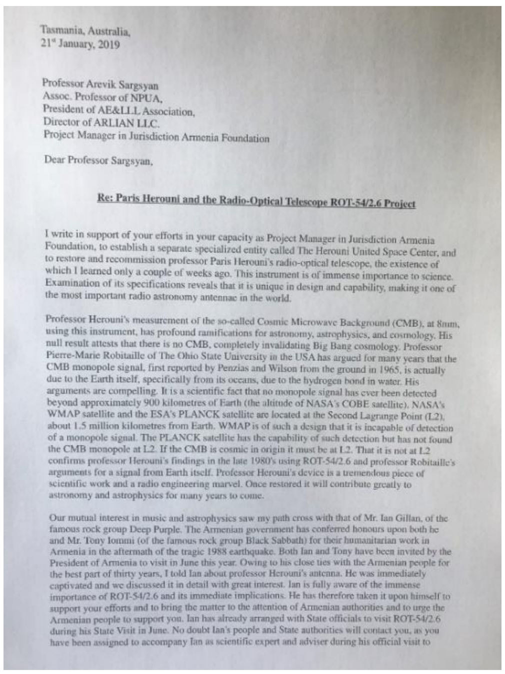
IN WITNESS WHEREOF, the Parties hereto have, through their duly authorized representatives, executed this MOU effective as of the date indicated on the first page.

"Pishtazan Sanat Faraz Ertebat"	**"JURISDICTION ARMENIA"**
Signature:	Signature:
Printed: Karim Mohammadpour Aghdam	Printed: ASHOT ASLANYAN
Title: Managing Director	Title: Executive director









Tasmania, Australia,
21st January, 2019

Professor Arevik Sargsyan
Assoc. Professor of NPUA,
President of AE&LLL Association,
Director of ARLIAN LLC.
Project Manager in Jurisdiction Armenia Foundation

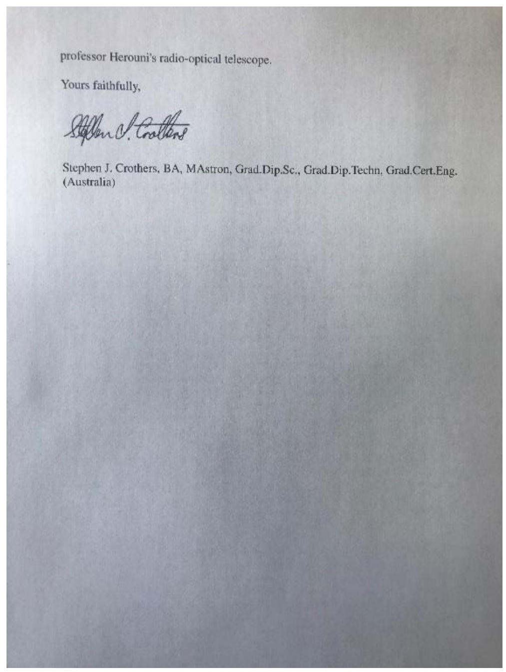
Dear Professor Sargsyan,

Re: Paris Herouni and the Radio-Optical Telescope ROT-54/2.6 Project

I write in support of your efforts in your capacity as Project Manager in Jurisdiction Armenia Foundation, to establish a separate specialized entity called The Herouni United Space Center, and to restore and recommission professor Paris Herouni's radio-optical telescope, the existence of which I learned only a couple of weeks ago. This instrument is of immense importance to science. Examination of its specifications reveals that it is unique in design and capability, making it one of the most important radio astronomy antennae in the world.

Professor Herouni's measurement of the so-called Cosmic Microwave Background (CMB), at 8mm, using this instrument, has profound ramifications for astronomy, astrophysics, and cosmology. His null result attests that there is no CMB, completely invalidating Big Bang cosmology. Professor Pierre-Marie Robitaille of The Ohio State University in the USA has argued for many years that the CMB monopole signal, first reported by Penzias and Wilson from the ground in 1965, is actually due to the Earth itself, specifically from its oceans, due to the hydrogen bond in water. His arguments are compelling. It is a scientific fact that no monopole signal has ever been detected beyond approximately 900 kilometres of Earth (the altitude of NASA's COBE satellite). NASA's WMAP satellite and the ESA's PLANCK satellite are located at the Second Lagrange Point (L2), about 1.5 million kilometres from Earth. WMAP is of such a design that it is incapable of detection of a monopole signal. The PLANCK satellite has the capability of such detection but has not found the CMB monopole at L2. If the CMB is cosmic in origin it must be at L2. That it is not at L2 confirms professor Herouni's findings in the late 1980's using ROT-54/2.6 and professor Robitaille's arguments for a signal from Earth itself. Professor Herouni's device is a tremendous piece of scientific work and a radio engineering marvel. Once restored it will contribute greatly to astronomy and astrophysics for many years to come.

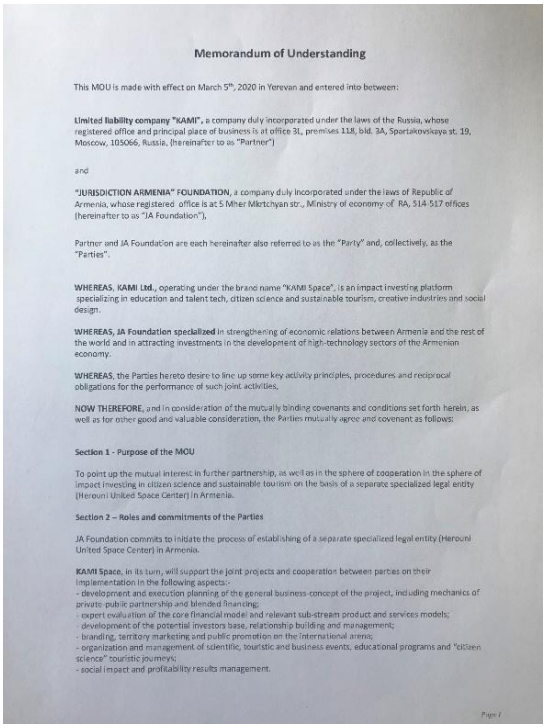
Our mutual interest in music and astrophysics saw my path cross with that of Mr. Ian Gillan, of the famous rock group Deep Purple. The Armenian government has conferred honours upon both he and Mr. Tony Iommi (of the famous rock group Black Sabbath) for their humanitarian work in Armenia in the aftermath of the tragic 1988 earthquake. Both Ian and Tony have been invited by the President of Armenia to visit in June this year. Owing to his close ties with the Armenian people for the best part of thirty years, I told Ian about professor Herouni's antenna. He was immediately captivated and we discussed it in detail with great interest. Ian is fully aware of the immense importance of ROT-54/2.6 and its immediate implications. He has therefore taken it upon himself to support your efforts and to bring the matter to the attention of Armenian authorities and to urge the Armenian people to support you. Ian has already arranged with State officials to visit ROT-54/2.6 during his State Visit in June. No doubt Ian's people and State authorities will contact you, as you have been assigned to accompany Ian as scientific expert and adviser during his official visit to



professor Herouni's radio-optical telescope.

Yours faithfully,

Stephen J. Crothers, BA, MAstron, Grad.Dip.Sc., Grad.Dip.Techn, Grad.Cert.Eng. (Australia)



Memorandum of Understanding

This MOU is made with effect on March 5th, 2020 in Yerevan and entered into between:

Limited liability company "KAMI", a company duly incorporated under the laws of the Russia, whose registered office and principal place of business is at office 3L, premises 118, bld. 3A, Spartakovskaya st. 19, Moscow, 105066, Russia, (hereinafter to as "Partner")

and

"JURISDICTION ARMENIA" FOUNDATION, a company duly incorporated under the laws of Republic of Armenia, whose registered office is at 5 Mher Mkrtchyan str., Ministry of economy of RA, 514-517 offices (hereinafter to as "JA Foundation"),

Partner and JA Foundation are each hereinafter also referred to as the "Party" and, collectively, as the "Parties".

WHEREAS, KAMI Ltd., operating under the brand name "KAMI Space", is an impact investing platform specializing in education and talent tech, citizen science and sustainable tourism, creative industries and social design.

WHEREAS, JA Foundation specialized in strengthening of economic relations between Armenia and the rest of the world and in attracting investments in the development of high-technology sectors of the Armenian economy.

WHEREAS, the Parties hereto desire to line up some key activity principles, procedures and reciprocal obligations for the performance of such joint activities,

NOW THEREFORE, and in consideration of the mutually binding covenants and conditions set forth herein, as well as for other good and valuable consideration, the Parties mutually agree and covenant as follows:

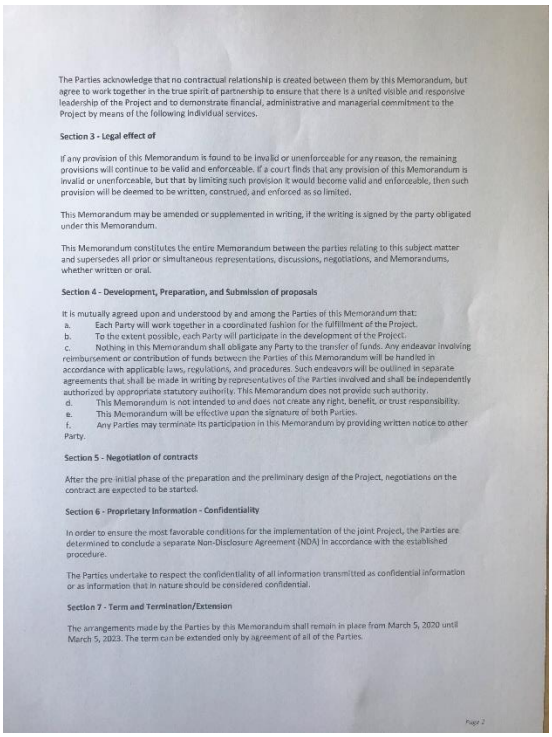
Section 1 - Purpose of the MOU

To point up the mutual interest in further partnership, as well as in the sphere of cooperation in the sphere of impact investing in citizen science and sustainable tourism on the basis of a separate specialized legal entity (Herouni United Space Center) in Armenia.

Section 2 – Roles and commitments of the Parties

JA Foundation commits to initiate the process of establishing of a separate specialized legal entity (Herouni United Space Center) in Armenia.

KAMI Space, in its turn, will support the joint projects and cooperation between parties on their implementation in the following aspects:-
- development and execution planning of the general business-concept of the project, including mechanics of private-public partnership and blended financing;
- expert evaluation of the core financial model and relevant sub-stream product and services models;
- development of the potential investors base, relationship building and management;
- branding, territory marketing and public promotion on the international arena;
- organization and management of scientific, touristic and business events, educational programs and "citizen science" touristic journeys;
- social impact and profitability results management.



The Parties acknowledge that no contractual relationship is created between them by this Memorandum, but agree to work together in the true spirit of partnership to ensure that there is a united visible and responsive leadership of the Project and to demonstrate financial, administrative and managerial commitment to the Project by means of the following individual services.

Section 3 - Legal effect of

If any provision of this Memorandum is found to be invalid or unenforceable for any reason, the remaining provisions will continue to be valid and enforceable. If a court finds that any provision of this Memorandum is invalid or unenforceable, but that by limiting such provision it would become valid and enforceable, then such provision will be deemed to be written, construed, and enforced as so limited.

This Memorandum may be amended or supplemented in writing, if the writing is signed by the party obligated under this Memorandum.

This Memorandum constitutes the entire Memorandum between the parties relating to this subject matter and supersedes all prior or simultaneous representations, discussions, negotiations, and Memorandums, whether written or oral.

Section 4 - Development, Preparation, and Submission of proposals

It is mutually agreed upon and understood by and among the Parties of this Memorandum that:
a. Each Party will work together in a coordinated fashion for the fulfillment of the Project.
b. To the extent possible, each Party will participate in the development of the Project.
c. Nothing in this Memorandum shall obligate any Party to the transfer of funds. Any endeavor involving reimbursement or contribution of funds between the Parties of this Memorandum will be handled in accordance with applicable laws, regulations, and procedures. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the Parties involved and shall be independently authorized by appropriate statutory authority. This Memorandum does not provide such authority.
d. This Memorandum is not intended to and does not create any right, benefit, or trust responsibility.
e. This Memorandum will be effective upon the signature of both Parties.
f. Any Parties may terminate its participation in this Memorandum by providing written notice to other Party.

Section 5 - Negotiation of contracts

After the pre-initial phase of the preparation and the preliminary design of the Project, negotiations on the contract are expected to be started.

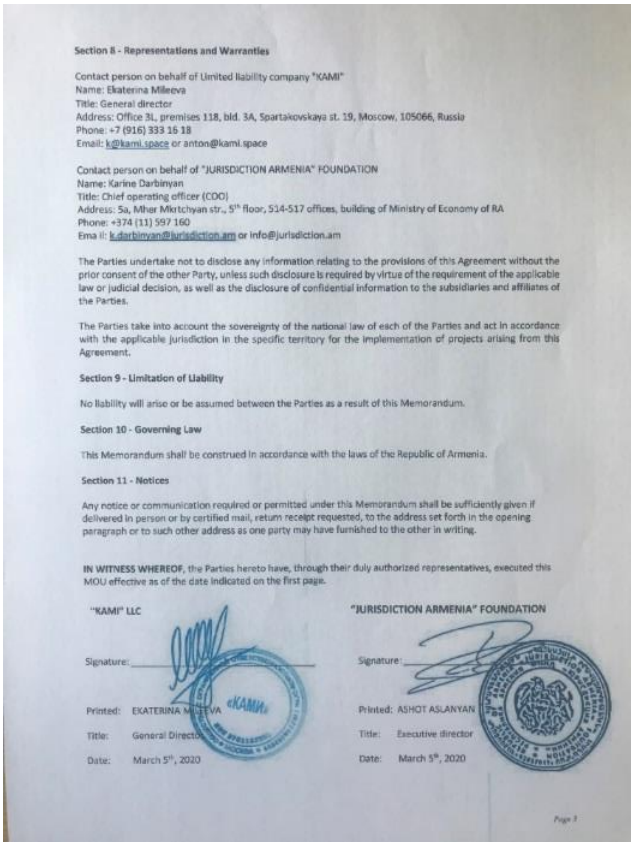
Section 6 - Proprietary Information - Confidentiality

In order to ensure the most favorable conditions for the implementation of the joint Project, the Parties are determined to conclude a separate Non-Disclosure Agreement (NDA) in accordance with the established procedure.

The Parties undertake to respect the confidentiality of all information transmitted as confidential information or as information that in nature should be considered confidential.

Section 7 - Term and Termination/Extension

The arrangements made by the Parties by this Memorandum shall remain in place from March 5, 2020 until March 5, 2023. The term can be extended only by agreement of all of the Parties.



Section 8 - Representations and Warranties

Contact person on behalf of Limited liability company "KAMI"
Name: Ekaterina Mileeva
Title: General director
Address: Office 3L, premises 118, bld. 3A, Spartakovskaya st. 19, Moscow, 105066, Russia
Phone: +7 (916) 333 16 18
Email: k@kami.space or anton@kami.space

Contact person on behalf of "JURISDICTION ARMENIA" FOUNDATION
Name: Karine Darbinyan
Title: Chief operating officer (COO)
Address: 5a, Mher Mkrtchyan str., 5th floor, 514-517 offices, building of Ministry of Economy of RA
Phone: +374 (11) 597 160
Ema il: k.darbinyan@jurisdiction.am or info@jurisdiction.am

The Parties undertake not to disclose any information relating to the provisions of this Agreement without the prior consent of the other Party, unless such disclosure is required by virtue of the requirement of the applicable law or judicial decision, as well as the disclosure of confidential information to the subsidiaries and affiliates of the Parties.

The Parties take into account the sovereignty of the national law of each of the Parties and act in accordance with the applicable jurisdiction in the specific territory for the implementation of projects arising from this Agreement.

Section 9 - Limitation of Liability

No liability will arise or be assumed between the Parties as a result of this Memorandum.

Section 10 - Governing Law

This Memorandum shall be construed in accordance with the laws of the Republic of Armenia.

Section 11 - Notices

Any notice or communication required or permitted under this Memorandum shall be sufficiently given if delivered in person or by certified mail, return receipt requested, to the address set forth in the opening paragraph or to such other address as one party may have furnished to the other in writing.

IN WITNESS WHEREOF, the Parties hereto have, through their duly authorized representatives, executed this MOU effective as of the date indicated on the first page.

"KAMI" LLC	"JURISDICTION ARMENIA" FOUNDATION
Signature:	Signature:
Printed: EKATERINA MILEEVA	Printed: ASHOT ASLANYAN
Title: General Director	Title: Executive director
Date: March 5th, 2020	Date: March 5th, 2020

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅՈՒՆ
ՌԱԴԻՈՍՊՈՐՏԻ ՖԵԴԵՐԱՑԻԱ

Ընդհանրական պող. 87, Երևան, ՀՀ, փ/ա 22, 0002
հեռ. (37410) 23-00-22
(37455) 00-33-99
http://www.frra.am

REPUBLIC OFARMENIA FEDERATIONOF RADIOSPORT

87 Arshakunjatsave., Yerevan, RA, P/B 22,0002
tel. (37410) 23-00-22
(37455) 00-33-99

РЕСПУБЛИКА АРМЕНИЯ ФЕДЕРАЦИЯ РАДИОСПОРТА

Пр. Аршакуняц 87, Ереван, РА, п/я 22,0002
тел. (37410) 23-00-22
(37455) 00-33-99

«ՀԱՅԱՍՏԱՆԻ ԻՐԱՎԱԶՈՐՈՒԹՅՈՒՆ» ՀԻՄՆԱՐԱՄԻՆ
«Հերուևու ազգային տիեզերական կենտրոն»
ստեղծման նախագծի պատասխանատու,
տեխ. գիտ. թեկնածու, ՀԱՊՀ դասախոս
Արևիկ Սարգսյանին

«Հայաստանի ռադիոսպորտի ֆեդերացիա» հասարակական կազմակերպությունն* իր աջակցությունն է հայտնում «Հերուևու ազգային տիեզերական կենտրոն»-ի ստեղծման նախագծին, որի նպատակն է ձևավորել և զարգացնել գիտատարտադրական և կրթական նշանակության էկոհամակարգը «Արագածի գիտական կենտրոն»-ի ակտիվների հիման վրա:

Ողջունելի է ակնառավոր ակադեմիկոս Պարիս Հերուևու ղեկավարությամբ նախագծած և կառուցած աշխարհում հայտնի ՌՕՀ-54/2.6 ռադիոօպտիկական աստղադիտակի վերագործարկման ծրագիրը:

Ֆեդերացիան 2017թ-ից սերտ համագործակցում է ծրագրի նախաձեռնողների հետ՝ ի դեմս «Հերուևու ազգային տիեզերական կենտրոն» նախագծի պատասխանատու, տեխ. գիտ. թեկնածու, ՀԱՊՀ դասախոս Արևիկ Սարգսյանի: Ֆեդերացիան դիտակի վերագործարկման ծրագրի մեծ ջատագովներից է տարիներ ի վեր: Մենք զտնում ենք, որ Հերուևու ռադիոօպտիկական այս ալեհավաքը մասնագիտական և գիտական անգնահատելի դեր ու նշանակություն կարող է ունենալ ոչ միայն Հայաստանի, այլև ամբողջ աշխարհի մասշտաբով:

Յուրաքանչյուր տարի հունիս և սեպտեմբեր ամիսներին անցկացվող ռադիոսպորտի միջազգային մրցաշարերին «Հայաստանի ռադիոսպորտի ֆեդերացիան» մասնակցում և, որպես կանոն, հաղթական դիրքեր է զբաղեցնում այդ նույն տեղանքից, որտեղ գտնվում է Հերուևու դիտակը՝ Արագածոտնի մարզ, գյուղ Օրգով:

Կցկին ողջունելով այս նախաձեռնությունը՝ հայտնում ենք մեր պատրաստակամությունը՝ աջակցել այն իրականացնողներին:

Հարգանքով՝

ՀՀՌՖ նախագահ Արման Բաբլոյան

20.04.2020թ.

**Հայաստանի ռադիոսպորտի ֆեդերացիա» հասարակական կազմակերպությունը հիմնադրվել է 1990-ականների սկզբներին: Կազմակերպության հիմնական նպատակն է նպաստել Հայաստանում ռադիոսպորտի զարգացմանը՝ համաձայնեցնել ռադիոկապի սիրողական և պրոֆեսիոնալ օպերատորներին, պատրաստել ռադիոկապի նոր մասնագետներ՝ դպրոցին և ընդհանուր պայմաններում աշխատելու, պատերազմական, արտակարգ և այլ իրավիճակներում համապատասխան կառույցներին աջակցելու համար: Ֆեդերացիայի անդամների անգնահատելի աշխատանքի արդյունքում է Հայաստանից աշխարհի հասել 1988թ-ի ամերիկ երկրաշարժի մասին առաջին տեղեկատվությունը, ապահովվել մեր սահմանների պաշտպանությունը՝ Արցախի ազատամարտի տարիներին: Մեծերի և ճիրան ռադիոկապի դերն ու նշանակությունն արդիական է մշտապես, ինչն էլ ընկած է ֆեդերացիայի գործունեության հիմքում:*

«Հայաստանի ռադիոսպորտի ֆեդերացիան» սերտ համագործակցում է «Հայաստանի ԻՈՍՄԱՅ» ՀԿ-ի հետ, Ռադիոսիրողների միջազգային միության /IARU/ անդամ է:

1.9. ANNEX 9

Expert opinion of independent expert Kees Van Klooster on the state of the ROT-54/2.6 radio-optical telescope

From: Ir. MSc. C.G.M. van 't Klooster Voorhout, 27 Sept 2018
Antenna Specialist, formerly with European Space Agency (ESA) in Estec, Noordwijk, The Netherlands

ROT 54/2.6

This report presents observations made with pictures explaining a status. There is a main issue to be repaired and carefully inspected (cardan suspension of assembly carrying optical telescope and sub-reflector). Its feasibility of repair is a very important task to be realized as soon as possible. Only then, the sub-sequent tasks can be carried out, like new cabling, control and calibration of angular control. This report describes the importance of the repair in the contaxt of the telescope status.

The details provided about ROT 54 are in the attachment. Many more observations and pictures are available. The main observation related to the cardan suspension is important here.

The radio-telescope exploits a fixed spherical mirror and a secondary mirror, which is dimensioned such that a secondary focus is created in a location in which a radio frequency feed is mounted.

The secondary mirror assembly with its supporting structure and 3 struts has a weight of 130 ton. The turning structure consists of the sub-reflector (15 ton) and total counterweight (12 ton + 6 ton for the optical telescope and additional counterweight respectively). The cardan bearing is 20 ton mounted on top of 3 supporting struts of each 12 ton. The struts are not straight but curved. This is beneficial for the allowable angular range. It has an electromagnetic benefit as well: the diffraction of the plane wave is spread out and does not form diffraction cones as severe as would be the case for a straight support.

Mass figures are broken down, but it requires a verification. It is clear that there is a loading on the axes in the cardan suspension, which is heavy. It must be precise as it determines pointing of the beam.

Fig. 1 - Views from Nord towards South with the church in village "Teger" on the Nord-South line
Fig. 2 - Schematic view East - West (ICAP 1989, P.M. Herouni "The First Radio Optical Telescope")

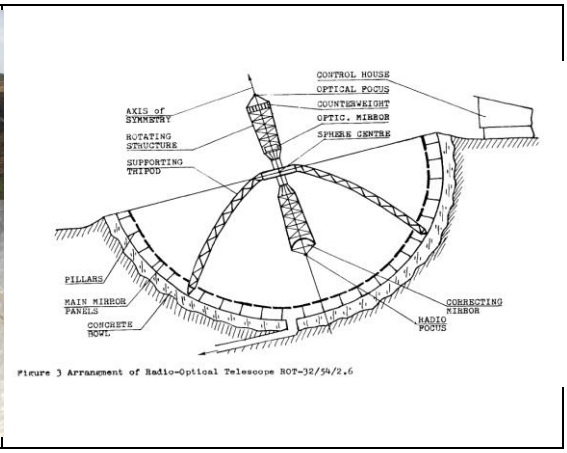


Figure 3 Arrangement of Radio-Optical Telescope ROT-32/54/2.6

The counter-ballast is usefully exploited with an optical telescope pointing into the same direction as the radio beam. It realized the first radio-optical telescope, explaining the short notation ROT 54/2.6 for the diameters of the main radio spherical mirror and the optical telescope mirror.
A particular important, main property of the spherical reflector is that it is fixed in the ground. No need for "a homologous designs" or "Finite Element Method" optimization for an accurate and light supporting construction as for a steerable main reflector. The main spherical reflector has a surface error which follows from a budget comprising mainly the error in the installation of the panels and the actual panel surface errors. The latter main reflector surface error **is not subject** to any deviation during a pointing operation of the radio telescope in principle.

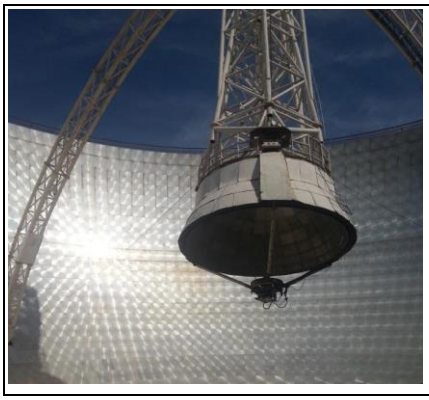
The Main Spherical Reflector and Panel Configuration

The main-mirror is mounted on concrete, fixed in the ground (Fig.2). The radio optical telescope ROT 54/2.6 has a 54 m non-movable spherical reflector, consisting of some 3800 panels of ca 1 by 1 meter (3700 m^2 = 2pi r^2 for a half-sphere □□4580 m^2 for R=27m): some panels are larger. Panel mounting is on 4 tuning screws: panel errors at the rim are larger by a ratio (panel size)/(screw separation).
All panels are made of aluminum-magnesium-zinc alloy. Eventually the absorption and emission coefficients for such material is needed in a thermal distortion analysis to assess gradients in temperatures, but this is for later. Steel mounting rods and panels are assumed to be well thermally conductive.
Panels are milled towards a spherical shape with a final error at panel level of ±10μ. With a radius of 27 meter and a panel sizing of 1 by 1 meter, the deviation of a flat panel from a spherically milled panel is 27000000*(1-cos(η)), with η=1/54 (1/2m at 27 m, assuming a 1by1 m panel) or about 4.63 millimeter.
With 180 panels in the upper rings there is an adaptation with such machining to circular shape. If it was a flat panel, the periodic deviation would equal 4.63/2 mm = 2.3 mm peak-peak across the panel and ~sqrt(2) more in diagonal sense. It would be ε= 2.3/(sqrt(3))=1.328mm across. (If we assume a uniform error distribution for convenience). It is a good first estimate order for rms, to be refined.
For a minimum wavelength λ_{min} = 20 * 1.328 it results that such a reflector would still be reasonably good at X-band (one could have used flat panels up to ~ X-band or 30 mmm wavelength), provided the panels are "perfectly mounted" perpendicular to the radius of main reflector. It shows perspective for higher bands !! In other words, a panel surface accuracy might be no issue below X-band, but the panel setting accuracy in terms of "rms" should not exceed a smaller value. How much? It depends.
The error in the panel setting can be much smaller obviously, given a systematic required spherically shaped panel surface. Accordingly the reflector would allow operation up to millimeter wave regime.
Given a secondary mirror of ~5 meter diameter and about ~±60° subtended angle, a small feed would be needed at centimeter wavelength below X-band (no allowance for a long feed-horn) resulting into a secondary pattern with a higher first side-lobe due to a predominant main aperture distribution with its maximum shifting towards the outer radius □relative high first side-lobe near to – 10 a -15 dB. At low frequency accommodation has to be complied with.
The panels have been precision milled with ±10 μ rms on a carousel-milling machine. All separate panels are mounted on a metal tube which is anchored into the concrete below the spherical main reflector. The distance between the 4 bolts is approximately 30 centimeter. Accordingly an error in the setting of a bolt of ±15μ would be magnified by a factor 2 to 3 at the panel edge to say ~±45μ.
Accordingly an estimate can be made for a total rms surface error for the spherical mirror.

Fig. 3 - Panel mounting, Average gap width between panels indicated as 2 mm

A very suggestive observation is made from the reflection of the Sun into the reflector. Panels are machined in a systematic manner leaving observable rings on the panel surface. The sun reflection observed over a number of panels is indicative for a reasonable good panel setting, because of the regularity of the characteristic sun reflection over more panels, caused by the separate panels and additionally a diffraction behavior in the optical domain due to circular rings observed at panel level (manufacturing process). An example is shown in Fig. 4. Slightly tilted panels could be found in this way.

Fig. 4 - The Sun reflected from spherical mirror.



An Indicative regular pattern from panel to panel results with a small white band on each panel. The orientation of such band varies gradually from panel to panel and is a reasonable indication that even today the panel setting might well be acceptable for operation in the centimeter wavelength regime. Displacement of the bright location varies over time due to Sun movement or by walking around the main reflector rim…

Obviously, a refined measurement approach has to confirm precise details, with a laser in the center of the half-sphere.

Fig.4 shows also the small platform on which the RF feed assembly has to be mounted.

Clearly, the access to the RF front-end is a situation to be taken into account, when considering the illumination of the secondary reflector. One should not go too much below 5 GHz, possibly 3 GHz (λ=10 cm), given the physical sizing of even low-gain RF-feeds and accommodation needed. Given such observations, the spherical mirror would be in **a reasonable status even today** for centimeter wavelength observations, with perspective for higher frequencies.

The sub reflector surface and secondary RF platform

The surface of the sub-reflector is shaped according to a precise required geometry (spherical aberration correction) and a location to be precise with respect to the main spherical reflector. The claim of inventing such correction has been made at the same time by Dr. P. M. Herouni and by specialists involved in the Arecibo reflector. With a perspective for utilization up into the millimeter wave regime, the ROT 54 radio telescope can be "electrically " larger than the Arecibo antenna.

The RF feeding point has to be located accurately with respect to the sub-reflector geometry. Being a low-gain RF feeding point, not much deviation in the RF coordinates is allowed. It has to be within about ±0.1 a ±0.2 λ.

This needs verification. It would be as a crude estimation ±3mm a ±6 mm in X-band. It is clearly more demanding in the millimeter wave regime. It demonstrates the criticality of a precise cardan suspension needed and bending aspects (already addressed in the book of P. Herouni) as function of pointing for higher frequencies. Resulting deviations can be decomposed into statistical and systematic deviations, to be entered in calibration tables. This is for future work.

The sub-reflector assembly and its revival of control capability

It is noted that the total mass of the tripod support and movable mass is 71 ton, resting on 3 positioners as strut support locations with a total of 130 ton with a major loading of the south strut due to the off-zenith direction of the main axis of symmetry.

Behavior of the beam direction due to systematic gravity influence

The movement of the secondary reflector provides a beam direction by putting it into a desired direction (θ-180)° for a main-beam into direction θ°, the angles measured with respect to the symmetry axis of the spherical reflector. The main symmetry axis is oriented towards a direction +25° to "South" leaving 15° with respect to the local zenith at 40°, the latitude of the location of the telescope. A beam pointing is available from 35° elevation ("South") to 85° elevation ("Nord").

All pointing deviations are due to bending and pointing errors of the movable structure of the sub-reflector. Such errors are in part systematic and can be calibrated. Given the mass and length of the pendulum-like structure this will be important. Given the off-zenith symmetry and loading of the "South" support strut, there will be a systematic behavior in the calibration table for angular errors due to (linear) bending.

A useful area of 32 meter diameter is selected from the spherical reflector. With a secondary reflector correcting the spherical aberration an aperture of 32 meter with a blockage of ~6 meter diameter is available, to be illuminated by a spherical small feed over ~±α°, with α leaving a little bit illumination thus side-lobe control. Given the aperture blockage and α towards α=60°. Room for side-lobe control is limited an needs optimization (efficiency is high). The first side-lobe is ~-15 dB. The effect on the pattern has been investigated already (ICAP paper P. Herouni 1989) and particular choices of RF illuminating feeds are related obviously.

The RF front-end equipment

There has been no discussion about RF front-end equipment, neither IF and backend. This subject needs elaboration. Priority has been given to discussion of the main cardan suspension and its current status. Reception of a simple but accurate and systematically known beacon signal for propagation measurements (narrow band CW) might be a very suitable way to assess a large number of error contributions and subsequent assessment of impact or improvement.

Reception of the Alfasat beacon at 19.7 GHz **and** 39.4 GHz could be a consideration at a later stage. Relevant background information about the propagation payload on Alfasat has been provided. Alfasat is positioned at 25° East in a slightly inclined orbit, thus virtually moving Nord-South daily over a couple of degrees.

A direct reception with a ROT 54 antenna pointed in a fixed position towards the satellite at 25° East would permit already 1 D pattern cuts, because the satellite is moving in a daily pattern (over ~ ±3°) in a systematic manner. Precise ephemeris data are provided on request (there are sometimes satellite control operations also). In this way a 1D (quasi) Nord-South pattern could be monitored, nicely related to predominantly one axis in the cardan system. It would require initial assessment and provision of RF reception capability for the CW signals. Alfasat propagation payload is available for some time more in the upcoming year and possibly after. The CW

carriers are rather stabile according to the information provided. Given a stabile 19.7 GHz CW signal, a direct reception by ROT 54 in comparison with a reception of the same signal with a much lower gain antenna can allow for holographic measurements. It would provide additional investigation capability and further fine tuning of the radio telescope.

Recapitulating

The spherical main reflector is in a very reasobale state, with perspective for further improvement

-a- The current status of the control of the sub-reflector and telescope assembly (movable part) is, that there is no control possible.

The main control room is out of order. Cables have been cut and it is likely that a new cabling is required. Control capability and associated cabling requires detailed assessment and repair.

-b- There has been no movement of the cardan suspension in the last 6 years.

-c- A main issue is, that one side of the East-West axis inside the cardan housing has a defect control arm. This needs priority as without a repair there is no control of the East West axis possible. The current understanding is, that the lever for control of the angle of the latter axis is loose from the axis, with a bracket with broken bolts. How this has happened is unclear.

-d- A careful inspection is needed.

Just repairing the bracket alone is not a guarantee for a free and smooth and accurate movement of a secondary reflector assembly (with telescope included) and eventual control. The latter movement is required as the angular pointing of the RF-beam depends on that movement.

Only after inspection and repair of the bracket and careful mechanism investigation, linear actuators for moving the East-West axis (and Nord South axis) might again be considered for movement.

Obviously the control capability can only be considered after such a repair and (successful) inspection.

In summary:

As there has not been any movement in the last 6 years, a lubrication of moving parts is important and might not directly guarantee accurate movement, given a status of materials and movable parts.

Currently the East-West axis is blocked on purpose with welded brackets. It must be inspected the exact status of the mechanical parts within the cardan suspension, which carried the large mass of more than ~ 30 ton with two perpendicular axes and a central controllable tube to which on one side the sub-reflector assembly is mounted and on the other side the optical telescope.

The importance of the latter is also understood from the main criticality of positioning the sub-reflector with RF-plateau accurately within limits. The stability of the positioning has to be within limits dictated by the allowable error in the directivity.

The latter positioning error is more critical if a stabile phase behavior has to be realized over an angular interval of movement, as could be the case for a tracking of a radio source in a VLBI observation. Such phase deviation if any should be calibrated out for a major part by using calibration tables, based on systematic deviations.

The major ball-bearings have to be inspected.

The major control capability for the heavy sub-reflector + optical telescope is directly important and related to deviations in precision and is more demanding obviously at higher frequency bands.

Only after a repair of control bracket (west –side EW axis), inspection and preventive actions (lubrication ?) of all movable parts inside the cardan housing and attachment to struts, the behavior with angle can be derived in more detail.

Accordingly an initial operation might preferably be at longer wavelength, for instance in X-band, for which there is also experience in observations. Possibly the 19.7 GHz beacon of Alfasat is very interesting and permitting analyses of various error sources with subsequent fine-tuning.

The summary of the opinion states: after correcting the little mechanical defect of the antenna cardan system, the antenna radio telescope is completely ready to work with short-range santimeters radio waves. Moreover, the surface of the mirror is excellent even in today's unfilled state, which is proved by the clarity of optical reflection.

This short report has been written by:
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Email: kvtklooster@gmail.com
On request some details are given below
C.G.M. (Kees) van 't Klooster received an IR-degree in 1978 in Electrical Engineering from Eindhoven University and a MSc-degree in Space System Engineering in 2001 from Delft University. He is Lifetime IEEE Member and author or co-author in more than 150 papers.
In 1978 he joined Physics Laboratory TNO as antenna engineer with as topics ferrite phase shifters, waveguide based phased array antennas and planar near-field testing. In 1984 he joined European Space Agency (ESA-Estec) in the Technical Directorate covering subjects like antennas for satellite projects (remote sensing and scientific) including Meteosat, European Remote Sensing (ERS) and other satellites. He was responsible in ESA R+D contract studies on slotted waveguide antennas, feeds and feed-arrays, SAR- and radiometer antennas in early and later phases, antenna testing aspects and various activities on and advancement of large deployable antennas for radio astronomy, remote sensing and telecommunication. He was awarded ESA Douglash Marsh fellowship in 1993, which he spent in Moscow at Lebedev Physical Institute in Radio-Astron space-VLBI project team. Achievements include initiation of dedicated new panel technology for ALMA with industry (Media-Lario) as a spin-off from X-ray telescope space technology and initiation of investigations with the institute JIVE into VLBI tracking of the Huygens probe during its landing on Titan. The work has been realised excellently by JIVE.
After retirement in 2015 he continues part time with antenna activities in universities and some consultancies.
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1.10. ANNEX 10

«ՀԵՐՈՒՆՈՒ ԱԶԳԱՅԻՆ ՏԻԵԶԵՐԱԿԱՆ ԿԵՆՏՐՈՆ» ՆԱԽԱԳԾԻՆ ԿԻՑ ԳԻՏԱԿԱՆ ՀԱՆՁՆԱԺՈՂՈՎԻ ՈՐՈՇՈՒՄ

«Հայաստանի իրավազորություն» հիմնադրամը (այսուհետ՝ ՀԻՀ) 2017թ. սեպտեմբերից նախաձեռնել է «Հերունու ազգային տիեզերական կենտրոն»-ի (այսուհետ՝ Կենտրոն) ստեղծման և ՌՕԴ-54/2.6 աստղադիտակի վերագործարկման նախագիծը: Նախագծի նպատակն է ձևավորել և զարգացնել «Հերունու ազգային տիեզերական կենտրոն» գիտաարտադրական և կրթական նշանակության էկոհամակարգն Արագածի գիտական կենտրոնի, այդ թվում՝ ՌՕԴ-54/2.6 ռադիոօպտիկական դիտակի հիման վրա:

ՀՀ էկոնոմիկայի նախարարության հանձնարարությամբ ՀԻՀ-ը մեկ ամիս առաջ պատվիրել է նախագծի բիզնես կոնցեպտի մշակումը մրցութային կարգով ընտրված խորհրդատվական ընկերությանը: Այդ փաստաթուղթը կամբողջականացվի ս.թ. մարտի վերջին:

ՌՕԴ-54/2.6 ռադիոդիտակի գործածության, վերագործարկելու հնարավորության վերաբերյալ տարածվող ասեկոսեների, իրականության հետ կապ չունեցող, առնվազն սխալ կարծիքների շրջանառությունը դադարեցնելու, ինչպես նաև կառավարական բարձր ատյաններում Հերունու ռադիոդիտակի պիտանելիության վերաբերյալ ճիշտ կարծիք ձևավորելու նպատակով ՀԻՀ-ը հրավիրել է Կենտրոնի ստեղծման ծրագրին կից Գիտական հանձնաժողով (այսուհետ՝ ԳՀ):

ԳՀ-ում ընդգրկված են Հայաստանի Հանրապետության և արտասահմանի առաջատար գիտնականներ, ոլորտի բարձրակարգ մասնագետներ և ակադեմիական հանրության ներկայացուցիչներ: ԳՀ անդրանիկ նիստը տեղի ունեցավ 2020թ. փետրվարի 27-ին:

ԳՀ-ը որոշեց.

հանձնարարել ՀԻՀ-ին պատվիրել Եվրոպական հետազոտական կոնսորցիումի գերերկար բազաներով ռադիոինտերֆերոմետրիայի ինստիտուտին (VLB ERIC (JIVE)) իրականացնել ՌՕԴ-54/2.6 դիտակի ներկայիս տեխնիկական վիճակի, դրա վերականգնման և հետագա կիրառելիության վերաբերյալ գիտատեխնիկական փորձաքննություն: Ընդհանուր փորձաքննության կատարման ծախսերը հոգալու վերաբերյալ ՀԻՀ-ին առաջարկվում է բանակցել JIVE-ի հետ:

Միեր Մարկոսյան

տ.գ.դ., պրոֆեսոր
Երևանի Կապի միջոցների գիտահետազոտական ինստիտուտի տնօրեն
Ճարտարապետության և շինարարության Հայաստանի ազգային համալսարան

Վահան Ավետիսյան

տ.գ.դ., պրոֆեսոր
Երևանի Կապի միջոցների գիտահետազոտական ինստիտուտ,
Հայ-Ռուսական համալսարան

Naira Hovakimyan

University of Illinois,
W. Grafton and Lillian B. Wilkins Professor
of Mechanical Science and Engineering

Armen Derderian

Former Head of RF Laboratory of European Space Agency,
Certified ISO9001 Quality Manager,
MBA, Electrical Engineer

Shant Hovnanian

Director- Innovation City Projects

Andrei Ogannessian

European Space Agency
Solar Orbiter Project
Functional Avionics Engineer

Ալբերտ Ղուլյան

ՀՀ ԳԱԱ ակադեմիկոս, տ.գ.դ., պրոֆեսոր
Ռադիոֆիզիկայի և էլեկտրոնիկայի ինստիտուտ

Արմինե Ավետիսյան

տ.գ.դ., պրոֆեսոր,
Հայաստանի ազգային պոլիտեխնիկական համալսարանի
Գիտական աշխատանքների ծառայությունների և ինովացիոն հետազոտությունների կենտրոնի պետ

Սուրեն Խուդավերդյան

տ.գ.դ., պրոֆեսոր,
Հայաստանի ազգային պոլիտեխնիկական համալսարանի
ՏՀՏևէ ինստիտուտի Կապի համակարգեր, ամբիոնի վարիչ

Հովհաննես Գոմցյան

տ.գ.դ., պրոֆեսոր,
Հայաստանի ազգային պոլիտեխնիկական համալսարանի
ՏՀՏևէ ինստիտուտի Ռադիոսարքավորումների ամբիոնի վարիչ

Արևիկ Սարգսյան

տ.գ.թ., պրոֆեսոր,
Հայաստանի ազգային պոլիտեխնիկական համալսարան,
Հայ-Ռուսական համալսարան
«Հերունու ազգային տիեզերական կենտրոն» ծրագրի ղեկավար

Կարեն Մարտիրոսյան

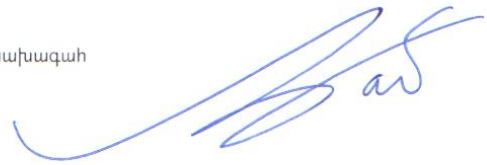
տ.գ.թ., «ԴԵԼՏԱ ՏԵԼԵԿՈՄ» ընկերության տնօրեն

Հրայր Աբրահամյան

տ. գ. թ., դոցենտ,
Հայաստանի ազգային պոլիտեխնիկական համալսարան,
«Հերունու ազգային տիեզերական կենտրոն» ծրագրի տեխնիկական ղեկավար

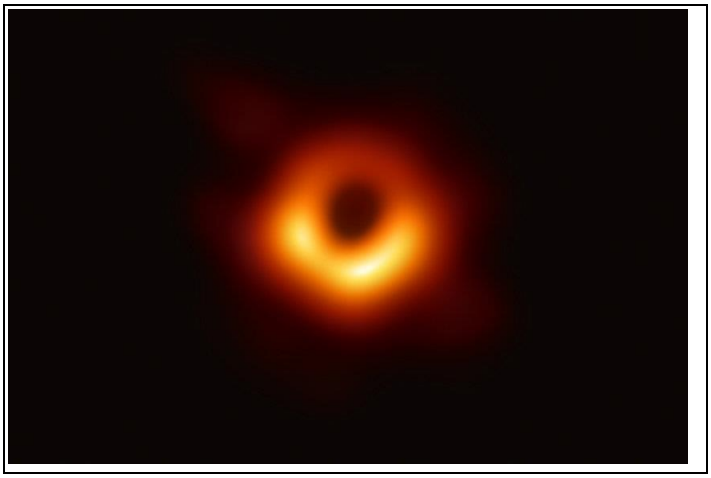
Արման Բաբլոյան

ՀՀ ռադիոսպորտի ֆեդերացիայի նախագահ



First image of the Black Hole

Image 1 - First Image of a Black Hole



The Event Horizon Telescope (EHT) — a planet-scale array of eight ground-based radio telescopes forged through international collaboration — was designed to capture images of a black hole. In coordinated press conferences across the globe, EHT researchers revealed that they succeeded, unveiling the first direct visual evidence of the supermassive black hole in the center of Messier 87 and its shadow.

The shadow of a black hole seen here is the closest we can come to an image of the black hole itself, a completely dark object from which light cannot escape. The black hole's boundary — the event horizon from which the EHT takes its name — is around 2.5 times smaller than the shadow it casts and measures just under 40 billion km across. While this may sound large, this ring is only about 40 microarcseconds across — equivalent to measuring the length of a credit card on the surface of the Moon.

Although the telescopes making up the EHT are not physically connected, they are able to synchronize their recorded data with atomic clocks — hydrogen masers — which precisely time their observations. These observations were collected at a wavelength of 1.3 mm during a 2017 global campaign. Each telescope of the EHT produced enormous amounts of data – roughly 350 terabytes per day – which was stored on high-performance helium-filled hard drives. These data were flown to highly specialized supercomputers — known as correlators — at the Max Planck Institute for Radio Astronomy and MIT Haystack Observatory to be combined. They were then painstakingly converted into an image using novel computational tools developed by the collaboration.

1.12. Annex 12

Yerevan Telecommunication Research Institute

TRAINING PROGRAM OF NEAR-FIELD ANTENNA MEASUREMENTS

The purposes of the courses give to students' basic knowledge on the near-field antenna measurements.

Course descriptions of:

- Antenna radiation field zones and make parameters;
- Basic method of the antenna measurements in the corresponding zones of antenna radiation field;
- Fundamentals of physics of the antenna measurements and its comparison at various scanning and measurements types in the near field;
- The near-field planar measurement theory, theoretical substantiations of potential opportunities at antenna measurements in the near-field;
- The limitation of plane of scan, problems of measurements sampling and measuring probe choose is considered too;
- Besides, of planar raster the plane-polar scanning is stated too;
- Algorithms of near-field-far-field transformation at various scanning cases and measurement types;
- Comparison of these algorithms on the basis of rapidity, on presence's degree of the apriori information and on reliability;
- The structure of the near-field antenna automatic measurement equipment and the basic requirements on its components.
- The description of anechoic chamber designs and the requirements;
- The more detailed describing of components of antenna near-field automatic measurement equipment: radio-measuring system, scanning system, control system for automatic measurements and software ;
- Requirements on its subassemblies and its possible realizations.

The course is finished by discussion of near-field measurements of the short millimeter waveband antennas. The description of existing measurement approaches is given. Characteristics of components of system of automatic measurement equipment of that range are considered.

Course program and time schedule:

Duration of the course 6 days

Monday	Zones of antenna radiation field and its parameters	Reactive, near and far zones of an antenna. Characteristics of fields in these zones. Antenna pattern, directivity, gain, efficiency factor, effective area, noise temperature.	**3 h**

	Methods of measurement of antenna parameters and it comparison cost, etc.	Far-field measurement method. Collimator or compact range method. Frenel zone measurement method. Near-field measurement method. Planar, cylindrical and spherical scanning as scanning types at near-field measurements. Comparison of measurement method depending on antenna directivity, parameters determination accuracy, weather conditions, equipment	**3 h**
Tuesday	Fundamentals of physic of nearfield antenna measurements	Fourier optics concept. Doppler beam forming concept. Aperture synthesis concept. Comparison of measurements with planar, cylindrical and spherical scanning. Onlyamplitude near-field measurements on various planes from the antenna and the same measurements on one plane with the help of two probes as variety of near-field measurements.	**3 h**
	Fundamentals of physic of nearfield antenna measurements	Fourier optics concept. Doppler beam forming concept. Aperture synthesis concept. Comparison of measurements with planar, cylindrical and spherical scanning. Onlyamplitude near-field measurements on various planes from the antenna and the same measurements on one plane with the help of two probes as variety of near-field measurements.	**3 h**
Wednesday	Near-field-farfield transformation algorithms	Transformation algorithms at different kinds of scanning and measurement types in case of planar measurements - raster scanning, plane-polar scanning, amplitude measurements on two different planes and amplitude measurements on one plane, but by two different probes. Transformation algorithms at cylindrical and spherical scanning. Comparative characteristics of algorithms on rapidity, on presence degree of apriori information quantity about of antenna, on reliability.	**4 h**
	Design of the automatic nearfield antenna measurement equipment	The general block diagram of the near-field measurement equipment. Its component systems. The radio-measuring system, its destination, composition and requirements on measurement accuracy of amplitude and phase of field amplitude-phase distribution. Scanning system, its destination, composition and the requirements on scanning flatness. The automatic control system, its destination, composition and the requirements on probe positioning accuracy. The interface, its destination, composition and requirements on it. The data processing unit, it destination and composition.	**2 h**

Thursday	Anechoic chambers	The design of anechoic chambers. Requirements on reflection of electromagnetic waves. Parameters of electromagnetic waves absorbers, it kinds and materials. Requirements on thermo-stability, humidity and pressure in the anechoic chamber.	**1 h**
	Radio-measuring system	Estimation of main initial parameters of the radio-measuring system – signal attenuation up to amply-phase meter input and noise frequency band of the system. Transmission lines of reference and useful signals. Requirements on shielding of transmission lines, on losses and on stability of transmission characteristics by amplitude and phase. Microwave oscillator and requirements on it by power stability and by noise performances. Amply-phase meter. Types of the signal processing. Requirements on amply-phase meter.	**3 h**
	Scanning system	Scanners with horizontal and vertical scanning planes. Frame scanners and T-scanners. Drives and carriages of scanners. Requirements on its.	**2 h**
	System for automatic control of measurements	Indication system of the probe position. A photo- and opto-sensors. System for control by scanner drives. System for control by interface. Requirements on systems.	**2 h**
	Software The software for near-field measurement automatic process.	The software for mathematical processing of near-field measured data.	**1 h**
	Near-field antenna measurement techniques in the short millimeter waveband	Thermographic method. Method by using of optical beam scanning of semi-conductor plate which is sensitive to the MICROWAVE. Mechanical scanning method. A feature of scanning systems and it drives. Designs of initial useful signal transmission lines from the stationary equipment to a mobile probe. Designs of radio-measuring systems depending on initial useful signal frequency range. Probe positional sensors.	**3 h**

All course includes acquaintance with near- and far-field antenna automatic measurement equipment.
Acquaintance with a radio optical telescope ROT-54/2,6.

Estimated Cost of the course *(without accommodation)* is 2000 Euro per person.
For 5 and more persons the cost will be 1500 Euro per person.
Hotel cost for foreigners – 60 Euro per day.