NEWSLETTER-AMSAT-EA

06/2022 JUNE

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New Satellites coordinated by IARU

The IARU has coordinated three new ham radio satellite projects in these last days:

CAS-10

CAS-10 is an 8U CubeSat sponsored by the Ham radio Satellite Group of China, CAMSAT.

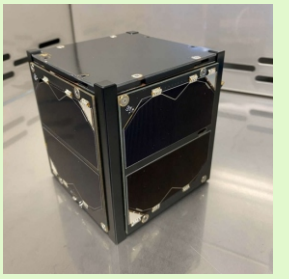
It will carry a linear transponder in V/U mode, a UHF telemetry beacon in CW, one GMSK UHF - AX.25 4.8k/9.6kbps telemetry downlink and one space camera that will store the images in the flash memory of the satellite.

Uplink - 145,870 Mhz (30kHz)
Downlink - 435,180 Mhz (30kHz)
Telemetry UHF CW - 435.575 MHz and the AX

It will be equipped with a remote control system based on DTMF that will allow radio amateurs to download the photos from the camera. will have a CW beacon to send telemetry data.

The launch is scheduled for November 2022 from Hainan launch site using a CZ-7 launch vehicle into a circular orbit at 400 km with an inclination of 42.9 degrees.

BINAR 2, 3, 4, 5, 6 ,7



The Binar series is made up of 1U type satellites and is sponsored by the Center for Science and Space Technology at the Curtin University.

They will include a UHF link for activities and student experiments, the operation of the Student payloads will be held from schools with ground stations built by the students.

Store and forward packets will be available to the entire amateur radio community. The beacon will include basic data on the state of the satelite.

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Experimental format transmissions are also planned, the beacon and telemetry will include OQPSK for 100 and 38.4 kbps GFSK for 19, 2, 9.6 and 1.2 kbps, plus intermittent CW.

The deployment is planned to be from the ISS during the first quarter of 2023 for Binar 2,3 and 4 and during the third quarter of 2023 for Binar 5,6 and 7.

Downlink will be 437,700

MRC-100

MRC-100 is a 3p PocketQube mission sponsored by the Technology and Economy University in Budapest.

It is expected to receive reception reports from the ham radio community to create a global electromagnetic pollution map.

UHF downlink at 436.720 MHz will use selectable data rates Of 1250, 2500, 5000 and 12500 bit/s with GMSK modulation.

The launch is planned from New Zealand in the fourth quarter of 2022 on a polar SSO of 600 km.

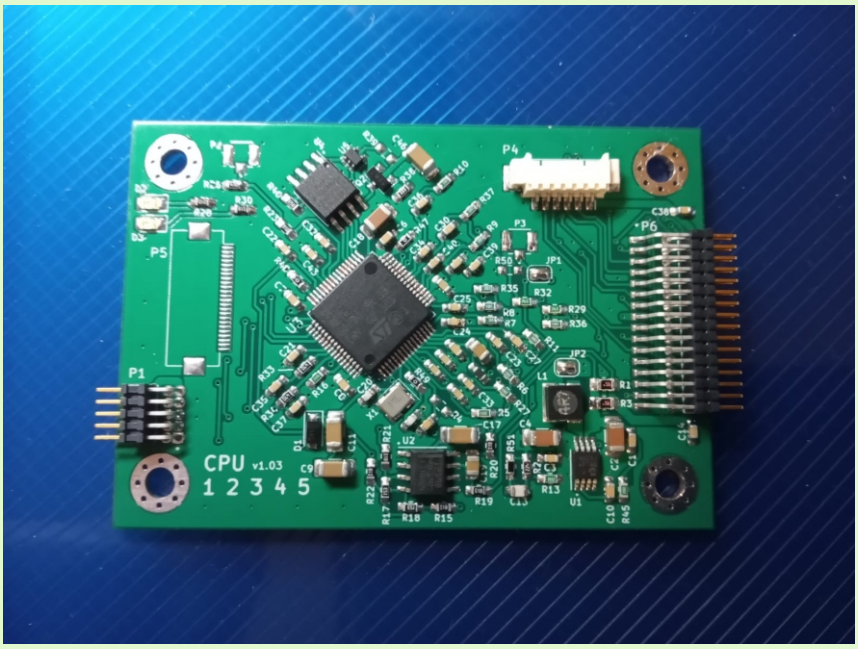
PORTABLE STATION OF THE MONTH (HB9G- John)





As we indicated in the previous bulletin, the satellite has a computer which manages all activities carried out in orbit. That computer module It is known by the english acronym IHU (Internal Housekeeping Unit) or OBC (On-Board Computer), which translated means 'Internal Management Unit' and on-board computer respectively. In previous missions GENESIS, EASAT-2 and HADES 8-bit computers from the Microchip company were used , specifically the 18F45K22 and 18F46K22. Although 8 bits, they are quite advanced chips that incorporate many functionalities.

the first model (the 45) was used in the first GENESIS and ran at only 4 MHz, speed. enough to act as an ASK repeater, which was its fundamental function. This relatively low speed also allowed the module consumption computer was very low, just a few milliamps. For HADES, EASAT-2 and the new GENESIS G and J model 46 was used, which has more internal memory resources, necessary for example to save digitized voice in the Flash memory. The speed had to be raised to 64 Mhz to be able to repeat voice and FSK digital data at higher speed.



For URESAT-1, we could keep using the PIC18F46K22 chip but it is a chip that for us is not suitable for all we need. If we want to do more complicated tasks like trying new modulations, more tx bit rates etc, we need more power.
For this reason, in the URESAT-1 we decided to use the ARM architecture with the 32bits STM microcontroler.

One thing we wanted to do in the previous missions was to synthesize voice for example to use voice for some telemetry instead of data. Unfortunately, having to work at 8 bits did not allow the algorithm to work, even with the chip at maximum speed of 64 MHz. We had to digitize voice and record it encoded in the Flash memory. That is why in the telemetry documents this transmission appears as 'VOCODER'. With the new 32 bit computer functions like this one, generating voice internally could be possible.

<u>The tasks carried out by the OBC are:</u>

- Monitor voltages and currents at different points (solar panels, energy bus…)
- Monitor temperatures at different points (panels,transmitter, receiver,CPU)
- Check battery status
- Generate telemetry packages with all the data collected
- Activate the SSTV photo camera
- Transmit pre-recorded images in the Flash memory of the SSTV module
- Activate FM/FSK transponder when service is requested
- Process telecommands sent from Earth
- And of course, run the chess program

At the time of writing these lines the chess program is already finished, although we are going to try to make it play better. Right now it is running under Linux and we have to port it to the satellite software. We will write a post explaining how it works.

The internal resources that the CPU uses to obtain information from the subsystems of the satellite are its ADC ports (analog-to-digital converters), I2C and SPI buses, which allow serial communication with other integrated circuits and of course digital input/output lines that allow you to activate and turn things off.

In the image you can see the engineering model of the on-board computer. It is not appreciated very well, but it fits in one hand.

Make your donation for the URESAT-1 project

REY (KING) Category (For contributions between €501 and €1,000)

- Your callsign in CW in an assured way from time to time, and randomly SSTV image with others and your own voice in the sat beacon and your own image on SSTV.
- Printed certificate + URESAT pin + mission patch + URESAT mug + URESAT cap + URESAT T-shirt.

DAMA (QUEEN) Category (For contributions between €301 and €500)

- Your callsign in CW in a guaranteed way from time to time, in addition randomly SSTV image with others and your own voice in the beacon.

- Printed certificate + URESAT pin + mission patch + URESAT mug + URESAT cap.

TORRE (ROOK) Category (For contributions between €201 and €300)

- Your callsign in CW in a sure way from time to time and also randomly an SSTV picture with others.
- Printed certificate + URESAT pin + mission patch + URESAT mug.

ALFIL (BISHOP) Category (For contributions between €101 and €200)

- Your callsign in CW in a sure way from time to
- Printed certificate + URESAT pin + mission patch.

CABALLO (KNIGHT) Category (For contributions between €51 and €100)

- The callsign may appear randomly in CW broadcasts.
- Printed certificate + URESAT pin.

PEÓN (PAWN) Category

All URE partners contribute to the realization of URESAT-1, therefore Therefore, our callsigns will go in the FLASH memory of the satellite, being able to be consulted by any associate.

Are you a pawn of the URESAT mission? Find yourself here… partner finder or callsign in general if the result is partner then congratulations.

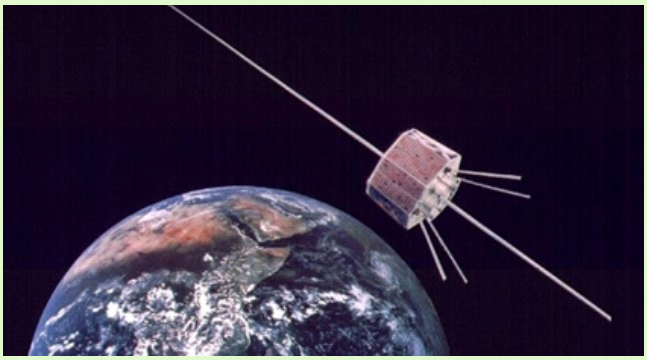
If you are not a member and therefore your callsign does not appear, you would still like it to be include in the flash memory of the satellite, for this you can make a contribution of €50 and it will be added to the database and you will receive the certificate accreditation as a donor.

DONATE

https://uresat.ure.es/donaciones/

When will the new season of mode A start?

EA1PA - Salva



Surely you all know that the veteran satellite AMSATOSCAR 7 (AO-07) is the only active LEO that allows the operation in mode A under a series of circumstances. Let us remember that the mode A assumes that the uplink is in VHF while The downlink is on 10 meters. Note that, for this mode, the transponder is of the “normal” type, and not "reversed" as usual.

The general characteristics of the transponder "A" of the AO-07 would be the
following:

- Uplink Bandwidth: 145.850 – 145.950 MHz(100kHz)
- Downlink bandwidth: 29,400 – 29,500 MHz (100kHz)
- Transponder Type: Normal (V/A)
- Power: 2000mW
- Polarization: Linear
- File line “Doppler.SQF” for tracking software SatPC32:
  AO-07,29450,145900,USB,USB,NOR,0,0,A MODE
- ID for LoTW confirmations: AO-7

Other interesting info about this satellite:

- Dimensions: 36.0 x 42.4cm (octahedron)
- Weight: 28.8kg
- Launch Date: November 15, 1974
- Period: 114.9 minutes.
- Perigee: 1447.0 km above latitude 46°N
- Apogee: 1465.8 km above latitude 74°S
- Tilt: 101.9°

The special circumstances to work it in mode A are based on the fundamental fact that it has to enter a phase of continuous illumination on its solar panels. I give more details below:

- Satellite transponders, modes A and B, not working simultaneously. Neither do any of them work in eclipse.

- Transponder “A” is active when constant light periods allow 24-hour timer to switch between modes B and A. In the above scenario of continuous sun light, without an eclipse in

periods of more than 24 hours, the satellite activates automatically mode A from mode B to approx.12:00 UTC (transponder switching time of the previous season). From that moment and during the following 24 hours the satellite would be active in mode A, returning to operate in mode B another 24 hours. So on, B > A > B > A... every 24 hours commuting at 12:00 UTC, during the entire period that the uninterrupted illumination of the solar panels lasts.

Having seen this, it is of great interest to study in depth the periods of illumination on the satellite and for this there is a very useful tool programmed by DK3WN, Mike Rupprecht, which allows us to analyze it graphically in an interval of 60 days.

The original program file can be downloaded at:

http://www.ne.jp/asahi/hamradio/je9pel/illum.zip

You can also use the slightly tweaked version of JE9PEL:

http://www.dk3wn.info/files/illum.zip

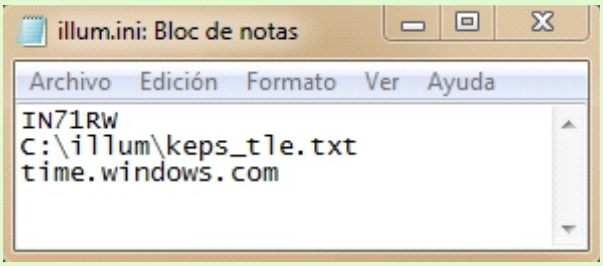
If we download and unzip this last one we find three files:

- The executable to run the ⇨ illum.exe program
- The ⇨ illum.ini configuration file
- The file that stores the TLE ("two-line element") data for describe orbit ⇨ keps_tle.txt

Nombre	Fecha de modifica...	Tipo	Tamaño
illum.exe	18/10/2010 10:39	Aplicación	96 KB
illum.ini	21/05/2022 8:12	Opciones de confi...	1 KB
keps_tle.txt	21/05/2022 8:15	Documento de tex...	1 KB

Before starting the program we edit the configuration file with the notepad. We see that it contains three lines that we will modify:

- 1st row ⇨ We introduce the locator, 6-digit format, of our location.
- 2nd row ⇨ Here we place the path where the TLE file is located on our computer.
- 3rd row ⇨ This row would correspond to the URL of a NTP server to synchronize the computer's clock.



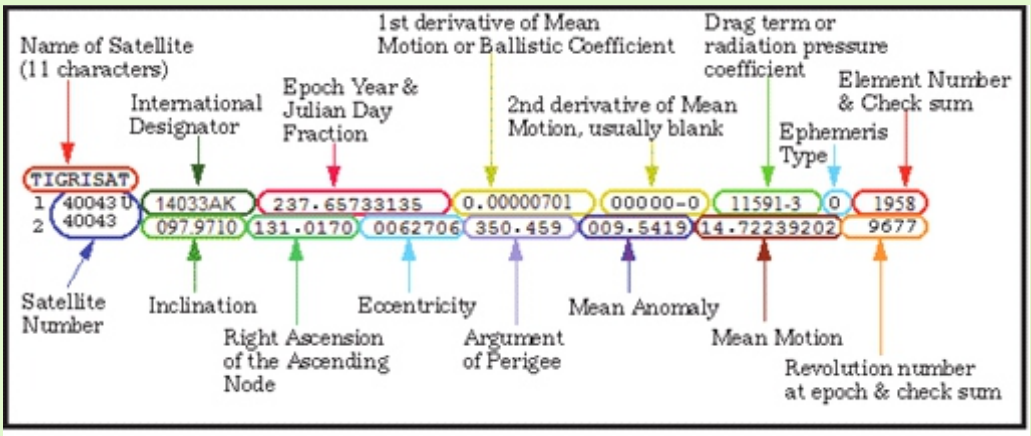
The next step would be to provide updated data to the Keps file. Again using any editor, we enter what corresponds to the AO-07 satellite and that we will find in some of the following sources (take the most recent version):

https://www.amsat.org/tle/current/nasabare.txt

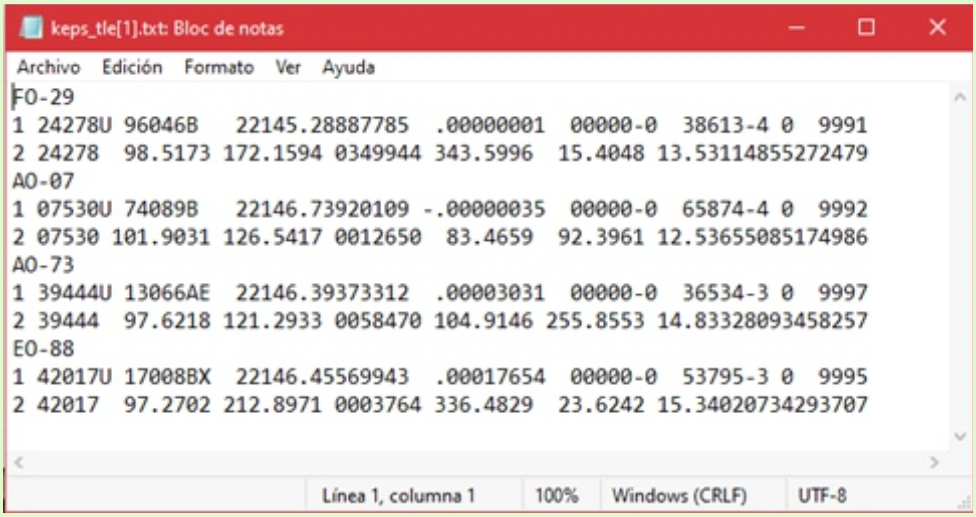
http://www.amsat.org/amsat/ftp/keps/current/nasa.all

http://www.celestrak.com/NORAD/elements/amateur.txt

The figure below shows the meaning of the data of the TLE format that describes the mathematical model of the orbit of a satellite:



In the keps_tle.txt file we can include any satellite we want. In my case, I find it very interesting to study, in addition to the AO-07, the FO-29 for the status of its batteries. Lately its operation is also conditioned by long periods of full illumination without an eclipse.



keps_tle[1].txt: Bloc de notas

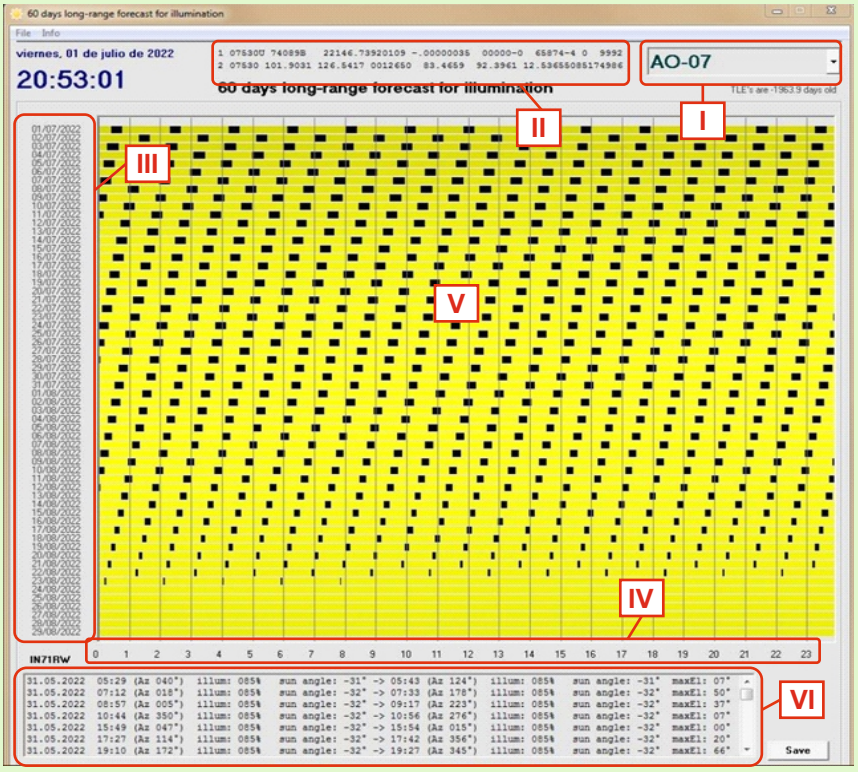
Archivo Edición Formato Ver Ayuda

```
FO-29
1 24278U 96046B   22145.28887785  .00000001  00000-0  38613-4 0  9991
2 24278  98.5173 172.1594 0349944 343.5996  15.4048 13.53114855272479
AO-07
1 07530U 74089B   22146.73920109 -.00000035  00000-0  65874-4 0  9992
2 07530 101.9031 126.5417 0012650  83.4659  92.3961 12.53655085174986
AO-73
1 39444U 13066AE  22146.39373312  .00003031  00000-0  36534-3 0  9997
2 39444  97.6218 121.2933 0058470 104.9146 255.8553 14.83328093458257
EO-88
1 42017U 17008BX  22146.45569943  .00017654  00000-0  53795-3 0  9995
2 42017  97.2702 212.8971 0003764 336.4829  23.6242 15.34020734293707
```

Línea 1, columna 1 | 100% | Windows (CRLF) | UTF-8

Once the previous steps are completed, we execute the program illum.exe. The execution is not immediate ,it takes a while to calculate all the passes for the next 60 days. Must wait a few moments.

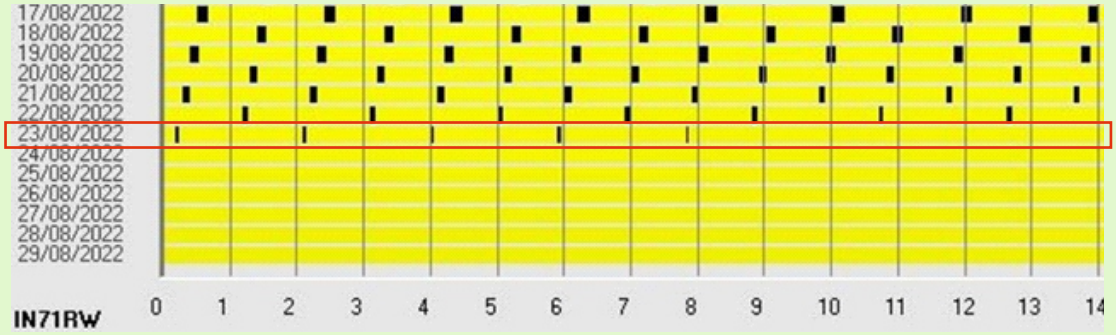
- We select the satellite we want in the drop-down menu ⇨ I
- The corresponding TLE data is displayed ⇨ II
- Ordinate axis for daily representation (60 days) ⇨ III
- Abscissa axis for hourly representation (24 hours/day) ⇨ IV
- Two-color graphical representation (yellow-black) ⇨ V
- "Raw data" that contains the data of all the passes with the possibility to save it in a *.txt file through the "Save" button ⇨ VI



Interpretation of forecast results is straightforward and almost immediate. The illuminated stages of the satellite would correspond to the intervals represented in yellow. In contrast, eclipses are displayed in black

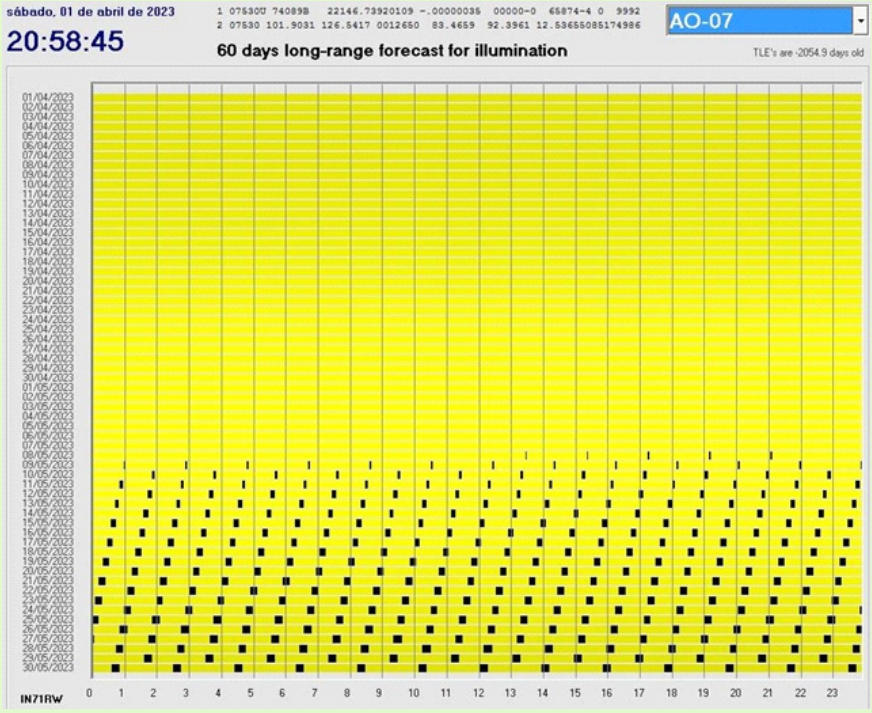
color. The length of the color bands gives us an idea of the duration of the two periods.

In the screenshot above we clearly identify that the periods of eclipse are gradually reduced until August 23. From that moment the black color disappears meaning that the satellite is in a region completely yellow that extends throughout the following days. As we commented before, on those dates the special circumstances for mode A transponder activation in alternating days. Consequently, it can be expected that approximately the start of the A-mode season will begin on August 24, one day after the last eclipse period.

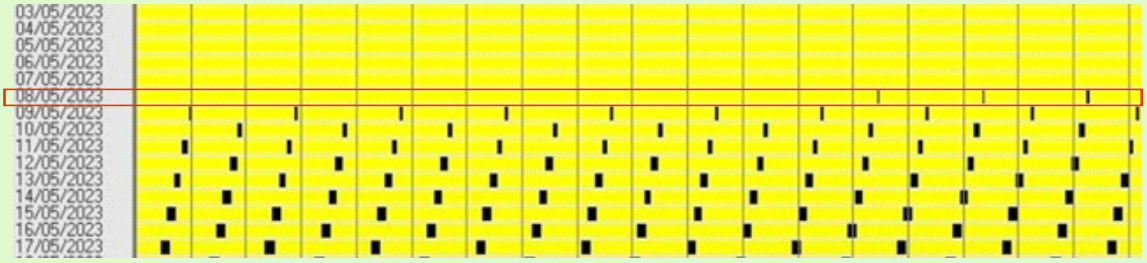


Once the beginning is known, maybe we´d like to know the duration of a full illumination period. For this we will have to estimate the date from which the operation returns to mode B on a daily basis for elapse in an interval of eclipse, even if it is of very short duration.

With the DK3WN tool, the study only reaches up to 60 days, which is now insufficient for our purpose. we would be forced to change the date of the computer and execute the routine again to be able to obtain a more distant forecast scenario. With this “trick” we would get this:



Therefore, we could establish that season A of AO-07 would start approximately on August 24, 2022 and end around May 8, 2023. In total I have counted 129 alternate days of operation in mode A. I hope I'm not wrong, I cross my fingers for that, anyway the final dates must be considered as approximate results that would be more accurate as we get closer to the event. At least I have shown you a "quick" method to predict this kind of thing.



That's all, I can only encourage you to work mode A (in fact the Transponder A works better than B). It is an affordable challenge, do not have fear. Not a lot of traffic, but still a very exciting operation and gratifying where any communication has a special flavor. Until end of August there is enough time to prepare the "setup"

By the way, it is also very interesting to predict the next period of continued illumination for the awesome FO-29 satellite as it is supposed that, in that case, it would be operational 24/7. If we proceed as we did with the AO-07, the sun's rays would fall uninterruptedly on its solar panels from July 20, 2022 to April 15, 2023.

Fabulous!, that day it´s coming! hope you enjoy a lot satellites and radio. Greetings and see you soon

Salva
EA1PA

The call referred to each of the routes of the Camino de Santiago and assigned to each of the sections of Galicia:

- AO1XCF (French Way)
- AO1XFM (Fisterra Muxía Road)
- AO1XVP (Via de la Plata)
- AO1XCI (English Way)
- AO1XCP (Primitive Way)
- AO1XCN (Northern Way)
- AO1XAU (Route of the sea of Arousa and river Ulla)
- AO1XCV (Winter Road)
- AO1XCU (Portuguese Way)
- AO1XPC (Portuguese Coastal Way)

SATELLITE ACTIVATION QO-100 (OUT OF AWARD)

Outside of the award and during its duration, the different special callsigns will be put on the air through the QO-100 satellite. During the day of July 25, an attempt will be made to transmit in TV mode through it with the callsign AO2022XAC. All Qso's made will also be confirmed in the same way as those of the award.

QSO's CONFIRMATION

The Qso's made will be fully confirmed through LOTW and eQSL. Additionally, they can be uploaded to other electronic confirmation platforms.

https://xacobeo2022.ure.es/

AMSAT-EA products in the URE store

For several weeks you have at your disposal several products of AMSAT-EA personalized with your callsign on the URE website.

Don´t hesitate

Support AMSAT-EA