

An Aircraft Equipment for New Lunar Crescent Observations

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1. Introduction

Each year Ramadan does not begin and end on the same evening for all the Muslims around the world. Nowadays, Islam is a world-wide religion and a global method for the new crescent determination seems necessary. By beginning and ending the Ramadan, as well as other feasts along the year, all together, the Muslims will get a much more religious unity among them.

The aim of the project described hereafter is to present a method globally acceptable.

2. The astronomical phenomenon

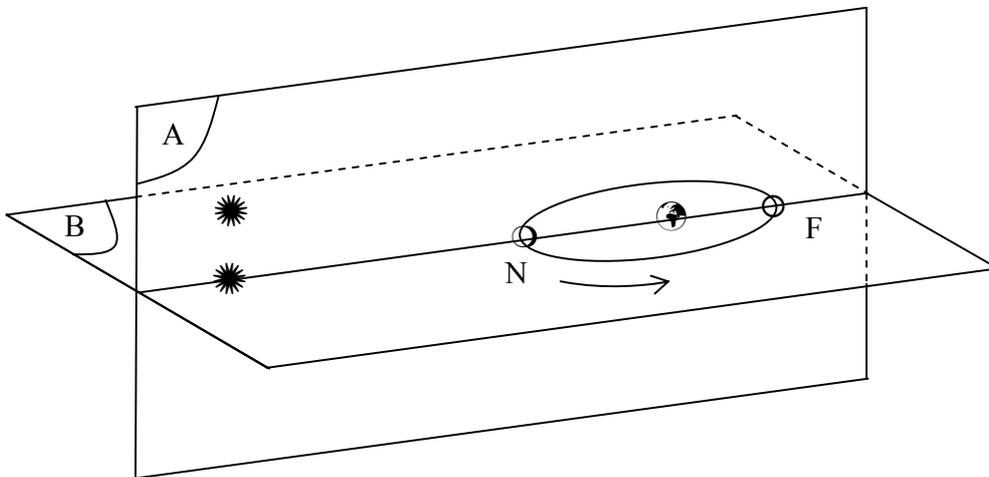


Fig. 1

Figure 1 shows a simplified view of the moon orbit accepted as a plane orbit (plane A) around the earth. Plane B is perpendicular to A and includes the earth and the sun. The full moon happens at F and the new moon at N. When the sun is located on the intersection line of the two planes A and B, the eclipses take place (i.e., eclipse of the sun if the moon is at N, or eclipse of the moon at F).

The rotation sense of the moon on its orbit is indicated by the arrow. Before N, it is the old crescent (the one in the morning), after N it is the new crescent (evening one).

3. The Present Situation

3.1 The mathematical point of view

By laser measurements, the distance from the earth to the moon is known today with a RMS accuracy of about 3 mm. These measurements give a mathematical astronomical model with 27 independent identified moon motions. Some Muslims, such as in Libya for example, have already adopted these models to define when starting the lunar months. However, other Muslims following the traditions set forth in the Holy Qoran think that it is imperative for them to see the new crescent. This religious point of view has to be respected and satisfied if we can do it.

3.2 The visual point of view

From the earth, the angle between the sun direction and the moon direction is minimum when the moon is at conjunction. At that moment, this angle is never larger than $\sim 7^\circ$. This is the only reason for which the observation of the crescent is impossible with naked eyes at conjunction.

When the moon leaves the conjunction position, the angle quoted above increases, and as the time went on, the moon becomes visible from the earth with naked eyes as a tiny crescent.

On the earth surface (lands and seas), the main problem comes from observing a very tiny new lunar crescent in the airglow just after the sunset where the glare effect affects the observation of the faint crescent in the dry haze. It is difficult because the contrast between the sharp new moon just a little illuminated and the surrounding sky is very low. In consequence, the lunar crescent can be observed with naked eyes only about 15 hours after the conjunction. Even if the sky is as clear as possible, the lower atmospheric layers contain dust, humidity and human pollution which scatter the solar light. To decrease the effect of these perturbations, some Muslims climb up high mountains.

After numerous observations, year after year, some criteria (Babylonian, Ibn Tariq, Fotheringham, Maunder, ...) were established to help the observers of the new crescent.

The new crescent observations are made either locally, or nationally, or by an international group of observers (e.g. ICOP, *Islamic Crescents' Observation Project*, see: <http://www.jas.org.jo/icop.html>).

4. How to improve the situation?

Because the new moon appears at different places at the earth surface (see for example Figures 2 and 3 for the appearance of the new moon of Ramadan and Shawal 1422 -- Nov. and Dec. 2001), a few solutions are suggested:

- a network of lunar observatories, **NLO**, on very high mountains around the world,
- observations from an aircraft, **Moonplane**, flying above the lower telluric layers,
- an artificial satellite, **Moonsat**, obeying to parallax computations and orbit changes.

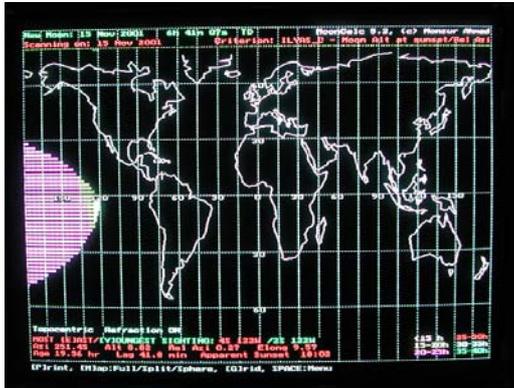


Fig. 2 - First crescent sighting on
15 November 2001

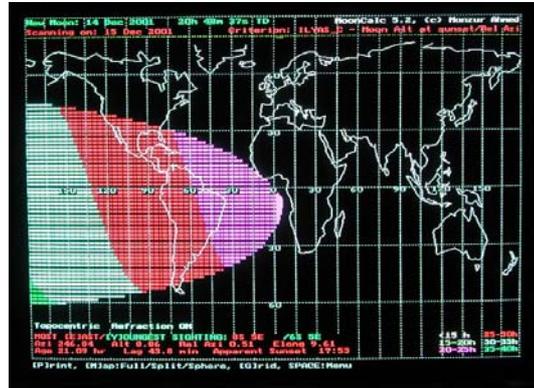


Fig. 3 - First crescent sighting on
15 December 2001

(from MoonCalc 5.2 by Dr. Monzur Ahmed)

4.1 Moonsat

In the Proceedings of the *International Conference on Lunar Calendar Practices: A Common Heritage in Islamic, Chinese, Hindu and Other Civilizations*, held on 24-25 November, 1998, Universiti Sains, Malaysia, it is stipulated p. 27:

« ...An interesting question was on the use of the satellites for the determination of the lunar visibility. The participants were informed that, according to the Syariah, such method was not permitted ».

We cannot discuss such a religious resolution.

4.2 NLO

Large regions in the world are covered by oceans. It should happen that the new crescent appears first in these regions (see Fig. 2 and 3).

Also we are never certain to get a clear sky from the ground-based Lunar Observatory nearest to the place of the new crescent emergence.

4.3 Moonplane

- Technology joins traditions

The plane should be considered as a high mountain moving with us where we want to be, i.e. at the new crescent emergence point. If the place is cloudy, the aircraft is able to fly some miles away following the earth rotation and reaching better observation conditions. Anyway to eliminate all the telluric problems, the aircraft can climb up above the highest clouds (cirrus).

There will be two Immans on board the aircraft, who could observe themselves the new crescent with naked eyes and/or with a refractor. Moreover, a telescope equipped with a CCD camera will follow the evolution of the new crescent.

When the Immans decreed that the new crescent is confirmed (this is a religious point of view), they immediately send the CCD images and an electronic message by Internet to all the mosques of the world and to the TVs of the Muslim states.

Once the observation is done, the aircraft goes and lands (as we go down from a mountain after seeing the new crescent). So, the aircraft observations should be a solution to the recurrent problem of the beginning and the end of the Ramadan and other feasts of the Muslim calendar.

- Principles of the aircraft method

The astronomer computes the first favourable place around the world where sighting the new crescent, and also the waiting path of the plane.

The pilot drives the aircraft to the computed place, and follows the best path waiting for the Immans to decide.

The Immans observe the new crescent and they decide about its emergence with their religious knowledge and responsibility.

- Observation practice on board the aircraft

One of the two rescue doors of the aircraft will be replaced by a special door with three optical-glass portholes:

- naked-eye observations by the Immans will be done through a porthole equipped with an optical glass,
- refractor observations will be done by the Immans through another porthole,
- the telescope and the CCD camera will register the new crescent images through a third one.

After having identified the new crescent, the Immans will send themselves a message with the CCD images of the new crescent (for example JPEG/JPG images) thanks to an on-board Internet equipment.

5. Prototype equipment and tests

A few years ago, in 1990, we have observed in Finland a solar eclipse from a business jet Falcon 20. This observation was sponsored by Dassault Aviation Company. Consequently, the equipment could be used for the first tests of new crescent observations on board comparable aircrafts. Our experience about on board observations could be used to observe the new crescent.

We have to define:

- how many hours after the conjunction will the aircraft observations be optimal for observing the new moon. (This depends on the angular distance between the sun and the moon at the conjunction and on the time for the Immans' decision). The determination criteria from the aircraft are different from the ground ones. The new crescent is expected to be observed between 6 and 10 hours after conjunction.

- what is the best orbit to follow after the conjunction to wait the Immans' decision.

Consequently, some observation tests have to be done during 3 or 4 new moons.

6. The project fulfilment

At the present stage, the tests on board a Falcon aircraft are essential to progress. It seems not necessary to buy a Falcon business jet because some Muslim governments have such an aircraft. They should make it their Islamic duty to lend one. The proposed equipment does not modify the structure of the aircraft, i.e. for the new crescent observations only one rescue door is changed by the special door of our experience.

After these tests, only a few days by year are necessary for determining the Ramadan, Shawal, Thu Al-Hujja and Muharram dates.

The whole equipment will be taken off the aircraft after the moon observations and should be stocked in the astronomical laboratory of the country which has lent the aircraft, to be overhauled and exhibited in a glass showcase.

7. Conclusion

Considering that the flying aircraft altitude is not much higher than a very high mountain, the present proposal can allow much more religion unity among all the Muslims of the world.

All the expenses of the project are estimated (tests and normal use) and we hope to finalize it in collaboration with the participation of a Muslim State.