

     	IPGP-CNRS-OCA ERC LISTEN FLASH Non sensible	Réf: LTF-2026-1 Date : 20/05/2026 Edition : 2/0 Page : 1/16
---	---	---

TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS

	Nom	Date et Signature
Préparé par :	Philippe Lognonné Marco Delbo	
Approuvé par :	Philippe Lognonné	
Vérifié par :	Pierre-Yves Froissart Daniel Sheward	

	TECHNICAL NOTICE (CTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 2/16
---	---	--

References

Classification : Non sensitive	
Key Words : ERC LTFLASH ; CAMERA	
Author : P.Lognonné	
Summary: This document describes the Technical part of the call for tender of the LISTEN FLASH Cameras	
Contrat : ERC LISTEN FLASH	
Software : Word MS-Office	Number of pages : 15

MODIFICATION HISTORY

Version	Date	Comments
1.0	3/29/2026	First draft
2.0	5/20/2026	Final UK version
3.0	6/16/2026	Final UK version for call for tender

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 3/16
---	---	--

TABLE OF MATTER

1.	Introduction	3
2.	Referenced documents	4
3.	Abbreviations	6
4.	Background and science objectives	7
4.1.	Background on listen flash erc project	7
4.2.	Background on lunar impact flashes	8
5.	Telescope subsystem.....	10
5.1.	J band camera optical requirement.....	10
5.2.	I band (or Z-band) camera requirement	11
6.	Operational requirements (for both I and J band cameras).....	12
7.	Exportation and delivery requirements (for both I and J band cameras)	13
8.	Quality requirements and warranty (for both I and J band cameras).....	13
9.	Outreach and advertisements	15
10.	Requirement Python Tool	16

1. INTRODUCTION

This document presents the technical requirements of the camera sub-system of the Twin Impact Lunar Telescopes (TILTs) which are being developed and deployed in the frame of the LISTEN FLASH Advanced ERC project funded by the European Commission. The TILT-1 telescope is shown in Fig. 1.



Figure 1: Picture of the First TILT Telescope in CALERN, France during tests in December 2025.

2. REFERENCED DOCUMENTS

Reference		Information
[1]	10.3030/101199624	Lunar Impact's Seismic and Telescopes European Network for Flash, Project description
[2]	10.1093/nsr/nwad329	Wang, C. Y.Jia, C.Xue, Y.Lin, J.Liu, X.Fu, L.Xu, Y.Huang, Y.Zhao, Y.Xu, R.Gao, Y.Wei, Y.Tang, D.Yu and Y.Zou, (2023) Scientific objectives and payload configuration of the Chang'E-7 mission, National Science Review, 11, nwad329
[3]		Panning, M. P., Avenson, B., Bailey, S. H., Bremner, P. M., Bugby, D., de Raucourt, S., Garcia, R., DellaGiustina, D.; Kawamura, T., Kedar, S., Lognonné, P., Neal, C., Pike, W. T. and Weber, R. C (2023) Farside Seismic Suite: A Long-Lived Geophysical Package and a Model for a Potential Lunar Seismic Network, 54th Lunar and Planetary Science Conference, 1266

[4]		Schmerr N., M. Benna, N. McCall, A. Marusiak, S. Bailey, D. DellaGiustina, V. Bray, P. Byrne, B. Avenson, D. Kim, N. Shah (2024) The Lunar Environmental Monitoring Station: An Artemis 3 Deployed Instrument, <i>Mars Interior and Geophysics after InSight conference</i> , Baltimore, abstract #610
[5]	10.1126/science.175.4027.1244	Watkins, J.S, R.L. Kovach (1972), Apollo 14 Active Seismic Experiment, <i>Science</i> , 175, 1244-1245,
[6]	10.1016/j.icarus.2011.11.028	Ortiz JL, Aceituno FJ, Aceituno J (1999) A search for meteoritic flashes on the Moon. <i>Astron Astrophys</i> 343:L57–L60
[7]	10.1016/j.icarus.2011.11.028	Bouley, S., D.Baratoux, J.Vaubailon, A.Mocquet, M.Le Feuvre, F.Colas, Z.Benkhaloun, A.Daassou, M. Sabil and P.Lognonné (2011), Power and duration of impact flashes on the Moon: Implication for the cause of radiation, <i>Icarus</i> , 218, 115-124
[8]	10.1093/mnras/stv1921	Ortiz, J.L., J. M. Madiedo, N. Morales, P. Santos-Sanz, F. J. Aceituno (2015), Lunar impact flashes from Geminids: analysis of luminous efficiencies and the flux of large meteoroids on Earth, <i>Monthly Notices of the Royal Astronomical Society</i> , 454, 344–352,
[9]	10.1016/j.icarus.2014.04.032	Suggs, R.M., D.E. Moser, W.J. Cooke, R.J. Suggs (2014), The flux of kilogram-sized meteoroids from lunar impact monitoring, <i>Icarus</i> , 238, 23-36
[10]	10.1093/mnras/stz355	Avdellidou, C., J Vaubailon (2019), Temperatures of lunar impact flashes: mass and size distribution of small impactors hitting the Moon, <i>Monthly Notices of the Royal Astronomical Society</i> , 484, 5212–5222
[11]	https://articles.adsabs.harvard.edu/pdf/2014acm.conf..365M	Moser, D., Suggs, R., and Suggs, R. J. (2014), Large meteoroid impact on the Moon on 17 March 2013, <i>Asteroids, Comets, Meteors conference 2014</i> , 365
[12]	10.1093/mnras/stu083	Madiedo, J.M, J.L. Ortiz, N.Morales, J.Cabrera-Caño (2014), A large lunar impact blast on 2013 September 11, <i>Monthly Notices of the Royal Astronomical Society</i> , 439, 2364–2369
[13]	10.1093/mnras/stad2707	Sheward,D, M. Delbo, C. Avdellidou, A. Cook, P. Lognonné, E. Munaibari, L. Zanatta, A. Mercatali, S. Delbo and P. Tanga (2024), Extending Lunar Impact Flash Observations into the Daytime with Short-Wave Infrared, <i>Monthly Notice of the Royal Astr. Soc.</i> , 529, 3828-3837

[14]	https://doi.org/10.1086/519736	Montañés-Rodríguez, P., Pallé, E., Goode, P.R., 2007. Measurements of the Surface Brightness of the Earthshine with Applications to Calibrate Lunar Flashes. <i>Astron. J.</i> 134, 1145–1149.
[15]	https://doi.org/10.1051/0004-6361/202555481	Sheward, D., Delbo, M., Avdellidou, C., Cook, A. and Lognonné, P., 2025. Detection of small fresh craters on the Moon - Linking fresh craters to their lunar impact flash events. <i>A&A</i> , 699, L3
[16]		Sheward, D., Delbo, M., Avdellidou, C., Lognonné, P. et al. 2026. Twin Impact Lunar Telescope network: Lunar Impact Flash observations of the 2025 Geminids, submitted to <i>Monthly Notices of the Royal Astronomical Society</i> .

3. ABBREVIATIONS

Acronym	Definition
ERC	European Research Council
FPS	Frames Per Second
FSS	Farside Seismic Suite
HG	High Gain
I	I band refers to the photometric band (0.7 to 1 μm) centred at 0.85 μm (in the near-infrared).
J	J band refers to an atmospheric transmission window (1.1 to 1.4 μm) centred on 1.25 μm (in the near-infrared).
LEMS	Lunar Environmental Monitoring Station
LG	Low Gain
LIF	Lunar Impact Flash
LT-FLASH	LISTEN FLASH
LS	Lunar Seismograph
R	The R band refers to the photometric band covering approximately 0.55 to 0.8 μm , centred around 0.64–0.66 μm (in the red part of the visible spectrum).
ROI	Region of Interest
SNR	Signal to Noise Ratio

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 7/16
---	---	---

SPSS	South Pole Seismic Station
VBB	Very Broad Band seismometer
z	The z band refers to the photometric band (0.8 to 1.0 μm) centred at approximately 0.91 μm in the near-infrared, as defined in the SDSS system.

4. BACKGROUND AND SCIENCE OBJECTIVES

4.1. BACKGROUND ON LISTEN FLASH ERC PROJECT

The LISTEN FLASH (LT-FLASH)^[1] high level science goals will address both the south hemisphere upper mantle and crustal structure of the Moon and the shallow layers of the lunar South Pole. We aim to determine seismically for the first time the bulk composition, porosity, layering of the South hemisphere lunar crust, a primary feldspathic crust product of the lunar differentiation.

Such goals are generally achieved on Earth by controlled seismic profiles, where an explosion is made for seismic waves generation and where several seismometers record the arrival time of different waves, such as compressive (P), shear (S) body waves or surface waves (R). The known time source and distance to the source provide then easily the seismic wave travel time and apparent propagation speed.

Seismometers will be deployed on the Moon in the 2026-2030 times frame. This includes the Chinese Lunar Seismometer (LS)^[2], to be launched before the end of 2026, and both the NASA robotic Far Side Seismic Suite (FSS)^[3] and the NASA Lunar Environment Monitoring Station (LEMS)^[4] onboard the first Artemis mission landing on the Moon, both expected for launch between 2028 and 2030. This network might be completed during this period by the South Pole Seismic Station (SPSS), onboard the second lunar landing Artemis mission.

The goal of the LISTEN FLASH ERC advanced project is to measure the time and location of natural impacts on the near side of the Moon and to target those rare but large enough to be detected from several hundred to a few thousand km away from these seismic stations. This will be made by monitoring the Lunar Impact Flash (LIF) generated by the impact process with a network of ground-based telescopes, notably, the Twin Impact Lunar Telescopes (TILTs).

As shown in Figure 1 each TILT consists of two telescope tubes on one mount. The telescopes are pointing the same direction but do not have to have the same field of view. We plan to have one telescope (per station) operating in the J-band and the other telescope in the I-band (Johnson) or the z-band of the SDSS.

These flashes are emitted during the impact process and act as impact light beacons for Earth observers. For large impacts away from the lunar limb and easily located, this will enable long distance seismic profiles for FSS and the South Pole stations (LS, LEMS and possibly SPSS) with a source location given directly by the LIF. These seismic data will image the crust and upper mantle of the Moon with natural “calibrated” seismic sources, equivalent to explosive ones (e.g. of 1 ton of trinitrotoluene for an impact of 16 kg at 24 km/s). For much smaller impacts near the South Pole, impacts of 40 gr at the same speed will release more energy than the 2.7 kg explosive source of Apollo 17, the heaviest shot of all active seismic experiments of Apollo^[5].

4.2. BACKGROUND ON LUNAR IMPACT FLASHES

The detection of LIFs was proposed in the early 1990^[6] and then developed experimentally extensively ^{[6],[7]}. Until 2023, this was done exclusively with visible-light video cameras mounted on Earth ground-based telescopes. This has limited the monitoring to Earth night and to impacts occurring on the lunar non-sunlit part. The luminous energy (E_L) is a fraction of the impactor kinetic energy (E_K). It is expressed as $E_L = \eta E_K$, where η is the luminous efficiency, that should have values in the range of $7 \times 10^{-4} - 6 \times 10^{-3}$ and with worst value ^{[7],[8],[9]} of 5×10^{-4} , with our team having recently calculated a likely value of 6×10^{-3} ^[15]. Night detection threshold is typically a few tens of grams with 40 cm diameter telescopes ^[9] and as low as a few grams with larger 1 m diameter class telescopes. LIF observations are typically carried out with visible light cameras (non-filtered, in the R and/or I bands) with a frame rate between 10 and 250 FPS. Global shutter cameras are preferred but not used exclusively in particular if the difference between the exposure time and the frame time is minimal (read out of few msec). Typically, these observations point the non sun lit hemisphere of the moon, which is illuminated by the Earthshine (Fig. 2)

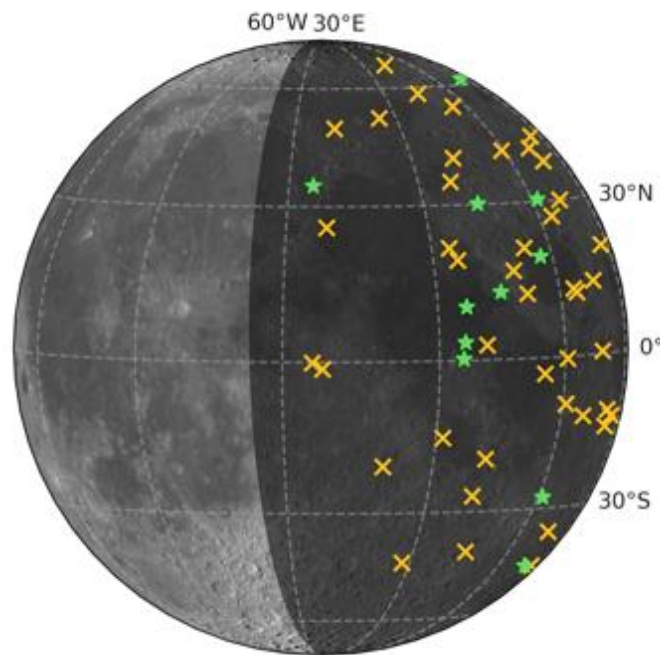


Figure 2: Example of flash detections obtained with the TILT-1 telescope during the 2025 Geminids observing campaign. Unconfirmed events are marked with orange crosses, while confirmed detections are indicated by green stars. Adapted from [16]. During these observations, the telescope was pointed toward the Earthshine hemisphere of the Moon (the darker region). For the LT-FLASH project, observations will also target LIFs occurring on the Moonshine (sun-lit) hemisphere, visible in this image as the bright crescent.

Impact flashes temperature distribution can be approximated by a Gaussian centered at 2700K^[10], with most of the events ranging from 1800K to 4500K. LIF durations range between ~5 to 100 msec for the faintest ones ^[10] (associate to impactor masses roughly smaller than ~0.5 kg) to several seconds for the largest LIFs detected ^{[11],[12]} (which are > 100 kg). LIFs were first time detected in the infrared, J band, in 2023 with a prototype of the LT-FLASH telescope ^[13]. The J band offers not only a better sensitivity, but also the capability to perform LIF detection during the daytime (on Earth) and potentially on both the sunlit and the non-sunlit areas on the moon. This is because LIFs have J

magnitudes between 4.8 and 1.2 brighter compared to their R-band magnitudes (depending on LIF temperatures; for 1800 and 4500 K, respectively). In addition, the brightness of the daylight sky is more than 10x fainter in the J band compared to the R-band and the sunlight reflected by the moon is about 5 times darker in the J band compared to their brightness in visible light. By observing day and night allows to increase the LIF time monitoring, which is critical for the detection of the rare large (1 kg-100 kg) impacts generating seismic waves detectable up to a few 1000 km.

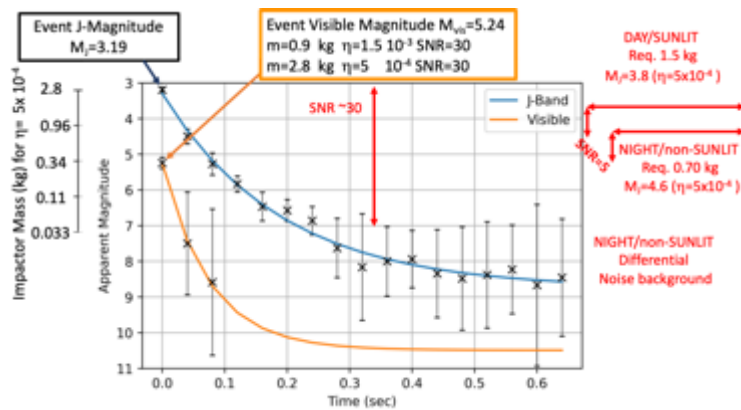


Figure 3: LIFs reference signal from Sheward et al [13], which is estimated as an impact of 2.8 kg (assuming $\eta = 5 \times 10^{-4}$). Note that large uncertainties remains on the mass for a given LIF magnitude and duration and that this figure shall be considered only as indicative. Images were made with stacks of 4 images and with a cumulative exposure of 4 msec. This shows from the observed backgrounds the expected signal and noise for observing conditions. Thresholds are for the 1 ms subframes. During night and for non-sunlit conditions longer exposure will be made, fully capturing the LIFs emission and reduce the mass threshold to 10 gr.

made to generate the required output sampling rate (< 20 ms). The more images that can be acquired during the output sampling rate, the larger the observation margins will be granted. However, we cannot exceed the 20 msec frame time.

We expect the photon noise to be the dominant source in low gain mode associated with observation of the sunlit hemisphere of the moon and of the Earthshine observations during the day. In contrast, we expect the camera self-noise to be dominant for night observation of the non-sunlit parts (Earthshine) of the Moon during Night. LIFs signals are scaled to impactor mass and the luminous efficiency whose value shall be assumed as the worst case ($\eta = 5 \times 10^{-4}$).

The Camera Requirements listed below have been validated by the results and methodology of Sheward et al. [13].

Observations of LIFs on the non-sunlit hemisphere of the moon are limited by the Earthshine, whose brightness varies between magnitude 13 and 16 per arcsec² in the V band [14]. With TILT-like telescope apertures a $V=10$ mag LIF can be detected with $SNR > 10$ in the J band on $V=13$ arcsec⁻² lunar background and $V=13$ arcsec⁻² sky background with 10 msec exposure.

The main problem is observations of LIFs on the sun-lit hemisphere of the moon whose brightness varies between V 4 and 6 arcsec⁻² [14]. To prevent pixel saturation, exposure time shall be shortened (we reckon detection of $V=9$ LIF can be detected with $SNR > 5$ in the J band on $V=4$ arcsec⁻² lunar background and $V=4$ arcsec⁻² sky background with 5 msec exposure) and a large electron full well desirable. Alternatively, we can imagine that a stack of images can be

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 10/16
---	---	--

5. TELESCOPE SUBSYSTEM

LT.0 The camera requirements are defined for a telescope with focal length of 170 cm, aperture diameter of 40 cm and instrument throughput of 0.7 (70%).

5.1. J BAND CAMERA OPTICAL REQUIREMENT

The Camera must have the following requirements:

Quantum efficiency in J Band

LT.1.0 The camera shall operate from 0.9 μm to 1.5 μm .

LT.1.1 The quantum efficiency in J band shall preferably be larger than 0.8. If not, the quantum efficiency shall be able to meet all requirements LT.1.2-LT.1.8.

Gain and saturation

LT.1.2 The camera shall have two gains (Low and High).

LT.1.3 The camera shall be able to capture 60 frames per sec or more.

LT.1.4 The camera shall have a global shutter.

LT.1.5 When operating at the maximum frame rate (60 FPS or higher) and imaging the sunlit lunar surface ($V = 4 \text{ mag arcsec}^{-2}$) under daytime observing conditions (sky brightness $V = 3\text{--}4 \text{ mag arcsec}^{-2}$) in Low Gain mode, the combined effects of detector readout time and pixel saturation shall not degrade the SNR of a LIF by more than a factor of 2 relative to a full integration exposure, where at 60 FPS a full integration exposure would be 16.6 msec with virtually read out time = 0.

NB: At 60 FPS, corresponding to a frame interval of 16.6 ms, one possible implementation satisfying this requirement is a readout time shorter than 8.3 ms together with reaching no more than ~70% of the saturation threshold that would be obtained with an exposure time of 4.15 ms. This would allow us to photometrically measure LIFs up to $V \sim 4$.

LT.1.6 The camera shall not reach 70% of its saturation level in high gain mode when imaging the non-sunlight part of the Moon during nighttime observation with the longest exposure time compatible with its faster rate.

LT.1.7 In Low Gain, the camera shall be able to detect level with a $\text{SNR} > 5$ a LIF of J band Magnitude 3.8 during day observations on the sunlit side of the Moon

LT.1.8 In Low Gain, the camera shall be able to detect with a $\text{SNR} > 5$ a Lunar Impact Flash of J band Magnitude 5.5 during night observations on the non-sunlit side of the Moon

Camera resolution and field of view

LT.1.9 The camera shall have a field of view covering 80% the full south hemisphere of the Moon in all conditions.

LT.1.10 The camera shall have a resolution of better than 2 arc sec per pixel.

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 11/16
---	---	---

Camera mechanics

LT.1.11 The camera should provide an optical interface with either an M42×0.75 mm (T-mount) or an M54×0.75 mm female thread. We require an interface larger than the classical C-mount in order to minimize stray light from the sunlit hemisphere of the Moon reflecting off the small-diameter mechanical tubes associated with the C-mount (see concept in Figure 4)

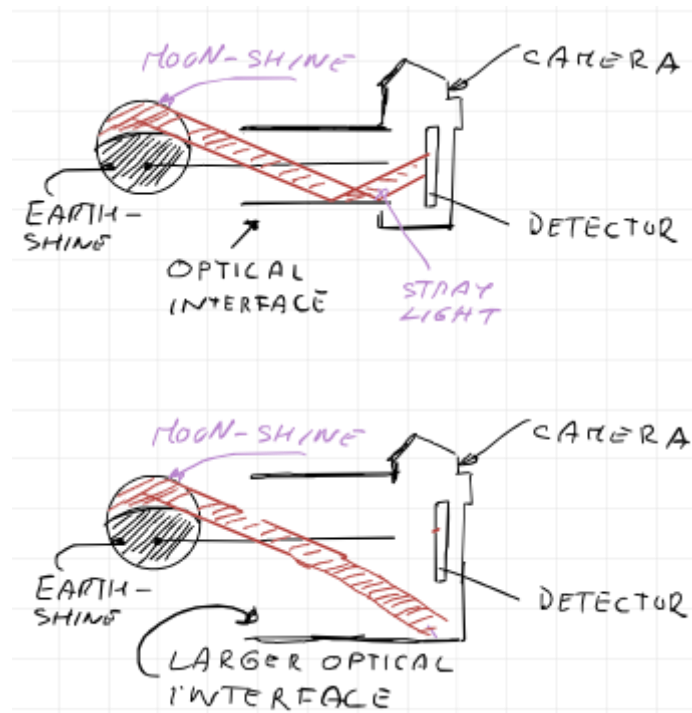


Figure 4: Optical interface for stray light reduction.

5.2. I BAND (OR Z-BAND) CAMERA REQUIREMENT

The Camera must have the following requirements:

Quantum efficiency in I-band or (Z-band)

LT.2.0 The camera shall operate from 0.7 μm to 1 μm

LT.2.1 The quantum efficiency in I band shall preferably be larger than 0.20. If not, the quantum efficiency shall be able to meet all requirements LT.2.2-LT.2.8.

Gain and saturation

LT.2.2 The camera shall have two gains (Low and High) and if not, its single gain shall be able to cover both LG and HG requirements;

LT.2.3 The camera shall be able to capture at least 100 frames per sec for a full resolution frame and possibly more than 200 frames per sec for $\frac{1}{4}$ of the frame

LT.2.4 The capture time of all pixels of a frame shall be known, and obtained within 0.1 msec or less compared to the time of an external trigger time stamp (global or rolling shutter)

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 12/16
---	---	---

LT.2.5 The camera shall not reach 70% of its saturation in low gain when imaging the sunlit part of the Moon during day observation for an exposure time >1 ms.

LT.2.6 The camera shall not reach 70% of its saturation in high gain mode when imaging the non-sunlit part of the Moon during night observation with the longest exposure time compatible with its faster rate.

LT.2.7 In Low Gain, the camera shall be able to detect with a $SNR > 5$ a Lunar Impact Flash of I band Magnitude 4.2 during day observations on the sunlit side of the Moon while not reach 70% of its saturation.

LT.2.8 In Low Gain, the camera shall be able to detect with a $SNR > 5$ a Lunar Impact Flash of I band Magnitude 9 during night observations on the non-sunlit side of the Moon

LT.2.9 In High Gain, the camera shall be able to detect with a $SNR > 5$ a Lunar Impact Flash of Magnitude I band 10 during night observations on the non-sunlit side of the Moon.

Camera resolution and field of view

LT.2.10 The camera shall have a field of view covering 100% the full south hemisphere of the Moon and 80% of the Moon in all conditions, if needed with a focal reducer

LT.2.11 The camera shall have a resolution of better than 2 arc sec per pixel.

Camera mechanics

LT.2.12 as in the case of the J band camera, the camera should provide an optical interface with either an M42 $\times$ 0.75 mm (T-mount) or an M54 $\times$ 0.75 mm female thread. We require an interface larger than the classical C-mount in order to minimize stray light from the sunlit hemisphere of the Moon reflecting off the small-diameter mechanical tubes associated with the C-mount (see concept in Figure 4)

6. OPERATIONAL REQUIREMENTS (FOR BOTH I AND J BAND CAMERAS)

Environmental

LT.3.1 The camera shall operate between -20°C to $+55^{\circ}\text{C}$

LT.3.2 The camera shall operate up to 85% of humidity

LT.3.3 No condensation shall occur on the detector when/if the detector is internally cooled.

LT.3.4 The camera shall operate with minimal maintenance or intervention

Electrical and Digital Requirements.

LT.3.5 The camera frame cadence shall be able to be timed externally by the commanding computer via trigger signal (TTL like square wave). An internal GPS clock is optional.

LT.3.6 The camera shall have thermo-electric cooling

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 13/16
---	---	--

LT.3.7 The camera digitization shall be equal or larger than 12 bits

Supply of a Software Development Kit (SDK)

LT.3.8 The contract holder shall provide, together with the camera delivery, a complete and fully functional software development kit (SDK) compatible with Linux operating systems (Ubuntu distribution, recent LTS version). The SDK shall include all libraries required for camera acquisition and control, documented code examples, and an API providing access to the essential sensor parameters (exposure time, gain, frame rate, detector temperature, etc.). The associated technical documentation shall be provided in English or French. Any proprietary SDK shall allow integration into a C++ or Python development environment.

7. EXPORTATION AND DELIVERY REQUIREMENTS (FOR BOTH I AND J BAND CAMERAS)

LT.4.1 The camera shall be compatible for final exportation to the following countries: All NATO countries, All EU countries, Australia, Chile, Japan, Morocco, Taiwan. If non-compliant with the requirement, the potential vendor shall provide the list of the authorized countries with exportations rules.

LT.4.2 The delivery of all Cameras is requested no later than 6 months after notification. However, the delivery of a first camera before October, 1st, 2026 and the last one before January, 1st, 2027 would be appreciated. The contractor shall provide in the CR the no-later delivery date of the other cameras.

8. QUALITY REQUIREMENTS AND WARRANTY (FOR BOTH I AND J BAND CAMERAS)

LT.5.1 The following parameters shall be specified by the vendor for the camera and guaranteed within 20%

Parameter	Specification information request	Unit
Spectral response	Figure of the Quantum efficiency as function of bandwidth	%
Camera Detector Gain	Value over the photometric band for LG/HG	e/photon
Full well capacity	Value for LG/HG	E
Readout Noise	Value for LG/HG	E
Dark Current	Value for LG/HG at the following temperature: - Ambient 20°C temperature if applicable	e/pixel/s

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 14/16
---	---	--

	- At sensor temperature for internally cooled sensors - At sensor temperature for externally cooled sensors	and Temperature(°C)
Camera Electronic Gain	Value for LG/HG	DU/e
Digital output format	Bit dynamic Exchange protocol	
Full frame Maximum Frame rate	Maximum rate for LG and HG	Hz
Readout time	Value for LG/HG for full frame (for global shutter) Value for LG/HG for pixel (for non-global shutter)	ms
Partial frame For binning and/or Rolling. Maximum Frame rate	Maximum rate for LG and HG with partial frame size (NX x NY)	Hz
Dynamic Range	Value for LG and HG	Db
Optical Interface	Obstacle free diameter of the camera mount (for stray light requirement) Mounting type	mm reference

LT.5.2 The following parameters shall be provided by the vendor

Sensor type		N/A
Number of active pixels	NX x NY	
Pixel Pitch		μm×μm
Active Area		Mm×mm
Exposure Time		Ms
Shutter mode		
Trigger Interface		
Power supply		V DC

	TECHNICAL NOTICE (CCTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 15/16
---	---	---

Cooling technology and cooling temperature		
Image correction		
Functions controlled by serial communications		
Camera power consumption		W
Dimension		mmxmmxmm
Storage temperature		°C
Weight		kg
Transportation shock tolerance	If any	g-duration
SDK	Programming language supported, documentation and functions	

LT.5.3 The evaluation of the performances listed in LT.5.1 will be made by IPGP and CNRS during a period of 3 months following the camera's deliveries. If parameters are non-conforms, IPGP and CNRS will provide to the contractor no later than 4 months after delivery a test report and a request for a camera replacement. Any replacing camera will have to be delivered no later than 6 months after request and the non-conform camera will be sent back to the contractor only after delivery of the replacement camera.

LT.5.4 The requested warranty is one year and warranty extension up to 3 additional years can be proposed by the contractor.

9. OUTREACH AND ADVERTISEMENTS

The LT FLASH project will enable the joint detection of lunar impacts by seismometers on the Moon and ground cameras. Recognizing that such achievement will be made possible by both the performances of the lunar installed seismometers and by the cameras implemented in the LISTEN FLASH telescopes, the contractor will have the authorization to use these achievements for commercial advertisements. The Camera type will also be named in the scientific publications co-authored by the ERC team-members.

All outreach and advertisement will have to strictly follow embargo rules for all publications and data release, will have to cite the associated publications and will have to respect ERC and Associated Space Agencies rules.

	TECHNICAL NOTICE (CTP) LTFLASH CAMERAS Non sensible	Réf : LTFLASH_26-001 Date : 20/05/2026 Edition : 1/0 Page : 16/16
---	---	---

The success of this project being outside the control of the LT FLASH team, especially for the space segment, the above outreach and advertisements cannot be considered as granted.

10. REQUIREMENT PYTHON TOOL

A Python tool is provided to assist in the assessment of the proposed cameras (see file `obsLif.py`).