

# Cliffbot tests during Amadee-15 simulation



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# Cliffbot objectives and tests objectives

- Cliffbot objectives:
  - Send a camera or other instruments to get information on non accessible slopes
- Cliffbot tests objectives:
  - Assess terrain trafficability (what obstacles can be crossed, what obstacles cannot be copped with, how to improve the capabilities)
  - Improve the operator situation awareness (pictures sent uphill)
  - Find the difficulties to operate the vehicle with a spacesuit
  - Find some examples of scientific applications (stratigraphy, measures)
  - Acquire pictures and videos for media purposes

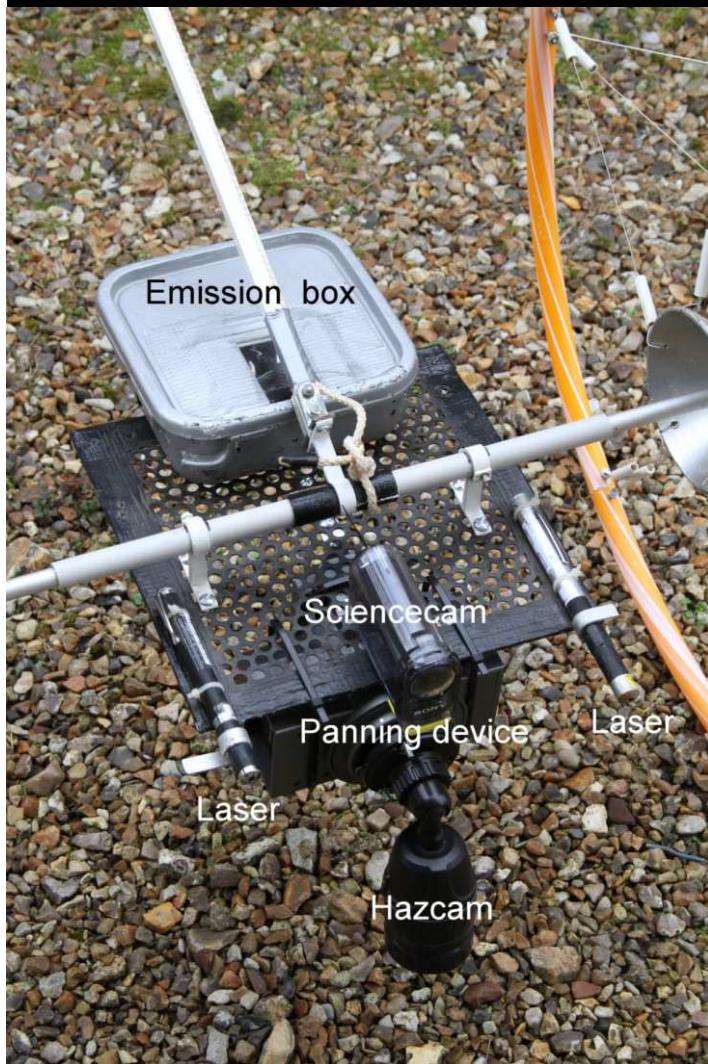




# Cliffbot configuration

From CRV3-4 (Morrocco 2013) to CRV3-5 (Amadee-15):

- Hazcam field of view increased from  $75^\circ$  to  $105^\circ$
- Hazcam fixed on panning device (adjustable; used at  $\pm 170^\circ$ ) with angular speed  $8^\circ/\text{s}$
- Objective: improve vehicle situation awareness for the operator



## Mass evolution

CRV3-3 (Dachstein): 4,47 kg

CRV3-4 (Morocco): 2,4 kg

CRV3-5 (Amadee-15): 3,72 kg



New equipments  
seen with the  
experiment plate  
upside down

## General view



# Cliffbot tests during the Amadee-15 simulation -Summary

Test n°	Date	Location (+indication on map or photo if possible)	Vertical height m (evaluated)	Rope length m	Comments	Data acquired
113	1/8	Kaunertal glacier road. Starting point: skier bridge 500 m before end of road. Part of the rocky glacier under the road used as a ski path	30	87	Operations by PI. Debugging test on an easy slope. Length record for CRV tests. Good Hazcam video reception. Blockage (up and down) by a block protruding between the spokes or right wheel when coming back. Spokes to be tightened (lateral inclination of wheels). One spoke bolt lost. One flag attachment broken. The hazcam can enter in contact with rocks when in its down position on shallow slope. Its axis was oriented 30° from the panning axis (adjustment for low slope). Probably panning mechanism not to be used on rough terrain. 1h of operations including 2 trips to the vehicle location for close up photos	No Sciencecam operations exceptd 1 <sup>st</sup> meters (slope with no interest). Pictures of the vehicle including detailed views of the blocking rock. Pictures of the Hazcam monitor screen.
114	1/8	150 m above the previous test on a large snow patch, on the mountain side of the road	12	25	Operations by PI. One anti roll pin to be refixed. Hazcam enters in contact with snow when elevated ground between the wheels on shallow slope	Photos (no Science cam and no Hazcam operations)
115	5/8	Rock above the small lake along the path	8	7	Operations by PI. Demonstration test for the TV team RMC Découverte. 6 down and up runs. Test which can be used for lichen size measurements.	Sciencecam and Hazcam operationnal
116	8/8	Above the ice glacier			Operations by the analog astronauts. Cameras oriented towards the slope down side. Preceeding attempt the 7th aborted by rain (and also no hazcam video signal on the monitor). Video tests ok the 7th evening.	No sciencecam video available
117	12/8	Same location			Operations by the analog astronauts	No sciencecam video available

**5 tests – 2 with analog astronauts - details in following charts**



# Cliffbot tests locations





# Test 113

1/8/15

Debugging  
test

Test 113 87 m run  
location



Hazcam  
views  
stitch

Length record but on a shallow slope



Test 113: CRV far  
away at 87 m



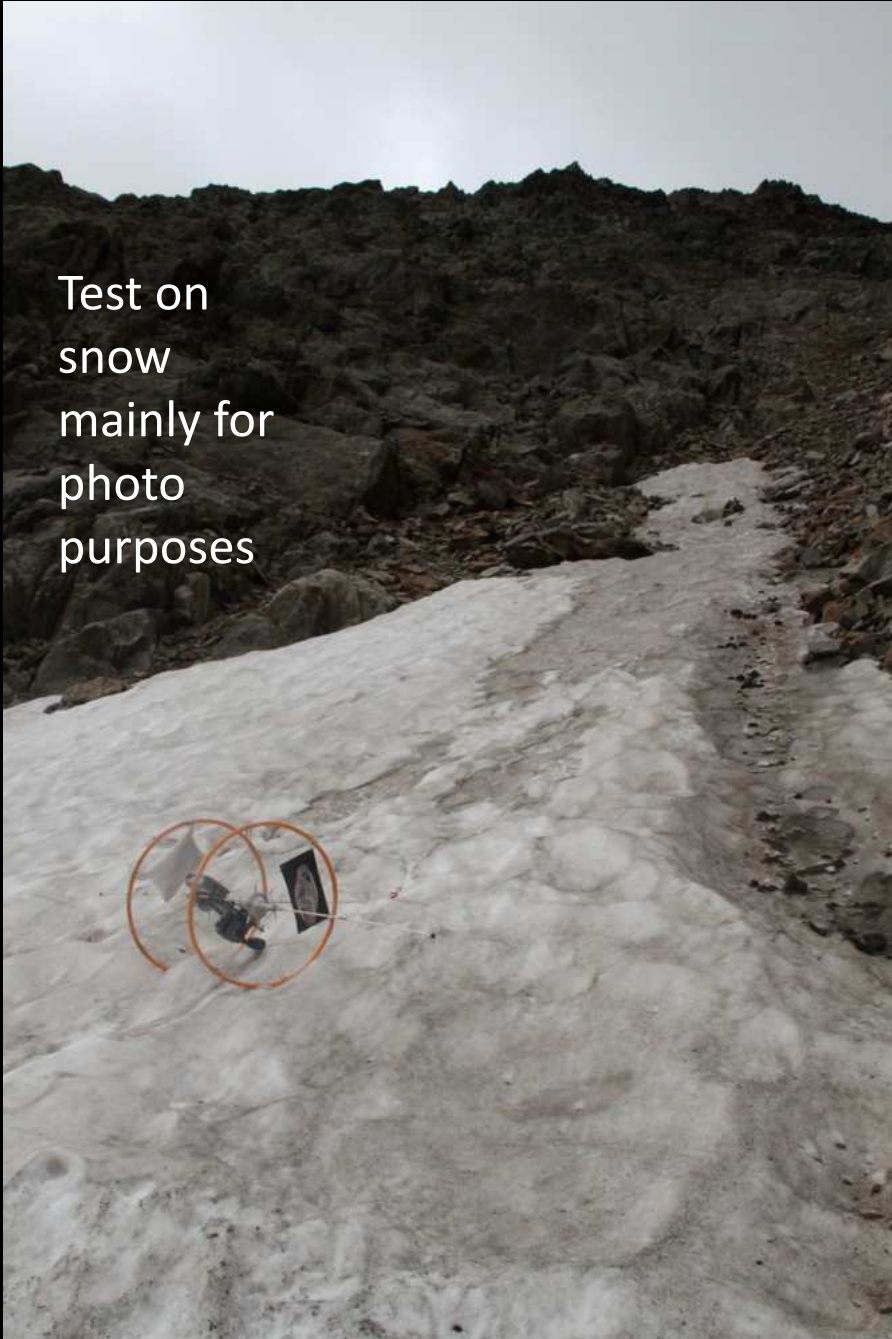
Rock between wheel and  
spikes blocking up and  
down motions but  
shallow slope – Seen also  
in Morocco – Could be  
solved by plain wheels



# Test 114

1/8/15

Test on  
snow  
mainly for  
photo  
purposes



When elevated ground between wheels, the hazcam enters in contact with the ground in the panning motion – Depends on panning amplitude selected and on the slope (risk minimized on vertical slopes) - Could be improved by changing camera attachment point

Risk seen also on  
previous test on a  
shallow sope with  
rocks





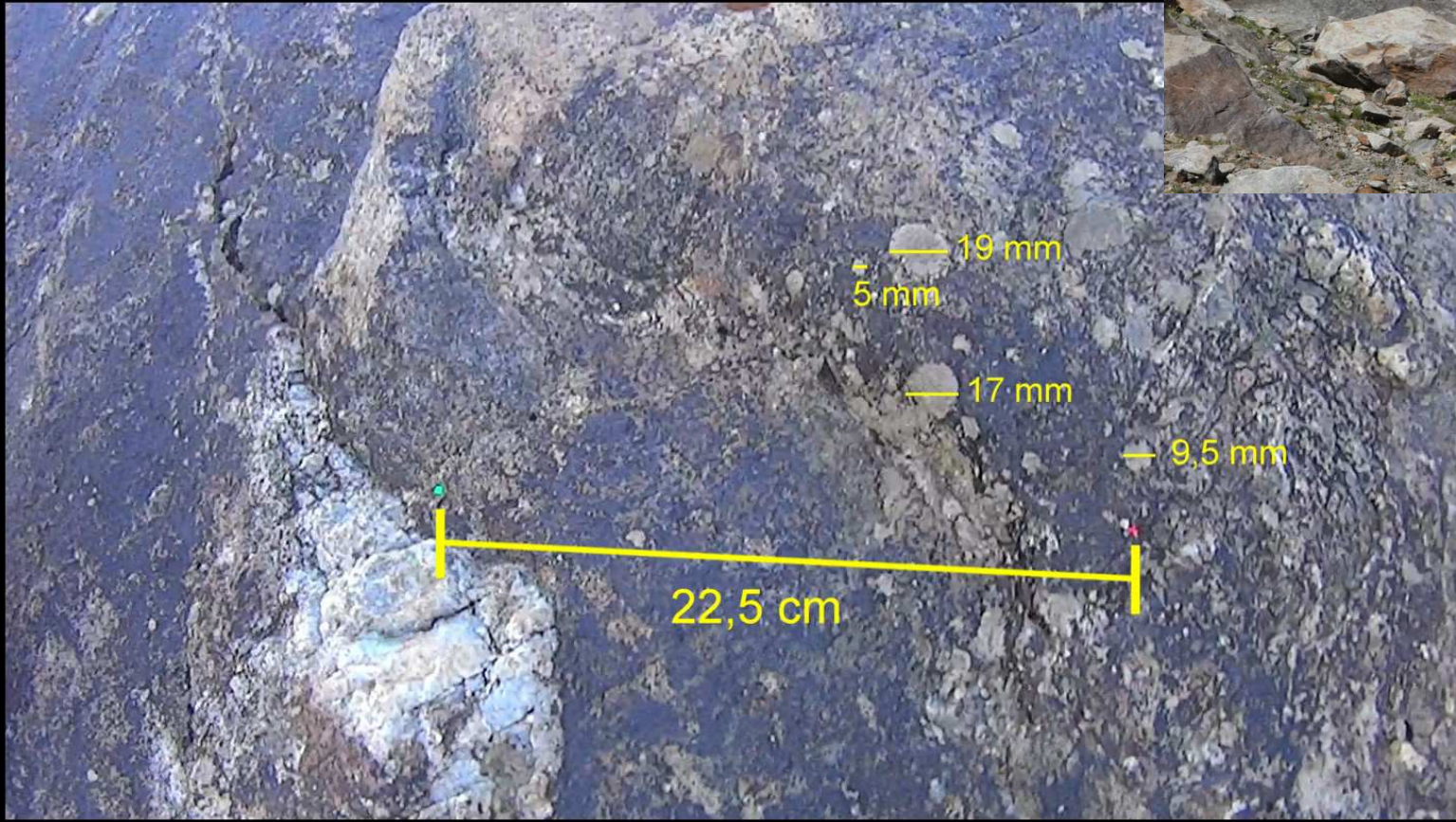
# Tests 115

5/8 /15

Demonstration test for the RMC Découverte TV team  
By product: demonstration of the CRV capabilities in  
features measurement i.e. lichens diameter



Test 115 rock  
slope location



The 2 lasers spot  
separated by 22,5 cm  
give the measurement  
reference





# Tests 116 – 117

8-12/8/15



Two tests by analog astronauts in Aouda suits  
No sciencecam video: difficulty in switching on the sciencecam ?



# Cliffbot tests during Amadee-15 simulation

- **2<sup>nd</sup> test campaign in CRV3-5 configuration after MDRS 151**
- **Small number of tests during Amadee 15**
- **Some results:**
  - **Plain wheels would avoid some blockage (or wheels external covers)**
  - **The panning mechanism can move the hazcam camera lens in contact to obstacles mainly on shallow slopes. Relocation to be studied**
  - **Not enough data to assess if the panning system improves the vehicle situation awareness by the operator**
  - **Features measurement capabilities demonstrated on lichens**
  - **Need to improve analog astronauts training on the experiments ?**

**... And thanks to ÖWF for Amadee 15 organization**



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