



Kaunertal 2015



Doc. O. Walter



Utah 2006

Doc. MDRS 43

BCC tests during Amadee-15



Mars 20XX

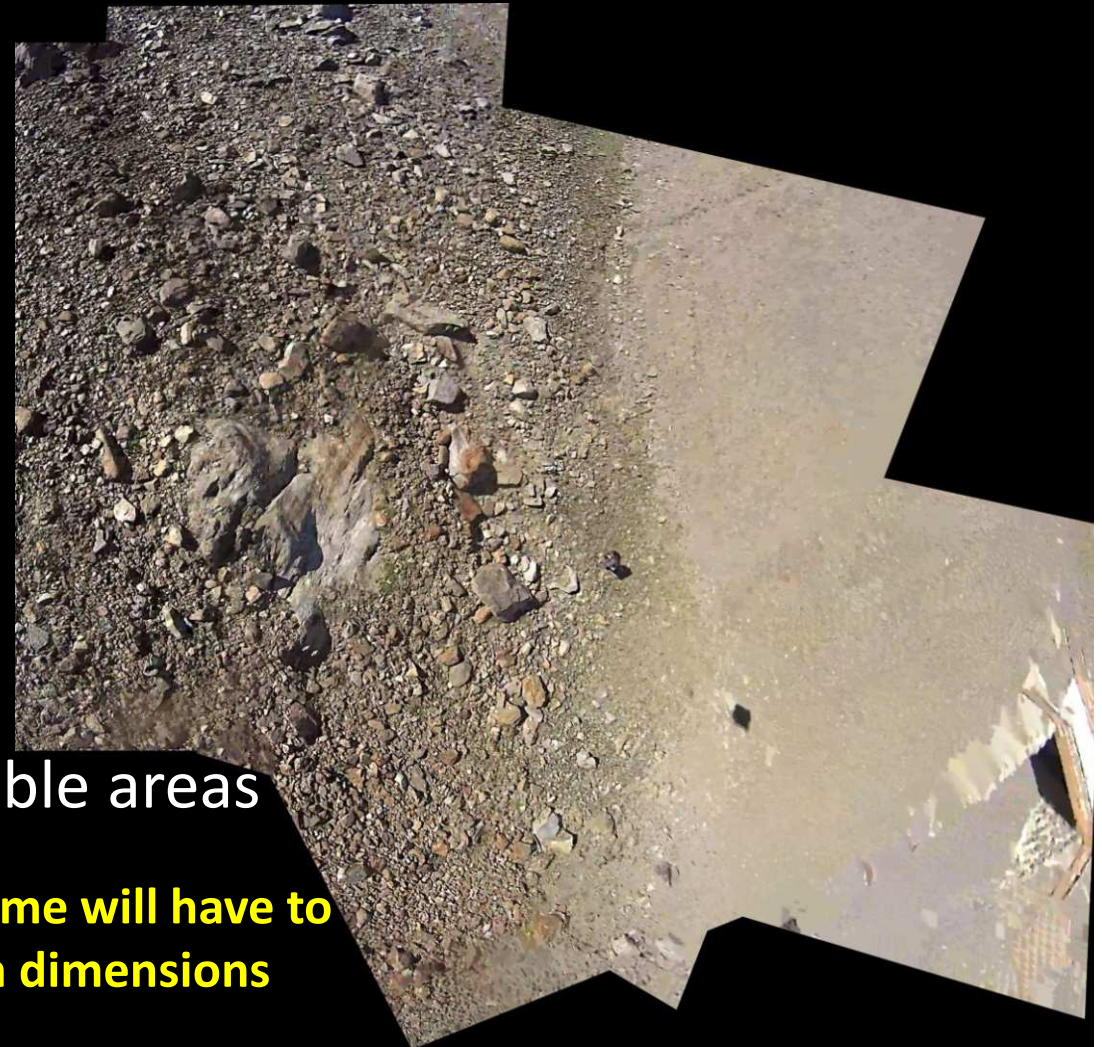
Doc. APM/Manchu



planete-mars.com

Balloon Carried Camera objectives

- Map the astronauts EVA tracks, giving context information on the area where geological samples are taken
- Monitor astronaut activities

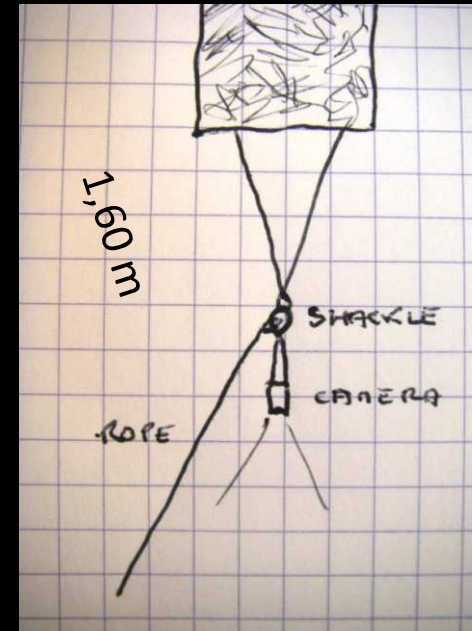


- Get informations on non accessible areas

On Mars for the same payload a balloon volume will have to be 80 times larger i.e. 4,3 times larger in each dimensions

Balloon Carried Camera characteristics

- Volume: ca 800 l
- Mass (deflated): 350 g including camera
- Enveloppe: 2 Mylar sheets 1,6 m x 2,1 m
- Helium filled from 10,2 l 200 b bottle
- Lift above weight at 3000m: ca 1,8N
- Camera: Sony HDR AS 15 120° field of view in a waterproof container



Two rope spools available



A 20 m heavier rope

A 250 m thin nylon wire with 1st 50 m doubled
Rupture load one wire: 7,5 daN

Tests during Amadee -15

Flights	Date	Objectives	Location	Comments
BCC 1	3/8/2015	Debugging test on media day	Ice glacier 300 m from the parking	Operations by PI + J. Neuner help for helium bottle transfert and inflation. Inflation on site on the glacier. Balloon in flight at 10 am. Video of the analog astronauts on the glacier. Three ground contacts linked to wind. Balloon brought back at 5.30 pm.
BCC 2	4/8/2015	BCC 1st utilisation by the analog astronauts – astronauts activity monitoring during LIFE experiment	Ice glacier above the preceeding points	Inflation complement after BCC1. Balloon transfert from OPS to site attached to ATV driven by analog astronaut. Low altitude (limitation by skilift cables near by): camera at 5 m; field of view 17m wide. Astronauts quickly out of field. Camera started by PI.
BCC 3	5/8/2015	Astronauts activities monitoring during EVA on rocky glacier and rocky glacier video mapping	Rocky glacier from the road to the skiers tunnel	Balloon found slightly deflated. Obturator tube partially debonded. Tightness relying on internal check valve. Repair and inflation complement. Balloon walking transfert to rocky glacier. Astronauts EVA monitoring then walk up the slope to the skiers tunnel for glacier slope video mapping. Numerous ground contacts linked to wind. Demonstration of BCC use for inaccessible area survey (cliff above the tunnel). Test of the thin nylon wire spool: unpractical.

Cancellation of BCC 4 the 9th for too strong winds

Cancellation of any further BCC flights the 11th for leaks on the balloon and helium bottle empty

3 tests – 1 with analog astronauts - details in following charts

Operational difficulties

- Gusts of wind bring the balloon to the ground
 - This was foreseen; lift is reduced at 3000 m; winds above 1,5m/s were expected to push the rope at 45°; 1,5 m or 5km/h is a small wind. The wind variations induce altitude variations which complicates photos stitching.
- Strong balloon rotation speed
 - One rope only was used (versus 2 in Utah during the BCC MDRS 43 balloon experiment) in order to minimize inconvenients to the analog astronaut. Rotation was expected but not as high as 60 rpm as observed. Rotation is beneficial to increase the field of view by photo stitching but is detrimental to media type videos; Rotation may be stabilized by a rod and tail linked to the balloon but with weight penalty.
- The long thin wire spool proved unpractical
 - Leads quickly to knots with an open spool. May be solved by a closed spool with only one hole (like the cliffbot spool)
 - The 20 m spool was operational
- The shock protecting rod in front of the camera container lens was too frail
 - A stiffer protecting tripod was initially foreseen but deleted by fear of weight penalty. The heavier the balloon and the more sensitive it is to wind.



Low level flight: under the daisies height !



Bent lens protecting rod



BCC 1

Astros stuck in the mud.
Surrounding reactions may
be documented



Ground and
water contact

Inflation on site on
the glacier



Storage in the sky
without camera
waiting for the EVA

20 m spool



Media day EVA

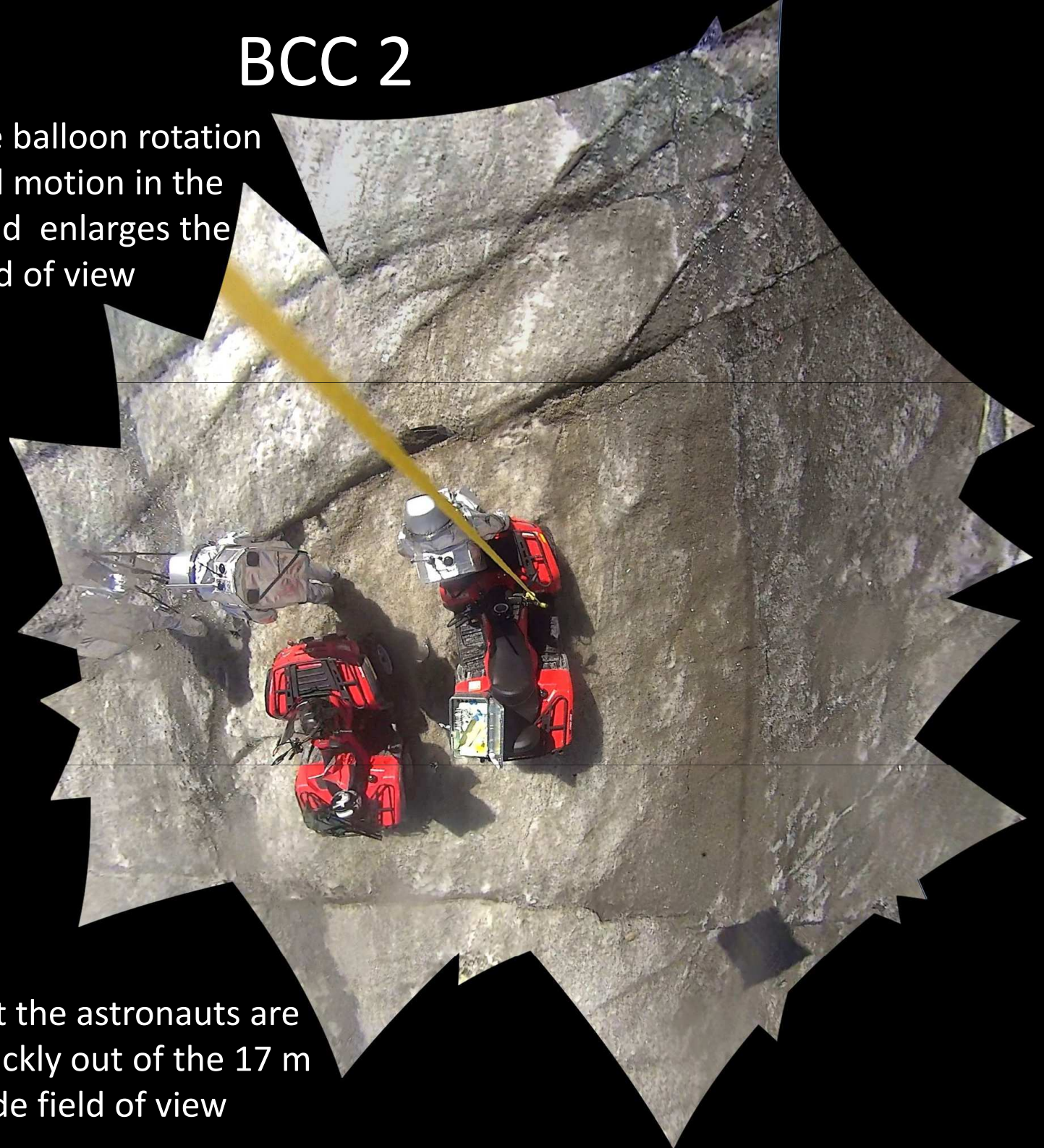
ATV transfert of the balloon to the EVA site facilitated by winds in the same direction as the ATV drive



← Camera
Camera altitude limited at 5 m by close by skilift cables

BCC 2

The balloon rotation and motion in the wind enlarges the field of view

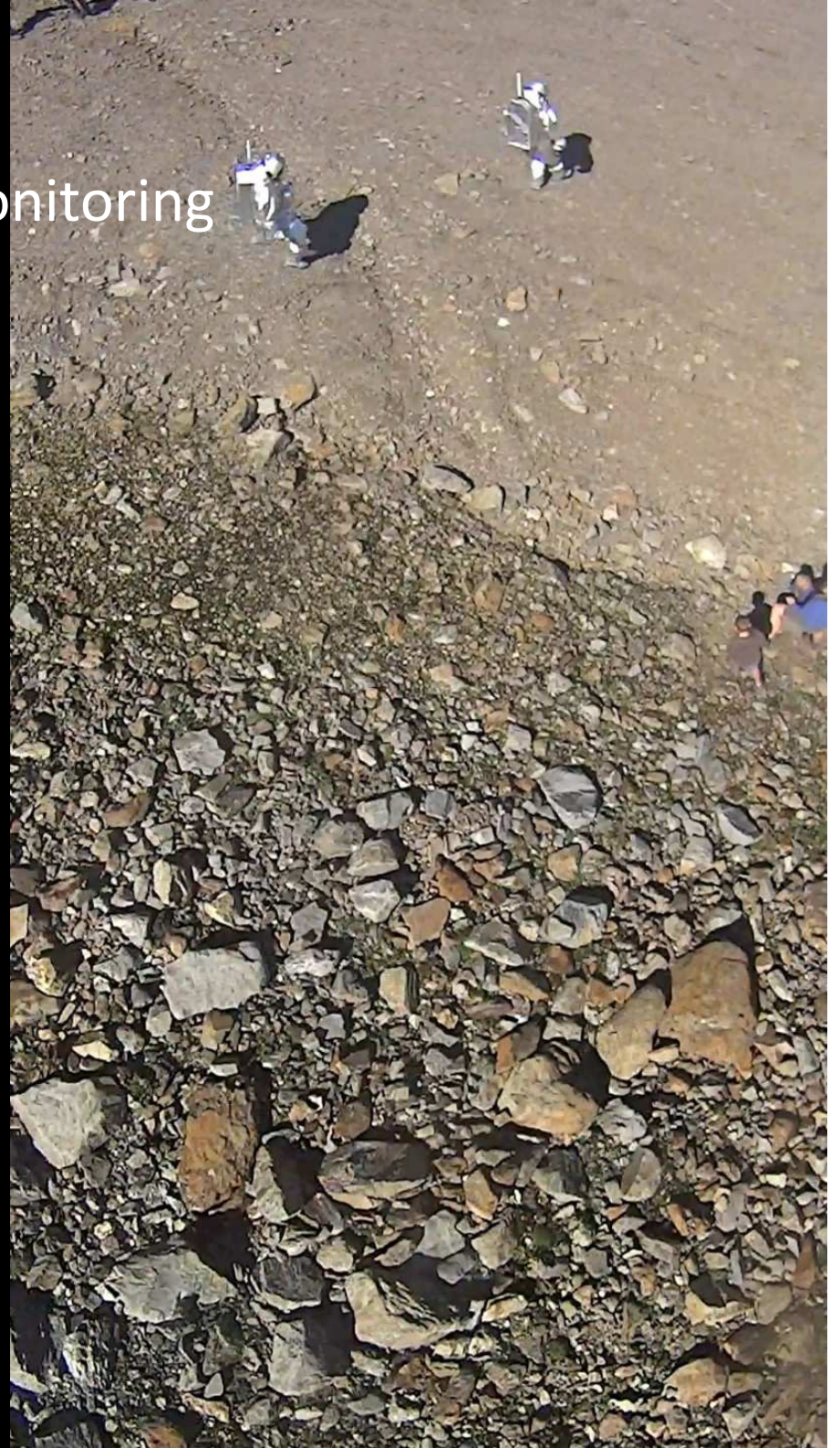


But the astronauts are quickly out of the 17 m wide field of view

BCC 3

Analog astronauts EVA monitoring

Leaving the ATVs



BCC 3

Rocky glacier mapping

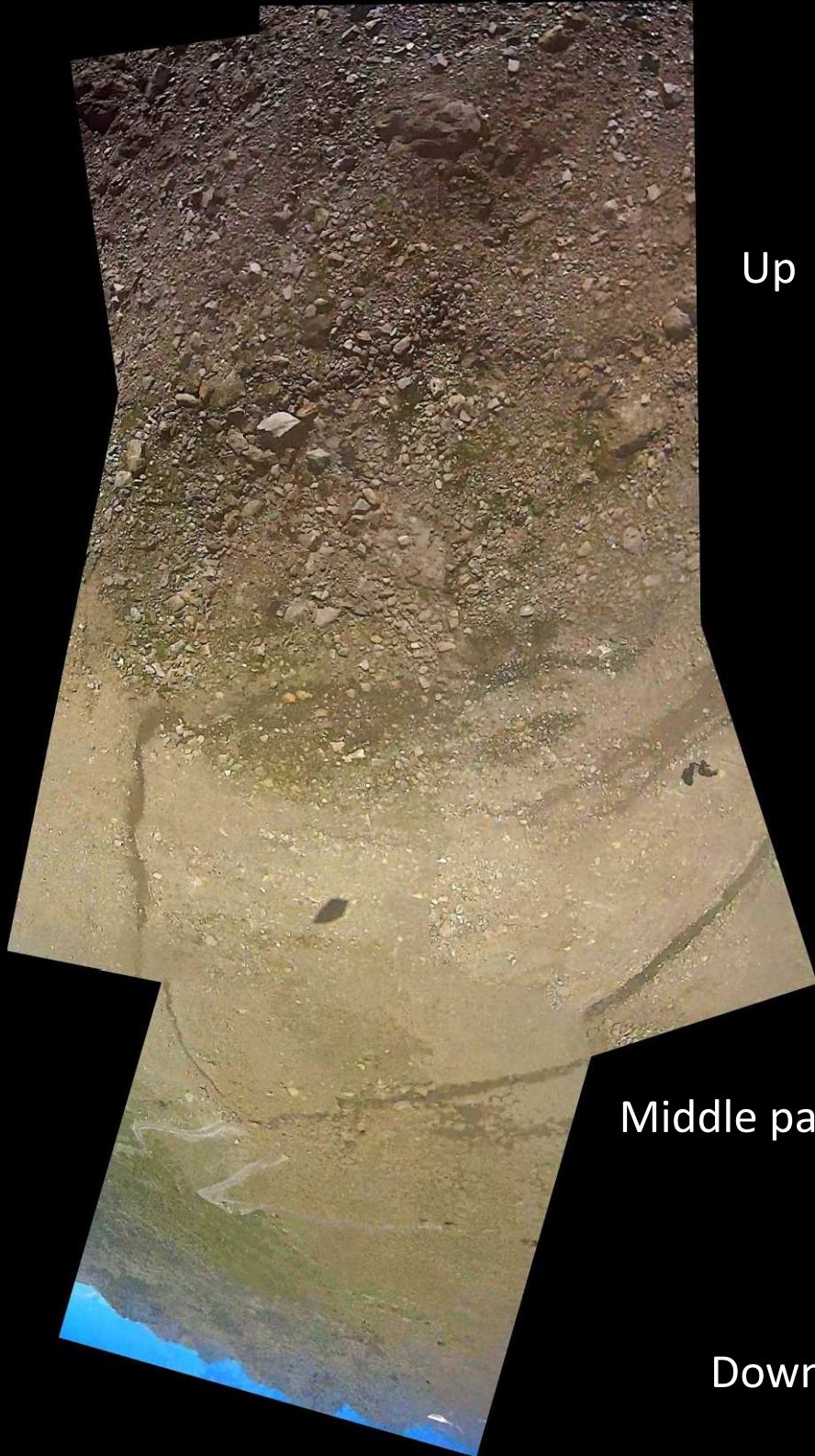
Up

Upper part

Middle part

Down

Lower part



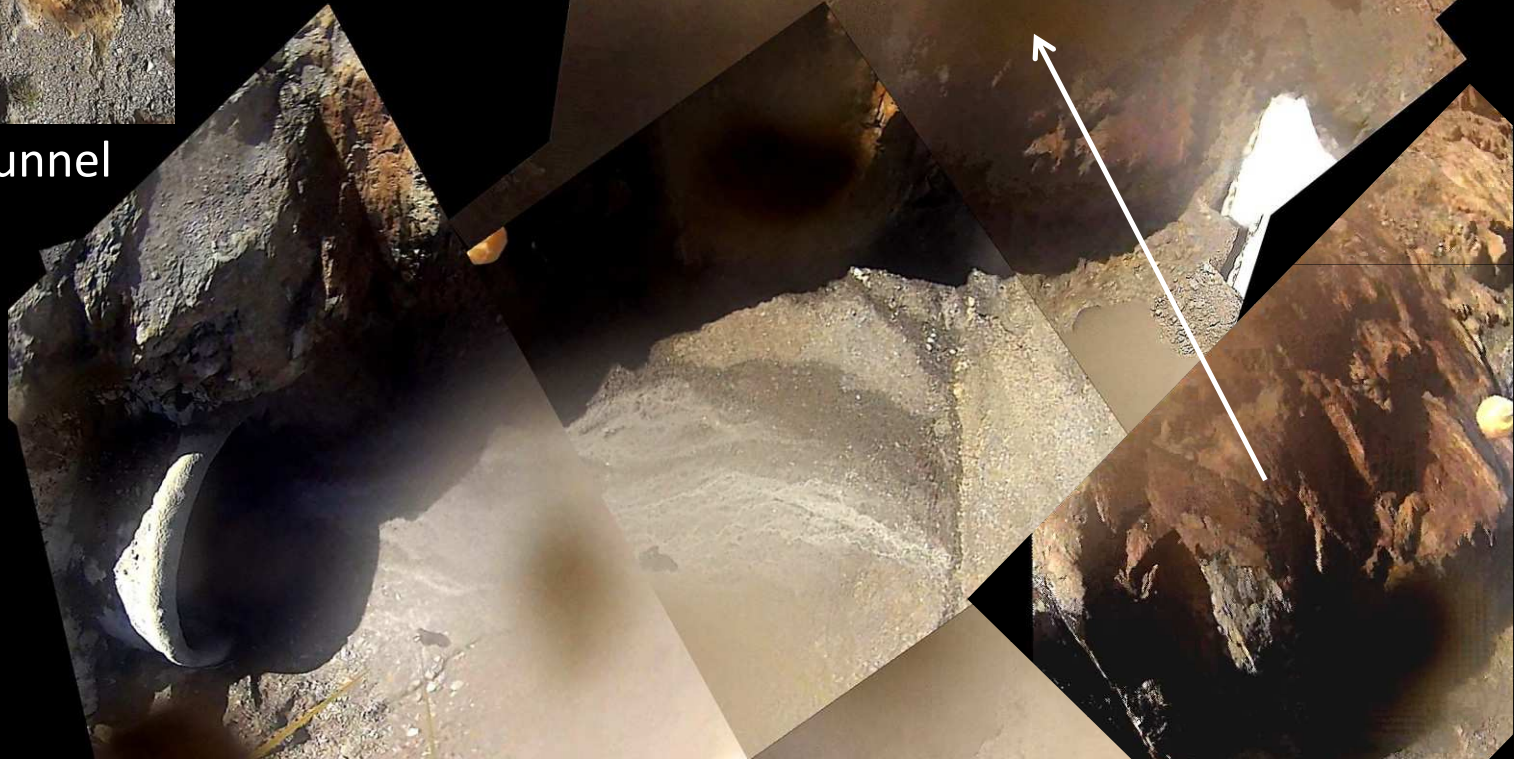
BCC 3

Example of non accessible area survey: the cliff above the rocky glacier skiers tunnel

Pictures partially blurred by fog on the camera container after ground/water contact



Ground details above the tunnel



BCC tests during Amadee 15 simulation

- **First BCC tests with a HD wide angle camera since MDRS 43**
 - Better pictures but high balloon rotation speed
- **Efficiency limitation by rather high winds**
- **Main objectives demonstrated**
 - Terrain mapping
 - EVA monitoring
 - Inaccessible areas mapping
- **No occasion of use by analog astronaut in a walking EVA**
- **Various improvements possible**



... And thanks to ÖWF for Amadee 15 organization

