
A remotely actuated suntracker protection for harsh environmental conditions.
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G. Buntinx, J. Bosseloirs, V. Vandeweerdt

Objectives

- Suppress manual operation of the lid that is somewhat difficult and dangerous when it is out of balance because of the wind or ice accumulation.
- Control the opening from anywhere if possible.
- (Avoid going outside in the wind and cold to open or close the lid.)

Problems

- Ice and snow may accumulate on the lid, in the openings, on the moving parts… anywhere.
- Ice, snow and water may fall (understand: fly) from anywhere.
- The refreezing water may glue the lid edges together, hold the lid to the ground or fill spaces that should remain empty.
- Water may cause short circuits.
- Temperatures down to -35°C and wind up to 150km/H when in use.
- Wind up to 230km/H when closed.

More problems…

- Lightning proof
- Not much room inside for moving parts
- Safe : hydraulics can be destructive and dangerous → lots of protections
- Reliable : 5 operation modes from totally manual to full automatic
- Very precise real-time status
- Not too expensive
- Simple

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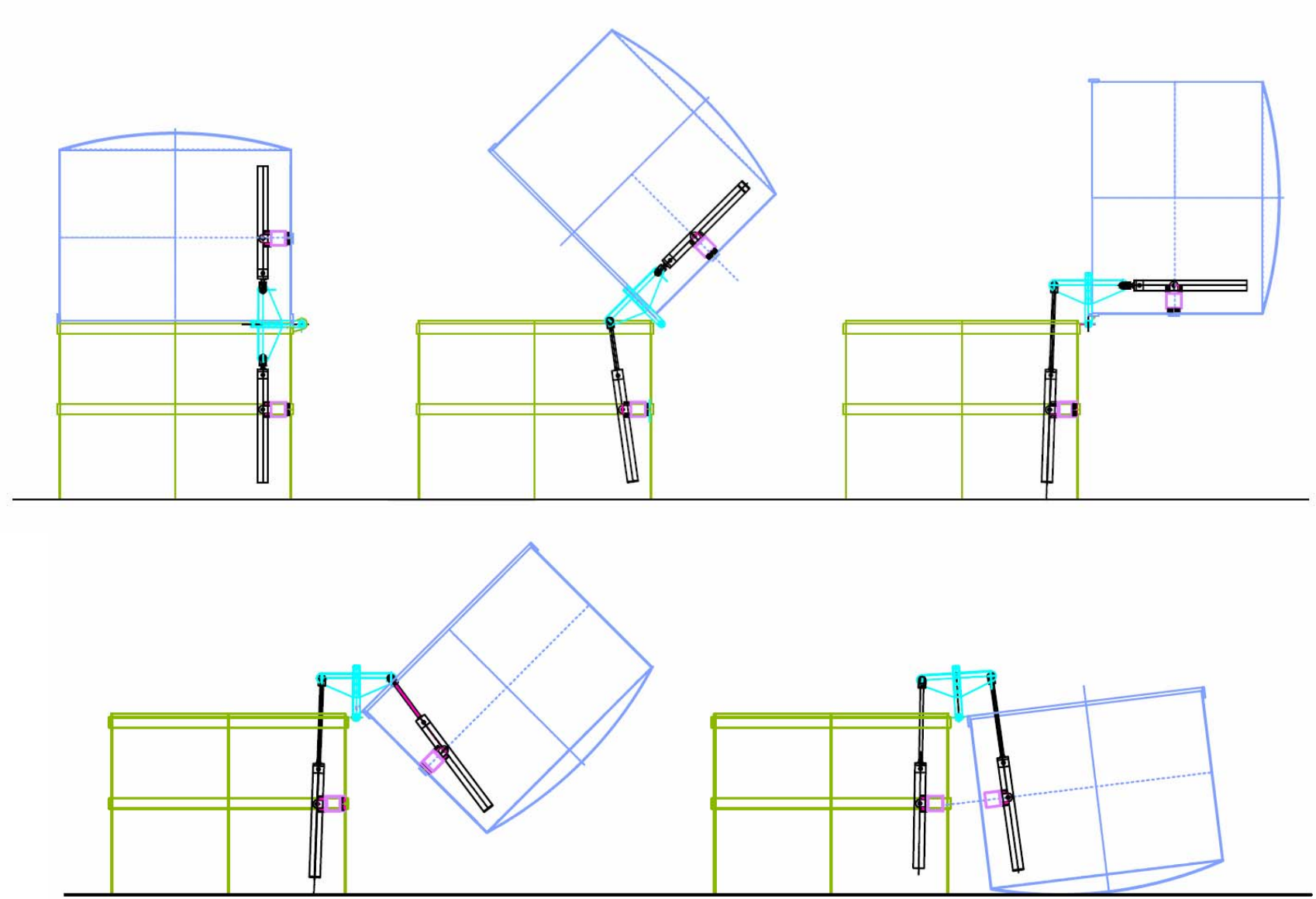
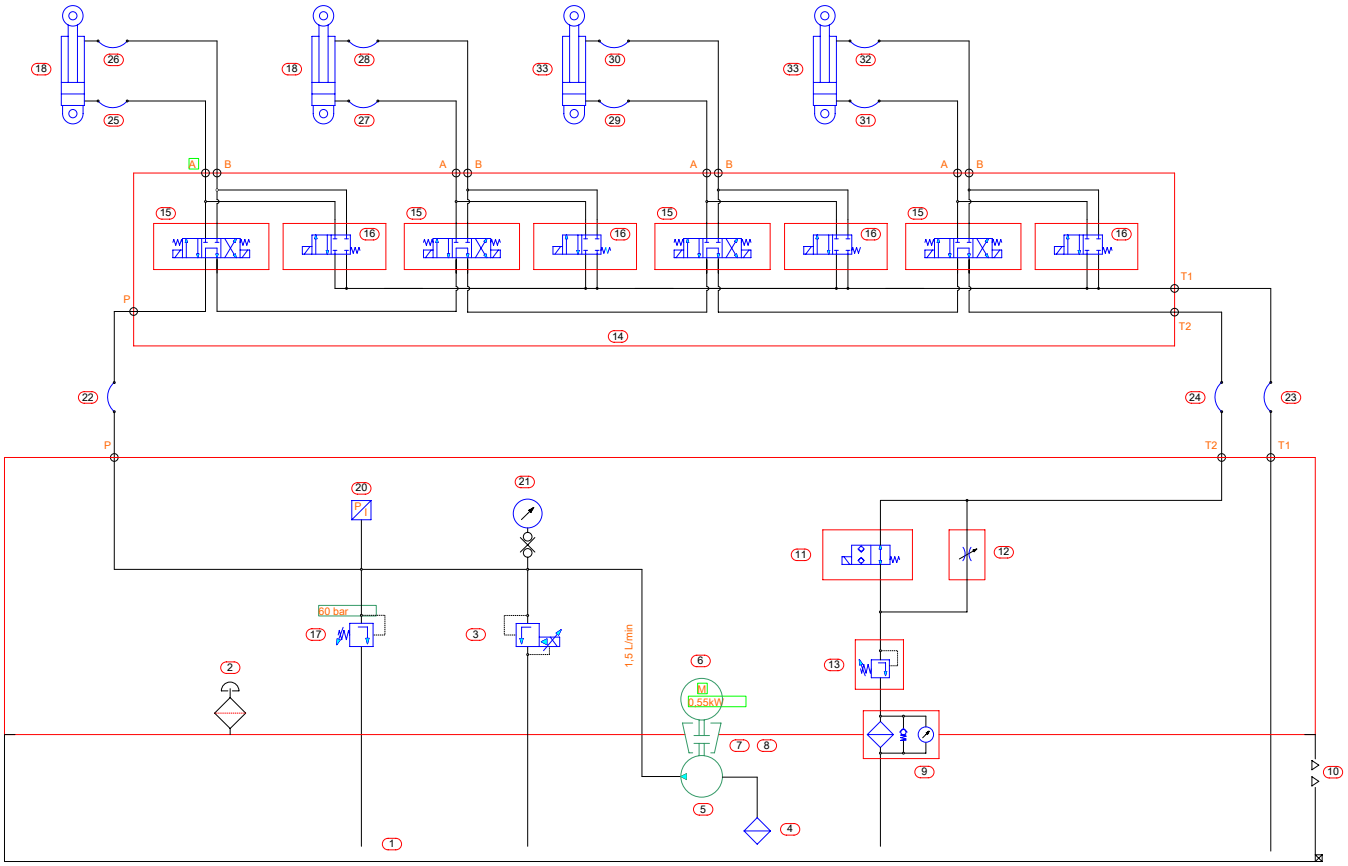
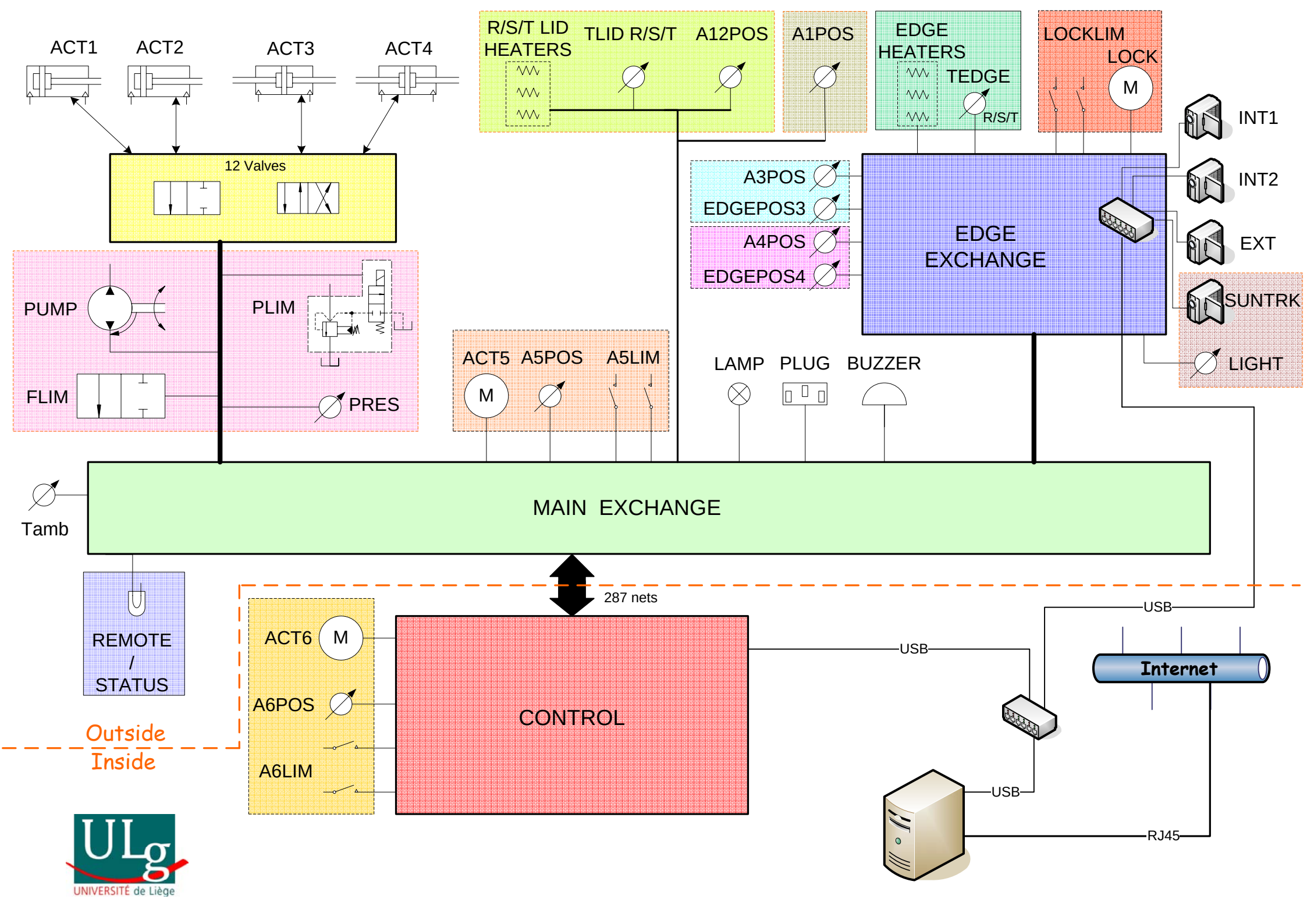
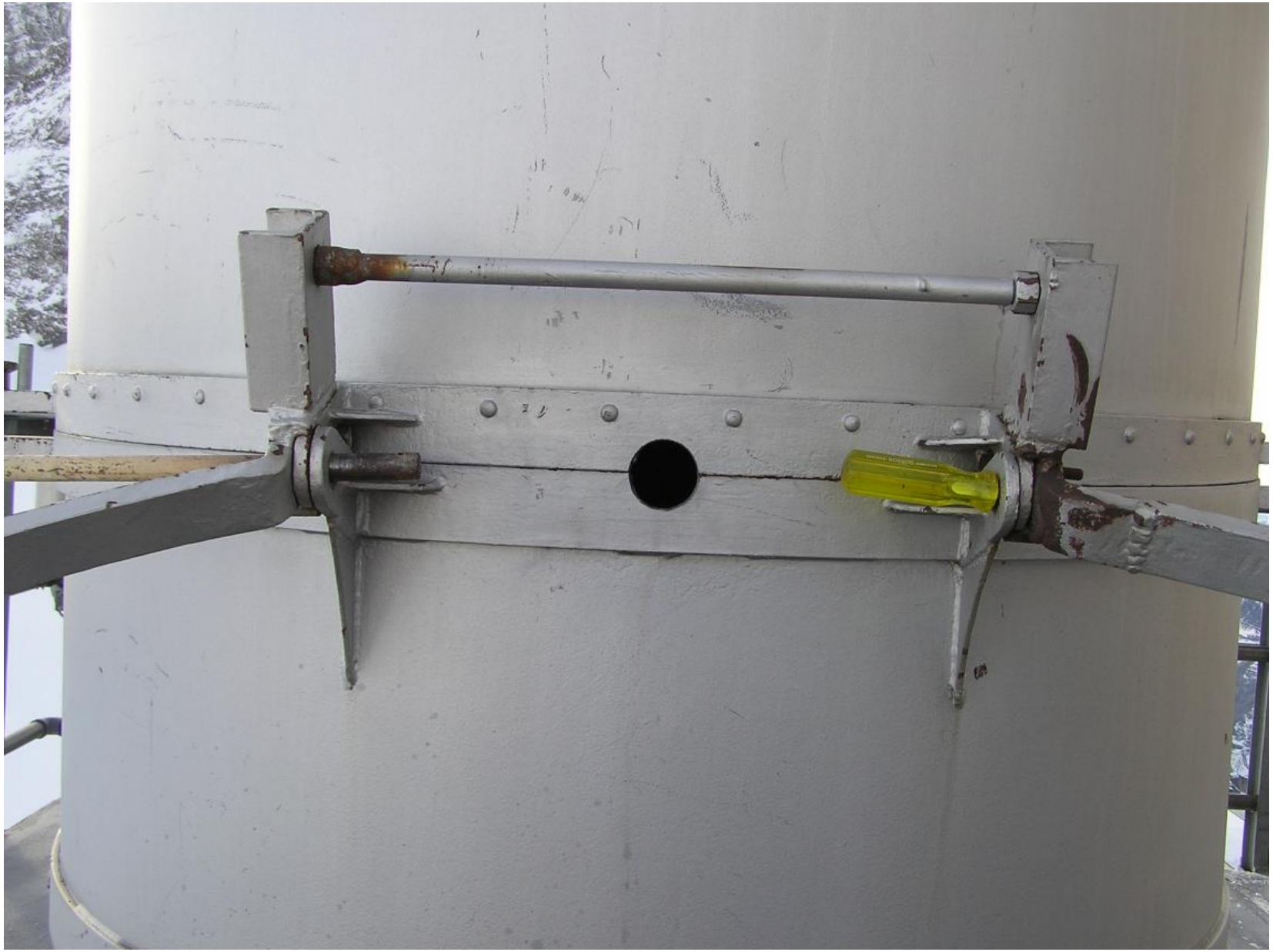
Movement Theory

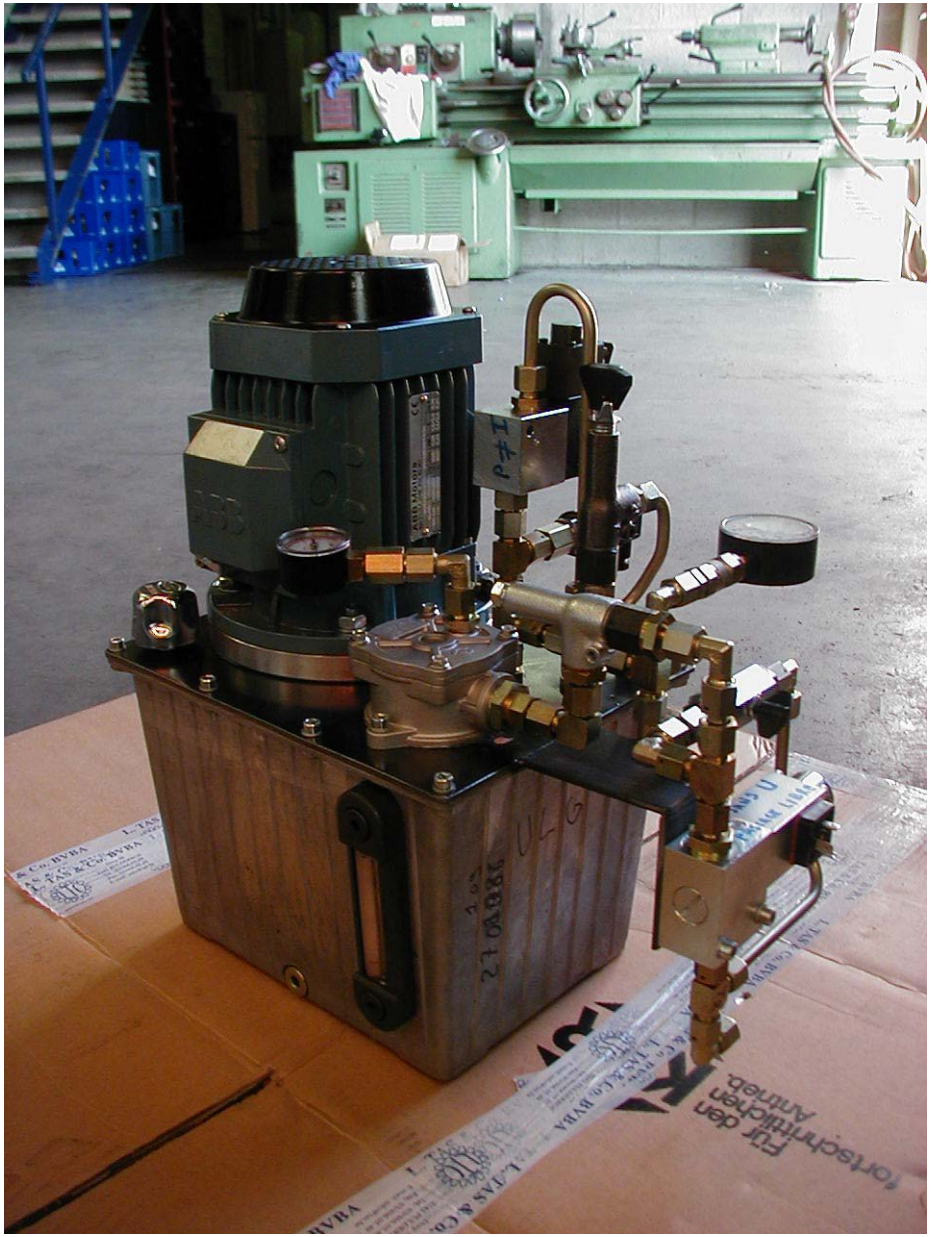


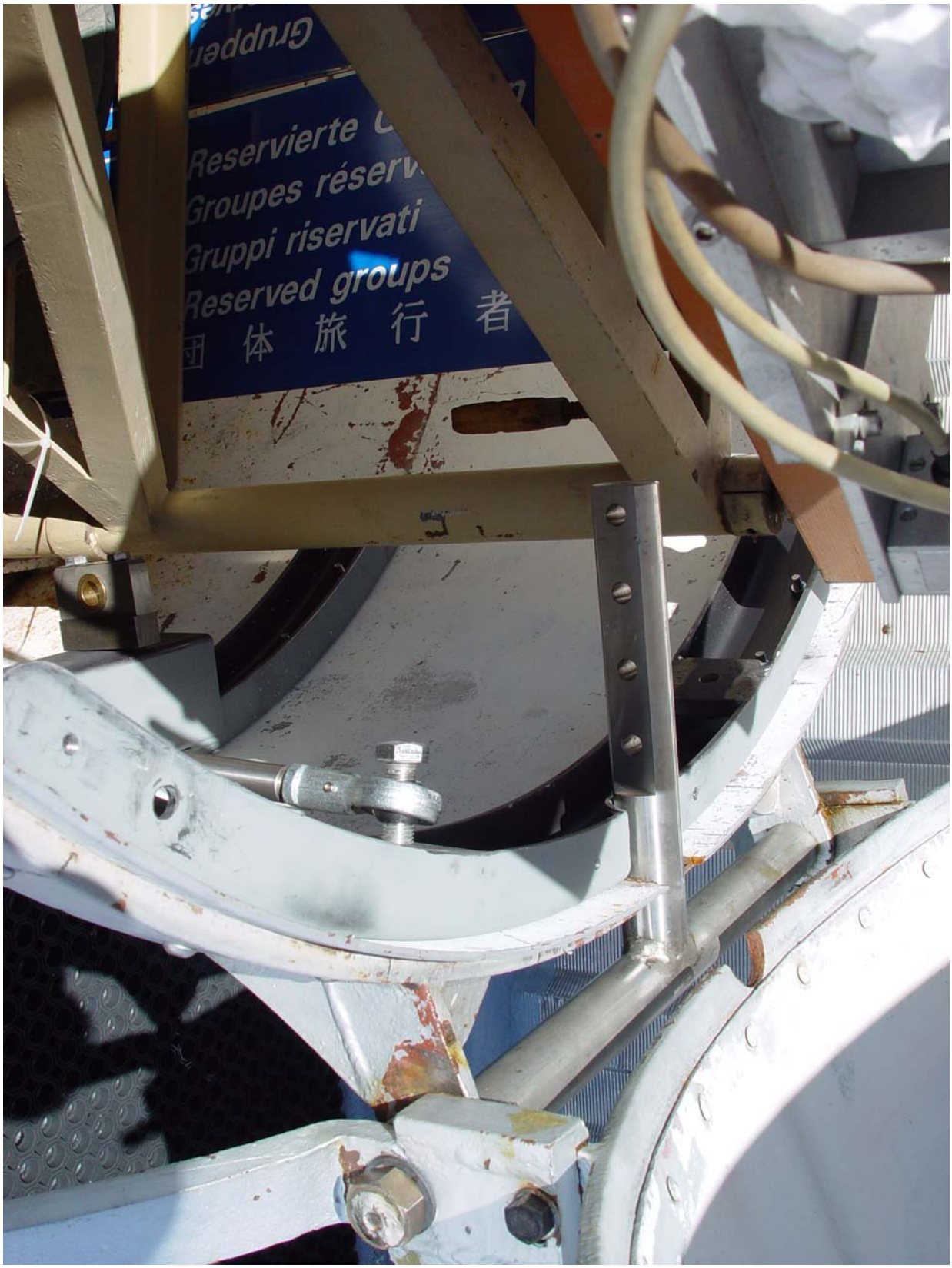


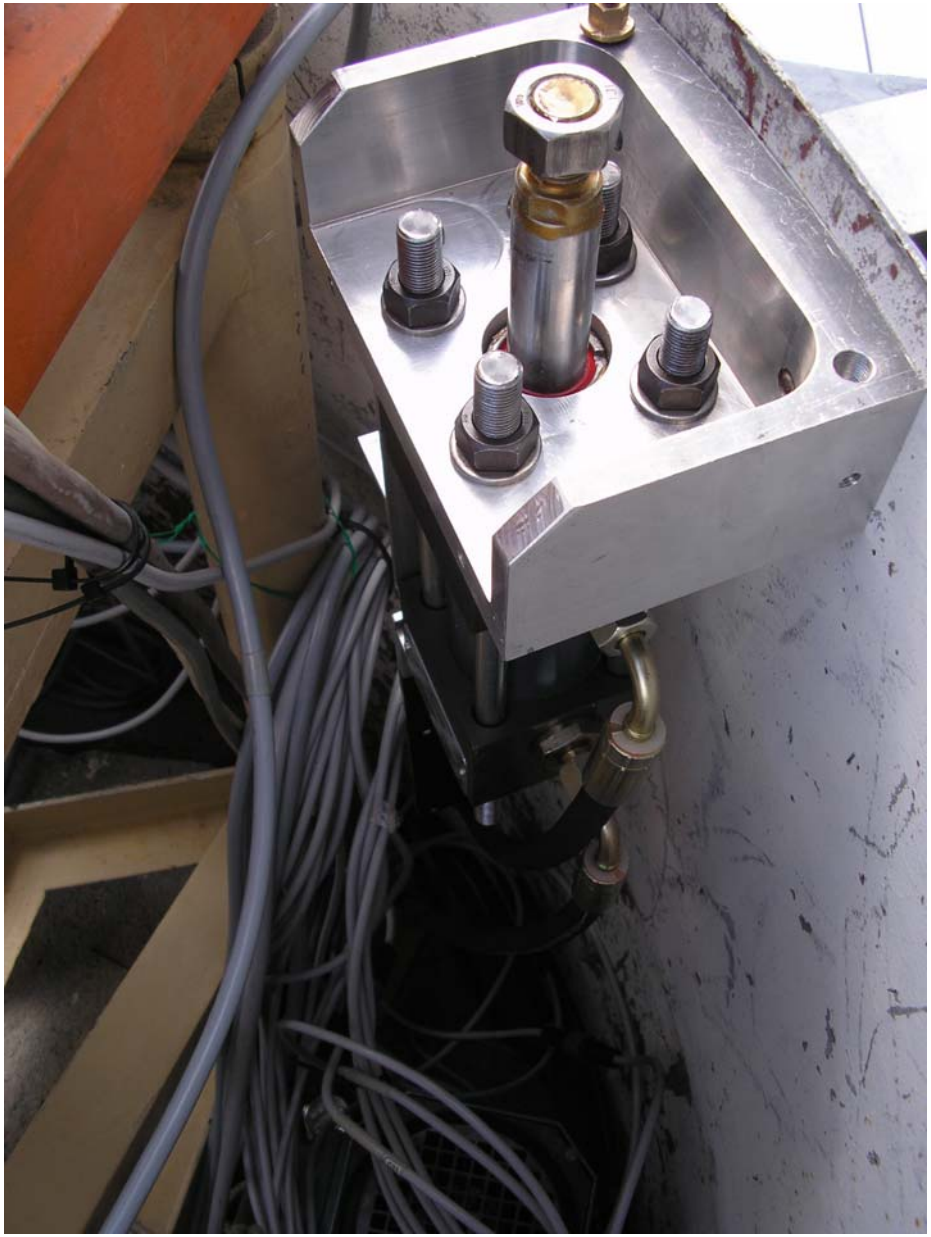
FLUITRONICS +32 85.51.96.96	B 4540 AMAY B 2870 BREENDONK L 1470 LUXEMBOURG	PROJET	GROUPE HYDRAULIQUE JUNGFRAUJOCH	CLIENT	ULG	DESSINE PAR	DUBOIS A.	02/09/04
				Réf. CLIENT	ULG04/1107833	VERIFIE PAR	SERVAIS Ch.	
				Réf. FLUITRONICS	2701109	APPROUVE PAR		
						REVISION 1	N° PLAN	5765-S
						ECHELLE -		

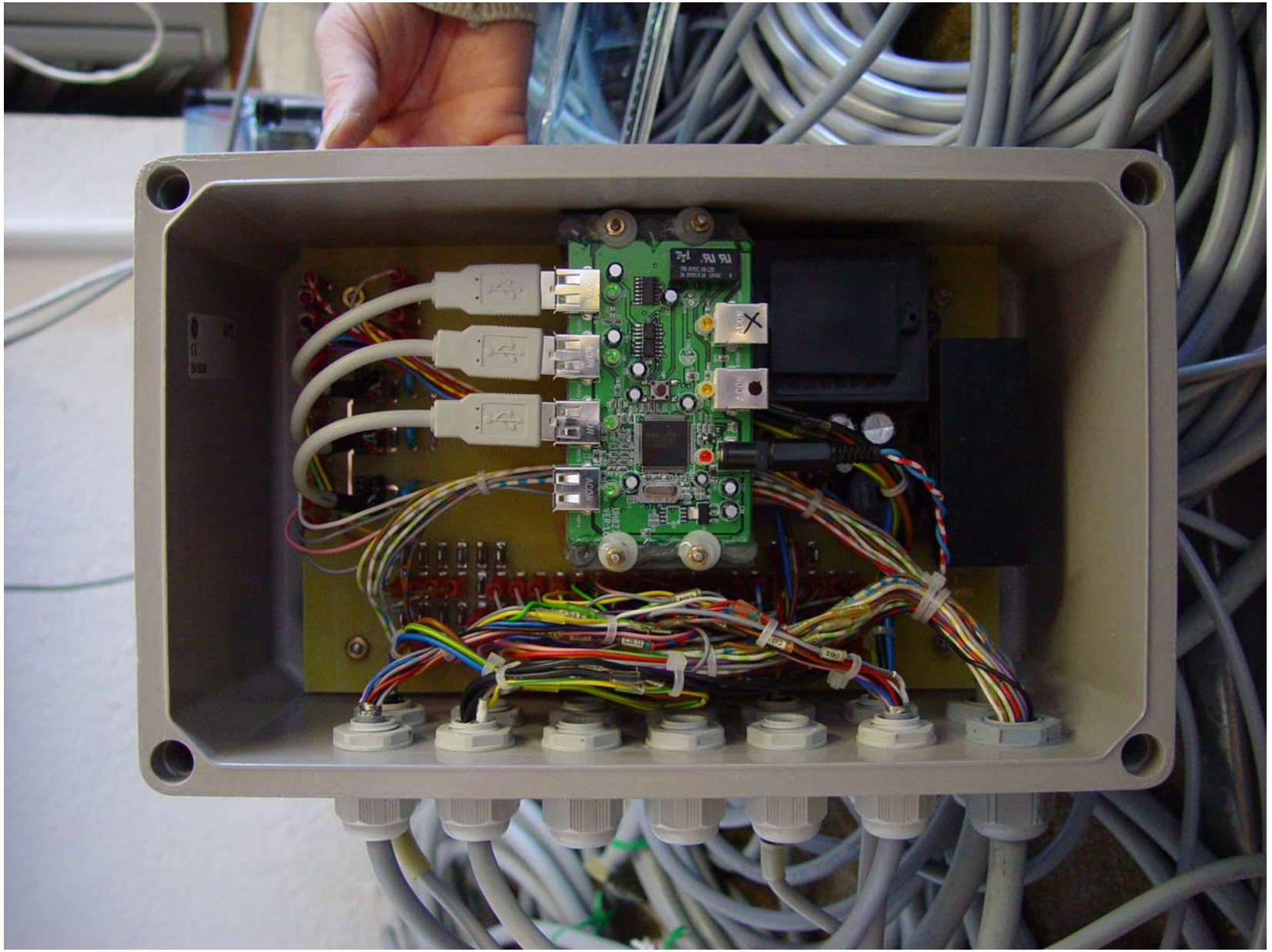

ACT1
ACT2
ACT3
ACT4
12 Valves
R/S/T LID HEATERS
TLID R/S/T
A12POS
A1POS
EDGE HEATERS
TEDGE
R/S/T
LOCKLIM
LOCK
M
INT1
INT2
EXT
SUNTRK
LIGHT
A3POS
EDGEPOS3
A4POS
EDGEPOS4
EDGE EXCHANGE
PUMP
PLIM
FLIM
PRES
ACT5
A5POS
A5LIM
M
LAMP
PLUG
BUZZER
MAIN EXCHANGE
Tamb
REMOTE / STATUS
287 nets
ACT6
M
A6POS
A6LIM
CONTROL
USB
USB
USB
Internet
RJ45
Outside
Inside
ULg
UNIVERSITÉ de Liège






Reservierte
Groupes réserv
Gruppi riservati
Reserved groups
団 体 旅 行 者



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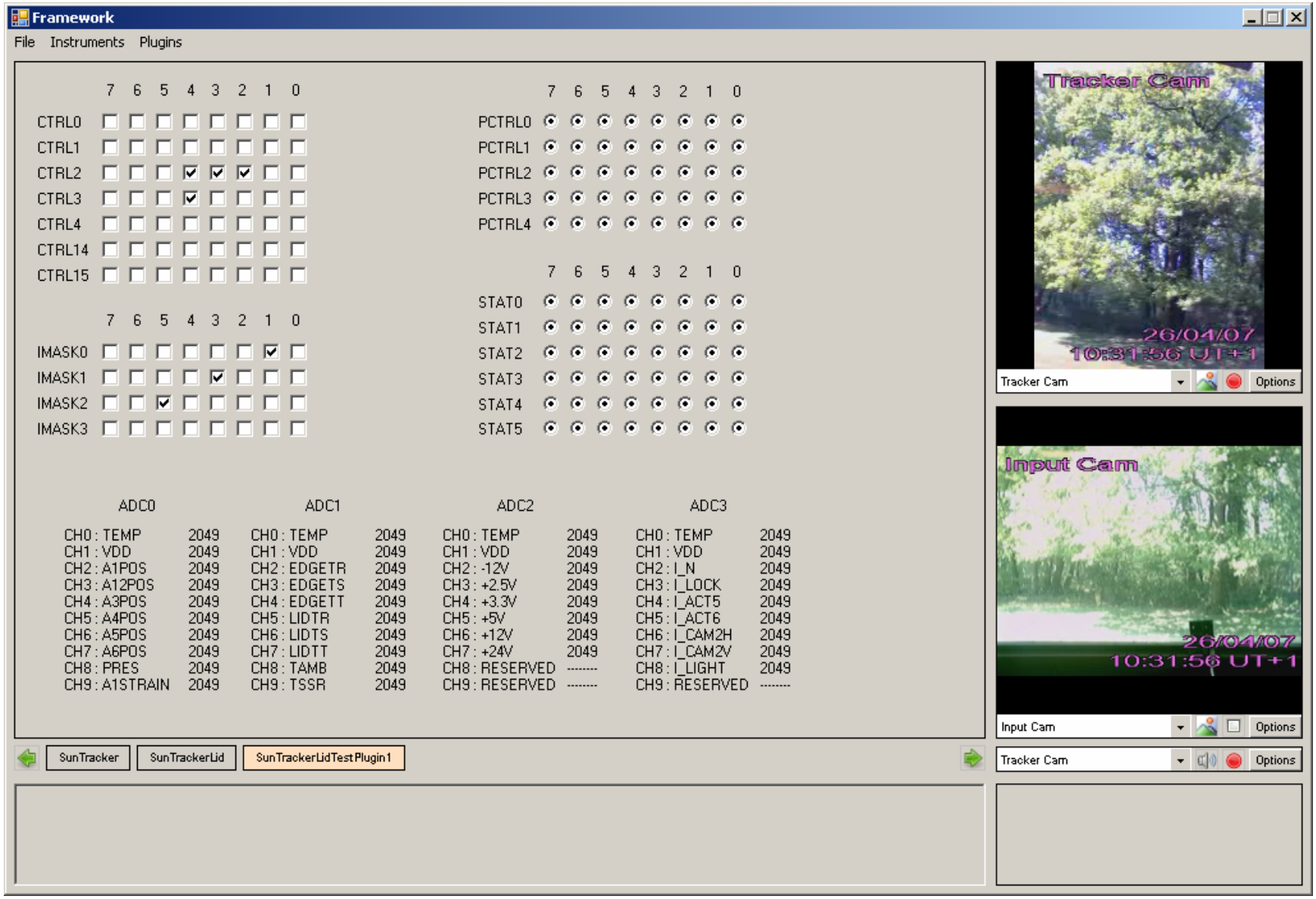
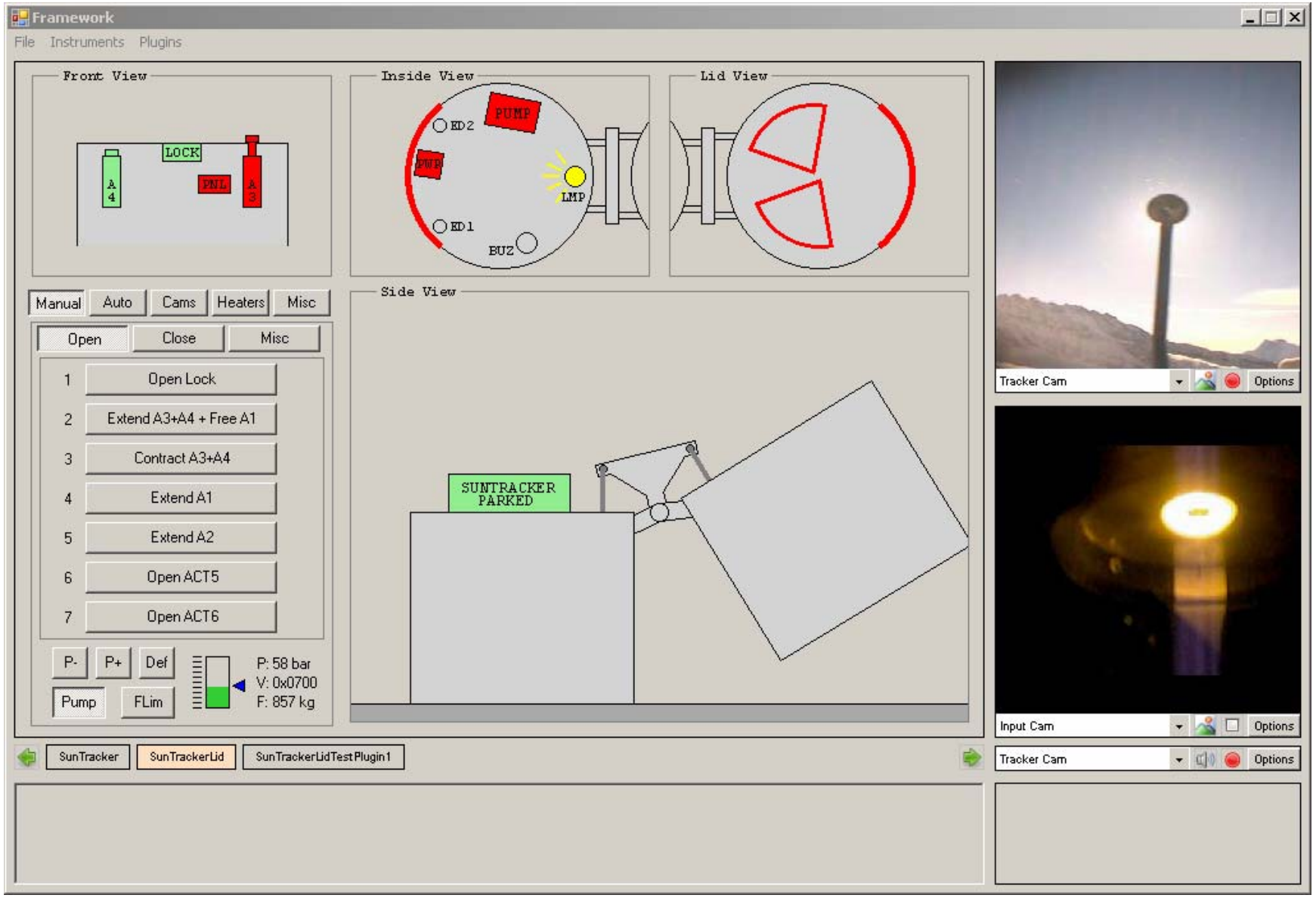
A1P 266
S_CAM2HLIM2
S_CAM2VLIM2
C_CAM3HEAT
C_CAM3LIGHT
S_PARK
S_SIDE
S_PUSH
S_STOP
S_CAM2HLIM1
S_CAM2VLIM1
C_CAM2HEAT
C_CAM2LIGHT
C_MDIR
C_FLIM
C_PUMP
S_UNPROT
S_EDGE1
S_EDGE2
C_CAM1HEAT
C_CAM1LIGHT
C_MBRAKE
S_LOCKO
C_SRC24_R
C_PLUG
S_A1LIME
S_A12LIME
S_A3LIME
S_A4LIME
C_CAM2VRUN
S_LOCKC
C_PSW24_2
C_LIGHT
S_A1LIMC
S_A12LIMC
S_A3LIMC
S_A4LIMC
C_CAM2HRUN
S_A6LIME
C_PSW24_1
C_SSRRESV
C_A1E
C_A2E
C_A3E
C_A4E
C_LOCKRUN
S_A6LIMC
C_HLID3
C_HEDGE3
C_A1C
C_A2C
C_A3C
C_A4C
C_ACT6RUN
S_A5LIME
C_HLID2
C_HEDGE2
C_A1F
C_A2F
C_A3F
C_A4F
C_ACT5RUN
S_A5LIMC
C_HLID1
C_HEDGE1


Framework
File
Instruments
Plugins
7 6 5 4 3 2 1 0
CTRL0
CTRL1
CTRL2
CTRL3
CTRL4
CTRL14
CTRL15
IMASK0
IMASK1
IMASK2
IMASK3
PCTRL0
PCTRL1
PCTRL2
PCTRL3
PCTRL4
STAT0
STAT1
STAT2
STAT3
STAT4
STAT5
ADC0
CH0 : TEMP 2049
CH1 : VDD 2049
CH2 : A1POS 2049
CH3 : A12POS 2049
CH4 : A3POS 2049
CH5 : A4POS 2049
CH6 : A5POS 2049
CH7 : A6POS 2049
CH8 : PRES 2049
CH9 : A1STRAIN 2049
ADC1
CH0 : TEMP 2049
CH1 : VDD 2049
CH2 : EDGETR 2049
CH3 : EDGETS 2049
CH4 : EDGETT 2049
CH5 : LIDTR 2049
CH6 : LIDTS 2049
CH7 : LIDTT 2049
CH8 : TAMB 2049
CH9 : TSSR 2049
ADC2
CH0 : TEMP 2049
CH1 : VDD 2049
CH2 : -12V 2049
CH3 : +2.5V 2049
CH4 : +3.3V 2049
CH5 : +5V 2049
CH6 : +12V 2049
CH7 : +24V 2049
CH8 : RESERVED --------
CH9 : RESERVED --------
ADC3
CH0 : TEMP 2049
CH1 : VDD 2049
CH2 : I_N 2049
CH3 : I_LOCK 2049
CH4 : I_ACT5 2049
CH5 : I_ACT6 2049
CH6 : I_CAM2H 2049
CH7 : I_CAM2V 2049
CH8 : I_LIGHT 2049
CH9 : RESERVED --------
Tracker Cam
26/04/07
10:31:56 UT+1
Tracker Cam
Options
Input Cam
26/04/07
10:31:56 UT+1
Input Cam
Options
SunTracker
SunTrackerLid
SunTrackerLidTestPlugin1
Tracker Cam
Options


Framework
File
Instruments
Plugins
Front View
LOCK
A 4
PNL
A 3
Inside View
PUMP
ED2
PWR
LMP
ED1
BUZ
Lid View
Manual
Auto
Cams
Heaters
Misc
Open
Close
Misc
1
Open Lock
2
Extend A3+A4 + Free A1
3
Contract A3+A4
4
Extend A1
5
Extend A2
6
Open ACT5
7
Open ACT6
P-
P+
Def
Pump
FLim
P: 58 bar
V: 0x0700
F: 857 kg
Side View
SUNTRACKER
PARKED
Tracker Cam
Options
Input Cam
Options
Tracker Cam
Options
SunTracker
SunTrackerLid
SunTrackerLidTestPlugin1

Movie

Conclusions

- Remotely controlling the protection cover of a large suntracker at a high altitude site is a very complex task that only looks simple.
- Hydraulic solutions are powerful but require additional security features to avoid endangering people or equipment.
- The proposed solution is relatively complex but provides very good reliability as well as precise remote control capability inside our new observation framework.

Movement Theory(2)