

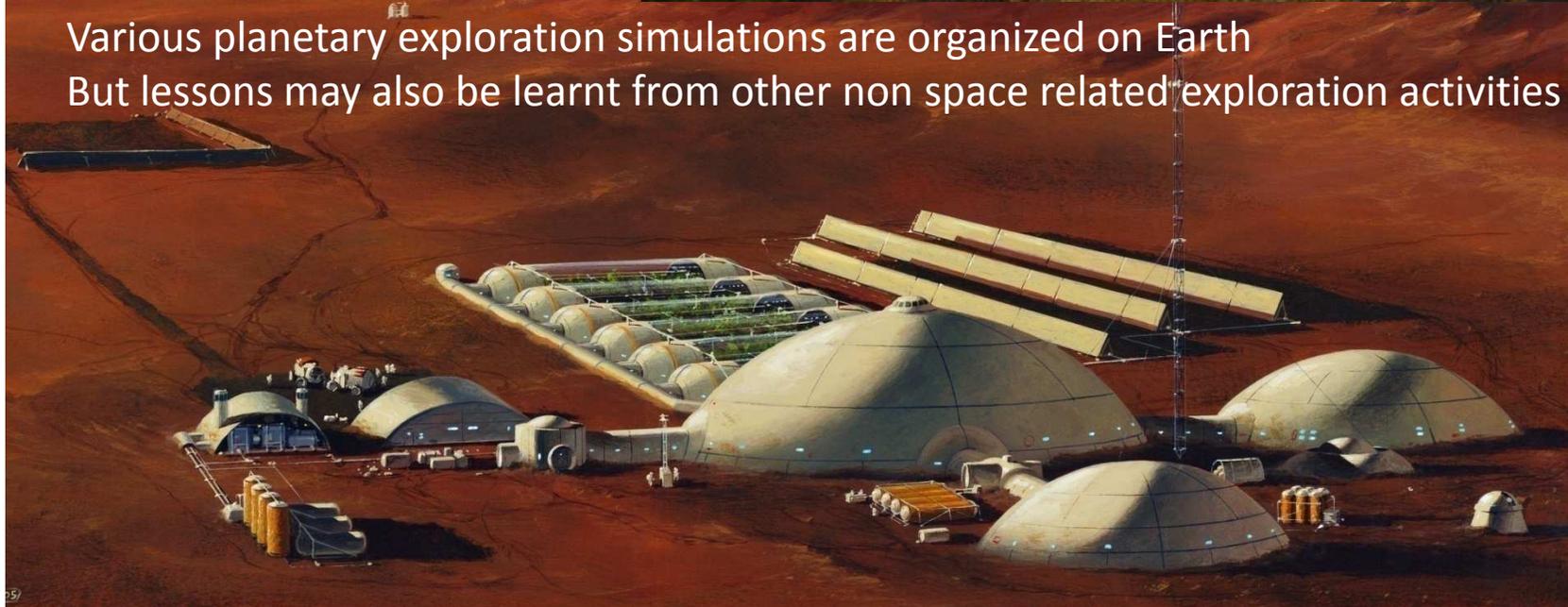
Isolated bases Mars Earth analogies



Crozet Islands
Alfred Faure base

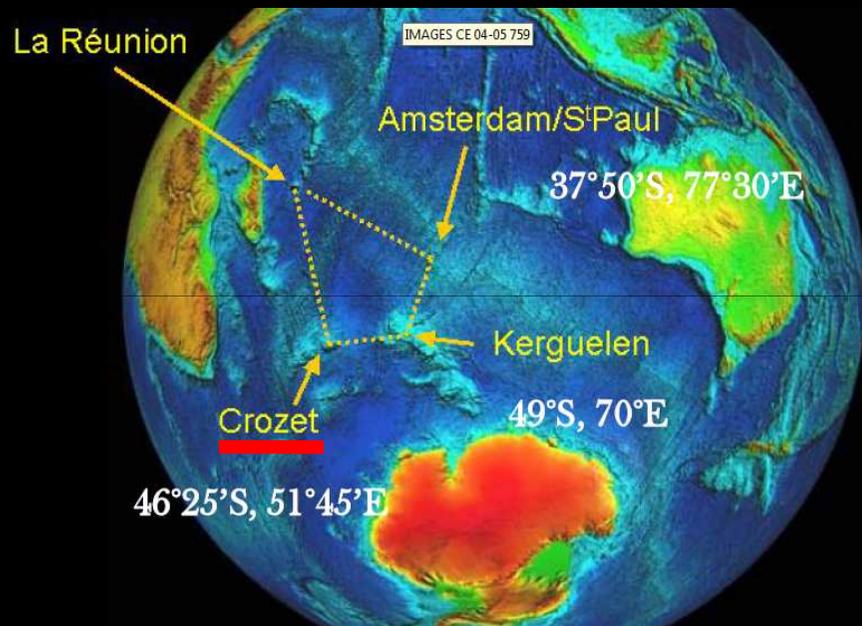


Various planetary exploration simulations are organized on Earth
But lessons may also be learnt from other non space related exploration activities

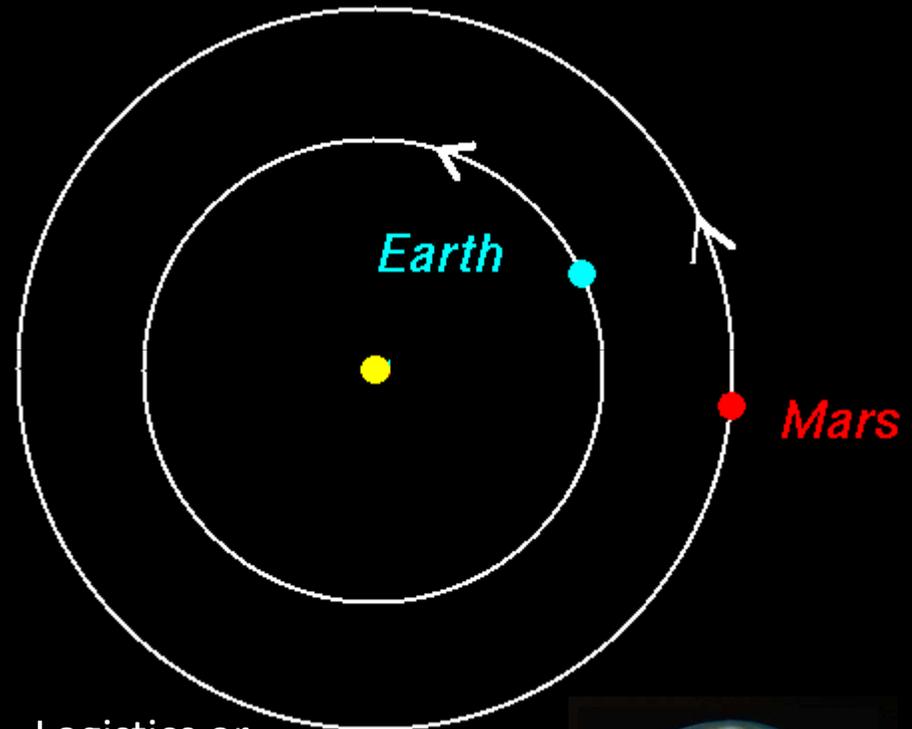


Locations

Island in the sea/Island in the sky

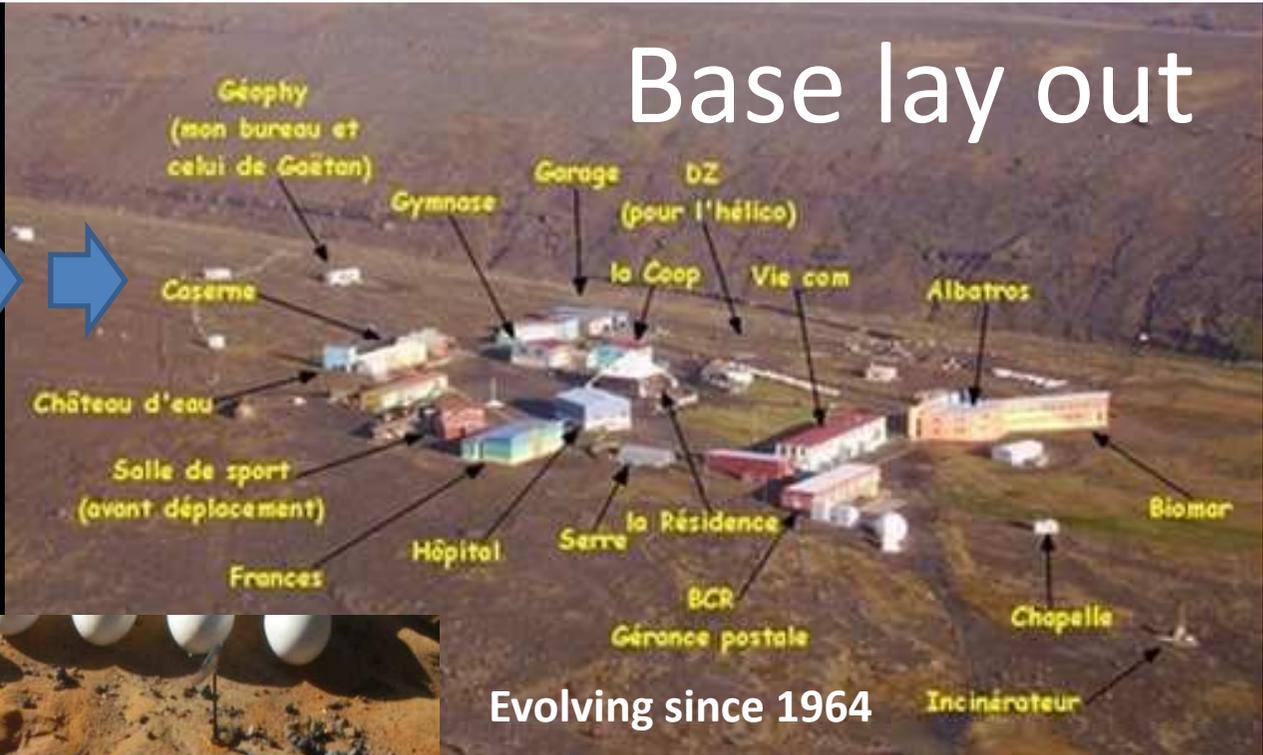


Logistics or crew missions every 3 months; but a five days travel at any time if necessary



Logistics or crew missions every 26 months and a 6 month travel

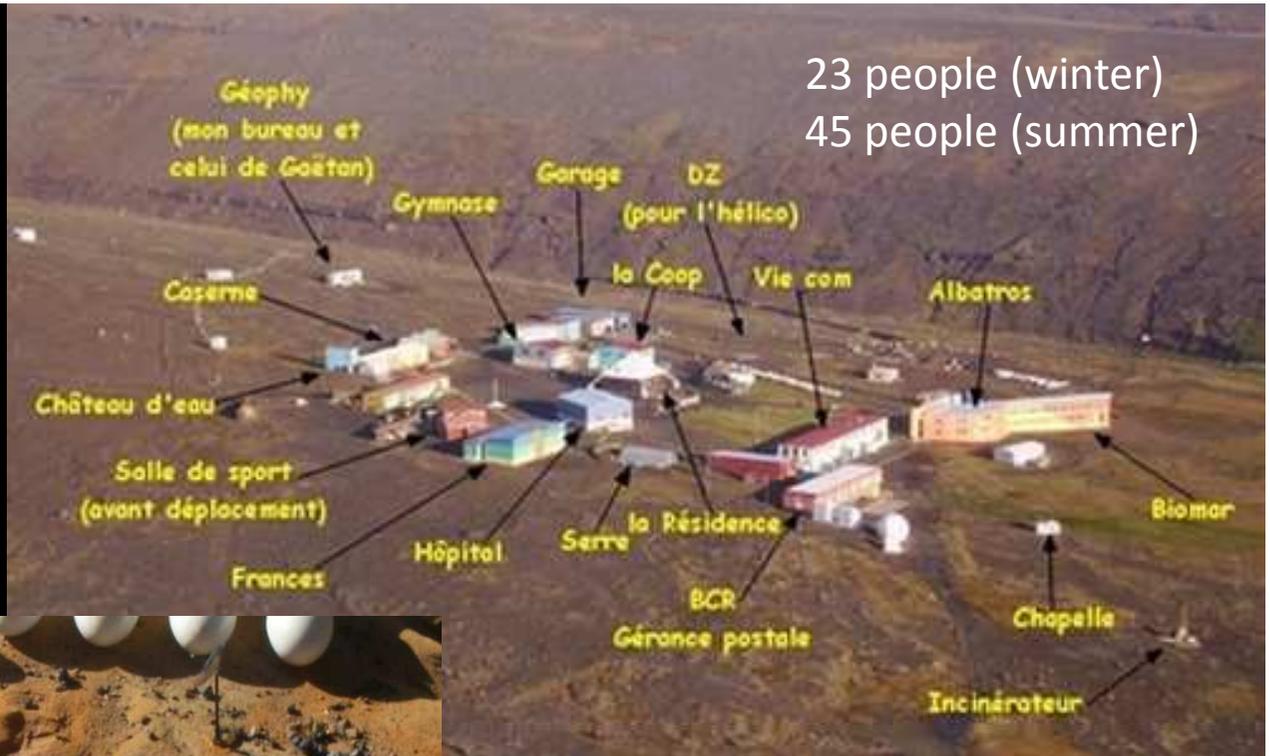
Multimodules:
typical of
progressive
installation
starting from 1st
generation



Evolving since 1964



Crew/ population



Base lay out

Large structures: typical of 2nd generation

Concordia



Base lay out

Large structures: typical of 2nd generation
... but evolving again in multimodules



Base lay out

Landing zone





All plants deleted in 2006
(excepted the apple tree) by
fear of contamination of local
plants by insects and
parasites

2012



2003



Base lay out
Greenhouse

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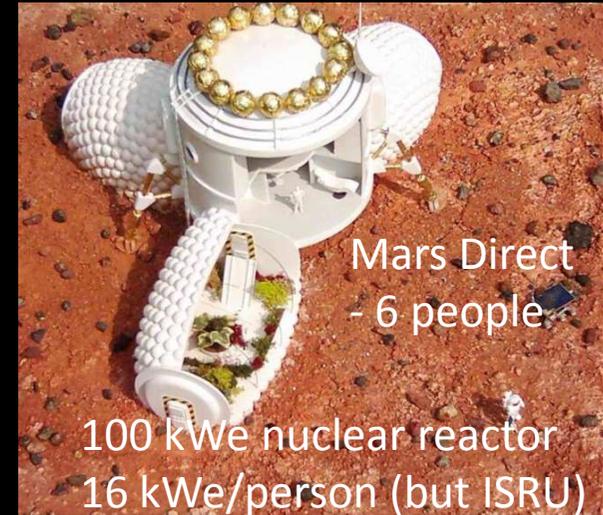
Similar non contamination questions



Power generation



Crozet 20-45 people
3X144kWe generators/one operating and the others as spares – 22 m³ fuel per month – 40% heating/60% electricity
7 kWe/person

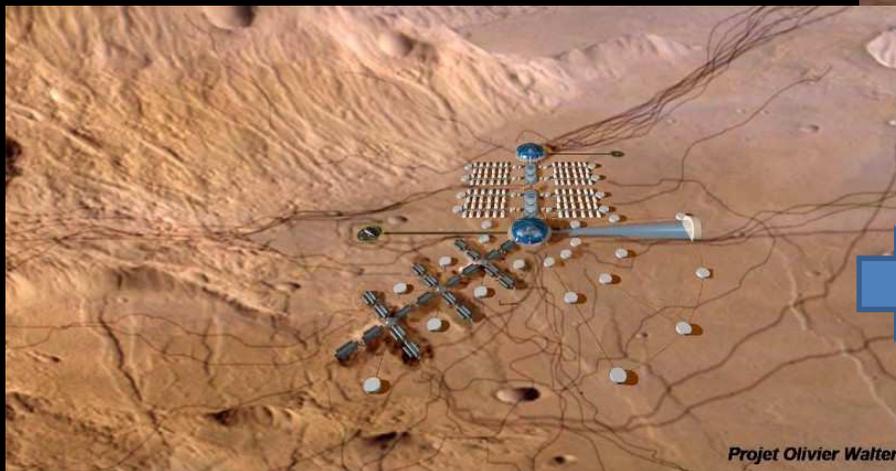


Mars Direct
- 6 people
100 kWe nuclear reactor
16 kWe/person (but ISRU)



NASA DRA 5 - 6 people
25 kWe nuclear reactor
4kWe/person

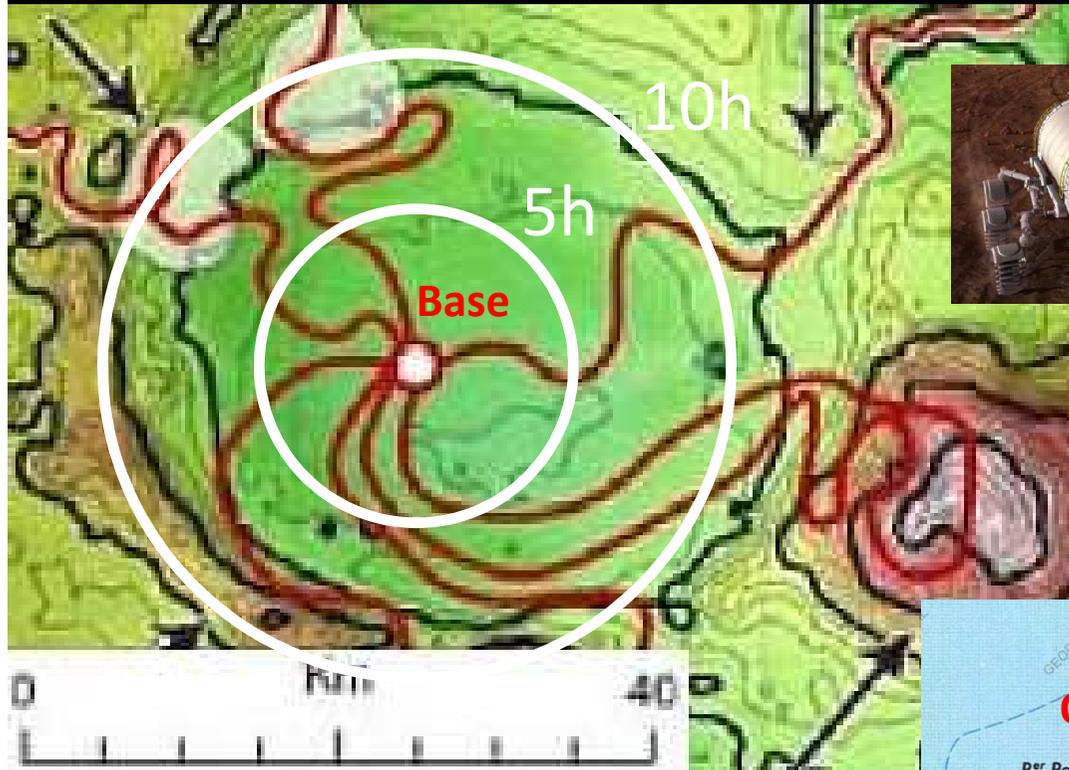
3 km away



Projet Olivier Walter

2000 people 160 MWe (what about use of thermal output ?)
80kWe/person – But high level of activity/production

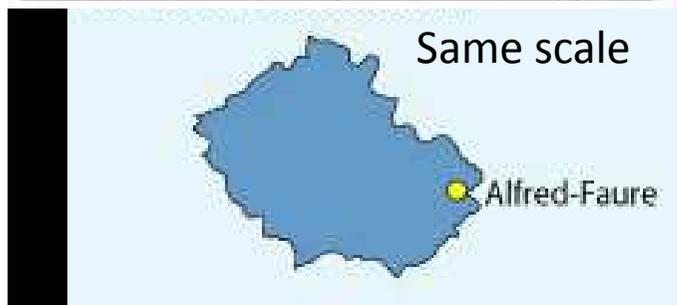
Exploration/operations around the base



3km/h and 30% detour

8h

5h



Different EVA rules for different zones: the base, zone 1, zone 2, zone 3. Numbers giving the minimum number of people for outside activities. Others constraints: number of radios...

Outposts

Crozet



Outposts for 5 to 10 (emergency) people with food (2 to 3 tons) outside storage; stays duration: some days



Mars



A pressurized rover is an outpost by itself



Inflatable ?

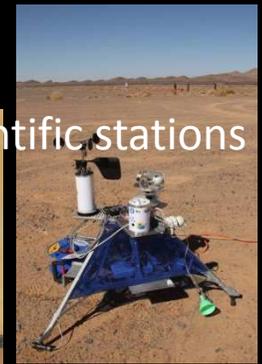
Depots (food, oxygen, propellant) ?



Antarctica style



Man tended scientific stations



Communications

Crozet

Vsat
110 kb/s
Ø 3,8 m

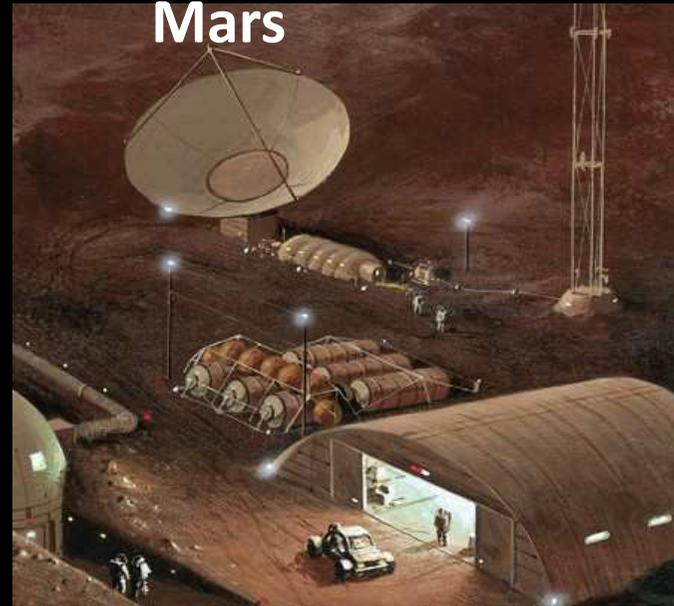
Inmarsat
284kb/s



To Earth

To EVA teams

Mars

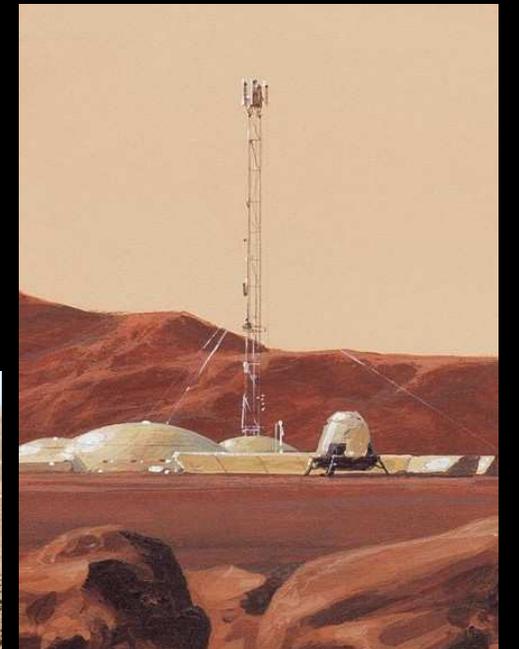


Antennas/repeaters on
elevated spots



Relay 26 (alt 700 m)

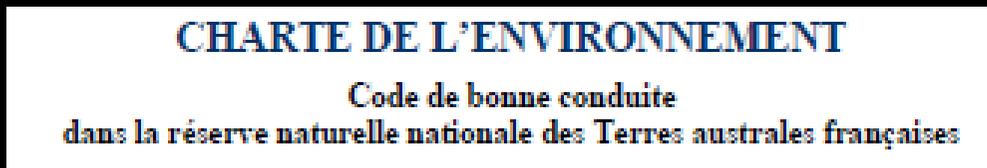
Mars2013



Environment regulations

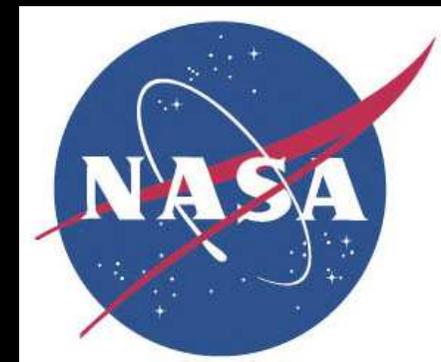
Crozet islands

Documentation:



Mars

Documentation:



Environment control



Crozet:
decontamination
before leaving
the ship



Activities



Crozet

A lot

No

Science

Biology

Geology

Sismology

Atmosphere

Magnetosphere



Mars

Data analysis sharing between base and « Earth »

Low real time data transmission rate

Batch invoices every 3 months:

- freezed biological samples
- data on hard drives

Specialized scientists on the field

Analysis by laboratories teams in France

High real time data transmission rate

Samples sent to Earth every 2 years

Specialized scientists on the field later on in 2nd exploration phase

Analysis by laboratory teams on Earth

The question of work sharing between the base and Earth Laboratories still an open question and will evolve during time

Activities

A lot of logistics/maintenance/management = non scientific activities

Crozet:

- Winter: 8 scientists / 15 non scientists - 35% of the crew (logistics/maintenance/management)
- Summer: 29 scientists /16 non scientists - 65% of the crew

Scientist to total crew number ratio increases with crew number (well known result) and also when facilities are modern

Apollo:

- One scientist in the whole program

Mars:

- Will increase with time and crew size

Crew psychology and motivations

To keep the morale high, the experience of antarctic bases led to well known recipes:

- Good food (dedicated cookers)
(not only for french bases !)



- Celebration of various events
to exit from routine and keep cohesion

- Birthday celebrations
- Other celebrations
- Games/Music
- Mid winter (election of a shadow management team)
- Competition between bases (videos,...)



Crew psychology and motivations

Other known « space related » examples

Mars 500



ISS



And strange worlds to get used to and live in

Crozet

Waterfalls falling upwards (wind)

Wind rising lake waters

Strange friends

And dangerous too (in one year: one near fatal accident, one near large ship sinking)

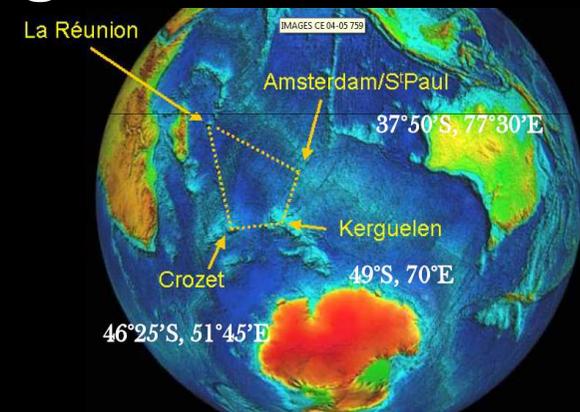
Mars





Conclusions

- Some isolated bases on Earth with mainly scientific activities - and not related to space activities - are also good analogues to learn about future Mars bases operations and prepare Mars exploration



- In some cases (Concordia) space exploration related researches have started (psychology, water recycling, by ESA)
- Other earth situations bring lessons (crew psychology and behavior in submarines,...)