Rescue from difficult places using Fjellpulken and snow mobile

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Starting point

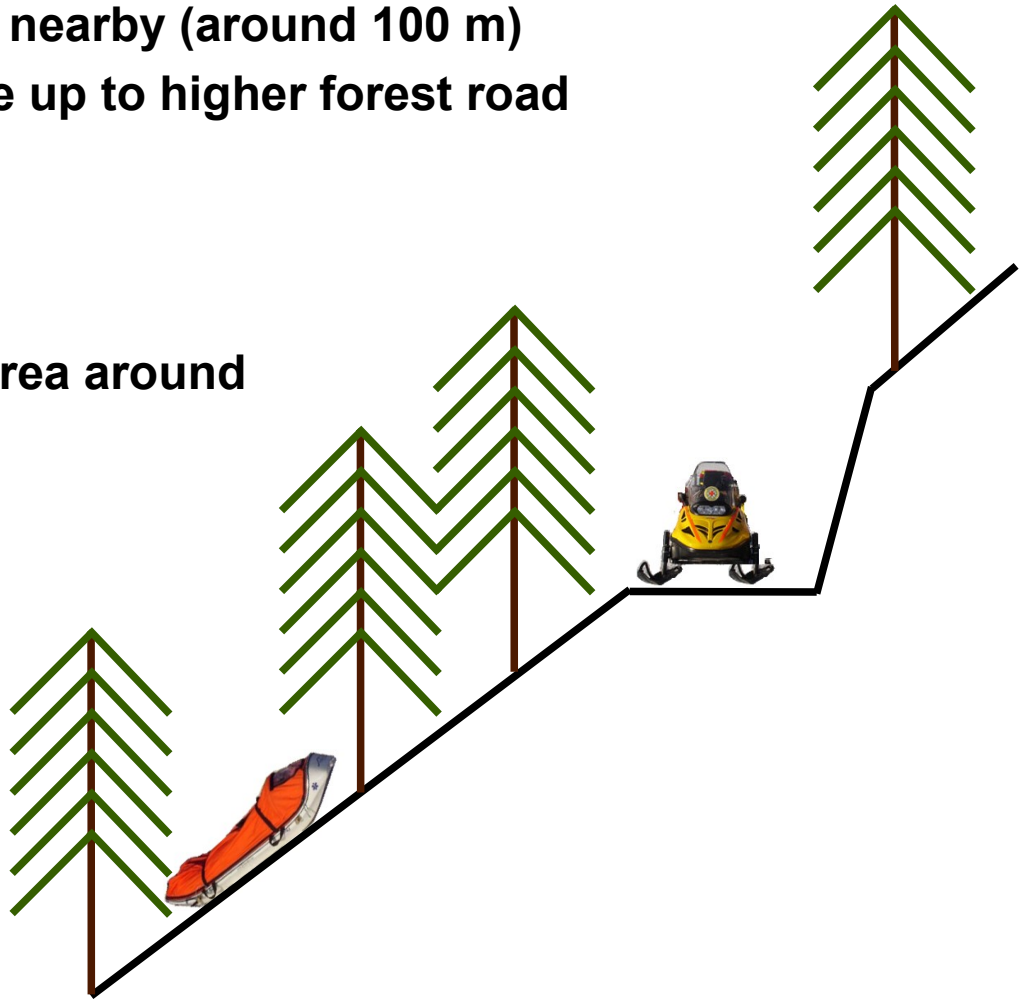
- German federal state of Saxony (Sachsen) has hilly teritory, forrest covered
- people do alpine skiing, cross country skiing, tobogganing
- typical winter rescue mission: team of 2, snow mobile, Fjellpulken
- accidents off piste / off track are seldom (Oberwiesenthal 2008: 3/170)
- special need for only those rescue missions:
  - special rescue equipment (basket stretcher)
  - larger team (4...6)

Preliminary considerations

- difficult terrain, unreachable by snow mobile
- forest road net mostly allows to go nearby (around 100 m)
- obvious: take Fjellpulken on a rope up to higher forest road using snow mobile

Concerns:

- driver can not see fjellpulken and area around
- snow mobiles can not go very slow at all
- trees, roots, rocks can abruptly stop or damage Fjellpulken resulting in injury of patient



Demands for solution

- radio helmet / handsfree sets allow continuous communication between driver and rescuer
- collision with fixed barriers must be taken into account
- predetermined break point should avoid damage of fjellpulken
- Fjellpulken must be used without modification
- redundancy should work for: activation of predetermined break point, failure of rope

Identify forces (I)

Winter 2007/2008: series to measure run-up forces of snow mobiles under different snow conditions

(Ski-doo „Alpina IV“ 54 PS; 1 driver, loaded like for rescue mission)

measurement done with load cell

Results:

- on compact snow: run-through of driving chain at 2.8 bis 3.4 kN

- on icy ground: run-through of driving chain at about 1.6 kN

- backward drive, load fixation on front: 1.4 kN

- but: fast start up with slack line or immediate stop of movement: > 4 kN

Identify forces (II)

Experiment 1: smooth start up

Experiment 2: smooth start up

Experiment 3: jerky start up with slack rope

Dimension of predetermined break point

Based on our experiments the predetermined break point should be activated at 4 kN.

These force can not reached by normal start and movement but should prevent patient and fjellpulken against major damages when a barrier is hit.

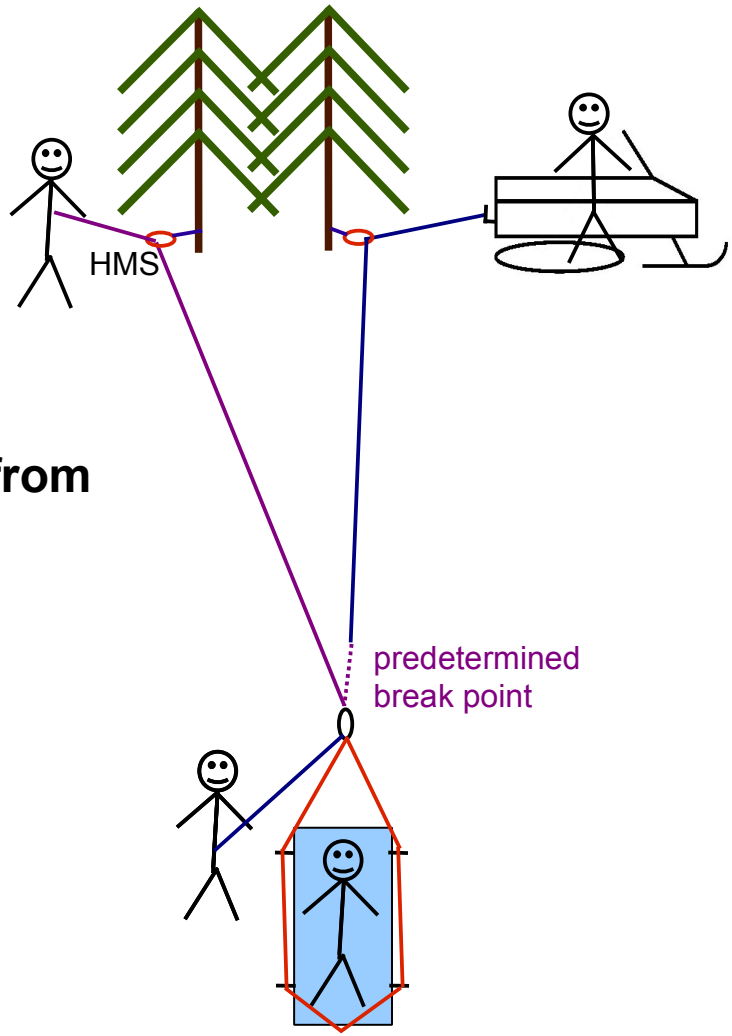
Realisation:

common 4 mm polyamide cord knottet as rope ring between 2 carabiners

Solution finding (I)

First Idea:
- fix Fjellpulken with run-around rope ring
- rescuer walks aside Fjellpulken
- central carabiner is used for attaching Fjell-pulken to lift-off and belay system
- rescuer is secured on central carabiner
- predetermined break point between rope and central carabiner
- third rescuer belays fjellpulken with extra rope from a second fixpoint

Disadvantages:
- 3 rescuers required
- fast get in the belay rope is difficult (snow mobile can not go very slow at all)



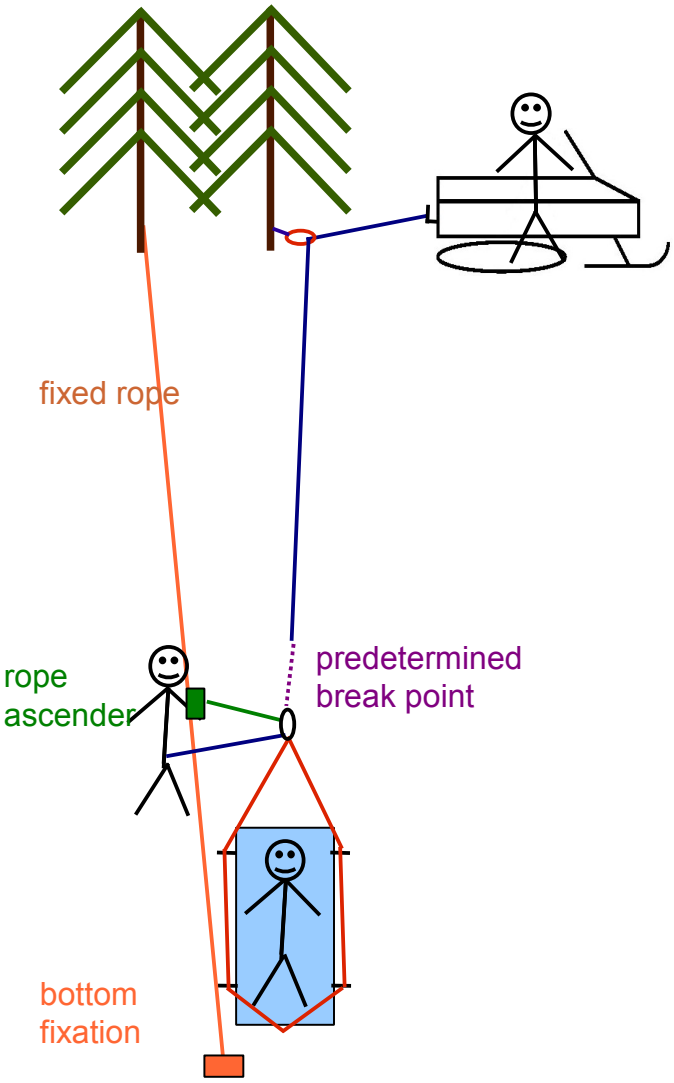
Solution finding (II)

Idea 2:

- **Fixation of fjellpulken, predetermined break point and central carabiner same as in variant 1**
- **rescuer ascends aside top of fjellpulken and is secured on central carabiner**
- **rope ascender is attached to the central carabiner with a sling**
- **rescuer moves up rope ascender on a fixed rope while getting up.**

Disadvantages:

- **requires extra fix rope which needs to be fixed also on the bottom end**
- **rescuer must walk down again to release that fixed rope**



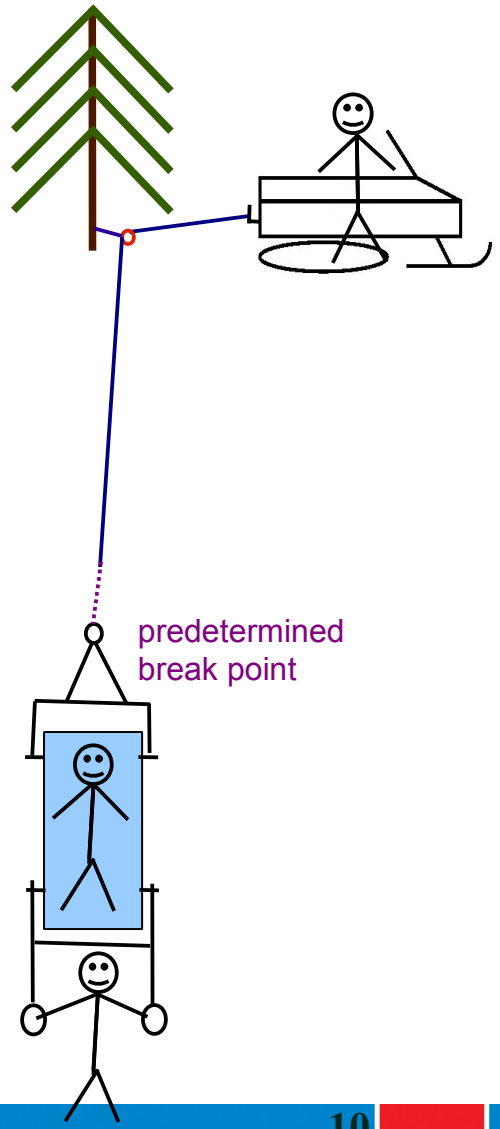
Solution finding (III)

Idea 3:

- original drawing bar remains at the Fjellpulken
- predetermined break point is mounted between drawing bar and rope
- rescuer walks below Fjellpulken and keeps the original brake handles
- rescuer wears crampons
- if predetermined break point is released, rescuer stops Fjellpulken with the original brake handles (standard accessory for skiing the Fjellpulken)

Disadvantages:

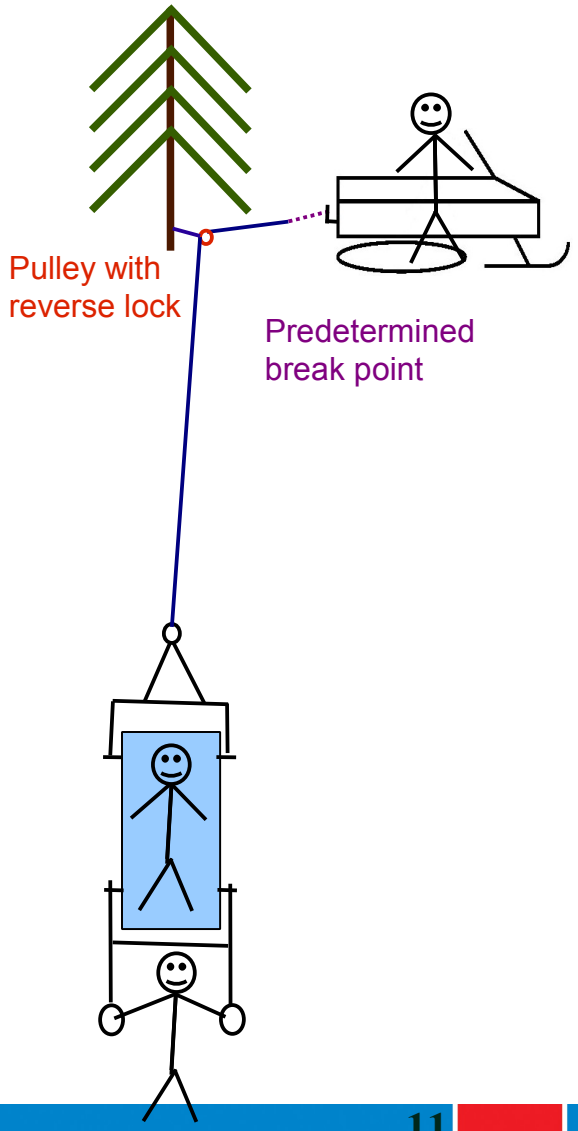
- safety concept requires action of rescuer



Solution finding (IV)

Final solution:

- **original drawing bar remains at the Fjellpulken, rope is attached directly to the drawing bar by steel carabiner**
- **predetermined break point is mounted between rope and snow mobile**
- **pulley with integrated reverse lock on fix point (ProTraxion etc.)**
- **rescuer wears crampons**
- **rescuer walks below Fjellpulken and keeps the original brake handles**
- **reverse lock keeps the Fjellpulken if predetermined break point is released**
- **additional redundancy by the brake handles**



Details

- never put slings directly in coupling device, always use (steel) carabiners

- brake handles must be secured, length must be adjusted correctly

Required material

- snow mobile with coupling device
- complete Fjellpulken with draw bar and brake handles
- static rope of 100 m or more
- pulley with integrated reverse lock
- HMS carabiner to lower the Fjellpulken down
- 5 lock carabiners, at least 2 from steel
- 4 mm polyamide cord for predetermined break point, 2 slings for fix point
- crampons
- 2 radio helmets / handsfree sets

Field introduction / timeline

Winter 2007/2008
- force measurements, variant finding (I to III) and tests by rescue team Oberwiesenthal

Winter 2008/2009
- Tests of variant IV in Oberwiesenthal
- review in technical commission, conclusion: Variant IV

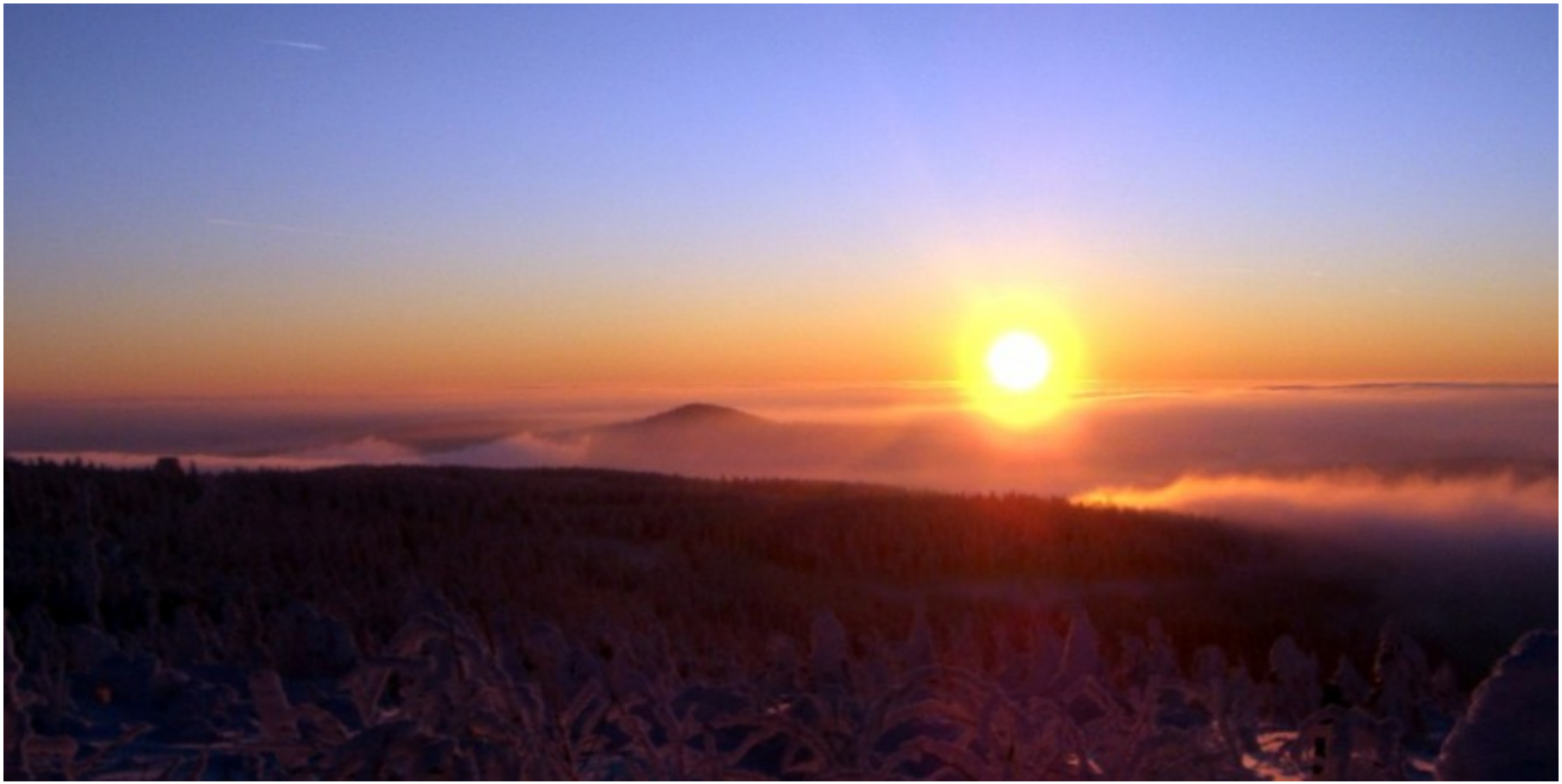
Winter 2009/2010
- creration of training materials and short instruction sheets (A5, laminated)
- training of all rescuers in Oberwiesenthal
- use in 3 real rescue operations
- review again in technical commission => go
- Instructors training for all rescue teams in Saxony at the end of winter

Winter 2010/2011
- full use in whole Saxony

Feedback by first users

- clear arrangement
- significantly faster than old method
- easy to handle in 2 member team
- works well also on icy skiing slopes

=> rescuers like it very much



Thank you for your attention