



# DEVELOPMENT HISTORY AVALANCHE AIRBAG SYSTEM

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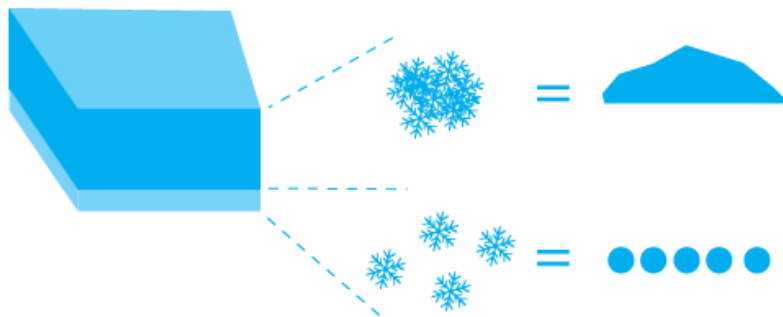


# SNOW AVALANCHE STRUCTURE

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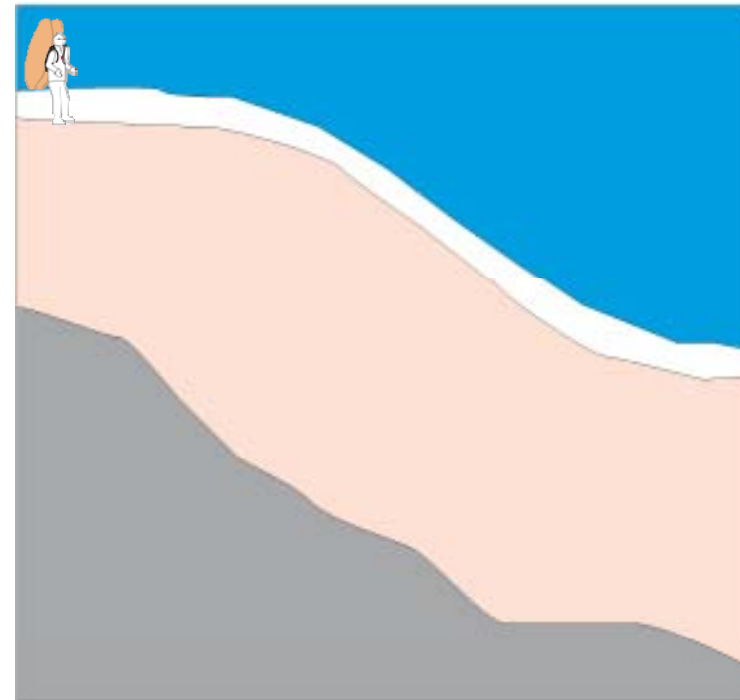
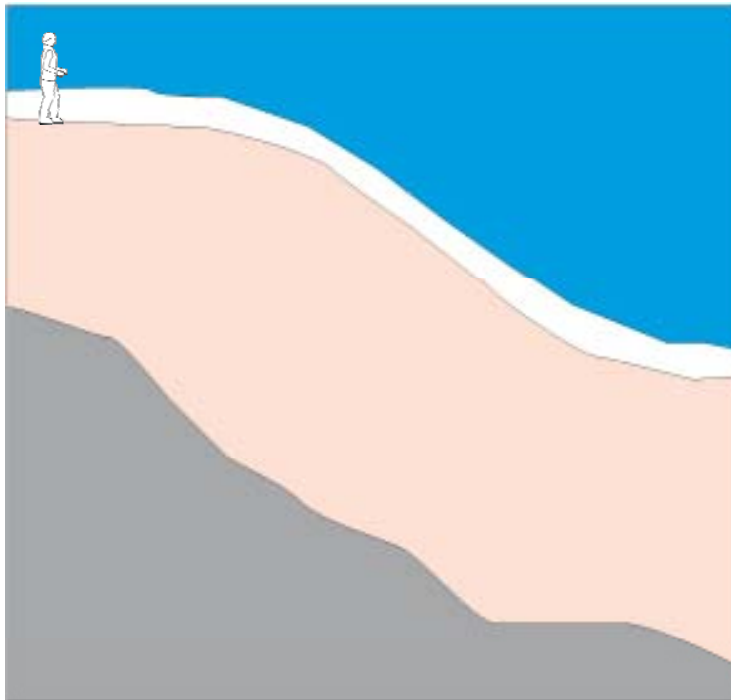
- Failure in the snowpack structure
- Particles of different size, hardness and density in motion
- Higher velocity near the surface of the avalanche



## GREATER VOLUME => CLOSER TO SURFACE



- The greater the volume of a particle in the flow of the avalanche, the greater the probability of staying on the surface

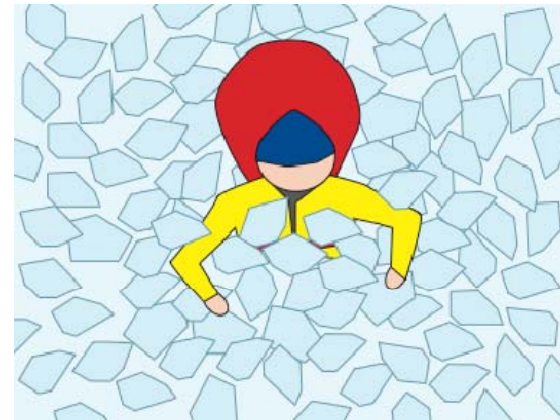
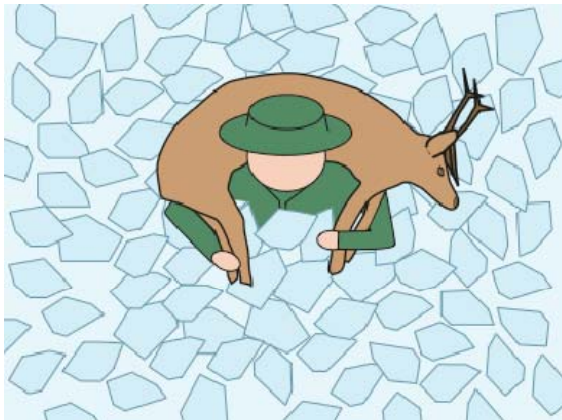


## HOHENESTER'S SELF TRIALS IN THE 70<sup>s</sup>

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- Forest engineer Josef Hohenester slides down steep couloirs with dead game fixed around his neck
- Frequent triggering of small slides
- Unexpected flotation from the additional volume of the game attached to his body
- Discovery lead to first experimental versions of flotation devices



# INVERSE SEGREGATION

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- Larger particles remain at or near the surface
- Small particles pushed to the bottom
- Inverse segregation is in effect only when the avalanche is in motion



## DEVELOPMENT OF THE FIRST FLOTATION DEVICE

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- Field trials over many years
- User releasable system for emergency situations
- Very short inflation time

## ISPO 1985: FIRST ABS ON THE MARKET

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- Mono airbag system
- System directly attached to the body
- Optional connection to back pack
- Weight: 4 kg





# VARIOUS ABS MODELS



# ACCIDENT ANALYSIS MONO AIRBAG SYSTEM

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- Additional volume keeps a very high percentage of caught subjects close to the surface
- Additional balance and flow control necessary in order to prevent collision with terrain features or anchoring effect of the snow sports equipment (skis) in lower, slower moving layers of the avalanche
- Flotation device must not hinder any active motion of the caught subject
- Flotation device must not hinder the skier escaping the avalanche

# THE DUAL AIRBAG SYSTEM

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- Balance control due to individually moving balloons
- Entire body very close to surface => important reduction of mechanical trauma
- Free sight and range of motion
- Pyrotechnical triggering



# WORLDWIDE DATABASE ON THE USE OF ABS

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- Independent database kept by the Swiss Institute for Snow and Avalanche Research, Davos
- All reported accidents of the worldwide usage of ABS systems are carefully documented and analyzed



# THE ABS ACCIDENT DATABASE

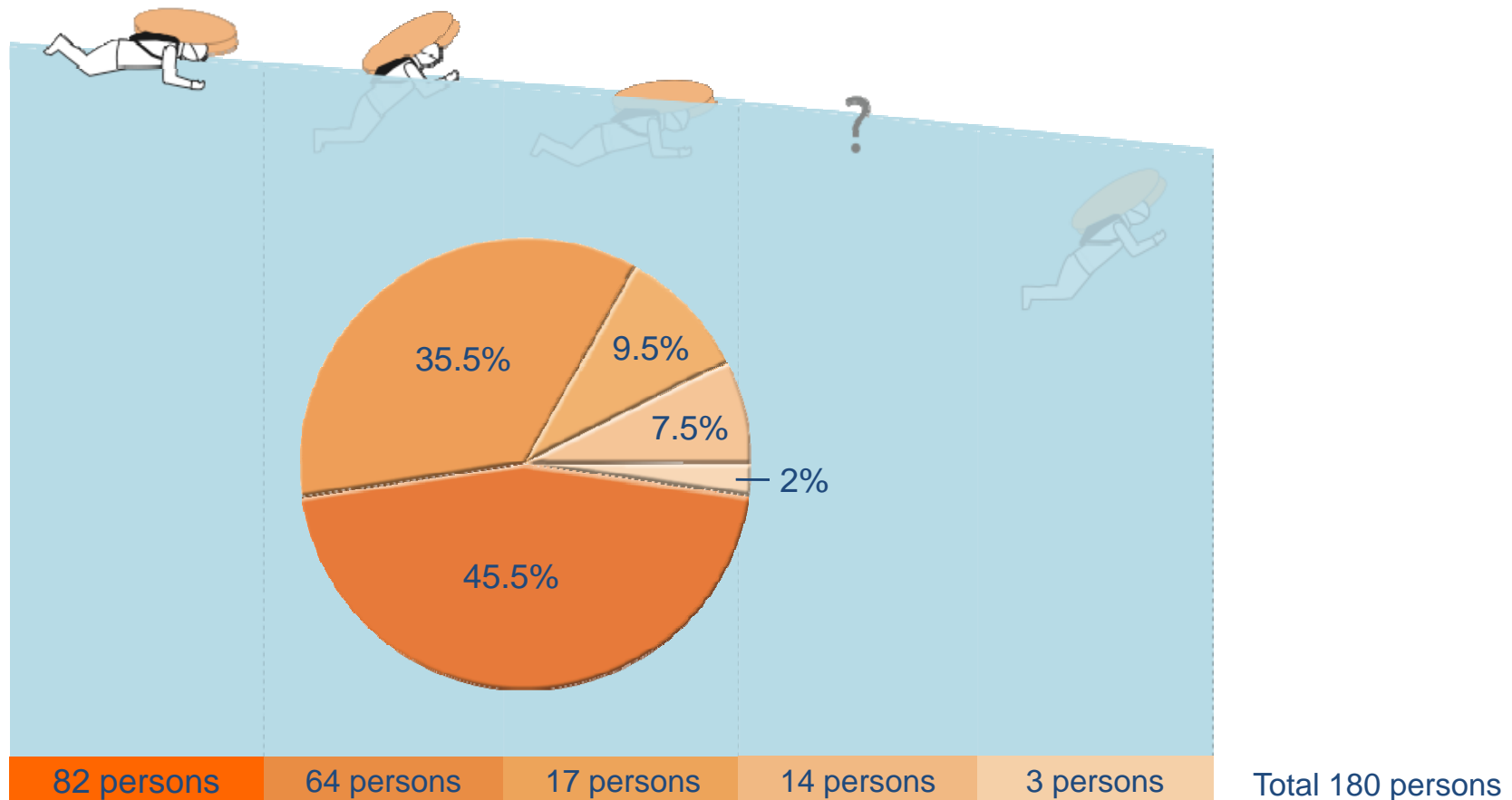
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- 167 documented avalanches
- 241 persons caught
- 41 without flotation devices
- 200 equipped with ABS Avalanche Balloon System,  
180 with fully inflated balloons  
20 with partially or non-inflated balloons

# DEGREE OF BURIAL

82 persons fully buried (45.5%), visible (=19.4%), unlikely (=7.8%)





## 167 AVALANCHE ACCIDENTS DOCUMENTED

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- 241 persons caught



THANK YOU FOR YOUR  
ATTENTION!

QUESTIONS?