An update of the SEASALT campaign proposal in reply to assignment of the FZK-ENDURO aircraft and comments of the aircraft operator.

Sylwester Arabas*

October 5, 2007

Figure 1: The FZK-ENDURO aircraft (ph. K. Bednarek, IGF UW)

Answers to issues addressed in comments of Dr Wolfgang Junkerman dated Sep. 26th 2007

Necessity for being more specific in the tasks for the aircraft operations, suggestion of performing the measurements from Austrian airfields St. Johann, Lienz and Zell am See.

The hereby note outlines a possible flight planning scheme in the specific location of the SkiCircus Resort / Berchtesgaden National Park vicinities (fig. 2). Two of the suggested airfields (St. Johann and Zell am See) are taken into account for deployment of the ENDURO aircraft (fig. 1).

Location of a 'reference valley' vs. range of the aircraft, slowness of the aircraft as a disadvantage in long distance

Reference valley should be within the nearest proximity of the snow-making one, as comparison is becoming affected by more and more factors with increase of distance.

*Institute of Geophysics, University of Warsaw, slayoo@igf.fuw.edu.pl

A valley laying withing the Berchtesgaden National Park (Germany) is suggested as it is expected to fulfil the assumption of unperturbed natural environment.

Such choice helps as well not to waste flight-time for ferry legs- the park is located in a $25km$ distance from both considered airfields.

The measurements over a national park are a strong advantage for the emergency scenario of the data analysis. In case of failure of the snow-making impact observations, the air-quality comparison is well justified having sampled the air over a clean forest and urbanised areas.

Estimation of required spatial resolution (3D) and quality (resolution of the sensors) of the measurements, slowness of the aircraft as an advantage for contour flying

With $1Hz$ or $10Hz$ time-resolution of the measurements and the $20\frac{m}{s}$ aircraft velocity, a $20m$ or $2m$ horizontal resolution is achieved, what is applicable for the expected spatial magnitude of snow-making systems impact (as they are designed to cover pistes of a typical width with the same order of magnitude). The more vertical levels achieved the better, having in mind numbers between 4 and 8.

Definition of possible flight patterns, special permit for flying below safe altitude issue

The 10-hour EUFAR credit is proposed to be divided into 3 flights. All flights could be performed within a triangle of three sides of approximate length of $40km$ (defined by St. Johann and Zell am See airfields and the far end of the national park). Flights would be preferably performed from the St. Johann airport as both approach and first ascent can yield valuable data- St. Johann ski station is equipped with snow-making system.

In order to allow judgement, if comparison between the three flights is possible (provided a relatively similar atmosphere state), a vertical sounding-leg should be performed on each flight.

A $6\frac{m}{s}$ ascent rate of the aircraft defines the sounding time for less than 10 minutes (to reach a level between $2500m$ and $3500m$).

Flight planning should take into account the need of having similar "flight level vs. ground level" combinations both in natural and snow-making affected cases to allow direct comparison.

The lowest altitude for the flights should be defined with awareness of

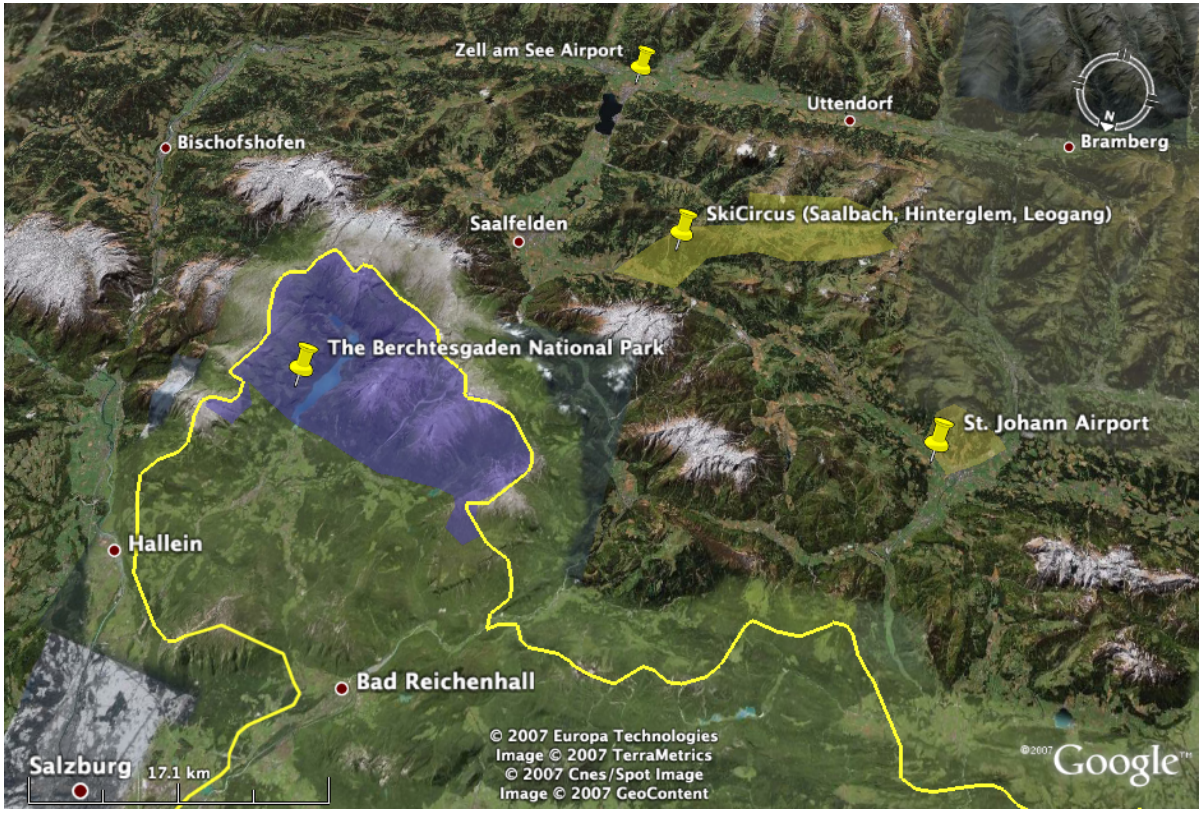
- aircraft limitations
- complicated terrain
- presence of ski-lift and electricity line pylons, ropes and wires
- ATC allowance.

The altitude is expected to be proposed by aircraft operator.

The exact flight profile planning is kept for future co-operation with the aircraft operator and the group of students to be gathered via the EUFAR "Join an existing campaign" opportunity as suggested in the initial proposal.

a rough estimate of the additional water budget due to snow production, (the scale, timing and magnitude of the expected effects)

One of the campaign motives is rooted in the lack of known estimation of the magnitude of water budget alteration in scientific literature. Such estimates are preset in press however in a very imprecise form (what was quoted in the initial proposal). However, the campaign is expected to provide just a qualitative proof of the phenomenon, not a quantitative result.



Man-made snow production

All main slopes and pistes in the Skicircus Saalbach Hinterglemm Leogang are snowed mechanically:

- 253 ha of mechanically snowed area
- 7 water reservoires
- approx. 420 snow making machines

Background information

Like everywhere in Austria the snow production in Saalbach-Hinterglemm must only contain natural elements: air and water. All additives are forbidden. To obtain sufficiently dry and not freezing snow production must be performed under a temperature of minus four degrees C. The man-made snow production at higher temperatures is not practical and is not practiced in Saalbach-Hinterglemm.

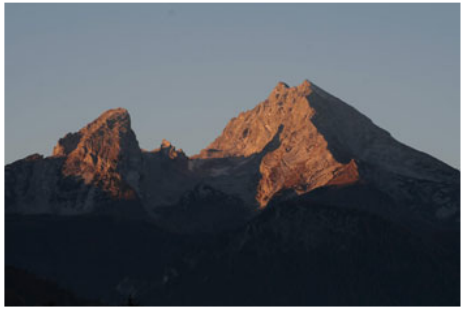
Limits on man-made snow production

A lengthening of the ski season over the average duration is not permitted. The official guidelines for the Salzburg region and the limitations of the Saalbach-Hinterglemm system allow man-made snow production from 1. November through 15. March.

The Berchtesgaden National Park

The Berchtesgaden National Park is located in southeast Germany in the Free State of Bavaria and borders on the Austrian state of Salzburg. The park was founded in 1978 and, covering a surface of 210 km2 or 81 sq. miles, it is state property in its entirety. Its high mountain landscapes are characterized by extensive forests and steep rock faces.

Protecting Nature
Environmental Education
Recreation
Hiking Suggestions
Important Adresses



Protecting Nature

The National Park's primary mission is to let nature take care of itself. This is why we intentionally abstain from human intervention in the heart of the protected area and nature's development is left to run its own course. Forests, for example, are allowed to grow old, decay and be reborn on their own. On the other hand the useable area can continue to serve traditional functions: summer grazing for cattle, as well as a fishery and boat traffic on Königssee.

03.10.2007 | 04.10.2007 | 05.10.2007

FIT FOR THE SNOW IN 60 HOURS

Fit for the snow in 60 hours – St. Johann in Tirol

*** Now even greater snow security with new snowmaking system ***

Come and enjoy guaranteed skiing pleasure – on the north side of the Kitzbüheler Horn – the skiing mountain of St. Johann in Tirol. Starting this winter, a total of 45 piste kilometres can be covered in snow simultaneously in only 60 hours!

Starting in Winter 07/08, the most modern snowmaking system in Austria will go into service. If required, a total of 45 km of piste can be covered in snow along its whole length **using a fully automatic system in only 60 hours.**

Figure 2: A pseudo-aerial view over the area of interest with both airfields and measurement areas highlighted accompanied by three website article cuttings of the SkiCircus resort, St. Johann ski station and *The Berchtesgaden National Park*

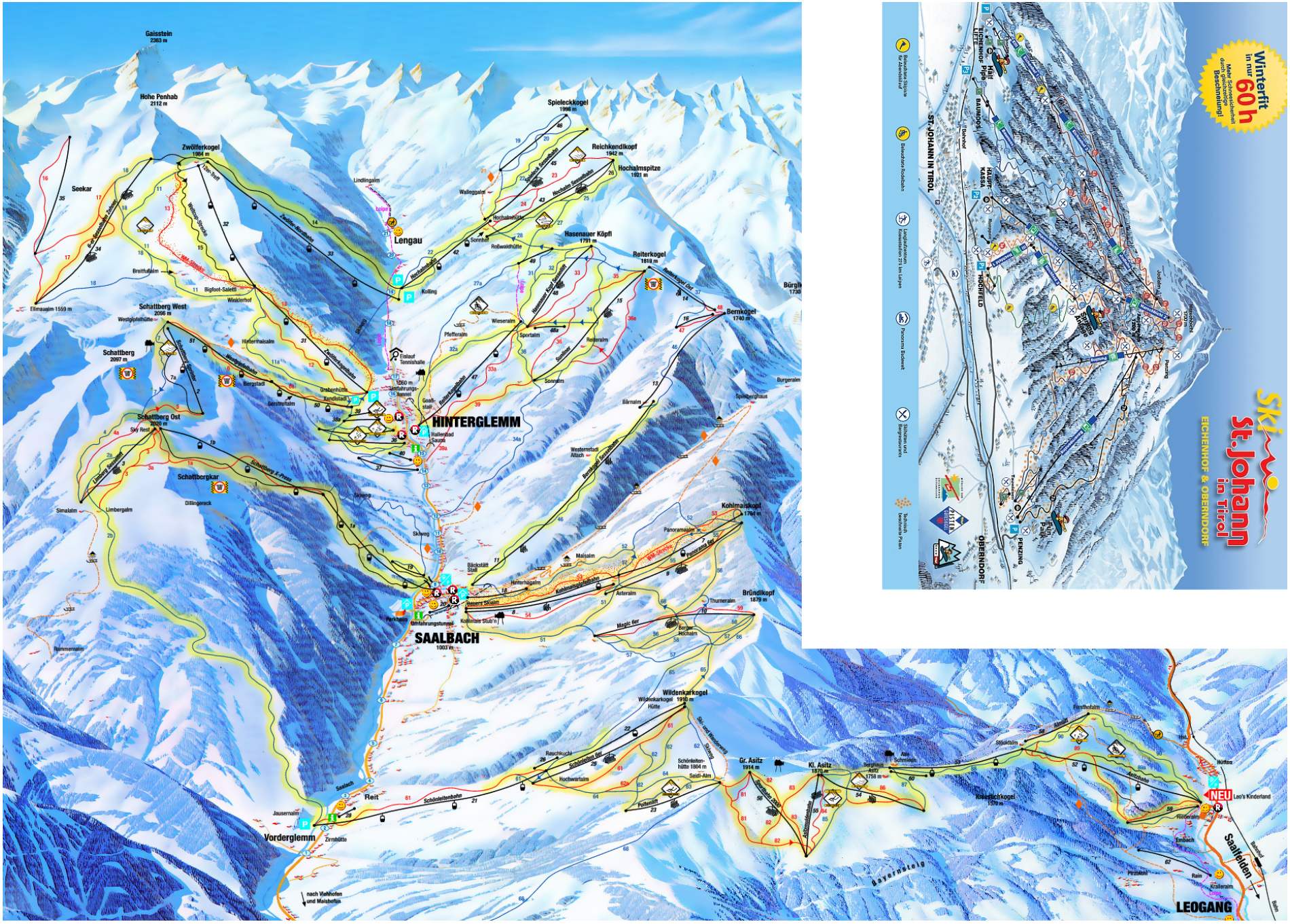


Figure 3: 2007/2008 winter season piste maps of the two ski resorts considered for the campaign (obtained from websites of the respective resorts) with snow-making areas highlighted (by yellow shading or orange spots)