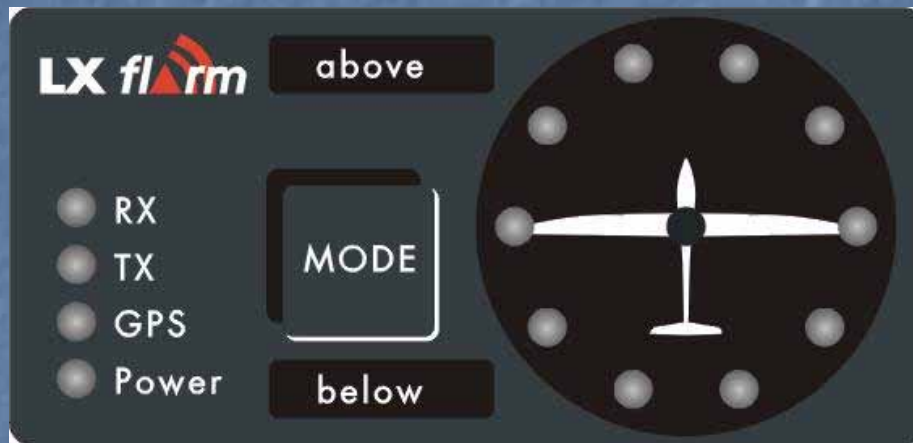


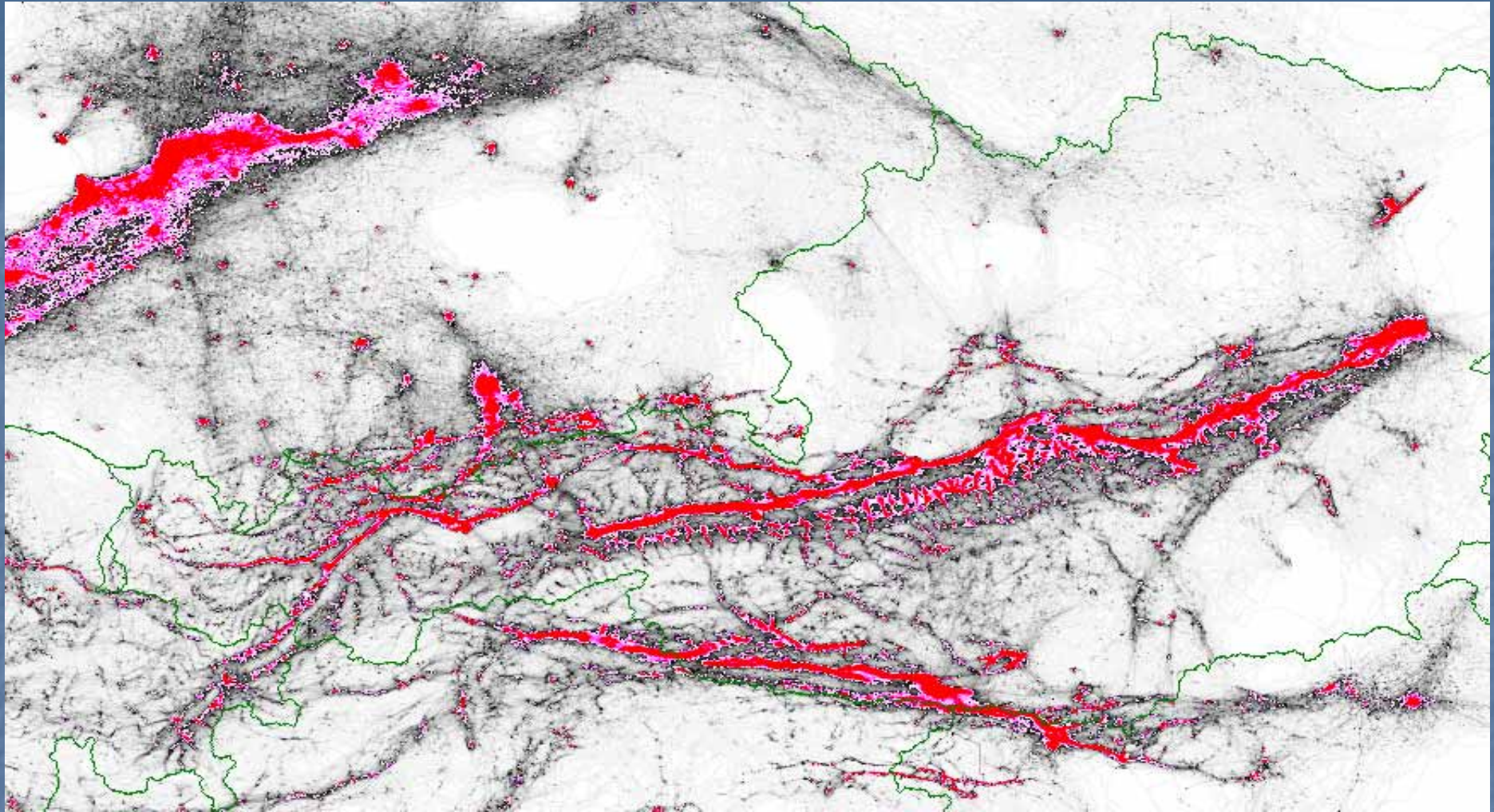


Robert Danewid



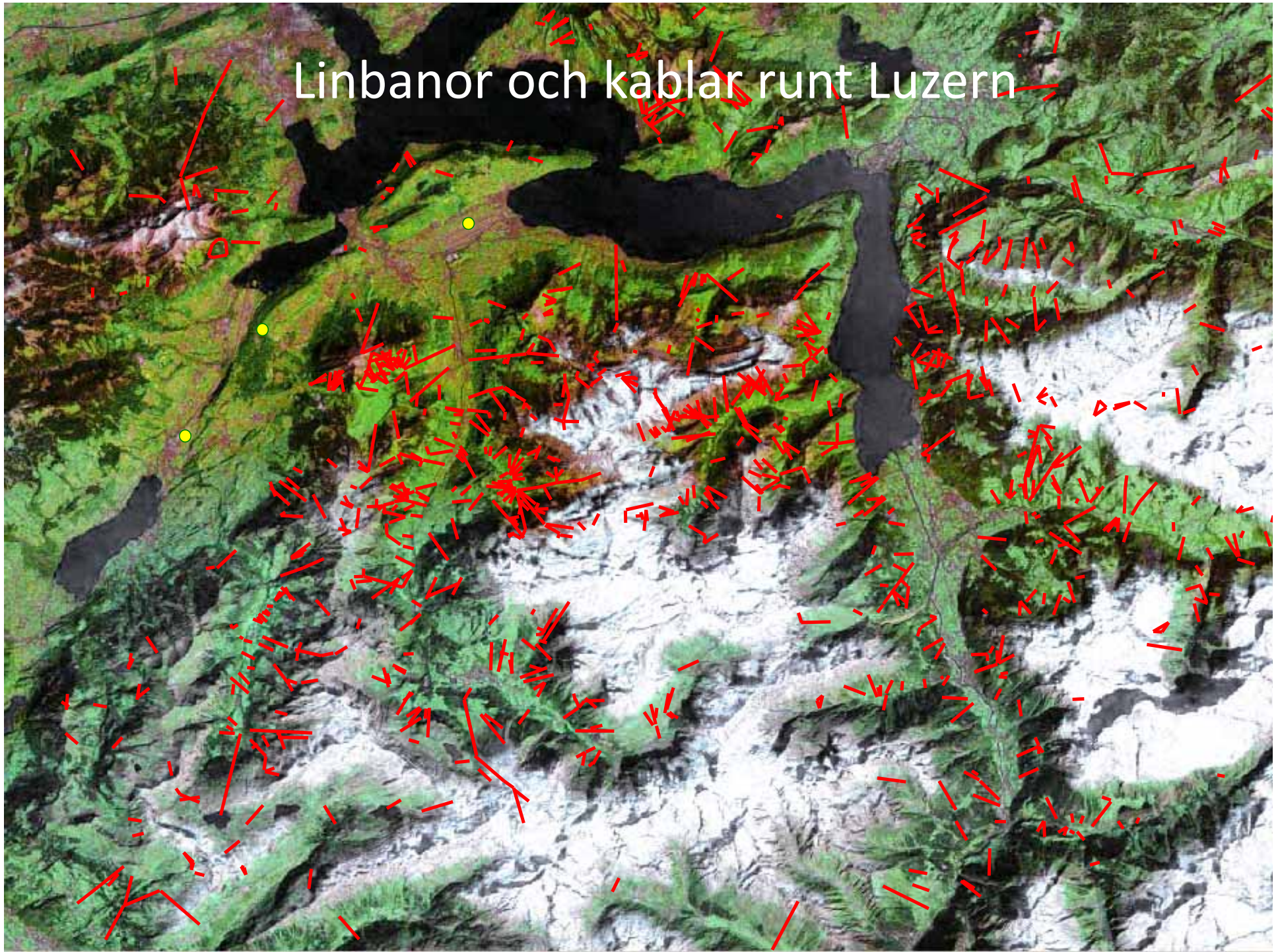
Flygning är farligt!

- Kollisioner = olycksorsak #2 i segelflyg
- Varannan som är iblandad i en kollision omkommer
- Vart tredje dödsfall i segelflyg är i en kollision
- Ofta ingen utredning när ingen skadas
- Near-Miss mycket vanligare, ofta oupptäckt



Thermal Airways (Österreich)

Linbanor och kablar runt Luzern



Reno / Nevada 2006















Speed each Closure Rate / s	120km/h 67m	160km/h 89m	200km/h 111m
--------------------------------	----------------	----------------	-----------------

Distance 20km $\Rightarrow$ 300s / 225s / 180s

Distance 10km $\Rightarrow$ 150s / 113s / 90s

Distance 5km $\Rightarrow$ 75s / 56s / 45s

Distance 4km $\Rightarrow$ 60s / 45s / 36s

fuselage $\Rightarrow$ max. resolution of a healthy young eye

Distance 3km $\Rightarrow$ 45s / 34s / 27s

Distance 2km $\Rightarrow$ 30s / 23s / 18s

Distance 1.5km $\Rightarrow$ 23s / 17s / 14s

Distance 1km $\Rightarrow$ 15s / 11s / 9s

Distance 900m $\Rightarrow$ 14s / 10s / 8s

Distance 800m $\Rightarrow$ 12s / 9s / 7s

Distance 700m $\Rightarrow$ 11s / 8s / 6s

Distance 600m $\Rightarrow$ 9s / 7s / 5s

wingspan = width of a thumb at arms length

Distance 500m $\Rightarrow$ 8s / 6s / 5s

Distance 400m $\Rightarrow$ 6s / 5s / 4s

Distance 300m $\Rightarrow$ 4.5s / 3.4s / 2.7s

fuselage $\Rightarrow$ mosquito on cockpit, or woolen thread

Distance 200m $\Rightarrow$ 3s / 2.3s / 1.8s

Distance 100m $\Rightarrow$ 1.5s / 1.1s / 0.9s

Distance 50m $\Rightarrow$ 0.75s / 0.56s / 0.45s

Distance 20m $\Rightarrow$ 0.3s / 0.23s / 0.18s

Distance 10m = 0.15s / 0.11s / 0.09s

**Reading distance 30cm
when printed on A4**

Wingspan: 15m

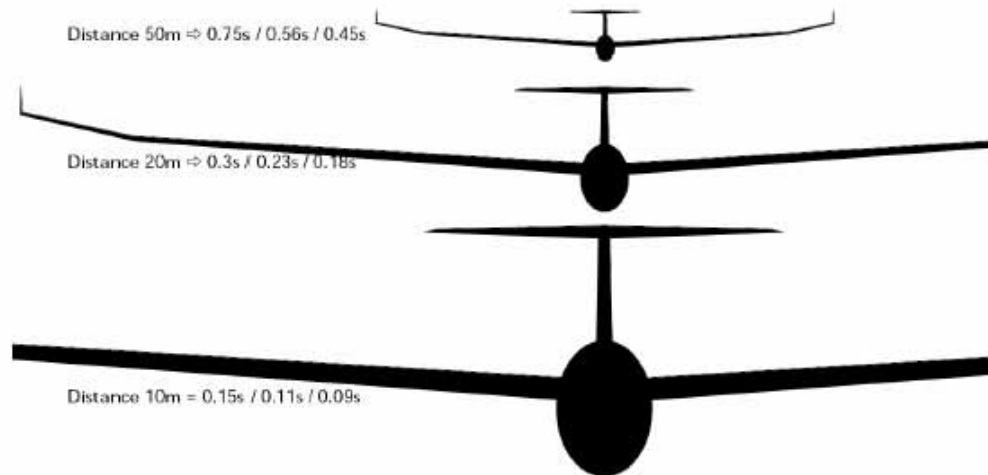
In reality, less contrast
and
TAS $\gg$ IAS



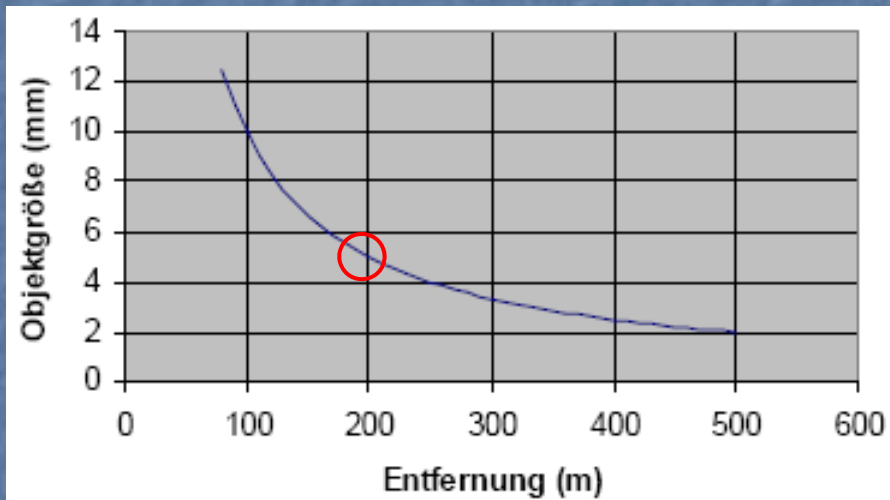
57mm Vario in 60cm distance



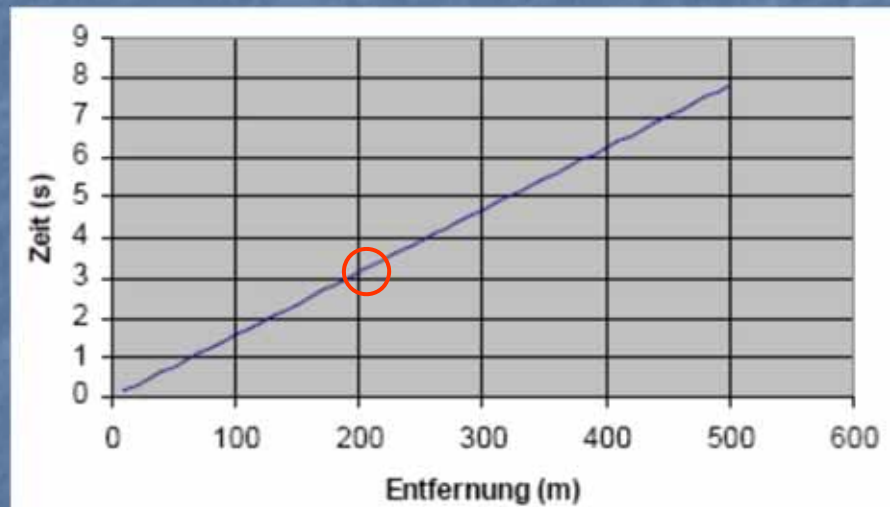
80mm Speed
in 60cm distance



Skenbar objektsstorlek vid
en meter från ögat



Tid till "impact" vid 230
km/h närmandehastighet



Flygsäkerhet (idé Sakka)

1. Titta ut
2. Titta ut
3. Titta ut
4. Scanna med rätt metod

Fokus
Färger
Långt håll



Upptäcker rörelser
Monokromt
Oskarpt

Scannings teknik



Photo: Robert Danewid

Distans till “målet”



“Detection distance”?



Airspeed $185 \text{ km/h} = 50 \text{ m/s}$

Närmande fart 100 m/s

$100 \text{ m} = 1 \text{ s}$

$200 \text{ m} = 2 \text{ s}$

$500 \text{ m} = 5 \text{ s}$

$1\,000 \text{ m} = 10 \text{ s}$

Svänga höger

- Reaktions tid – 1s
- Rolla in i en brant sväng – 2 s
- 30 grader sväng – 2 s
- Totalt 5 s
- 2 x185 km/h – 100 m/s – 500 m

Dyka

- Reaktions tid – 1s
- Dyka till en 20 graders dykning – 1 s
- Sjunka 3 m – 1 s
- Totalt 3 s
- 2 x 185 km/h – 100 m/s – 300 m

Sammanfattning

- För att vara säker måste vi se det andra flygplanet på en distans av 1 km
- Om närmare - ska vi dyka i s f svänga
- Vi måste använda rätt scanningsteknik

FLARM är ett audiovisuellt
hjälpmedel för bättre "look out"



FLARM Historik

- Från Schweiz – kolissionsvarning om flygplan och terräng
- 2001 Första idéerna
- 2003 Examensarbeten på temat
- Maj 2004 första prototypen
- 2004 100 enheter färdigställs på beställning. Utökas raskt till 450
- FLARM-föreningen ombildas till ett aktiebolag
- Schweiziska räddningstjänsten utrustar sina helikoptrar med FLARM
- Juni 2006 OSTIV Pris
- Idag >17 000 i bruk world wide

"Swiss FLARM" eller "FLARM original"



Potential Collision Situations Between Gliders



Frontal Approach



Approach from side and back



Glider 1 entry in thermal with glider 2 circling



Opposite direction* or offset spiral



Similar spiral turns

Human eye	Good	Poor	Good (1) Very poor (2)	Poor	Good
FLARM help	Very good	Very good	Very good (1) Good (2)	Good	Poor **

** This situation is contrary to basic safety rules (with or without Flarm) !*

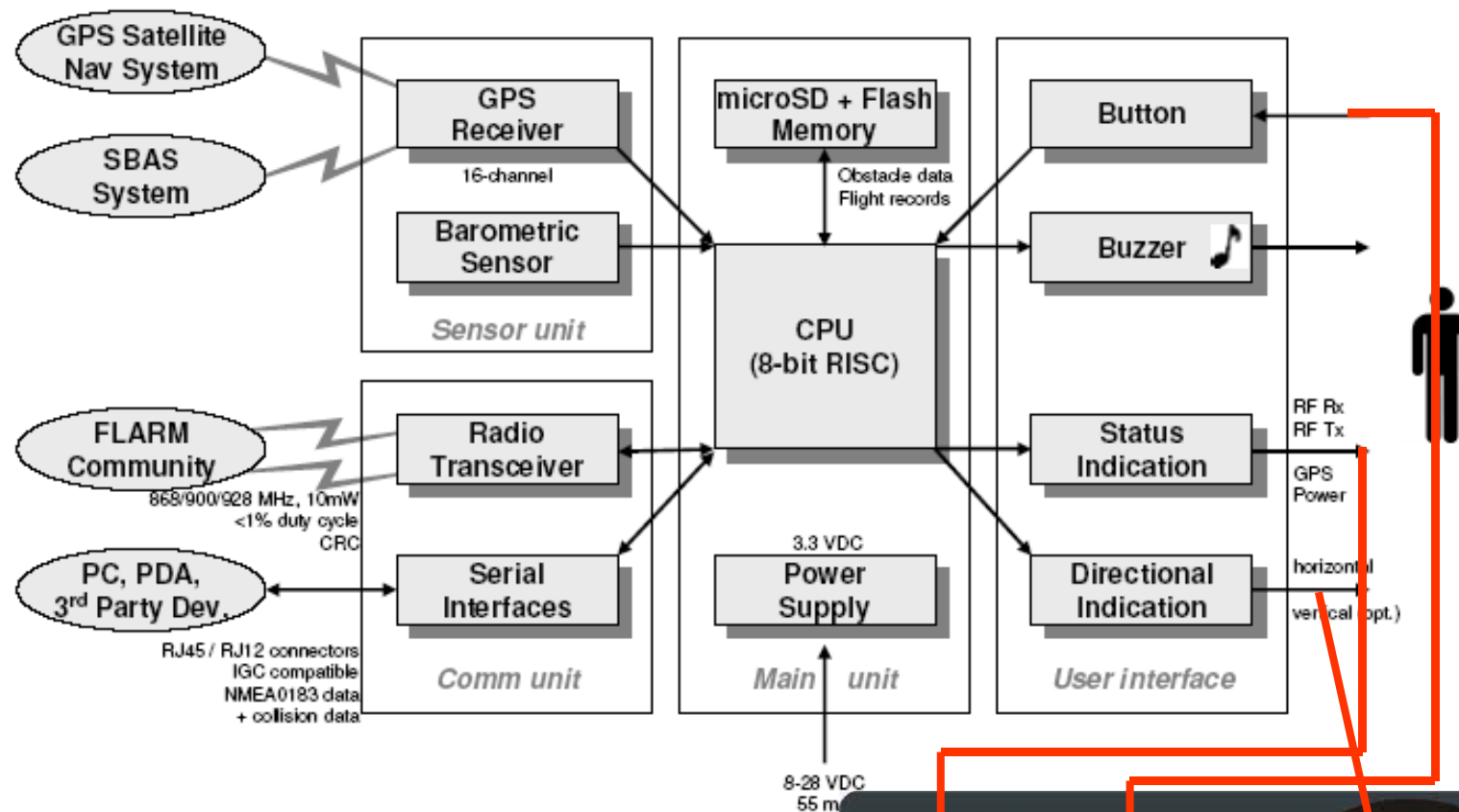
*** While circling: Use of the function „suppress sound alarms“ (double-click) helps, but...
LOOK OUTSIDE*

How does it work

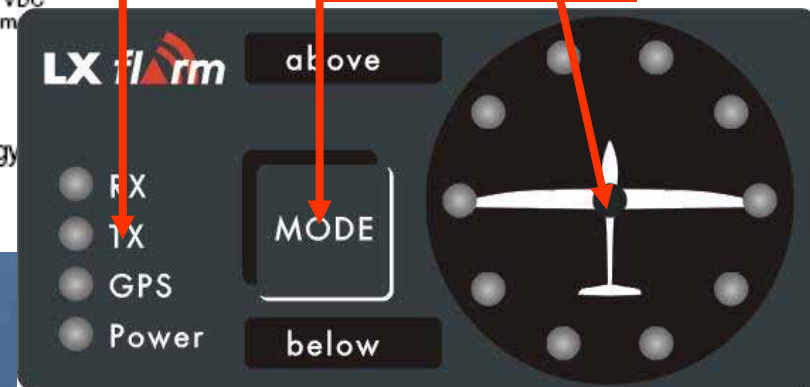
- Broadcast own GPS-derived flight-path prediction over license-free radio
- highly selective aircraft-aircraft warnings, 2-3 km range
- obstacle warnings based on internal database
- flight recorder in IGC-format
- NMEA-interface with configurable traffic data
- simple user interface



Hardware block diagram



© 2007 by FLARM Technology





Men.....

FLARM är inget kollisionsvarningssystem
som TCAS!

Det är ett "situational awareness system"

Look out, Look out, Look out, Look out, L

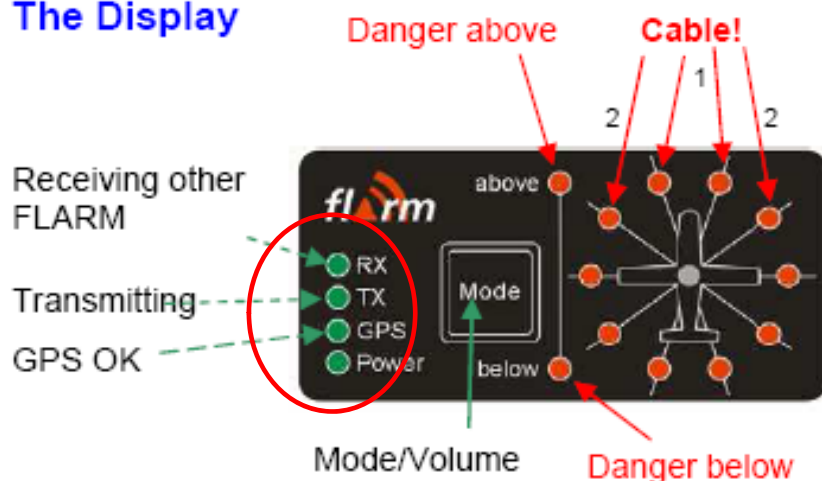


Version 2 Quick Reference

Important: only the original manual is binding

<http://www.flarm.ch>

The Display



After switching on FLARM is always useable.

RX, TX blinks briefly per second and interrupts long.
GPS blinks long per second and interrupts briefly. Otherwise an error situation.

Cable! LED pairs 1 and 2 blinking alternately.
 The closer, the faster the blinking!



Danger above/below (or same altitude) as own aircraft.



Mode -button

1x short Volume change is briefly confirmed

3 sec Switch between **WARNING** (only danger) & **NEAREST** (all)



Version 2 Quick Reference

Important: only the original manual is binding

More detail

Mode selection with Mode-button

WARNING Only danger situations are indicated. **Always blinking** with aural alert.

NEAREST Also traffic infos within 500m altitude and 2 km distance. Indication only **steady**, not blinking.

Doubleclick All indications suppressed for 5 min.
Doubleclick again = back to normal indication.

> 8 sec Pressed engages restart
> 20 sec Factory Reset (please do not use!)

LED's

Obstacle Obstacle warning always ahead. **The closer, the faster the LEDs are blinking.**

Aircraft **Danger in indicated direction**

Attention! Direction indication of objects with strong wind inaccurate! (Heading – Track).

GPS Power Should light continuously with short interruptions. Lights continuously, when > 8 Volt.

Copyright 2008

FLARM startar alltid i "Nearest" Mode

*To change mode of operation (nearest to warning and vice versa) press **MODE** button for approximately **2 seconds**. If the radial LED's will run from top toward bottom means change over to NEAREST*

Note!

To change mode of operation press **MODE** button for approximately 2 seconds. If the radial LED's will run from top toward bottom means change over to NEAREST and vice versa. After each **new power on**, the unit will start in Nearest mode.



”The data below is from a standard Flarm, with original antenna, mounted on the instrument panel of the rear seat in a Duo Discus. The transmission range in flight direction is clearly affected by the attenuation caused by the front seat pilot and fuselage.”

FLARM radio transmission analysis (preliminary, beta)

The green area is the minimum recommended range for speeds up to 200km/h
The blue area is the average receive range of the submitted flightdata

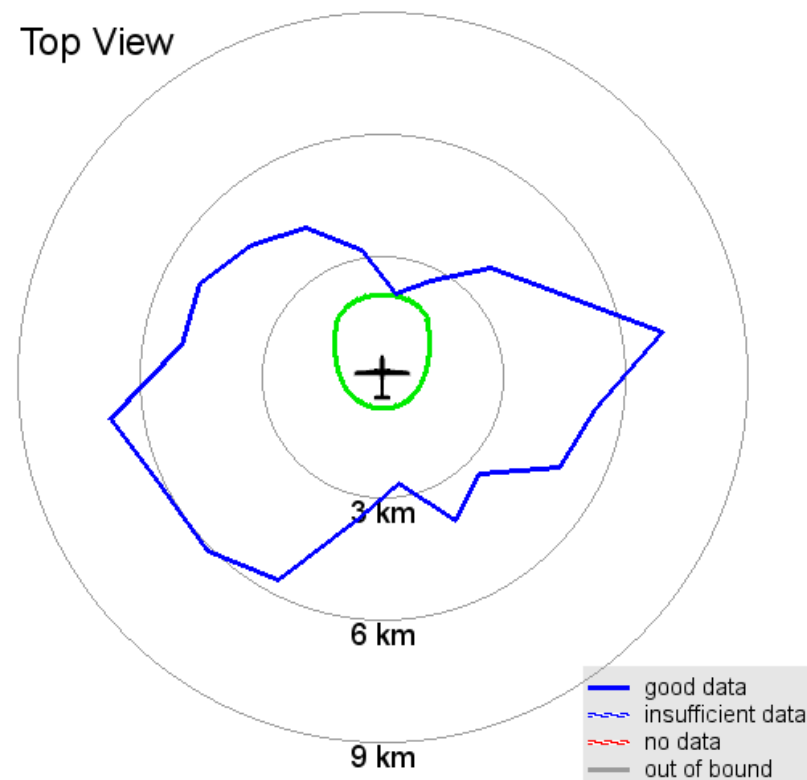
File : 834GZL21.IGC
Pilot : Joe Doe
Radio ID: DD9B24
HW Type : Flarm06
FW Vers : 4.00

Total points: 1061
Average distance: 4586m
Maximum distance: 24584m



Version 0.8beta (c) FLARM Technology. Patents Pending

Top View



data processed on Sat, 22 Mar 08 06:20:50 +0100



LX RedBox med
IGC logger

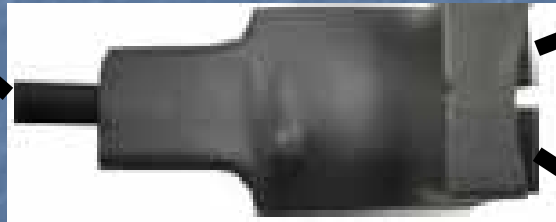


“LFK standard”

Oudie



UHA
USH
URO
UKA
UKV



Splitter

FLARM display



Sammanfattning

- ✓ FLARM "ser" bara andra flygplan med FLARM
- ✓ Vi har FLARM i alla klubbens flygplan
- ✓ Ljungbyhed har FLARM i alla sina flygplan
- ✓ FLARM är ett *hjälpmedel* att *titta ut* mer
- ✓ De tre viktigaste råden att komma ihåg
 - ✓ 1. Look out!
 - ✓ 2. Look out
 - ✓ 3. Look out

LX FLARM sponsored by Inter Hannover

