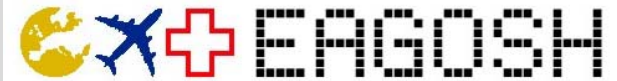




BG Verkehr

Berufsgenossenschaft für
Transport und Verkehrswirtschaft

German Social Accident Insurance
Institution for Transport and Traffic



38th EAGOSH Meeting
6-7 May 2015

Thermal Comfort

An Aviation topic?

Thomas Sye

Cold feet sensation on the flight deck of commercial aircraft



A possible prevention measure?

Cold feet sensations in the flight deck of Airbus A 320/A 321 aircraft

- Cold feet, caused by uncomfortable floor temperature
- Large vertical air temperature gradient
- Airbus A 320/A321 on medium haul-flights without underfloor heater, only

„even with sick socks and lined shoes both pilot's feet started to get numb“

Possible causes

- very low outside temperature at normal flight level (FL 350- 390): about - 60° C (-76° F, 213 K)
 - associated with cooling of aircraft skin
- lack of underfloor-heater (cost reduction)
- flight instruments with low or no heat emission

Investigation

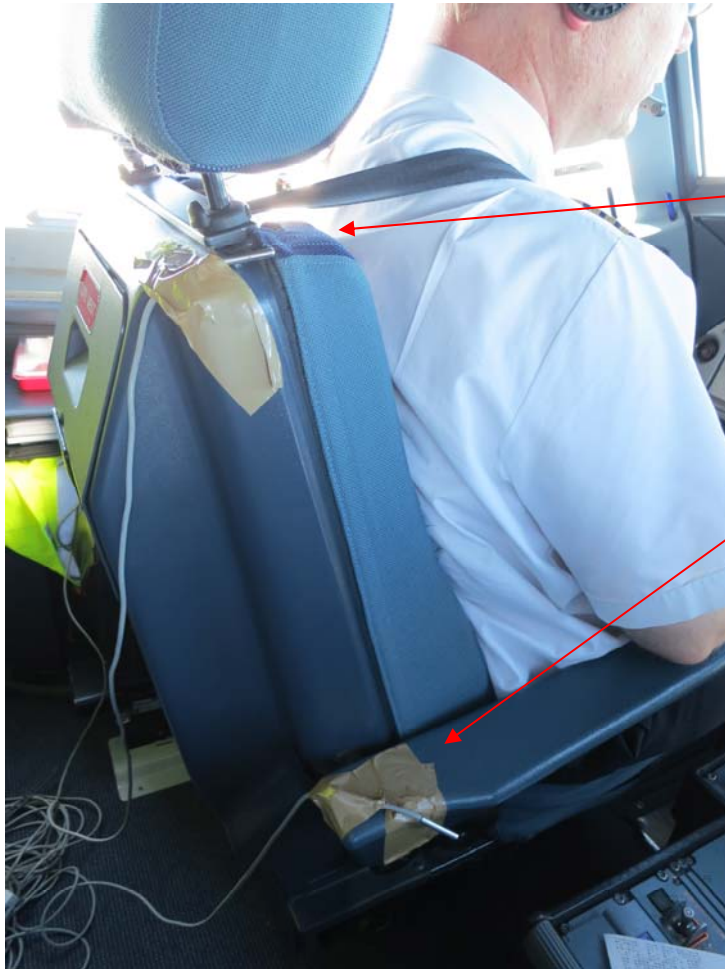
- The objectives were to evaluate the thermal local discomfort in the area of the pilot seat especially focusing on
 - Cold feet and warm head at the same time
 - Cold feet, caused by uncomfortable floor temperature

Taking into account: DIN ISO 7730 "Ergonomics of the thermal environment - Analytical determination and interpretation of thermal comfort using calculation of the PMV (Predicted Mean Vote) and PPD (Predicted Percentage of Dissatisfied) indices and local thermal comfort criteria"

Method

- The thermal situation in the flight deck of 3 Airbus A 320/321 has been investigated on 6 medium – haul flights from Germany to Egypt and Teneriffa (Spain) and Fuerteventura (Spain)
 - 2 flights with under-floor heater (foot warmer)
 - 4 flights without under-floor heater (foot warmer)
- Measured (inflight, 4 - 5 hrs):
 - course of floor temperature near the pedals
 - vertical temperature profile at the pilots seat at three measuring points

Measurement



Two measuring points at the pilots seat

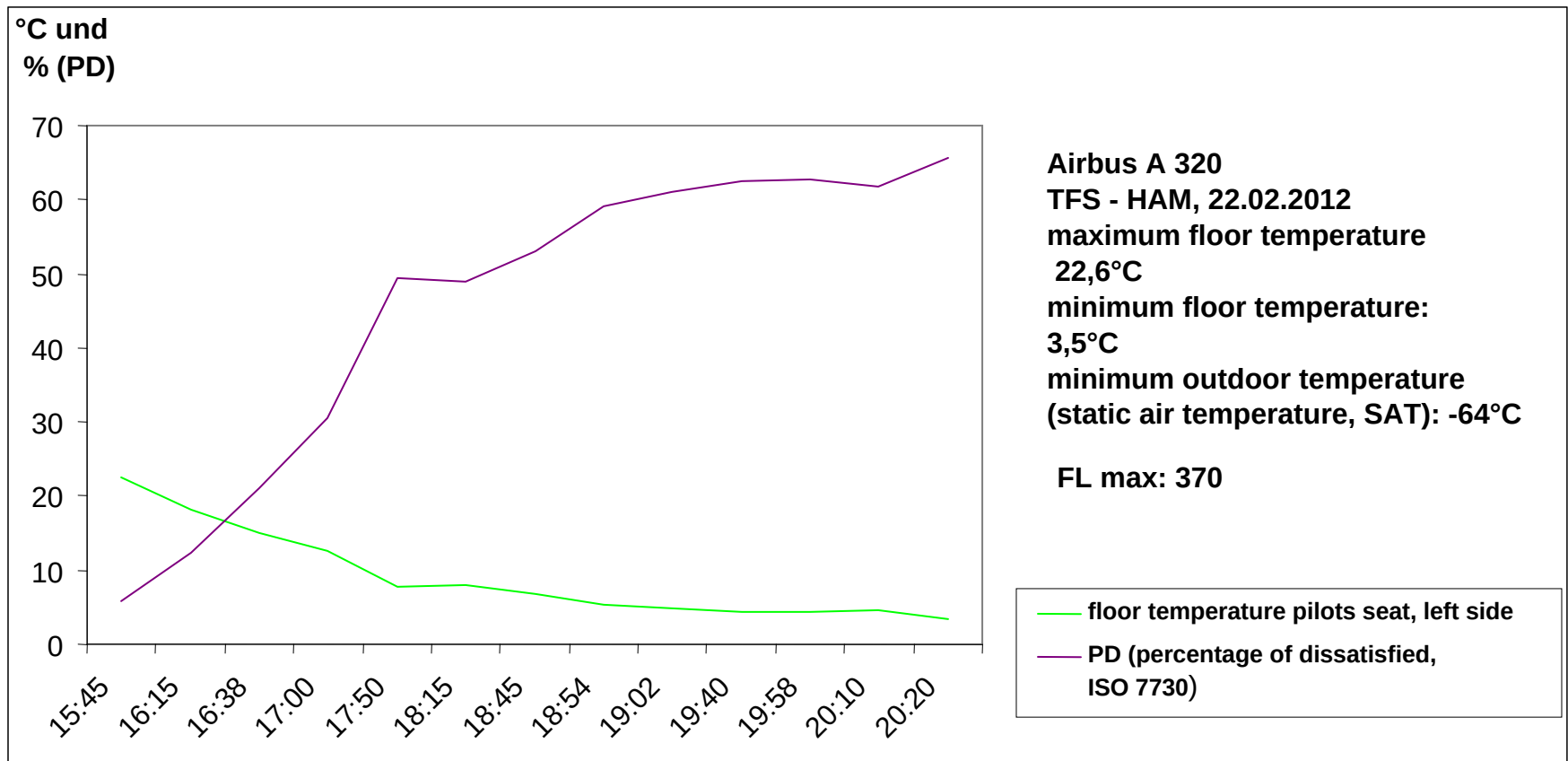
Measurement



3th measuring
point near the
pedals

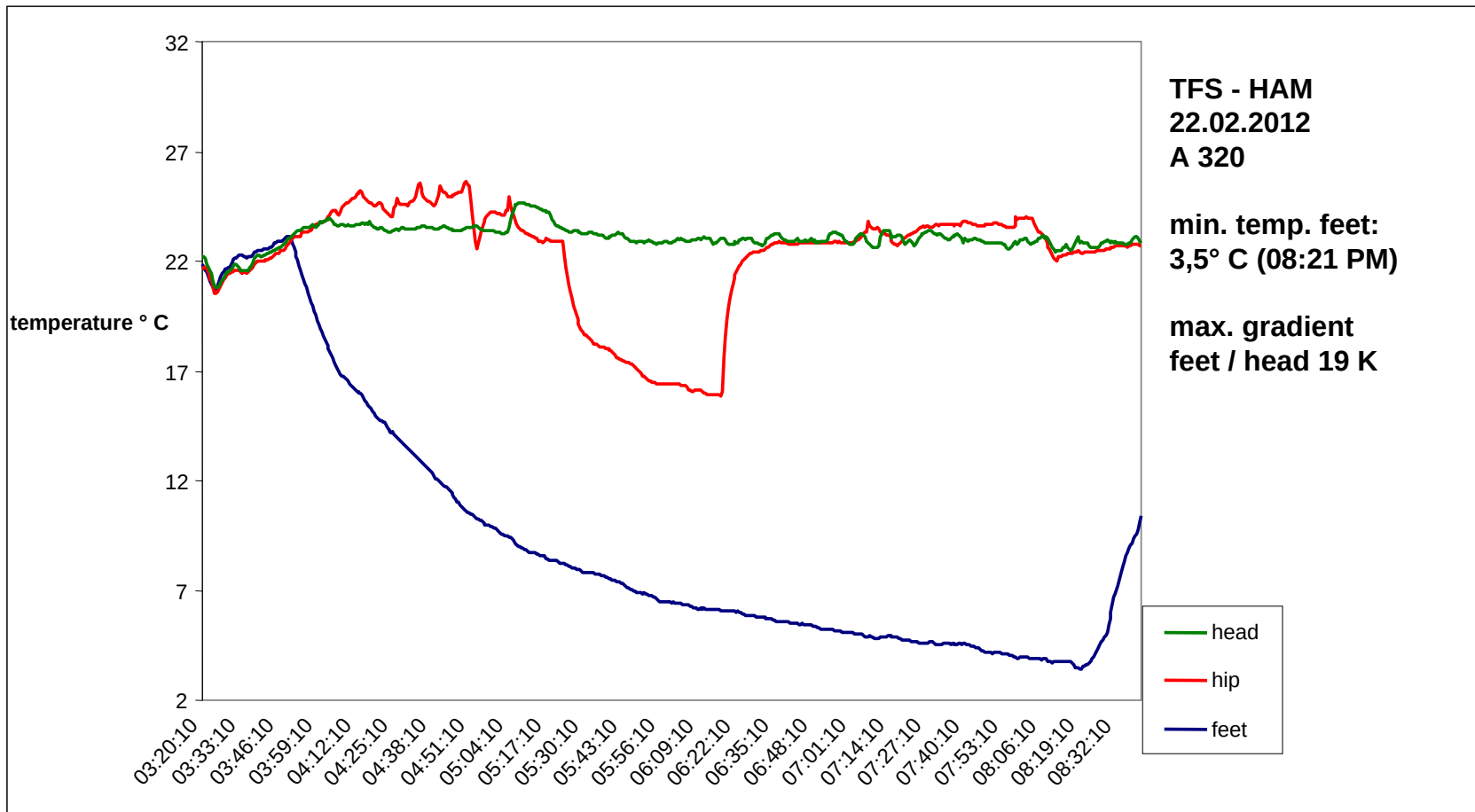
Results (floor temperature and resulting percentage of dissatisfied (PD))

aircraft without underfloor heater



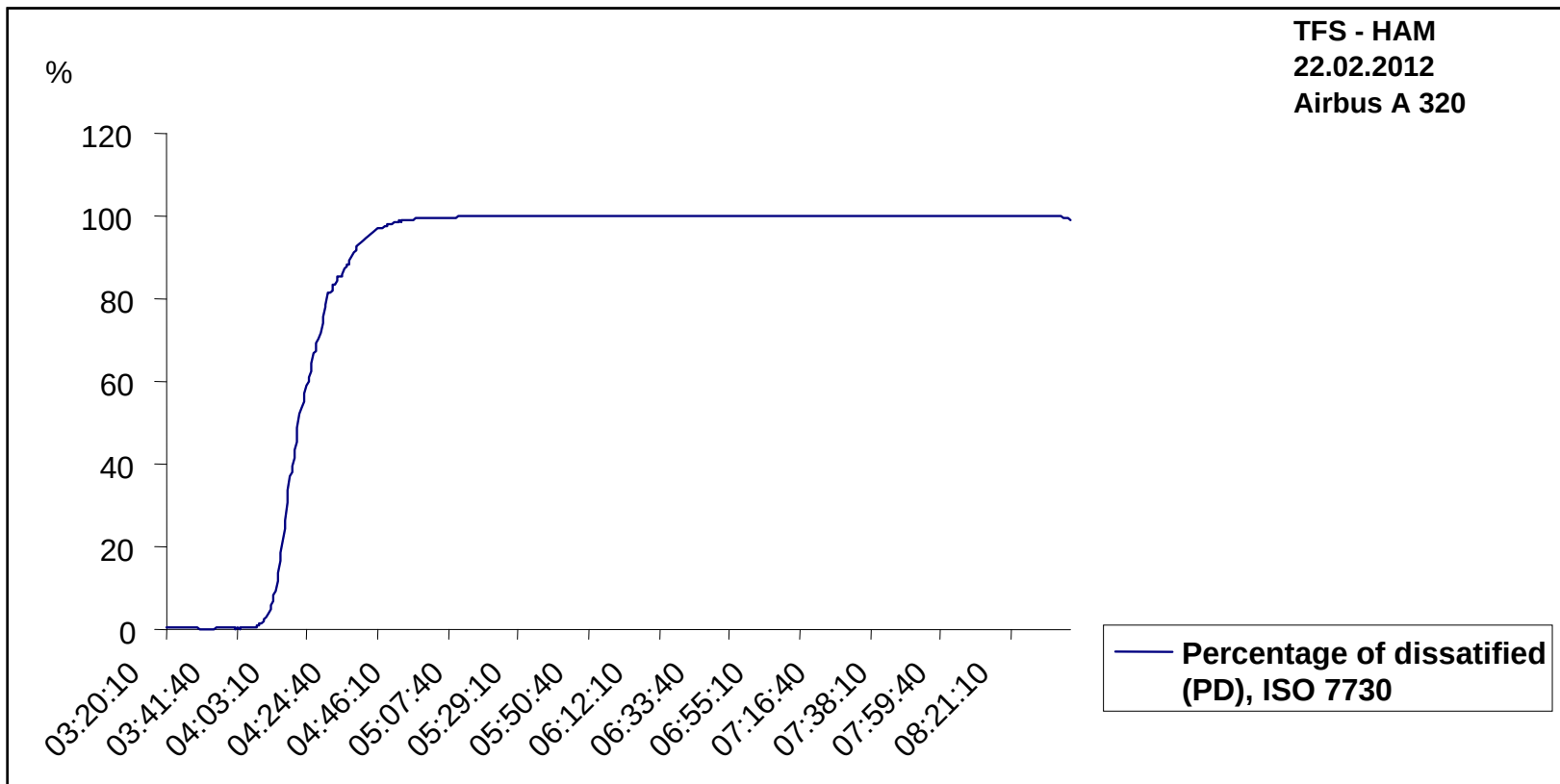
Results (vertical temperature gradient)

aircraft without underfloor heater



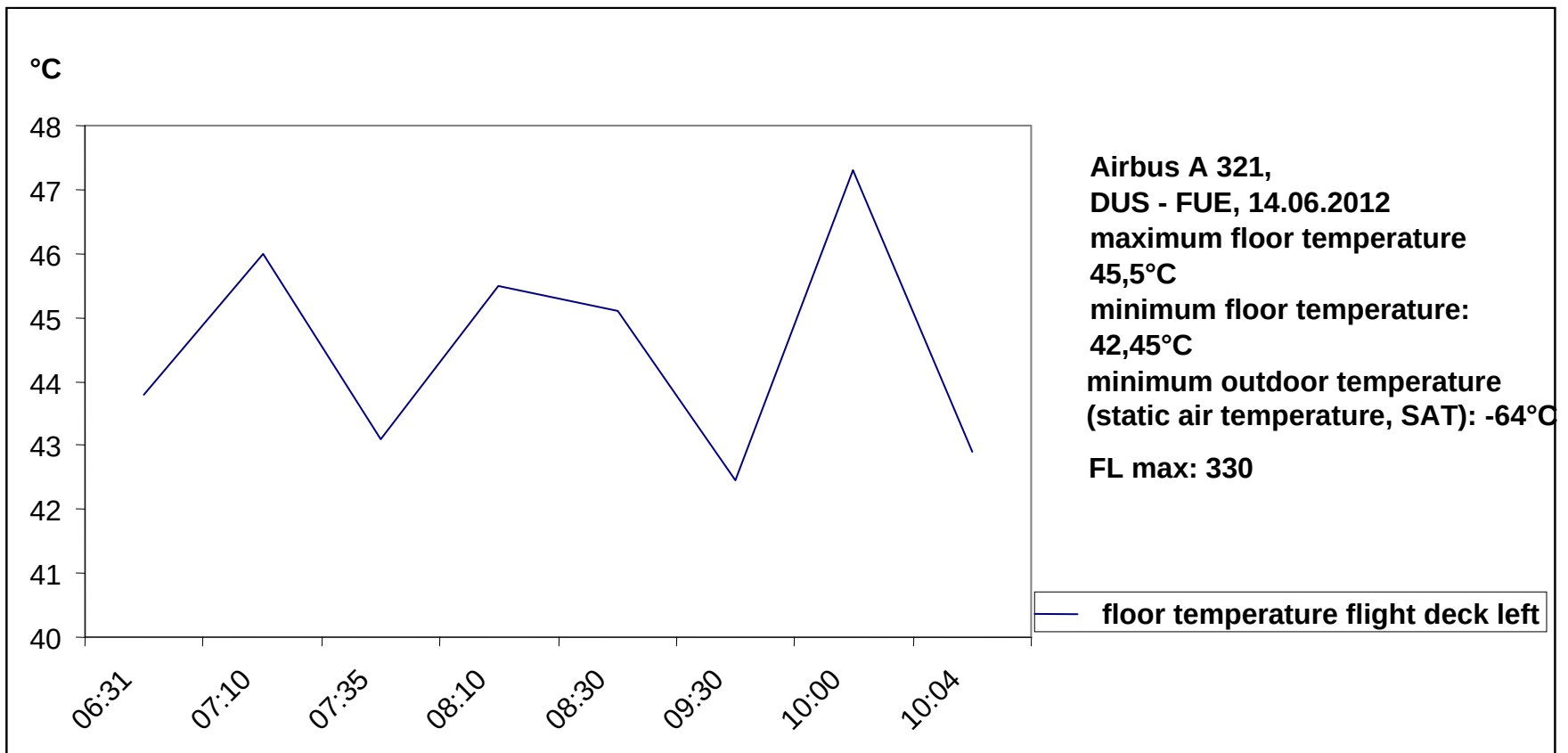
Results (resulting percentage of dissatisfied (PD), ISO 7730, vertical temp. gradient)

aircraft without underfloor heater



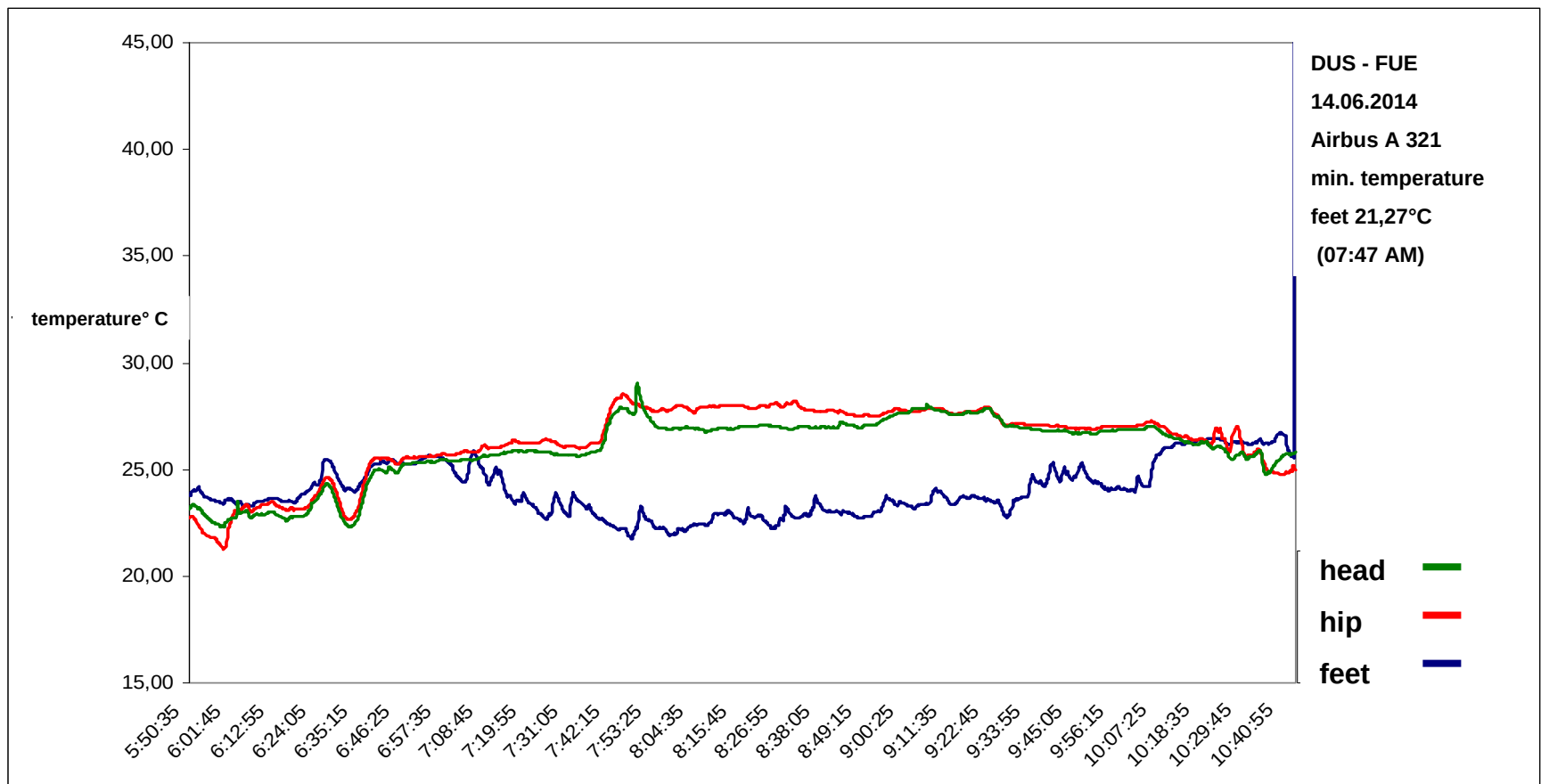
Results (floor temperature inflight)

aircraft with underfloor heater



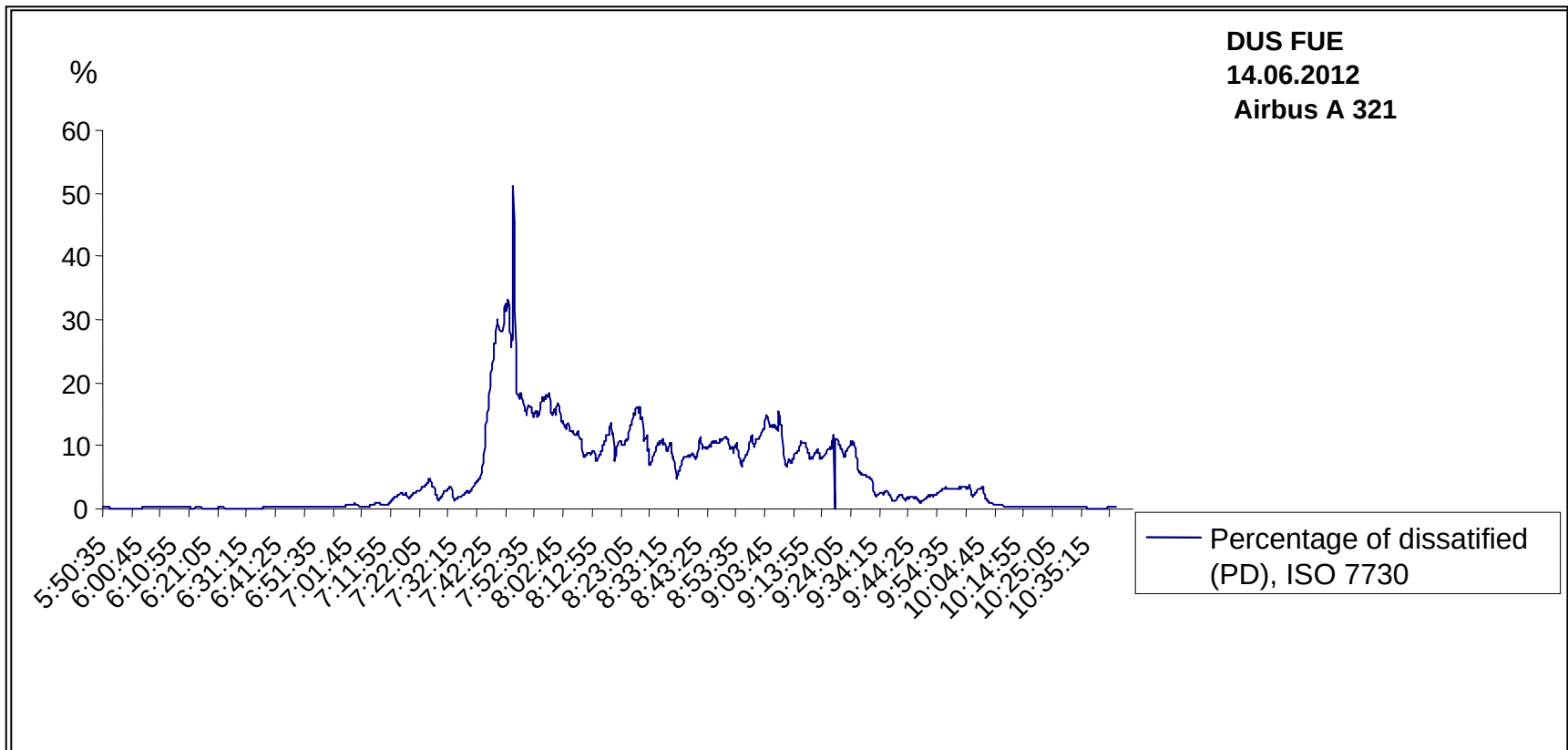
Results (vertical temperature gradient)

aircraft with underfloor heater



Results (resulting percentage of dissatisfied (PD), ISO 7730, vertical temp. gradient)

aircraft with underfloor heater



Discussion

Working as a pilot is

- connected with high responsibility to flight safety
- requires high concentration and attention
- Due to the observed local thermal discomforts in the cockpit of the investigated commercial aircraft without underfloor heating a reduction in attention and concentration of the flight deck crew, especially during the takeoff and landing phase can not be excluded. This must be considered in the risk assessment

Measures/ Recommendations

By use of auxiliary electrical heating systems (under-floor heater) an increase of working performance of the cockpit crew is possible. An increase of flight safety is to be expected and thereby a possible peril of passengers can be prevented.

Thanks for listening!
Questions?