

Air-Traffic Related

Communications and Transport Systems: Research and Education Performed at the Division

Christiane Schmidt

AEAR group

(reads "air group")

Academic Excellence in ATM (and UTM) Research group
Communications and Transport Systems, ITN, Linköping University
<https://sites.google.com/view/aeargroup/home>



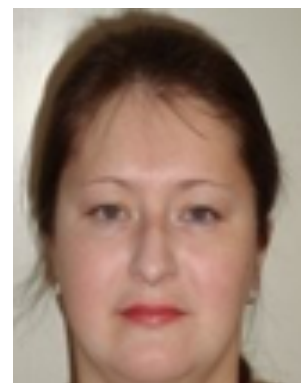
Tobias



Alan



Kristofer



Anastasia



Tatiana



Val



Clas

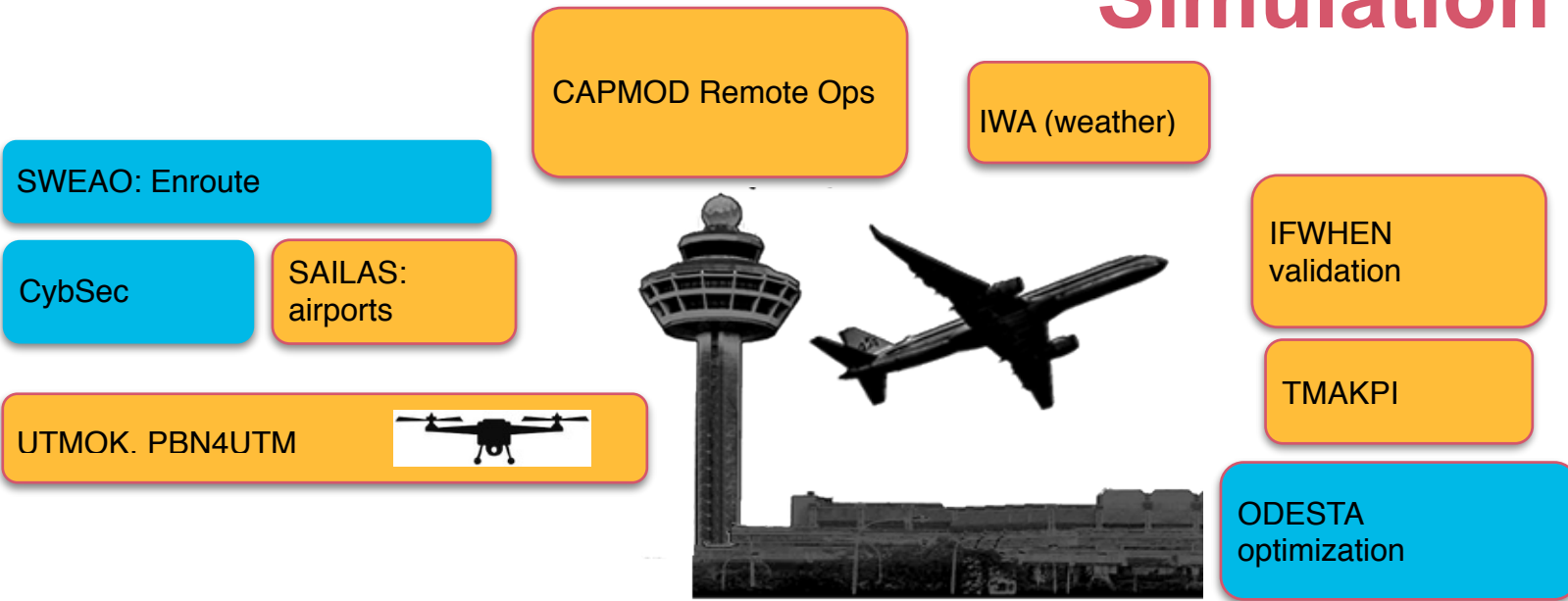


Christiane



Leo

Modeling Optimization Algorithms Simulation



Papers

- SID'15,'16,'17x2,'18x2
- ATM Seminar'17x2,'19x3
- ICRAT'16x2,'18
- DASC'16x2,'17x3,'18, '19x3
- ICUAS, NoiseCon,....
- ICNS'17x2 (Best and 3rd best paper awards)



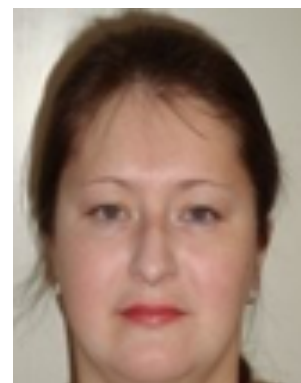
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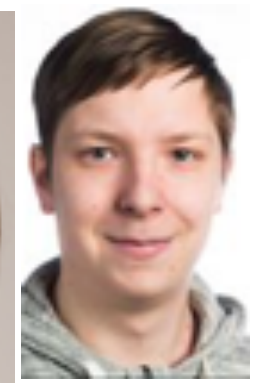
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SWEAO: Enroute

CybSec

SAILAS: airports

UTMOK. PBN4UTM



CAPMOD Remote Ops

IWA (weather)



IFWHEN validation

TMAKPI

ODESTA optimization

TRANSPORT STYRELSEN



UPPSALA UNIVERSITET



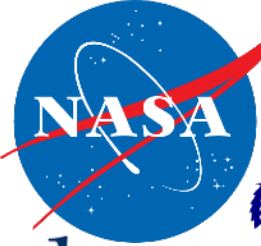
swedavia SWEDISH AIRPORTS



TRAFIKVERKET



EUROCONTROL



Berkeley UNIVERSITY OF CALIFORNIA



ECOLE NATIONALE DE L'AVIATION CIVILE



German Aerospace Center



Integrating Weather Prediction Model into ATM planning
(SESAR Engage project)

Capacity Modeling for Controller Workload Evaluation at RTC Arlanda
Predecessor:

KODIC - Kompetens, kapacitet och optimering i digital flygledningscentral

CAPMOD Remote Ops

IWA (weather)

SWEAO: Enroute

CybSec

SAILAS:
airports

IFWHEN
validation

TMAKPI

UTMOK. PBN4UTM



ODESTA
optimization



How to design an optimal airspace?

Optimal Choice of Subsidized Routes in Air Transportation

Adaptive layered structure design, risk-based routing, emergency landing (location of zones) and safe routes, strategic deconfliction market

How much UTM traffic is OK, before: safety compromised, too much noise, communication jammed, long delays...
Under various assumptions: CD&R capabilities, operation paradigms. Focus: very low level, uncontrolled airspace

Security and Privacy of Air Traffic Communication

Great minds think alike

- KPIs (LFV, SESAR) "If you can't measure it you can't improve it"
- TMA enroute (LFV, SESAR, TS, LiU) [ODESTA](#) in [INFORMS OR/MS Today SI](#)
- Routes sectors (Swedavia, ODESTA, SESAR, TS)
- Weather, fleet (TS, SESAR)

ODESTA (Optimizing Aircraft Descent for Environmentally Sustainable Aviation) '20-23
KTH CSA

[idea: LiU (opt)]

+z (CDO, fuel/noise), weather, tradeoffs;
fwd-looking

TMA KPI (Towards Multidimensional Adaptive KPIs)
'19-22 TrV

[idea: LFV (performance)]

Baseline KPI development:

- to drive the design in ODESTA (optimization algorithms)
- to assess solution quality in IFWHEN (validation framework)

IWA (Impact of Weather on ATM) '19-21 SESAR

ODESTA2d (Optimal Design of Terminal Airspace) '15-18 VINNOVA + LFV (in-kind)

2d, integrated strategic design,

noise, weather,

fleet mix (1-size-fits-all)

IFWHEN (Impact of Fleet Diversity and Weather Hazards on Emissions, Noise and Predictability): '19-21, TS

[idea: TS (what was going on)]

vertical (in)efficiency, per-flight view,
noise/fuel/punctuality tradeoffs, weather,
airspace users diversity; historical

Research directions

- Mutli-aviation airspace: Capacity estimation and route planning for various kinds of air traffic:
 - unmanned aerial vehicles (UAV) traffic management (UTM)
 - urban air mobility (UAM)
 - conventional air traffic management (ATM)
 - space2ground missions
- Airspace design for mixture of users
- Performance-based services (PBS)
- Development and optimization of environmental and other KPIs
- Lowering environmental impact of aviation (low-noise PBN routes) in terminal maneuvering areas (TMAs)
- Economic mechanisms and game-theoretic concepts for strategic traffic deconfliction.
- Controllers workload and scheduling for multiple Remote Tower Operations
- Risk assessment, safety and efficiency of flight paths
- Facility location for UTM and ATM – airports, vertiports, takeoff and landing areas (TOLAs), launchpads

Keywords

- Unmanned air traffic management (UTM)
- Conventional air traffic management (ATM)
- Algorithms, optimization, modeling, simulation
- Decision support tools for UTM and ATM



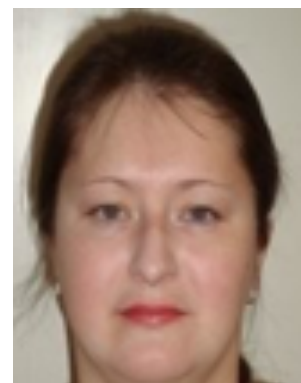
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Education

Education

- Bachelor's Programme in Air Transportation and Logistics, 180 credits
- (Plus elective course in Communication and Transportation Engineering, M Sc in Engineering, 300 credits)

Semester 1 (Autumn 2019)

Course code	Course name	Credits	Level	Timetable module	EMV
Period 0					
TNFL01	Air Traffic and Air Transportation	6*	G1X	-	M
TNSL01	Mathematics	12*	G1X	-	M
TNSL03	Logistics Project	6*	G1X	-	M
Period 1					
TNFL01	Air Traffic and Air Transportation	6*	G1X	-	M
TNSL01	Mathematics	12*	G1X	-	M
TNSL03	Logistics Project	6*	G1X	-	M
Period 2					
TEAE07	Legislation Issues in Avionics and Logistics	6	G1X	4	M
TNSL01	Mathematics	12*	G1X	-	M
TNSL03	Logistics Project	6*	G1X	-	M

Semester 2 (Spring 2020)

Course code	Course name	Credits	Level	Timetable module	EMV
Period 1					
TEIE53	Industrial Economics	6	G1X	1	M
TNIU66	Statistics and Probability	6	G1X	4	M
TNSL22	English for Logisticians	6*	G1X	3	M
Period 2					
TNSL21	Geographical Information Systems	6	G1X	2	M
TNSL22	English for Logisticians	6*	G1X	3	M
TNSL24	Programming Basics for Logistics Algorithms	6	G1X	1	M

Semester 3 (Autumn 2020)

Course code	Course name	Credits	Level	Timetable module	EMV
Period 1					
TNIU75	Linear Algebra	6	G1X	1	M
TNSL08	Production and Distribution	6*	G2X	2	M
TNSL20	Basic Logistics Algorithms	6	G2X	3	M
Period 2					
TEAE11	Intellectual Property Rights	6	G1X	2	E
TEIE83	Cost Benefit Analysis	6	G1X	2	E
TEIO29	Leadership and Organisation	6	G1X	2	E
TMQU08	Quality and Business Development	6	G2X	2	E
TNSL05	Optimization, Modeling and Planning	6	G2X	1	M
TNSL08	Production and Distribution	6*	G2X	3	M

Semester 4 (Spring 2021)

Preliminary courses

Course code	Course name	Credits	Level	Timetable module	EMV
Period 1					
TKMJ24	Environmental Engineering	6	G1X	2	E
TNSL07	Simulation of Logistics Systems	6	G2X	1	M
TNSL16	Traffic Infrastructure, Safety and Planning	6*	G1X	3	E
TNSL23	Logistics and Profit Analysis	6	G2X	4	M
Period 2					
TEAE14	Market Communication and Analysis	6	G1X	3	E
TNFL07	Logistics of Airline Companies	6	G2X	4	M
TNSL09	Health Care Logistics	6	G2X	1	E
TNSL16	Traffic Infrastructure, Safety and Planning	6*	G1X	3	E
TNSL18	Decision Models	6	G2X	2	E
TPTE06	Industrial Placement	6	G1X	-	V

Semester 5 (Autumn 2021)

Preliminary courses

Course code	Course name	Credits	Level	Timetable module	EMV
Period 1					
TEIE84	Industrial Economics, Continued Course	6	G1X	4	E
TNFL06	Airport Planning	6	G2X	2	M
TNSL17	Optimization in Logistics	6	G2X	3	E
TNSL19	Logistics Project - continuation course	6*	G2X	1	M
Period 2					
TEAE11	Intellectual Property Rights	6	G1X	2	E
TEIE83	Cost Benefit Analysis	6	G1X	2	E
TEIO29	Leadership and Organisation	6	G1X	2	E
TMQU08	Quality and Business Development	6	G2X	2	E
TNK098	Planning of Public Transportation and Railway Traffic	6	A1X	4	E
TNSL06	Logistics and Engineering	6	G1X	1	E
TNSL15	Logistics and Sustainable Development	6	G2X	3	M
TNSL19	Logistics Project - continuation course	6*	G2X	1	M

Semester 6 (Spring 2022)

Preliminary courses

Course code	Course name	Credits	Level	Timetable module	EMV
Period 1					
TKMJ24	Environmental Engineering	6	G1X	2	E
TNFL10	Air Traffic Management	6	G2X	1	M
TNG042	Scientific Methodology in Logistics	2	G2X	4	M
TNIU23	Calculus in One Variable II	6	G1X	2	E
TNSL13	Planning for Rescue Systems	6	G2X	3	E
TNSL14	Logistics Case	6	G2X	2	E
Period 2					
TQXX10	Degree project - Bachelor's Thesis	16	G2X	-	M

<https://liu.se/studieinfo/en/program/6kftl/4246>

- Air Traffic and Air Transportation
 - Overview Air Transport
 - What kind of problems appear?
- English for Logisticians
 - Case Studies from ATM
- Logistics for Airline Companies
 - Demand modelling and forecasting
 - Resource management
 - Revenue management
 - Perturbation management
- Airport Planning
 - Airport structures, components and processes
 - Strategic airport planning
 - Airport master planning
 - Airport system planning
 - Forecasting
 - Environmental aspects
- Air Traffic Management
 - Single European Sky ATM Research Joint Undertaking
 - Automation, complexity, safety and capacity
 - Aircraft trajectory optimization
- (elective Master's course) Planning of Air Traffic

AUTOMATIONS DAG FLYG LfV & LIU

Automation, luftrum, flygtrafikledning och människan i fokus

Välkommen till Automationsdagen där vi har fokus på flygtrafikledning, särskilt vad gäller säkerhet och prestanda med människan i fokus. Här möter du forskare i en personlig, interaktiv miljö som visar upp resultat och lösningar inom flera olika områden. Du får möjlighet att diskutera, ställa frågor och själv pröva flera av tillämpningarna. Det är en öppen dag så du väljer själv hur länge du vill delta.

Automationen tar små och stora steg – allt för säkerhet, effektivitet och hållbarhet. Inom flyg och flygtrafikledning är utmaningarna både spetsiga och breda. Drönare, AI, ny teknik tillsammans med hög datorkraft görs nu tillgängligt för konsumenter. Frågan är – hur det kommer flygbranschen tillgodo?

Automationsdagen är både en delrapportering av Automationsprogrammet 1 (2015–2019) och input till framtidens Automationsprogram. Trafikverket är sponsor för Automationsprogrammet och har flera forskningsprojekt inom framtidens flygtrafikledning i sin portfölj. Resultat och rapporter finns tillgängliga på www.trafikverket.se.


LFV Air Navigation Services of Sweden och Linköpings Universitet (LiU) samarbete har gett fantastiska resultat och mer ska det bli. Avsikten är att ha 15–20 forskare och representanter från KTS, MIT och IDA för att träffa just dig.

Varmt välkommen hälsar LFV, LiU och Trafikverket med partners!

Björn Wahlström, Chef Forskning & Innovation, LFV
Billy Josefsson, Manager Automation & Mänsklig prestanda, LFV
Martin Rantzer, Prefekt, Linköpings Universitet (LiU)
Marie Fridolin, Verksamhetsstyrningschef Strategisk utveckling, Trafikverket

TID OCH PLATS

Tisdag 19 november 2019
klockan 09.30

URBAN ICT ARENA 
Borgarfjordsgatan 12
164 55 Kista

KARTA

ANMÄLAN

Anmäl dig genom att O.S.A.
senast 8 november 2019 till
ann-louise.manning@lfv.se
Ange om du har någon matallergi.
Mer information kommer.

FRÅGOR

Om du har frågor kring dagen,
var vänlig och kontakta

billy.josefsson@lfv.se
0708-19 23 31

AGENDA ÖPPEN DAG

- 09.30 Frukostfika och mingel
- 10.00 Start och välkommen
- 12.00 *Mingellunch & musical interlude*
- 15.00 Avslutning



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THANKS.



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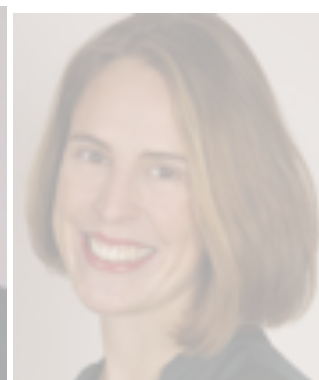
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