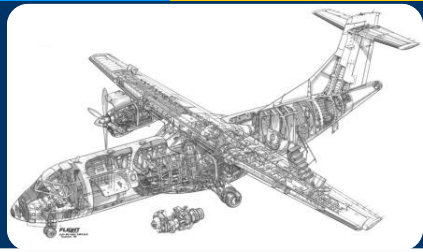
THE IMPACT OF THE EUROPEAN GATES CONCEPT ON EN-ROUTE CONGESTION

- Hitham Fakih
- University of Žilina / EUROCONTROL
- Supervisor: Antonin Kazda

- EIWAC 2010 - Tokyo, 11th Nov. 2010

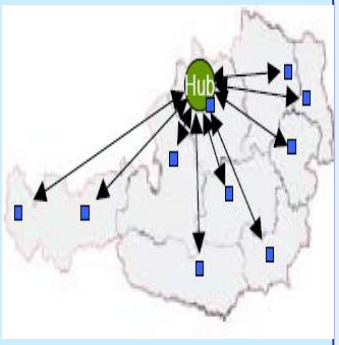
PRESENTATION OUTLINE



1. RESEARCH PROBLEM
2. RESEARCH FOCUS
3. RESEARCH FINDINGS
4. CONTRIBUTION
5. CONCLUSION

RESEARCH PROBLEM

- Aircraft Instruments
- 2x Traffic; based on predicted growth



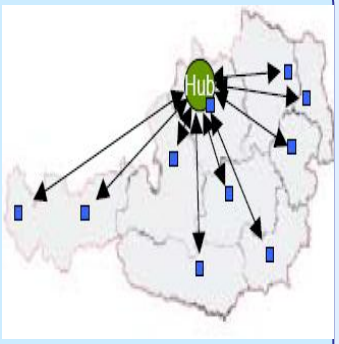
- Mega hubs
- En-route Congestion
- European Gates

- CFMU Data
- ICAO Data

- High Speed Train
- Prediction for 2020
- Prediction for 2030

RESEARCH PROBLEM

- Aircraft Instruments
- 2x Traffic; based on predicted growth for 2030



- Mega hubs
- En-route Congestion
- European Gates

- CFMU Data
- ICAO Data
- HST 2020

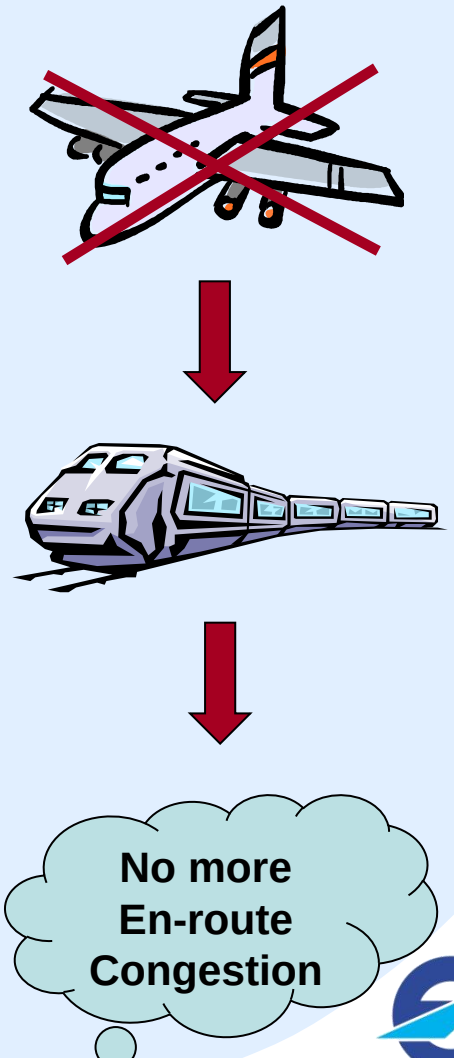
While aircraft instruments and navigation systems in aviation has been driven by research, the need for a mega structure has been neglected.

To limit En-route congestion we can either limit the daily flight frequencies or by building a bigger hub which will quantify the growth constraining impact on En-route sector capacity limits.

Based on the CFMU and ICAO data analyses we were able to estimate the number of flights which will be abandoned when the HST will be running in 2020.

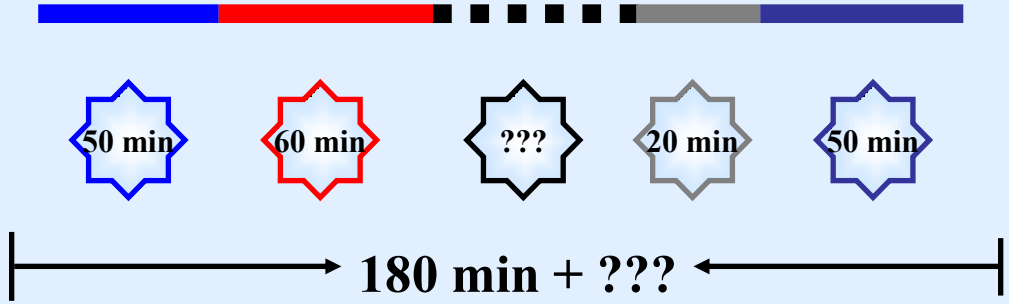
RESEARCH FOCUS

- ✈ Reduce en-route and airport congestion
- ✈ Increase runway capacity
- ✈ Reduce travel time for PAXs
- ✈ Reduced negative impact of transport on environment
- ✈ More balanced PAX modal split in Europe
- ✈ More slots dedicated for long-haul flights
- ✈ Increase airports catchment area
- ✈ More travel choice for PAXs
- ✈ Higher PAX throughput at airports



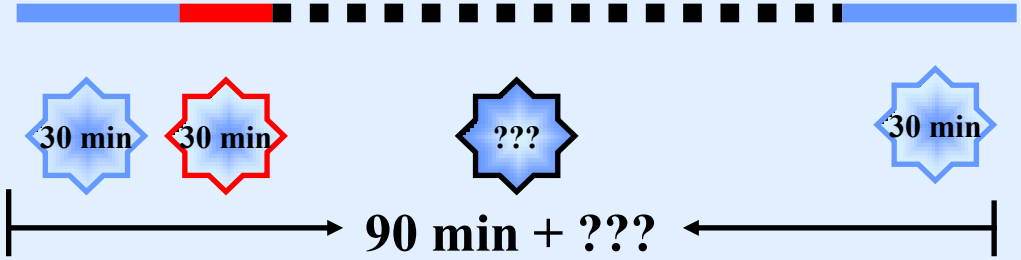
But… practice is different than theory

TRAVEL TIME AIR VS. RAIL



Air Travel Time

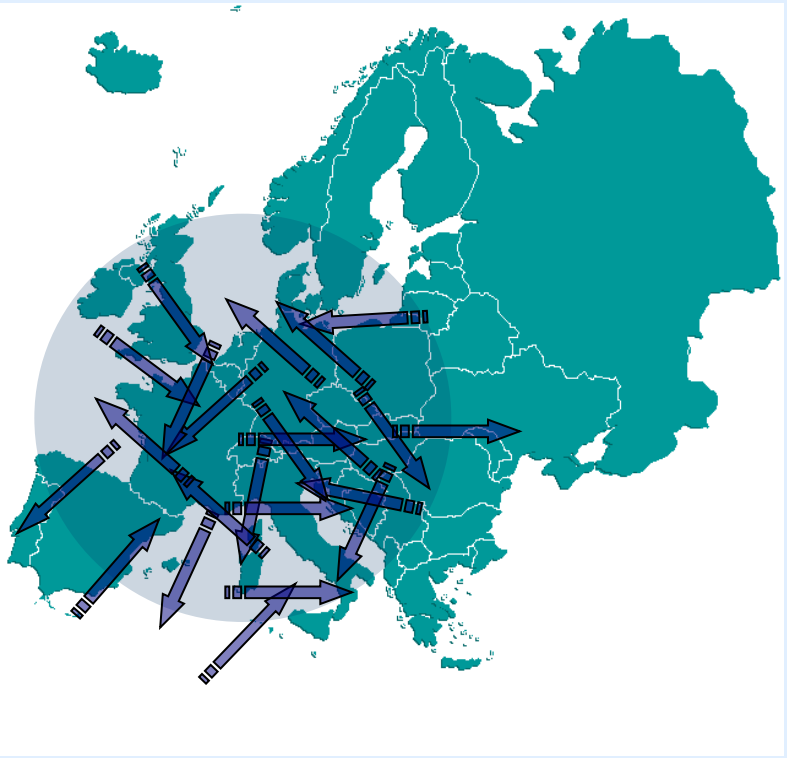
Transport to Airport
Time spent at the Airport (check-in, boarding)
Flight time
Awaiting for the baggage + customs
Transport from the Airport



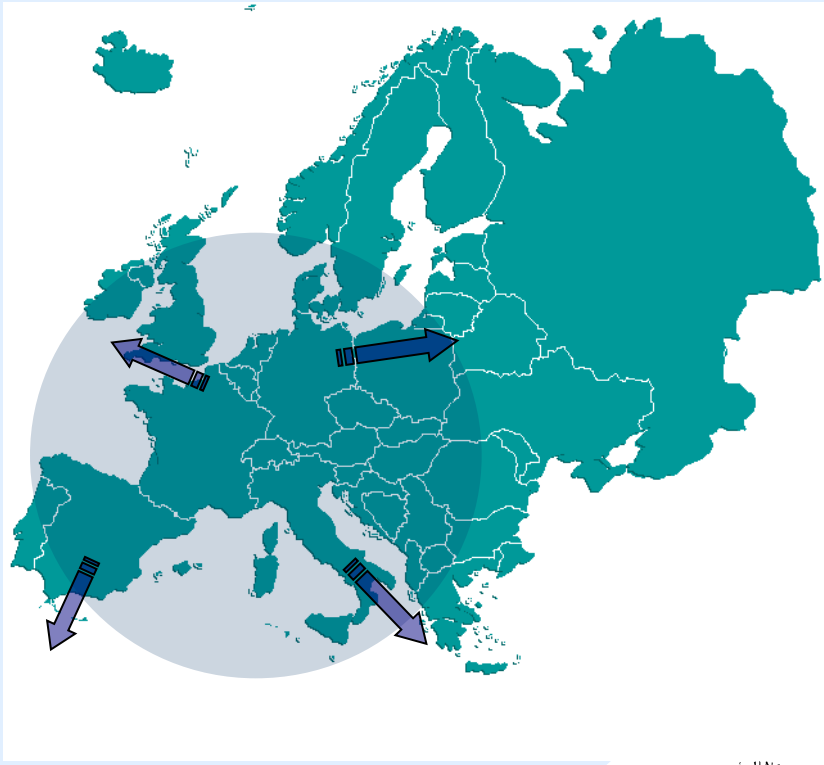
Rail Travel Time

Transport to Station
Time spent at the Station
Travel time
Transport from the Station

RESEARCH FOCUS
European Gates



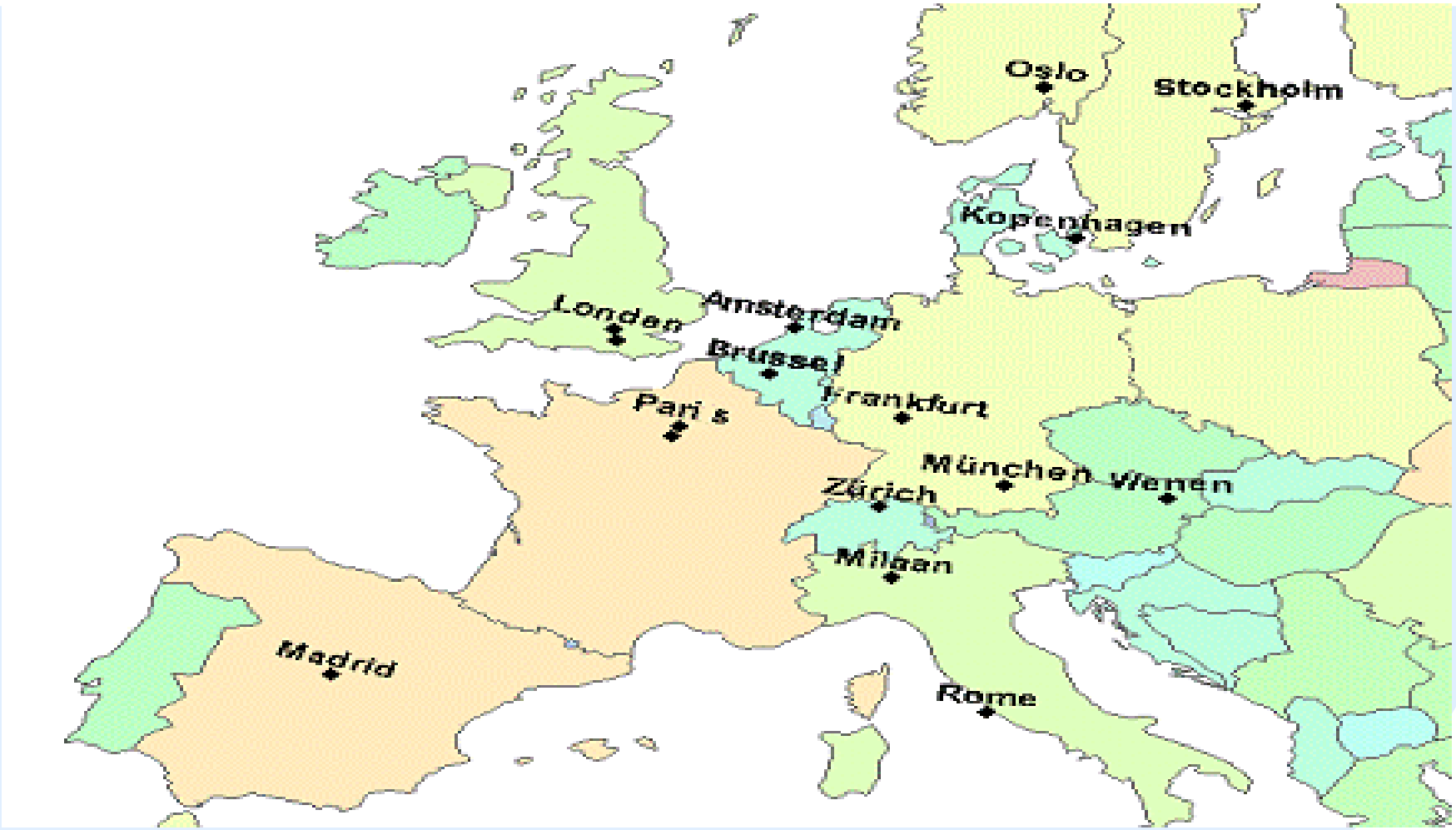
??



RESEARCH FOCUS

-

Current Hub and Spoke System in Europe

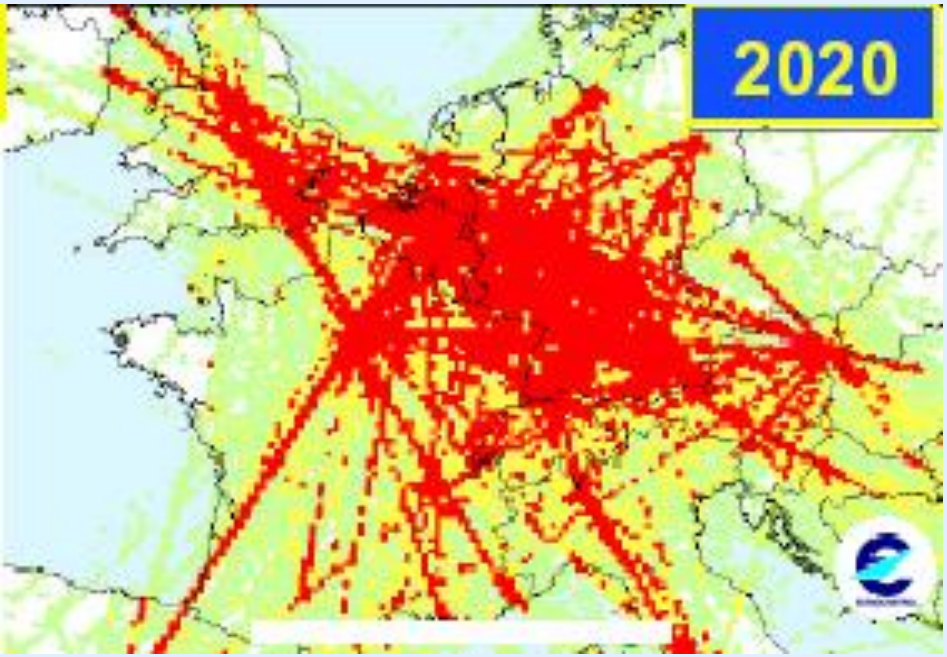


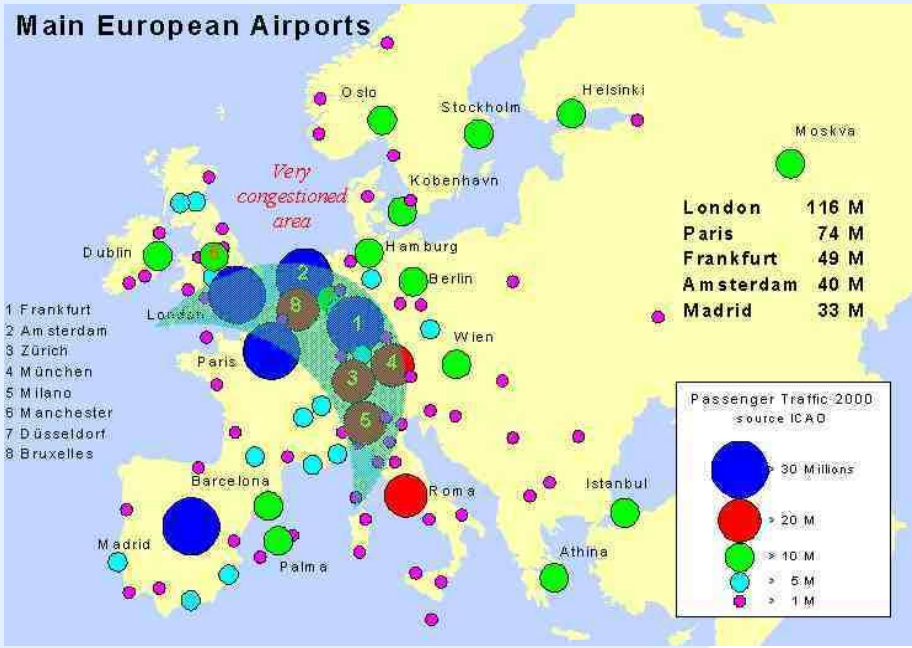
RESEARCH FOCUS

-

Current and Future Hub and Spoke System in Europe

- 66% of airport derived ATFM delays caused by only 8 European airports
- These 8 airports handle only 19% of European traffic
- Levels of congestion expected for the year 2020 will reach beyond our limits





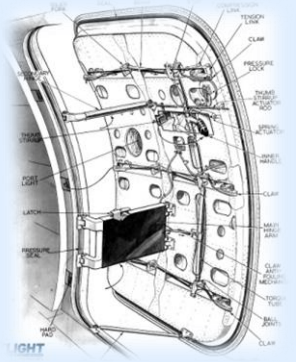
RESEARCH FINDINGS

-

Filtering the CFMU Data

Point ID	Name	Latitude	Longitude	Country	Constr. Flights	Extra miles	Average miles/flight
MOU	MOULINS	464224N	0033754E	LF	1489	37391	25.11148422
MAKOL	MAKOL	421014N	0290834E	LT	846	28009	33.10756501
RIDSU		494456N	0082848E		594	27851	46.88720539
BRD	BRINDISI	403639N	0180010E	LI	475	21220	44.67368421
GEN	GENOVA	442528N	0090456E	LI	1153	19433	16.85429315
NTS	NANTES DVOR	470939N	0013647W	EI	898	18630	20.74610245
LERGA		451526N	0034501E	LF	1112	16618	14.9442446
SUMIR		461532N	0112135E	LI	526	15628	29.71102662
SPY	SPIJKERBOOR	523225N	0045114E	ED	853	15104	17.70691676
PAM	PAMPUS	522005N	0050532E	ED	854	14568	17.05854801
VADEM		464318N	0062900E	LS	302	14508	48.0397351
KUDES	KUDES	473115N	0085126E	LS	685	13707	20.01021898
DIDAM		520203N	0061937E	ED	689	13344	19.36719884
WAL	WALLASEY VOR	532331N	0030804W	EG	1475	12873	8.727457627
GOW	GLASGOW VOR/DME	555214N	0042645W	EG	441	12237	27.74829932
VADOM	VADOM	483302N	0011615E	LF	273	12123	44.40659341
ALG	ALGHERO	403741N	0081438E	LI	442	12114	27.40723982
PTV	PITHIVIERS VOR	480920N	0021553E	LF	602	11885	19.74252492
MASEK	MASEK	504345N	0093554E	ED	372	11729	31.52956989

The filtering of the CFMU data for July 2004 to investigate the horizontal extension of flights (Extra NM)

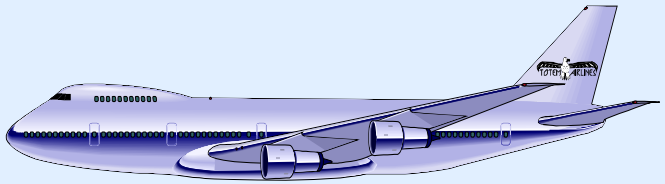


Busiest hour(s)	Number of aircraft	Extra NM
19-20	19	477.1182001
14-15	13	430.3983452
8-9	10	468.8720539
10-11	18	804.1263158
11-12	39	657.3174328
12-13	34	705.3674833
7-8	30	448.3273381
15-16	16	475.3764259
18-19	21	371.8452521
7-8	28	477.6393443
19-20	14	672.5562914
9-10	42	840.4291971
7-8	23	445.4455733
6-7	40	349.0983051
9-10	11	305.2312925
15-16	14	621.6923077
12-13	16	438.5158371
11-12	28	552.7906977
9-10	27	851.2983871
14-15	44	594.9432213
13-14	8	155.6619718

RESEARCH FINDINGS AND RESULTS

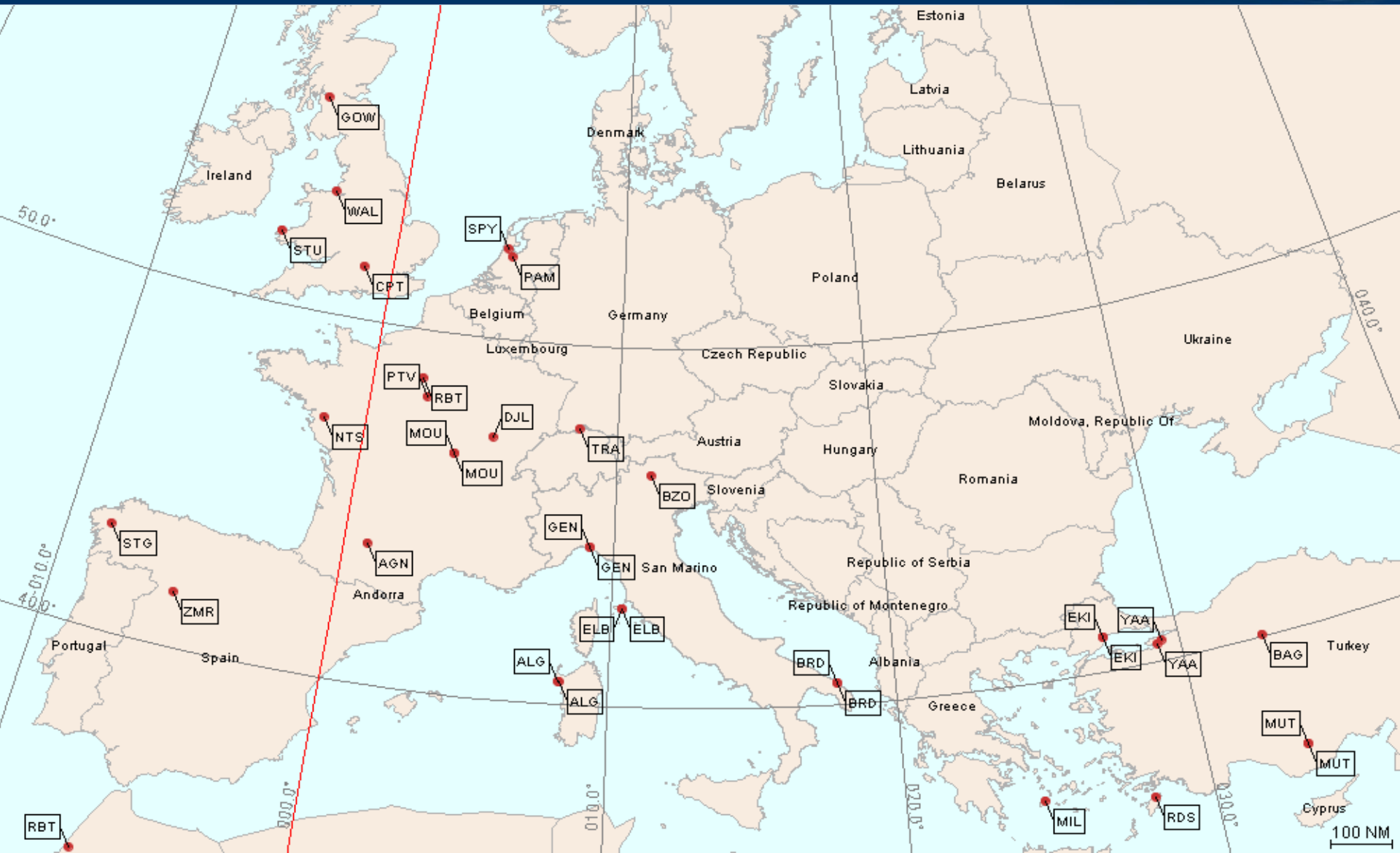
-

Constraining Points – Constrained Flights



The most constraining waypoints in Europe

The most constraining NAVAIDS in Europe



High Speed Railroad Map Europe 2008

Legend: (Jun-2008)
- 320 - 350 km/h
- 300 km/h
- 250 km/h
- 200 - 230 km/h
- < 200 km/h

Sundsvall
Bergen
Tampere
Lahti
Turku
Helsinki
Sankt-Peterburg
Uppsala
Oslo
Västerås
Stockholm
Tallinn
Skien
Stavanger
Linköping
Moskva
Kristiansand
Göteborg
Riga
Glasgow
Edinbourgh
Smolensk
Arhus
Belfast
Newcastle
Vilnius
Malmö
Kobenhavn
Kaliningrad
Minsk
Br'ansk
Dublin
Manchester
Liverpool
Leeds
Gdansk
Kursk
Cork
Hamburg
Bremen
Poznan
Char'kov
Birmingham
Cardiff
Amsterdam
Berlin
Warzawa
Kijev
Bristol
Rotterdam
Hannover
London
Dnepropetrovsk
Doneck
Antwerpen
Essen
Leipzig
Wroclaw
Rostov
Bruxelles
Köln
Dresden
Katowice
L'vov
Lille
Liège
Praha
Ostrava
Krakow
Le Havre
Frankfurt
Rouen
Nürnberg
Mannheim
Brno
Brest
Stuttgart
Rennes
Paris
Strasbourg
Bratislava
Le Mans
München
Wien
Budapest
Cluj-Napoca
Kisin'ov
Odessa
Nantes
Dijon
Salzburg
Tours
Basel
Innsbruck
Graz
Bern
Zürich
Brasov
Sevastopol
Genève
Ljubljana
Lyon
Zagreb
Bucuresti
Constanta
Torino
Milano
Verona
Clermont-
Ferrand
Venezia
Beograd
Bordeaux
La Coruna
Varna
Oviedo
Sarajevo
Genova
Bologna
Montpellier
Split
Vigo
Bilbao
Sofija
León
Toulouse
Firenze
Istanbul
Porto
Marseille
Nice
Valladolid
Huesca
Skopje
Ankara
Zaragossa
Salamanca
Barcelona
Roma
Thessaloniki
Eskisehir
Madrid
Tirane
Napoli
Bari
Adana
Lisboa
Toledo
Konya
Valencia
Izmir
Faro
Athinai
Sevilla
Cordoba
Alicante
Palermo
Cádiz
Malaga
Catania

Map of the HST for Europe in 2020

European HS Network

Forecast for 2020

New lines
- v ≥ 250 km/h
- v < 250 km/h
- Planned lines

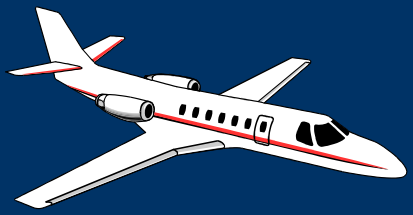
Upgraded lines
- v ≤ 230 km/h
- v ≤ 200 km/h
- Planned lines

Information given by the Railways

UIC - High-Speed
Updated 17.11.2006 - IB

Merging of the HST map and the constraining points to find the optimum location of the European Gates

Map of Europe showing the possible locations of the European Gates



CFMU Data Filtration

Inbound International Flights into Europe for a period of one week 18-24 July 2005

Queries

- Amsterdam - Frankfurt - City pairs analysis
- Amsterdam - Paris - City pairs analysis
- Barcelona - Madrid - City pairs analysis
- Barcelona - Paris - City pairs analysis
- Bologna - Milano - City pairs analysis
- Bordeaux - Paris - City pairs analysis
- Brussels - Frankfurt - City pairs analysis
- Brussels - Paris - City pairs analysis
- Frankfurt - Amsterdam - City pairs analysis
- Frankfurt - Brussels - City pairs analysis
- Frankfurt - Hann - City pairs analysis
- Frankfurt - London - City pairs analysis
- Frankfurt - Paris - City pairs analysis
- Hann - Frankfurt - City pairs analysis
- Inbound INTL from N & S America to Europe
- **Inbound INTL into Europe**
- INTL from E
- Lisboa - Madrid - City pairs analysis
- London - Frankfurt - City pairs analysis
- London - Paris - City pairs analysis
- Lyon - Paris - City pairs analysis
- Madrid - Barcelona - City pairs analysis
- Madrid - Lisboa - City pairs analysis
- Madrid - Malaga - City pairs analysis
- Madrid - Valencia - City pairs analysis
- Malaga - Madrid - City pairs analysis
- Marseille - Paris - City pairs analysis
- Milano - Bologna - City pairs analysis
- Milano - Napoli - City pairs analysis
- Milano - Roma - City pairs analysis
- Milano - Zurich - City pairs analysis
- Napoli - Milano - City pairs analysis
- Outbound INTL from E

FLT_DEP_AD	FLT_DEST_AI	ID	TAKE_OFF_TIME	LANDING_TIME	AO_ICAO_ID
OSDI	LOWW	0016514620050718	7/18/2005 12:50:45 PM	7/18/2005 4:19:40 PM	AUA
OMDB	EGKK	0016512220050718	7/18/2005 10:46:15 AM	7/18/2005 5:44:25 PM	UAE
UAAA	EBBR	0016513320050718	7/18/2005 6:45:00 AM	7/18/2005 1:41:55 PM	CLA
UUDD	EDDL	0016512020050718	7/18/2005 12:18:00 PM	7/18/2005 3:26:00 PM	GMI
ZSPD	LIMC	0016436720050718	7/18/2005 4:37:15 AM	7/18/2005 4:10:20 PM	AZA
ZBAA	EKCH	0016524120050718	7/18/2005 7:02:00 AM	7/18/2005 3:56:40 PM	SAS
DTMB	LIRF	0016518520050718	7/18/2005 12:16:40 PM	7/18/2005 1:16:25 PM	TAR
VRMM	EGCC	0016514120050718	7/18/2005 5:46:00 AM	7/18/2005 4:36:05 PM	MON
ZBAA	EDDL	0015025520050718	7/18/2005 4:27:00 AM	7/18/2005 1:50:20 PM	LTU
RJAA	EGLL	0015196420050718	7/18/2005 4:28:00 AM	7/18/2005 4:17:55 PM	BAW
OJAM	LTAI	0016527320050718	7/18/2005 5:10:00 AM	7/18/2005 6:32:40 AM	
UBBB	LTAG	0016525120050718	7/18/2005 5:24:00 AM	7/18/2005 8:53:00 AM	RCH
UUDD	LBWN	0014847420050718	7/18/2005 2:42:00 AM	7/18/2005 4:54:50 AM	SBI
DTTJ	LIPX	0016527820050718	7/18/2005 1:23:32 PM	7/18/2005 3:11:27 PM	KAJ
ULLI	LFPO	0014973120050718	7/18/2005 4:41:00 AM	7/18/2005 7:28:15 AM	PLK
KIAH	EGSS	0016538820050718	7/18/2005 9:46:10 AM	7/18/2005 6:26:55 PM	BAW
KPHL	EGCC	0016537720050718	7/18/2005 2:53:10 AM	7/18/2005 9:05:10 AM	USA
DTTA	LFMN	0012500820050718	7/18/2005 7:20:40 AM	7/18/2005 8:29:05 AM	TAR
GCLP	EGCC	0016533120050718	7/18/2005 2:08:00 PM	7/18/2005 5:58:10 PM	FCA
HECA	LIMC	0014991320050718	7/18/2005 1:18:05 AM	7/18/2005 4:56:35 AM	AZA
OBBI	LGSA	0016554120050718	7/18/2005 2:45:00 PM	7/18/2005 6:31:25 PM	
DTMB	LEVC	0016556920050718	7/18/2005 3:35:15 PM	7/18/2005 5:06:35 PM	TAR
DTTJ	LIMC	0016555020050718	7/18/2005 5:42:10 PM	7/18/2005 7:31:35 PM	TAR
DTTJ	LIMC	0016552320050718	7/18/2005 6:35:15 PM	7/18/2005 8:25:55 PM	TAR
VIDP	EGLL	0016552720050718	7/18/2005 8:19:00 AM	7/18/2005 5:12:35 PM	VIR
VRMM	EGKK	0016548320050718	7/18/2005 8:48:00 AM	7/18/2005 7:26:45 PM	MON
DTTJ	LIRN	0016548420050718	7/18/2005 5:36:50 PM	7/18/2005 6:46:55 PM	TAR
UUWW	EGSS	0016545920050718	7/18/2005 7:49:00 AM	7/18/2005 11:14:50 AM	IFA
HESH	LIME	0015222520050718	7/18/2005 4:50:58 AM	7/18/2005 8:54:53 AM	AMV
DTMB	LPPT	0016565720050718	7/18/2005 5:37:20 PM	7/18/2005 8:09:50 PM	TAR
ULLI	EDDF	0014734520050718	7/18/2005 2:59:00 AM	7/18/2005 5:16:35 AM	DLH
OMDB	LTBA	0015086620050718	7/18/2005 4:58:00 AM	7/18/2005 8:50:10 AM	UAE
GCFV	LOWW	0016559120050718	7/18/2005 4:26:40 PM	7/18/2005 8:16:45 PM	NLY
UUDD	LRCK	0016559520050718	7/18/2005 8:44:00 AM	7/18/2005 10:37:00 AM	SBI
CYYZ	EDDF	0015145020050718	7/18/2005 4:03:00 AM	7/18/2005 11:08:20 AM	ACA
ULLI	EDDM	0016574620050718	7/18/2005 5:25:00 AM	7/18/2005 7:55:35 AM	
DTMB	LEBB	0016569720050718	7/18/2005 4:52:45 PM	7/18/2005 7:06:30 PM	TAR
OKBK	EGLL	0015195420050718	7/18/2005 5:21:00 AM	7/18/2005 11:20:15 AM	BAW
OMDB	LTBA	0016585920050718	7/18/2005 10:54:00 AM	7/18/2005 2:36:35 PM	UAE

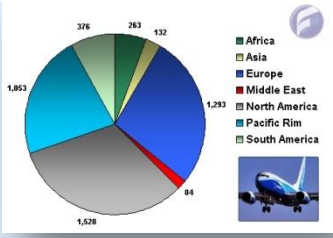
Record: 1 of 16665 | No Filter | Search

Datasheet View

EUROCONTROL

The European Gates and the possible number of flights that can be removed between city pairs

Routes	Flights per week	Total Flights	Time of Flight	Estimated Total Time
Gate 1				
Paris – London – Paris	269 - 275	544	1hr 20mins	3hrs 05mins
Paris – Lyon – Paris	108 - 109	217	1hr 10mins	2hrs 55mins
Paris – Bordeaux – Paris	131 - 136	267	1hr 05mins	2hrs 50mins
Paris – Marseille – Paris	195 - 189	384	1hr 20mins	3hrs 05mins
Paris – Amsterdam – Paris	117 - 115	232	1hr 20mins	3hrs 05mins
Paris – Brussels – Paris	56 - 57	113	1hr 00mins	2hrs 45mins
Paris – Frankfurt	149	149	1hr 20mins	3hrs 05mins
Total flights from/to Paris		1906		
Gate 2				
Madrid – Valencia - Madrid	114 - 119	233	0hrs 55mins	2hrs 40mins
Madrid – Malaga – Madrid	22 - 19	41	1hr 05mins	2hrs 50mins
Madrid – Lisbon – Madrid	15 - 15	30	1hr 10mins	2hrs 55mins
Madrid – Barcelona – Madrid	43 - 48	91	1hr 15mins	3hrs 00mins
Total flights from/to Madrid		395		
Gate 3				
Milano – Bologna – Milano	41 - 40	81	0hrs 55mins	2hrs 40mins
Milano – Roma – Milano	72 - 69	141	1hr 15mins	3hrs 00mins
Milano – Napoli – Milano	115 - 116	231	1hr 30mins	3hrs 15mins
Milano – Zurich – Milano	65 - 66	131	0hrs 55mins	2hrs 40mins
Total flights from/to Milano		584		
Gate 4				
Frankfurt – Paris	140	140	1hr 10mins	2hrs 55mins
Frankfurt – Hannover – Frankfurt	48 - 45	93	1hr 00mins	2hrs 45mins
Frankfurt – Amsterdam – Frankfurt	92 - 100	192	1hr 10mins	2hrs 55mins
Frankfurt – Brussels – Frankfurt	68 - 63	131	1hr 00mins	2hrs 45mins
Frankfurt – London – Frankfurt	185 - 197	382	1hr 35mins	3hrs 20mins
Total flights from/to Frankfurt		938		
Total number of flights		**3823**		



CONCLUSIONS

1. After filtering and analysing the CFMU data in more depth the constraining WAYPOINTS and NAVAIDS were plotted on a map and compared to the HST network in order to find the optimum location of the European Gates.

2. Analyses of the time difference between short-haul flights and High Speed Train proved that HST can attract passengers to take the train rather than to fly in the rang of four hours trip.

3. The estimated percentage of abandoned flights can fluctuate depending on how effective and reliable would the HST be.

CONCLUSIONS

4. Facts about the distance, time and Carbon Dioxide emissions between High Speed Train, short-haul flights and owned vehicles can help in convincing the passengers to choose the transport with the least CO_2 emissions.
5. The European Gate Concept with a HST station will help in reducing en-route congestion and that by reducing the number of the intra-European traffic.

"We apologise to passengers for the severe delays. Rest assured our engineers are working hard to trace the computer fault…"

QUESTIONS