Multiple Remote Tower – Challenges and Solutions

Validation Exercise with HC
SESAR PJ.05.02

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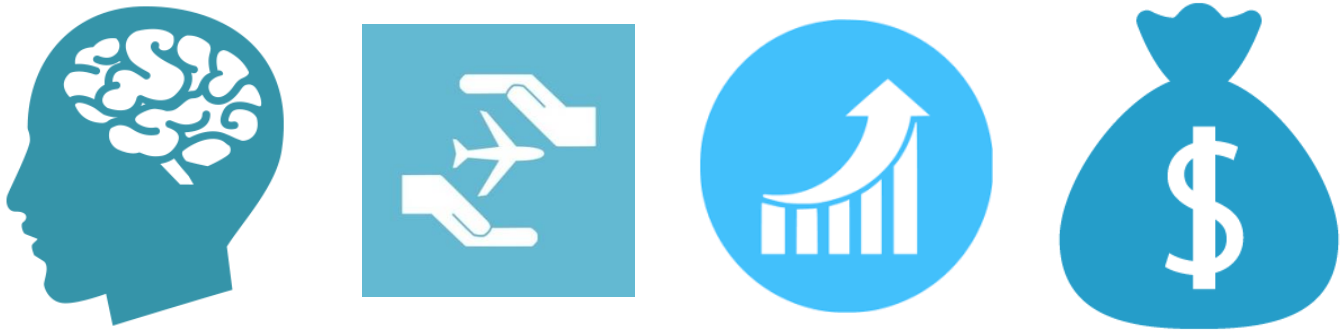
Validation Context PJ.05.02

- Which impact does Multiple Remote Tower have on…
  - Human Performance
  - Safety
  - Capacity
  - Cost Efficiency?



Set-Up EXE-05.02.V3-2.4 – HC

Multiple Remote Tower module:

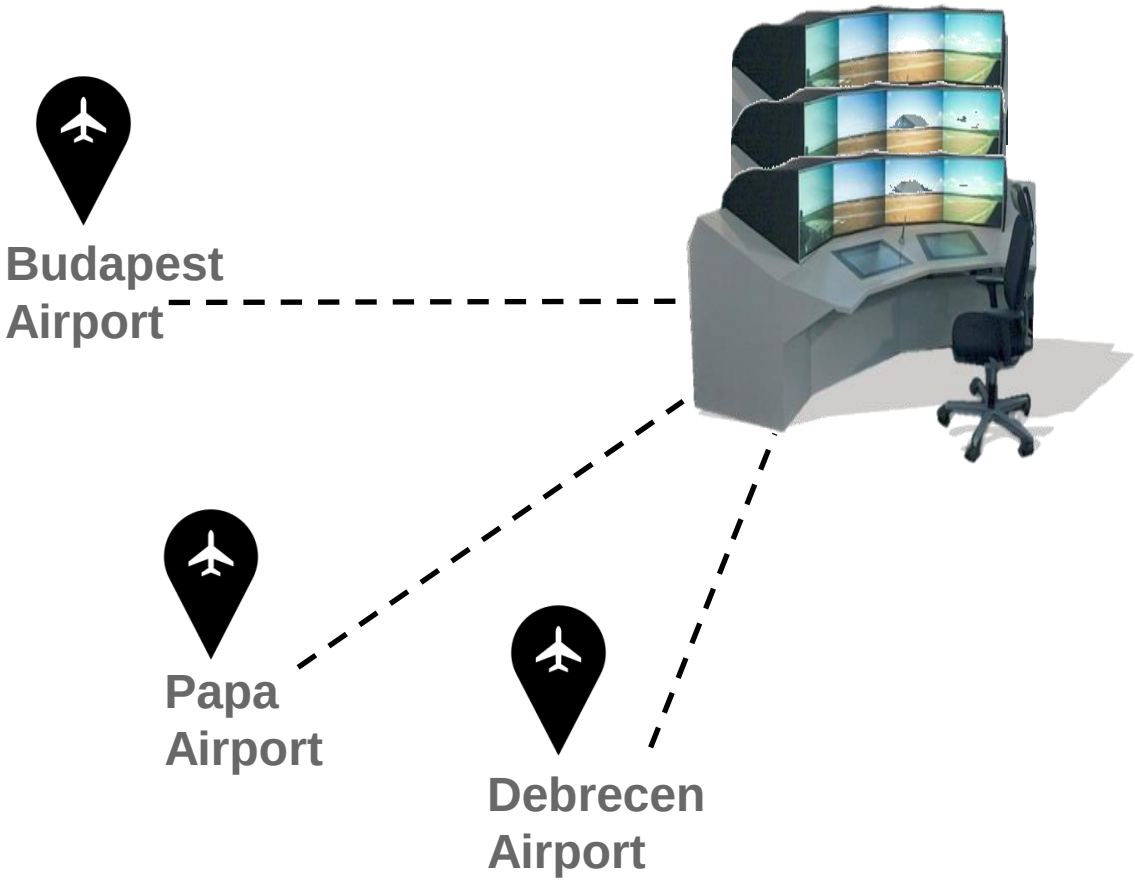
- ATS provided to one medium-sized and two small-sized airports
- DLR real-time simulation platform
- Frequentis control unit prototype

Participants:

- 7 ATCOs from HungaroControl (HC)

Design:

- 5 scenarios with different variables



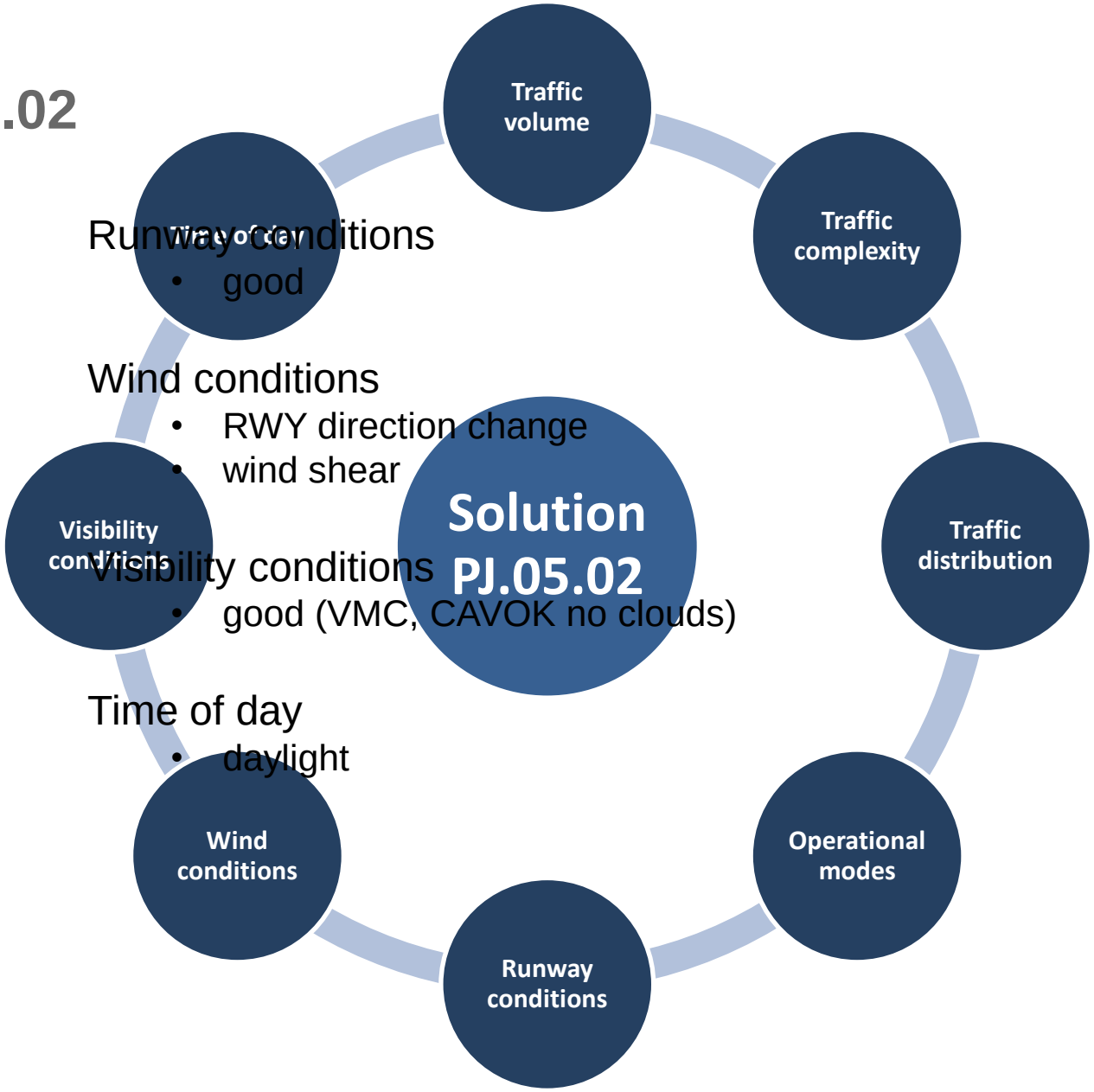
Key Parameters for PJ.05.02

Traffic volume
- ~ 20 + 2

Traffic complexity
- mainly IFR (90%)

Traffic distribution
- varied across SCN (even/uneven)

Operational modes
- normal operations
- unplanned RWY closures
- emergency



Runway conditions
- good

Wind conditions
- RWY direction change
- wind shear

Visibility conditions
- good (VMC, CAVOK no clouds)

Time of day
- daylight

Scenarios with Independent Variables (IV)

Scenario ID	No. of ADs	Time	Traffic distribution	Type of Incident
Training	3	00:30	even	none
SCN 1	3	00:50	uneven	unplanned closure of AD (oil leak)
SCN2	3	00:50	uneven	RWY direction change
SCN3	3	00:50	even	unplanned closure of AD (oil leak)
SCN4	3	00:50	even	RWY direction change
SCN5	3	00:30	even	AC emergency (engine failure, no fire)

Agenda for the Exercise Days

Begin	Day 1	Day 2
08:30	Briefing	Run 3
09:30	Training	Run 3
10:30	Training	Run 4 / Run 4
11:30	Run 1	Run 5
12:30	Lunch	Lunch
13:30	Run 1	Run 5
14:30	Run 2	Debrief
15:30	Run 2	
16:30	Debrief	

ATCO 1

ATCO 2

Role Distribution

Day 1	ATCO 1	ATCO 2
Briefing	Briefing	
Training	Active Training	Passive Training
Training	Passive Training	Active Training
Scenario 1	Active ATC	Questionnaires
Lunch	Lunch	
Scenario 1	Questionnaires	Active ATC
Scenario 2	Active ATC	Questionnaires
Scenario 2	Questionnaires	Active ATC
Debriefing	Debriefing	

Day 2	ATCO 1	ATCO 2
Scenario 3	Active ATC	Break
Scenario 3	Questionnaires	Active ATC
Scenario 4	Active ATC	Questionnaires
Scenario 4	Questionnaires	Active ATC
Scenario 5	Active ATC	Questionnaires
Lunch	Lunch	
Scenario 5	Questionnaires	Active ATC
Debriefing	Debriefing	

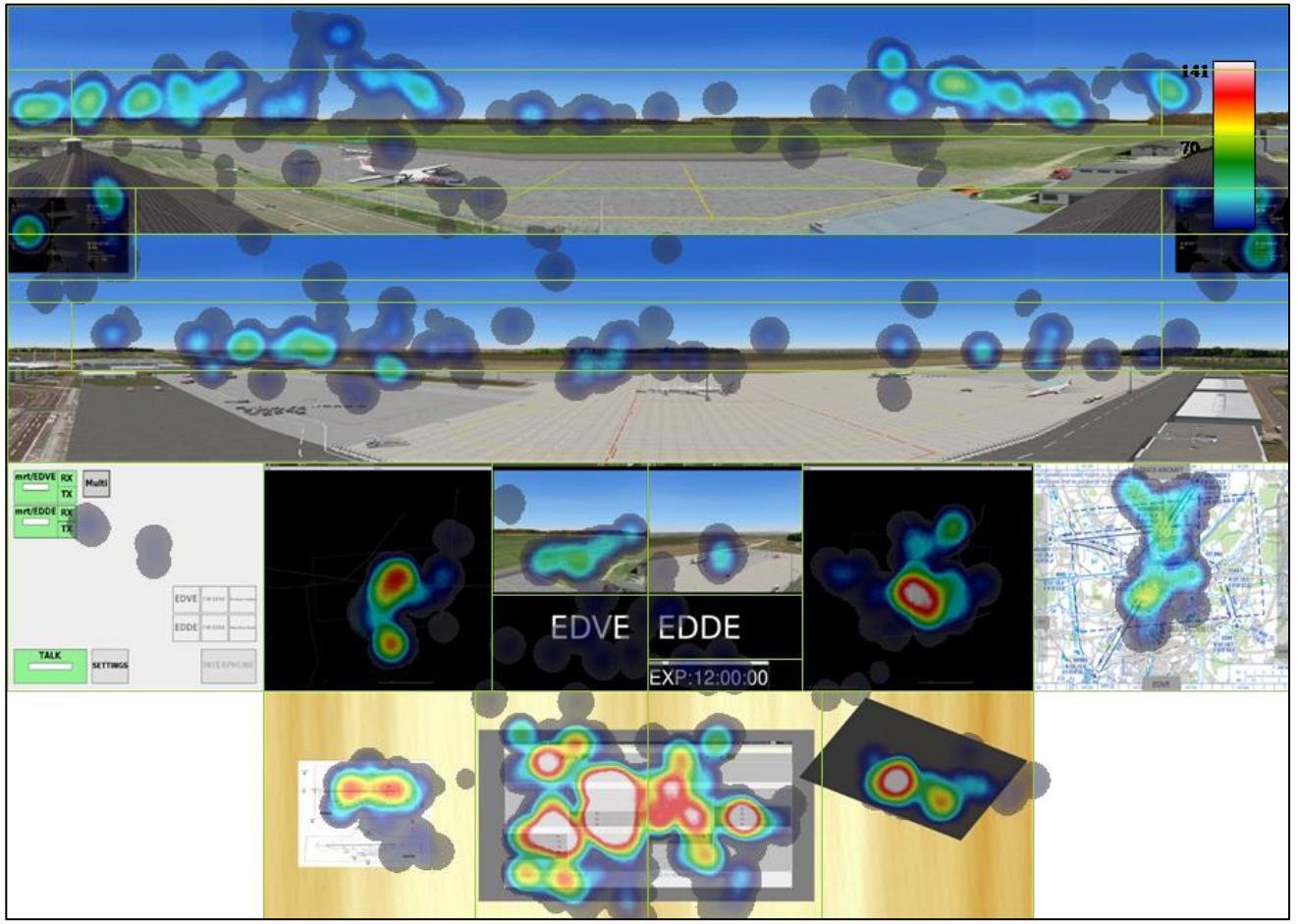
ATCO Task

- active ATC as usual
- workload rating every 5min (ISA scale)

	1	2	3	4	5
Workload Heading	**Under-Utilised**	**Relaxed**	**Comfortable Busy Pace**	**High**	**Excessive**
Spare Capacity	**Very Much**	**Ample**	**Some**	**Very Little**	**None**
Description	Nothing to do. Rather boring.	More than enough time for all tasks. Active on ATC task less than 50 % of the time	All tasks well in hand. Busy but stimulating pace. Could keep going continuously at this level.	Non-essential tasks suffering. Could not work at this level very long.	Behind on tasks; losing track of the full picture.

Eyetracking

- discover scanning patterns
- measure visual attention



Papenfuss, A., & Friedrich, M. (2016). Head Up Only – A design concept to enable multiple remote tower operations. Institute of Flight Guidance, German Aerospace Center, Braunschweig.

Questionnaire Data & Debriefing

Questionnaires after each scenario and after the simulation covering…

human performance

safety

capacity

cost efficiency

ID	Question
PE01	I was generally able to perform the necessary ATC tasks.
PE02	My situational awareness was sufficient at any time.
PE03	I was generally able to prioritize tasks.
PE04	I was generally able to set up a traffic sequence (e.g. VFR into IFR; sequence on final).
PE05	I was able to identify all relevant aircraft.

… and additional debriefing interviews

Questionnaire: Challenging Situations

Can the situation be solved without major impairment?

YES

No impairment Good	ATCO workload is low to easily achieve the desired performance.	1
No impairment Good	ATCO workload is adequate to achieve the desired performance.	2
Minor impairment Fair	ATCO requires a minor increased workload to achieve the desired performance.	3

NO

Can the situation be solved by measures reducing capacity?

YES

ATC influences capacity

Impairment of efficiency

Minor Unpleasant delays	ATCO responds with delay to pilot's requests.	4
Moderate Disturbing delays	Situation leads to moderate delays in the traffic management.	5
High Very disturbing delays	Situation leads to strongly delays in the traffic management.	6

NO

Can the situation be solved by measures reducing safety?

YES

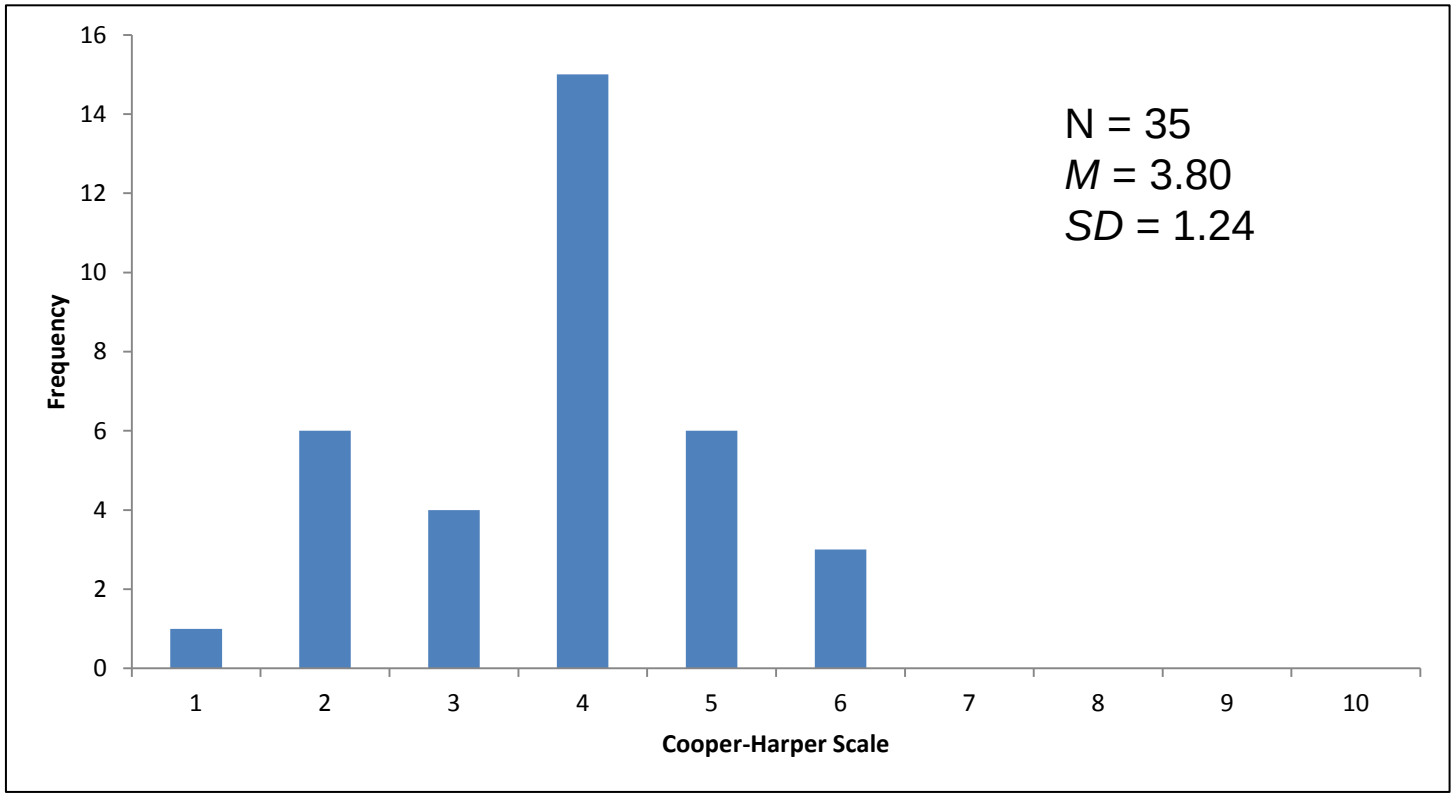
ATCO workload is too high and should be reduced

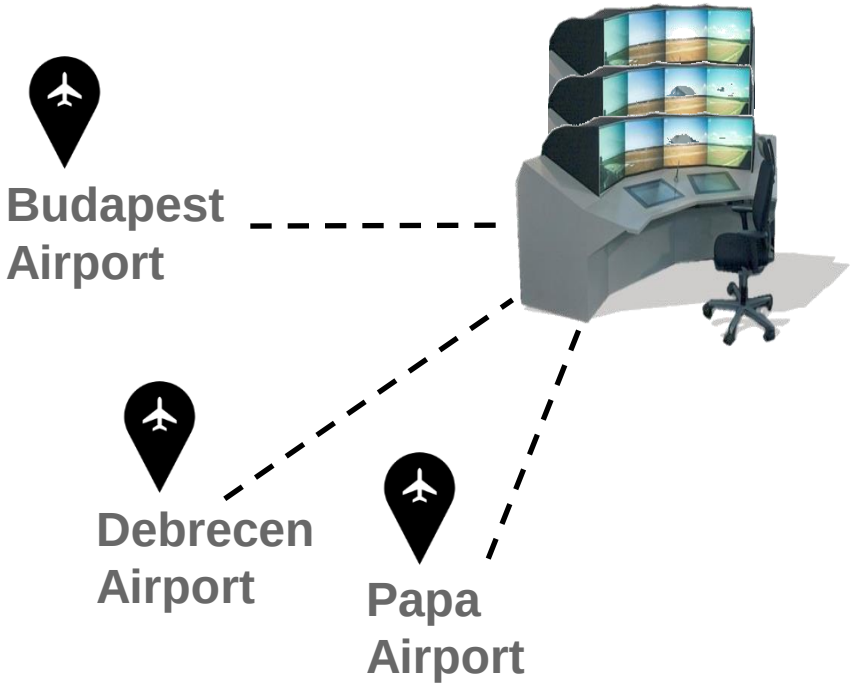
NO

Impairment of safety

Impairments in prediction of traffic development	ATCO directs traffic sporadically, abruptly and does no longer plans ahead.	7
Impairments due to information processing	ATCO cannot build a complete picture of the traffic situation, confuses information and corrects himself/herself often.	8
Impairments due to information gathering	ATCO must neglect areas/information while monitoring and therefore misses aircraft.	9
Major Impairment	ATCO cannot longer control the traffic situation.	10

Challenging Situations: First Results





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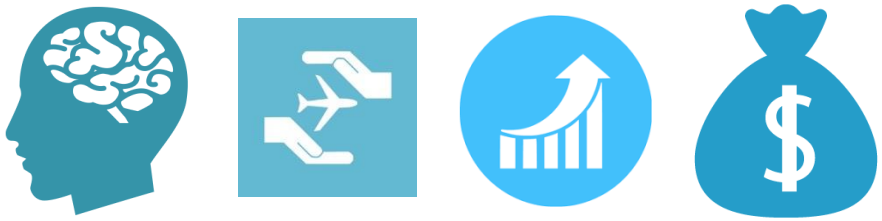

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