Asia-Pacific Economic Cooperation

Develop Air Connectivity in the APEC Region

CONSOLIDATED REPORT

Tourism Working Group | October 2016

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Asia-Pacific Economic Cooperation

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Glossary

The following section presents a list of commonly used expressions and abbreviations found within the report.

Connecting Potential – Common rates of passengers connecting beyond/behind when travelling through a hub to/from a particular region.

Induction/Stimulation – Initial spike in passenger demand when a new non-stop service is offered due to better accessibility, shorter travel time, lower cost etc.

Load Factor – The ratio of seats sold to available seats on a particular flight.

Direct/Non-stop services – Refers to an air route that is flown between two airports without intermediate landing stops.

List of Abbreviations

PDEW – Passenger daily each way (passenger demand in each direction between a select origin and destination).

SDEW – Seats daily each way (number of seats offered in each direction on a non-stop or one-stop flight segment).

OD – Origin and destination.

Airport Codes:

AAQ – Anapa, RUS

ACA – Acapulco, MEX

ADL – Adelaide, AUS

AER – Sochi, RUS

AGU – Aguascalientes, MEX

AKJ – Asahikawa, JPN

AKL – Auckland, NZ

ANF – Antofagasta, CHL

AOR – Alor Setar, MAS

AQP – Arequipa, CHL

ARH – Arkhangelsk, RUS

ASF – Astrakhan, RUS

ATL – Atlanta, US

AUS – Austin, US

AYP – Ayacucho, PE

BCD – Negros Occidental, PH

BDJ – Banjarmasin, INA

BHE – Blenheim, NZ

BJX – Silao, MEX

BKI – Kota Kinabalu, MAS

BKK – Bangkok, THA

BLI – Bellingham, US

BMV – Buon Ma Thuot, VN

BNA – Nashville, US

BNE – Brisbane, AUS

BOS – Boston, US

BPN – Balikpapan, INA

BUR – Burbank, US

BWN – Bandar Seri Begawan, BD

BXU – Butuan, PH

CAN – Guangzhou, PRC

CBO – Cotabato, PH

CCP – Concepción, CHL

CEB – Cebu, PH

CEI – Chiang Rai, THA

CEK – Chelyabinsk, RUS

CEN – Ciudad Obregón, MEX

CGK – Jakarta, INA

CGO – Zhengzhou, PRC

CGQ – Changchun, PRC

CGY – Cagayan de Oro and Iligan, PH

CHC – Christchurch, NZ

CJA – Cajamarca, PE

CJC – Calama, CHL

CJJ – Cheongwon-gu, ROK

CJU – Jeju, ROK

CKG – Chongqing, PRC

CLT – Charlotte, US

CME – Ciudad del Carmen, MEX

CNS – Cairns, AUS

CNX – Chiang Mai, THA

CSX – Changsha, PRC

CTS – Hokkaido, JPN

CTU – Chengdu, PRC

CUN – Cancun, MEX

CUZ – Cusco, PE

CVG – Cincinnati, US

CXR – Nha Trang, VN

DAD – Da Nang, VN

DAL – Dallas, US

DCA – Washington, US

DEN – Denver, US

DFW – Dallas, US

DGO – Durango, MEX

DGT – Dumaguete, PH

DJB – Jambi City, INA

DLC – Dalian, PRC

DLI – Da Lat, VN

DME – Domodedovo, RUS

DMK – Bangkok, THA

DPS – Bali, INA

DRW – Darwin, AUS

DTW – Detroit, US

DUD – Dunedin, NZ

DVO – Davao City, PH

EAT – Douglas County, US

EWR – Newark, US

EZE – Buenos Aires, ARG

FAT – Fresno, US

FLL – Fort Lauderdale, US

FOC – Fuzhou, PRC

FSZ – Shizuoka, JPN

FUK – Fukuoka, JPN

GDL – Guadalajara, MEX

GEG – Spokane, US

GMP – Seoul, ROK

GUM – Tamuning and Barrigada, GUM

GYS – Guangyuan, PRC

HAK – Haikou, PRC

HAN – Ha Noi, VN

HGH – Hangzhou, PRC

HKG – Hong Kong, China, HKC

HKT – Phuket, THA

HND – Tokyo, JPN

HNL – Honolulu, US

HRB – Harbin, PRC

HUI – Hue, VN

HUZ – Huizhou, PRC

IAD – Washington, US

IAH – Houston, US

ICN – Seoul, ROK

ILO – Ilo, PE

IQQ – Iquique, CHL

IQT – Iquitos, PE

ISG – Ishigaki, JPN

ITM – Osaka, JPN

IWK – Iwakuni, JPN

JFK – New York, US

JHB – Johor, MAS

JJN – Quanzhou, PRC

JNZ – Jinzhou, PRC

JOG – Yogyakarta, INA

JUL – Juliaca, PE

KBR – Kota Bharu, MAS

KBV – Krabi, THA

KCH – Kuching, MAS

KGD – Kaliningrad, RUS

KHH – Kaohsiung, CT

KHN – Nanchang, PRC

KIX – Osaka, JPN

KKE – Kerikeri, NZ

KLO – Kalibo, PH

KMG – Kunming, PRC

KNH – Kinmen, PRC

KNO – Kuala Namu, INA

KOJ – Kirishima, JPN

KRR – Krasnodar, RUS

KUF – Samara, RUS

KUL – Kuala Lumpur, MAS

KWL – Guilin, PRC

KZN – Tatarstan, RUS

LAS – Las Vegas, US

LAX – Los Angeles, US

LED – Saint Petersburg, RUS

SVX – Yekaterinburg, RUS

LGA – NY–La Guardia, US

LGK – Padang Matsirat, Langkawi, MAS

LHW – Lanzhou, PRC

LIM – Lima, PE

LOP – Lombok, INA

LPF – Liupanshui, PRC

LPT – Lampang, THA

MBT – Masbate City, PH

MCC – Sacramento, US

MCO – Orlando, US

MDW – Chicago, US

MDZ – Mendoza, ARG

MEL – Melbourne, AUS

MEX – Mexico City, MEX

MFM – Macau, MAC

MIA – Miami, US

MLM – Alvaro Obregon, Michoacan, MEX

MNL – Manilla, PH

MRY – Monterey, US

MSP – Minneapolis–Saint Paul, US

MTT – Cosoleacaque, MEX

MTY – Apodaca, MEX

MZG – Magong City, CT

NBC – Nizhnekamsk, RUS

NGB – Ningbo, PRC

NGO – Nagoya, JPN

NKG – Nanjing, PRC

NKM – Nagoya, JPN

NNG – Nanning, PRC

NPE – Napier, NZ

NPL – New Plymouth, NZ

NRT – Tokyo, JPN

NSN – Nelson, NZ

NTG – Nantong, PRC

OAK – Oakland, US

OAX – Oaxaca, MEX

OKA – Naha, JPN

OOL – Gold Coast, AUS

ORD – Chicago, US

OVB – Novosibirsk, RUS

OZC – Ozamiz, PH

PDG – Sumatra, INA

PEK – Beijing, PRC

PEN – Penang, MAS

PER – Perth, AUS

PHL – Philadelphia, US

PHX – Phoenix, US

PIU – Piura, PE

PLM – Palembang, INA

PLW – Palu, INA

PMC – Puerto Montt, CHL

PMR – Palmerston North City, NZ

PNK – Pontianak, INA

POM – Port Moresby, PNG

PPQ – Paraparaumu, NZ

PQC – Phu Quoc, VN

PSP – Palm Springs, US

PUS – Busan, ROK

PVG – Shanghai, PRC

PVR – Puerto Vallarta, MEX

PXU – Pleiku, VN

PYX – Pattaya, THA

RDU – Raleigh, Durham, US

REP – Siem Reap, KHM

REX – Reynosa, US

RGN – Mingaladon, MMR

RNO – Reno, US

ROC – Rochester, US

ROT – Rotokawa, NZ

ROV – Rostov-on-Don, RUS

RSU – Yeosu, ROK

RTW – Saratov City, RUS

RXS – Roxas City, PH

SAN – San Diego, US

SCL– Santiago, CHL

SEA – Seattle, US

SFO – San Francisco, US

SGN – Ho Chi Minh, VN

SHA – Shanghai, PRC

SHE – Shenyang, PRC

SIN – Singapore, SGP

SIP – Simferopol, UKR

SJC – San Jose, US

SJD – San Jose del Cabo, MEX

SLC – Salt Lake City, US

SLP – San Luis Potosi, MEX

SMF – Sacramento, US

SNA – Santa Ana, US

SOC - Solo/Surakarta, INA

SPN – Saipan, US

SRG – Semarang, INA

STL – St. Louis, US

STW – Stavropol Krai, RUS

SUB – Surabaya, INA

SVO – Moscow, RUS

SVX – Koltsovo, RUS

SWA – Jieyang Chaoshan, PRC

SYD – Sydney, AUS

SYO – Sakata, JPN

SYX – Sanya, PRC

SZX – Shenzhen, PRC

TAC – Tacloban, PH

TAM – Tampico, MEX

TAO – Qingdao, PRC

TAV – Tau, ASM

TBP – Tumbes, PE

TDX – Trat, THA

TGG – Kuala Terengganu, MSA

TGZ – Chiapa de Corzo, MEX

TIJ – Tijuana, MEX

TKG – Bandar Lampung, INA

TLC – Toluca, MEX

TNA – Jinan, PRC

TPE – Taipei, CT

TPP – Tarapoto, PE

TRC – Torreon, MEX

TRU – Trujillo, PE

TSA – Songshan, CT

TSN – Tianjin, PRC

TTJ – Tottori, JPN

TXG – Taichung, CT

TYN – Taiyuan, PRC

UFA – Ufa, RUS

UIH – Qui Nhon, VN

UKB – Kobe, JPN

UPG – Makassar, INA

URC – Urumqi, PRC

USM – Koh Samui, THA

VCL – Chu Lai, VN

VDH – Dong Hoi, VN

VER – Veracruz, MEX

VII – Vinh, VN

VKO – Moscow, RUS

VOZ – Voronezh, RUS

VSA – Villahermosa, MEX

VVO – Vladivostok, RUS

WAG – Whanganui, NZ

WEH – Weihai, PRC

WLG – Wellington, NZ

WNZ – Wenzhou, PRC

WRE – Whangarei city, NZ

WUH – Wuhan, PRC

WUX – Wuxi, PRC

XIY – Xi'an, PRC

XMN – Xiamen, PRC

YEG – Edmonton, CDA

YGJ – Yonago, PRC

YHZ – Halifax, CDA

YKA – Kamloops, CDA

YLW – Kelowna, CDA

YNJ – Yanji, PRC

YOW – Ottawa, CDA

YPR – Prince Rupert, CDA

YQM – Moncton, CDA

YQR – Regina, CDA

YSJ – Saint John, CDA

YTS – Timmins, CDA

YUL – Montreal, CDA

YVR – Vancouver, CDA

YWG – Winnipeg, CDA

YXC – Cranbrook, CDA

YXS – Prince George, CDA

YXT – Terrace-Kitimat, CDA

YYB – North Bay, CDA

YYC – Calgary, CDA

YYJ – Victoria, CDA

YYZ – Toronto, CDA

YZP – Sandspit, CDA

YZR - Sarnia, CDA

ZAL – Valdivia, CHL

ZCL – Calera de Victor Rosales, MEX

ZQN – Queenstown, NZ

ZUH – Zhuhai, PRC

1 Executive summary

1.1 Introduction

Improved air connectivity can be a catalyst for the growth of travel and trade, ultimately enhancing economic and social development and creating jobs, especially for women, young people, and in rural areas.

This important research project was proposed in 2014 by Thailand and co-sponsored by Australia; Indonesia; Malaysia; Peru; the Philippines; and Chinese Taipei with the aim to develop air connectivity in the APEC Region and in turn stimulate a more efficient flow of goods, services, capital and people.

The project was approved in December 2014, and in May 2015 IATA Consulting was selected to complete this project. Between May 2015 and July 2016, a market demand assessment and analysis of true Origin/Destination air traffic demand between the APEC economies was conducted, that was calibrated with existing flights, seat capacity and flight schedules, using IATA's travel intelligence software. The results were aligned with an analysis of new aircraft with increased flying range.

To achieve air connectivity with non-stop flights between every APEC economy, there are 210 economy pairs possible of which:

- 131 (62%) are connected with non-stop flights
- 79 (38%) are NOT connected with non-stop flights

Of the 79 economy pairs that are currently not connected with non-stop flights:

- 47 (22%) cannot be connected due to aircraft technology limitations
- 6 (3%) can be connected based on the market demand recommendations of this project

This consolidated report is complemented by an executive summary report, and 21 customized APEC economy reports, that provide greater details and make market demand driven recommendations for new non-stop flights, hubs, and improved flight schedule connection times. This can help airlines and regulators make faster decisions to improve air connectivity across the APEC Region.

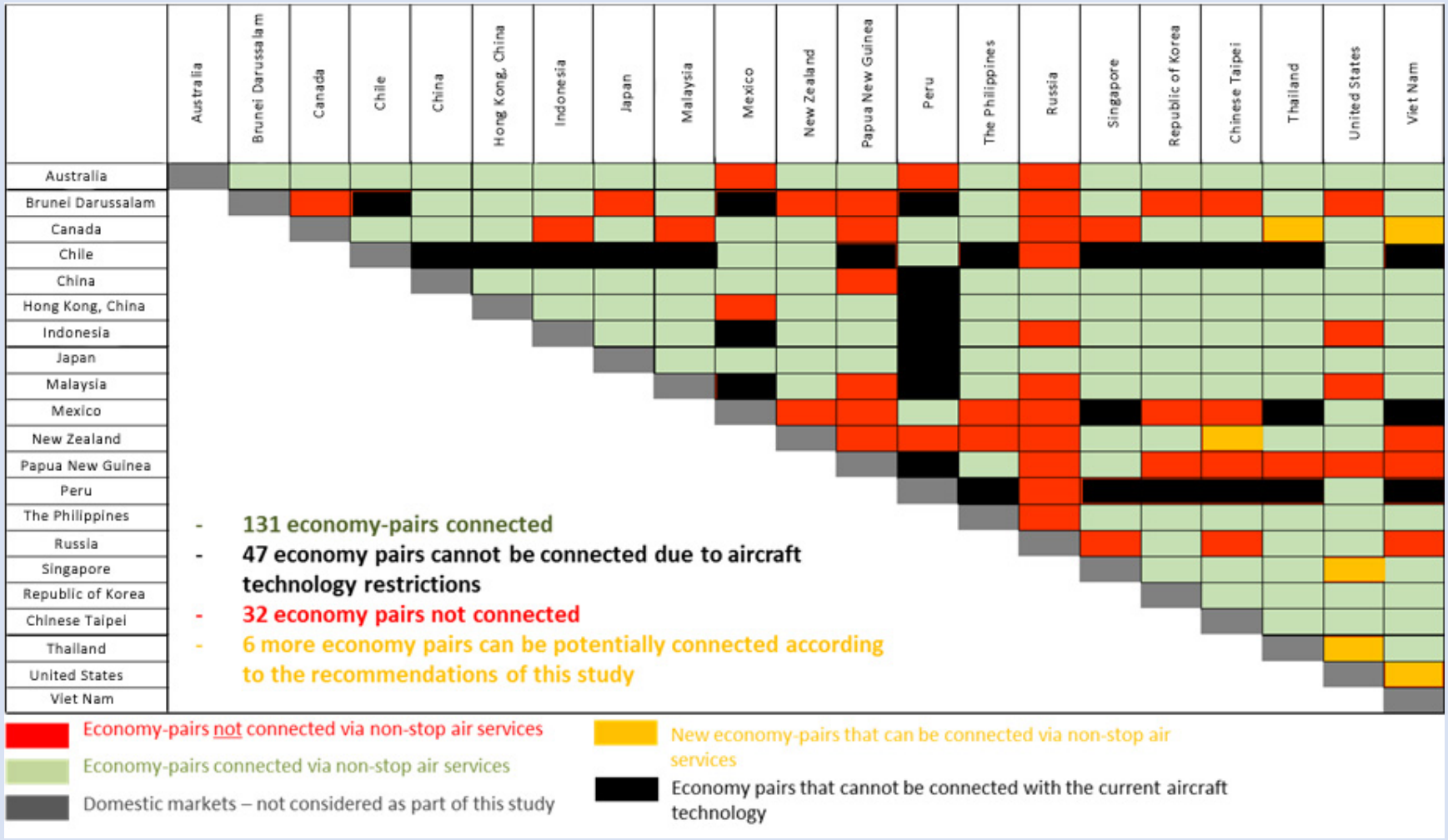

Figure 1: Summary of air connectivity in APEC

1.2 New route recommendations for APEC economies

Based on a market demand assessment that included an analysis of over 18,500 routes, recommendations were made for new non-stop flights, hubs, and improved flight schedule connection times that can help airlines and regulators make faster decisions to improve air connectivity across the APEC Region.

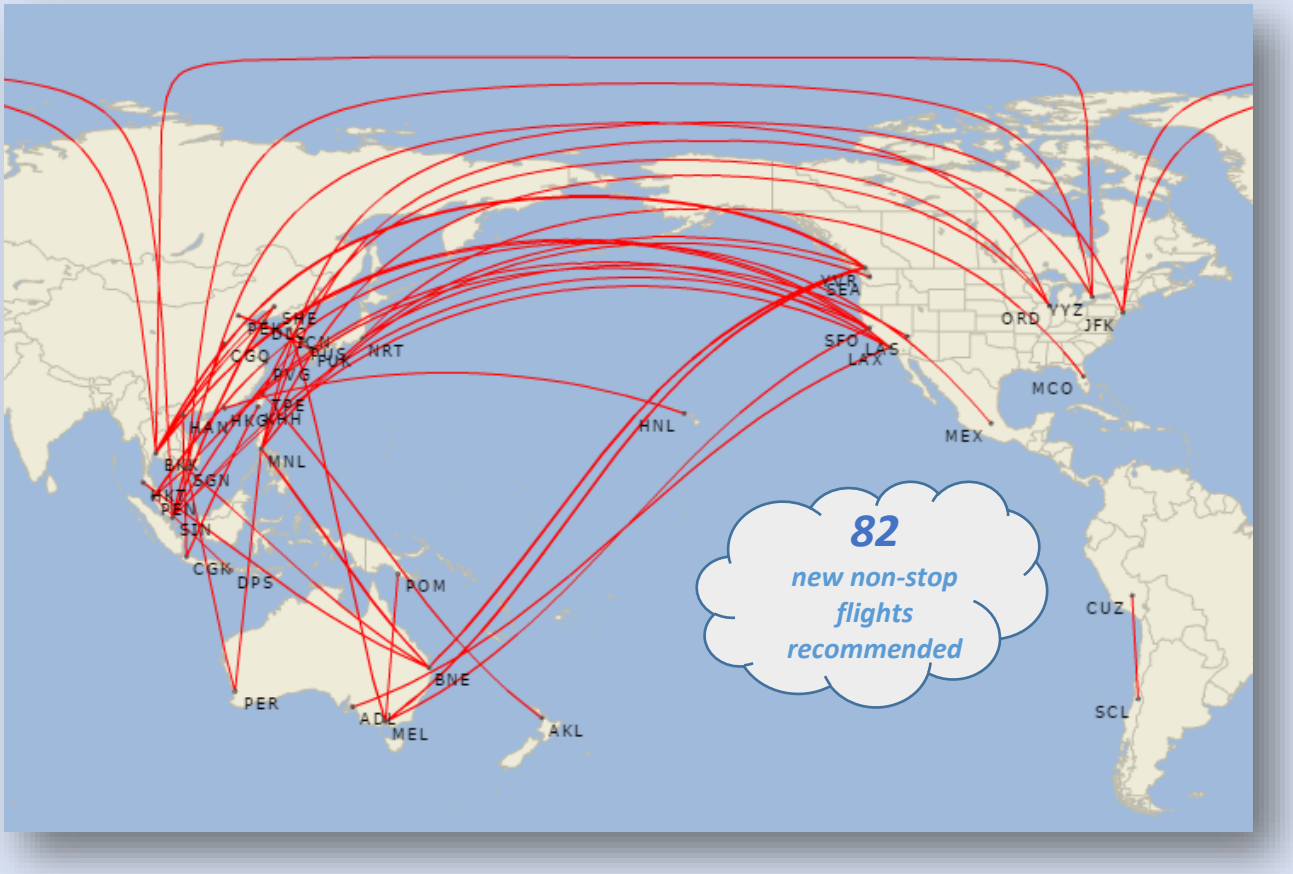

Figure 2: Potential new routes recommended for the APEC region

1.3 Future developments of air connectivity in APEC

One of the greatest challenges in connecting APEC economies by air is the physical distance between the economies on the two sides of the Pacific Rim. At present, the majority of trans-pacific traffic is routed through hubs in North Asia such as HKG, HND, NRT and ICN, and hubs on the West Coast in Canada and the United States such as LAX, SFO, SEA and YVR. These hubs are home to some of the world largest airlines and run at the optimal efficiency to facilitate air connectivity.

Aircraft technology had improved over the years and the latest aircraft in the market such as the Airbus A350 and Boeing B787 are capable of flying ultra-long-haul routes up to 14,000km[1]. It is therefore expected that more trans-pacific non-stop routes will be opened. However, even with the latest aircraft technology, there are still 47 APEC economy pairs unable to connect due to the physical distance. It is foreseen that in the future APEC will still need to rely on the major hubs to bridge the economies that cannot be connected directly.

Tourism Ministers have recognized the importance of air connectivity in the APEC region. On May 28 and 29 of 2016, the 9th Tourism Ministerial Meeting was held in Lima, Peru, under the theme "Connecting Asia-Pacific Tourism through Travel Facilitation" to emphasize air connectivity and travel facilitation as key catalysts to further enhance economic development through travel and tourism in the APEC region. APEC economies should follow this strategic direction in order foster efficient and secure travel to achieve the target of 800 million international tourists among APEC economies by 2025 as agreed to in the Macao Declaration in 2014 and supported by the APEC Leaders in 2014.

1.4 Recommendations to improve air connectivity in APEC

This section summarizes the recommendations on new routes that can be opened from each APEC economy in the medium term. It also highlights some recommended changes to the current flight schedules that will enhance the connectivity in major hub airports in APEC.

[1] Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.1 Australia

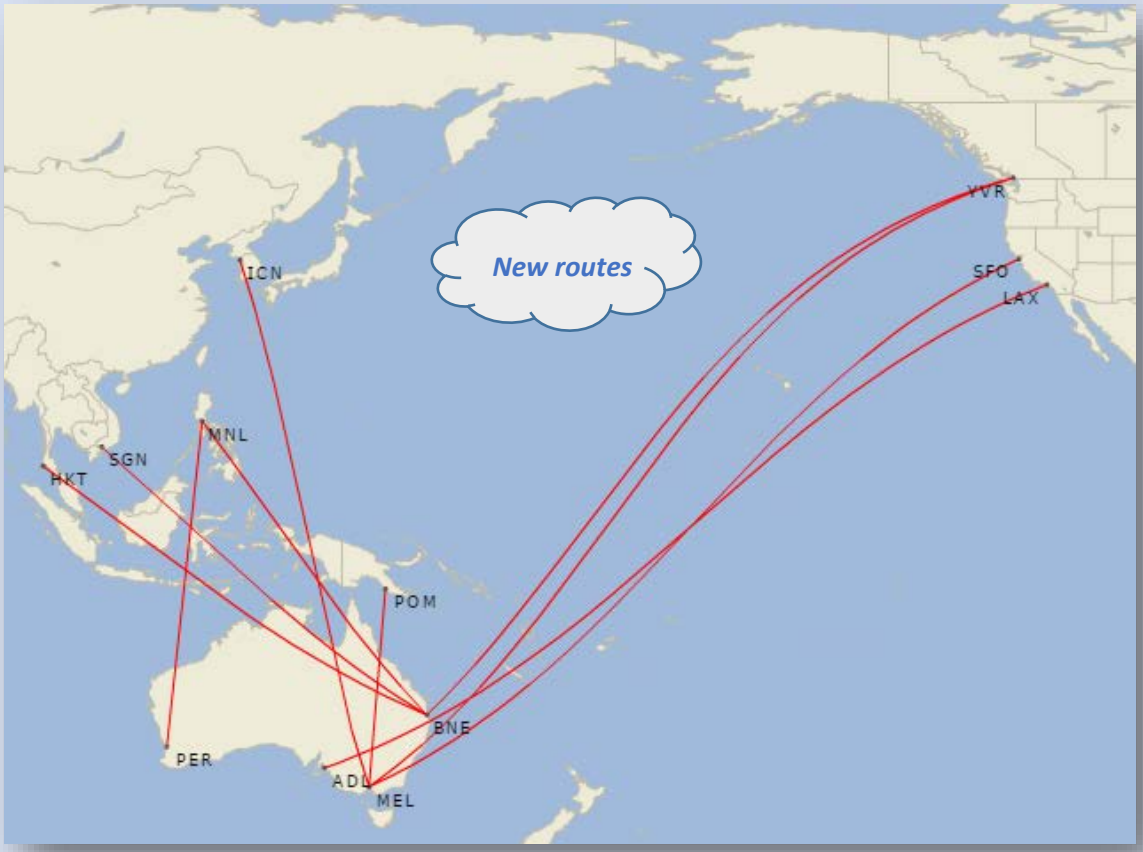

Figure 3: New routes recommendation for Australia

- MEL – SFO
- BNE – SGN
- ADL – LAX
- MEL – YVR
- MEL – ICN
- BNE – HKT
- MEL – POM
- BNE – MNL
- PER – MNL
- BNE – YVR[2]
- PER – SGN

[2] BNE to YVR route had started by Air Canada in June 2016

Schedule improvements

- Emirates flight 419 from SYD could arrive approximately three hours later at 04:00 in order to provide shorter connecting times to all key connecting markets which have departures commencing at 06:00.
- Thai Airways flight 484 from PER arriving at 15:05, and Thai Airways flight 476 from SYD arriving at 15:25, may consider landing one hour later in order to provide a connecting time shorter than three hours.
- Thai Airways flight 474 from BNE arriving at 20:10, and TG flight 466 from MEL at 20:35 with onward connections to numerous secondary destinations (SGN, HAN, KBV, and CEI), could be optimized through an earlier arrival in the afternoon at approximately 16:00.
- Thai Airways flight 461 (scheduled departure at 08:10) departing slightly later in the day (10:00am) would allow some behind connections. All other departures to Australia depart at night, or in the evening, allowing for arrivals in the day to easily connect onwards.
- Malaysia Airlines flight 140 could significantly optimize connection time if it was to arrive two to three hours later than its current scheduled 03:20 arrival. Most onward departures for Malaysia Airlines occur after 07:00.
- Air Asia X flight 237 from PER arriving at 12:15; it is currently necessary to wait 3-4 hours for many onward connections including key markets such as HKT, TPE and PVG. Having the flight arrive 2 hours later would optimize these connections.
- Air Asia X flight 233 from PER arriving at 22:25 has very limited onward connecting options and bringing the schedule forward to earlier in the day would allow for more connecting options. A similar recommendation applies to Malaysia Airlines flight 124 (arrival at 22:00); arriving two hours earlier in the day would enable more onward connections.
- All of the Australian flights depart at approximately the same time in Australia and arrive between 06:30 and 07:00 in LAX. Connections to YVR could be improved as wait times are currently at least 3 hours. Due to the frequency of flights to other primary connecting destinations beyond/behind LAX there are no other suggested schedule changes.
- For flights from LAX to Australia departures also occur around the same time, leaving between 22:15 and 23:35, behind connections are well aligned with these departures.
- Cathay Pacific flight 138 from SYD arrives approximately 2 hours before all other inbound flights from Australia. As this results in long connecting times in HKG (3 to 4 hours on most market) a later evening departure from SYD would make the connecting options more convenient.

- Cathay Pacific flight 178 departing MEL at 00:50 arriving at 07:00 could be delayed by one hour in order to optimize connections to NKG.
- All of the evening flights from Australia to HKG arriving between 17:45-17:55 could be scheduled to arrive earlier in order to catch onward connections to ICN, FOC, YYZ and certain other markets.
- Most of the flights departing HKG to Australia are well connected. As seen at other hub airports, morning departures are often unable to capture some key connecting markets, such as ICN or NKG on Cathay Pacific flight 139 to SYD departing at 08:40. If these morning departures were to leave slightly later, they would provide additional connecting options.
- Many flights departing Australia in the afternoon arrive in SIN in the evening, with about nine scheduled flights from Australia in the 20:40-00:20 time period. These flight have limited connecting options until morning departures the next day. If flights were scheduled to arrive slightly earlier in the day, it would provide accessibility to many key onward connecting markets.
- For flights heading to Australia, the morning departures from SIN between 07:05 and 09:40 have limited options for behind connections. It is recommended that these departures be pushed back by around 45 minutes in order to enable more morning wave connections.
- Singapore Airlines flight 242 from SYD arriving at 00:20, and Singapore Airlines flight 208 from MEL arriving at 00:20, could both be scheduled to arrive later in the morning (03:00-04:00). Current wait times on almost all connections are over 6 hours.
- There are typically three flights per day from Australia to ICN. Asiana Airlines flight 603 from SYD arriving at 18:50 could be optimized by arriving approximately one hour earlier. Currently most connections to top destinations are unavailable, or are within less than 45 minutes.
- Qantas flight 61 from BNE arriving at 18:00 has limited onward connecting options. Currently, departures to the top onward destinations such as CTS, ITM and NGO, occur within less than 45 minutes, preventing accessibility to many of these destinations. It would be better for this flight to arrive slightly earlier in the day.
- Departures to Australia occur primarily in the evening between 19:00 and 20:00. Currently arrivals from key behind connecting markets (CTS, ITM, NGO, and FUK) are scheduled approximately 4 hours earlier between 15:00-16:00. Should the evening departures leave slightly earlier, they would better accommodate these connecting passengers.
- Flights from SYD and BNE on Hawaiian Airlines flights arriving at 10:25 and 11:15 could be scheduled to arrive slightly later in order to shorten connection times to JFK, and LAS, which are both over a four-hour wait.

New aircraft technology

The following map illustrates the range limit[2] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 4: Range limit for the latest generation of aircraft from Sydney (Source: GCMap)

[2] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.2 Brunei Darussalam

New routes

IATA analyzed the supply and demand to all major OD markets to and from Brunei Darussalam and concluded that Brunei Darussalam is adequately served. As a result, there is no immediate new route opportunity recommendations for Brunei Darussalam. However, IATA would recommend Brunei Darussalam to continue to monitor the market evolution and reassess new air services opportunities on a regular basis.

Schedule improvements

IATA examined flights departing to and from Brunei Darussalam and found that the connecting waves of Royal Brunei Airlines are well balanced. Based on the analysis, there are currently no recommendations for connectivity improvements at Brunei International Airport

New aircraft technology

The following map illustrates the range limit[3] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 5: Range limit for the latest generation of aircraft from Bandar Seri Begawan (Source: GCMap)

[3] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.3 Canada

New routes

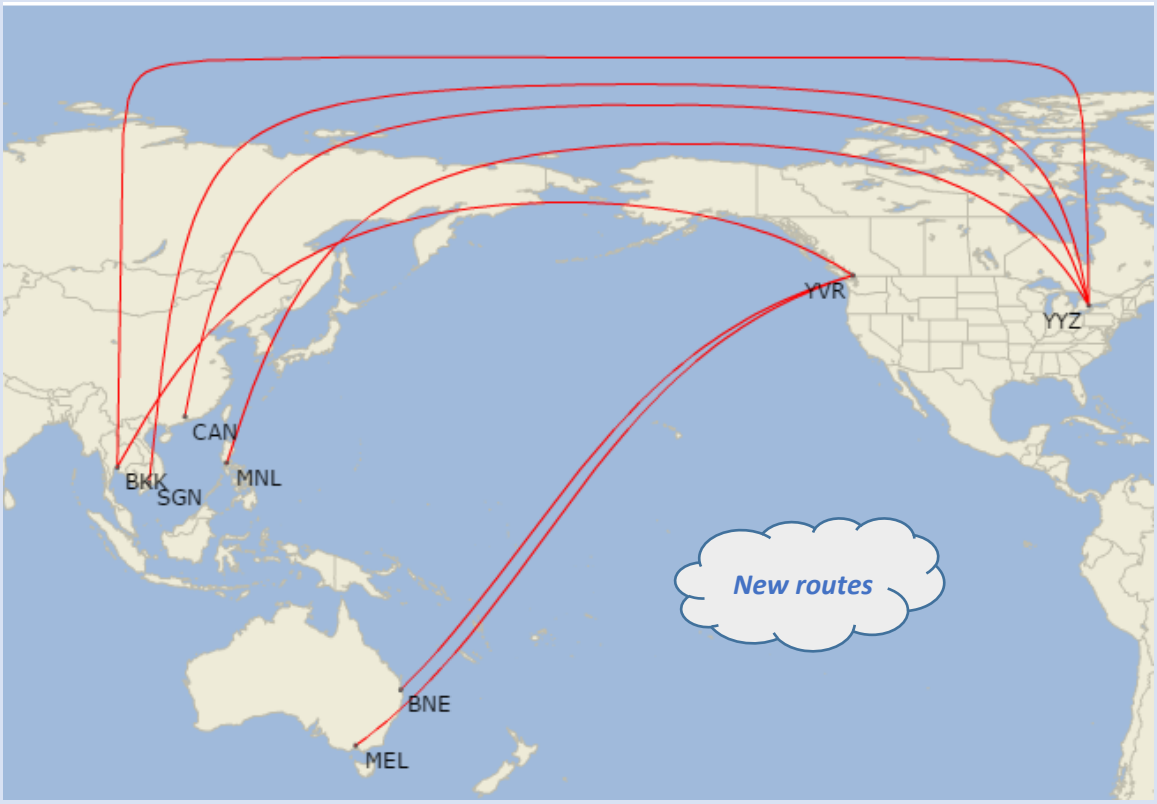

Figure 6: New routes recommendation for Canada (Source: SRS Analyzer)

- YYZ – MNL
- YYZ – SGN
- YVR – MEL
- YYZ – CAN
- YVR – BKK
- YVR – BNE[4]
- YYZ – BKK

[4] BNE to YVR route was started by Air Canada in June 2016

Schedule improvements

- Air Canada flight 64 from Incheon currently arrives in YVR at 11:50. If the arrival time can be brought forward by 45 minutes to 11:05, it will allow 10 more domestic and US connections to YXS, YYJ, YKA, YPR, YYZ, YXT, YZP, YLW, YYC and LAX.
- Air Canada flight 7 for Hong Kong, China currently leaves YVR at 13:20, missing connections from seven domestic markets – namely YYJ, YSJ, YXC, YYZ, YWG, YKA and YEG. These connections can be enabled if the departure time moves back 45 minutes to 14:05.
- WestJet flight 1865 from Honolulu currently arrives in YVR at 07:10; if the arrival time can be made earlier by 40 minutes, it will enable six more onward connections to YYC, YQR, YYZ, YXT, YSJ and YUL.
- Air Canada flight 16 from HKG currently arrives in YYZ at 18:10, missing seven domestic and U.S. connections by 20 minutes. If the arrival time can be brought forward to 17:50, it will allow connections to JFK, EWR, YZR, YYB, YSB, IAD, DEN and YUL.
- Air Canada flight 87 departing for PVG currently leaves YYZ at 13:00. If this flight were brought back to 13:40, it would allow 11 more connections from Canada and the U.S., namely DTW, YOW, LGA, YTS, PHL, BOS, ROC, STL, YUL, YXU and DEN.
- Air Canada flight 31 departing for PEK leaves YYZ at 14:55 and misses connections from 12 Canadian and U.S. cities. If the departure were retimed to 15:25, it will allow connections from YQB, MSY, Newark, YXU, BOS, YOW, LGA, YWG, DCA, YTS, YQM and YUL.
- WestJet flight 1237 from MCO arrives in YYZ at 14:28 and misses six domestic onward connections in a 30-minute timeframe. If it were retimed to arrive at 13:58, it could potentially allow connections to YUL, YVR, YHZ, YEG, YYC and YFC.

New aircraft technology

The following maps illustrate the range limit[5] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 7: Range limit for the latest generation of aircraft from Vancouver (Source: GCMap)

[5] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

Figure 8: Range limit for the latest generation of aircraft from Toronto (Source: GCMap)

1.4.4 Chile

New route

Figure 9: New route recommendation for Chile

- SCL – CUZ

Schedule improvements

- LATAM airlines flight 801 bound for AKL currently leaves SCL at 23:55. Should the departure time be moved back by 40 minutes to 00:35, the flight will be able to allow more connections from IQQ, CJC and LIM.
- By moving the departure time of LATAM flight 532 to JFK by 35 minutes to 22:50, it will allow connections from MCC, CCP, and EZE.
- If LATAM flight 704 to Madrid is retimed by 25 minutes to a 18:40 departure from SCL, it will allow connections from CCP, CJC, PMC, ZAL and MDZ.

New aircraft technology

The following map illustrates the range limit[6] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 10: Range limit for the latest generation of aircraft from Santiago (Source: GCMap)

[6] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.5 China

New routes

Figure 11: New routes recommendation for China

- SHE – SIN
- DLC – BKK
- SHE – BKK
- PEK – FUK
- PVG – PEN
- CGO – SIN[7]
- DLC – SIN
- PVG – MEX[8]

[7] Tigerair commenced the SIN – CGO route from June 2016
[8] Aeromexico started the PVG – MEX route from February 2016

Schedule improvements

- Air China flight 137 currently departs PEK for GMP at 18:45. Should the departure time be moved back by 15 minutes to 19:00, it would enable 5 more domestic connections (KHN, TAO, CKG, XIY and CGQ), and 2 more connections from the US (SFO, LAX).
- Air China flight 161 currently departs PEK for KIX at 16:25. Delaying the departure time by 15 minutes would enable more domestic connections of flights arriving from KMG, NNG, NKG, ZUH and CAN.
- Delta Airlines flight 188 currently leaving PEK for DTW at 16:50 would benefit from delaying the departure time by 15 minutes. This would enable more domestic connections from XIY, SZX, WNZ, LPF and DLC.
- American Airlines flight 262 departs PEK for DFW at 16:25. Moving back the departure time by 15 minutes would enable additional domestic connections from KMG, NNG, FOC, JJN, HGH, NKG, ZUH, CAN, PVG and SHA.
- Air New Zealand flight 288 currently departs PVG for AKL at 14:15. Should the departure time be moved back by 15 minutes to 14:30, it would enable more connections from China (SHE, HUZ, JJN, HRB, KWL, JNZ) as well as from NRT and HKG.
- Shanghai Airlines flight 841 currently departs PVG for BKK at 22:30. Moving back the departure time by 15 minutes would enable more connections of flights arriving from China (CGQ, SHE, FOC, DLC, KHN and TSN) as well as from Japan (AKJ and NRT).
- China Eastern Airlines flight 719 currently departs PVG for NGO at 11:40. Should the departure time be moved back by 15 minutes to 11:55, it would enable more connections from domestic airports (PEK, NNG, XIY, LHW and WUH) as well as from HKG and TPE.
- China Eastern Airlines flight 759 currently departs PVG for PNH at 20:00. Should the departure time be moved back by 15 minutes, it would enable more connections from domestic airports (SHE, DLC, PEK, YNJ, HRB, TSN) as well as from ORD, FUK, SEA and AUK.
- China Southern Airlines flight 329 currently departs CAN for YVR at 14:00. Should the departure time be moved back by 15 minutes to 14:15, it would enable more connections from domestic airports (NKG, GYS, CKG, WNZ and SWA) as well as from PEN and RGN.
- China Southern Airlines flight 381 currently departs CAN for BNE at 21:15. Should the departure time be moved back by 15 minutes to 21:30, it would enable more connections from domestic airports (LJG, SHA, NTG, CGQ, KMG and PEK).

- Thai Airways flight 669 currently departs CAN for BKK at 15:45. Delaying the departure time by 15 minutes would enable more connections of flights arriving from LHW, CTU, TYN and HGH.

New aircraft technology

The following map illustrates the range limit[9] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 12: Range limit for the latest generation of aircraft from Beijing (Source: GCMap)

[9] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.6 Hong Kong, China

New route

Figure 13: New route recommendation for Hong Kong, China

- HKG – HNL

Schedule improvements

- Cathay Pacific flight 897 from LAX currently arrives into HKG at 15:25. Should the arrival time be brought forward by 30 minutes to 14:55, it will allow 9 extra connections to APEC economies in South East Asia, namely BKK, BKI, HGH, CGK, KUL, PVG, TPE, SGN and CEB.
- Similarly, Cathay Pacific flight 841 from JFK is currently missing 6 connections to BKK, MNL, SIN, TPE, HKT and PER. These connections can be made available if the arrival time is moved forward 35 minutes to 13:25.
- Cathay Pacific flight 870 departing for SFO currently leaves HKG at 14:15. By moving back the departure time by 40 minutes to 14:55, it will allow 6 more connections from other APEC economies cities: HGH, HAN, WUH, XMN, WNZ and TPE.
- Cathay Pacific flight 826 leaves HKG for YYZ at 17:10. By moving the departure time back by 45 minutes to 17:55, it will allow 8 more connections from TXG, CTU, XMN, KHH, SIN, NKG, NGB, and HKT.

New aircraft technology

The following map illustrates the range limit[10] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 14: Range limit for the latest generation of aircraft from Hong Kong, China (Source: GCMap)

[10] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.7 Indonesia

New routes

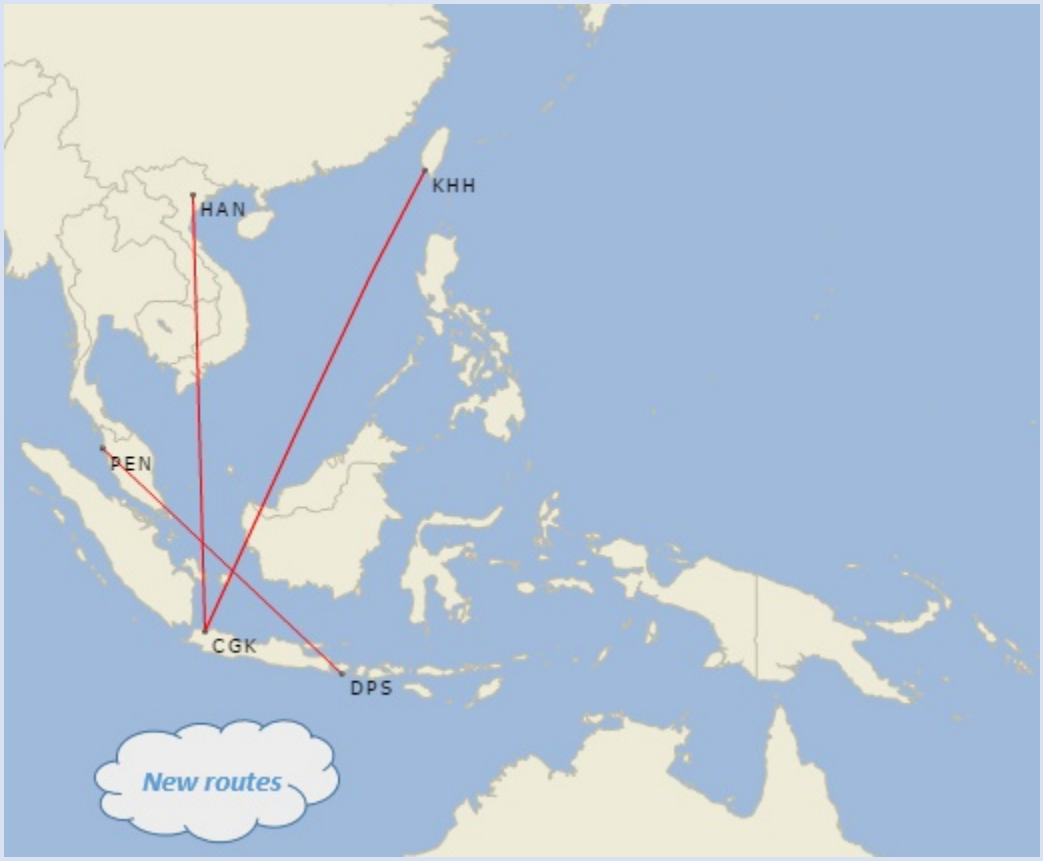

Figure 15: New routes recommendation for Indonesia

- DPS – PEN
- CGK – HAN
- KHH – CGK

Schedule improvements

- Garuda Indonesia flight 898 from CGK to CAN currently leaves CGK at 08:40. Should the departure time be moved back by 30 minutes to 09:10, it will allow extra connections from 7 domestic destinations: SUB, LOP, PLM, DPS, PDG, TKG and BDJ.
- The morning Garuda Indonesia flight 866 departure to BKK currently leaves CGK at 9:40. By moving the departure time ahead by 45 minutes to 10:25 will allow 9 more domestic connections from PLW, JOG, SOC, SRG, PLM, PNK, SUB, DJB, and TKG.

- Currently the Garuda Indonesia flight 713 from SYD arrives into CGK at 15:45. If the arrival time can be brought forward to 15:00, it will allow better onwards domestic connections to SIN, BKK, PNK, SUB, KNO, JOG, PLM and SRG.

New aircraft technology

The following map illustrates the range limit[11] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 16: Range limit for the latest generation of aircraft from Jakarta (Source: GCMap)

[11] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.8 Japan

New routes

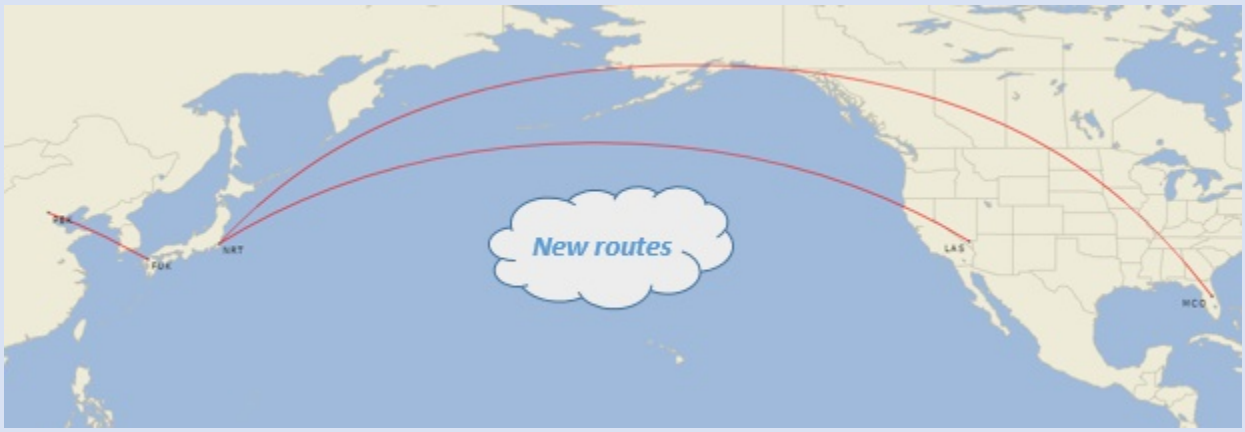

Figure 17: New routes recommendation for Japan

- FUK – PEK
- NRT – LAS
- NRT – MCO

Schedule improvements

- All Nippon Airways flights 2152 from CTS currently arrive in NRT at 09:25. If the arrival time can be made earlier by 35 minutes to 08:50, it will allow 3 more international connections to Chinese markets: PVG, XMN, and HKG.
- All Nippon Airways flights 968 from PVG currently arrive in HND at 05:40. A total of 7 more domestic connections, to IWK, YGJ, SYO, KOJ, TTJ, ISG and UKB, will be enabled if the arrival time can be brought forward by 50 minutes to 04:50.
- All Nippon Airways flights 105 from LAX currently arrive in HND at 05:00. 1 more domestic connections to ISG will be enabled if the arrival time can be brought forward by 10 minutes to 04:50.

New aircraft technology

The following map illustrates the range limit[12] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 18: Range limit for the latest generation of aircraft from Tokyo (Source: GCMap)

[12] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.9 Republic of Korea

New routes

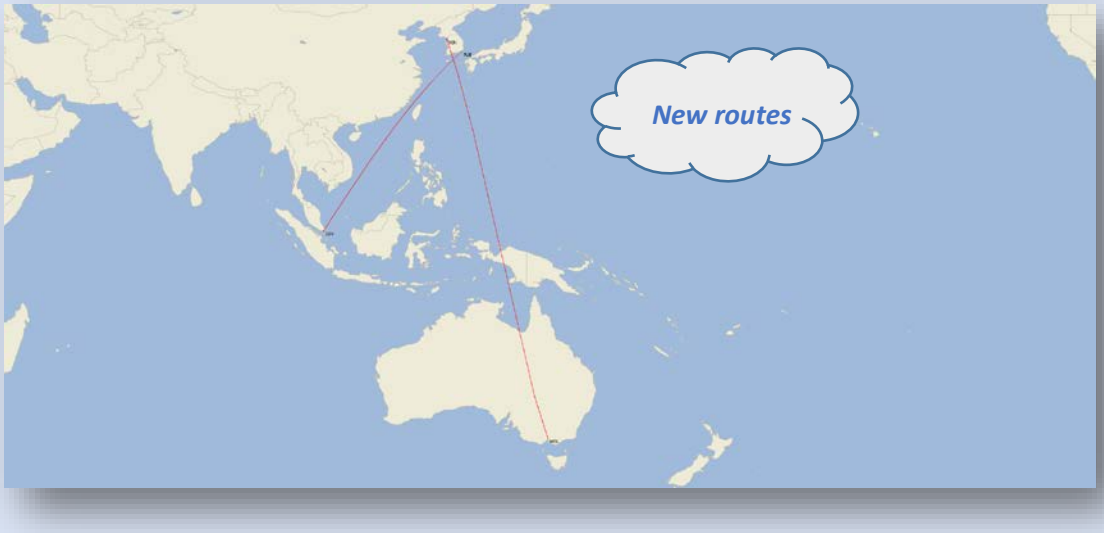

Figure 19: New routes recommendation for the Republic of Korea

- ICN – MEL
- PUS – SIN

Schedule improvements

- Korean Air flight 17 currently departs ICN for LAX at 15:00. Should the departure time be changed by 25 minutes to 15:25, it will enable 5 more connections from NKM, PVG, CGO, TSN and KIX.
- Korea Air flight 641 bound for SIN currently leaves ICN at 18:40. By moving the departure time by 20 minutes to 19:00, it will allow more connections from North America, namely SEA, LAX, SFO and YVR.
- Asiana flight 741 currently leaves for BKK at 18:30. By postponing the departure time by 10 minutes, it will allow 2 more connections from SFO and LAX.
- Asiana flight 232 to HNL currently leaves ICN at 20:20 and is missing connections from PVG, PEK, SGN, WEH and NKM. These connections can be enabled should the departure time retimed by 40 minutes to 21:00.

New aircraft technology

The following map illustrates the range limit[13] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 20: Range limit for the latest generation of aircraft from Seoul-Incheon (Source: GCMap)

[13] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.10 Malaysia

New routes

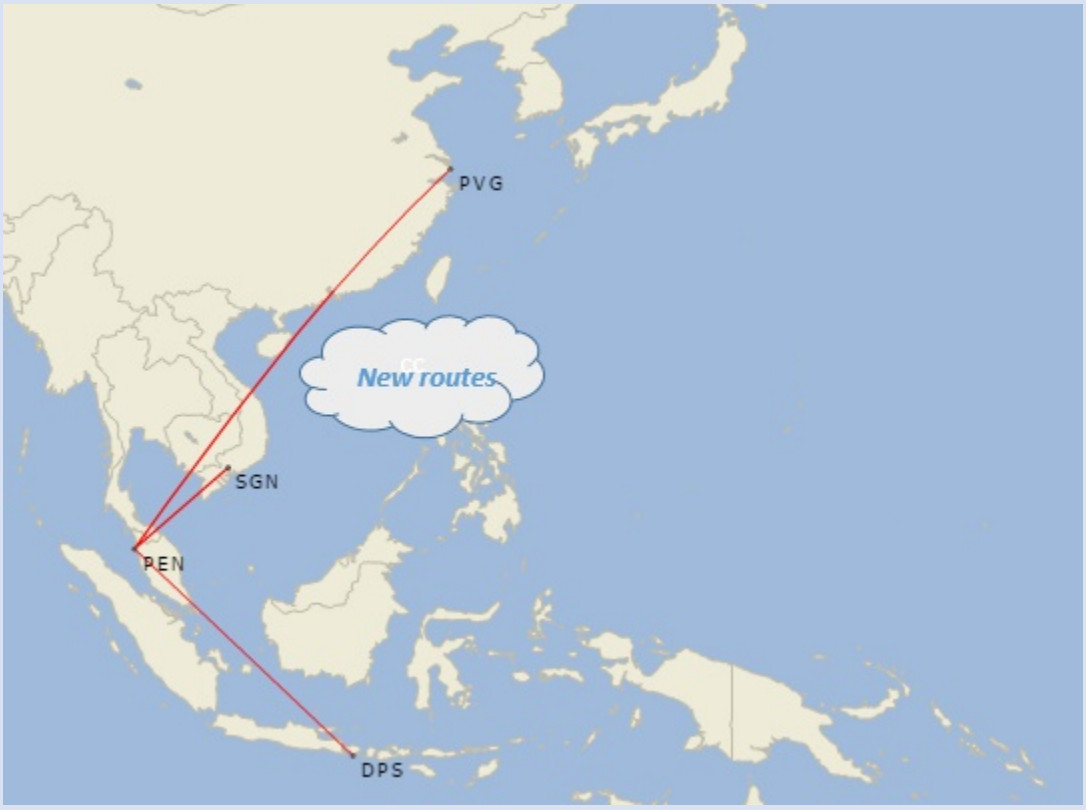

Figure 21: New routes recommendation for Malaysia

- PEN – PVG
- PEN – SGN
- PEN – DPS

Schedule improvements

- Malaysia Airlines flight 140 from SYD could significantly optimize connection time if it was to arrive two to three hours later than its current scheduled 03:20 arrival. Most onward departures for Malaysia Airlines occur after 07:00.
- Malaysia Airlines 129 to MEL is currently departing at 10:30. By delaying the departures for 20 minutes, it will allow better connections from domestic cities of JHB, AOR and TGG.

- For Air Asia X flight 237 from PER arriving at 12:15, it is currently necessary to wait 3-4 hours for many onward connections, including key markets such as HKT, TPE and PVG. Having the flight arrive 2 hours later would optimize these connections.
- The AirAsia X flight 506 to ICN, and flight 532 to ITM, are both departing at 01:00. By delaying both departures to 01:40, it will allow connections from 6 more cities in the region, namely KCH, HKT, KBR, DPS, PEN and SUB.

New aircraft technology

The following map illustrates the range limit[14] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 22: Range limit for the latest generation of aircraft from Kuala Lumpur (Source: GCMap)

[14] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.11 Mexico

New routes

IATA analyzed the supply and demand to all major OD markets to and from Mexico and was able to identify MEX – PVG as one of the potential routes. This route was started by Aeroméxico in February 2016. Other markets to/from Mexico are adequately served. As a result, there is no immediate new route opportunity recommendations for Mexico. However, IATA would recommend Mexico to continue to monitor the market evolution and reassess new air services opportunities on a regular basis.

Schedule improvements

- Currently Aeroméxico flight 623 from IAD arrives into MEX at 05:07. By shifting forward the arrival time by 10 minutes it will enable a better connection with a range of domestic destinations in Mexico, including AGU, GDL, TRC, MRY, CEN, CME, MTT and REX.
- Similarly, by shifting forward the arrival time of Aeroméxico flight 401 by 20 minutes to 05:00 will enable better domestic connections to AGU, GDL, TRC, MRY, CEN, CME, MTT and REX.
- For Aeroméxico flight 2682 to DFW, if the departure time can delay for 30 minutes, it will allow connections from TAM, GDL, ACA, ZCL, PVR, DGO, VSA, and OAX.
- Bringing up the arrival time of InterJet flight 3971 from DFW by 30 minutes, to 17:30, will allow for connections to OAX, VSA, AGU, and TGZ.
- Currently the InterJet flights 3986 to IAH is missing connecting passengers from 10 domestic markets. Delaying the flight departure time by 60 minutes to 10:30 will allow for passengers from VSA, TGZ, BJX, AGU, SLP, CUN, MTT, VER, ZCL, and OAX.

New aircraft technology

The following map illustrates the range limit[15] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 23: Range limit for the latest generation of aircraft from Mexico City (Source: GCMap)

[15] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft. Operating at high altitude airports may have an impact on aircraft performance.

1.4.12 New Zealand

New route

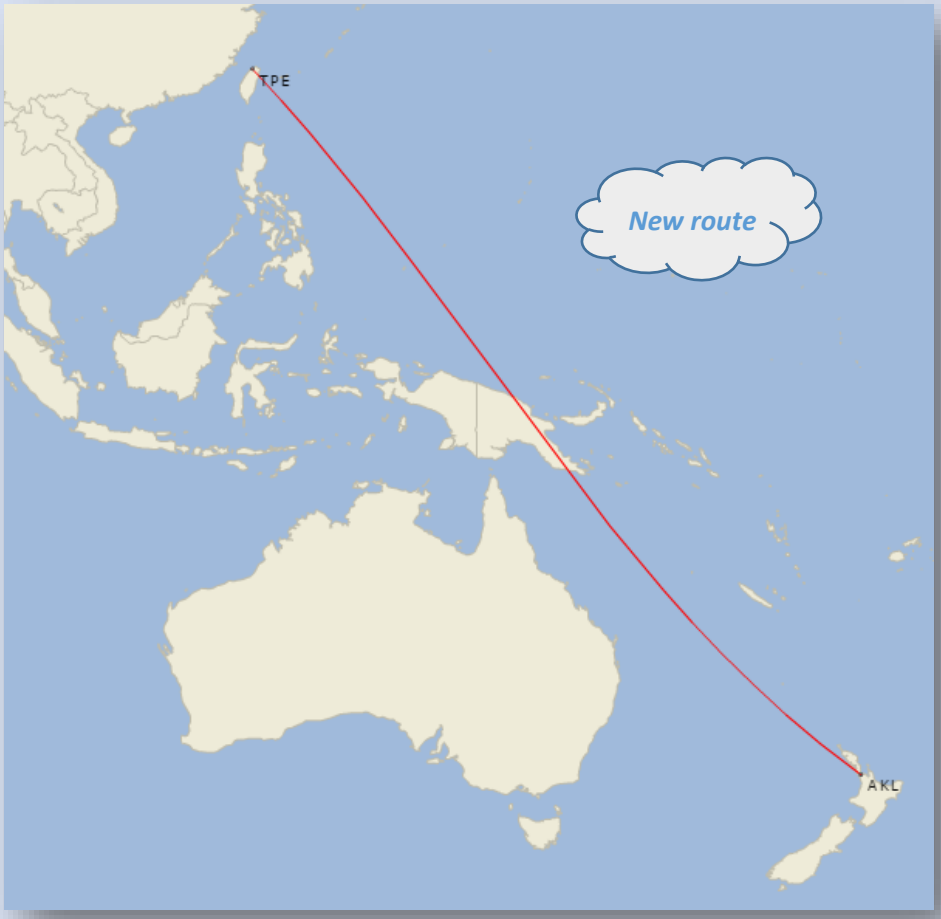

Figure 24: New route recommendation for New Zealand

- AKL – TPE

Schedule improvements

- Air New Zealand flight 99 to NRT currently leaves AKL at 08:45. If the departure time can be delayed by 35 minutes to 09:20, it will allow 12 more domestic connections to this flight. The domestic connections include CHC, WLG, NPL, KKE, WRE, ROT, PMR, WAG, BHE, NPE, NSN, and PPQ.

- By shifting the departure time of Air New Zealand flight 703 to SYD by 15 minutes from 09:00 to 09:15, it will allow 5 more connections from CHC, WLG, PMR, WAG, and BHE.
- Air New Zealand flight 80 from HKG currently lands in AKL at 10:00. If the arrival time can shift forward by 30 minutes, it will allow for better connections onwards to CHC, WLG and NPL.

New aircraft technology

The following map illustrates the range limit[16] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 25: Range limit for the latest generation of aircraft from Auckland (Source: GCMap)

[16] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.13 Papua New Guinea

New route

Figure 26: New route recommendation for Papua New Guinea

- POM – MEL

Schedule improvements

- For Virgin Australia flight 188 from POM arriving at 17:10, postponing the flight arrival time by two hours in BNE would not only offer a shorter connecting time for travel to PER, it would also make it possible to catch connections to WLG and CHC. These improvements would make the PER destination more attractive, and make it possible to enhance connectivity to WLG and CHC.

- For Air Niugini flight 5 arriving in BNE at 16:40, postponing by 60 minutes the current arrival time would shorten the connecting time for beyond travel to PER (currently a three hour connecting time).

New aircraft technology

The following map illustrates the range limit[17] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 27: Range limit for the latest generation of aircraft from Port Moresby (Source: GCMap)

[17] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.14 Peru

New route

Figure 28: New route recommendation for Peru

- CUZ – SCL

Schedule improvements

- LATAM Airlines flight 2604 currently departs at 12:45 for LAX. By pushing back the departure time by 40 minutes, it will allow better connections from CUZ and AQP.
- LATAM Airlines flight 2800 for IAD currently departs at 09:20. By pushing back the departure time by 45 minutes, it will enable connections from AYP, CJA, CUZ and AQP.
- LATAM Airlines flight 2638 from SCL currently lands at LIM at 09:30. By bring forward the arrival time by 25 minutes, it will allow onward connections to TBP, CUZ, JUL and CJA.
- Avianca flight 818 to TRU currently leaves LIM at 21:32. Connections from MIA and MEX can be enabled if the departure time is postponed by 45 minutes.

New aircraft technology

The following map illustrates the range limit[18] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

[18] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.15 The Philippines

New routes

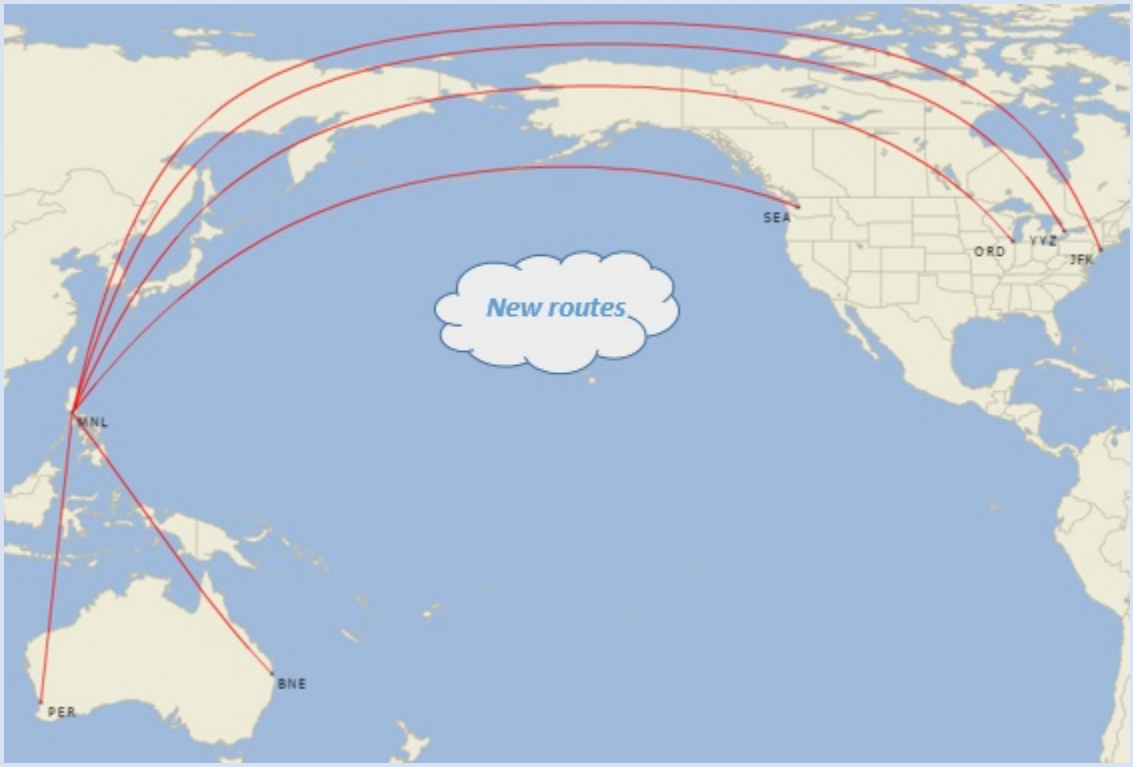

Figure 30: New routes recommendation for the Philippines

- MNL – YYZ
- MNL – JFK
- MNL – ORD
- MNL – SEA
- MNL – BNE
- MNL – PER

Schedule improvements

- Philippine Airlines flight 502 from SIN currently arrives into MNL at 14:20. The onward connections to NRT, YVR, PUS, BCD and CEB can be enabled by bring forward the arrival time by 40 minutes.
- Philippine Airlines flight 733 from BKK arrives into MNL at 03:15. Connections to TAC, CEB, MBT, OZC, RXS and BXU will be enabled if the arrival time is brought forward by 30 minutes.
- Philippine Airlines flight 102 to LAX currently leaves MNL at 21:00. By pushing back the departure time by 30 minutes, it will enable connections from BCD, CEB, DVO, TAC and HKG.

- Cebu Pacific flight 109 from HKG currently lands in MNL at 10:35. By bringing forward the arrival time by 40 minutes, it will allow onward connections to TAC, BCD, DGT, CGY and CEB.
- Cebu Pacific flight 311 from TPE arrives in MNL at 03:10. By bringing forward the arrival time by 45 minutes, it will allow onward connections to TAC, CBO, DVO, CGY and CEB.

New aircraft technology

The following map illustrates the range limit[19] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 31: Range limit for the latest generation of aircraft from Manila (Source: GCMap)

[19] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.16 Russia

New routes

IATA analyzed the supply and demand to all major OD markets to and from Russia and concluded that Russia is adequately served. As a result, there is no immediate new route opportunity recommendations for Russia. However, IATA would recommend Russia to continue to monitor the market evolution and reassess new air services opportunities on a regular basis.

Schedule improvements

Most of the flights to and from APEC economies are concentrated in Moscow Sheremetyevo airport. Therefore, IATA examined flights departing to and from SVO. Based on optimal connecting time-related considerations, IATA developed a series of suggested improvements pertaining to certain flight schedules to and from the airport. Suggested improvements are listed below.

- Aeroflot flight 271 currently arrives at SVO at 15:50 but the arrival time will not allow onward connections to 5 Russian domestic cities, namely AER, KRR, LED, ARH, and KGD. Should Aeroflot flight 271 be able to arrive 55 minutes earlier at 14:55, it will enable such connections to the 5 cities.
- Similarly, if Aeroflot flight 275 from HKT can arrive 55 minutes early at 15:55, it will allow onward connections to RTW, ROV, LED, SIP, KUF, STW, and AER.
- China Eastern flight 5009 from Xi'an is currently arriving at 17:00 and will miss some onward connections with Skyteam partner Aeroflot.
- For the Aeroflot flight 212 to HKG, should the departure time be delayed by 40 minutes to 20:00, it will allow connections from Sochi and LED.
- Postponing the departure time of Aeroflot flight 106 to Los Angeles by 60 minutes will enable connections from 12 domestic cities in Russia, namely KGD, KZN, ROV, VOZ, NBC, SVX, UFA, STW, CEK, KRR, KUF, and ASF.

New aircraft technology

The following map illustrates the range limit[20] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 32: Range limit for the latest generation of aircraft from Moscow (Source: GCMap)

[20] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.17 Singapore

New routes

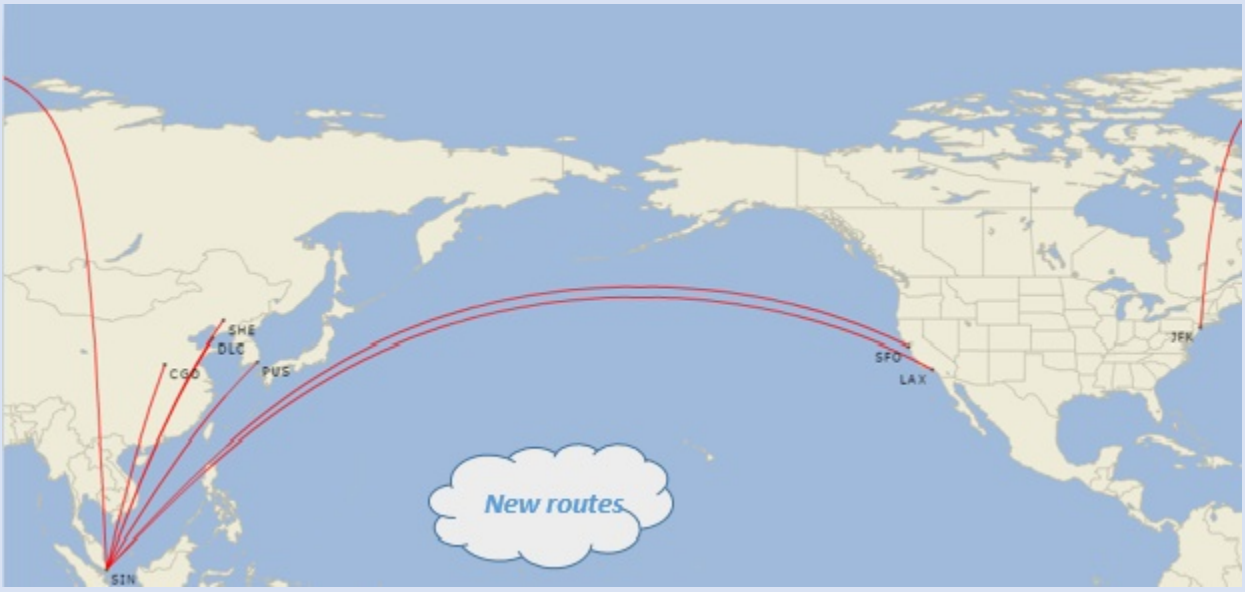

Figure 33: New routes recommendation for Singapore

- SIN – JFK
- SIN – SFO[21]
- SIN – LAX[22]
- SIN – PUS
- SIN – CGO[23]
- SIN – DLC
- SIN – SHE

[21] United commenced the SIN– SFO route in June 2016
[22] Singapore Airlines announced LAX and JFK route would resume once they take delivery of the A350-900ULR aircraft
[23] Tigerair commenced the SIN – CGO route in June 2016

Schedule improvements

- Singapore Airlines flight 950 currently departs SIN for CGK at 06:20. Should the departure time be moved back by 15 minutes to 06:35, it would enable three more connections from CAN, HKG and PVG.
- Singapore Airlines flights 826/828/830/832/836 are currently departing SIN for PVG at 01:15/08:05/09:45/12:45/17:25. Alternating the departure times of these flight by 5 minutes (flight 832), 10 minutes (flights 826/SQ828), and 15 minutes (flights 830/836), would enable 8 more connections of flights arriving from SYD, DPS, CGK and KUL.
- Singapore Airlines flight 118 currently departs SIN for KUL at 18:45. Delaying the departure time by 15 minutes would enable four more connections from MEL, MNL, SGN and CGK.
- Singapore Airlines flights 172 currently departs SIN for SGN at 09:45. Delaying the departure time by 15 minutes would enable 3 more connections from DPS, CGK and KUL.

New aircraft technology

The following map illustrates the range limit[24] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 34: Range limit for the latest generation of aircraft from Singapore (Source: GCMap)

[24] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.18 Chinese Taipei

New routes

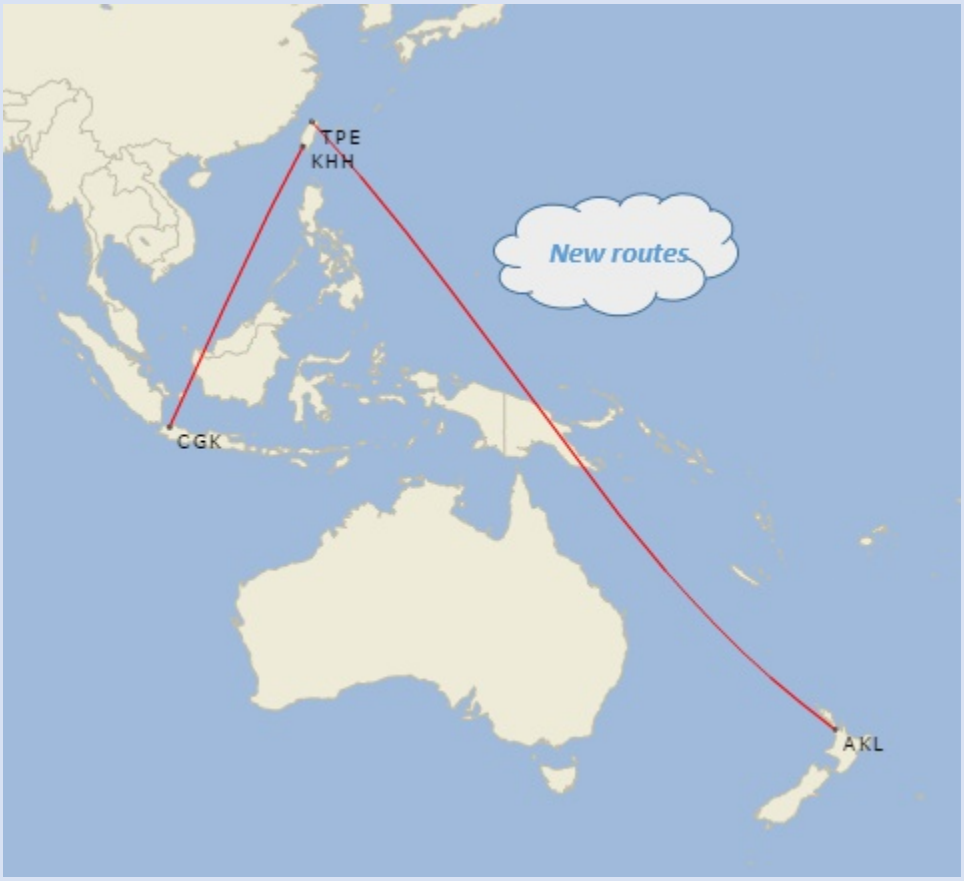

Figure 35: New routes recommendation for Chinese Taipei

- TPE – AKL
- KHH – CGK

Schedule improvements

- EVA Air flight 52 currently leaves for IAH at 22:00. If the departure time can be delayed by 30 minutes to 22:30, it can potentially catch the connections from BKK, MNL, HKG, and DPS.
- China Airlines flight 53 for BNE currently leaves TPE at 23:50 and misses the connections from PEK and HKG. The connections can be optimized by delaying the departure time by 35 minutes to 00:25.

New aircraft technology

The following map illustrates the range limit[25] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 36: Range limit for the latest generation of aircraft from Chinese Taipei (Source: GCMap)

[25] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.19 Thailand

New routes

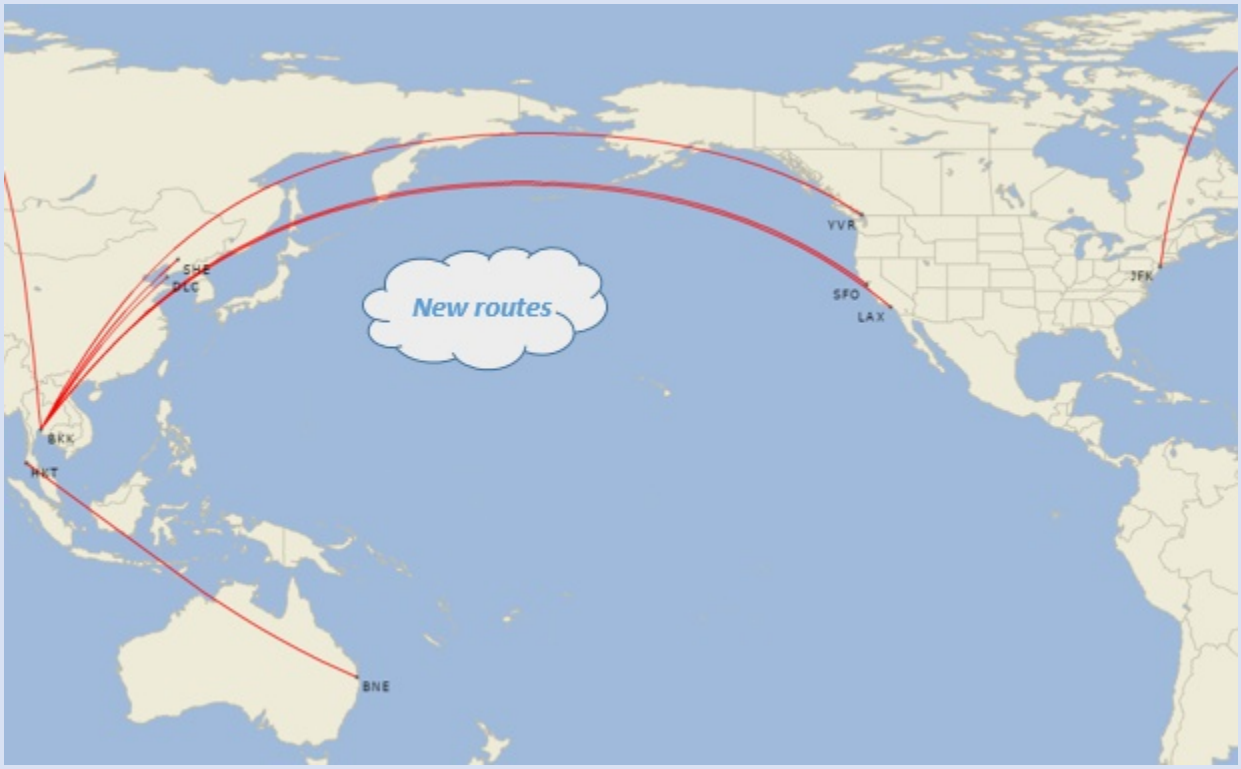

Figure 37: New routes recommendation for Thailand

- BKK – LAX
- BKK – JFK
- BKK – DLC
- BKK – SHE
- BKK – SFO
- BKK – YVR
- HKT – BNE

Schedule improvements

- Thai Airways flight 121 from CNX currently arrives into BKK at 22:10. By bringing forward the arrival time by 40 minutes, it will enable connections to HND, PEK and ICN.

- Thai Airways flight 476 from SYD currently arrives into BKK at 16:20 and misses the connections to CNX and KBV by 20 minutes. These connections can be enabled by rescheduling the SYD.

- Thai Airways flight 222 from HKT arrives into BKK at 22:00. If the flight can be rescheduled to arrive 30 minutes earlier, it will allow connections onto HND, PEK and ICN.

- Thai Airways flight 491 to AKL currently departs BKK at 18:45. By delaying the departure time by 20 minutes, it will allow connections from CTU, CAN and HKT.

- Bangkok Airways flight 274 from HKT currently arrives into BKK at 16:05. If the arrival time is brought forward by 20 minutes, it will allow connections to CNX, TDX, LPT and CEI.

New aircraft technology

The following map illustrates the range limit[26] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 38: Range limit for the latest generation of aircraft from Bangkok (Source: GCMap)

[26] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.4.20 United States

New routes

Figure 39: New routes recommendation for the United States

- LAX – BKK
- LAX – SGN
- JFK – SIN[27]
- JFK – BKK
- SFO – SIN[28]
- JFK – MNL
- SFO – BKK
- ORD – SGN
- SFO – SGN
- LAX – SIN[29]
- ORD – MNL
- SFO – MEL
- SEA – MNL
- MCO – NRT
- LAS – NRT
- HNL – HKG
- LAX – ADL

[27] Singapore Airlines announced JFK route would resume once they take delivery of the A350-900ULR aircraft
[28] United commenced the SIN – SFO route in June 2016
[29] Singapore Airlines announced LAX route would resume once they take delivery of the A350-900ULR aircraft

Schedule improvements

- Air New Zealand flight 1 currently departs LAX for AKL at 21:30: Delaying the departure time by 15 minutes to 21:45 would enable more than 15 additional connections from the US domestic destinations, including PHL, IAH, BOS, ORD, ATL, LAS, DFW, AUS, as well as from MEX and CUN.
- Virgin Australia flight 2 currently departs LAX for SYD at 22:35. Delaying the departure time by 15 minutes would enable more than 10 additional connections of flights arriving from domestic the US airports, including IAH, SJC, JFK, BOS, DAL, ATL, SMF, RNO and SLC.
- All Nippon Airways flights 5 currently leave LAX for NRT at 12:45. Delaying the departure time by 15 minutes would enable 13 more connections from the US domestic airports, including PHX, ORD, JFK, CVG, SFO, and IAD, as well as MEX, GDL, MTY from Mexico.
- Korean Airlines flight 12 currently departs LAX for ICN at 23:30. Delaying the departure time by 15 minutes to 23:45 would enable 6 more connections from domestic the US airports: DTW, EWR, RDU, DTW, OAK and LAS.
- American Airlines flight 183 leaves LAX for PVG at 11:20. Delaying the departure time by 15 minutes would enable connections from DEN, DFW, CLT, JFK, MCO, SJC, SAN, DEN, DAL and MLM.
- All Nippon Airways flights 7 currently leave SFO for NRT at 12:20. Delaying the departure time by 15 minutes would enable 6 more connections from JFK, PHL, ORD, BOS, SAN and YVR.
- Air New Zealand flight 7 currently departs SFO for AKL at 21:45. Delaying the departure time by 15 minutes to 22:00 would enable more connections from the US domestic destinations (LAS, IAH, MIA, ATL, DFW, DEN, JFK, BUR, as well as from CUN from Mexico).
- United Airlines flight 35 currently departs SFO for KIX at 11:35. Delaying the departure time by 15 minutes would enable more connections of flights arriving from domestic the US airports (IAD, FAT, EWR and PHX).
- Philippine Airlines flight 105 currently departs SFO for MNL at 23:30. Delaying the departure time by 15 minutes to 23:45 would enable more connections from domestic the US airports: CLT, BUR, MSP, EWR, IAD, FLL, IAH, JFK and LAS.
- Delta Air Lines flight 167 currently leaves SEA for NRT at 12:53. Delaying the departure time by 15 minutes would enable 6 more connections from SMF, OAK, BLI, DFW, GEG and EAT.

- Delta Airlines flight 199 currently departs SEA for ICN at 12:08. Delaying the departure time by 15 minutes to 12:23 would enable more connections from the US domestic destinations (DTW, MSP, MDW, DEN, EWR and SNA).
- Hainan Airlines flight 496 currently departs SEA for PEK at 14:00. Delaying the departure time by 15 minutes would enable more connections of flights arriving from PSP, GEG, IAH, BNA, DEN, and YYC.

New aircraft technology

The following maps illustrate the range limit[27] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

Figure 40: Range limit for the latest generation of aircraft from New York (Source: GCMap)

[27] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

Figure 41: Range limit for the latest generation of aircraft from Los Angeles (Source: GCMap)

1.4.21 Viet Nam

New routes

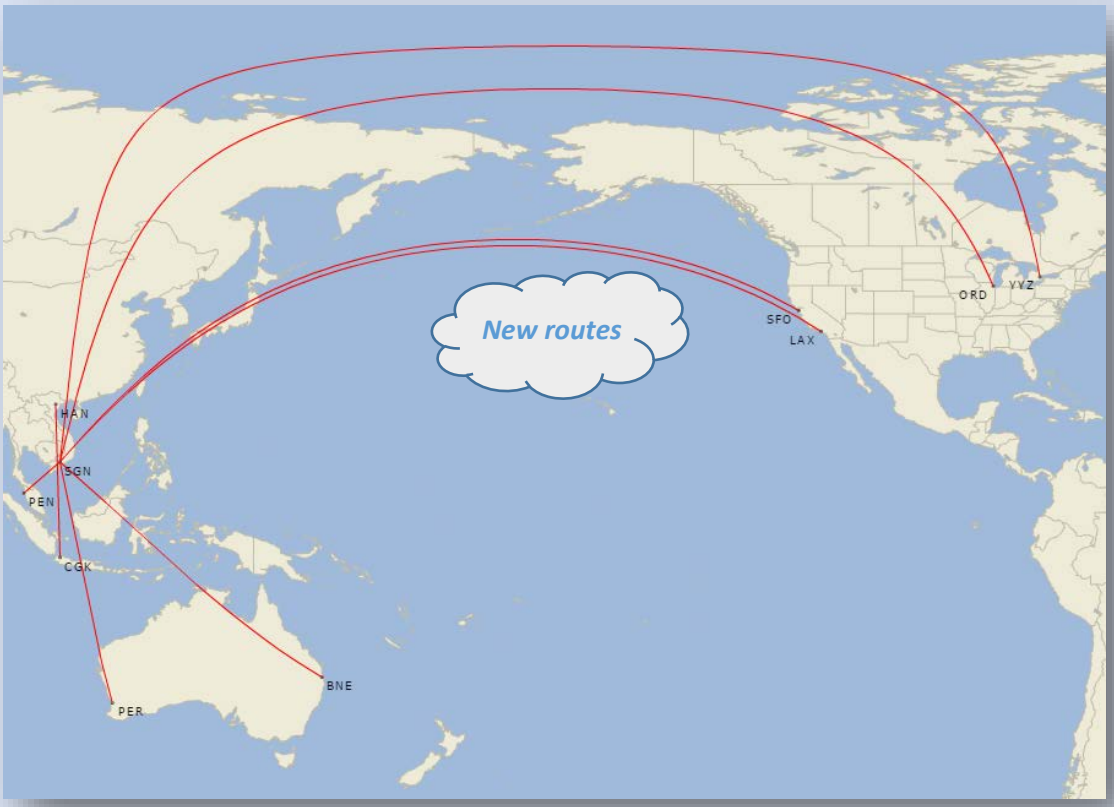

Figure 42: New routes recommendation for Viet Nam

- SGN – LAX
- SGN – ORD
- SGN – SFO
- SGN – PEN
- SGN – PER
- SGN – BNE
- SGN – YYZ
- HAN – CGK

Schedule improvements

- Vietnam Airlines flight 124 currently departs SGN for DAD at 12:55. Should the departure time be moved back by 15 minutes to 13:10, it would enable 2 more connections from REP and TPE.
- Vietnam Airlines flight 262 currently departs SGN for HAN at 23:10. Delaying the departure time of this flight by 15 minutes would enable 3 domestic connections (VCL, BMV, DLI), and one international connection from SYD.
- VietJet Air flight 155 currently departs HAN for SGN at 18:45. Pushing back the departure time by 10 minutes would enable 2 more connections from MFM and ICN.
- Vietnam Airlines flight 416 currently departs HAN for ICN at 23:40. Delaying the departure time of this flight by 15 minutes would enable 6 additional domestic flights (from SGN and PQC) to connect.
- Vietnam Airlines flight 506 currently departs HAN for CAN at 12:40. Delaying the departure time of this flight by 15 minutes would enable 7 additional domestic flights (from SGN, UIH, VCL, PXU, VDH, PQC and CXR) to connect.

New aircraft technology

The following map illustrates the range limit[28] of the latest aircraft technology from Airbus (A350-900) and Boeing (B787-9):

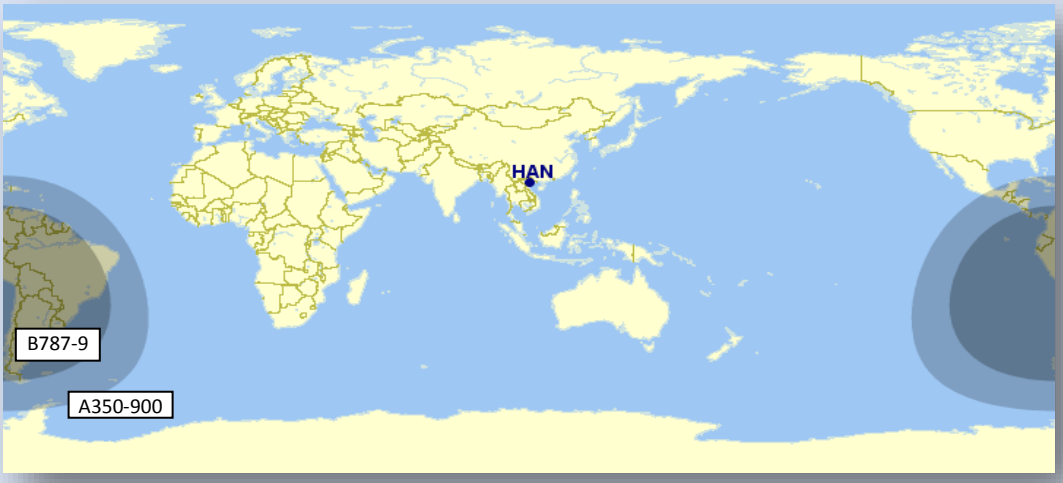

Figure 43: Range limit for the latest generation of aircraft from Ha Noi (Source: GCMap)

[28] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

1.5 General recommendations to improve connectivity in APEC

Air connectivity is usually assessed from the perspective of an airline, or a destination, and this is a unique assessment because it is from the perspective of an economic region.

This project focused on market demand and it is recognized that there are many other components that need to be taken into consideration before a new route is implemented including government perspectives, and airlines perspectives including financial modeling and many other inputs.

In addition to the recommended new routes, and schedule improvements, IATA recommends the following:

- Strengthening tourism cooperation on air connectivity among the APEC economies, as instructed by APEC Tourism Ministers in the Lima Declaration of the last TMM9, since increased international and domestic connectivity can help regionally distribute the social and economic benefits of tourism
- Engage with APEC working groups including the Tourism Working Group (TWG), the Transport Working Group (TPTWG) and the Business Mobility Group (BMG)"in order to further liberalize the air services market to other APEC economies allowing the fullest access to the major airports in the economy
- Start engaging with airlines early and provide the fullest support to the airlines involved because new air route development is usually a lengthy process as it involves a significant amount of investments from the airline to open a new route
- Work closely with different stakeholders for example tourism boards, the Chamber of Commerce etc. to gain a deeper understanding of the development of the aviation demand
- Encourage airlines to explore the opportunities on the ultra-long-haul market when they take delivery of new generation of long-haul aircraft
- Ensure adequate long term planning and investments are in place for the aviation infrastructure
- Closely work with the airline industry to enhance sustainability and profitability of the industry
- Explore the possibility of improving security and travel facilitation with electronic or smart visa systems as advocated by the World Economic Forum (WEF), United Nations World Tourism Organization (UNWTO), the World Travel and Tourism Council (WTTC), and other organizations
- Reduce Passenger Movement Charge on international air passengers

Appendix A: Methodology

This section explains the methodology applied by IATA and presents the data used to feed the various underlying analysis. To conduct the analysis, IATA took systematic steps identified in Figure 44.

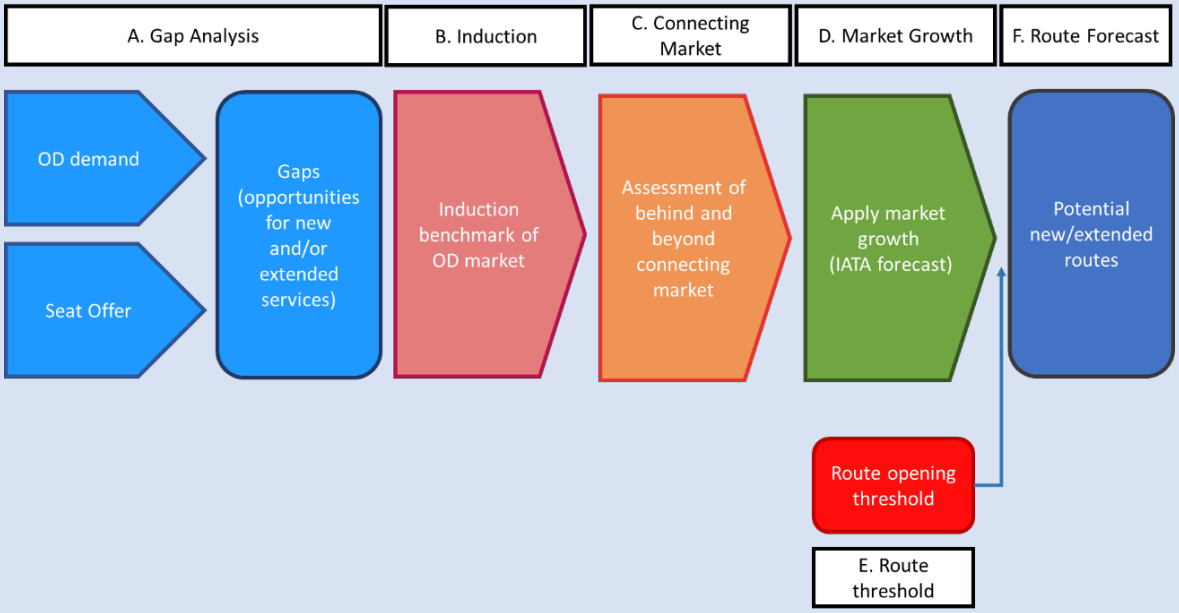

Figure 44: Process used to complete analytical work

The first step involved a demand-supply gap analysis aimed at identifying the unserved routes, and presenting potential demand for future development. The size that this potential demand could actually represent if turned into direct service in the future was subsequently forecast, using realistic assumptions related to induction, connecting potential, and demand growth.

Data fueling the model

Principal data for the model originates from Airport IS. IATA's Airport IS system uses IATA billing and settlement plan data to provide detailed demand and supply information on total air traffic. This data has been available for over a 10-year historical period (since 2005).

Approximately 18,500 international APEC routes were analysed in the execution of this study. Airport IS data was particularly relevant in the gap analysis and assumption development.

Academic articles and published ratios were also used to justify some of the assumptions, including induction and origin destination traffic captured through direct service.

For some of the other variables used in the final traffic determination, economic forecasts were extracted from IHS Global Insight, one of the world's largest commercially available economic databases.

Tourism data was mainly extracted from the World Travel and Tourism Council.

Gap analysis

IATA applied a funnel approach in conducting the analysis. It first considered the market at the economy pair level, followed by city pairs leading to a market potential assessment (see figure below). Both seat supply and seat demand were considered in the analysis to identify gaps in air service.

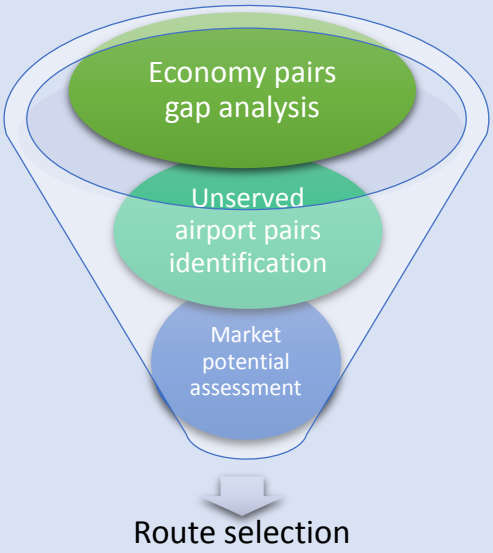

Figure 45: Funnel approach used to conduct analysis

The economy-pair analysis allowed IATA to identify unserved markets. The analysis showed that there is a daily demand of 1,643 Passengers Daily Each Way (PDEW) via existing connecting routes between the United States and Viet Nam where no non-stop service is presently available.

When extending the analysis down to the city pairs, it was possible to identify the largest unserved routes between the two economies. There are, for instance, 221 PDEW traveling between SGN and LAX.

The top 30 unserved routes for the entire APEC region are presented in the table below.

Origin Airport	Origin Economy	Destination Airport	Destination Economy	2015 OD Demand	Currently Served non-stop?	1-stop seats in 2015
MNL	The Philippines	YYZ	Canada	224	No	184
LAX	United States	SGN	Viet Nam	221	No	0
JFX	United States	MNL	The Philippines	202	No	178
JFX	United States	SYD	Australia	191	No	391
JFX	United States	SIN	Singapore	190	No	427
SFO	United States	SIN	Singapore	179	No	591
LAX	United States	BKK	Thailand	165	No	199
SFO	United States	SGN	Viet Nam	162	No	0
JFX	United States	MEL	Australia	133	No	0
PUS	Republic of Korea	SIN	Singapore	128	No	0
LAX	United States	SIN	Singapore	124	No	410
SAN	United States	YVR	Canada	123	No	28
JFX	United States	BKK	Thailand	121	No	0
JFX	United States	ITM	Japan	110	No	0
JFX	United States	SGN	Viet Nam	106	No	0
MCO	United States	NRT	Japan	105	No	246
SIN	Singapore	SHE	China	104	No	278
BKK	Thailand	DLC	China	99	No	197
IAH	United States	MNL	The Philippines	99	No	0
SHE	China	BKK	Thailand	97	No	45
JFX	United States	FOC	China	95	No	90
HKT	Thailand	BNE	Australia	94	No	0
LGA	United States	CUN	Mexico	91	No	44
LAX	United States	CGK	Indonesia	90	No	0
FLL	United States	YVR	Canada	88	No	12
MNL	The Philippines	BNE	Australia	85	No	66
MIA	United States	YVR	Canada	83	No	0
MIA	United States	YVR	Canada	83	No	9
SFO	United States	BKK	Thailand	82	No	0
SEA	United States	MEX	Mexico	81	No	34

Table 1: Top 30 unserved routes within APEC, 2015 data

Induction

To determine realistic estimates of the success of new air service, various assumptions were considered and applied to current passenger demand.

Induction is a well proven concept that explains how new direct air service has a significant impact on increasing the total number of O&D passengers on a city pair market. This is due to product improvement: shorter travel time, greater convenience, and more affordable ticket prices. The extent to which the market will be stimulated varies based on current levels of service (price and flight frequency) offered on a particular route. As stated in the Successful Air Service Development presentation (ICF International, 2014) a market's first non-stop flight can stimulate demand 100% to 300%.

IATA quantified this induction value to show a relationship between two primary factors: region pair and the size of the market before a new route is initiated.

The table below shows a sample of the stimulation rates considered for the analysis. For some instances where inadequate data (less than 4 routes) was available to conduct a region pair analysis, other variables were considered including the average of all routes, the average of long-haul routes or the average of short-haul routes, depending on the specific market.

Market	Base of 10,000 annual pax	Base of 25,000 annual pax	Base of 50,000 annual pax
All APEC Economies	130%	42%	18%
Long Haul	101%	36%	16%
Short Haul	150%	50%	21%
Australasia - South East Asia	159%	75%	44%
North America-Asia	104%	40%	
Asia - South East Asia	162%	53%	
Asia - North East Asia	155%	58%	27%
South East Asia - China	203%	78%	
South East Asia - North East Asia	125%		
Within Asia	160%	55%	24%
Within Southeast Asia	205%		

Table 2: Induction rates used during the analysis

Connecting potential

Increasing the quality of connections through alliance agreements, codeshares, shorter journey times or fewer stops increases overall travel demand in connecting markets. It is a normal phenomenon for new routes to not only increase demand for the city pairs served but also for beyond and behind destinations that are now more easily accessible (Swan, 2008). On long-haul routes, typically two-thirds of the passengers will make a connection.

IATA's analysis found that connecting markets would stimulate at various rates depending on the region of origin and the hub airport being flown through. These ratios are applied in determining the impact of a new route on connecting flows.

Table 3 below shows an example for Viet Nam:

	SGN	HAN
North America	16.2%	
Australasia	39.9%	
Asia	9.7%	5.3%
South East Asia	9.4%	3.7%
China	4.9%	7.2%
North Asia	14.4%	13.7%

Table 3: Connecting potential rates used when flying to/from APEC regions and SGN/HAN

	LAX	SFO	ORD	BNE	MEL	YYZ
South East Asia	31.3%	19.9%	94.7%	12.7%	9.3%	49.6%

Table 4: Connecting potential rates used when flying to/from South East Asia to a selection of other main hubs

Demand growth

This refers to the consideration of the natural growth observed on a market segment. IATA Economics publishes a detailed inter- and intra-regional global traffic forecast. These demand growth forecasts were used to provide a regionally specific rate of growth to and from Thailand between 2016 and 2018.

Growth was typically seen to be around 5%. Demand growth also refers to the fact that approximately 80% of a market will choose a non-stop flight option if it is available (Belobaba, 2015).

Other

Other factors, including distance and available traffic rights, were used to refine the assessment of potential new service to be offered. Distance determines the feasibility of offering a non-stop flight with existing technology, using 15,000km as a maximum distance. Available traffic rights consider the bilateral agreements between economies and the current use of those bilateral rights.

Final route forecast

After conducting the gap analysis and applying the established rates from the various assumptions, the future market potential was estimated, as illustrated in Figure 46 below for the SGN-LAX route.

				1	2	4	
Origin Airport	**Destination Airport**	**Destination Economy**	**2015 OD Non-direct Demand**	**OD Captured Though Deorect Service**	**OD Stimulation**	**Behind/Beyond Connecting Potential**	**Caculations**
SGN	LAX	United States	(A) 221	(B) 80%	(C) 12%	(D) 31%	
				(1) 177	21		(1) = AxB
				(2)			(2) = 1xC
			Subtotal	(3)	198		(3) = 1+2
		BNE-MNL Total Market Potential (2015 Base)				(4) **288**	(4) = 3/(1-D)

Figure 46: Example of the various assumptions being applied to determine the potential for new air service.

Appendix B: Overview of IATA and IATA Consulting

IATA

IATA: The International Air Transport Association was founded in 1945 as the prime vehicle for inter-airline cooperation in promoting safe, reliable, secure and economical air service for the benefit of the world's consumers. IATA is fully committed to supporting the commercial aviation industry's stakeholders and governments in their efforts to achieve profitability and long-term viability.

IATA's mission:

To represent, lead, and serve the airline industry.

IATA's vision:

To be the force for value creation and innovation driving a safe secure and profitable air transport industry that sustainably connects and enriches our world.

IATA in numbers:

- 250+ member airlines
- 83% of total air traffic
- D387B processed by IATA financial systems
- 1,400+ employees
- 54 offices in 53 countries

IATA Consulting

IATA Consulting overview

IATA Consulting has comprehensive experience in the full array of business challenges facing the aviation sector. Serving the airline industry for 70 years, IATA has developed unrivalled practical experience, which we bring forth to provide the best solutions to our clients.

With our depth and breadth of aviation industry experience, we assist clients to maximize the value of their operating model, realize growth ambitions and gain insights that translate into sustainable competitive advantages.

IATA Consulting has expertise in the following areas:

SAFETY & FLIGHT OPERATIONS

Solutions for aviation organizations and airlines to improve safety, efficiency and air transport management.

ENVIRONMENT & ECONOMICS

Solutions for fulfilling the vision of a safer, more competitive and sustainable aviation industry.

AIRLINES

Solutions to achieve real and lasting results in every aspect of airline commercial and operational management.

AIRPORTS, PASSENGERS & SECURITY

Solutions to plan your airport efficiently to avoid costly mistakes and profit from untapped opportunities.

GROUND HANDLING & CARGO

Solutions to optimize your operations and improve your safety and security while reducing costs.

Our Clients

IATA Consulting has successfully demonstrated its capabilities by providing airlines, airports, tourism offices, and other organizations with accurate, unbiased and reliable high quality information and analysis to help them define and understand their markets, while ensuring their long-term facility development and financial success.

IATA is trusted by multiple clients all over the world including airlines, airports, governments and aviation institutions.

Why IATA Consulting was chosen for this project

IATA has, over time, recruited and retained some of the most highly experienced and capable aviation consulting resources within the aviation industry. Due to its position at the heart of the industry, IATA has access to exceptionally skilled and informed subject matter experts and specialists. IATA Consulting's objective is to make a positive difference in its clients' performance, while delivering quality services to all industry stakeholders.

IATA Consulting provides its customers with vast knowledge and expertise in all sectors of the industry worldwide. Our approach has been finely tuned to leverage IATA's global presence and industry thought leadership position in the development of tailored solutions that fit with local cultural considerations and embody international best practices. Our consultants rely on international state-of-the-art standards, unmatched access to data, and products and expert resources to provide cost-efficient and highly informed solutions.

IATA is backed by a robust set of decision support tools, Airport IS and Pax IS have been essential to undertake this study.

Airport IS and **Pax IS** are the most comprehensive aviation databases available in the marketplace, capturing 100% of traffic around the world and bringing together total market supply and demand under a single platform. The data provided is accurate and reliable as it is captured through IATA's Billing and Settlement Plan (BSP).

Produced by

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