Operations

Advanced Information Systems and Business Analytics for Air Transportation

M.Sc. Air Transport Management

May 16-21, 2016

Slides prepared by Benny Mantin

Operations

- Operations are at the core of the airline business
  - At the strategic level: network design
  - Tactical level: aircrafts and schedules
  - Operational level: day-to-day operations
  - Other key operational aspects:
    - Revenue management
    - Maintenance
    - Service
    - Irregular operations

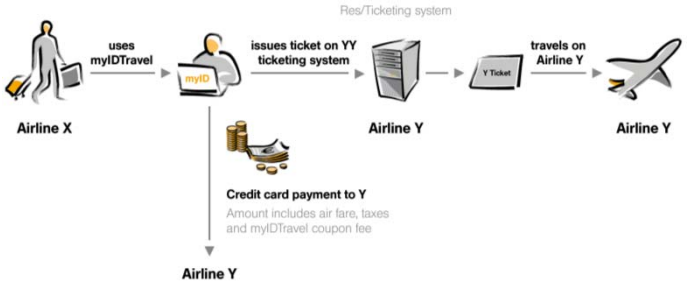
Current state

- Solutions generally
  - Paperless
  - Automation
  - Optimization
  - Shift to mobility

Digital cabin management (innova)
Recently transferred all flight reporting functions to iPads

flywize™
Cost-optimization for flight plan calculations

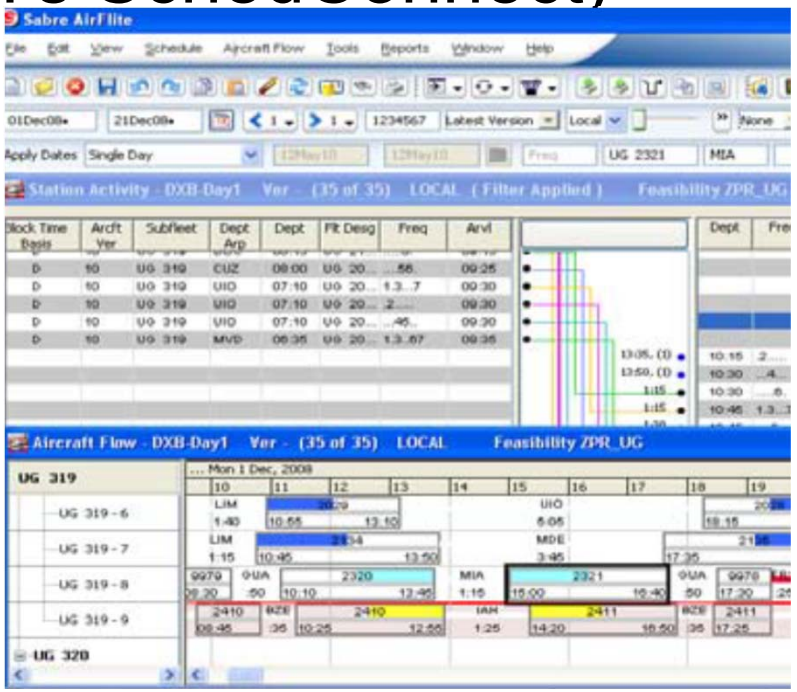
Navigation and charting
Lido/FlightOps optimizes process
Lufthansa Systems



myIDTravel: ticketing management for employees

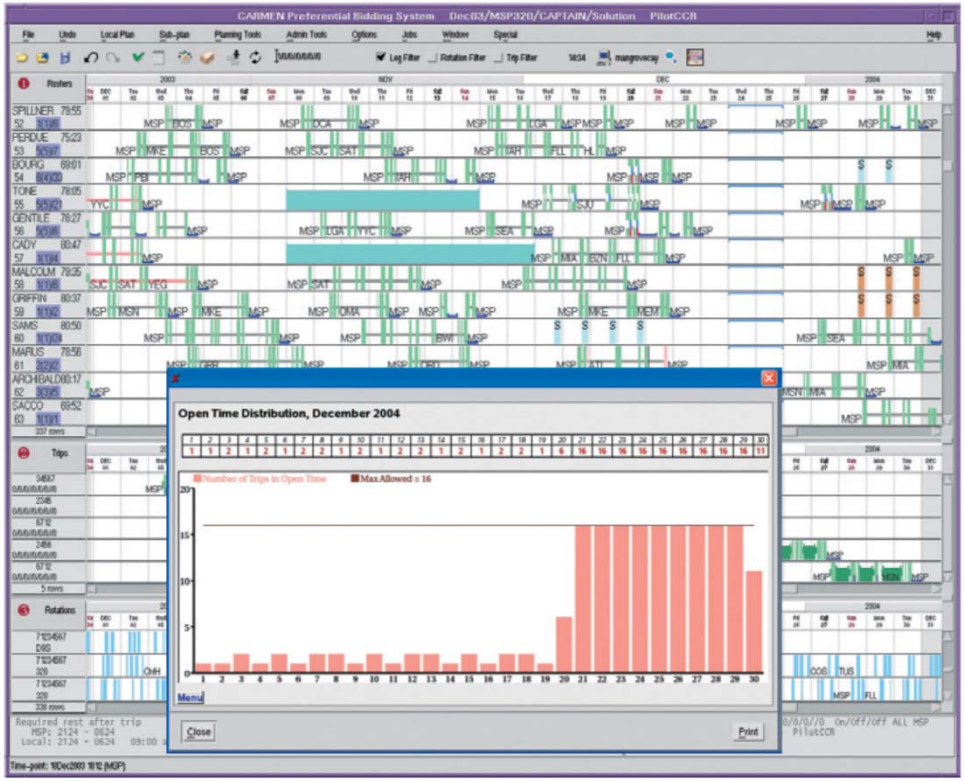
Examples

- Flight scheduling/management
  - A challenging problem
  - Generally no optimal solutions
  - Issue: code-sharing (LH's SchedConnect)



Examples

- Crew Scheduling/management
  - Challenging
    - Pairing, bidding, experience…



Rosters
Incomplete assignments
Rotations
Distribution of unassigned

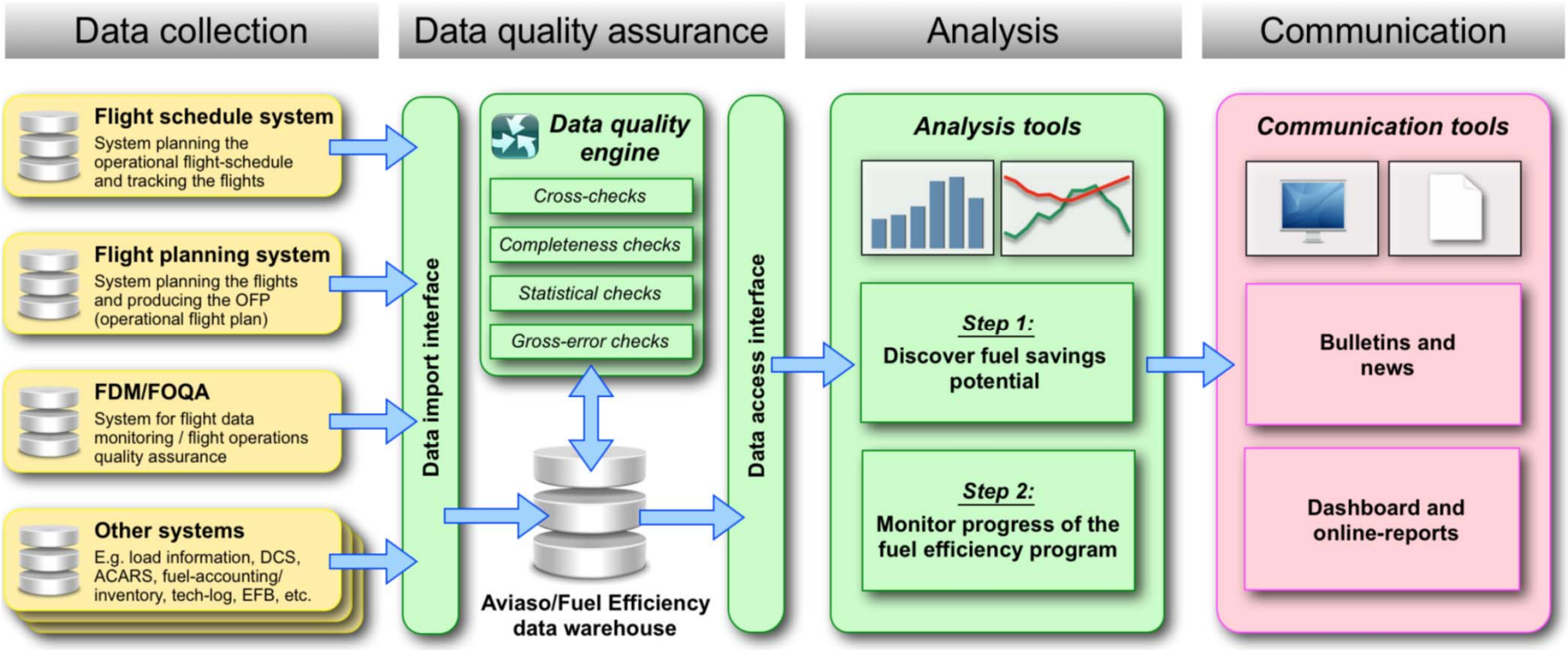
JEPPESEN
A BOEING COMPANY

Opportunities

- Consider a passenger arriving at the gate departure lounge
  - What does the passenger want to know?
    - Which row is currently being board?
    - Are we departing on time, and if not when?
  - In both cases the available information is not adequate.
- Boarding process is still inefficient
  - Blockage
    - Seat interference
    - Aisle interference
  - Passengers bring luggage that does not fit, too heavy to lift.
  - Solution? Passenger profiling?

Fuel efficiency

- From “inventory” perspective, here is a trade-off:
  - Too much fuel results with unnecessary weight
  - Not enough fuel and you might have to initiate an emergency landing…
- Solution approaches:
  - Optimization of flight profiles
  - Operational procedures such as
    - Reduced utilization of Auxiliary Power Unit (APU) or
    - One-engine taxi on the apron
  - Maximize aerodynamic characteristics
  - Reduce weight
  - Historical data to improve operations
    - IT systems that support post-flight analysis
  - Big Data
    - Predictive analytics to optimize fuel depending on the route, conditions, and other factors that may influence flight duration



FuelPlus Aviation Fuel Management

Openairlines

Aviaso connecting aviation and software

Brussels Airlines case study

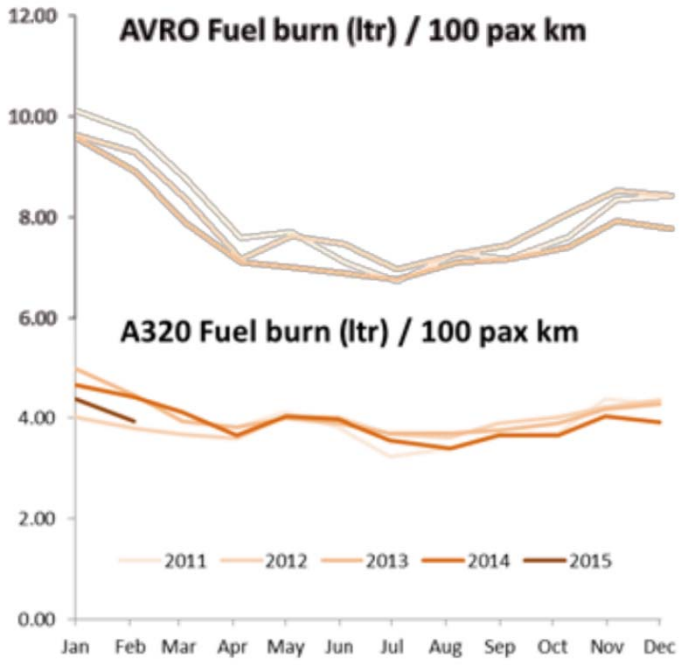
- 2012: Saving target: €6 million (2%)

2012	2013	2014	2015	2016
Initial target -2% fuel burn SECURED		Extended target -3% fuel burn SECURED	Fuel efficiency 3.0 -3.6% fuel burn ONGOING	

- Trivial fuel saving initiatives:
  - Reduced flaps landing'
  - '3 engine taxi-in'
  - use of ground power units
  - Weight reduction
  - in-flight speed reduction

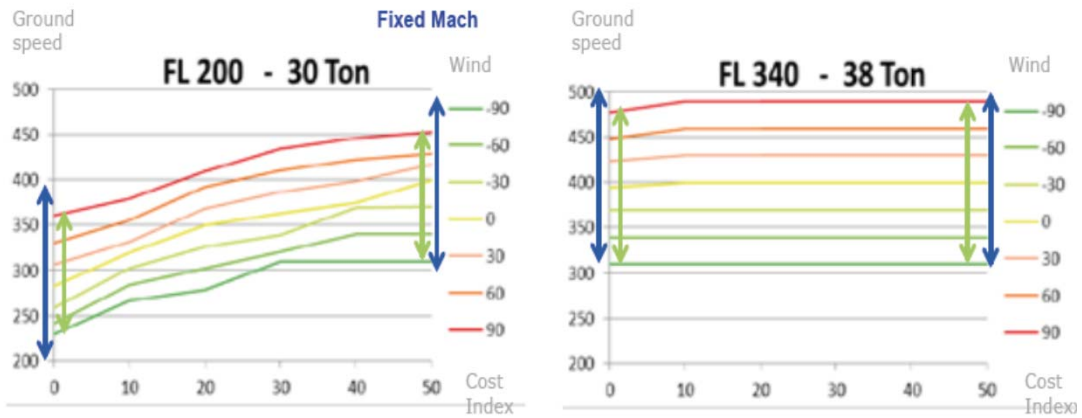
Lightweight equipment

- The main trade-off: time vs cost
  - Fly faster and save time
  - Fly slower and save fuel
  - Don't' forget: delays…



Test flights

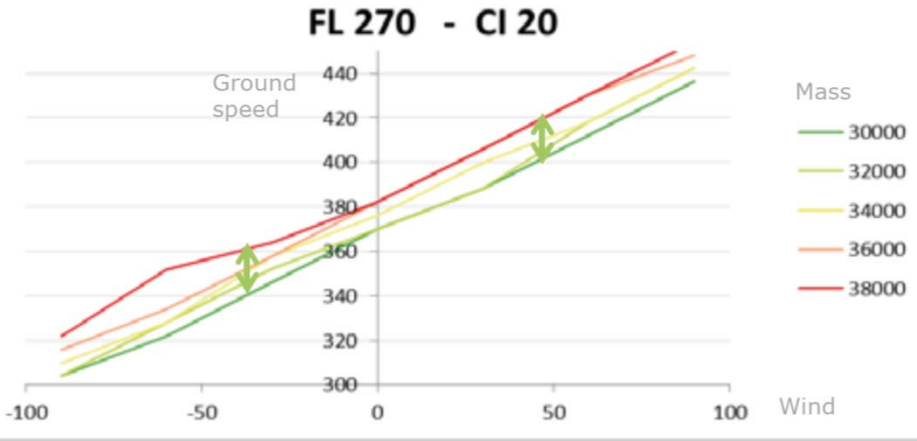
- Many factors:
  - Mass
  - Flight level
  - Speed, wind
  - …
- Some observations:
  - At low flight levels big difference on flown block times
  - Avoid flying at low levels
  - Fly at full capacity



LOW & LIGHT versus HIGH & HEAVY

- L&L gives highest speed variation
- L&L gives highest compensation of wind effect

IMPORTANT: CI flying will reduce the effect of wind on flight time. Avoid low SLF @ low level and low CI.



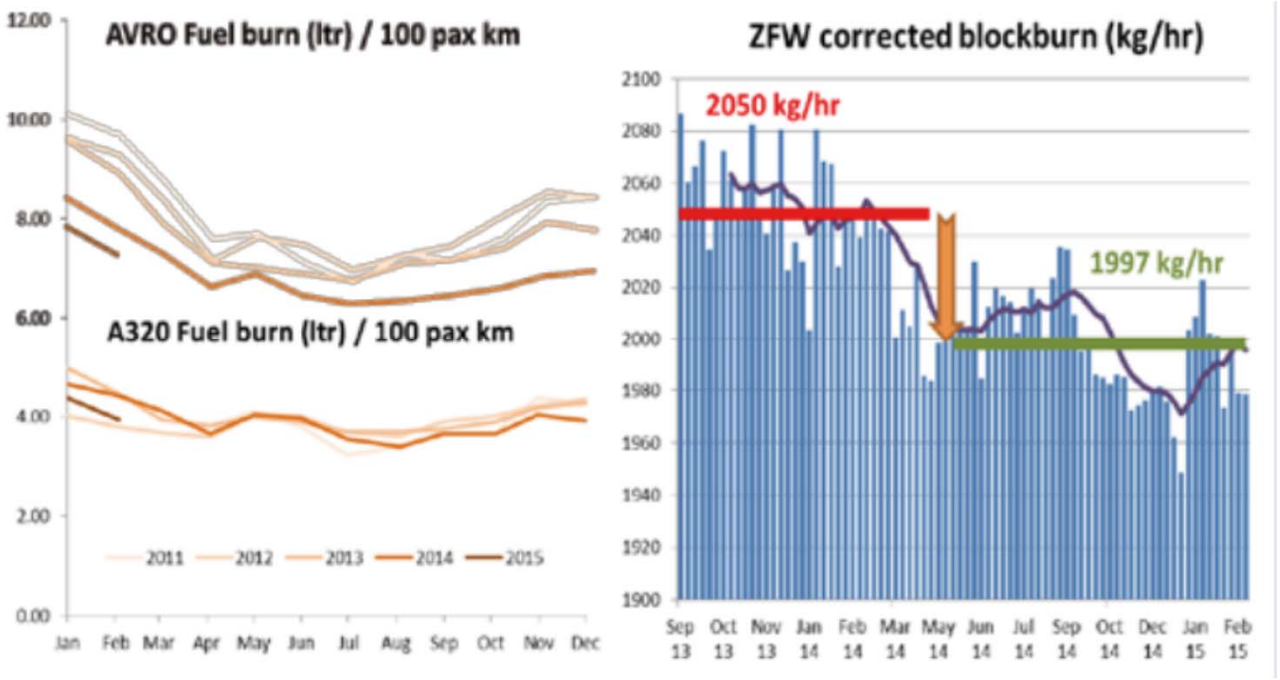
Effect of mass & wind at low level.

- Effect of heavy vs light is identical to 20 kts headwind.

IMPORTANT: Economy and efficiency go hand in hand. Fly fully loaded planes.

Outcomes

- 90% of flights at 5 min delay from 7 min (less dispersion)
- 2.5% savings in fuel burn



- Bear in mind: they have also increased seat load factor to facilitate fuel burn reduction

Airline Irregular operations

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June 1-6, 2015

Slides prepared by Benny Mantin

JetBlue's experience

- Valentine's day storm in 2007
  - Icy conditions at JFK
  - Most airlines canceled flights ahead of time
  - JetBlue decided follow its schedule
    - 8am: readied aircrafts for takeoff, weather permitting
    - 3pm: realized the outcome
    - Sent buses, some waited up to 11 hours
    - Due to cancellations, passengers had to rebook:
    - Luggage piled up
    - Operations planners had an application that found the best way to recover
    - During disruption off-duty crews call HQ to report location and availability

- Only via SLC reservation system
- Employees work from home
- Capacity: 650 agents
- Navitaire expanded to 950 (max before system upgrade is required); JetBlue struggled to find employees to staff
- Others volunteered to assist, but were not trained

- No computerized system to record and track
- System recorded number of bags and tag numbers
- A technology team developed an application to scan the tags and track the bags. This was completed within three days!!!

- The solution could not be transferred to the flight operations' application…
- A fix was patched within hours, but too late for this instance

- Due to the large volume of cancellations and calls, crews could not call HQ
- No database for tracking off-duty crews. A solution was developed within a day…

To restore reputation JetBlue initiated a massive campaign

Cancellations

All customers whose flight is cancelled by JetBlue will, at the customer's option:

- Receive a full refund
  OR
- Receive re-accommodation on the next available JetBlue flight at no additional charge or fare.

If JetBlue cancels a flight within 4 hours of scheduled departure and the cancellation is due to a *Controllable Irregularity*, JetBlue will also issue the customer a $50 Credit good for future travel on JetBlue.

Delays

Departure Delays

Customers whose flight is delayed due to a Controllable Irregularity are entitled to compensation good for future travel on JetBlue:

Delay time:	Compensation amount:
• 1:30 - 1:59 hours:	$25 Credit
• 2 - 2:59 hours:	$50 Credit
• 3 - 3:59 hours:	$75 Credit
• 4 - 4:59 hours:	$100 Credit
• 5 - 5:59 hours:	$125 Credit
• 6 or more hours:	$200 Credit

*JetBlue will provide free movies on flights that are greater than two hours in duration for customers whose flight is delayed more than 3 hours after scheduled departure.

Onboard ground delay on arrival

Customers who experience an Onboard Ground Delay on arrival are entitled to compensation good for future travel on JetBlue:

Delay time:	Compensation amount:
• 1 - 1:59 hours:	$50 Credit
• 2 - 2:59 hours:	$125 Credit
• 3 or more hours:	$200 Credit

Overbookings

(As defined in JetBlue's Contract of Carriage)
Customers who are involuntarily denied boarding shall receive $1,300.

http://www.jetblue.com/p/about/ourcompany/promise/Bill_Of_Rights.pdf

JetBlue's winter nightmare

- Is JB overreacting?
- JB "consistently cancels flights sooner than rivals when storms pummel the U.S. Northeast"
  - 74% of flights cancelled 12+ hours before schedule
  - United Continental second with 43%
  - According to the CEO: **"By canceling in advance, you can deploy the crew onto other flights. […] We can fly more people where they want to go, and we have to give less refunds, frankly."**
- During the first week of January 2014 essentially shut operations at Boston's Logan and three NY airports.
- On Monday it cancelled 435 flights (about half its schedule) affecting 49,000 pax (with a total of 150k over six days)
  - Some cancellations due to federal rule on pilot rest time and how delay is being counted
- Note: JB registers 0.67 complaints per 100,000 passengers (one of the lowest, compare with UA's 2.3), and it has one of the lowest rates of canceled flights.

Read: http://uk.businessinsider.com/r-jetblue-earliest-to-cancel-during-storms-says-fewer-refunds-result-2015-4?r=US&IR=T

Operational trends

- Operations research
  - Math formulas to optimize schedules and reduce delays
  - Limitation: abstract away from passengers' perspective
- Operational control centers
  - Complex computer systems, centralized; dedicated teams to different functions; specific teams reach out to premium customers
  - Limitation: no personalization to most passengers
- Re-accommodation technology
  - Automatic rebooking
  - Limitation: generally ignore passengers' preferences
- Self-service tools
  - Empower passenger to solve irregular operations problems
  - Limitation: airlines IS has not matured yet to provide customization
- Prioritizing customers
  - Minimize impact on loyal consumers
  - Limitation: hard to implement, especially at hub airports and due to mergers and alliances (many premium customers)

Source: Passengers first

Challenges

- Cross- carrier re-accommodation
  - Airlines try to re-accommodate passengers on their own airline for economic and loyalty reasons.
  - Legacy system constraints present obstacles to cross-carrier re-accommodation.
  - Individual agreements between airlines do not always adequately compensate the receiving airline for the full value of the seat.
  - Impact: reconsider and revise policies as my improve handling of IROPS, ease disruption to passenger
- Siloed nature of airline systems and functions
  - Siloed functions to provide greater focus on key areas of the business.
  - Key functions for irregular operations such as mobile strategy are driven by marketing.
  - Revenue impact of irregular operations on passenger loyalty is not adequately measured.
  - Impact: single view of customer is absent avoiding proper prioritizing; multiple departments need to coordinate efforts

Source: Passengers first

Challenges

- Ensuring information is timely and authoritative
  - Communication is often not timely.
  - Airlines compete with third-party apps that have better information.
  - Impact: Passenger communication must be more timely, provide greater insight into the nature of the delay, and be personalised to the passenger's needs.
- Collaboration between industry players
  - Account for 60-70% of pax booked
  - Impact: Key information, such as the passenger's mobile number, is often missing, preventing the airline from contacting the passenger. =>perceived conflict of customer ownership between airlines and distributors: Who will provide the solution for the irregular operations. If the distributor re-accommodates the passenger, this often results in a no-show on the re-accommodated flight provided by the airline.
- Airline-Airport coordination
  - Lack of coordination with airport and ground handlers, due to limitations in information-sharing across systems, or unwillingness to share
  - Impact: impact flow of baggage during journey disruptions, availability of staff to assist pax at airports (where agents are outsourced)

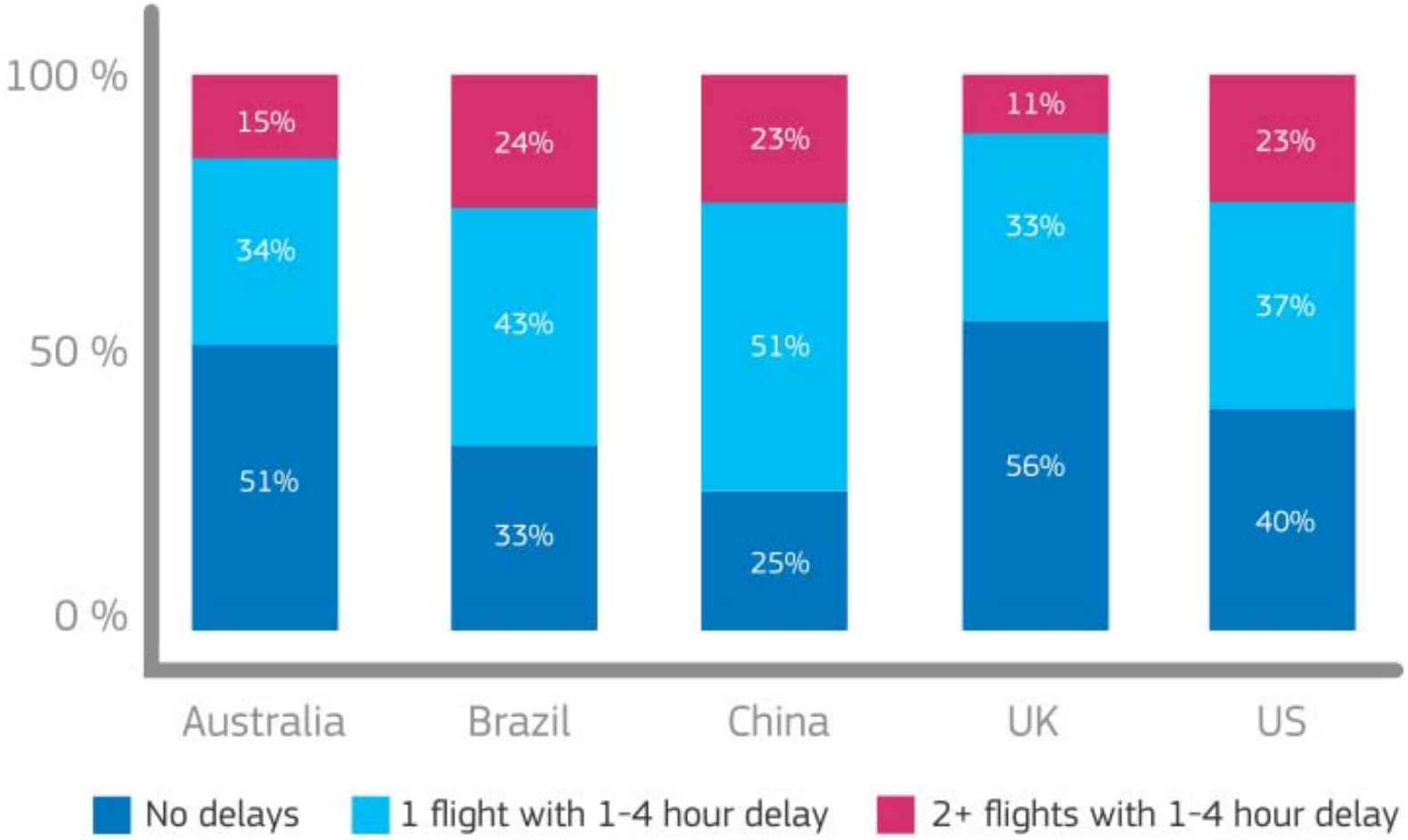
Source: Passengers first

Key Findings

- Greatest challenge/opportunity:
  - Managing moderately delayed passengers.
- Top issue:
  - Lack of communication
  - Airlines must alter customer sentiment by providing proactive, authoritative communication around delays/disruptions.
- Passengers believe they should be compensated:
  - Many are happy with soft compensation.
  - Soft compensation should be viewed as an investment in loyalty, regardless of whether the carrier is at fault.
- Experiences and expectations may differ by culture
- Passengers continue to talk through social media.
- Airlines must embrace social network analysis
  - Understand the influences and find ways to change passenger sentiment.

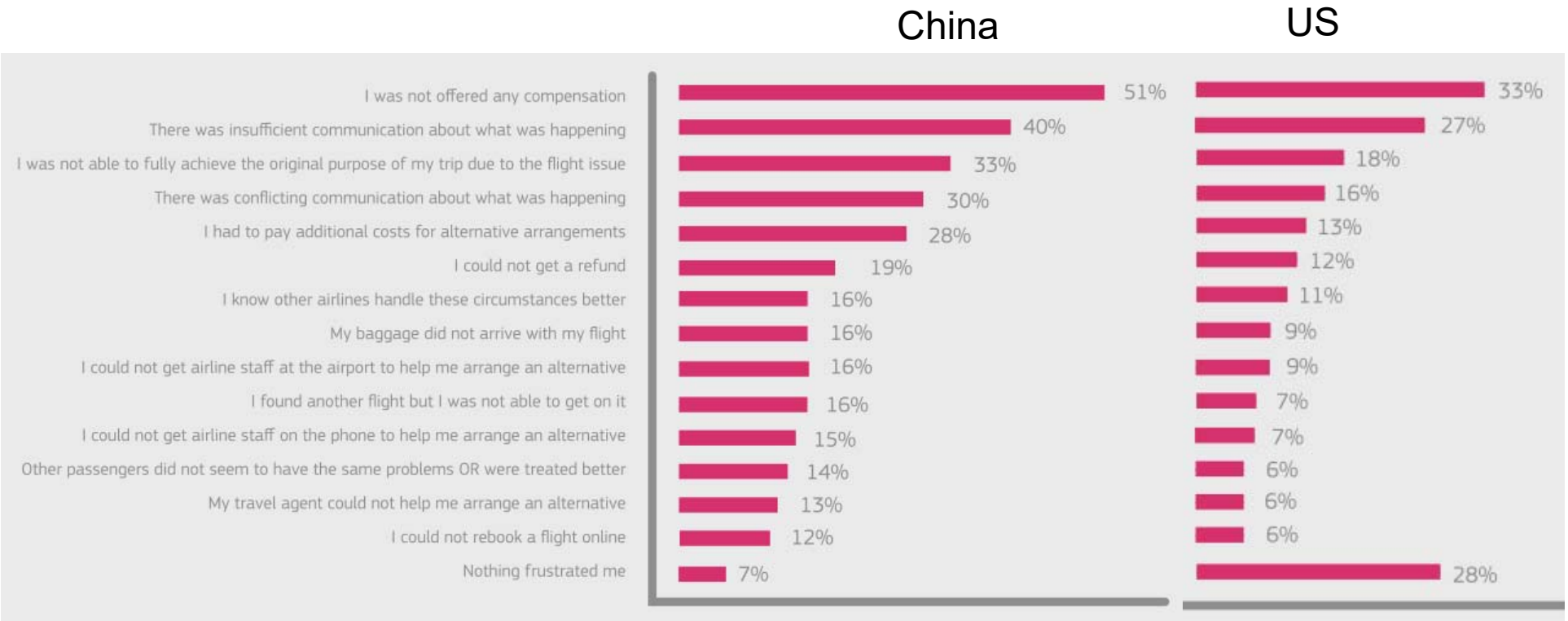
Source: Passengers first

Passenger Journey Disruptions, 1-4 Hour Delays, by Market



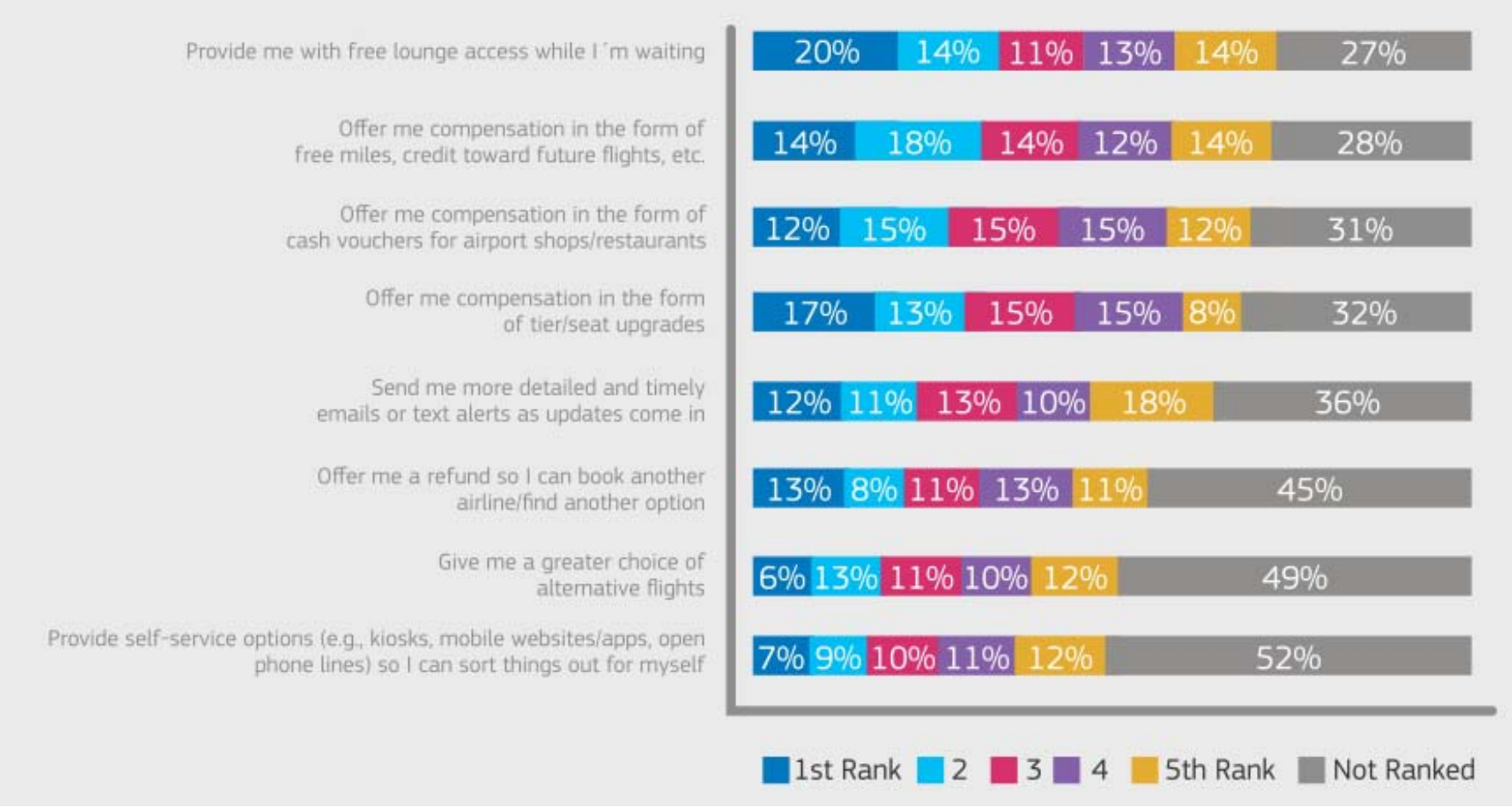
Source: Passengers first

Frustration with Airline Delays/Disruptions



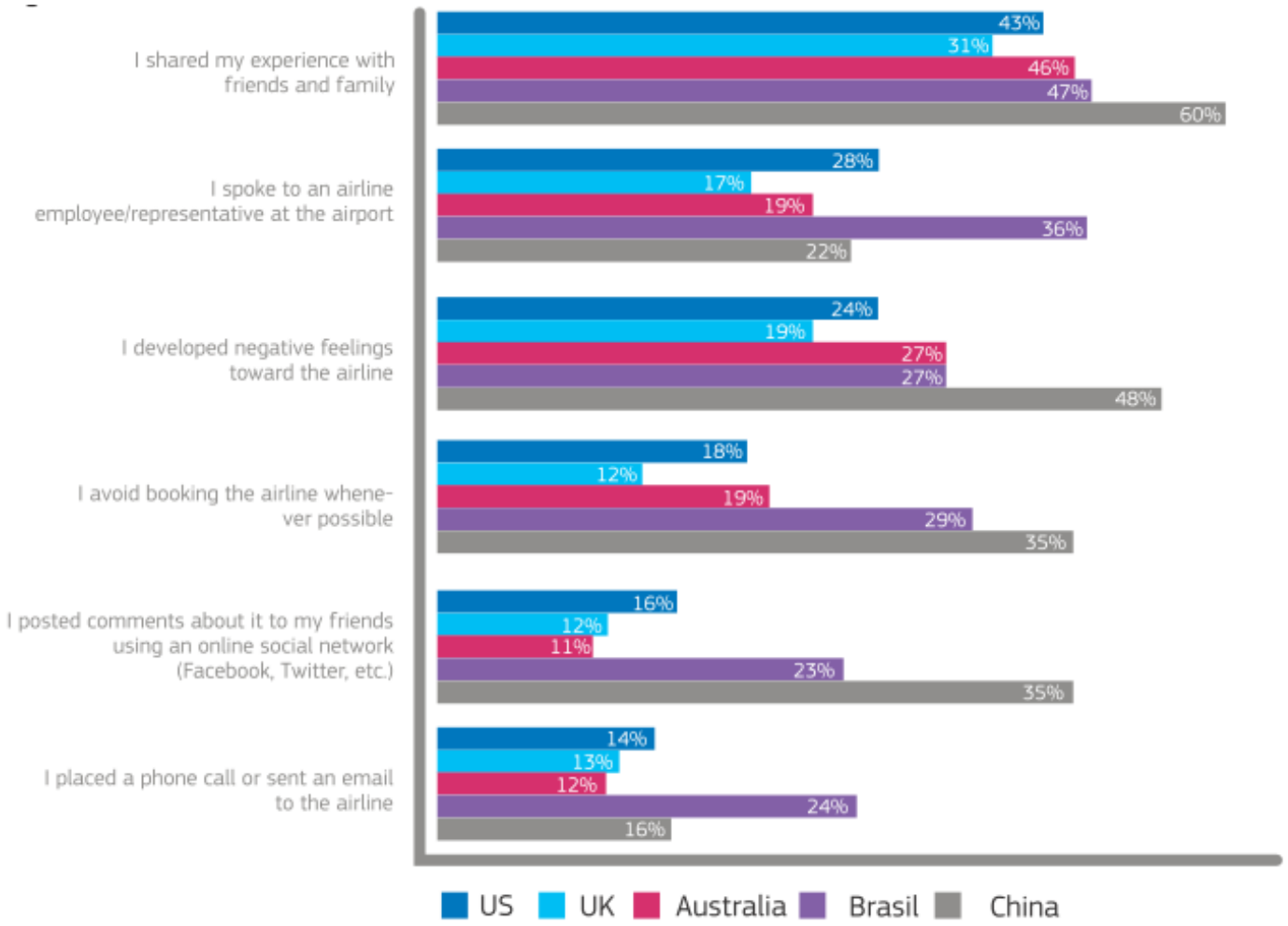
Source: Passengers first

Top Solutions to Improve Passenger Journey Disruption: Australia



Source: Passengers first

Reactions to flight Delays Disruptions

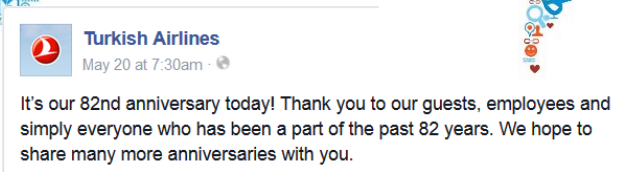


Source: Passengers first

Social Media & Passenger Frustrations

- Often social media amplifies passengers' negative sentiment about irregular operations.

- Most airlines manage social media only rudimentarily and lack sophisticated analytics to measure brand impact
- Airlines' typical social media strategy:
  - Counting followers
  - Promotions
  - Brand management



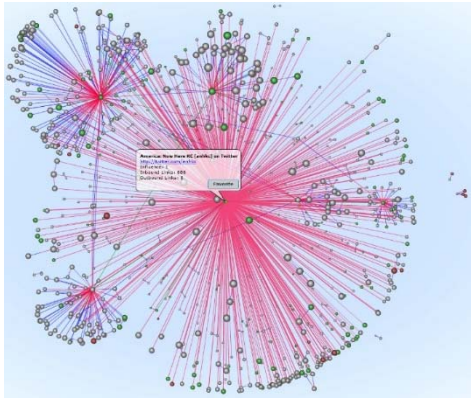
⇒Airlines need to embrace and execute a more strategic approach to social media and better understand passengers' true influence.

- Learn from certain airlines that have used social media as a communication platform when other systems have failed (e.g., AA).

Source: Passengers first

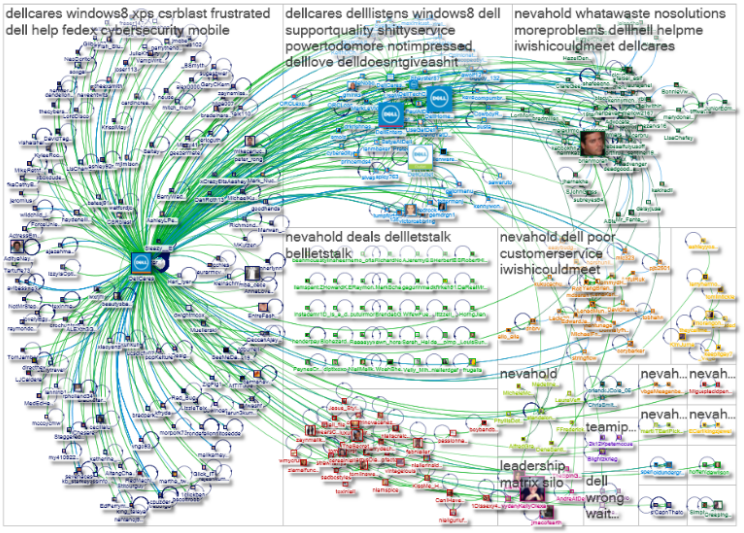
Social Network Analysis & Mapping

- Emerging field, graphical representations of that social network.
- Visual representation of conversations
  - Identify the level of influence key passengers have as they express frustration about journey disruptions.
  - Allow airlines to change passenger sentiment
  - Identify valuable passengers
  - Distribute personalized offers



Mapping social media mentions can show which Twitter users are the most influential within one specific topic.

Social Network Twitter Map for customer complaints for a major business



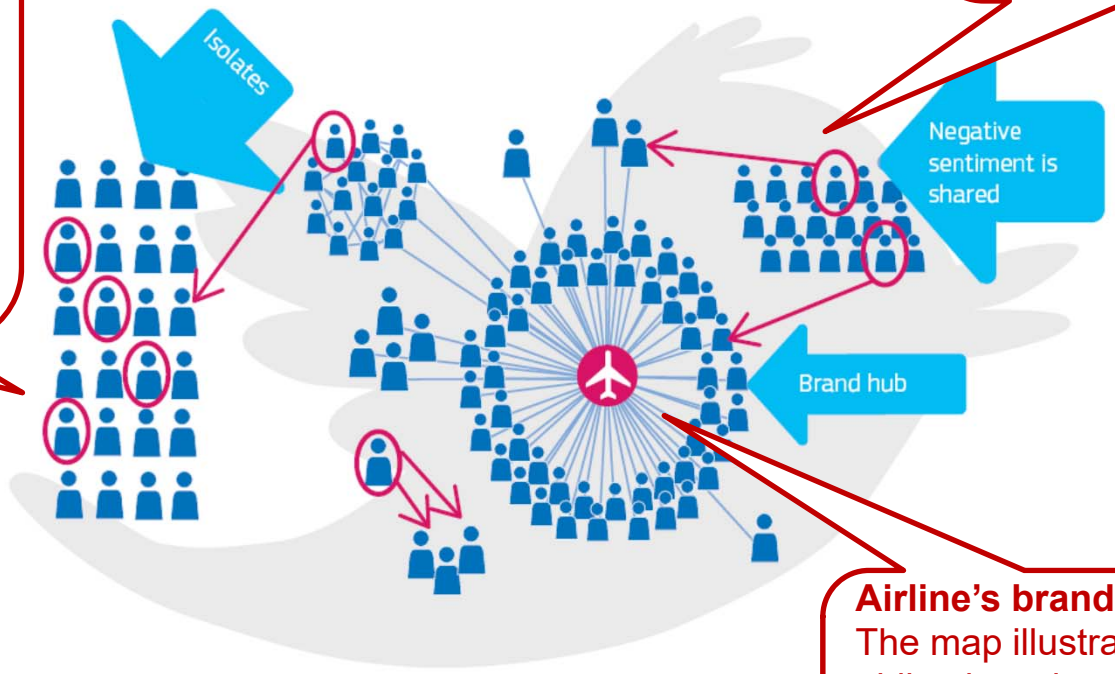
Source: Passengers first

Social media mapping: characteristics

Network Graphs
The Social Media Research Foundation

Isolates – These passengers tweeted about the airline, but have not been engaged by the brand. Engaging with them provides an opportunity for the airline to address the negative sentiment.

Tracking negative sentiment – This part of the map shows how negative sentiment from one customer can be communicated to others who are inter-connected.



Airline's brand hub – The map illustrates how airline brand accounts tend to use a broadcast (i.e. one-to-many) social media strategy.

Source: Passengers first

Analyzing the True Revenue Impact of Irregular Operations

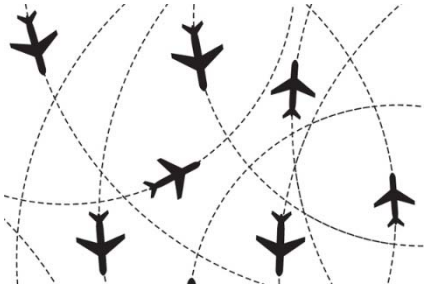
- How to measure the impact of irregular operations on customers?
  - Not only focusing on direct costs
    - fuel, crew and aircraft maintenance
  - Customer-centric approach is needed
    - customer loyalty, lifetime value and customer influence.
- What is an individual's revenue contribution and influence?
  - Depending on the individual's influence on a social network
  - Integrating traveler data with operational performance, to clearly track how customer behavior is influenced.
- Substantial cost in implementing a customer-centric approach to irregular operations management.
  - Need to balance relative cost of losing a customer's life-time revenue against investing in proactive tactics

Source: Passengers first

Implementing a Standard Service Approach

- Delays and cancellations are part of daily operations
  - Minor and moderate delays represent the biggest opportunity
  - Implementing a standard service approach to managing irregular operations forces the airline to rethink the process of re-accommodation.
- The question to ask is not how an airline can shift people from a delayed or cancelled flight to another aircraft, but how the delay impacts each passenger's planned journey
- Airlines must be the authoritative source for real-time information
  - Avoid passengers relying on a third-party flight-tracking app
- Airlines must deliver to each passenger, through social media, meaningful information about the impact of a delay on that passenger's journey.

Other considerations

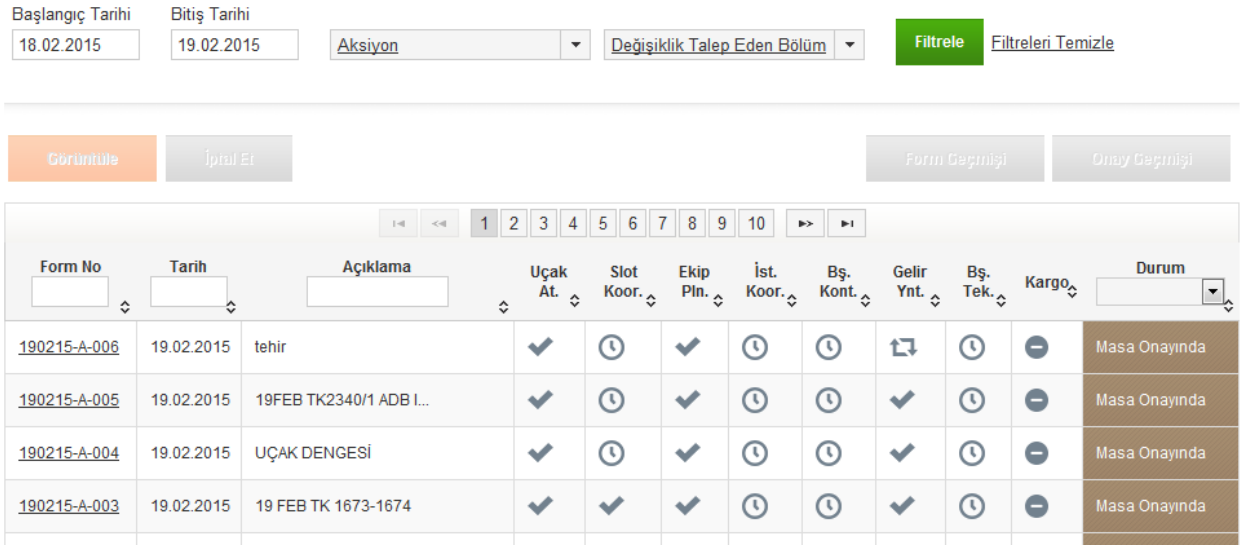


- Robust scheduling
  - Can react to irregular operations
  - Consumers weigh irregular operations more than statistics
  - Create schedules flexible enough to enable the vast majority of passengers to stay on their scheduled itineraries, if delays occur
- Passenger compensation
  - Abandon a compensation model that only focuses on fault.
  - The reality: passengers' expectations have been impacted.
  - Improve effectiveness of response to delays/cancellations, even if the airline is not at fault.
    - Economical: based on passenger value.
    - Electronic delivery and personalized

IROPS at THY

- In 2014: 19.6% of flights experienced a delay (US: 21.3%) The objective is 86%
- Operation Control Center (OCC) founded in 2006
- Reorganized in 2012 as the Integrated OCC (IOCC)
  - IOC management
  - Flight operations
  - Maintenance operations
  - Station operations
  - Flight capacity and efficiency
  - Operations planning
  - Fuel management
  - Crisis management
  - (full description in appendix)

Tulin's analysis



- Need: IT system support for decision making. A communication tool.:
  - Information and tasks
  - Information dashboard

Tulin's analysis

RISK ASSESMENT TABLE						
Likelihood		**Consequences**				
		Insignificant	Minor	Moderate	Major	Catastrophic
Almost Certain	90%	High	High	Extreme	Extreme	Extreme
Likely	50 - 90	Moderate	High	High	Extreme	Extreme
Moderate	10 -- 50	Low	Moderate	High	Extreme	Extreme
Unlikely	3 -- 10	Low	Low	Moderate	High	Extreme
Rare	< 3	Low	Low	Moderate	High	High

Event Type	Likelihood	Impact	Severity
WEATHER PROBLEM	Moderate	Major	EXTREME
STRIKE - TURKEY	Unlikely	Major	HIGH
STRIKE - Other Country	Moderate	Minor	MODERATE
ATC FAILURE	Moderate	Moderate	HIGH
ACCIDENT - Major	Rare	Major	HIGH
POLITICAL INSTABILITY - Turkey	Rare	Major	HIGH
POLITICAL INSTABILITY - Other	Moderate	Minor	MODERATE
Airport Related Problems	Moderate	Major	EXTREME
IT System Failure	Unlikely	Major	HIGH
Airplane INCIDENT	Unlikely	Minor	Low
Natural Disaster (IST)	Rare	Catastrophic	HIGH
SECURITY (Bomb Threat)	Moderate	Minor	MODERATE

APPENDIX

IOCC

- **Integrated Operations Control Management**
- Operational Analysis, Control and Solutions
- Sustainability of Operations
- Decision Making Mechanism
- Strategy and Actions
- On time Performance
- Coordination with stakeholders

- **Flight Operations Control Management(FOCC)**
- Flight Planning– Flight Tracking
- Crew Coordination
- Cost Saving
- Airport Slots, Slot Coordination
- Flight Dispatch Release
- Revenue Management, Controlling of Load factor for the flights
- **Irregular Operations Planning:**
  - Humanitarian Aid
  - Fog
  - Aircraft Hijack
  - Winter Operation
  - Political Instability
  - Strike
  - Sand Storm
  - Bomb Threat
  - Natural Disasters - Earthquake
  - Volcanic Ash Cloud
  - Closed Air Field
  - Aircraft Accident

- **MAINTENANCE OPERATIONS CONTROL MANAGEMENT (MOCC)**
- Avoid Delays
- Flight Cycle/Flight Hour Limitations and Optimization Controls for Aircraft changes
- Tracking of aircrafts' technical status
- Coordination with THY Technic
- Aircraft Tail Assignment
- Management of Maintenance Slots

- **Station Operations Control Center (SOCC)**
- Stations Contact Management
- Coordination with Stations
- Operational Analysis
- Reports and Solutions
- Movement Information Tracking and Providing support for completion of actual data
- Disruption Management and Decision Making
- Control and Management of Operational Information

- **Flight Capacity and Efficiency Management**
- ATC Reporting
- Taking Preventive Measures for Winter Operations
- Coordination with Eurocontrol, IATA, CAA
- Navigation management based on performance
- Coordination for AHL –Istanbul Airport Terminal Area Rehabilitation
- Coordination for ATC – Air Traffic Control
- Coordination for Air Space Management
- Capacity Analysis for AHL – Congestion
- Efficient Departure – Arrival Management

IOCC

- **Operations Planning and Support Management (OPDM)**
- Dispatch for VIP Flights
- Sector Planning, Airport Authorization
- Over flight Permissions Management
- Meteorological Controls

- **Flight Planning and Performance Management (UPPM)**
- Flight Information and Navigation Systems
- Air – Land Communication Systems
- Navigation Documentation
- Flight Performance Engineering
- Weight and Balance
- Electronic Flight Bag

- **Operational Fuel Management**
- Fuel Saving
- Fuel Quality Control
- KPI Tracking

- **Crisis Management and Support**
- Contingency Planning
- Rehearsals for Contingency
- Family Support Teams Management and Trainings
- Keep Crisis Management Room ready