

# Automated Crew Assignment

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**AGIFORS**



# bmi Operations

- 13 Crew Bases
  - including the following hubs:  
LHR, MAN, EMA
- 8 Fleet Types
  - F70, F100, B737, A320/321/330, Saab 340, Emb 145
- Crew Size
  - 550 Technical Crew
  - 1,550 Cabin Crew
- 350 daily flights



# Rostering issues at bmi

- Large amount of crew preferences
  - Minimum/Maximum night stops
  - Block windows
- Crew requests that restrict work flow
  - Days off request
  - Early finish/late start
- Complex Union rules
  - Standby restrictions surrounding days off
  - Early/late duty start restrictions

# Rostering issues at bmi (cont)

- Large number of crew bases
  - Crew can operate from several bases
- Balancing of crew workload
  - Some bases have a limited number of crew
- Limited time for roster generation
  - Roster generation process must be completed in 14 days

# Desirable Roster Qualities

- Good proportion of assignment
- Equitable distribution of duties
- Equal balance of flying/duty hours
- Cope with pre-assigned crew preferences
- Good roster flow
- Even spread of days off
- High crew utilisation

# Key Crew Expectations

- Equal distribution of work
  - Flying hours
  - Duty hours
  - Standbys
- Crew preferences
  - Number of night stops

# Proposed Solutions

- Complexity of problem dictates the need for advanced system automation
- Multiple and sometimes conflicting rostering objectives drive the need for a more global, optimisation-based approach
- Partnering with Sabre for system development

# System Design

- A two phased optimisation approach will be utilised
- Initial phase will address work flow patterns
  - Determine ideal on/off sequences while satisfying flying requirements and pre-assignments
- Secondary phase that maximises coverage and satisfies fairness issues
  - Fairness is incorporated into the objective function using a multi-weight scoring algorithm

# System Design (cont)

- Phase 1: Work Flow Pattern Generation/Optimisation
  - Determine ideal on/off sequences (e.g. 5 on/2 off)
  - Desired work flow patterns can be entered with different priority weightings
  - Work flow patterns will be optimised around pre-assigned duties
  - Objective is to maximise number of desired patterns
  - Assignment of work flow patterns must satisfy flying and standby requirements on a daily basis
  - All days off rules will be satisfied

# System Design (cont)

- Phase 2: Duty Assignment
  - Key objective is to assign pairings and standbys whilst preserving ideal work flow patterns
  - Assignment process is based on fairness
    - Balance of duty hours
    - Balance of flying hours
    - Balance of standby duties
  - Fairness elements are components of objective function for optimisation
  - Assignment will consider crew night stop preferences
  - Multiple assignment combinations/passes are evaluated to maximise coverage of duties

# Future Design Considerations

- Overall design is flexible enough to incorporate future considerations
- Additional crew preferences
  - Flight, station, days off (generic or specific)
  - Buddy preferences

## Additional fairness criteria

- Layover stations and hours
- Renewal of qualifications
  - Pre-emptive assignment of duties to keep crew current (e.g. station qualifications or fleet qualifications)

# Implementation Approach

- Implementing features in phases so as to learn how to tune solution quality as complexity increases
- Phase 1: Evaluate and tune system to achieve ideal work flow patterns with existing pre-assigned duties
- Phase 2: Evaluate and tune scoring function to achieve fairness goals
- Other extensions include additional crew preferences and ensuring recurrent qualifications of crew

# Expected Solution Benefits

- Maximisation of pairing coverage
  - Key factor in optimisation process
  - Logic to enhance coverage by moving requested days off

Improve crew satisfaction and preferences

- Fairness scoring function takes a more global view of roster period and scores multiple possible assignments before selecting best crew
- Pattern Quality
  - Allows crew planner to control quality of roster work and days off patterns
  - Strikes acceptable balance between crew and management aims

# Timescale

- Phase 1: Delivery in July 2001
  - bmi will conduct Beta testing for several months
  - Anticipated to roll out for production use by Sep 2001
- Phase 2: Delivery expected first quarter 2002
- Refinement of model will be a joint exercise among several airline users
  - Annual formal and quarterly focus group meetings to determine common needs and future development

# Questions

- Any questions?

