A Primer on PRAS

The Boston Logan Airport

Preferential **R**unway **A**ssignment **S**ystem

What is it,
What was it intended to do, and
How is it working?

Why Preferential Runway Use

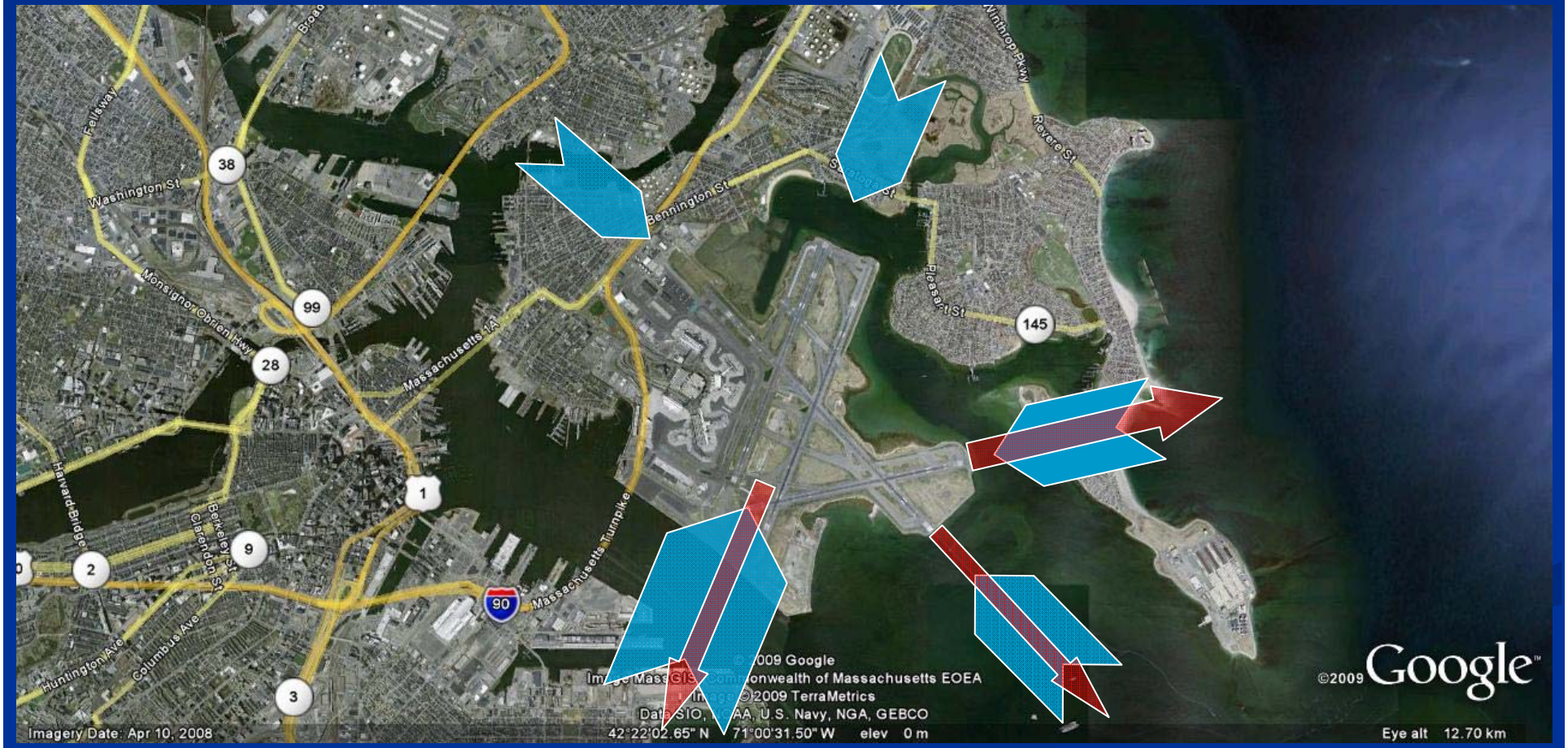
- Similar to flight track preferences, runway use programs are designed to direct, within operating capabilities, aircraft from over populated areas to areas of compatible land use.
- Use of approaches over compatible land are a principal component because approaches must be on a stable course from about 5 miles out.
- Departures may be routed to the nearest compatibly used land/water by the shortest flight route.

1959-1968

- Preferential runway use has been in place at BOS since 1959. Prior to 1968, runways were intuitively selected based on wind direction with a preference to route traffic over water rather than populated areas.
- Configuration with landings on Runway 4 and departures on Runway 9 was believed to provide a good combination of both wind selection and noise abatement, followed by Runway 22R/L for landings and takeoffs.
- At night,
  - Landings were most preferred on Runway 33L
  - Takeoffs were most preferred on Runway 15L

Early Runway Use Philosophy

By 1968, usage preferences had been established for takeoffs on 15R, 9, and 22L/R; all runways were considered equal for landings, but Runway 22R/L and 15 were least preferred



1975 - PRAS Formalized

- In 1975, a program was adopted to provide a maximum of noise abatement, without hindering continued operation of the airport.
- It established runway priorities for both daytime and nighttime periods.

PRAS Intent

- Long Term – reduce the total noise impact on the population residing within the 65 DNL contour; and maximize over-water operations to from 15R/33L
- Short Term – Provide relief from continuous operation over any one area (dwell); and from persistent operation over any one area for a period of days (persistence)

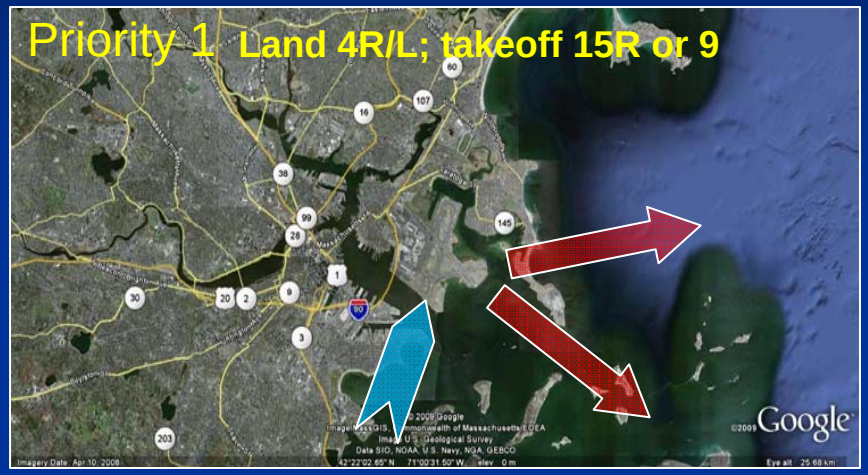
Early PRAS goals were to:

- Conditions allowing, use compatible over-water corridors for departure and arrival
- Distribute remaining noisy events more equitably from all runway ends using annualized runway use goals
- Moderate the length of exposure of any one sensitive area to over-flight events
  - Less than 8 hours on one day (dwell)
  - Less than 23 hours in a 3-day period (persistence)

Constraints on PRAS Use

- Weather constraints and operating criteria were identified:
  - Crosswinds do not exceed 80 degrees
  - Wind velocity is not more than 15 kts.
  - Runways are clear and dry
- The runway use scheme selected had to have capacity to accommodate the expected traffic demand during its period of use.
- Landings on 22R and takeoffs on 4L could be used by aircraft weighting 12,500# or more only when a significant operational requirement or emergency situation exists

1975 Day Runway Use Priorities



1977 PRAS Modification

- It was modified in 1977 to establish a separate preferred use scheme for night that differed from the daytime scheme and took into account lower traffic levels at night.

1977 PRAS Modification

Further, at night

- a maximum tailwind of 5 kts. deemed acceptable
- weather had to provide 3 miles visibility and 1000 ft. ceilings, with winds less than 15 kts.
- runways were to be clear and dry
- full runway length was required except on 15R.
- landings on 22R and takeoffs on 4L could be used by aircraft weighting 12,500# or more only when a significant operational requirement or emergency situation exists.

Pilots-in-charge retain ultimate runway choice

1977 PRAS Night Priorities

In 1977, a new nighttime preferential selection was established, and 22R shall not be used at night for any landings and no departures shall be assigned to 4L, unless no other runways are available.

1982 PRAS Program Goals

- Minimize the number of residents in areas where the DNL is greater than 70 and 75 dB, without significantly increasing these high impacts for any group of residents.

1982 PRAS Mandatory Weather-Based Constraints

- No significant wind shear
- Visibility greater than 5000’ (one statute mile)
- Runway braking action much be good and runways free of snow, slush, ice or standing water
- On clear and dry runways
  - Crosswinds must not exceed 20 kts.
  - Tailwinds must not exceed 7 kts.
- On runways not clear and dry
  - Crosswinds must not exceed 15 kts.
  - Tailwinds must not exceed 3 kts.

1982 PRAS Mandatory Activity-Based Constraints

- Only those runway combinations that can accommodate the demand level at the time can be considered. Note that:
  - To transition from one runway use pattern to another now takes up to 30 minutes, so winds must be forecast to hold for a length of time to warrant any configuration shift,
  - Shifts can take as little as 5 minutes if they are planned for,
  - Shifts from lower to higher capacity configurations must be in place before high capacity demand period begins, and
  - Shifts from higher to lower capacity configurations must wait until the high capacity period ends.

1982 PRAS Elements

- PC based program installed to select preferred runway configuration
- Based on 572 jet operations daily
- Intended to limit the persistence of noise over populated areas off single runway ends daily, over a period of days, and annually
- The only priority was for nighttime takeoffs on Runway 15R and arrivals on 33L

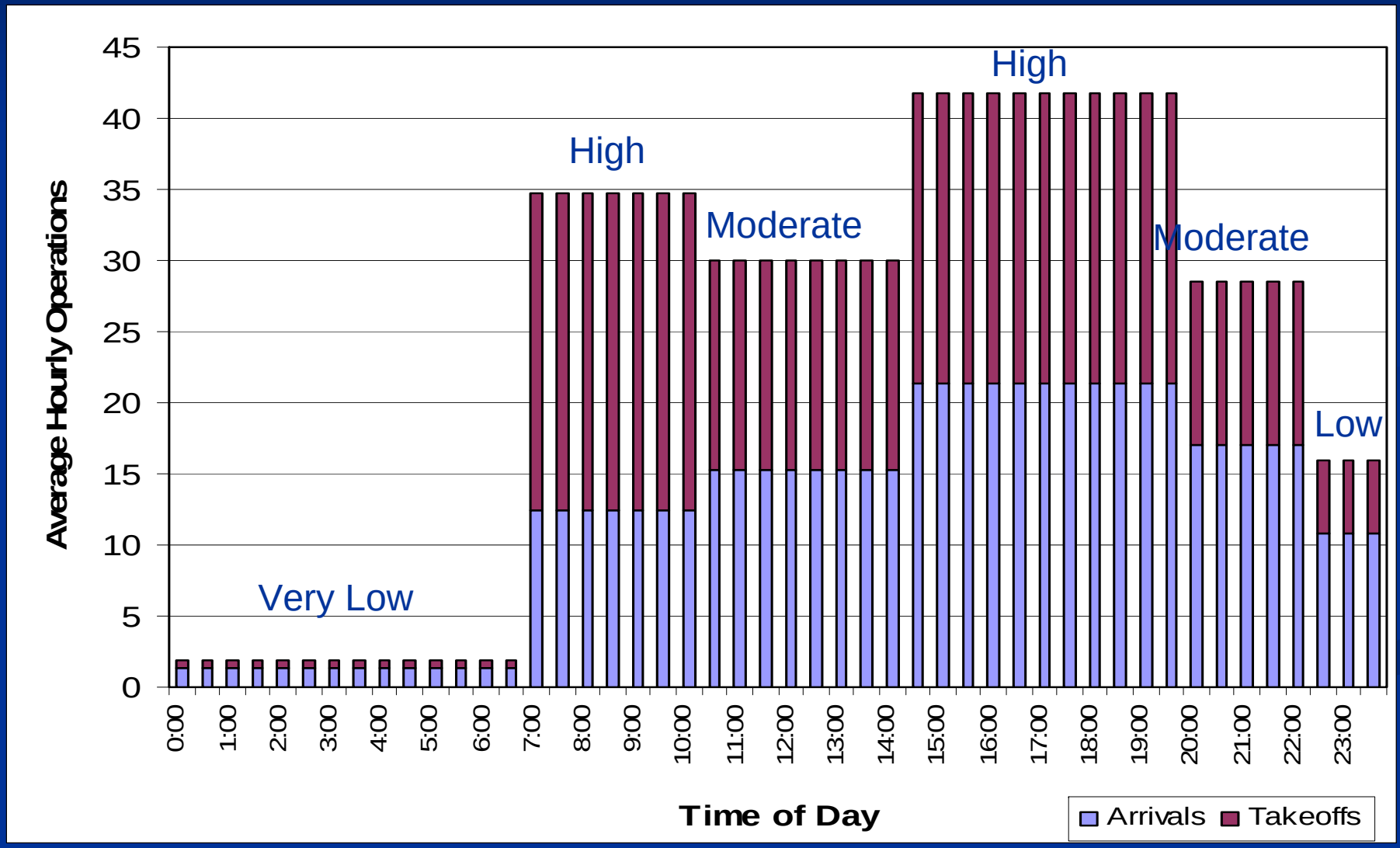
Definitions

- Dwell – provide relief during each 7am – midnight from the operation of aircraft over any one neighborhood for more than 8 hours
- Persistence – provide relief during the period of 7am – midnight from persistent operation of aircraft over any one neighborhood for three consecutive days for more than 23 hours

PRAS was designed to select runways

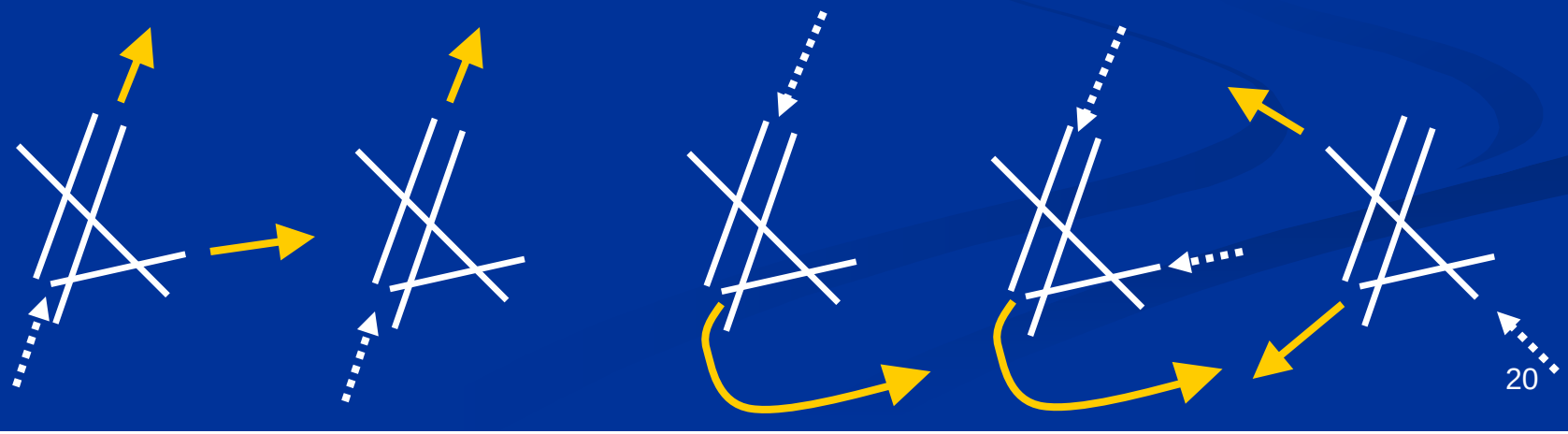
- For four different demand levels
- For wind direction and velocity
- For the hours between 6 a.m. and midnight only, because specific runways were preferred at night.

PRAS Demand Periods (1980)



High Demand Period Runways
(all demand levels per hour)

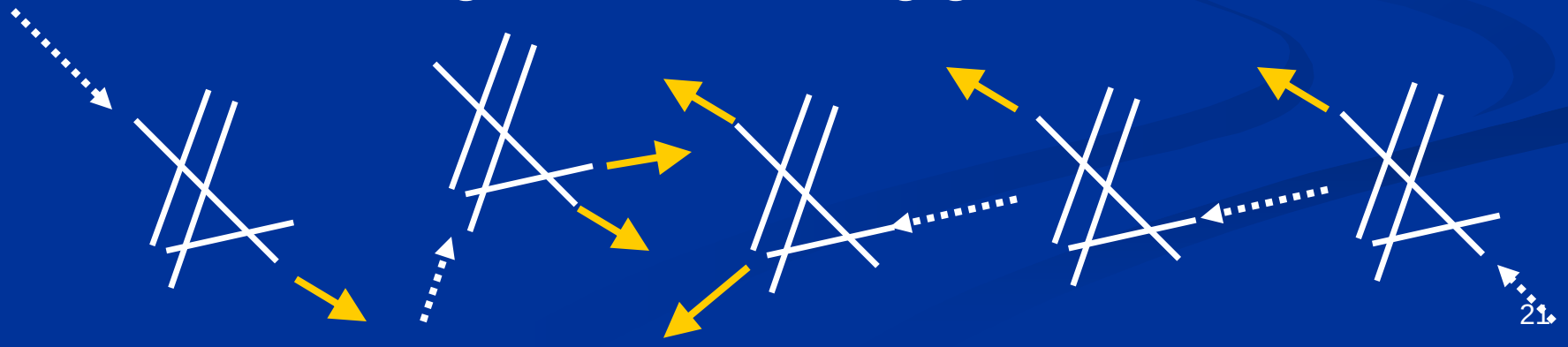
Land	Takeoff
Runway 4	Runways 9 and 4
Runway 4	Runway 4
Runway 22	Runway 22
Runways 27 and 22	Runway 22
Runway 33	Runways 27 and 33



Moderate Demand Period Runways
(32 to 60 jet operations per hour)

Land	Takeoff
Runway 15	Runway 15
Runway 4	Runways 9 and 15
Runway 27	Runways 27 and 33
Runway 27	Runway 33
Runway 33	Runway 33

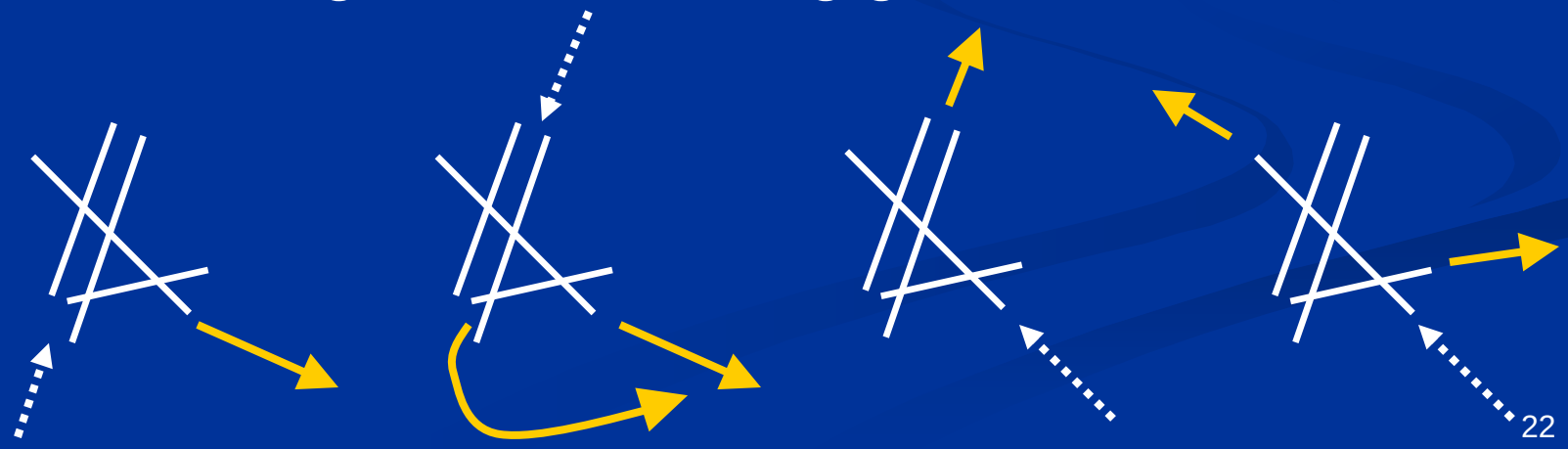
Plus all configurations serving greater demand levels



Low Demand Period Runways (13 to 31 jet operations per hour)

Land	Takeoff
Runway 4	Runways 15
Runway 22	Runways 15 and 22
Runway 33	Runway 4
Runways 33	Runways 9 and 33

Plus all configurations serving greater demand levels



Very Low Demand Period Runways
(less than 13 jet operations per hour)

Land	Takeoff
Runway 27	Runway 15
Runway 33	Runway 15
Runway 33	Runway 22

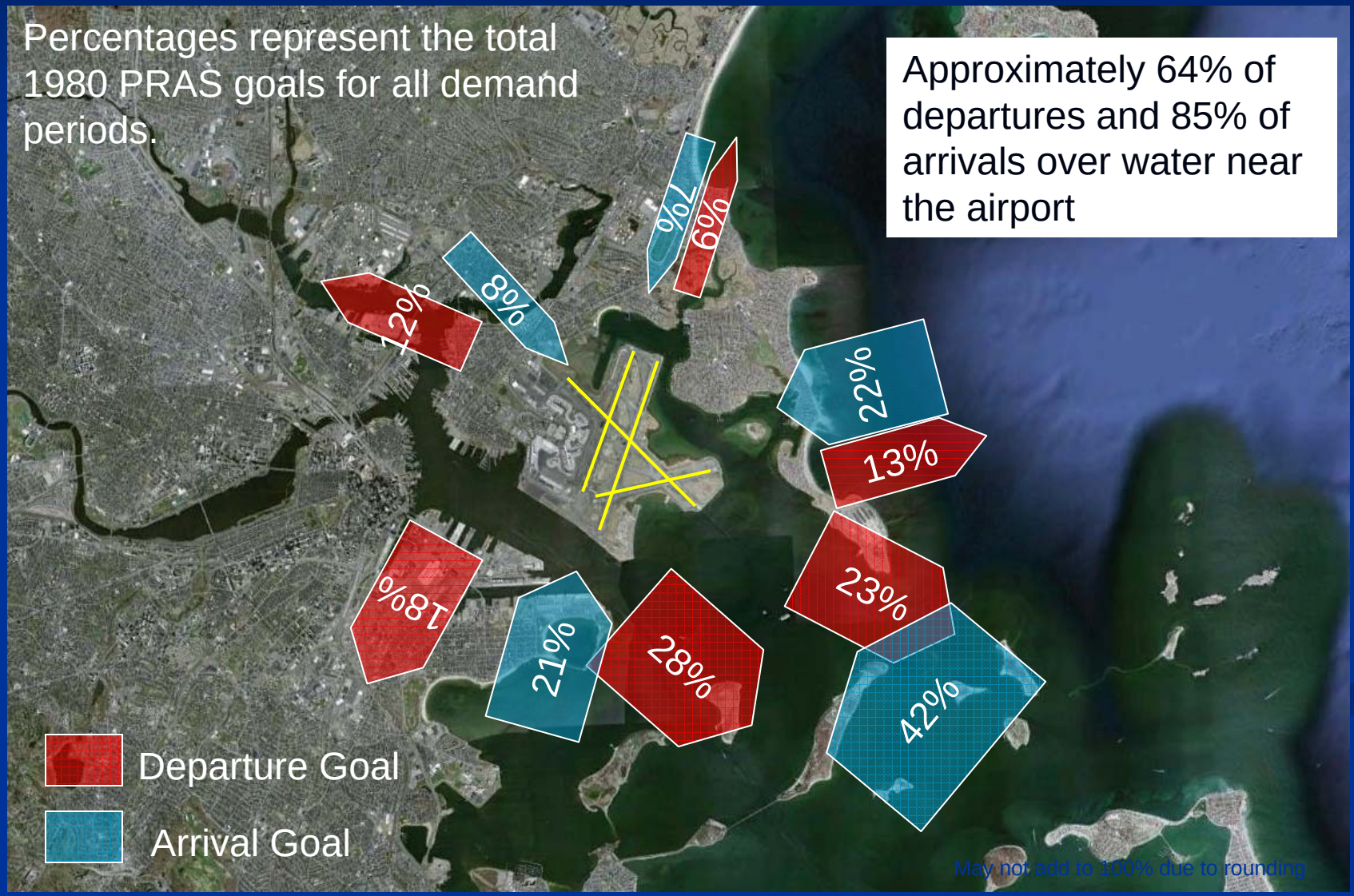
Plus all configurations serving greater demand levels

8.0%

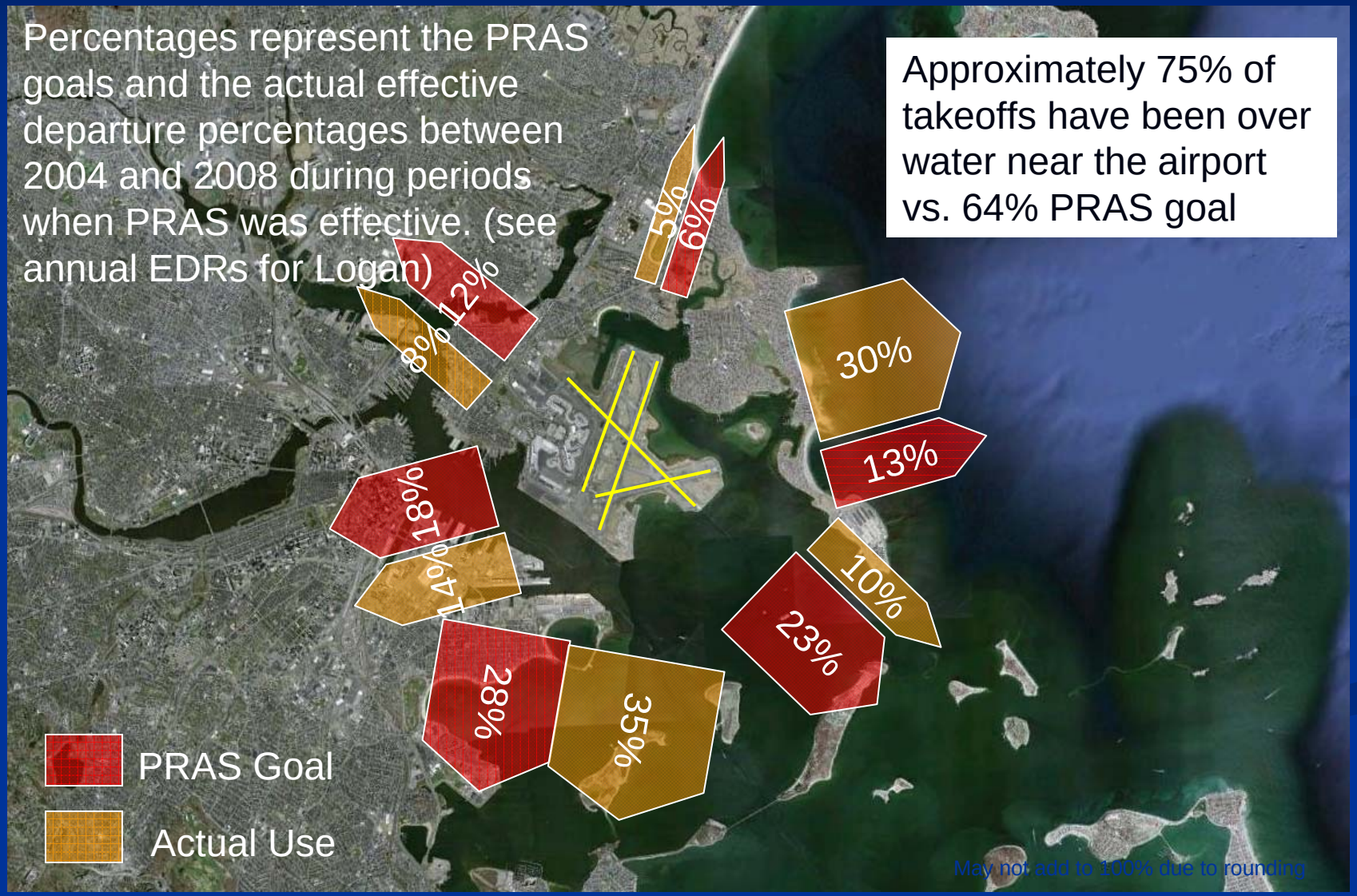
How has PRAS Worked?

- System went into place in 1983 and worked.
- Runway use has been tracked and compared to PRAS goals for nearly 30 years.
- Functionality of the dwell and persistence reporting was abandoned after much effort in early 2000's after FAA changed its traffic management software – the PRAS software and control software were incompatible and fixes could not be found after much time and money were spend on trying to make it work.

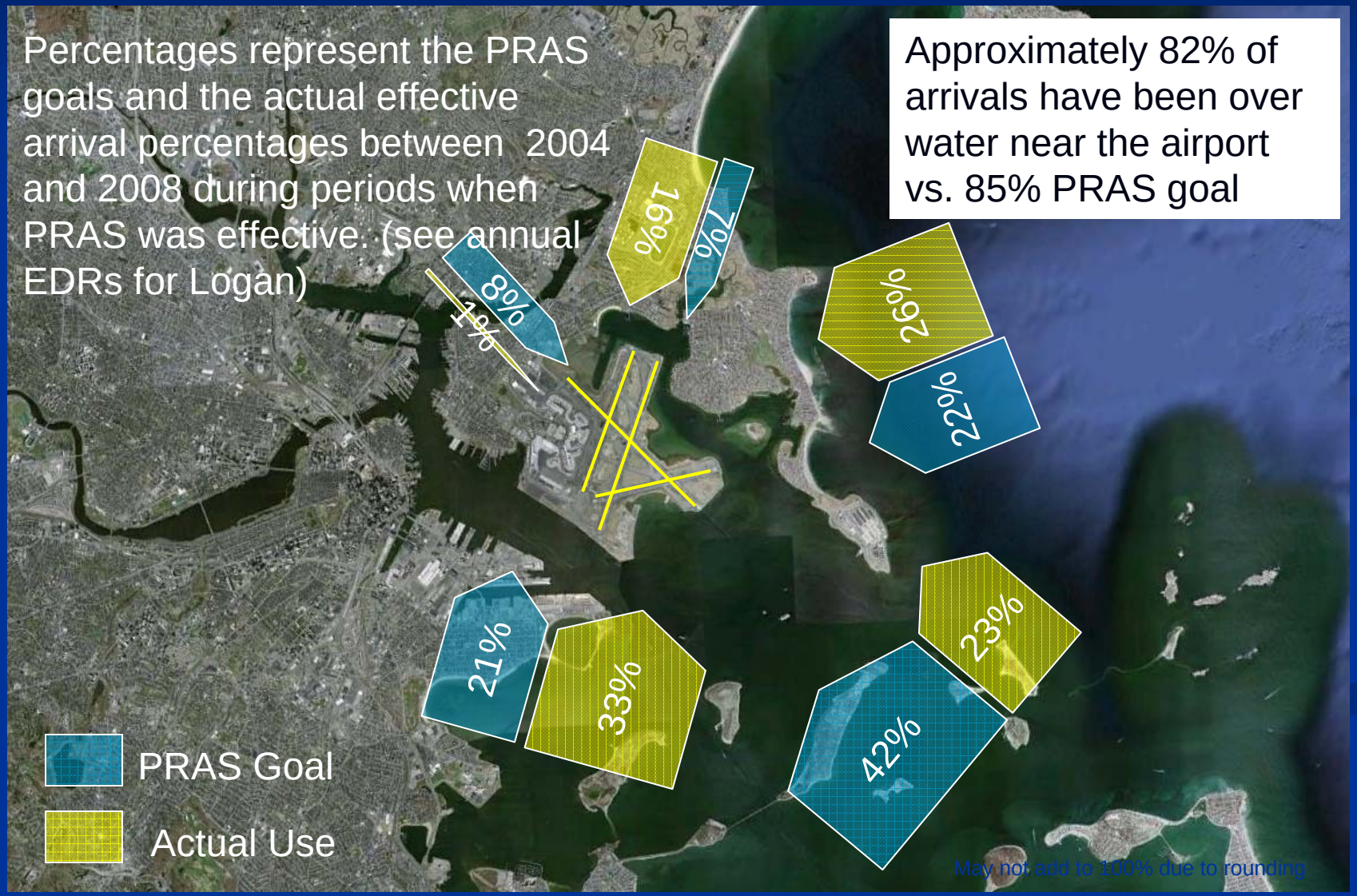
1980 PRAS Arrival & Departure Goals



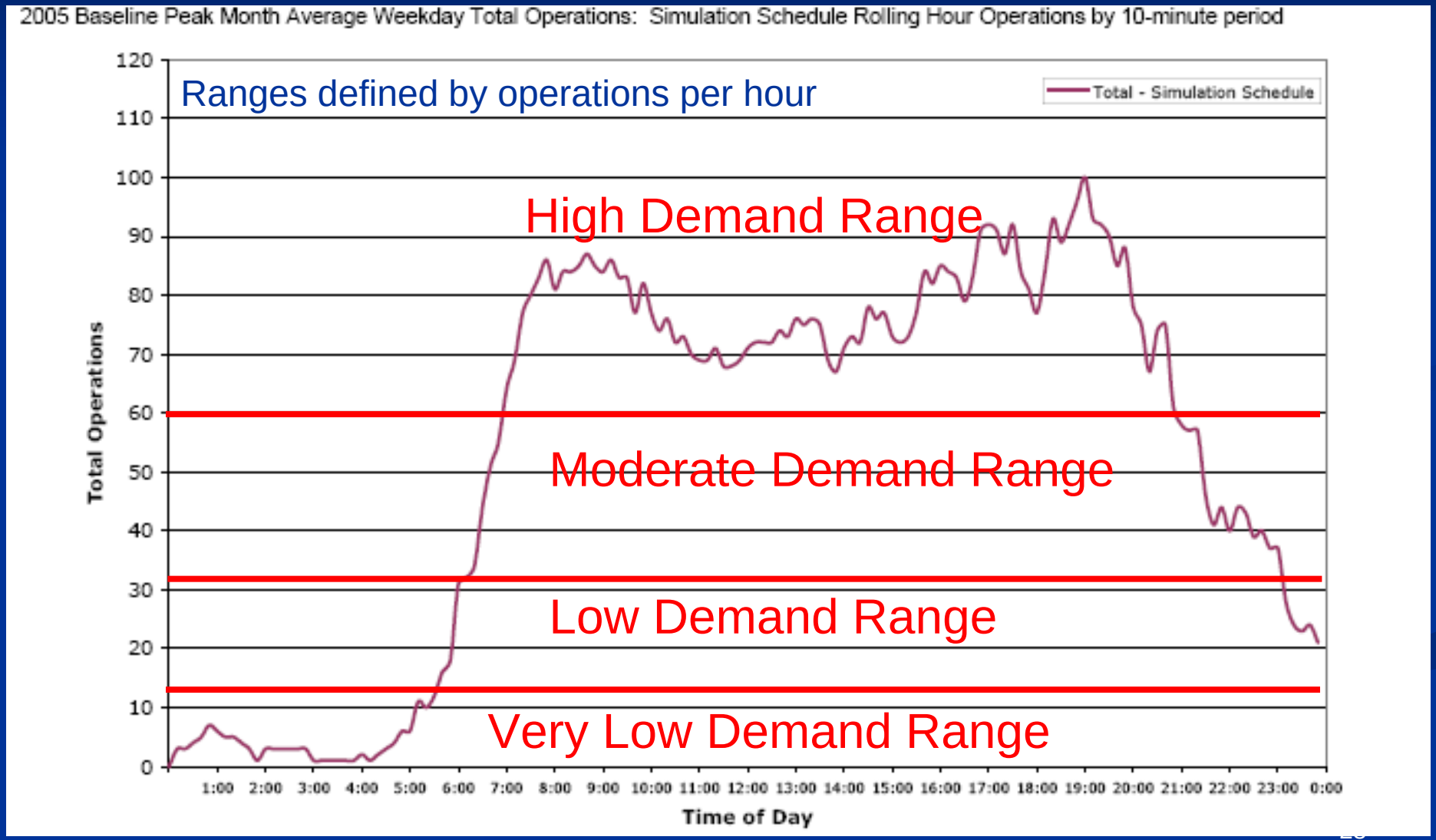
Recent PRAS Departure Effectiveness – 2004 through 2008



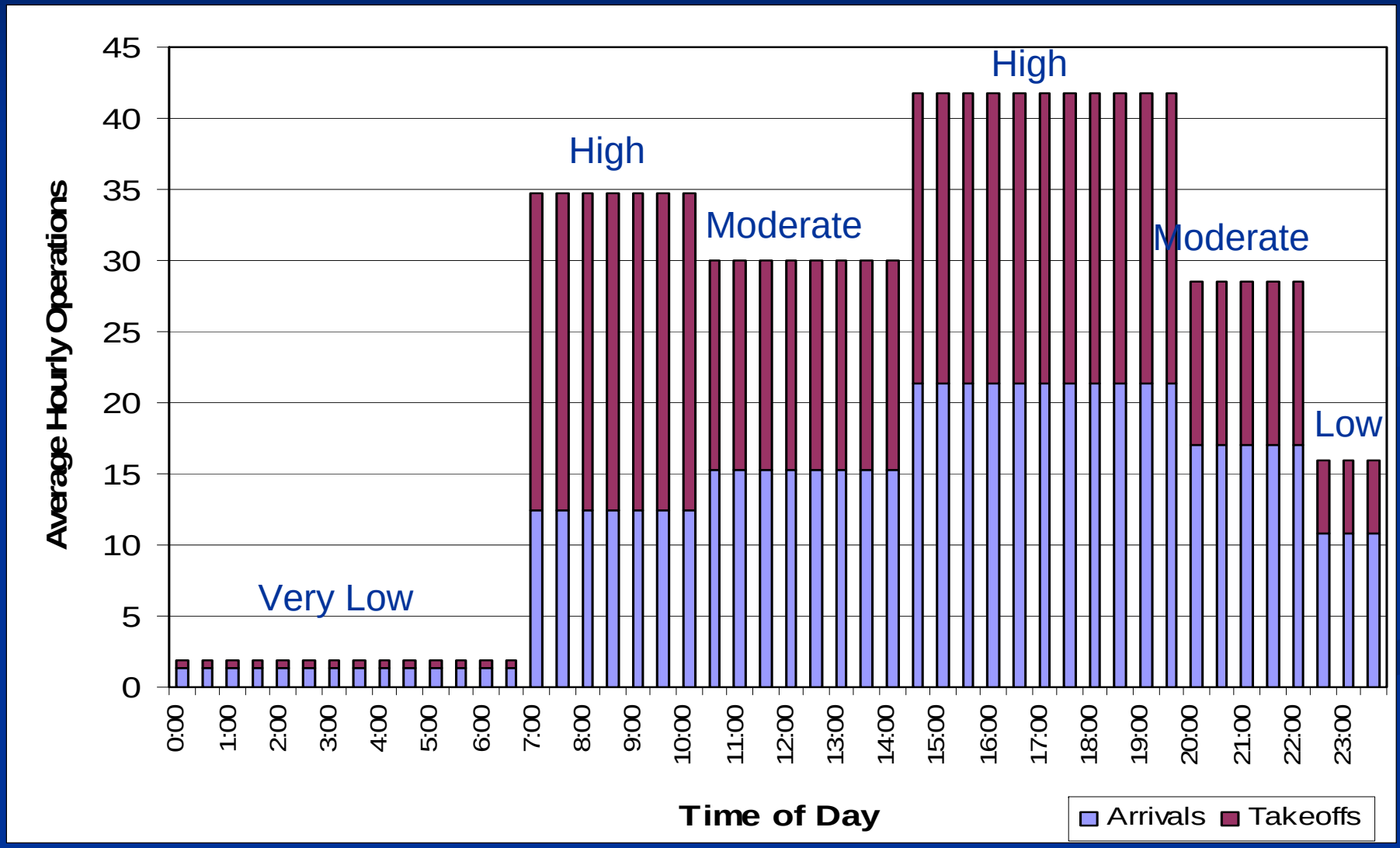
Recent PRAS Arrival Effectiveness 2004 through 2008



PRAS Capacity Constraint Ranges Over Baseline 2005 Operational Flow



PRAS Demand Periods (1980)



PRAS and Current Demand Period Allocations

Demand Level	1982 PRAS Design	2005 Baseline
High Demand (60+ ops per hour)	0731 – 1030 1431 - 2200	0650 - 2050
Moderate Demand (32-59 ops per hour)	1031 – 1430 2001 - 2200	0600 – 0650 2050 - 2310
Low Demand (13 -31 ops per hour)	0601 – 0730 2201 – 2400	2310 – midnight 0530 - 0600
Very Low Demand (<13 ops per hour)	0001 - 0600	Midnight - 0530

Times to effectively move off primary runway configurations have been reduced by 53% or from 9.5 to 4.5 hours daily since the implementation of PRAS goals in 1982

IC Observations

- PRAS was a good system when implemented, but it was designed for conditions that have changed
  - Jet operations have grown by about 50%
  - Peak operating period now extends through the day, rather that in shorter periods.
  - Technology has outgrown the software for the system and solutions were not found.
- Given the combination of operations growth and the improvement of technology, the system, as designed is probably obsolete.

Next Steps

- Withdraw support for the PRAS as designed, particularly the elements directed at dwell, and recommend development of a preferential runway use program for off peak hours between 10 p.m. and 7 a.m.
- Focus on finding a way to maintain persistence as a component of the system for all hours by looking at overall configuration acceptance rates and wind coverage and population distribution.