



Automatic missed approach and late go-around detection

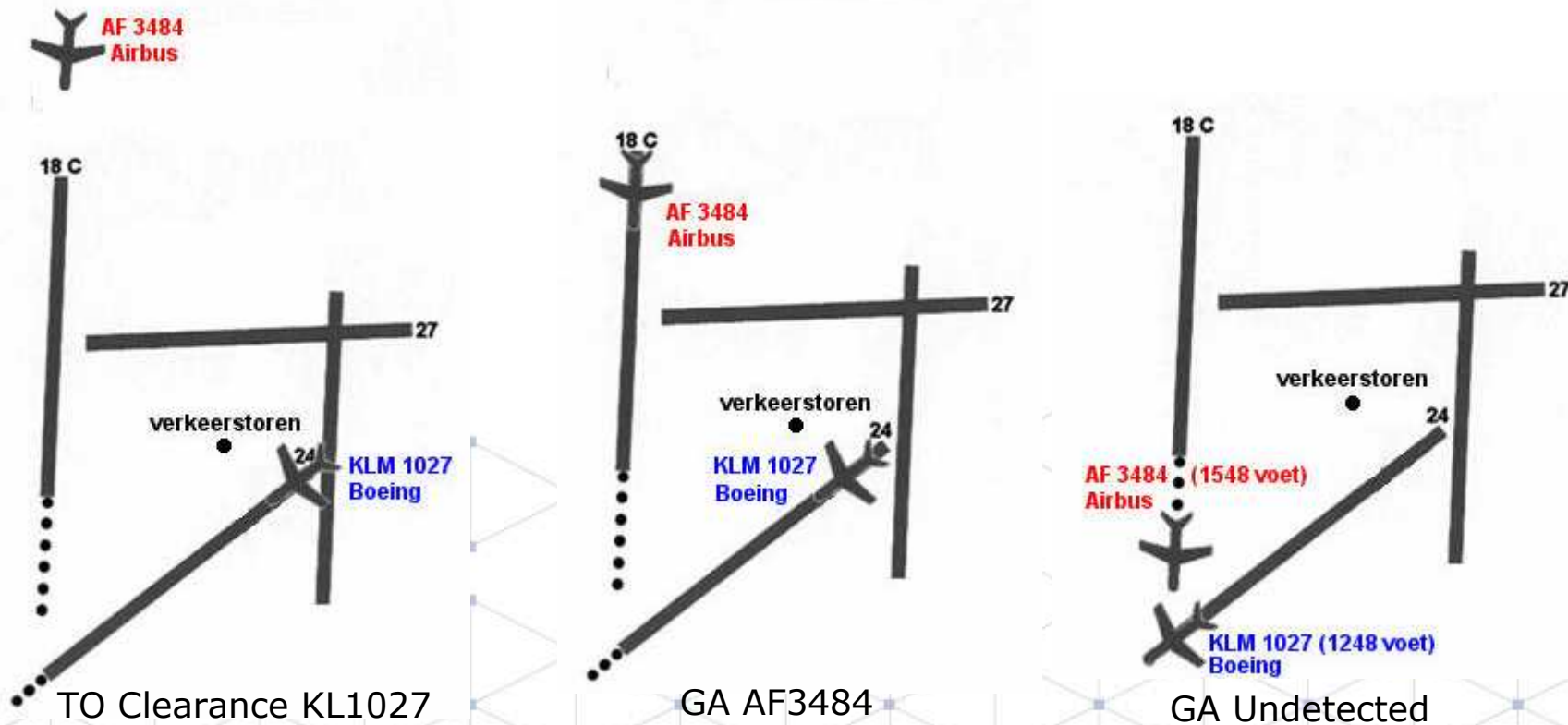


**Job Brügger
Safety Manager
ATC The Netherlands**

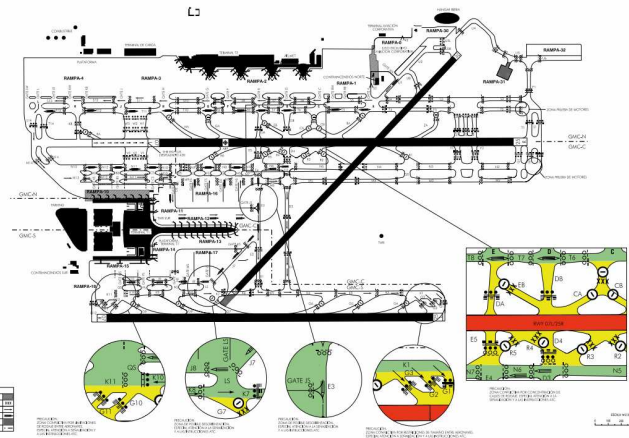
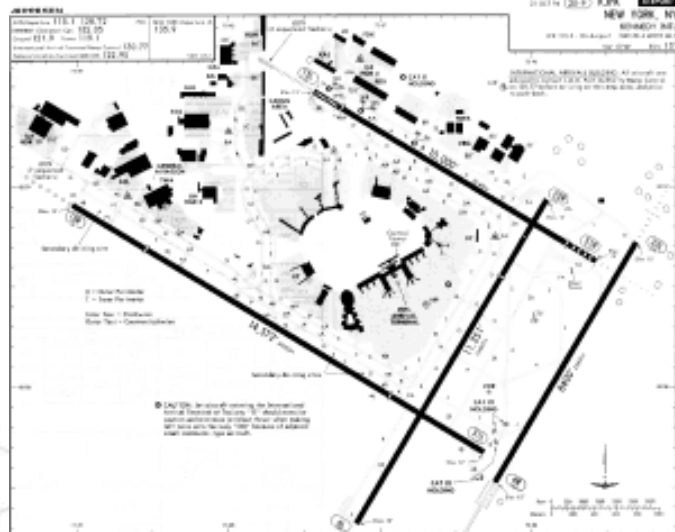
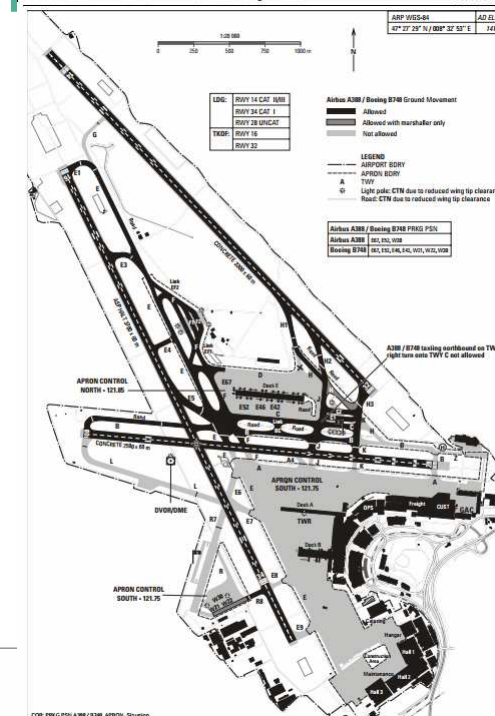
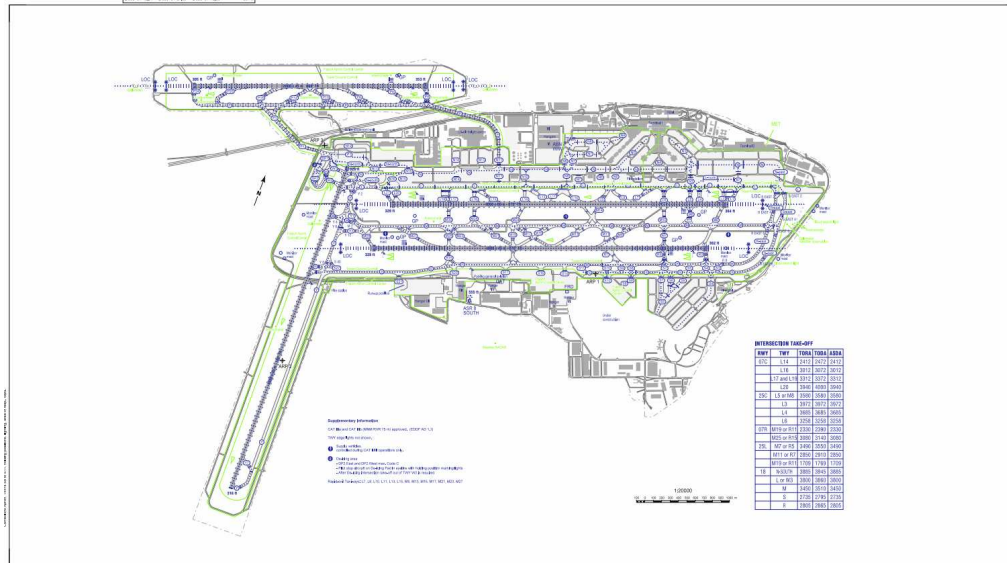
Background (2007)



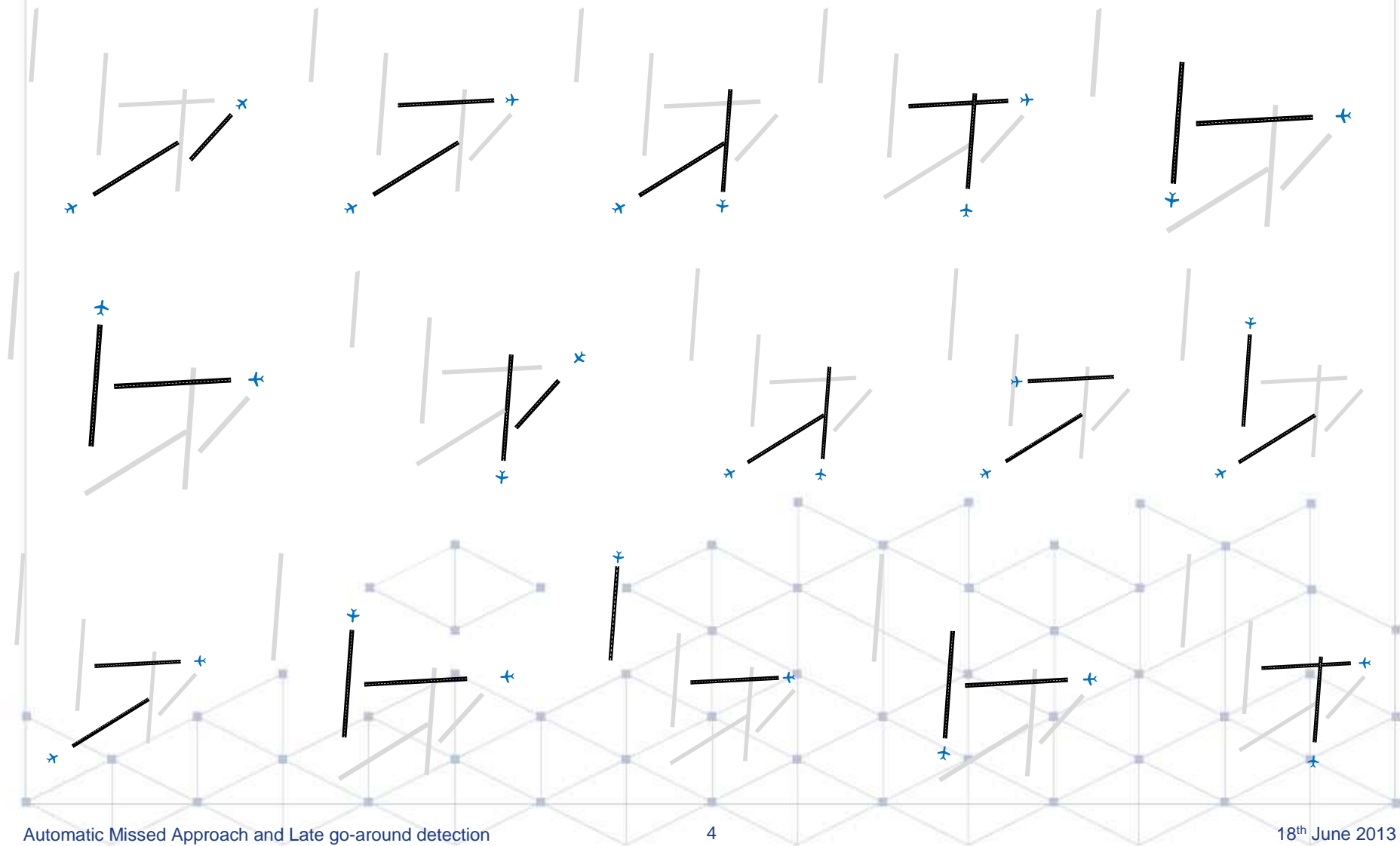
- Near mid-air collision at Schiphol between Airbus A318 approaching to RWY18c and Boeing 737 departing from RWY24.
- Airbus A318 made a missed approach and crossed path of the departing B737. Closest distance 460m at same altitude.



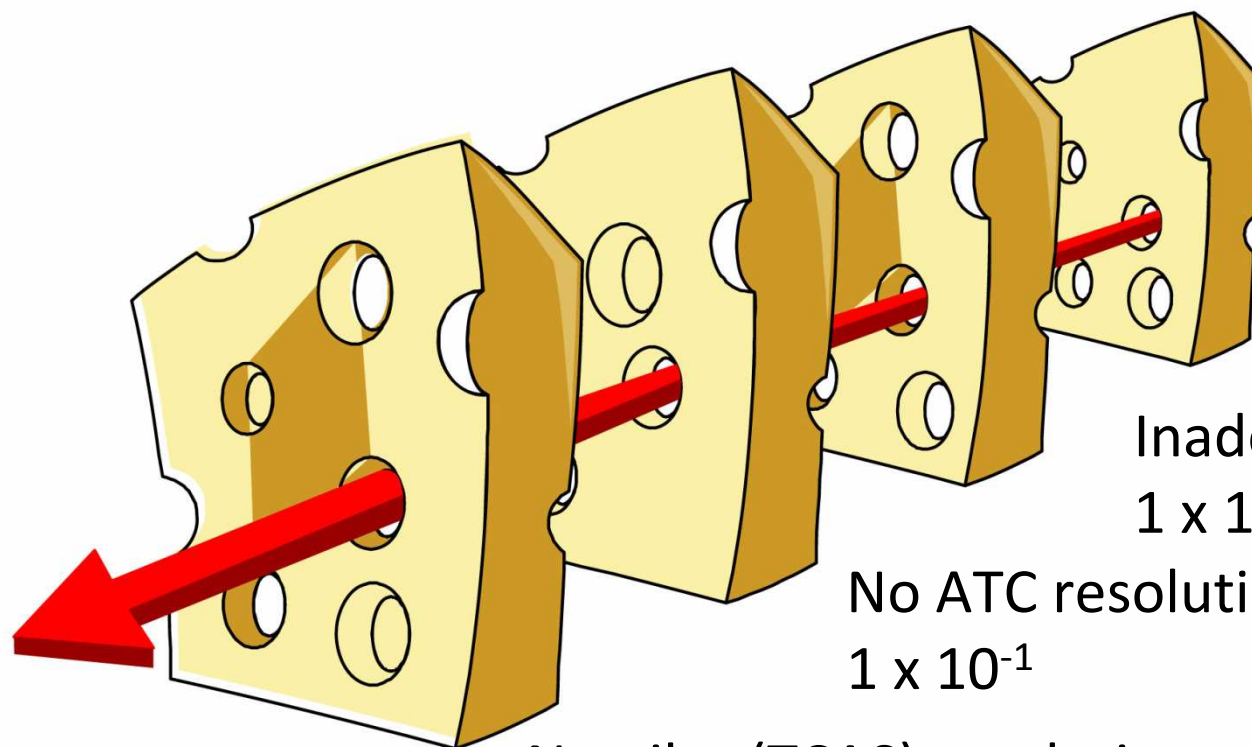
We can't be the only one ...



...SPL dependent rwy combinations



Estimated collision risk 8.5×10^{-9}



Missed approach
 2×10^{-3}

Inadequate timing
 1×10^{-1}

No ATC resolution
 1×10^{-1}

No pilot (TCAS) resolution
 8.5×10^{-1}

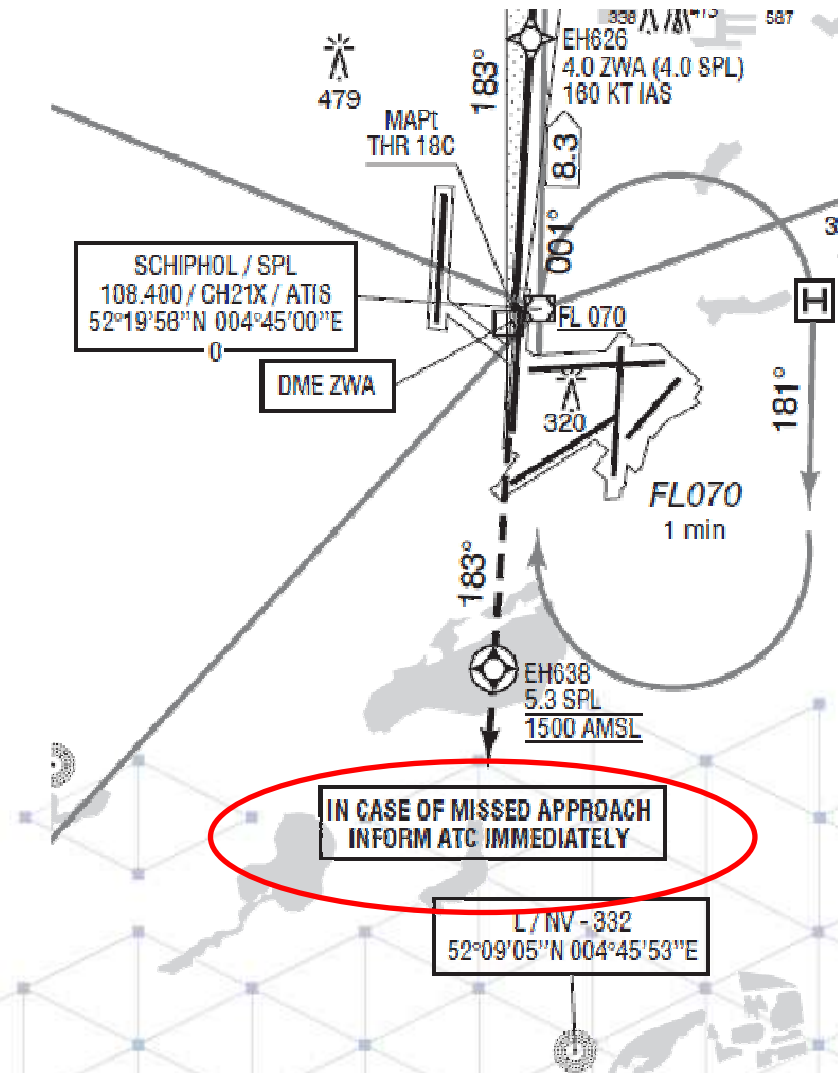
No separation
 5×10^{-4}



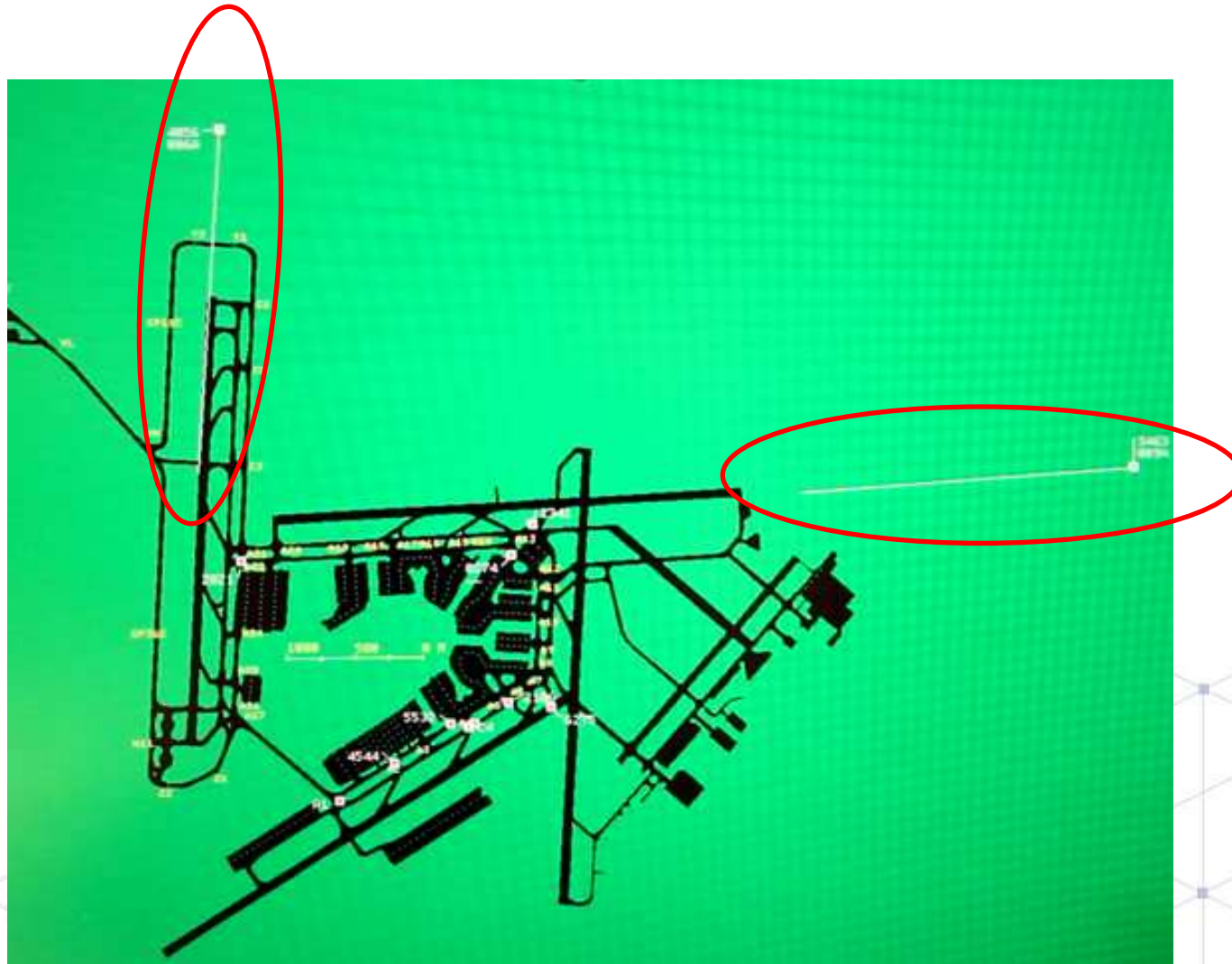
Mitigation measures

1. Restrict use of dependent rwy combinations
2. Change the timing procedure
3. Monitor operations
4. Training and Safety Culture
5. Increase detection probability

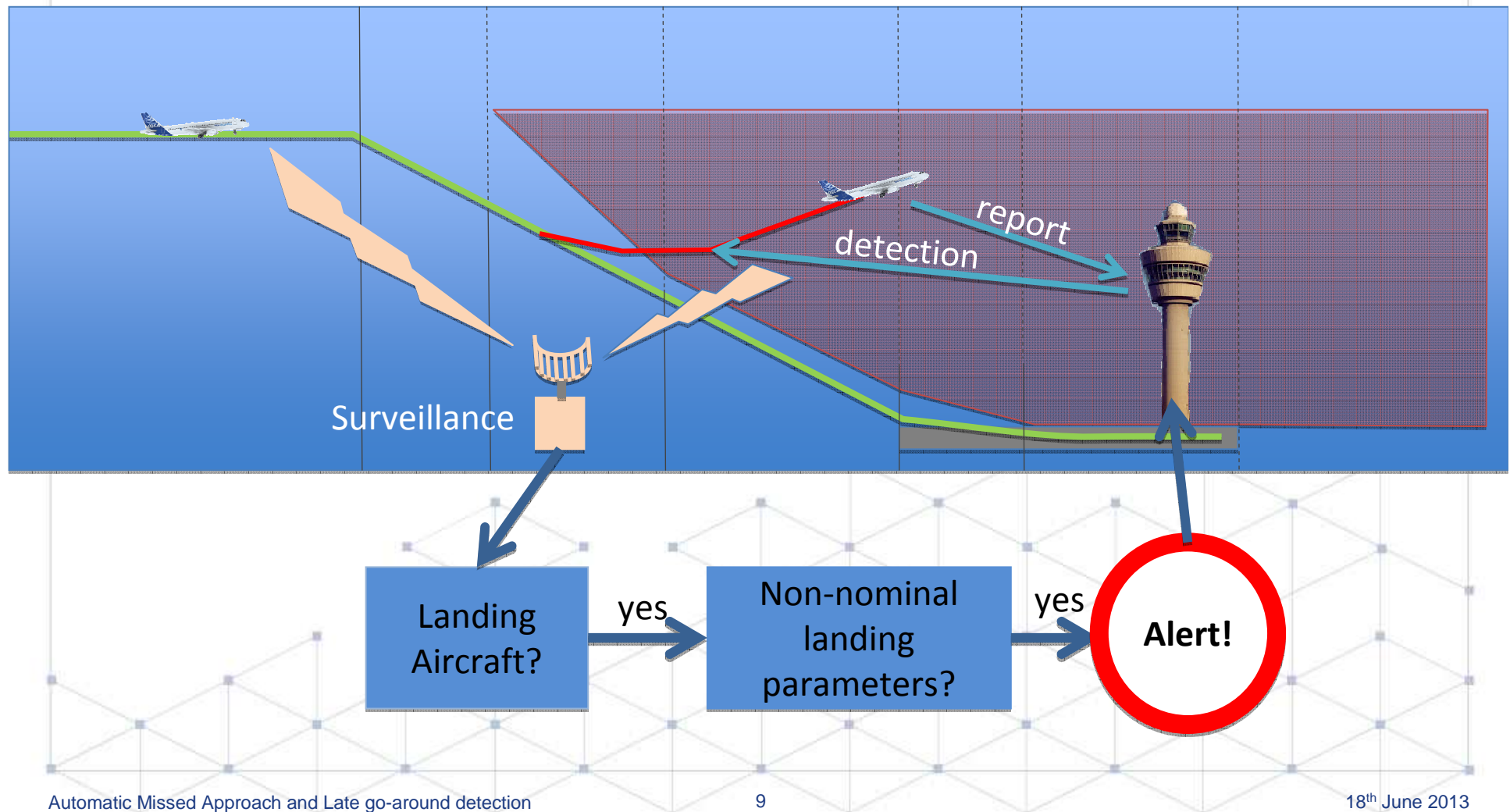
5.1 Increase detection probability



5.2 track vector on GND radar



5.3 automatic go-around detection





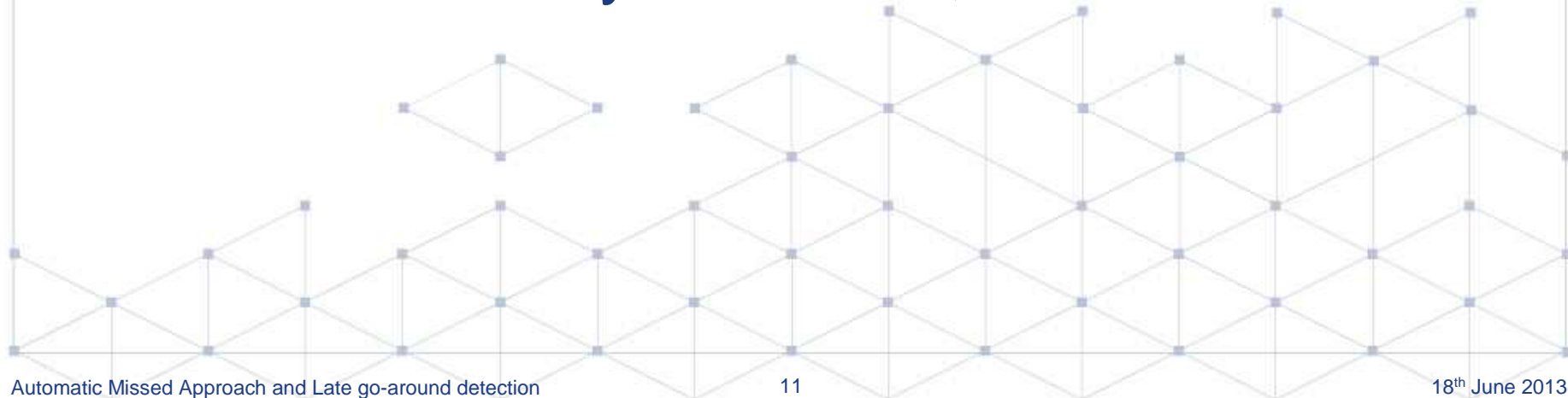
Preliminary Algorithm

- Preliminary algorithm developed on minimum amount of readily available data (with limited resolution and sample rate):
 - Position [x, y]: 1/64 NM
 - Mode-C altitude: 100 ft
 - Groundspeed: 1 kts
 - Tracker sample rate: $\frac{1}{4.19}$ (0.24) Hz
- Dataset contains MA/GA plus flights with severe weather landings

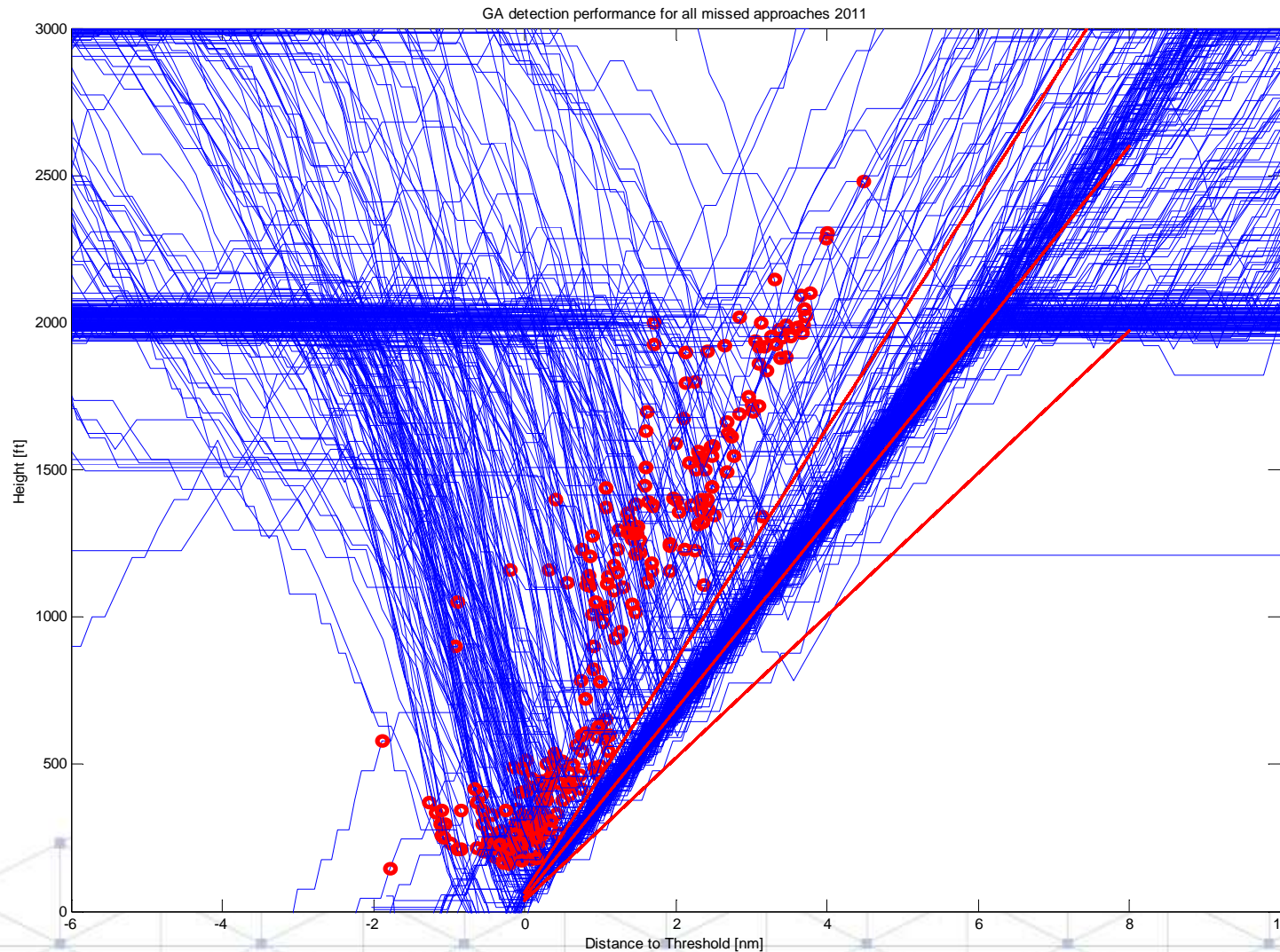


Algorithm Development per phase

- High final: deviation from reference path
- Low final: persistent pos. ROC
- Stable final: path deviation+positive ROC
- Flare/Land: altitude
- Overshoot: by definition, if not land



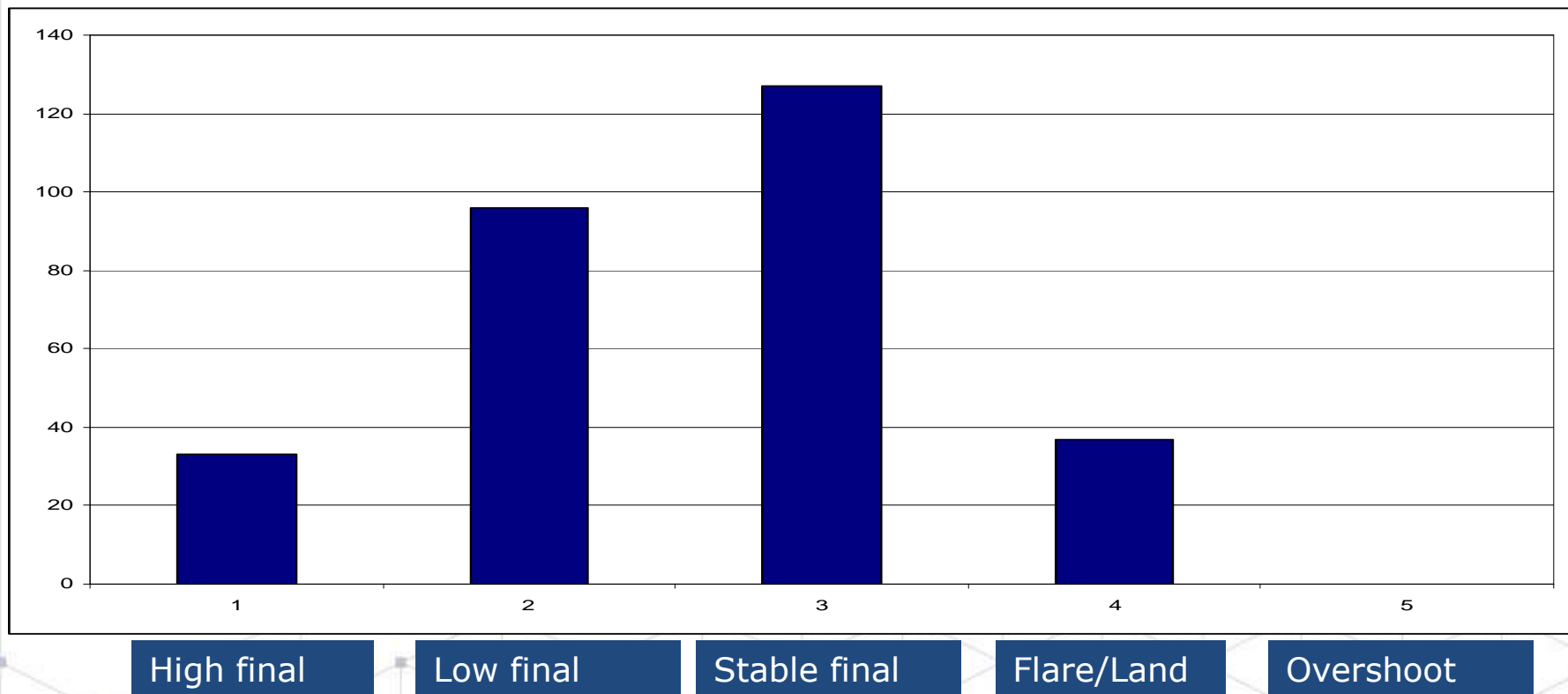
Results (1/3) for 293 MA, 2011



Results (2/3)



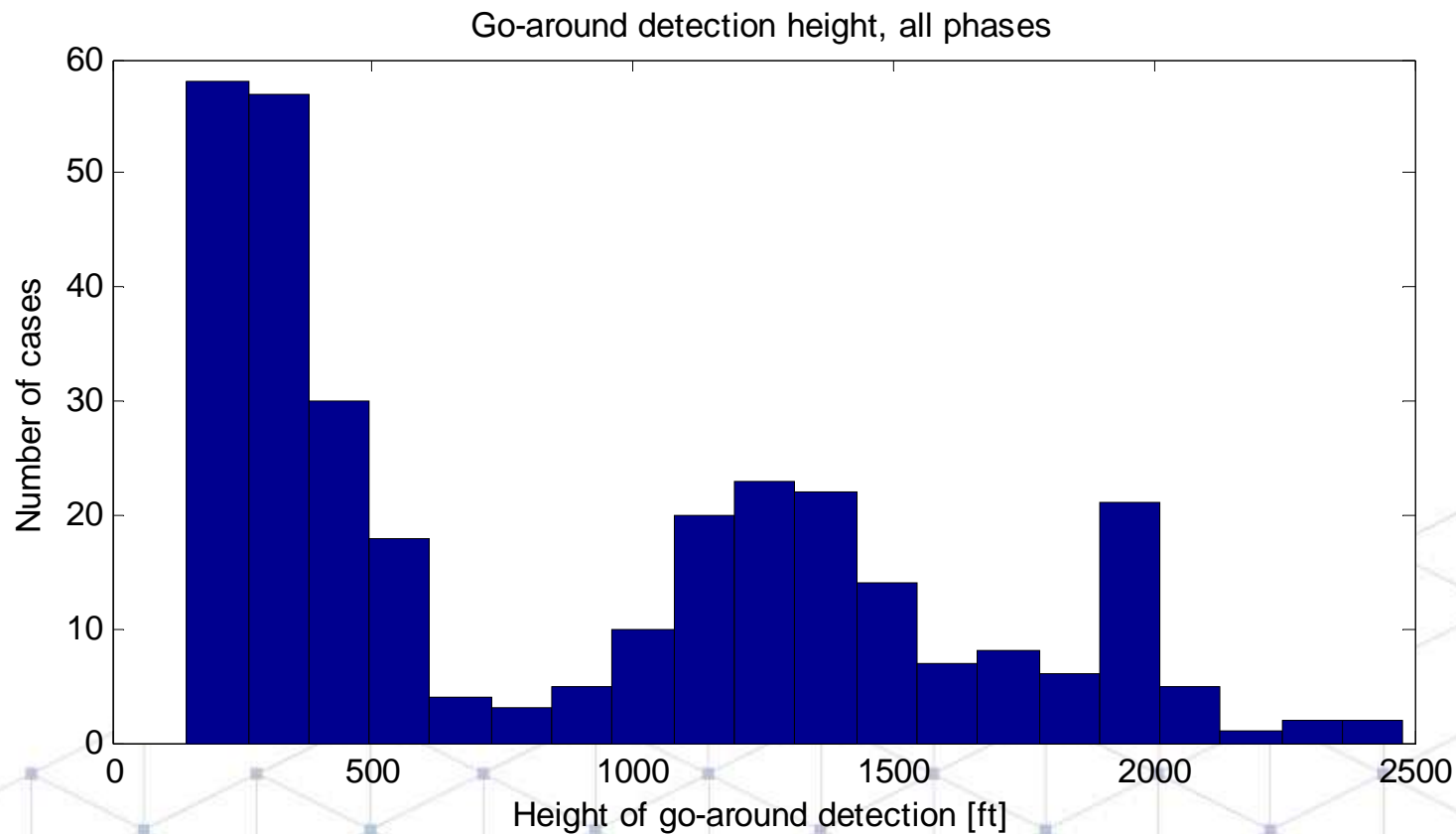
Number of Detections per Phase (293 cases, 2011)



Results (2/3)



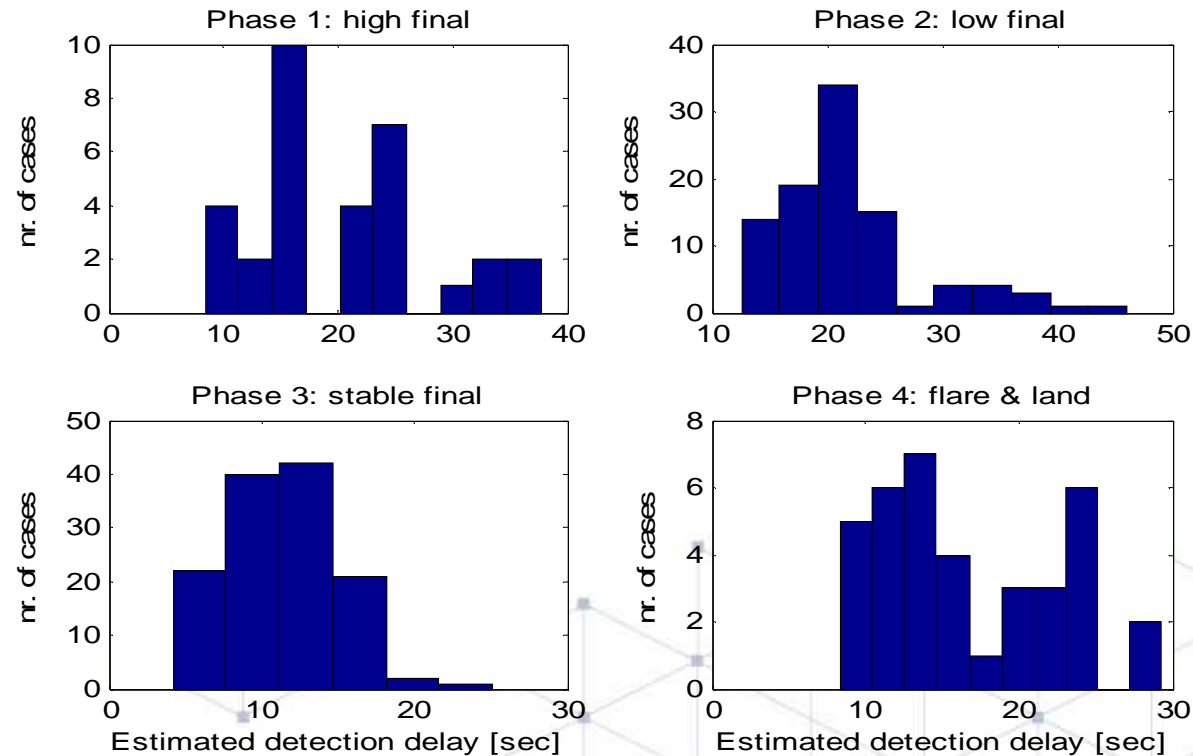
Identified Go-around Altitude (293 cases, 2011)



Results (3/3)

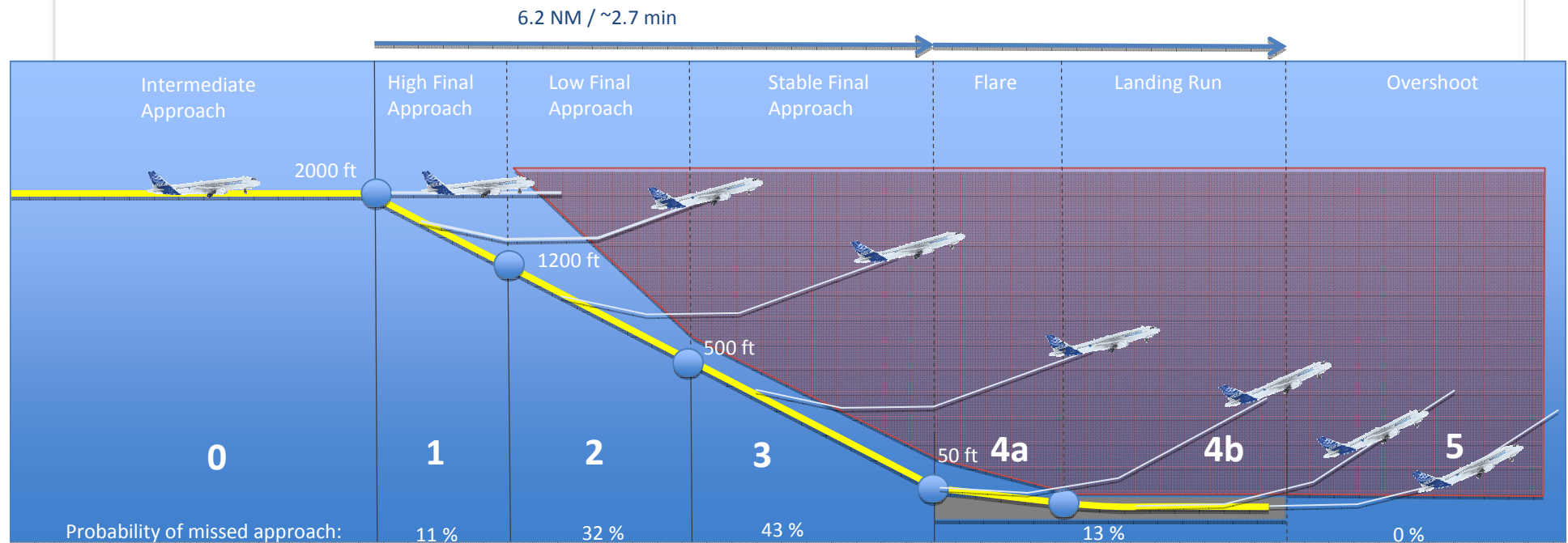


Estimated Detection Delay per Phase



	MEAN [SEC]	STANDARD DEVIATION [SEC]
Phase 1	20.6	8.1
Phase 2	21.5	6.8
Phase 3	10.7	4.4
Phase 4	16.9	6.3

Achievable responsiveness



21 s

22 s

11 s

17 s

False alerts:

- non-stabilised approach
- circling

Options for improvement

- Use 25 ft altitude resolution Mode S
- Use Multilateration data for 1 sec update

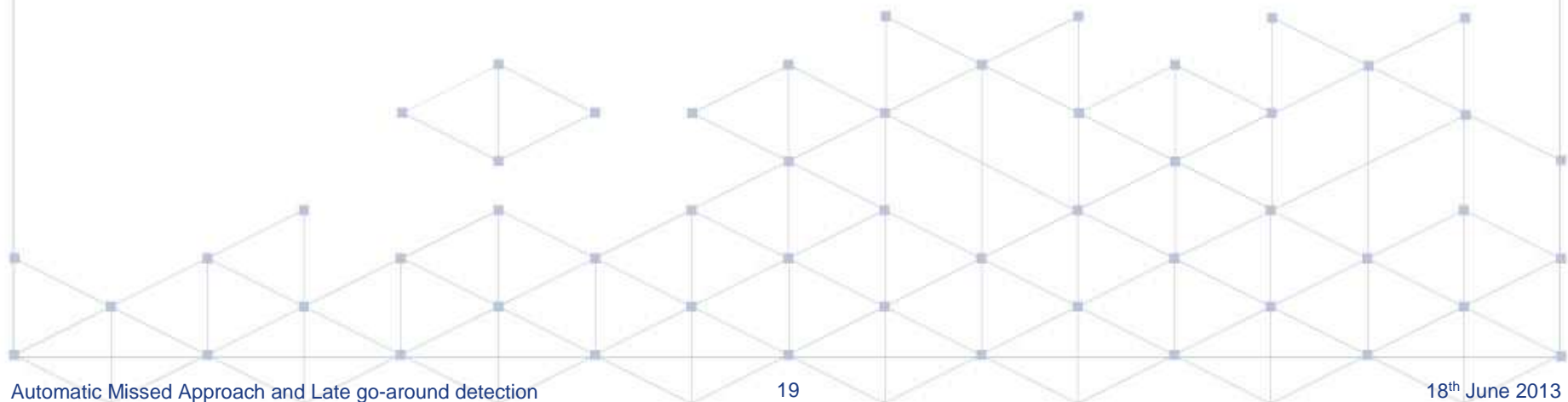






Automatic Go around detection: results

- Operational concept defined
- HMI acceptable
- Functionality usable
- Implementation before winter operations 2014.





Luchtverkeersleiding Nederland

Bezoekadres

Stationsplein ZuidWest 1001
1117 CV SCHIPHOL

Postadres

Postbus 75200
1117 ZT SCHIPHOL

T +31 (0)20 4062000

F +31 (0)20 6484999

E communications@lvnl.nl

W www.lvnl.nl

www.luchtverkeersleider.nl

