iFly final project presentation
Introduction

Henk Blom

National Aerospace Laboratory NLR
Delft University of Technology
e-mail: blom@nlr.nl

iFly project

- 4+ Year innovative ATM project (2007-2011) within EC DG-TREN/MOVE
- Objective: development of an advanced airborne self separation ATM operational concept the design of which takes into account:
  - Safety targets
  - Human responsibilities
  - Complexity is well understood
- Builds on theoretical results of HYBRIDGE project for EC DG-INFSO
  - Novel methods in rare event modelling and estimation
  - Novel methods in conflict modelling and resolution
- 18 Partners, 11 of which are from HYBRIDGE
  - Total effort: ~ 45 person-years
  - Budget: 5.2 MEuro (3.3 MEuro by EC)
  - NLR is coordinator

iFly participants

1. NLR (NL)
2. Honeywell (CZ)
3. ISDEFE (ES)
4. Univ. of Tartu (EE)
5. Athens U. Economics & Business (GR)
6. ETH Zurich (CH)
7. L'Aquila University (IT)
8. Politecnico di Milano (IT)
9. Cambridge Univ. (UK)
10. NTU Athens (GR)
11. Twente Univ. (NL)
12. ENAC (FR)
13. Dedale (FR)
14. NATS En Route (UK)
15. INRIA (FR)
16. Eurocontrol Experimental Centre (F)
17. DSNA-DTI-SDER (FR)
18. Leicester Univ. (UK)

Motivation

- Free Flight has been “invented” as a potential solution for high traffic demand airspace [RTCA, 1995]
- During recent years ATM community research trend is to direct self separation research to situations of less dense airspace (e.g. MFF, ASSTAR)
- Key research question: Up to which traffic demand is safe airborne self separation feasible?
- This question has previously been addressed for a specific airborne self separation concept, known as AMFF (Autonomous Mediterranean Free Flight)

Final iFly Presentations

1. What were the main findings for AMFF?
   - Prof. Henk Blom (NLR & TU Delft, The Netherlands)

2. How does an advanced airborne self separation ConOps look like?
   - Dr. Petr Casek (Honeywell, Czech Republic)

3. What en-route traffic demand can safely be accommodated?
   - Prof. Henk Blom (NLR & TU Delft, The Netherlands)

4. Which advanced CD&R approach support this best?
   - Prof. John Lygeros (ETH Zurich, Switzerland)

5. What are the main issues of Shared Situation Awareness?
   - Prof. Maria DiBenedetto (U. of L'Aquila, Italy)

6. How is the cost-benefit analysis for application over Europe?
   - Prof. Kostas Zografos (Athens U. of Economics & Business, Greece)

7. What are the potential benefits for SESAR and NEXTGEN?
   - Prof. Henk Blom (NLR & TU Delft, The Netherlands)

iFly final project presentation

What were the main findings for AMFF?

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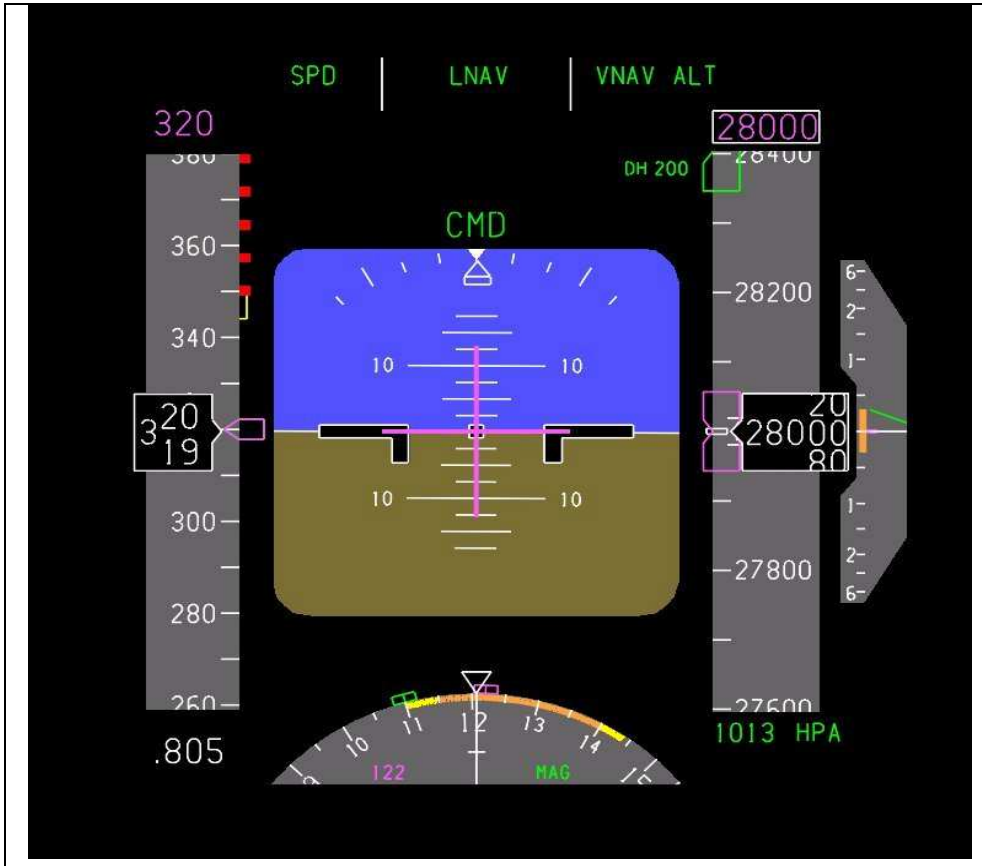
Autonomous Mediterranean Free Flight (AMFF)

- Future concept developed for traffic over Mediterranean area
- Aircrew gets freedom to select path and speed
- In return aircrew is responsible for self-separation
- Each a/c equipped with ASAS (Airborne Separation Assistance System)
- Conflicts are solved one by one (pilot preference)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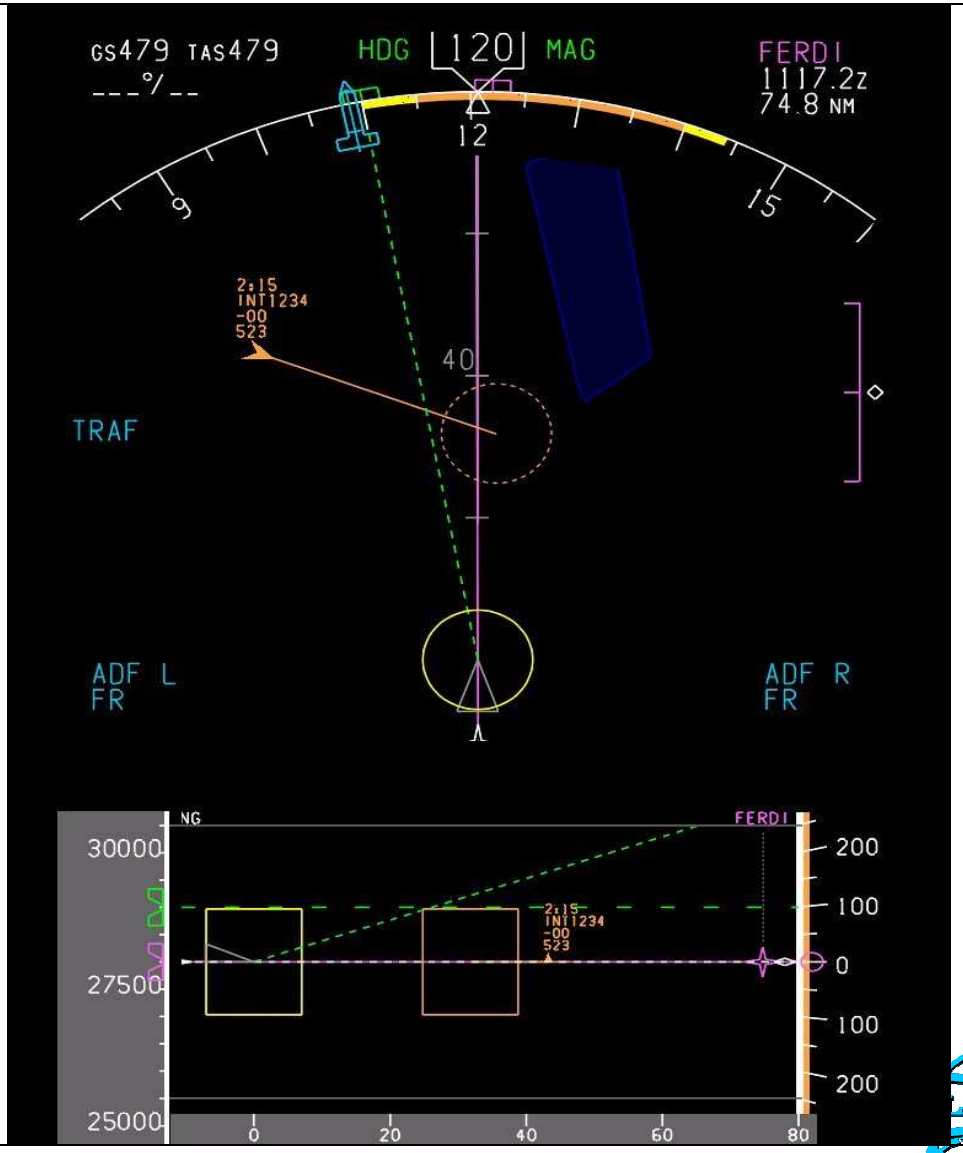
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Evaluations performed for AMFF

- Real-time pilot-in-the-loop simulations (MFF project)
- Safety Analysis RTCA-DO264 = EurocaeED78a (MFF project)
- Rare Event Monte Carlo simulation (Hybridge project)

Monte Carlo Simulation Scenarios

- Two aircraft encounter under AMFF
- Eight aircraft encounter under AMFF
- Random traffic high density under AMFF

Events measured:

MTC = Medium Term Conflict

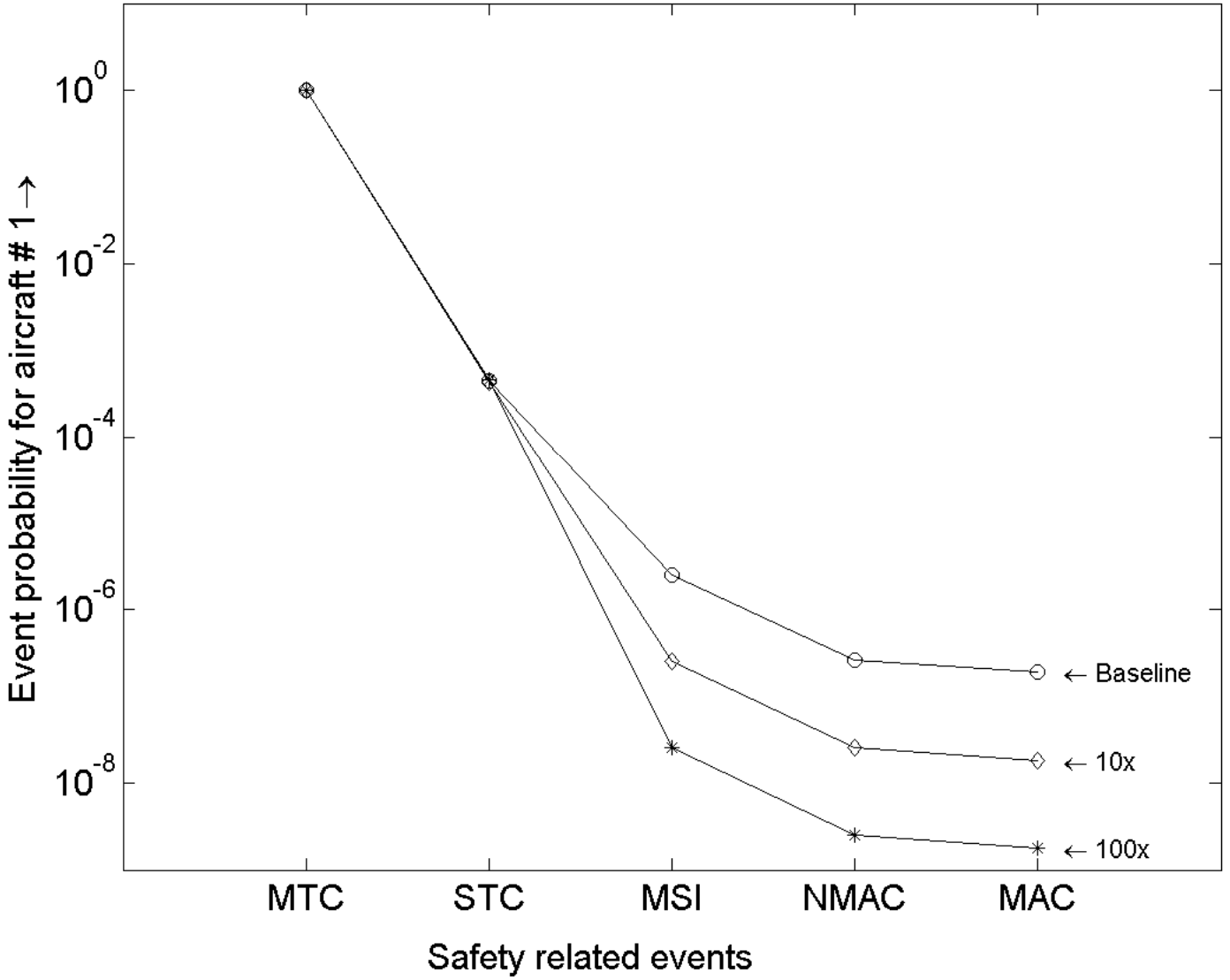
STC = Short Term Conflict

MSI = Minimum Separation Infringement

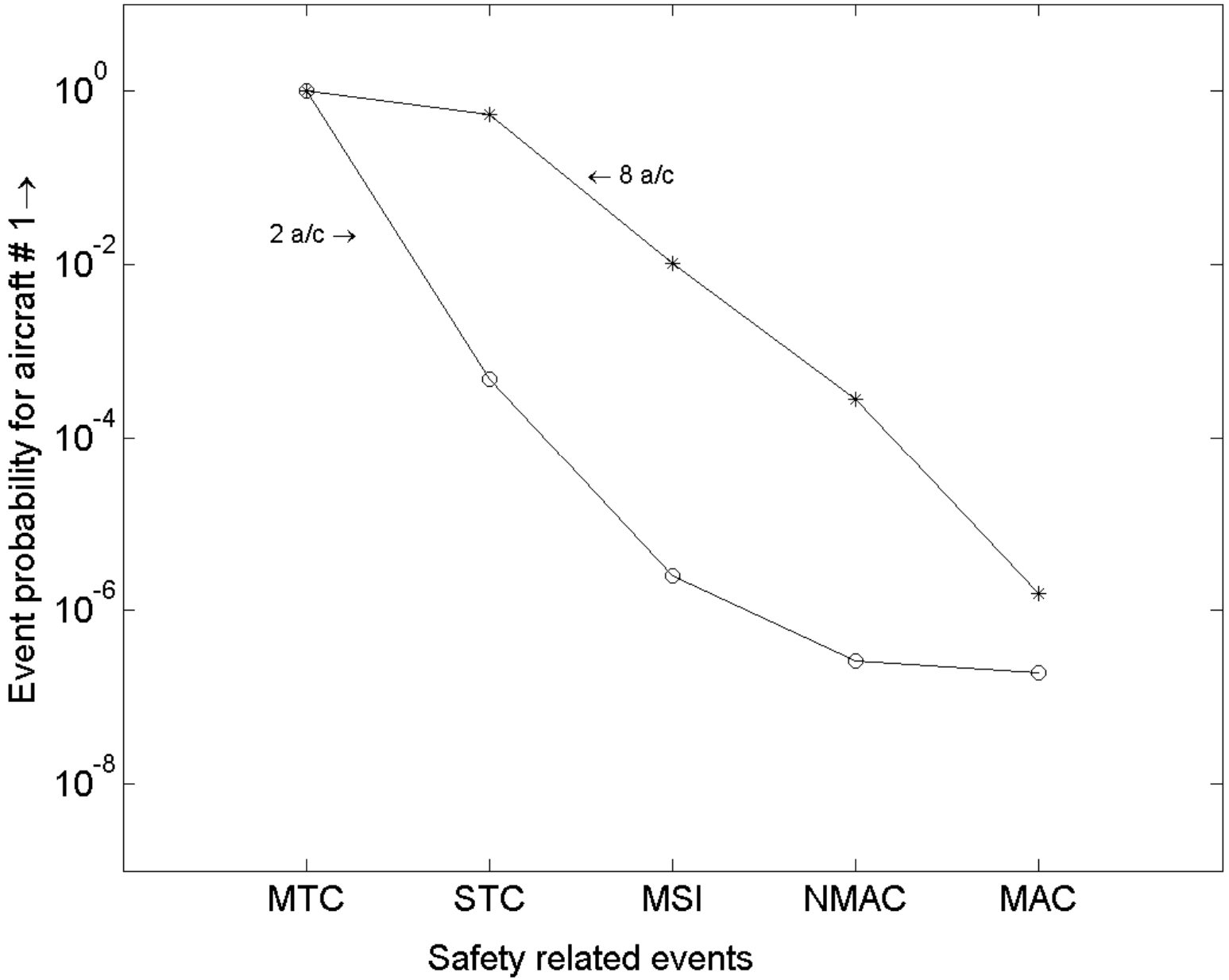
NMAC = Near Mid Air Collision

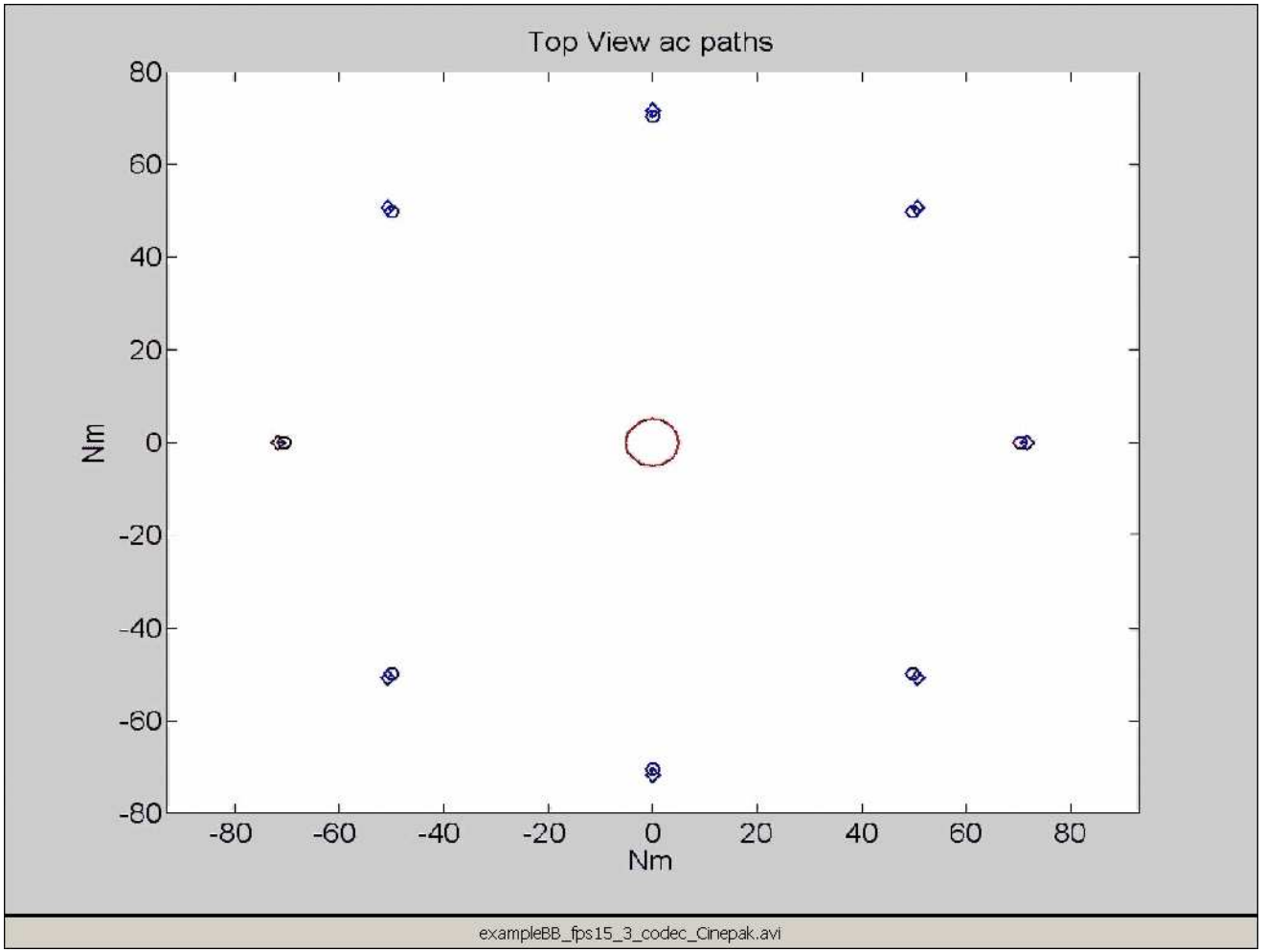
MAC = Mid Air Collision

Two-aircraft head-on encounter under AMFF and ASAS dependability at baseline values and at factors 10x and 100x better values



Two-aircraft vs. eight-aircraft encounter under AMFF and baseline ASAS dependability

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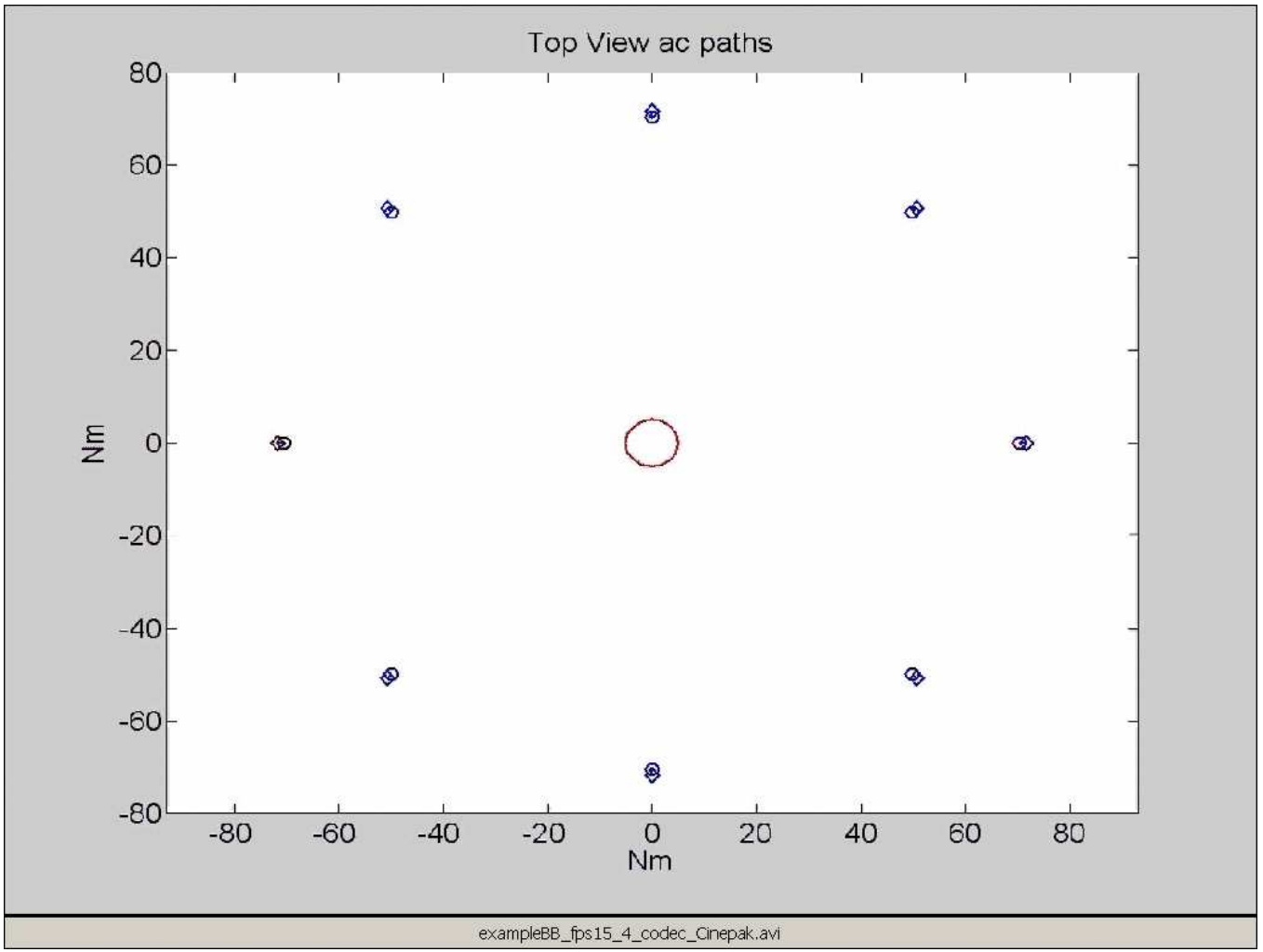
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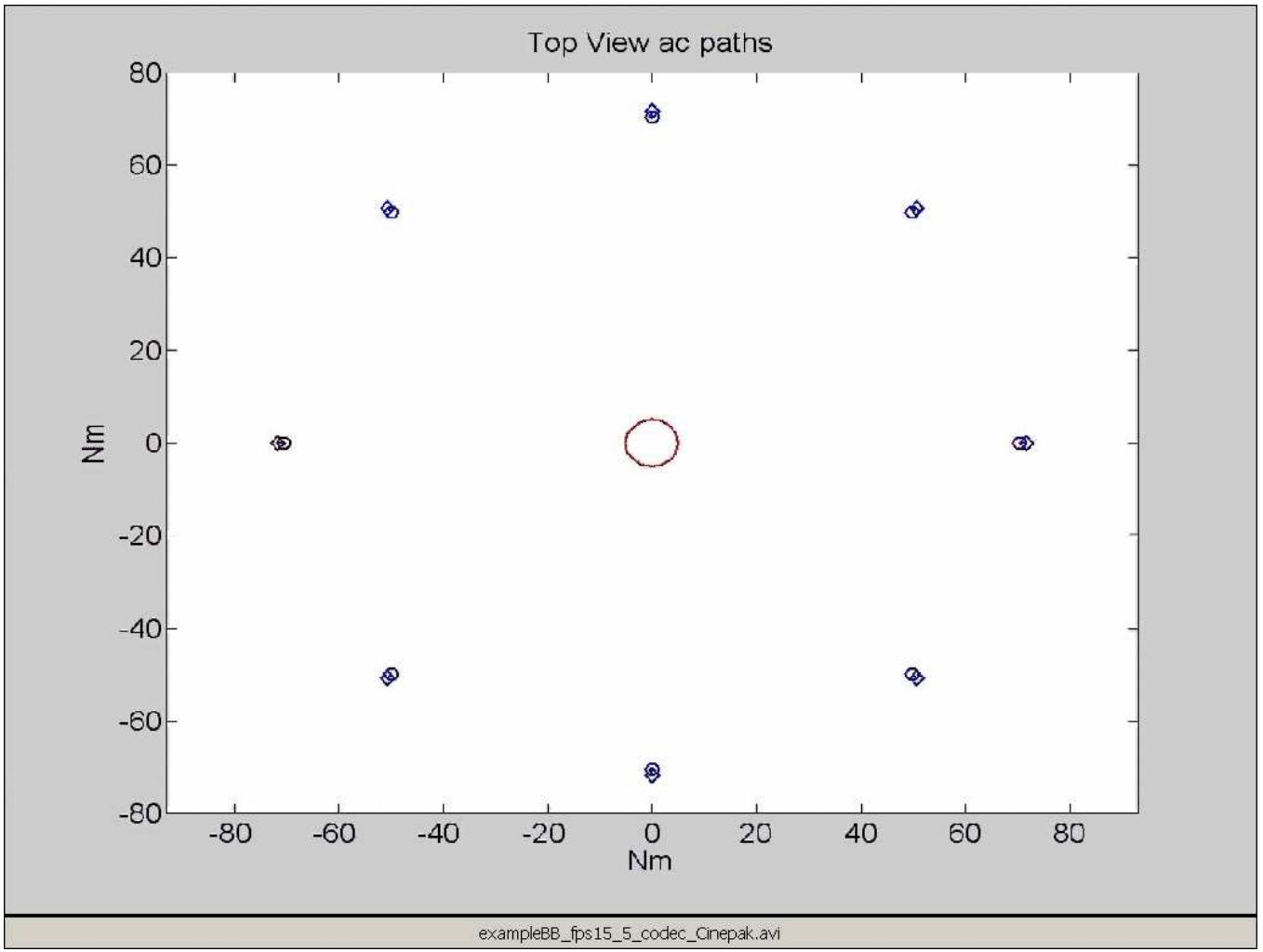
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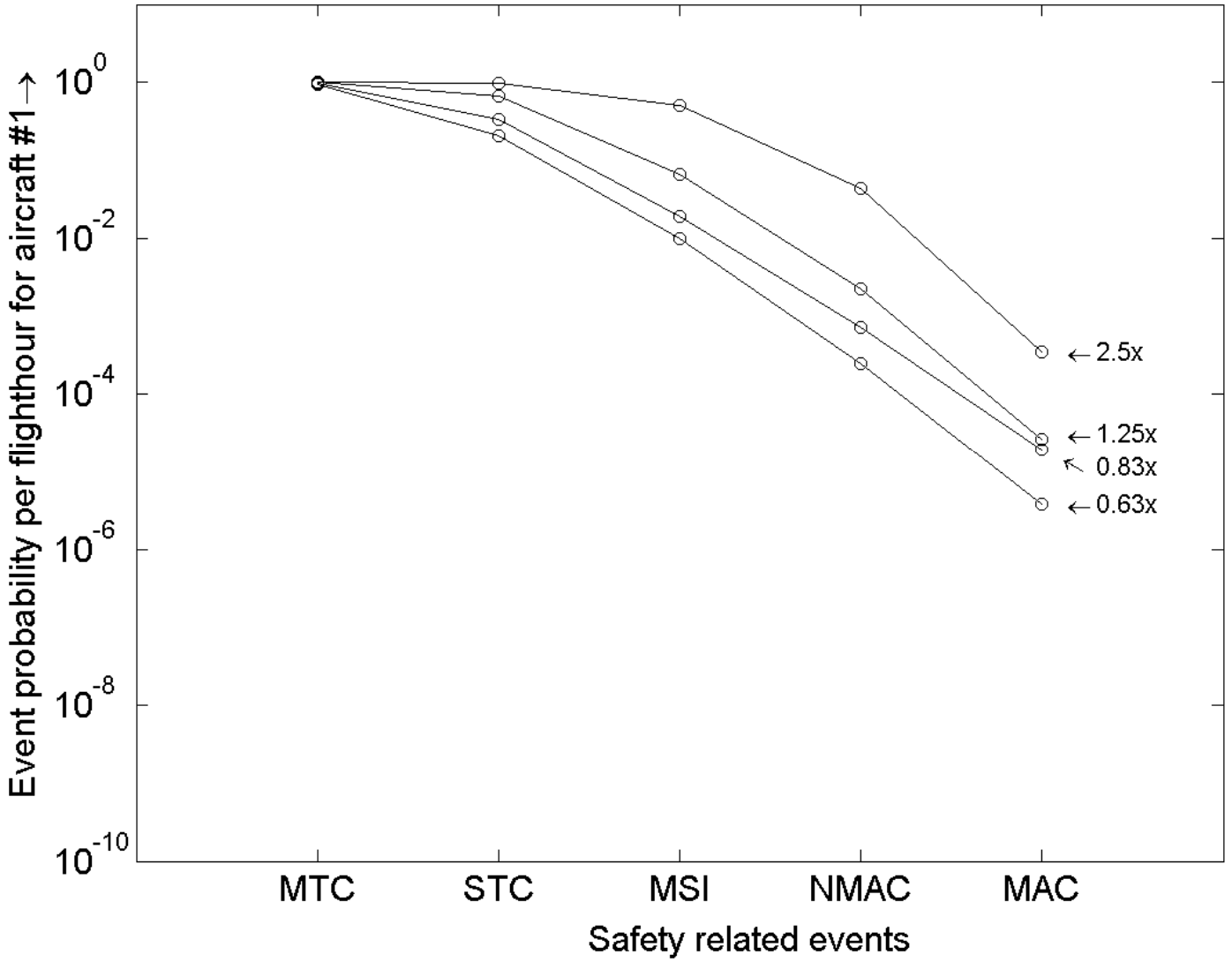
Random traffic under AMFF and traffic density up to 2.5x the density above Frankfurt on 23rd July 1999



AMFF conclusions

- AMFF works great for pilots, as long as they can have trust in the ASAS supporting systems
- AMFF supporting systems should comply with RTCA DO246 (= Eurocae ED78a) identified safety objectives
- Under high en-route traffic demands, AMFF falls short on rare event safety risk
- In order to answer the key question, we need to consider an airborne self separation ConOps that is much more advanced than AMFF