iFly final project presentation

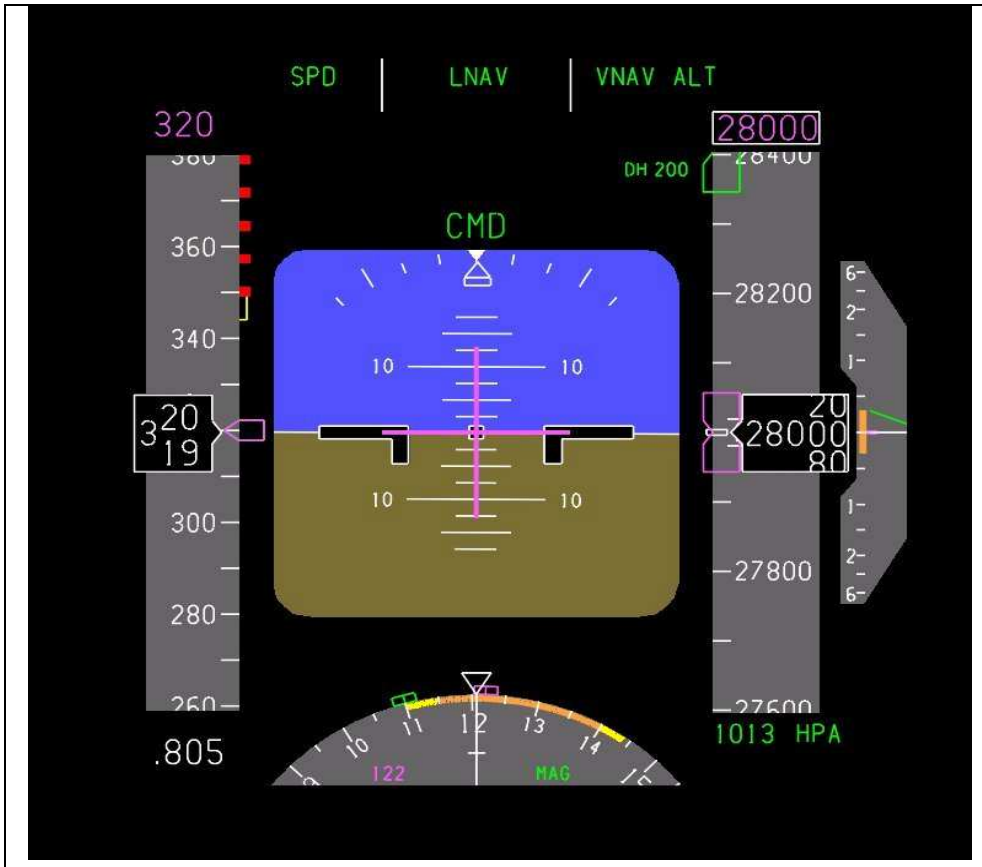
What were the main findings for AMFF?

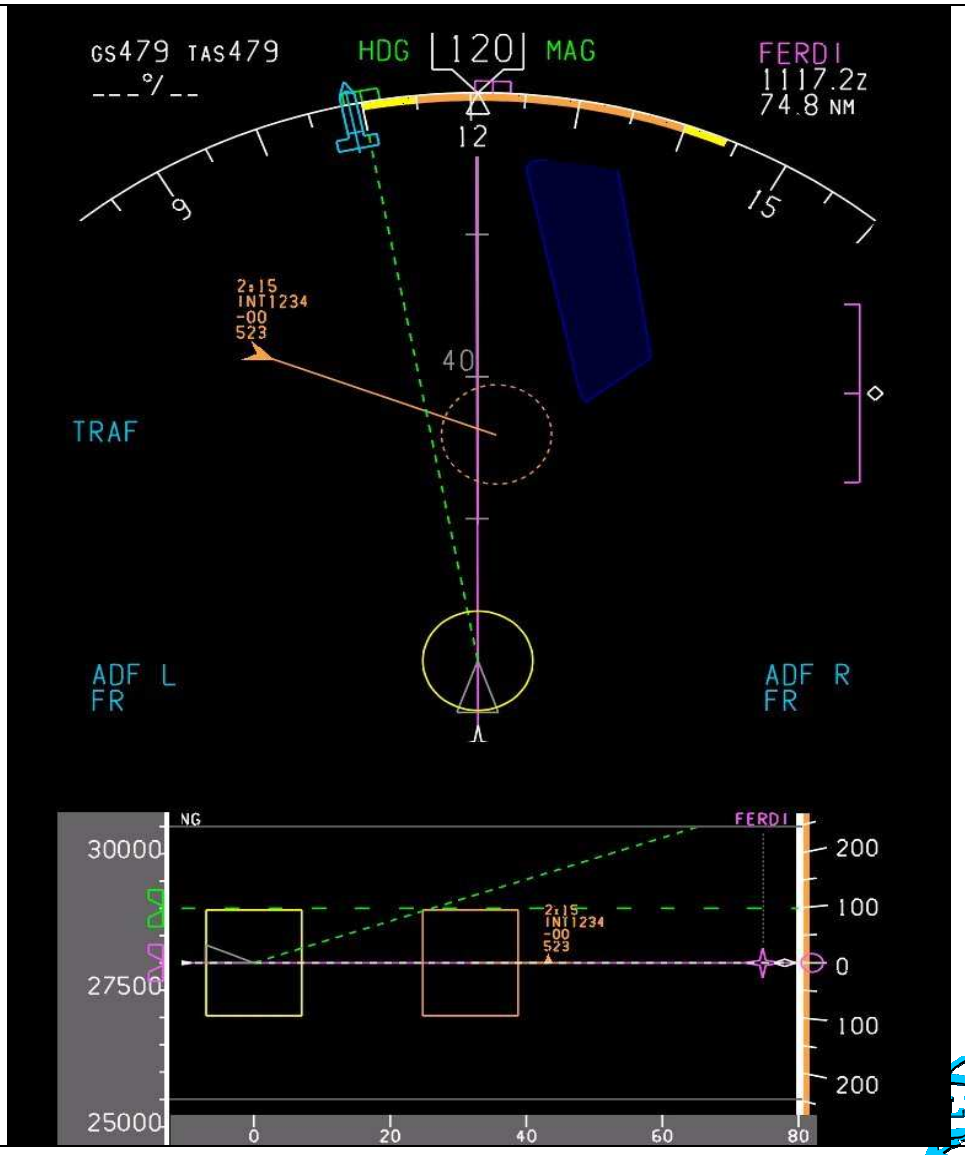
Henk Blom

National Aerospace Laboratory NLR
e-mail: blom@nlr.nl

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)


SPD
LNAV
VNAV ALT
320
28000
DH 200
CMD
360
340
320
19
300
280
260
10
10
10
10
28200
20
28000
80
27800
27600
1013 HPA
.805
122
MAG


GS479 TAS479
---°/--
HDG 120 MAG
FERDI
1117.2z
74.8 NM
12
9
15
2:15
INT1234
-00
523
40
TRAF
ADF L
FR
ADF R
FR
NG
FERDI
30000
27500
25000
200
100
0
100
200
0
20
40
60
80

Evaluations performed for AMFF

- Real-time pilot-in-the-loop simulations (MFF project)
- Safety Analysis RTCA-DO246 = 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

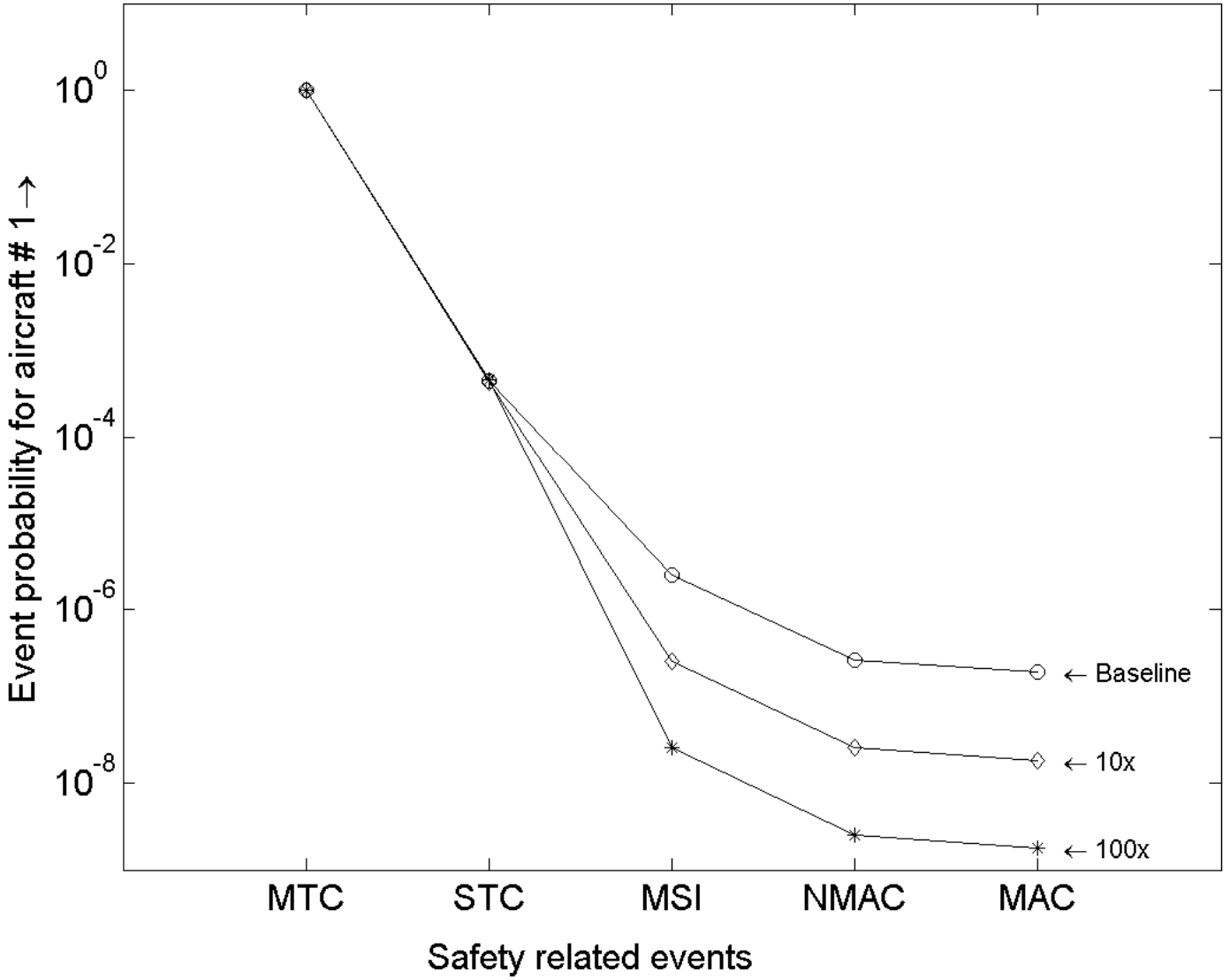
STC = Short Term Conflict

MSI = Minimum Separation Infringement

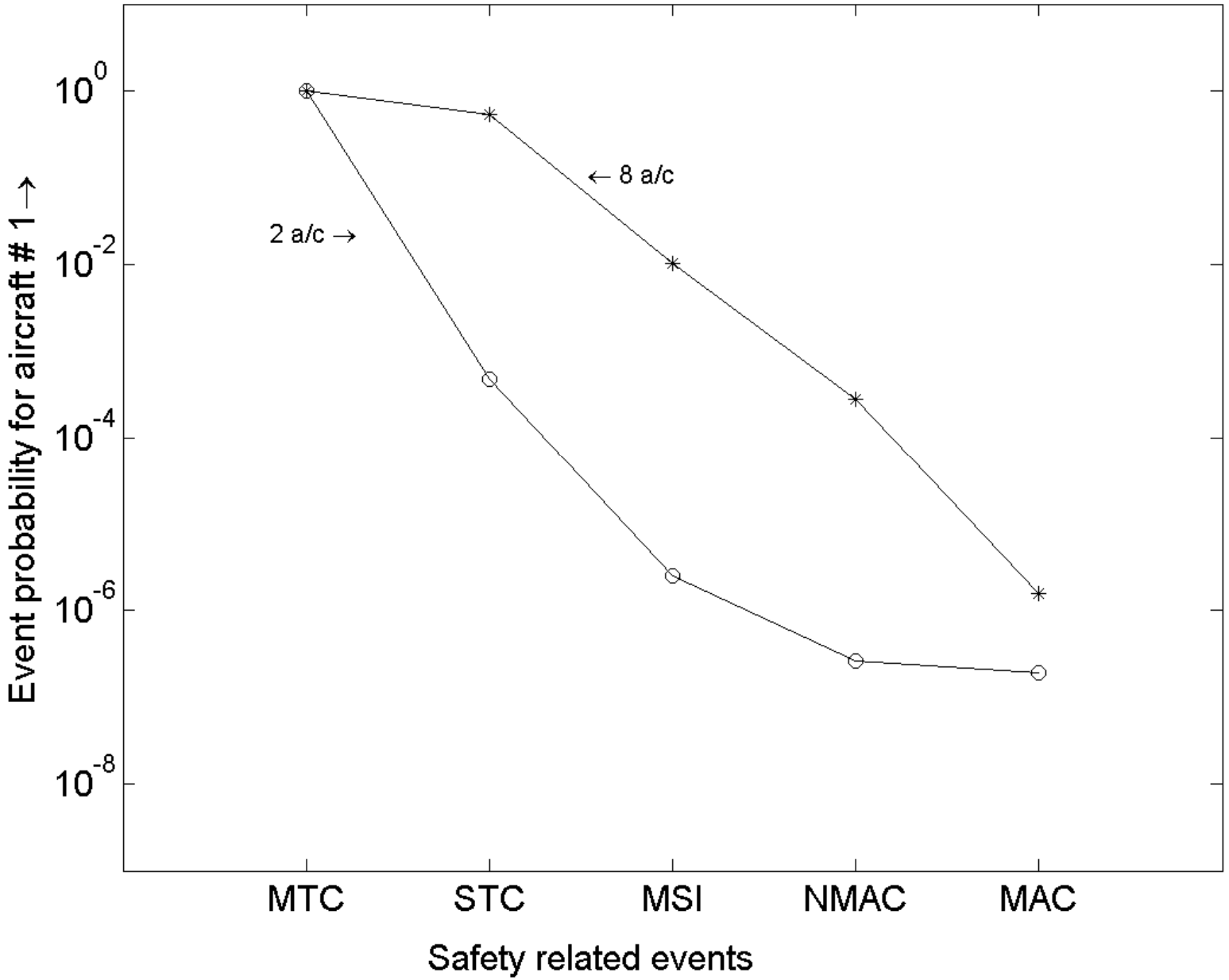
NMAC = Near Mid Air Collision

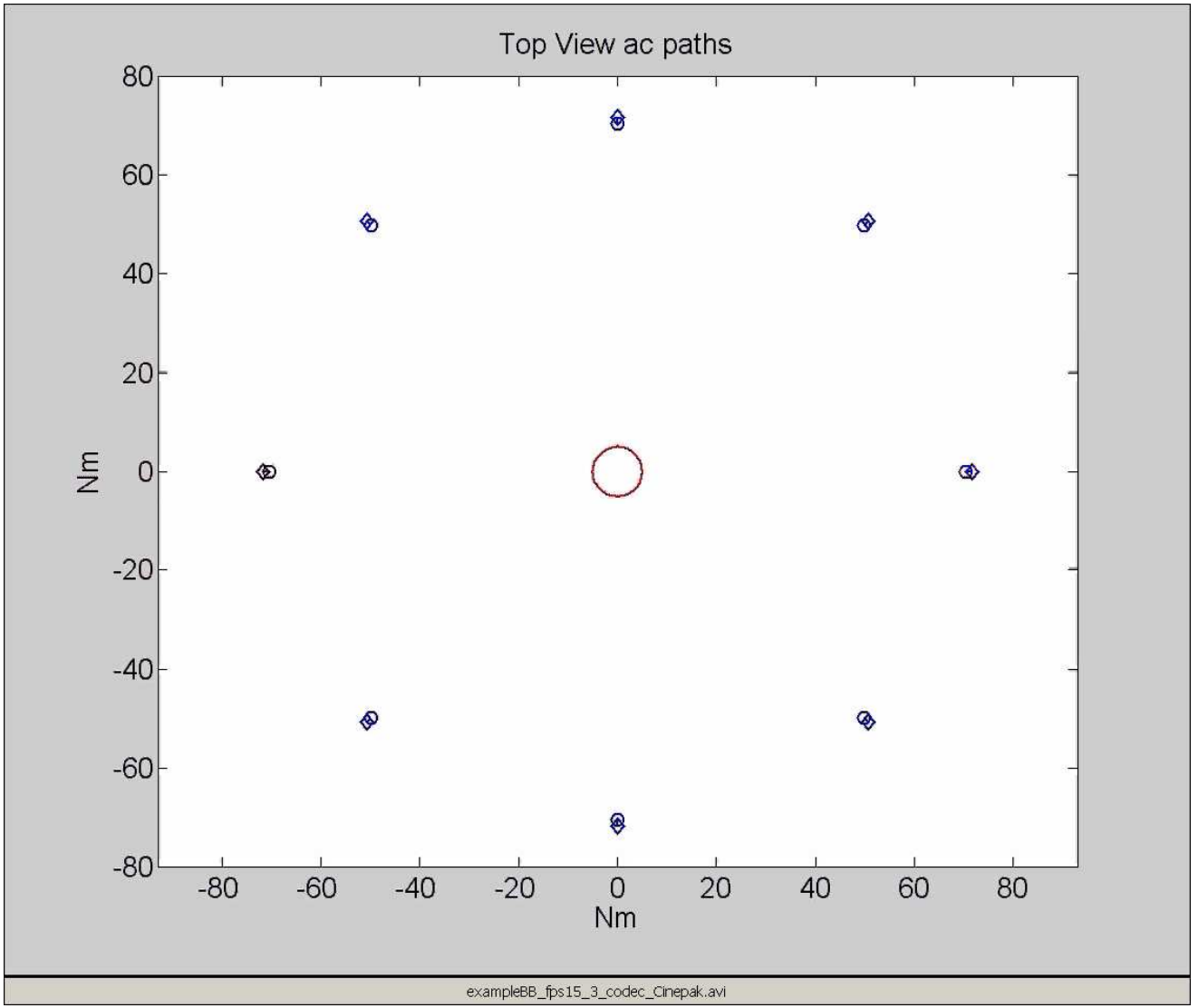
MAC = Mid Air Collision

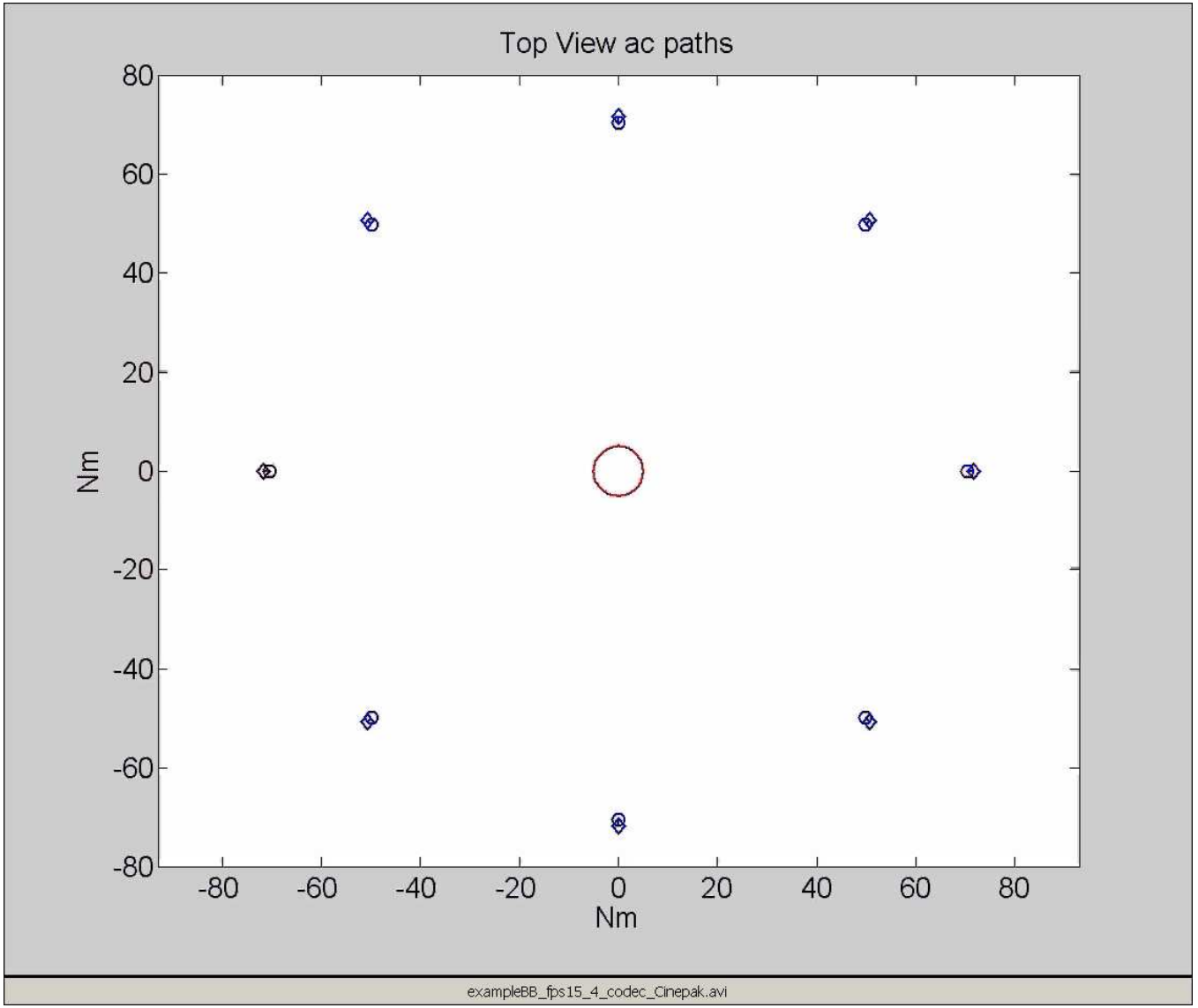
Two-aircraft head-on encounter under AMFF and ASAS dependability at baseline values and at factors 10x and 100x better values

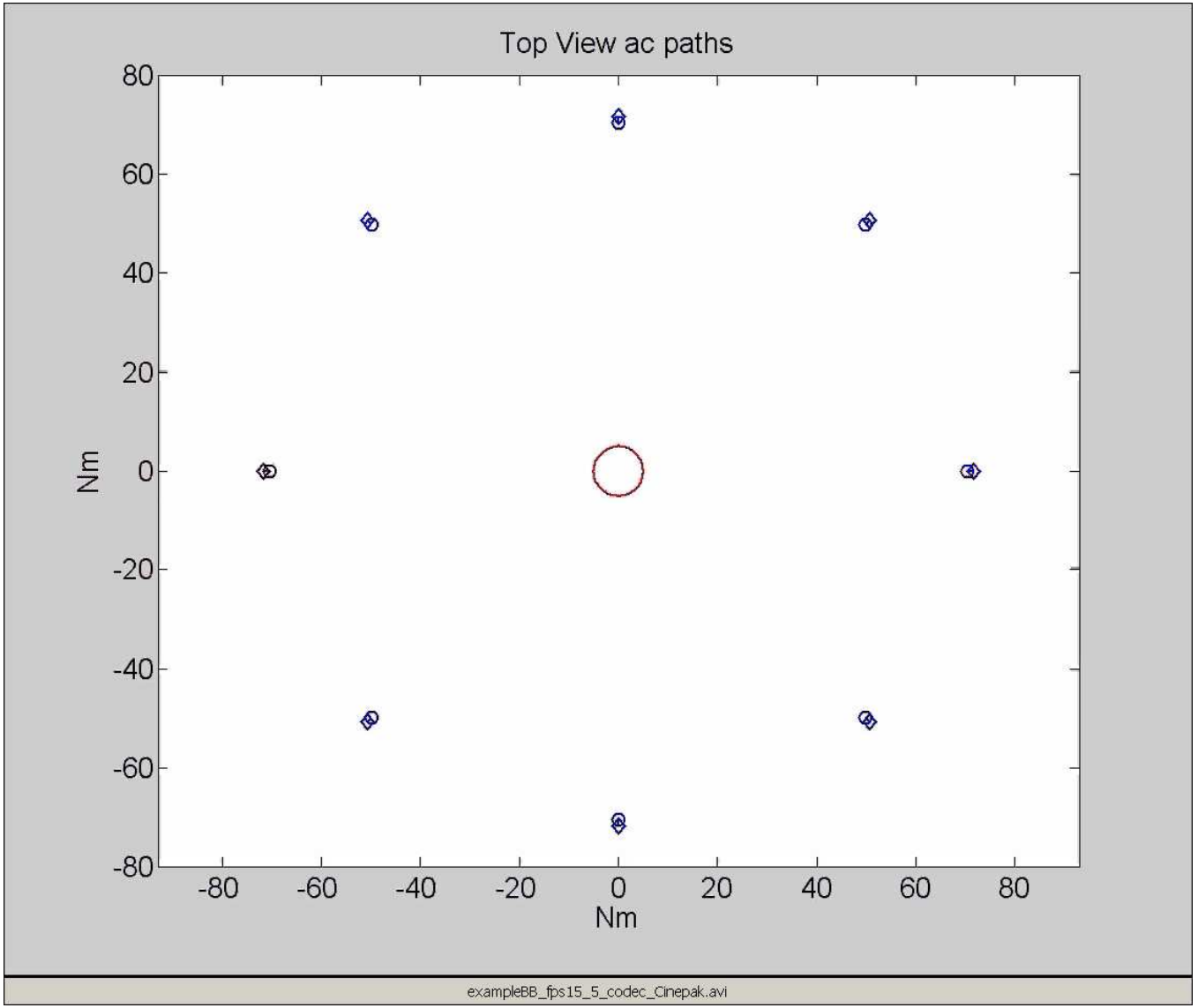


Two-aircraft vs. eight-aircraft encounter under AMFF and baseline ASAS dependability

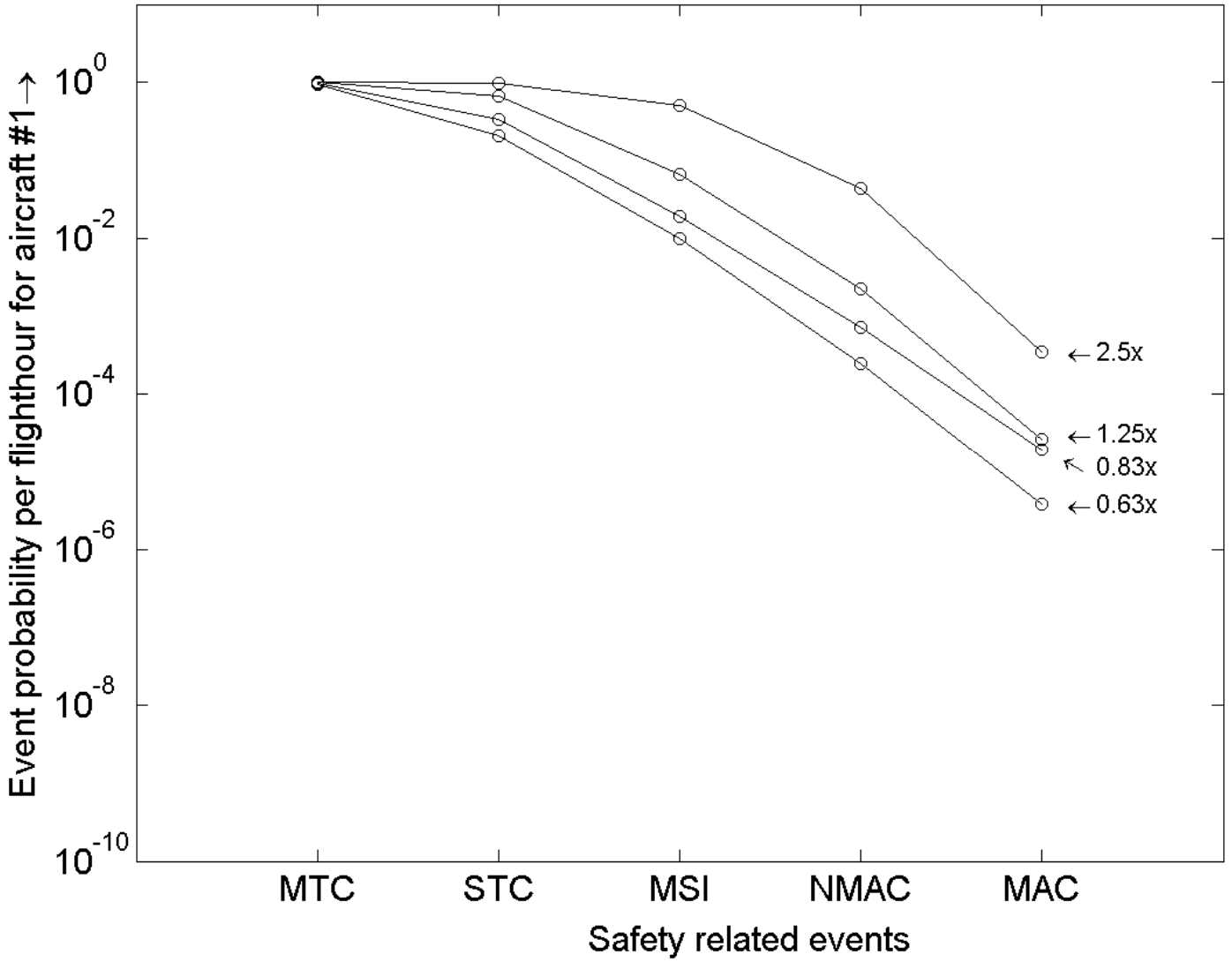



Top View ac paths
80
60
40
20
0
-20
-40
-60
-80
Nm
-80
-60
-40
-20
0
20
40
60
80
Nm
exampleBB_fps15_3_codec_Cinepak.avi


Top View ac paths
80
60
40
20
0
-20
-40
-60
-80
Nm
-80
-60
-40
-20
0
20
40
60
80
Nm
exampleBB_fps15_4_codec_Cinepak.avi


Top View ac paths
80
60
40
20
0
-20
-40
-60
-80
Nm
-80
-60
-40
-20
0
20
40
60
80
Nm
exampleBB_fps15_5_codec_Cinepak.avi

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