



# **Summary of Link Performance Versus Safe Flight 21 Applications**

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# Agenda



- Review SF 21 application requirements and relationship to MASPS requirements
- Review link support for SF 21 applications

# SF 21 ADS-B Requirements



- SF 21 implementation focuses on near and mid-term, primarily short-range (20 nmi or less) applications conducted in low density environments
- SF 21 applications are the basis for CBA benefits assessment

# SF 21 Enhancement 1 MASPS Requirement/Assessment: Weather and Other Information in the Cockpit



## MASPS Requirement

No MASPS requirement.

## Assessment

<b>1.0 Weather and Other Information in the Cockpit</b>	<b>1090ES</b>	<b>UAT</b>	<b>VDL4</b>
<b>1.1.1 Initial FIS-B based on today's availability</b>	<b>C</b>	<b>Ö</b>	<b>Ö</b>
<b>1.1.2 Add products such as NOTAMs, lightning, icing, turbulence, real time SUA, and volcanic ash</b>	<b>C</b>	<b>Ö</b>	<b>Ö</b>

# SF 21 Enhancement 2: Cost Effective CFIT Avoidance



Cost effective Controlled Flight Into Terrain (CFIT) avoidance is not a direct application of ADS-B.

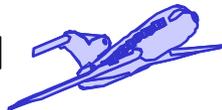
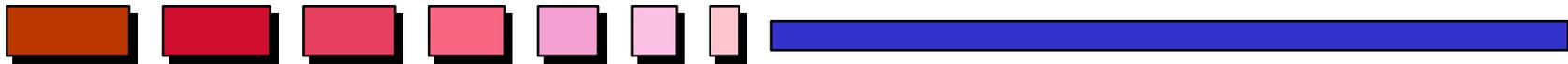
# SF 21 Enhancement 3 MASPS Requirements: Improved Terminal Operations in Low Visibility



## MASPS Requirement

SF 21 App	Min Acq Rng for SV & MS	Nominal Update Period (95 <sup>th</sup> percentile)	Nominal Coast Period (99 <sup>th</sup> percentile)
3.1.1 ... existing (ADS-B only)	10 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi};$ $\leq 5 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 10 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$
3.1.2 ...new (ADS-B only)	10 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 5 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 10 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$
3.1.3 ...new (ADS-B/TIS-B)	10 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 5 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 10 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$
3.2.1 App spacing...visual	10 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 5 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 10 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$
3.2.2 App spacing...IAP	20 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 7 \text{ sec}, 3 \text{ nmi} < R \leq 20 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 14 \text{ sec}, 3 \text{ nmi} < R \leq 20 \text{ nmi}$
3.4 Departure spacing...VMC in radar	10 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 5 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 10 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$

# SF 21 Enhancement 3 Assessment: Improved Terminal Operations in Low Visibility (2)



## Assessment

<b>3.0 Improved Terminal Operations in Low Visibility</b>	<b>1090ES</b>	<b>UAT</b>	<b>VDL4</b>
<b>3.1.1 Enhanced visual approaches (visual acquisition with existing procedures – ADS-B only)</b>	<b>Ö</b>	<b>Ö</b>	<b>C</b>
<b>3.1.2 Enhanced visual approaches (visual acquisition with new procedures – ADS-B only)</b>	<b>Ö</b>	<b>Ö</b>	<b>C</b>
<b>3.1.3 Enhanced visual approaches (visual acquisition with new procedures – ADS-B &amp; TIS-B)</b>	<b>TIS-B not evaluated</b>		
<b>3.2.1 Approach spacing (for visual approaches)</b>	<b>Ö</b>	<b>Ö</b>	<b>C</b>
<b>3.2.2 Approach spacing (for instrument approaches)</b>	<b>Ö</b>	<b>Ö</b>	<b>C</b>
<b>3.4 Departure spacing/clearance (VMC in radar)</b>	<b>Ö</b>	<b>Ö</b>	<b>C</b>

# SF 21 Enhancement 4 MASPS Requirements: Enhanced See-And-Avoid



## MASPS Requirement

SF 21 App	Min Acq Rng for SV & MS	Nominal Update Period (95 <sup>th</sup> percentile)	Nominal Coast Period (99 <sup>th</sup> percentile)
4.1.1 Enhanced visual acquisition... (ADS-B only)	10 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi};$ $\leq 5 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 10 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$
4.1.2 Enhanced visual acquisition... (ADS-B & TIS-B)	10 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi};$ $\leq 5 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 10 \text{ sec}, 3 \text{ nmi} < R \leq 10 \text{ nmi}$
4.2.1 Conflict Detection	20 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 7 \text{ sec}, 3 \text{ nmi} < R \leq 20 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 14 \text{ sec}, 3 \text{ nmi} < R \leq 20 \text{ nmi}$
4.2.2 Conflict Resolution	20 nmi	$\leq 3 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 7 \text{ sec}, 3 \text{ nmi} < R \leq 20 \text{ nmi}$	$\leq 6 \text{ sec}, R \leq 3 \text{ nmi}$ $\leq 14 \text{ sec}, 3 \text{ nmi} < R \leq 20 \text{ nmi}$

# SF 21 Enhancement 4 Assessment: Enhanced See-And-Avoid



## Assessment

<b>4.0 Enhanced See And Avoid</b>	<b>1090ES</b>	<b>UAT</b>	<b>VDL4</b>
<b>4.1.1 Enhanced visual acquisition of other traffic for see-and-avoid (using ADS-B only)</b>	<b>Ö</b>	<b>Ö</b>	<b>Ö</b>
<b>4.1.2 Enhanced visual acquisition of other traffic for see-and-avoid (using ADS-B and TIS-B)</b>	<b>TIS-B not evaluated</b>		
<b>4.2.1 Conflict detection</b>	<b>Ö</b>	<b>Ö</b>	<b>C</b>
<b>4.2.2 Conflict resolution</b>	<b>Ö</b>	<b>Ö</b>	<b>C</b>

# SF 21 Enhancement 5 MASPS Requirements: Enhanced En Route Air-to-Air Operations



## MASPS Requirement

SF 21 App	Min Acq Rng for SV & MS	Nominal Update Period (95 <sup>th</sup> percentile)	Nominal Coast Period (99 <sup>th</sup> percentile)
5.2.1 Pilot situational awareness beyond visual range.	20 nmi	$\leq 3 \text{ sec, } R \leq 3 \text{ nmi;}$ $\leq 7 \text{ sec, } 3 \text{ nmi} < R \leq 20 \text{ nmi}$	$\leq 6 \text{ sec, } R \leq 3 \text{ nmi}$ $\leq 14 \text{ sec, } 3 \text{ nmi} < R \leq 20 \text{ nmi}$

# SF 21 Enhancement 5 Assessment: Enhanced En Route Air-to-Air Operations



## Assessment

5.0 Enhanced En Route Air-to-Air Operations	1090ES	UAT	VDL4
5.2.1 Pilot situational awareness beyond visual range	0	0	C

# SF 21 Enhancement 6 MASPS Requirements: Improved Surface Surveillance & Pilot Navigation



## MASPS Requirement

SF 21 App	Min Acq Rng for SV & MS	Nominal Update Period (95 <sup>th</sup> percentile)	Nominal Coast Period (99 <sup>th</sup> percentile)
6.1.1 Runway & final approach occupancy awareness (ADS-B only).	10 nmi	$\leq 3$ sec	$\leq 7$ sec
6.1.2 Runway & final approach occupancy awareness (ADS-B & TIS-B).	10 nmi	$\leq 3$ sec	$\leq 7$ sec
6.2 Airport surface situational awareness.	5 nmi	$\leq 1.5$ sec	$\leq 3$ sec

# SF 21 Enhancement 6 Assessment: Improved Surface Surveillance & Pilot Navigation



## Assessment

6.0 Improved Surface Surveillance & Pilot Navigation	1090ES	UAT	VDL4
6.1.1 Runway & final approach occupancy awareness (ADS-B only)	Not assessed (lack of data)		
6.1.2 Runway & final approach occupancy awareness (ADS-B and TIS-B)			
6.2 Airport surface situational awareness			

# SF 21 Enhancement 7 MASPS Requirements: Enhanced Surface Surveillance for Controller



## MASPS Requirement

SF 21 App	Min Acq Rng for SV & MS	Nominal Update Period (95 <sup>th</sup> percentile)	Nominal Coast Period (99 <sup>th</sup> percentile)
7.1 Enhanced existing surface surveillance with ADS-B.	5 nmi	1 sec (98%)	NA
7.2 Surveillance coverage at airports without existing surface surveillance.	5 nmi	1 sec (98%)	NA

# SF 21 Enhancement 7 Assessment: Enhanced Surface Surveillance for Controller



## Assessment

7.0 Enhanced Surface Surveillance for Controller	1090ES	UAT	VDL4
7.1 Enhance existing surface with ADS-B	0	0	0
7.2 Surveillance coverage at airports without existing surface surveillance	0	0	0

# SF 21 Enhancement 8 MASPS Requirements: ADS-B Surveillance in Non-Radar Airspace



## MASPS Requirement

SF 21 App	Min Acq Rng for SV & MS	Nominal Update Period (95 <sup>th</sup> percentile)	Nominal Coast Period (99 <sup>th</sup> percentile)
8.2 Radar-like ADS-B services.	En Route: 200 nmi Terminal: 60 nmi	En Route: 12 sec (98%) Terminal: 5 sec (98%)	NA
8.3 Tower situational awareness...	Surface: 5 nmi Parallel Runway: 10 nmi	Surface: 1 sec (98%) Parallel Runway: 1 sec (98%)	NA

# SF 21 Enhancement 8 Assessment: ADS-B Surveillance in Non-Radar Airspace



## Assessment

<b>8.0 ADS-B Surveillance in Non-Radar Airspace</b>	<b>1090ES</b>	<b>UAT</b>	<b>VDL4</b>
<b>8.2 Radar-like services with ADS-B</b>	0	0	0
<b>8.3 Tower situational awareness beyond visual range</b>	0	0	0

# SF 21 Enhancement 9 MASPS Requirement/Assessment: Establish ADS-B Separation Standards



## MASPS Requirement

No MASPS requirement.

## Assessment

<b>9.0 Establish ADS-B Separation Standards</b>	<b>1090ES</b>	<b>UAT</b>	<b>VDL4</b>
<b>9.1.1 Radar augmentation with ADS-B to support mixed equipage in terminal airspace</b>	0	0	0
<b>9.1.2 Radar augmentation with ADS-B to support mixed equipage in enroute airspace</b>	0	0	0

# SF 21 Applications: Overall Assessment



## Assessment

	1090ES	UAT	VDL4
OVERALL ASSESSMENT	0	0	C