



NASA  
P.O. Box 273  
Edwards, CA 93523 USA  
661-276-2440  
661-276-3880 FAX  
[www.access5.aero](http://www.access5.aero)

## COVER SHEET

### Access 5 Project Deliverable

**Deliverable Number:** PD004

**Title:** Recommendations for Sense & Avoid Policy Compliance

**Filename:** PD004\_Sense\_Avoid\_Policy\_Compliance\_Position\_Paper\_v0\_FINAL.doc

**Abstract:**

Since unmanned aircraft do not have a human on board, they need to have a sense and avoid capability that provides an “equivalent level of safety” (ELOS) to manned aircraft. The question then becomes - is sense and avoid ELOS for unmanned aircraft adequate to satisfy the requirements of 14 CFR 91.113? Access 5 has proposed a definition of sense and avoid, but the question remains as to whether any sense and avoid system can comply with 14 CFR 91.113 as currently written.

The Access 5 definition of sense and avoid ELOS allows for the development of a sense and avoid system for unmanned aircraft that would comply with 14 CFR 91.113. Compliance is based on sensing and avoiding other traffic at an equivalent level of safety for collision avoidance, as manned aircraft. No changes to Part 91 are necessary, with the possible exception of changing “see” to “sense,” or obtaining an interpretation from the FAA General Counsel that “sense” is equivalent to “see.”

**Status:**

<b>WP – Work in Progress Draft</b>

**Limitations on use:**

None. The position paper was tabled pending further discussions and collision avoidance requirements development. Previous discussions and requirements development efforts did not provide sufficient rationale to recommend any rule/policy change.

## ACCESS 5 POSITION PAPER

**Project:** Access 5

**Paper Number:** SE-2

**Regulation Reference:** 14 CFR 91.113

**Date:** April 30, 2005

**Status:**

Proposal	Draft Position	Closed	SEIT-Approved	Access 5-Approved
	X			

**Subject:** Sense and Avoid Policy Compliance

---

**Statement of Question/Issue:**

Currently, unmanned aircraft are only allowed to operate within the NAS through means of segregation from manned aircraft. One primary reason is due to the lack of an approved/certified collision avoidance system for use on unmanned aircraft. Since unmanned aircraft do not have a human on board, they need to have a sense and avoid capability that provides an “equivalent level of safety” (ELOS) to manned aircraft. The question then becomes - is sense and avoid ELOS for unmanned aircraft adequate to satisfy the requirements of 14 CFR 91.113? Stated another way, is there an alternative method of compliance for 14 CFR 91.113 practicable for use with unmanned aircraft? Access 5 has proposed a definition of sense and avoid, but the question remains as to whether any sense and avoid system can comply with 14 CFR 91.113 as currently written.

**Discussion:**

Both manned and unmanned aircraft must meet the see and avoid requirement as stated in 14 CFR 91.113. Manned aircraft use human vision, sometimes with cueing assistance, to see and avoid. Model aircraft have continued to use human vision to fly safely, by staying low enough and close enough to be observed by the pilot on the ground. Military unmanned aircraft have used ground observers, chase aircraft, and radar to see or sense the presence of other aircraft and then maneuver to avoid.

According to 14CFR 91.113, regardless of whether an aircraft is operating under visual flight rules (VFR) or instrument flight rules (IFR) the pilot in command is to remain vigilant to see and avoid other aircraft. Since unmanned aircraft do not have a pilot on-board the aircraft, they cannot literally comply with the “see and avoid” requirement beyond a short distance from the location of the unmanned pilot. No performance standards are presently defined for unmanned Sense and Avoid systems, and the FAA has no published approval criteria for a collision avoidance system that would satisfy the “see and avoid” requirement.

**Access 5 Project Position:**

Page 2 *This document was prepared by a collaborative team through the Policy work package. This was a funded effort under the Access 5 Project.*

The Access 5 definition of sense and avoid ELOS allows for the development of a sense and avoid system for unmanned aircraft that would comply with 14 CFR 91.113. Compliance is based on sensing and avoiding other traffic at an equivalent level of safety for collision avoidance, as manned aircraft. A key point to note is that the complete answer to sense-and-avoid ELOS is expected to be a system or systems that address both cooperative and non-cooperative traffic situations. However, under certain conditions (e.g. in Class A airspace or above, with a certain type of control system, and perhaps some other limitations), it may be possible to obtain a favorable sense-and-avoid ELOS determination using a cooperative only system.

Therefore, unmanned aircraft systems that meet an ELOS for midair collisions, compared to manned aircraft, would comply with 14 CFR 91.113. No changes to Part 91 are necessary, with the possible exception of changing “see” to “sense,” or obtaining an interpretation from the FAA General Counsel that “sense” is equivalent to “see.”

**Project Coordination:**

SEIT	ID	PM					