ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: MINIMUM SAFE ALTITUDE WARNING (MSAW)

1. **PURPOSE.** This Advisory Circular describes the capabilities and limitations of Minimum Safe Altitude Warning (MSAW).

2. **CANCELLATION.** AC 90-72 dated 11/30/76 is canceled.

3. **DISCUSSION.**

   a. To assist air traffic controllers to detect aircraft that are within or are approaching unsafe proximity to terrain/obstacles, the FAA has furnished ARTS III facilities with a computer function called Minimum Safe Altitude Warning (MSAW). The function generates an alert when a participating aircraft is, or is predicted to be, below a predetermined minimum safe altitude. Aircraft on an IFR flight plan that are equipped with an operating altitude encoding transponder automatically participate in the MSAW program. That is, no specific request is necessary. Pilots on VFR or no flight plans may, provided they are equipped with an operating altitude encoding transponder, participate by asking the air traffic controller. The controller will evaluate any observed alerts and, when appropriate, issue a radar safety advisory.

   b. Federal Aviation Regulations place responsibility for safe altitude management on the pilot. Minimum Safe Altitude Warning provides the controller information which when judged to be significant can be relayed to assist the pilot with that responsibility. Participation in the MSAW program does not relieve the pilot of responsibility for safe altitude management.

4. **FUNCTIONAL DESCRIPTION.**

   a. For general terrain altitude monitoring, MSAW maintains a computerized grid map of the terminal area. The grid map is comprised of 2-mile squares. The highest known obstacle in each grid or bin determines the mimimum safe altitude for that location. The minimum safe altitude is 500 feet above the highest terrain/obstacle in each bin. The ARTS computer compares the current Mode C altitude of an aircraft against the

minimum safe altitude. It then looks ahead 30 seconds to see if the aircraft will enter a bin below the minimum safe altitude if it continues its present heading, altitude or rate of climb/descent. Then, the program assumes a 5-degree climb and computes to see if the aircraft will remain above the minimum safe altitude if it were to start climbing immediately. For the look ahead, a buffer of 300 feet, instead of 500 feet, above the highest obstacle is used.

    b. Minimum Safe Altitude Warning monitors the final approach course from the final approach fix and a point approximately 2 miles from the landing threshold. It first checks 100 feet below the minimum descent altitude (MDA)/ stepdown fix altitude. It then looks ahead down the final approach course using the computer established descent rate to determine if the aircraft will be 200 feet below the MDA/stepdown fix altitude in 15 seconds.

5. OPERATIONAL DESCRIPTION.

    a. If an aircraft is, or is predicted to be, below a minimum safe altitude the computer alerts the controller by displaying "LA" in the aircraft's data tag. An aural alarm is also sounded to attract the controller's attention. The controller will evaluate the situation and, if appropriate, issue a radar safety advisory; i.e., "LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY."

    b. It is the pilot's responsibility to evaluate the situation and determine what action may be necessary when an advisory is received. The pilot is expected to inform ATC immediately should any action be taken after receiving a radar safety advisory.

6. LIMITATIONS.

There are situations under which the controller will not receive an MSAW generated low altitude alert. In some instances, the controller may not be aware of the condition. The situations include:

    a. ATC radar beacon interrogator is not operating.

    b. The ARTS III computer with the MSAW program is not operating.

    c. The aircraft is not being tracked by the ARTS III.

    d. The aircraft's Mode A or C transponder is sending garbled, weak or erroneous signals. (Both Mode A and Mode C signals are required for MSAW processing.)

e. The aircraft is not within radar coverage because it is below line of sight or too far away from the radar site.

f. A departing aircraft is within 3 miles of the airport, or an arrival is on final approach to an instrument runway and within 2 miles of the airport or between the stepdown fix and the airport. (Because of the various types of activity in an airport traffic area it is not currently practical to continue MSAW processing within these areas.)

g. The aircraft has been inhibited from computer processing for low altitude alerts. (Aircraft are sometimes purposely operated at low altitudes. Minimum Safe Altitude Warning processing of these flights will be inhibited because the controller would receive continuous alerts (false alarms) causing the intentionally low flying VFR pilot to be unnecessarily advised to check his altitude.)

h. Due to radar antenna rotation time, the computer needs about 10 seconds to establish a definite course and/or altitude change. Consequently, there are two conditions which may result in low altitude alerts being issued too late to permit the pilot to take corrective action. These are:

(1) An aircraft's projected track is clear of any known obstacle and an abrupt turn is made towards one.

(2) An aircraft operating at an altitude just above the programed MSAW altitude makes an abrupt descent.

7. VFR PILOT PARTICIPATION.

VFR pilots of aircraft equipped with an operating altitude encoding transponder may particpate in the MSAW program by asking the controller. When participating, they are requested to fly at least 500 feet (1000 feet where applicable) above the highest obstacle within 2 miles of their route.

Phraseology: "(Name of facility), (aircraft identification) request MSAW."

Example: "Los Angeles Approach Control, N457G request MSAW."

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