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Federal Aviation Agency

ADVISORY CIRCULAR

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AIR TRAFFIC CONTROL
AND
GENERAL OPERATIONS

EFFECTIVE :
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SUBJECT : WEATHER RADAR RADOMES

1. PURPOSE. This Advisory Circular highlights some important points to consider in the selection and maintenance of weather radar radomes.
2. DISCUSSION. A radome is a covering whose primary purpose is to protect a radar antenna from the elements. It is a part of the airframe and therefore must have certain physical, as well as electrical properties. Physically, a radome must be strong enough to withstand the airloads that it will be subjected to and it must be contoured to minimize drag. These properties vary with the shape, design speed, and size of the airplane on which it is to be installed. Electrically, a radome must permit the passage of the radar's transmitted signals and return echoes with minimum distortion and absorption. In order to do this it must have a certain electrical thickness. The electrical thickness of a radome is related to the physical thickness, operating frequency, and the types of material and construction used. This relationship is defined by a number of complex mathematical equations which are of interest only to radome design engineers. These equations show that for given physical properties a radome will have a certain electrical thickness for a certain narrow range of operating frequencies. (This is the reason why C-band radomes won't give optimum performance with X-band radar and vice versa.) Also, a very small variation in physical thickness will cause a sizable variation in electrical thickness. This can spell the difference between an efficient radome and one that can reduce radar range, distort displays, and cause inaccurate directions and false targets. Hence, a radome must be precisely built for optimum performance.
3. RADOME DAMAGE. Probably the most frequent damage to radomes is holes in the structure caused by static discharges. These can be large holes that are readily apparent, or small pin holes that are almost imperceptible. Any hole, regardless of size, can cause major damage to a radome as moisture can enter the radome wall, and cause internal delamination. If the moisture freezes, more serious damage will occur.

If sufficient moisture collects, the radiation pattern will be distorted, and the transmitted signals and return echoes will be seriously attenuated. Ram air through a hole can delaminate and break the inner surface of the radome and result in separation of the skins or faces of the material from the core. This can severely weaken the radome structure. Other types of damage are dents and scratches caused by impact with stones and birds and improper handling of the radome when it is removed for maintenance of the radar antenna. This type of damage is easily found by inspection.

4. MAINTENANCE. All repairs to radomes, no matter how minor, must return the radome at least to its original or properly altered condition, both electrically and structurally. The performance of proper maintenance to precision radomes requires special knowledge and techniques and the use of proper tools and materials. An improper minor repair can eventually lead to an expensive major repair. A radome having undergone major repairs should be tested to ascertain that its electrical properties have not been impaired. The testing of radomes is an art in itself and requires test equipment that usually is found only in repair facilities that specialize in radome maintenance.
5. CONCLUSION. Weather radar, regardless of cost, will not perform efficiently and accurately without a radome that is precisely built to be compatible with the radar that is installed. Careful periodic inspection of radomes will reveal minor damage that, if undiscovered, can result in expensive major repairs. Insist on proper repairs to your radome.


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