

## CONTROL OF OBSTACLES

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Aerodrome Safety Publications are published by the CAAS for purposes of promulgating supplementary guidance materials to the Standards and Recommended Practices (SARPs) in the Manual of Aerodrome Standards. The publications are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with SARPs. Aerodrome Safety Publications may explain certain regulatory requirements by providing interpretive and explanatory materials.

## **1 Purpose**

- 1.1 The purpose of this Aerodrome Safety Publication (ASP) is to promulgate supplementary guidance materials to aerodrome operators on control of obstacles. This ASP aims to provide guidance on what is acceptable to the Aerodrome and Air Navigation Services Regulation (AAR) Division with regard to the technical requirements in the Manual of Aerodrome Standards (MOAS), Chapter 8 – Obstacle Restriction and Removal, and Chapter 10 – Visual Aids for Denoting Obstacles and any other requirements stipulated by the Civil Aviation Authority of Singapore (CAAS), where necessary.
- 1.2 This ASP recommends and explains the process of obstacle control viz. marking and lighting of obstacles, conducting of obstacle surveys, removal or lowering of obstacles and reporting of obstacles to the appropriate authorities. By considering the ASP, the aerodrome operator should be able to establish an effective obstacle control process, and keep his aerodrome and its vicinity safe for aircraft operations.

## **2 Applicability**

- 2.1 The ASP applies to all aerodrome operators certified under paragraph 67 of the Singapore Air Navigation Order (ANO).

## **3 Cancellation**

- 3.1 This ASP supersedes ASP 01/2014.

## **4 Effective Date**

- 4.1 This ASP takes effect on 5 April 2017.

## **5 Introduction**

- 5.1 The effective utilisation of an aerodrome may be considerably influenced by man-made activities<sup>1</sup> and natural growths (e.g. trees) within the aerodrome and its vicinity. These may result in:
  - (a) Limitations on the distances available for take-off and landing operations;
  - (b) The range of meteorological conditions in which take-off and landing operations can be undertaken;
  - (c) A reduction in the payload of some aircraft types; or

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<sup>1</sup> Man-made activities include construction activities and aerial activities such as flying or operating a kite, parasail, captive balloon, model aircraft or unmanned airship.

- (d) Any of the combinations above.

5.2 Obstacle limitation surfaces (OLS) is defined in the MOAS as:

*“A series of surfaces that define the volume of airspace at and around an aerodrome to be kept free of obstacles in order to permit the intended aircraft operations to be conducted safely and to prevent the aerodrome from becoming unusable by the growth of obstacles around the aerodrome.”*

5.3 The OLS have been established by CAAS Air Navigation Services (ANS) Policy Branch (hereinafter referred to as “ANS Policy”). ANS Policy continues to:

- (a) safeguard the OLS;
- (b) issue the necessary approvals for construction vehicles and equipment to be used, including their height requirements and technical specifications of visual aids to be installed on the vehicles and equipment;
- (c) issue the necessary clearances for aerial activities; and
- (d) provide height consultation to the Urban Redevelopment Authority and developers in Singapore, including the maximum allowable height of each building and the technical specifications of obstacle lights, if required to be installed on the top of the building.

5.4 As the holder of an aerodrome certificate issued under paragraph 67 of the ANO, the aerodrome operator is responsible to ensure aircraft operate safely from his aerodrome. In this regard, he is responsible for the limitation and control of obstacles within his aerodrome and making arrangements for the removal or lowering of obstacles around his aerodrome. For the latter, the aerodrome operator should formalise an arrangement with the ANS Policy and other relevant authorities to deal with the timely removal or lowering of obstacles. For those obstacles that could not be removed or lowered, and if deemed that these obstacles would need to be marked and lit, the aerodrome operator should also formalise an arrangement with the ANS Policy and other relevant authorities for the monitoring of these visual aids. Such arrangements could be captured in the aerodrome manual and/or procedures owned by the aerodrome operator, provided that the ANS Policy and other relevant authorities are consulted and have agreed to it. These arrangements could be reviewed and changed, at any time, by any party, if necessary. However, all affected parties will need to be consulted and agreed to the proposed changes before the changes can be effected and documented.

## 6 Objective

6.1 The objective of obstacle control is for the aerodrome operator to ascertain that man-made structures, natural growths (e.g. trees) or aerial activities likely to infringe the OLS are discovered before they pose a danger to

aircraft operations. Hence, the aerodrome operator should put in place a process of systematic and frequent obstacle surveys at his aerodrome and its vicinity. In addition, the obstacle surveys should include checks for any unauthorised construction equipment and hazardous aerial activities, which may pose a danger to aircraft operations. The aerodrome operator is to take necessary corrective actions to address any penetrations, non-compliances and / or unauthorised aerial activities.

6.2 The aerodrome operator should minimally consider the following elements for its obstacle control process:

- (a) Frequency and timing of obstacle surveys;
- (b) Marking and lighting of obstacles other than natural growths;
- (c) Staff competency and training;
- (d) Calibration of equipment required for obstacle surveys;
- (e) Conduct of day obstacle surveys;
- (f) Conduct of night obstacle surveys;
- (g) Documentation and follow-ups;
- (h) Promulgation of information on obstacles; and
- (i) Obstacle data analysis and continuous improvement.

## 7 Frequency and timing of obstacle surveys

7.1 The aerodrome operator should conduct regular day and night obstacle surveys within his aerodrome and its vicinity, and should consider, but not limited to, the following when determining the frequency and timing of such surveys:

- (a) Locations and types of activities e.g. construction works, operating or flying a kite or model aircraft;
- (b) Timing at which the activities are being carried out;
- (c) Area of coverage and scope of each survey;
- (d) For tree surveys, the species of natural growths (e.g. species of trees); and
- (e) Records on previous penetrations, non-compliances and / or unauthorised aerial activities.

## 8 Marking and lighting of obstacles other than natural growths

8.1 The aerodrome operator should make every effort to have the obstacles removed or reduced in height so that they no longer pose danger to aircraft operations.

8.2 Where it is impractical to remove an obstacle or to have an obstacle reduced in height, it should be appropriately marked and / or lit so as to be clearly visible to pilots in all weather and visibility conditions. The MOAS, *Chapter*

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*10 - Visual Aids for Denoting Obstacles*, contains detailed requirements concerning marking and / or lighting of obstacles.

- 8.3 It should be noted that the marking and lighting of obstacles is intended to reduce hazards to aircraft by indicating their presence. It does not necessarily reduce operating limitations which may be imposed by the obstacle.
- 8.4 Vehicles and other mobile objects, excluding aircraft, on movement area of an aerodrome are obstacles and should be marked and if the vehicles and aerodrome are used at night or in conditions of low visibility, lighted, except that aircraft servicing equipment and vehicles used only on aprons may be exempt.
- 8.5 The airport operator should inspect all obstacle lights and markings within the aerodrome and its vicinity, and take necessary steps to have unserviceable lights repaired or replaced, and faded markings painted or replaced.

## **9 Staff competency and training**

- 9.1 Under the ANO, paragraph 67D (1), an aerodrome operator shall employ an adequate number of qualified and skilled personnel to perform all critical activities for the operation and maintenance of his aerodrome. In this regard, for obstacle control within the aerodrome and its vicinity, the aerodrome operator is to ensure that his staff is able to perform the surveys competently through sufficient and appropriate training.
- 9.2 The aerodrome operator should put in place a formal and structured training programme for his staff involved in obstacle control. The training programme should include recurrent training so as to keep the staff updated on new knowledge and technology which may enhance his work.
- 9.3 The relevant aerodrome staff should also be conversant with the following:
  - (a) Correct use of equipment as required for the obstacle surveys;
  - (b) Familiar with the aerodrome layout and its surroundings;
  - (c) Identify different types of tall construction equipment used at sites;
  - (d) Identify different species of trees and their characteristics found within the aerodrome and its vicinity;
  - (e) Read obstacle charts and be able to accurately relate obstacles in the chart to their actual ground locations;
  - (f) Calculate and measure the range and bearing of an obstacle from the aerodrome reference point; and
  - (g) Promulgate a Notice to Airmen (NOTAM) to inform air traffic service and pilots of an obstacle and its location.

## **10 Calibration of equipment required for obstacle surveys**

- 10.1 The equipment required for obstacle surveys such as height measuring equipment and Global Positioning System (GPS) device should be calibrated to ensure its accuracy and integrity before using. In most cases, calibration may be done in-house i.e. by the aerodrome staff. Hence, the staff should be familiar with the self-calibration process. In other cases, calibration can only be done by the manufacturer. In this regard, the equipment should be sent to the manufacturer for calibration as recommended before its due date.
- 10.2 The aerodrome staff should ensure that the equipment is properly calibrated at all times and its calibration records are retained.
- 10.3 The aerodrome staff should also ensure that there is spare equipment available to be used for obstacle surveys when the main equipment is found to be unserviceable.

## **11 Conduct of day obstacle surveys**

- 11.1 Day obstacle surveys within the aerodrome and its vicinity are conducted to ascertain the following:
  - (a) All requirements including maximum allowable height approved by ANS Policy and marking of construction equipment are being complied with at all times;
  - (b) No objects (e.g. construction equipment) other than those approved by ANS Policy are erected;
  - (c) Markings on vehicles and other objects (e.g. construction equipment and buildings) are properly maintained;
  - (d) No natural growths (e.g. trees) which penetrate its allowable height;
  - (e) No aerial activities which contravene ANO Paragraph 64 other than those permitted;
  - (f) Follow-up on previous penetrations, non-compliances and / or unauthorised aerial activities, if any.
- 11.2 The aerodrome staff conducting the obstacle surveys should be aware of the developments within the aerodrome and its vicinity. He should also be aware of the outcomes of the previous surveys conducted, i.e. any penetrations, non-compliances and / or unauthorised aerial activities noted, to effectively plan his survey route. As the route may change from time to time, the staff should record down the changes and their reasons in the checklists used. Being the one to conduct the day obstacle survey, the aerodrome staff should be familiar with the area to be surveyed and the locations of sites to be checked.
- 11.3 The aerodrome staff should carry with him the following non-exhaustive items for the day survey:

- (a) A copy of checklists for day obstacle survey (to be completed by staff during the survey);
- (b) A copy of information on construction vehicles and equipment and other requirements granted by ANS Policy;
- (c) A copy of information on aerial activities and other requirements granted by ANS Policy, if any;
- (d) A copy of information on outcomes of previous surveys conducted;
- (e) A copy of up-to-date obstacle charts / aerodrome maps;
- (f) A copy of up-to-date street directory;
- (g) Binoculars;
- (h) Digital camera;
- (i) GPS device;
- (j) Height measuring instrument; and

11.4 The aerodrome staff should first make reasonable effort to assess the sites i.e. obtaining the necessary permission from and / or making necessary arrangements with the appropriate entity such as land / building owner. After doing so, if the staff is still not able to gain access to any of the sites, he should immediately seek assistance from ANS Policy. Meanwhile, the staff should make use of observation points to assist him in his survey.

#### *Survey of construction activities*

- 11.5 The aerodrome staff, when on-site, should obtain documentary proof of the approval given by ANS Policy from the person-in-charge of the construction site and verify the numbers, types and heights of construction equipment used at the site. A calibrated height measuring instrument should be used to measure the heights of all construction equipment available at the site. If height measurements of the construction equipment could not be easily taken, the staff could refer to the heights of the surrounding structures for reference.
- 11.6 In the event where a construction equipment has exceeded the height limit granted by ANS Policy, the aerodrome staff is required to advise the person-in-charge to lower the equipment to the allowable height. If the equipment could not be lowered, the staff should immediately report the penetration to CAAS AAR Division, ANS Policy, the air traffic service units and other appropriate authorities, and promulgate a NOTAM so that aircraft operations can be conducted safely at all times.
- 11.7 In the event where the person-in-charge is not able to produce documentary proof of approval given by ANS Policy, the aerodrome staff should advise the person-in-charge to cease operations, retract / lower equipment and seek ANS Policy's approval before the recommencement of the operations. To facilitate the application process, the staff should provide an up-to-date copy of the CAAS application form for use of construction vehicles and equipment to the person-in-charge or refer the person-in-charge to the



online application form on CAAS corporate website for the latter to submit his application to ANS Policy. The aerodrome staff should follow-up with ANS Policy and visit the site the next day or two to ensure approval has been sought and the person-in-charge complies with the requirements stated in the approval.

- 11.8 If the operations could not be ceased, the staff should inform ANS Policy to ascertain if any of the equipment used has exceeded its height limit, and if yes, the staff should first advise the person-in-charge to lower the equipment and report the non-compliance to ANS Policy accordingly. If lowering of the equipment could not be achieved, the staff should immediately report the penetration to CAAS AAR Division, ANS Policy, the air traffic service units and other appropriate authorities, and promulgate a NOTAM so that aircraft operations can be conducted safely at all times.
- 11.9 In addition to sighting the approval from ANS Policy, the aerodrome staff should verify the relevant MOAS requirements and conditions stated in ANS Policy's approval. An example is the marking of the object using flags which is applicable to surveys conducted within the aerodrome as well as its vicinity. Flags should be displayed on top of, or around the highest edge of the object. It is important to note that the flags should not increase the hazard presented by the object they mark. The aerodrome staff should inspect the flags used. Binoculars should be used for this instance. Flags that are of poor conditions (e.g. faded, torn) should be replaced.
- 11.10 The following are the specifications of flags used for marking different objects:
  - (a) Flags used to mark the fixed objects should not be less than 0.6 m on each side and flags used to mark mobile objects, not less than 0.9 m on each side
  - (b) Flags used to mark fixed objects should be orange in colour or a combination of two triangular sections, one orange and other white, or one red and the other white, except that where such colours merge with the background, other conspicuous colours should be used.
  - (c) Flags used to mark mobile objects should consist of a chequered pattern, each square having sides of not less than 0.3 m. The colours of the pattern should contrast each with the other and with the background against which they will be seen. Orange and white or alternatively, red and white should be used, except where such colours merge with the background.
- 11.11 Another example is the markings painted on buildings and structures located within the aerodrome. The staff should also inspect these markings during the survey. Markings that are of poor conditions (e.g. faded) should be repainted.



11.12 The following are the specifications of markings used for marking buildings and structures located within the aerodrome:

- (a) An object should be coloured to show a chequered pattern if it has essentially unbroken surfaces and its projection on any vertical plane equals or exceeds 4.5 m in both dimensions. The pattern should consist of rectangles of not less than 1.5 m and not more than 3 m on a side, the corners being of the darker colour. The colours of the pattern should contrast each with the other and with the background against which they will be seen. Orange and white or alternatively red and white should be used, except where such colours merge with the background.
- (b) An object should be coloured to show alternating contrasting bands if:
  - i) it has essentially unbroken surfaces and has one dimension, horizontal or vertical, greater than 1.5 m, and the other dimension, horizontal or vertical, less than 4.5 m; or
  - ii) it is of skeletal type with either a vertical or a horizontal dimension greater than 1.5 m.

The bands should be perpendicular to the longest dimension and have a width approximately  $\frac{1}{7}$  of the longest dimension or 30 m, whichever is less. The colours of the bands should contrast with the background against which they will be seen. Orange and white should be used, except where such colours are not conspicuous when viewed against the background. The bands on the extremities of the object should be of the darker colour.

*Note: Table 10-1 of the MOAS shows a formula for determining band widths and for having an odd number of bands, thus permitting both the top and bottoms to be of the darker colour.*

- (c) An object should be coloured in a single conspicuous colour if its projection on any vertical plane has both dimensions less than 1.5 m. Orange or red should be used, except where such colours merge with the background.
- (d) When mobile objects are marked by colour, a single conspicuous colour, preferably red or yellowish green for emergency vehicles and yellow for service vehicles should be used.

11.13 In any event where the aerodrome staff is not able to ascertain the dimensions of the flags or the markings, he may obtain documentation proof

from the person-in-charge that the flags used or the markings painted are indeed in compliance with the requirements. If the person-in-charge is not able to show any documentary proof, the aerodrome staff should advise the person-in-charge on the requirements and the replacement of the flags or the repainting of the buildings and structures, if required. The staff should report the non-compliance to ANS Policy.

## *Survey of trees*

- 11.14 In the case of natural growths (e.g. trees), agreement should ideally be reached in writing with the property owner to ensure that future growth will not penetrate the height limits thus, creating new obstacles. The property owner can give such assurance by agreeing to trim the trees when necessary, or by permitting access to the premises to have the trimming done by the aerodrome operator's representative.
- 11.15 It is important to understand the species of the trees which pose a problem, assess the growth rate of these trees and trim them low enough so that the ensuing growth will be below the height limits until the next survey. In this regard, the aerodrome staff should identify trees that are near to their height limits for closer monitoring and / or possible proactive actions (e.g. trimming) to prevent them from exceeding their height limits.
- 11.16 If a tree was found to have exceeded its height limit, the aerodrome staff should immediately inform CAAS AAR Division, ANS Policy, the air traffic service units and other appropriate authorities of the penetration, and promulgate a NOTAM so that aircraft operations can be conducted safely at all times. The aerodrome staff should arrange for the affected tree to be trimmed and after trimming the affected tree, the staff should verify if the height of the tree is below its height limit, and cancel the existing NOTAM issued, if required.

## *Survey of aerial activities*

- 11.17 Survey of aerial activities cleared by the ANS Policy should be conducted by the aerodrome staff. The staff should ensure that the aerial activities are carried out in accordance with the clearance granted by ANS Policy. If the staff sighted any unauthorised aerial activities during the day survey that contravenes ANO Paragraph 64, he should inform the person-in-charge to cease the activity and advise the latter to seek ANS Policy's clearance before the recommencement of the activity. The aerodrome staff should report the unauthorised activity to ANS Policy.
- 11.18 In the event where an unauthorised aerial activity cannot be stopped, the staff should inform ANS Policy to ascertain if the activity has exceeded its height limit, and if yes, the staff should immediately report the penetration to CAAS AAR Division, ANS Policy, the air traffic services units and other appropriate authorities, and promulgate a NOTAM so that aircraft operations

can be conducted safely at all times. For all other cases, the staff should immediately report the unauthorised aerial activity to ANS Policy.

## 12 Conduct of night obstacle surveys

12.1 Night obstacle surveys within the aerodrome and its vicinity are conducted to ascertain the following:

- (a) All requirements including maximum allowable height approved by ANS Policy and lighting of construction equipment are being complied with at all times;
- (b) No objects (e.g. construction equipment) other than those approved by ANS Policy are erected;
- (c) Lighting on vehicles and other objects (e.g. construction equipment and buildings) are properly maintained;
- (d) No aerial activities which contravene ANO Paragraph 64 other than those permitted;
- (e) Follow-up on previous non-compliances and / or penetrations, if any.

12.2 The aerodrome staff conducting the obstacle survey should be aware of the developments within the aerodrome and its vicinity. He should also be aware of the outcomes of the previous surveys conducted, i.e. any penetrations, non-compliances and / or unauthorised aerial activities noted, to effectively plan his survey route. As the route may change from time to time, the staff should record down the changes and their reasons in the checklists used. Being the one to conduct the night obstacle survey, the aerodrome staff should be familiar with the area to be surveyed and the locations of sites to be checked.

12.3 The aerodrome staff should carry with him the following non-exhaustive items for the night survey:

- (a) A copy of checklists for night obstacle survey (to be completed by staff during the survey);
- (b) A copy of information on construction vehicles and equipment and other requirements granted by ANS Policy;
- (c) A copy of information on aerial activities and other requirements granted by ANS Policy, if any;
- (d) A copy of information on outcomes of previous surveys conducted;
- (e) A copy of up-to-date obstacle charts / aerodrome maps;
- (f) A copy of up-to-date street directory
- (g) Binoculars;
- (h) Digital camera;
- (i) GPS device;
- (j) Height measuring instrument; and
- (k) Torchlight

- 12.4 The aerodrome staff should first make reasonable effort to assess the sites i.e. obtaining the necessary permission from and / or making necessary arrangements with the appropriate entity such as land / building owner. After doing so, if the staff is still not able to gain access to any of the sites, he should immediately seek assistance from ANS Policy. Meanwhile, the staff should make use of observation points to assist him in his survey.

## *Survey of construction activities*

- 12.5 The aerodrome staff, when on-site, should obtain documentary proof of the approval given by ANS Policy from the person-in-charge of the construction site, if this was not already done during the day obstacle survey. He should verify the numbers, types and heights of construction equipment used at the site. A calibrated height measuring instrument should be used to measure the height of all the construction equipment available at the site. If height measurements of the construction equipment could not be easily taken, the staff could refer to the heights of the surrounding structures for reference. If there were no works at night, the aerodrome staff should ensure that all equipment are retracted / lowered and lighted in accordance with the requirements.
- 12.6 In the event where a construction equipment has exceeded the height limit granted by ANS Policy, the aerodrome staff is required to advise the person-in-charge to lower the equipment to the allowable height. If the equipment cannot be lowered, the staff should immediately report the penetration to CAAS AAR Division, ANS Policy, the air traffic service units and other appropriate authorities, and promulgate a NOTAM so that aircraft operations can be conducted safely at all times.
- 12.7 In the event where the person-in-charge is not able to produce documentary proof of approval given by ANS Policy, the aerodrome staff should advise the person-in-charge to cease operations, retract / lower equipment if works are ongoing and to seek ANS Policy's approval before the recommencement of the operations. To facilitate the application process, the staff should provide an up-to-date copy of the CAAS application form for use of construction vehicles and equipment to the person-in-charge or refer the person-in-charge to the online application form on CAAS corporate website for the latter to submit his application to ANS Policy. The aerodrome staff should follow-up with ANS Policy and visit the site the next day or two to ensure approval has been sought and the person-in-charge complies with the requirements stated in the approval.
- 12.8 If the operations could not be ceased, the staff should inform ANS Policy to ascertain if any of the equipment used has exceeded its height limit, and if yes, the staff should first advise the person-in-charge to lower the equipment and report the non-compliance to ANS Policy accordingly. If lowering of the equipment could not be achieved, the staff should immediately report the penetration to CAAS AAR Division, ANS Policy, the air traffic service units

and other appropriate authorities, and promulgate a NOTAM so that aircraft operations can be conducted safely at all times.

- 12.9 In addition to sighting the approval from ANS Policy, the aerodrome staff should verify the relevant MOAS requirements and conditions stated in ANS Policy's approval. An example is the lighting of the object using obstacle lights. Such lights should be located as close as practicable to the top of the object. The top light should be arranged as to at least indicate the points or edges of object highest in relation to the OLS. Binoculars should be used for this instance.
- 12.10 The aerodrome staff should conduct checks to determine the serviceability of the obstacle lights, and ensure that these lights meet the specifications as required. Besides checking for the presence of the physical light fixture and whether it is properly lit i.e. the particular light has similar intensity / brightness as the other lights located on the construction equipment or a group of construction equipment, the staff should also check if the specifications of the light stated in the MOAS and / or the approval granted by ANS Policy are being complied with.
- 12.11 In any event where the aerodrome staff is not able to ascertain the characteristics of the light, he may obtain documentation proof from the person-in-charge that the lights used are indeed in compliance with the requirements. If the person-in-charge is not able to show any documentary proof, the aerodrome staff should advise him on the requirements and the replacement of the lights, if required. The staff should report the non-compliance to ANS Policy.
- 12.12 It is important to note that ANS Policy may, in their approvals for construction vehicles and equipment, state requirements on the type of obstacle lights to be installed on vehicles and mobile objects. In any event where the ANS Policy requirements differ from the MOAS requirements, the more stringent requirements will apply. The aerodrome staff, if uncertain, may at any time seek clarification from CAAS AAR Division and / or ANS Policy.

### *Survey of aerial activities*

- 12.13 Survey of aerial activities cleared by the ANS Policy should be conducted by the aerodrome staff. The staff should ensure that the aerial activities are carried out in accordance with the clearance granted by ANS Policy. If the staff sighted any unauthorised aerial activities during the night survey that contravenes ANO Paragraph 64, he should inform the person-in-charge to cease the activity and advise the latter to seek ANS Policy's clearance before the recommencement of the activity. The aerodrome staff should report the unauthorised activity to ANS Policy.
- 12.14 In the event where an unauthorised aerial activity cannot be stopped, the staff should inform ANS Policy to ascertain if the activity has exceeded its

height limit, and if yes, the staff should immediately report the penetration to CAAS AAR Division, ANS Policy, the air traffic services units and other appropriate authorities, and promulgate a NOTAM so that aircraft operations can be conducted safely at all times. For all other cases, the staff should immediately report the unauthorised aerial activity to ANS Policy.

## *Survey of buildings*

- 12.15 Similar to the construction equipment mentioned in the above paragraphs, buildings located at the aerodrome and its vicinity are required to be surveyed for obstacle lights. The aerodrome staff should conduct checks to determine the serviceability of the obstacle lights, and ensure that these lights meet the MOAS specifications as required. Besides checking for the presence of the physical light fixture and whether it is properly lit i.e. the particular light has similar intensity / brightness as the other lights located on the same building or nearby buildings, the staff should also check if the specifications of the light stated in the MOAS and / or the approval granted by ANS Policy are being complied with.
- 12.16 In any event where the aerodrome staff is not able to ascertain the characteristics of the light, he may obtain documentation proof from the person-in-charge that the lights used are indeed in compliance with the requirements. If the person-in-charge is not able to show any documentary proof, the aerodrome staff should advise him on the requirements and the replacement of the lights, if required. The staff should report the non-compliance to ANS Policy.

## *Survey of vehicles and mobile objects within the airside*

- 12.17 As part of the obstacle survey within the airside, the aerodrome staff should be aware that for follow-me vehicles, low-intensity obstacle lights, Type D should be displayed as close as practicable on top of the vehicles. Such low-intensity obstacle lights should be flashing yellow and meet the specifications stated in Table 10-3 of the MOAS.
- 12.18 The aerodrome staff should also be aware that for vehicles and other mobile objects within the aerodrome excluding follow-me vehicles and aircraft, low-intensity obstacle lights, Type C, should be displayed as close as practicable on top of the vehicles or objects. Such low-intensity obstacle lights should be flashing-blue for vehicles associated with emergency or security and flashing-yellow for others. These lights should also meet the specifications stated in Table 10-3 of the MOAS.
- 12.19 The aerodrome staff should conduct checks to determine the serviceability of the obstacle lights on vehicles and mobile objects, and ensure that these lights meet the MOAS specifications as required. Besides checking for the presence of the physical light fixture and whether it is properly lit i.e. the particular light has similar intensity / brightness as the other lights found on



the same vehicle / mobile object or other similar vehicles and mobile objects located around the same area, the staff should also check if the specifications of the light stated in the MOAS are being complied with.

- 12.20 In the event where the aerodrome staff is not able to ascertain the characteristics of the light, he may obtain documentation proof from the person-in-charge of the vehicle or mobile object that the obstacle lights installed on the vehicle or mobile object are indeed in compliance with the requirements. If the person-in-charge is not able to show any documentary proof, the aerodrome staff should advise him on the requirements and the replacement of the lights, if required. Meanwhile, the vehicle or mobile object should not be used unless the lights are replaced and have met the requirements.

## **13 Documentation and follow-ups**

- 13.1 The aerodrome staff should take clear photographs of the sites and all construction equipment, trees, aerial activities, buildings, vehicles and mobile objects sighted during the survey. These photographs should be printed and filed with the completed checklists.
- 13.2 In all cases, it is important that the aerodrome staff records down all the survey information and outcomes in the checklists as they may be used for subsequent surveys or obstacle data analysis. For NOTAM promulgation, geographical coordinates of the location of the penetration / unauthorised aerial activity should be determined in terms of World Geodetic System – 1984 (WGS-84) format using a calibrated GPS device. The aerodrome operator should annotate in the up-to-date aerodrome obstacle charts, locations of the on-going activities near the aerodrome as well as the penetrations, non-compliances and unauthorised aerial activities noted during the surveys. For the latter, the aerodrome staff should conduct follow-ups including revisiting the site the next day or two to ensure proper closures of these penetrations, non-compliances and unauthorised aerial activities, and subsequently inform CAAS AAR Division and / or ANS Policy on their closures.
- 13.3 It is a good practice for the aerodrome staff to share the survey conducted and its outcomes with the other staff who may be conducting subsequent surveys. This sharing may be incorporated into the daily handing / taking over sessions between staff.

## **14 Promulgation of information on obstacles**

- 14.1 The geographical coordinates, top elevation, type, marking and lighting, if any of the obstacles within the aerodrome and its vicinity should be



measured and reported by the aerodrome operator to the Aeronautical Information Service (AIS).

- 14.2 Whenever a penetration, either temporary or permanent in nature, is identified, the aerodrome operator is required to report the penetration immediately to CAAS AAR Division, ANS Policy, the air traffic service units and other appropriate authorities. To this end, the aerodrome operator conducting the obstacle surveys is responsible to ensure that information on obstacles is promptly transmitted to the AIS. The aerodrome operator has the most direct interest in seeing that information is properly disseminated, and through the periodic surveys, the aerodrome operator is most likely to be aware of the presence of new obstacles. It is in his best interest for the aerodrome operator to report all data on obstacles, including marking and lighting, if any to the AIS for promulgation. Such data should be amended at regular intervals as may be necessary to keep it up-to-date.

## **15 Obstacle data analysis and continuous improvement**

- 15.1 The aerodrome operator should make use of the obstacle data collected and conduct periodic data analysis. This should allow the aerodrome operator to review the overall effectiveness of the obstacle control process. Through such analysis, the aerodrome operator should also be able to identify potential risks and hotspots, and develop mitigating measures to address them.
- 15.2 The aerodrome operator should seek continuous improvement in the obstacle control process to ensure that safe aircraft operations can be carried out safely and efficiently at his aerodrome. The aerodrome operator should review the process and ensure that it is in compliance with the CAAS requirements at all times.

## **16 Conclusion**

- 16.1 A successful obstacle control process requires the collaboration of parties including but not limited to, aerodrome operator, aerodrome regulator, other authorities, property / construction site owners and the general public. Such collaboration should provide a safe environment for efficient and safe operation of aircraft near the aerodrome. In this regard, the aerodrome operator should also constantly engage the relevant parties to ensure that the established process is a robust and effective one.

## **17 Reference**

Singapore Air Navigation Order;  
Manual of Aerodrome Standards;

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ICAO Annex 14, Volume I;  
Doc 9137, Airport Services Manual Part 6 – Control of Obstacles;  
Doc 9137, Airport Services Manual Part 8 – Airport Operational Services;  
Civil Aviation Authority of New Zealand – Advisory Circular 139-10.

## 18 Queries

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