

# DRONES: ICT IN ACTION

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**Introduction and conclusion by Lorraine Chaffer GTA NSW**

The development of ICT hardware and software creates many opportunities for Geography teachers to collect geographical data in the field and develop student conceptual knowledge and understanding. Starting with a small project that builds confidence with new equipment and / or software benefits both students and teachers, who can then extend the use of that technology to other aspects of geographical study such as observing and recording changes to natural and human environments over time, environmental processes and management.

The use of drones at Monte Sant' Angelo Mercy College was the initiative of two classroom teachers seeking to develop the geographical skills of their year 9 students in a way that was exciting and different.

## Using drones for skill development

At Monte Sant' Angelo Mercy College we were looking at a way to engage students in the learning of geographical skills as well as allowing them to collect their own data and make observations. The skills that were identified specifically for Year 9 Geography were types of photos, large-scale versus small scale of photographs, calculating distance using photographs and maps, determining aspect and estimating time of day from photographs.

After discussion and a little help from the ICT Department we decided that using a drone could bring those skills to life. The school purchased a drone and while this might seem quite extravagant, a drone capable of taking still and video images can be purchased from the Apple Store for \$299.95. In some schools faculties, such as Science, could share this cost.

After learning how to fly the drone and assessing its capability, a lesson was created with the purpose of taking photographs that could be used to develop geographical skills. A Lesson Plan and Risk Assessment used in preparation for the drone related lessons have been included in this report along with comments made by participating students. Three student worksheet examples conclude this article.

## Student feedback

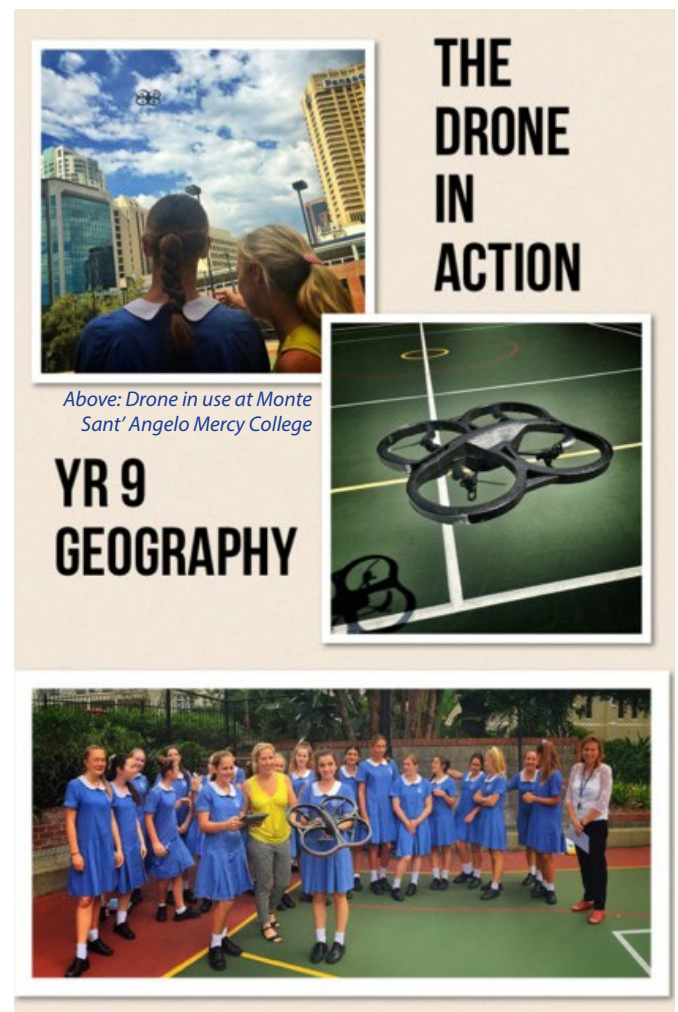
Has using the drone helped in your understanding of large and small-scale photos?

**100% found this really helpful to understand scale**

Has using the drone helped in your understanding of the time of day the photos were taken?

**85% said yes they found it really helpful and now understand this skill, 15% said it helped a little but are still a bit confused**

Has using the drone helped in your understanding of determining the direction the photographer was facing?



*Above: Drone in use at Monte Sant' Angelo Mercy College*

**YR 9  
GEOGRAPHY**

*Above: Year 9 students fly the drone over the school grounds to take aerial photographs and video footage*

**85% said yes they found it really helpful and now understand this skill, 15% said it helped a little but are still a bit confused**

Can you now differentiate between different types of photos?

**81% yes they can, 15% still a little confused and 5% still cannot differentiate between photos.**

## Lesson Plan

<b>Subject/Course:</b> Year 9 GEOGRAPHY	<b>Date:</b> Friday 20 <sup>th</sup> March 2015
<b>Topic:</b> Geographical Skills and Tools	
<b>Lesson Title:</b> Using the Drone to teach Geographical Skills	
<p><b>Lesson Objectives:</b></p> <p>By the end of the two lessons students will have a greater understanding of geographical skills including identifying types of photos, differentiating between large and small-scale photographs, calculating distance and direction, determining aspect and estimating time of day from photographs.</p>	
<p><b>Pre-lesson discussions:</b></p> <p>Prior to the lesson, teachers will discuss a range of Geographical Skills with the students – much of which is revision from Year 7 and 8.</p>	
<p><b>Summary of tasks/actions:</b></p> <p>In the first 55-minute lesson the Year 9 girls will learn about how the drone can be used to learn and apply geographical skills (including direction, scale, types of photos, aspect and distance). Some students within the class will have the opportunity to experience flying the drone on the top Tennis Court of the College. The purpose of this activity is to record both video footage and photographic data that can then be used to teach a range of geographical skills. Photos taken by the Drone will be both Vertical Aerial Photos and Oblique Aerial photos of the College.</p> <ol style="list-style-type: none"> <li>Students will develop and gain a greater understanding of Geographical Skills and related concepts including: <ul style="list-style-type: none"> <li>Collection and observation of digital images</li> <li>Determining different types of photos (Ground level, vertical aerial and oblique aerial)</li> <li>Direction the photographer was facing</li> <li>Scale of photographs (large scale vs. small scale)</li> <li>Estimating time of day using photos</li> <li>Aspect</li> </ul> </li> <li>Students will have fun integrating technology into their lesson to enhance their learning experience.</li> <li>In the second 55 minutes students will return to the Geography classroom to view the footage taken from the Drone using the Ipad connected to the large screen.</li> <li>Students discuss this footage and use it to answer Geographical Skills questions including the direction the photographer was facing, scale (small and large photographs), types of photographs, estimating time of day using photos, calculating distance and determining aspect. These skills relate specifically to the footage (photo and video footage) taken using the Drone.</li> <li>Worksheets were created for students to demonstrate an understanding of each of these skills.</li> </ol>	
<p><b>Materials/Equipment:</b></p> <ul style="list-style-type: none"> <li>Drone plus protective cover</li> <li>Charged batteries for Drone</li> <li>Ipad with APP used for the Drone</li> <li>First Aid Kit on hand</li> <li>Worksheets for the geographical skills</li> <li>Risk Assessment</li> <li>Survey for students at conclusion of the lesson</li> </ul>	<p><b>References:</b></p> <p>10 Uses of Drones and Students (article and Slideshare)  <a href="http://www.huffingtonpost.com/vala-afshar/10-uses-of-drones-in-high_b_5988758.html">www.huffingtonpost.com/vala-afshar/10-uses-of-drones-in-high_b_5988758.html</a></p> <p>Drones used in creative ways at Universities (article)  <a href="http://techpageone.dell.com/tech-culture/drones-used-in-creative-ways-at-universities/">http://techpageone.dell.com/tech-culture/drones-used-in-creative-ways-at-universities/</a></p> <p>Five Surprising Drone Uses (National Geographic article)  <a href="http://news.nationalgeographic.com.au/news/2013/12/131202-drone-uav-uas-amazon-octocopter-bezos-science-aircraft-unmanned-robot/">http://news.nationalgeographic.com.au/news/2013/12/131202-drone-uav-uas-amazon-octocopter-bezos-science-aircraft-unmanned-robot/</a></p>

## Risk Assessment

### 1. Activity

<b>Activity description:</b> Using drones in Year 9 Geography		
<b>Teachers/Leaders:</b> Ms. V Sefton (Classroom teacher), Mrs P Smith (Teacher), member of ICT staff		
<b>Class group:</b> Year 9 Geography		<b>No. of students:</b> 23 students
<b>Start date:</b> 20/3/15	<b>Finish date:</b> 20/3/15	<b>Supervisor ratio:</b> One staff member to 9 students

### 2. Identifying potential risk to students

Inherent risk	Action required/approval
<b>Low</b> – Little chance of injury	<ul style="list-style-type: none"> <li>Manage through regular planning processes</li> </ul>
<b>Medium</b> – Some chance of an incident and injury requiring first aid	<ul style="list-style-type: none"> <li>Complete a risk assessment</li> <li>Consider obtaining parental/carer permission, and if activity held off-site parental/carer permission is required</li> <li>If activity is held off-site, refer to school variation of routine application</li> </ul>
<b>High</b> – Likely chance of a serious incident and injury requiring medical attention	<ul style="list-style-type: none"> <li>Risk assessment must be completed</li> <li>A member of the executive must approve the activity</li> <li>Parental/carer permission is recommended and if the activity is held off site, parental/carer permission is required</li> </ul>
<b>Extreme</b> – High chance of serious incident resulting in highly debilitating injury	<ul style="list-style-type: none"> <li>Consider conducting an alternate activity</li> <li>Risk assessment must be complete</li> <li>Principal approval is required prior to activity being conducted</li> <li>Parental permission must be obtained for student participation</li> </ul>

### 3. Supervision of students

This activity will be conducted on school grounds therefore a number of teachers may be observing the activity or be close by.

The classroom teacher, as well as another Geography teacher will supervise students.

A member of the ICT department will also be assisting with the activity.

The staff to student ratio will be at a minimum, one staff member to nine students.

All teachers supervising students will have current First Aid Qualifications.

All teachers have experience flying the drones and have been trained in how to land drones in case of an emergency or danger.

### 4. Activity specific equipment and facilities

First aid kit to be taken to McQuoin Centre and the Tennis Courts where the activity is taking place

School nurse is available on-site

This activity will be no longer than a 40 minutes – therefore students should not need sunscreen as they will not be more than 20 minutes flying the drone on the tennis court

Students will be wearing school uniform, therefore protective footwear will be worn

Drones will be protected by a safety barrier- this protects the students from the propeller and protects the drone from breakage

## Risk Assessment

### 5. Legal requirements: Governing Bodies/Associations

- As of 11/12/14 it is illegal to fly any drone for commercial gain without clarification
- The drone may not fly closer than 30 metres to vehicles, boats, buildings, that are not on your private property or you must have explicit permission from the private property owner. (The drone will only be flown on the grounds of MSAMC)
- Drones are not to be flown over any populated areas such as beaches, heavily populated parks or sporting grounds when a game is taking place (The drone will only be flown on the grounds of MSAMC)
- Drones are not to be operated within a 5.5 km radius of any aerodrome, airfields, airport, seaplane taking off, helicopter landing sites which may be located at local hospitals, police stations or other locations you may not be aware of. (The drone will only be flown on the grounds of MSAMC)
- Drones can only be operated in daylight hours (The drone will be operated during school hours)
- You may not fly a drone above 123 metres. (The drone will be set to fly no higher than 27 metres)

Sources: Civil Aviation Safety Regulations 1998, [rpastraining.com.au/casr-101-uav-drone-legal-or-illegal](http://rpastraining.com.au/casr-101-uav-drone-legal-or-illegal)

### 6. Activity – specific hazards/ risk and associated control measures

Activity	Risk	Control measure
Students assemble in McQuoin Centre	<b>Low</b>	If a student falls on the way from the classroom to the McQuoin Centre, first aid will be available.
Demonstration on drones operation.  A discussion of what the drone will be measuring	<b>Low</b>	<p>The activity is occurring on tennis courts and in the School Hall, therefore away from building works.</p> <p>Students may get in the way of a drone. The drone may make contact with them. This is unlikely to happen as teacher has experience flying the drone and knows how to make an emergency landing with the drone. The drone has a protective shield on it, so if it did make contact with the student, the student will sustain minimal injury.</p> <p>Weather will be monitored, if it is raining or too windy the activity will be postponed to a more suitable weather climate.</p> <p>First aid kits and a nurse on site will be available.</p>

## A new perspective for Geographers

*“For all of human history our perspective has basically been stuck at eye-level and now for the first time in history we can see the world the way the birds do”.*

Chris Anderson, 3D Robotics

<http://paulstamatiou.com/getting-started-with-drones-quadcopters/>





## Drone applications

Drones are being used in many situations relevant to geographical study. When students understand how drones work and use them in applications at a local scale their understanding of drone use at a global scale will be enhanced.

Drones are being used globally for:

- mapping vegetation, agricultural areas and urban places (landuse)
- monitoring changing environments such as deforestation and coastal erosion
- collecting data for GIS applications
- wildlife monitoring
- environmental management
- disaster relief and management such as the after the Nepal Earthquake
- assisting with precision agriculture
- policing
- developing GIS relevant to all of the above applications

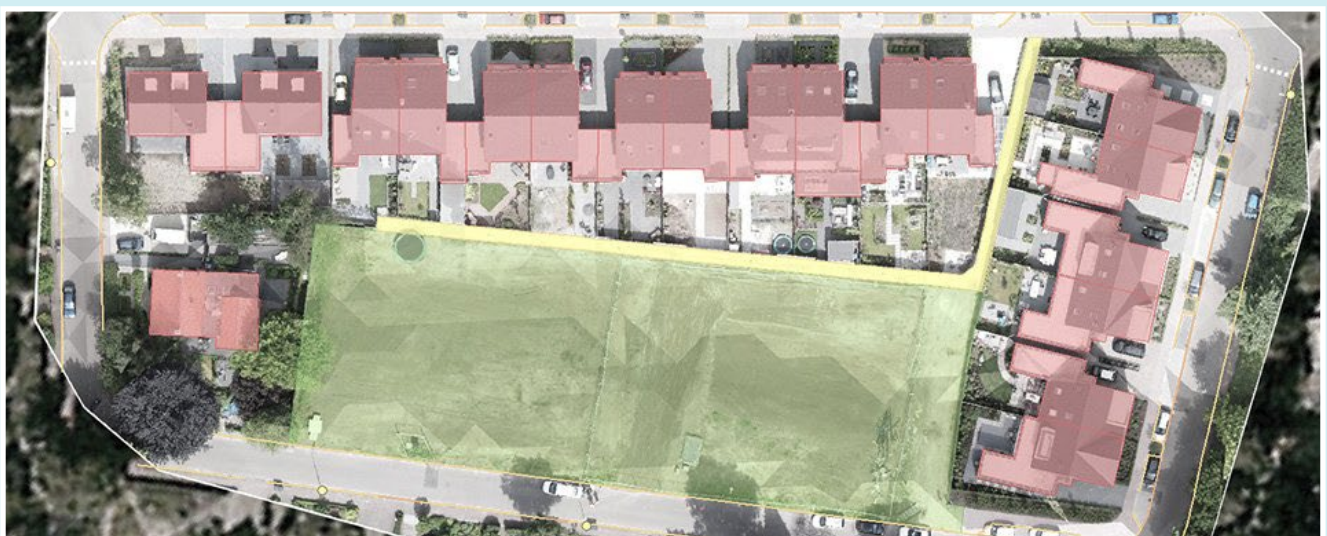
## Microdrones: Mapping made easy



<http://www.microdrones.com/en/applications/areas-of-application/mapping-gis/>

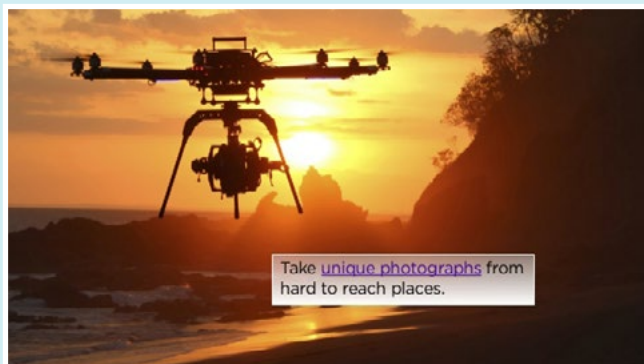
*"Mapping zones/areas etc. are an important part of Geographic Information Systems, and one which is simplified primarily by the use of microdrones. Using a laser scanner, entire areas can be captured quickly and easily, and later processed on computer. Moreover, highly detailed high-resolution landscape photography can be created with professional cameras."*

## Drones used to map neighbourhoods



<http://www.microdrones.com/en/applications/areas-of-application/mapping-gis/>

## Some uses of drones illustrated in Slideshare



[www.huffingtonpost.com/vala-afshar/10-uses-of-drones-in-high\\_b\\_5988758.html](http://www.huffingtonpost.com/vala-afshar/10-uses-of-drones-in-high_b_5988758.html)

### Let your drone do drone things

*For aerial mapping, drones are perfect. Repeatable, accurate flight makes a drone the ideal flight platform for near-ground mapping. The combination of today's high-resolution cameras and inexpensive flying devices enables mapping at levels of detail never before imagined.*

[https://www.mapsmadeeasy.com/drone\\_mapping](https://www.mapsmadeeasy.com/drone_mapping)

## Still from an animation illustrating the path a mapping drone will take



### Mapping with drones

*"By precisely controlling the flight pattern, flight speed and camera frame rate, it is possible to achieve perfect coverage and overlap. Plenty of overlap and nadir (straight down) images are the key components to collecting great data and making great maps".*

[https://www.mapsmadeeasy.com/drone\\_mapping](https://www.mapsmadeeasy.com/drone_mapping)

### Further reading

10 Uses of Drones (article and Slideshare)

[www.huffingtonpost.com/vala-afshar/10-uses-of-drones-in-high\\_b\\_5988758.html](http://www.huffingtonpost.com/vala-afshar/10-uses-of-drones-in-high_b_5988758.html)

Australian AUV (Unmanned Automatic Vehicle)

<http://www.auav.com.au>

Getting started with drones (Everything you need to know about how drones work, how to fly them and modify them).

<http://paulstamatiou.com/getting-started-with-drones-quadcopters/>

Schools use drones for learning

<http://www.nbcnews.com/video/nightly-news/51118873>

University of New England projects

<https://www.uned.edu.au/about-uned/academic-schools/school-of-science-and-technology/research/precision-agriculture/research-areas-and-current-projects/smart-drones>

ABC Splash: Rise of the machines: Using drones

<http://splash.abc.net.au/home#!/media/524587/rise-of-the-machines-using-drones>

National Geographic

[http://education.nationalgeographic.com.au/education/news/data-drones/?ar\\_a=1](http://education.nationalgeographic.com.au/education/news/data-drones/?ar_a=1)



## Worksheet one

### Distinguishing between 'Larger Scale' and 'Smaller Scale' photographs

#### Smaller Scale photographs

These photos have greater distance/area represented in the photo. Therefore 1 cm on a map will show a larger distance in the photo. These photos will show LESS detail. Features will look very small and you will not be able to see much detail on the features.

#### Larger Scale photographs

These photos have a smaller distance/area represented in the photo. Therefore 1 cm on a map will show a smaller/shorter distance in the photo. These photos will show MORE detail. Features will look larger and you are more likely to see the finer detail on the features.

*Hint: Perhaps an easy way to determine this difference is when you compare two photos/images and you are asked to identify the 'larger' scaled image between them, think to yourself 'Which one of these images is closer to being as large as in real life'? This photo will be your larger scale image and the other photo will therefore have a smaller scale in comparison. You can use this tip when comparing the scale of maps.*

Using the two photos taken by the drone below, determine which of these photos has the LARGEST SCALE and which has the SMALLEST SCALE.



Image 1: ..... scale.



Image 2: ..... scale.

## Worksheet two

### Determining the difference between 'Ground Level', 'Oblique Aerial' or 'Vertical Aerial' photographs?

**Ground Level photographs** are those taken from the ground and without an angle, whereas aerial photos are taken from the air of a high point, such as a lookout or tall building. They can be either oblique OR vertical.

#### Oblique Aerial photographs

Oblique photos are those photos taken on an 'oblique' angle (between 3° and 90°) to the ground, to produce a 'perspective' view. They can be 'low oblique' (horizon not visible) or 'high oblique' (horizon visible). Oblique photos have the advantage of enabling geographers to show large areas of ground in a single photo. They are helpful when determining how natural and human features are distributed across the landscape. They also have the benefit of being able to show the height of features more accurately. However, scale is distorted (not uniformly even) which makes measuring distances difficult.

#### Vertical Aerial photographs

A vertical aerial photograph is taken with the camera lens pointing directly downwards. There is no tilt (only up to 3°). These types of photos are frequently used to produce topographic maps as they produce a reliable scale, making measurement of distances easier and more accurate. They are useful as there is nearly uniform scale throughout the photo, making measuring distances easier and more accurate. However, they do not clearly depict the height of objects (buildings, cliffs) if they are directly beneath the camera.

Identify and label the following three images as either 'Ground Level', 'Vertical Aerial' or 'Oblique Aerial' photos:



Image 1: Type of photo .....



## Worksheet two .... continued



Image 2: Type of photo .....



Image 3: Type of photo .....



## Worksheet three

### How do I estimate the time of day that a photograph was taken?

To estimate the time of day a photo was taken, you firstly need to look for clues within the photo. An easy clue to help you determine the time a photo was taken is **SHADOWS** found within the photo. Look for features within the photograph that cast shadows. Tall buildings and bridges are good examples. If shadows from these features appear to be long, it is likely that the time of day will be either early morning or later in the afternoon. If there are very short shadows it is more likely that the sun is directly overhead and the time will be closer to midday.

**Remember, the sun always rises in the EAST and sets in the WEST – no matter where you are in the world.** You will also need to determine the orientation of your photo. This can be worked out when looking at a map of the area that the photo was taken.

Using the two images below, estimate the time each photo was taken:

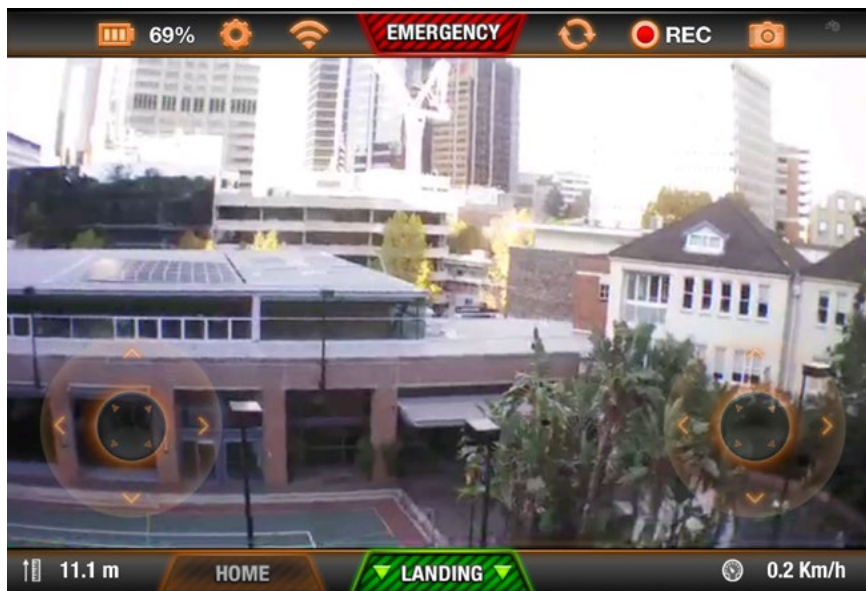


Image 1: Taken at approx  
..... AM / PM

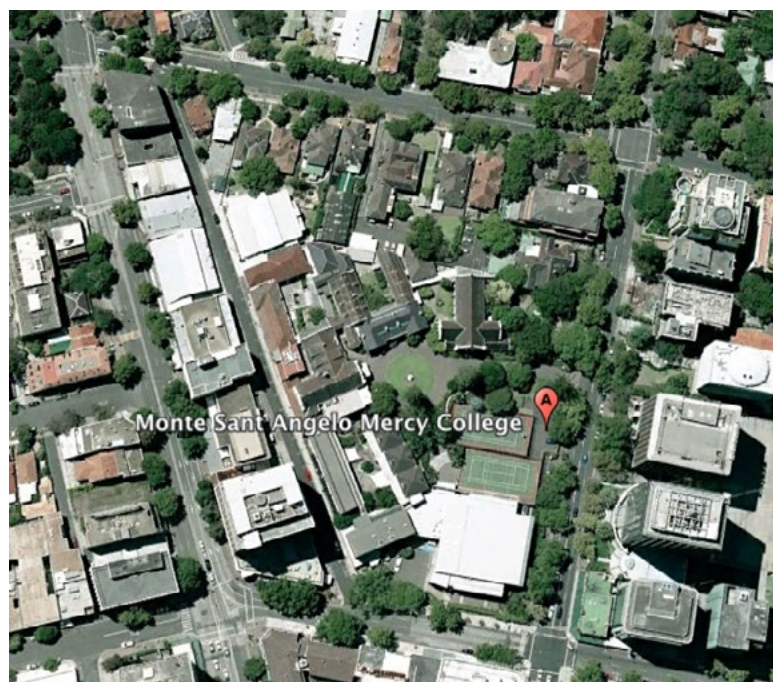


Image 2: Taken at approx  
..... AM / PM