Methodology

Within the brief of work, the most pressing requirement was the analysis of the veracity of the identification and location of the various images involved and indeed the possibility of the misidentification of the actual images themselves.

To enable this work, copies and scans of the images contained within "Hit and Run" were made in order to more easily view them together, allowing for comparisons between them to take place.

At time of report, the printed images in the book is the only source of imagery available. It is important to note that as of necessity, as images are prepared for printing, they are "screened" in order for them to be printed. This screening technique resamples the image into thousands of small dots of various colours, which together make up the printable image. This reduction of the image from "continuous tone" to "half tone" effectively destroys the fine nuances within the image making magnified interpretation of the imagery, impossible. See
https://en.m.wikipedia.org/wiki/Color_printing for further in-depth information.

Additionally, it is obvious that the images printed have all been cropped for publication. Cropping is the "trimming" of an image to make it smaller in physical size and can be utilised in order to make the image usable in a different shape or size space. It can also be used to "crop off" unwanted parts of the image.

These aspects are seriously limiting factors in the photo interpretation and analysis process which could only be rectified by the provision of the original, uncropped, digital image files, complete with EXIF data.

EXIF data (Exchangeable Image File Format) is a metadata file that is automatically created by a camera at the time of an exposure being made. The file contains information about the image it refers to like date, time, camera, lens, shutter speed, aperture and including, if the camera is GPS capable, the GPS coordinates of the camera at the time of exposure. In terms of the analysis, this particular information would be invaluable as it would provide absolute confirmation of the location of the camera when the image was taken.

For the analysis itself, many aspects of the images were considered;

1. Identification of features on a building to potentially find a match of features between that and other buildings, thereby assessing that the images were potentially taken of the same building.
2. Comparison of geographical features surrounding the buildings to find matches between features in other images.
3. Analysis of the topography around the wider building sites to create matches with known topography around other buildings and their surrounds.
4. Analysis of the shape, construction type and position to identify where the object or building is geospatially located.

Initially, simple comparisons between the available photographs was used followed by comparisons between the photographs in the book with satellite imagery. Information regarding the satellite imagery used is outlined in a separate document on "Data Sources".

For the initial analysis, a careful comparison of the images within the book was carried out. Obvious "alike" images were grouped together and then identifiable "like" features within the images were

compared to make "matches" of the features. Care had to be taken with regard angle of shot, direction of shot and surroundings to ensure that similar, but not exact matches, were discarded.

Where a single match of feature was identified, this in itself was not deemed sufficient to comprise a useful comparison so further matches within the photographs were sought. Unless multiple matches were positively identified, the photographs were deemed unique.

In all cases, small nuances within the photographs had to be taken into account which was made difficult, as has been recorded earlier, due to the destructive process used to take the photographs to print.

Following on from that, various areas of analysis and comparison was employed;

1. Did the building or features shape and size, fit the building or feature that appeared on the satellite image?
2. Did the surrounding topography of the building or feature, fit the topography on the satellite image?
3. If there was significant shadow cast by a building or feature, did this align with the calculated shadow utilising sun angle and azimuth tables?
4. Were there other images that had been positively identified and located that an unidentified and located image could be tied to?

If any photographs could not be positively linked to the location within the Operational Area, a search of the immediate area was undertaken to endeavour to match the photograph with a structure on the satellite image. If the immediate area proved to have no match, the radius of search was progressively extended out until either a match was found or the extent of the satellite image was reached.

If a match was still not found, the location of that photograph was deemed unproven.

It should be noted that for a number of the images in the presentation, some enhancement was required in order to make the visual comparisons more robust. This enhancement was kept to a minimum and consisted of opening the scanned images in Adobe Photoshop and using various tools within the software.

The main changes made were in the Brightness and Contrast of the images. The brightness and/or contrast of the image can be increased or reduced to allow more detail to appear. Additionally, where the images "blow out" due to back lighting or over exposure, these areas can be "burnt in" meaning that the software increases the density of the image in selected areas to reveal more detail.