

Spatial Adjustment Manager  
for  
Upgrading Digital Cadastre and  
Spatially Related Utility, Asset  
and Annotation Layers

White Paper

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## Introduction

The Spatial Adjustment Manager (SAM) and the Spatial Adjustment Engine (SAE) are a well proven mechanism to upgrade Digital Cadastre and/or Utility, Asset Data and Annotation Layers as the digital cadastre changes.

With the supply of high resolution orthorectified aerial photography it has become an issue plotting inaccurate layers over the top of these images. Very often, the linework simply does not fit the fencing, road centrelines, and other features shown in the aerial images, thus rendering the plot somewhat diminished in its impact.

SAM Orthophoto provides a quick and easy mechanism to either quickly and less rigourlessly upgrade the vector to match the raster or to more rigourlessly upgrade the vector to match the vector.

This document describes the process in more detail. Note that this process fits into the SAM/SAE IT environment described in the SAM/SAE White Paper.

## Placement of SAM Orthophotography

SAM Orthophotography works as a Plug-In in the same way as the documented process in the SAM-SAE White Paper.

The Digital Cadastre and related themes may be presented to SAM via FME Objects, Databases and supported file structures.

The spatial data is held in SAM's memory whilst the Vector->Raster Joins are created. The Vector->Raster Joins are stored in a database (currently Postgres). During the upgrade process the vector data is transferred into a series of tiled databases that enable the total area to extend to hundreds of square kilometres.

When the user feels that there is sufficient control (Vector-Raster Joins) they may run an upgrade of the vector data, and view the original and upgraded vector over the orthophotography.

If the fit is not sufficient, additional Vector->Raster Joins may be added, and another adjustment run. Both the Best Guess Algorithm (BGA) and the Least Squares Adjustment Algorithm are available for the upgrade process.

When the fit of the vector to the raster meets expectations, the vector can be either exported for cartographic/map making purposes or checked back into the master spatial database.

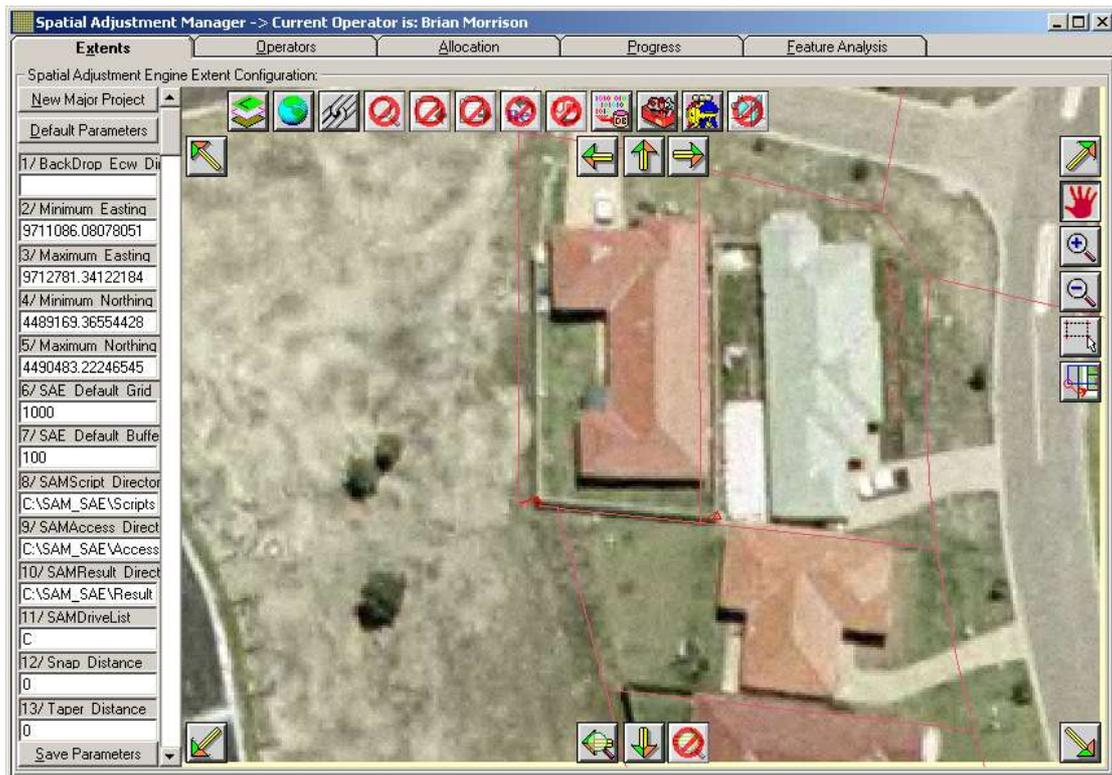
This document covers the operational aspects of SAM Orthophotography.

Each process is described in greater detail:

### ***Process 1/***

Process 1/ is to collect common points between the Digital Cadastre and the Raster. These joins are called Vector To Raster Joins, as the Vector Linework is to be moved to the Raster.

The following image shows the SAM application ready to collect Vector->Raster Joins:



## ***Explanation of Data Capture Procedure***

SAM/SAE was enhanced for this pilot project to capture ‘joins’ between positions in orthophotography and the matching point in the Digital Cadastre.

This process was built on top of the EA’s existing Smallworld – FME Objects – SAM/SAE interface to greatly facilitate this process if EA chooses to run it in-house.

SAM would extract the DCDB from a job environment in Smallworld and display this over the orthophotography, which is commonly supplied as .ecw files.

The operator has all the necessary tools to zoom and pan around the data. The  button allows the ‘join’ to be created between the ortho Control Point and the DCDB vertex.

The operation is very quick and intuitive.

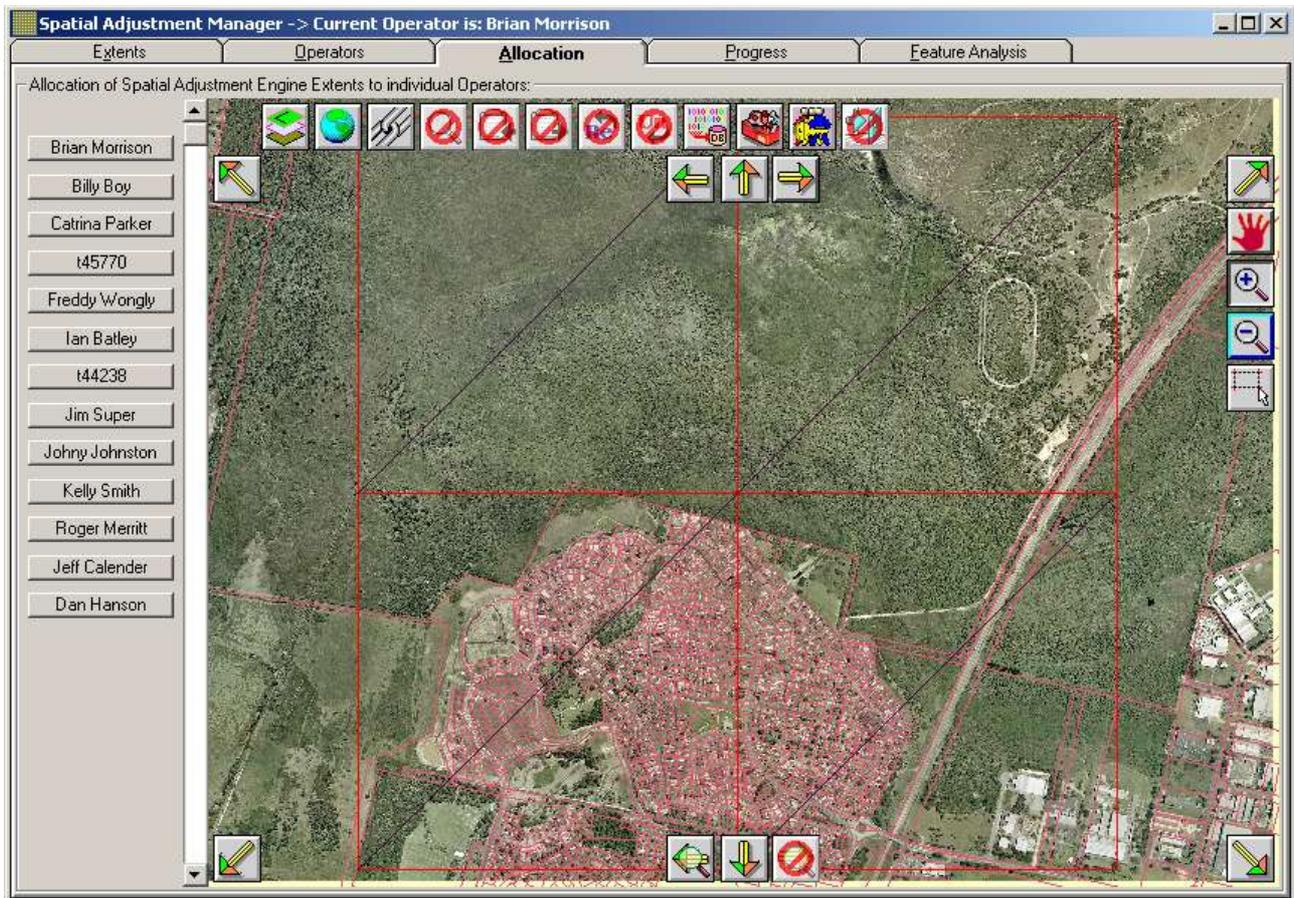
To add a join, the user simply places the cursor over the pixel in the ortho where the DCDB vertex should be, and holds the left mouse button down. The user then moves the cursor to nearby the DCDB Vertex and releases the mouse button. The SAM software finds the nearest vertex in the DCDB theme and renders the join and saves this data to a database table.

To delete a join, the user simply places the cursor near the DCDB vertex and clicks the right mouse key. SAM will find the nearest vertex and delete any joins to it.

SAM provides the necessary support to have multiple operators collecting joins simultaneously on separate jobs.

## Process 2/

Process 2/ consists of allocating each tile out to an operator and their PC.



The Supervisor can allocate blocks of tiles (1 to all) out to operators. This effectively means that when an operator logs into a PC and runs SAM, that SAM can pick up their network name and know which tiles the supervisor has allocated them to run.

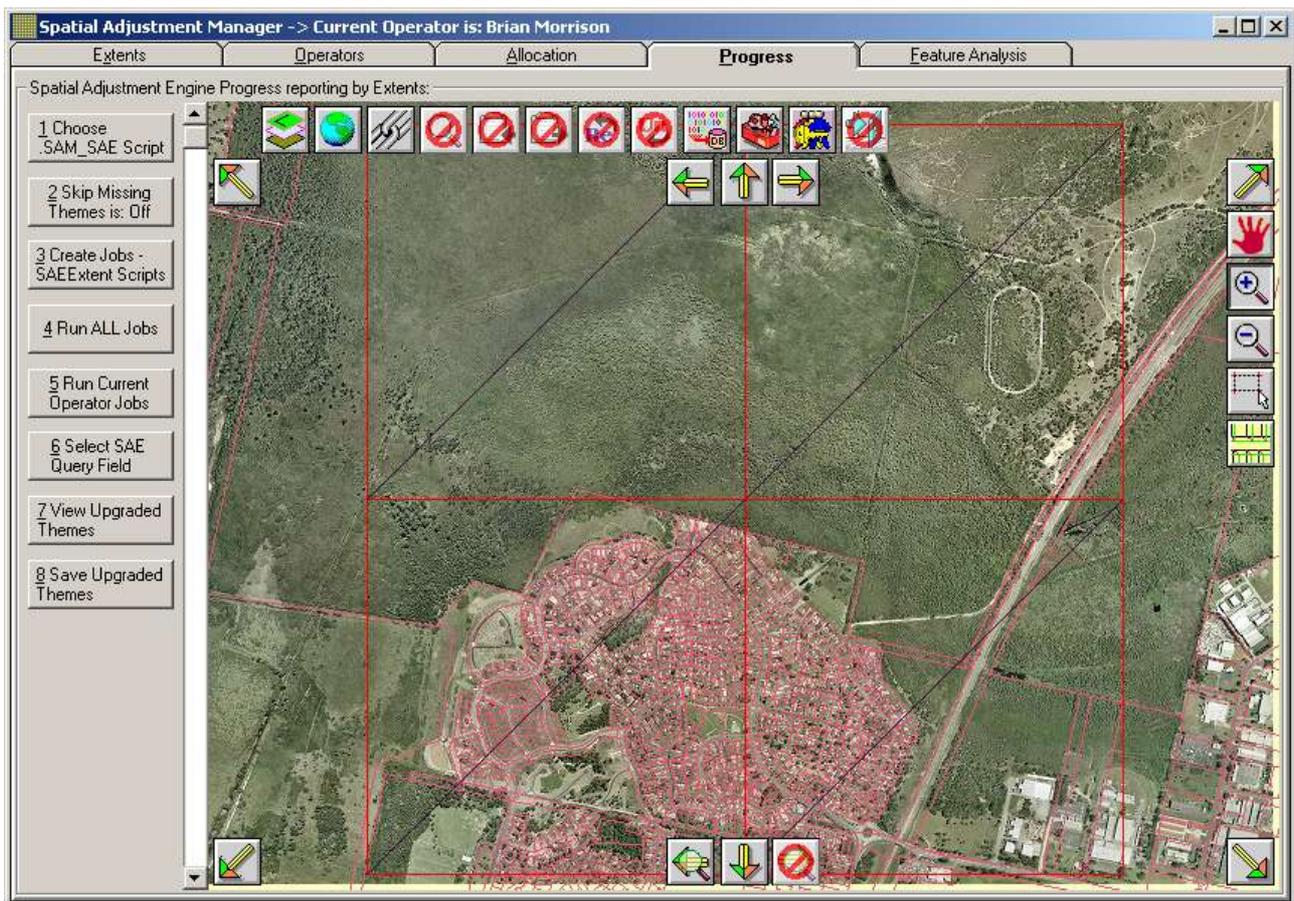
Conversley, for smaller sites, the supervisor may allocate all the tiles to their own login.

A tile is allocated by clicking on the operator's name on the left, and using the  tool to box the tiles for that operator to process.

## Process 3/

Process 3/ is carrying out the Upgrade of the Vector to the Raster control.

The following image shows SAM ready to carry out the upgrade of the digital cadastre, assets, utility and annotation layers.



Part of the configuration of the SAM/SAE will include the customisation of the “.SAM\_SAE” Script for the user's environment. If this script has not yet been chosen it needs to be selected using Button 1/

The user will step through buttons 3, 4 and 7 sequentially to see the resulting upgraded vector.

If additional control is required then the user returns to the Extents Tab and adds more Vector->Raster Joins, and runs through buttons 3, 4 and 7 to see the resulting vector.

### **Process 4/**

Process 4/ allows the results to be saved to a temporary spatial format or back into the spatial master dataset:

From there the local GIS may be used to carry out any map production required, with the added benefit that the vector will fit the underlying orthophotography.

## **What Results can be Expected**

SAM can be expected to upgrade the vector in accordance with the raster control.

Given the vector and the orthophotography have been collected with the intent of being a true representation at the earth's surface, the two should always roughly overlay each other.

However, each have been collected from different sources with a wide variety of possible errors.

The primary dataset is usually the digital cadastre. This has been compiled from a wide variety of digitizing practices covering a wide variety of mapping sources including linen plans at various

scales, orthophotography at various scales, coordinate geometry entry based on various control at various precisions, etc. In some cases the digital cadastre may be quite accurate internally (good relative position) and simply be in the wrong spot. In such cases a block shift is sufficient to fit those parcels, but one must know how to bleed that shift back into the surrounding digital cadastre.

In other cases the linen plans were originally drafted using a variety of estimates over the council area, with subsequent subdivisions fitted into the surrounding parcels more for cartographic effect than positional accuracy.

Assumptions about tree and shrub height lead to 10 metre horizontal errors at the extremity of the aerial photography, and any digitizing of the digital cadastre from that also incorporates that error.

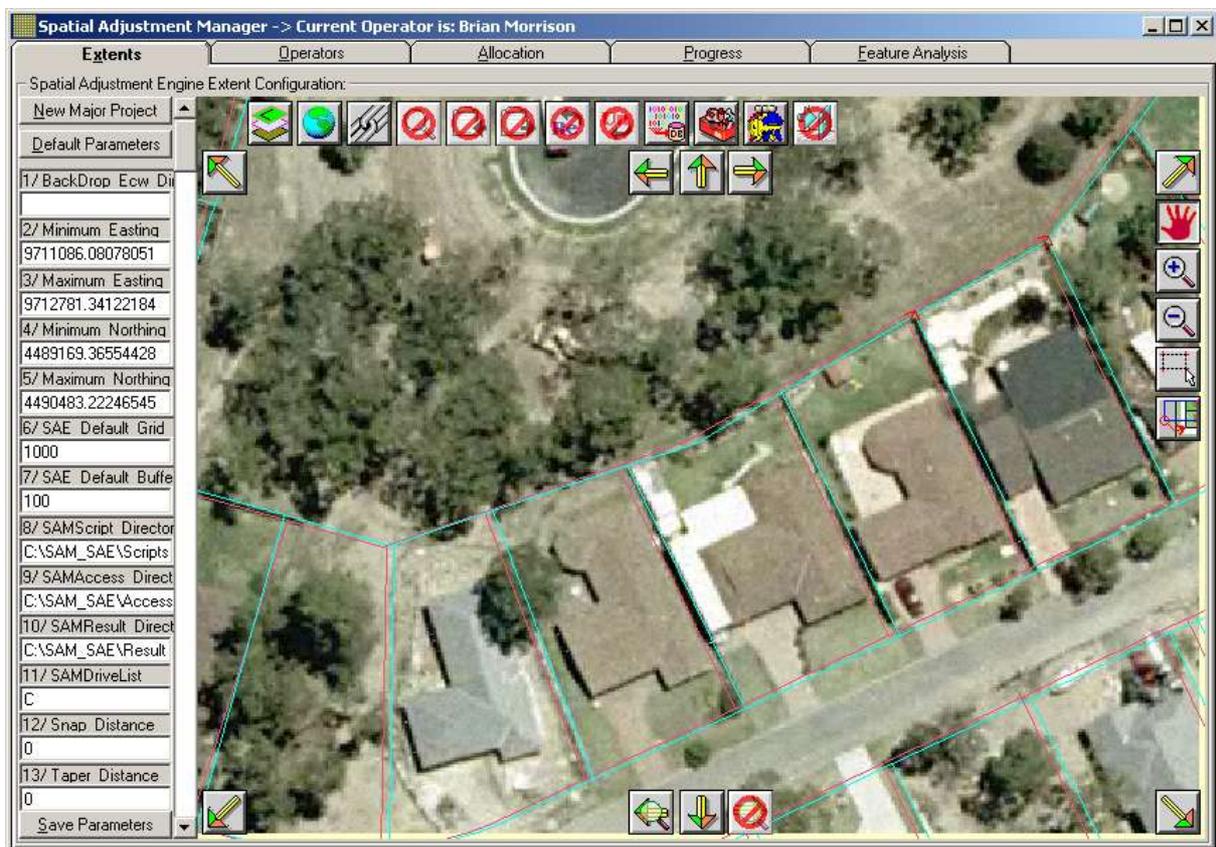
Given the number and nature of the possible errors in both the vector and raster datasets one would have to be concerned about the possibility of achieving an accurate result.

However there is little to be concerned about if the objective is to adjust the vector simply to fit the orthophotography for mapping purposes.

If the objective is to make a substantial improvement in the absolute and relative accuracy of the vector data then the accuracy of the orthophotography becomes a critical issue.

The visibility of common features between the raster and the vector becomes an issue. Older suburban areas have ample trees covering many of the fence intersections at the rear of the properties. Fortunately these areas were developed when front fences were allowed, and these fence intersections provide a common point between the digital cadastre and the orthophotography.

Newer areas are being developed under council guidelines which disallow front fencing, thus the only common points are the fence intersections at the rear of the properties. Fortunately there are still sufficient fence intersections still visible to move the digital cadastre well.



There is much work to be done to provide users with a comprehensive guide to the various issues with upgrading vector to orthophotography, but initial estimates are that 0.25m ortho can be used

to achieve sub-metre accuracy.

Still, with a very modest amount of work it is possible to upgrade digital cadastre and spatially related themes such as council and utility assets and annotation layers as shown above.

## **Supported Formats**

SAM currently supports only the .ecw format for raster data.

SAM currently supports Postgres for the storage of the Vector->Raster Joins.

Please refer to the SAM/SAE White paper for vector formats supported.