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Kayzo KIMATA

THE ROPE-WAY CAMERA SYSTEM FOR ARCHAEOLOGICAL SITES

Abstract

The Nara National Cultural Properties Research Institute, to which the reporter belong, has been employing the photogrammetric mapping method to make records of excavated archaeological sites. As the maps of the sites demand such large scale as 1:20 to 1:50, we use mainly a helicopter for a camera station, and use sometimes acrane.

It often happens that an excavation site is not broad, but unearthed site feature are too complicated tomake record maps by hands of investigation members. Besides a helicopter is comperatively expensive, and a crane is not suitable to conditions of the site location.

I developed a new system for taking appropriate photography in those cases. It consists basically of two metal frame tower, a wire rope streched between them, and a camera suspended from it.

1. PREFACE

The Nara National Cultural Properties Research Institute, to which the reporter belong, has been emploing the photogrammetric mapping method to records of excavated archaeological sites. As the maps of the sites demand such large scales as 1:20 to 1:50, we use mainly ahelicopter for a camera station, and use sometimes acrane.

Though there are many advvntages in loading an aerial mapping camera on a hericopter, its availability is limited within area near around base airports of hericopters, because of their high flying cost. And also this method dose not pay itself if an excavated sites is not broad, and swiftness of work, one of the main merits of the photogrammetric mapping, has little part to play.

When excavation site is small, streo-cameras suspended from a crane boom are convenient. As the boom of a crane stretches as far as 40 meters, photo-scale as large as 1:200 is easily obtained with one of our stereo-camera the NAB-150 (f=150mm). But cranes have their demerits too. Tooperate acrane in an excavation site properly, following conditions are needed.

They are, a sufficient space for stretching the boom, a solid ground to support the weight of 24 ton crane car, an access way of more than 4 meters in width, and aflat surface of 7 meters square for stabilizing jacks.

It is not rare that an excavation site dose not satisfy all of those conditions.

2 THE ROPE-WAY CAMERA SYSTEM FOR VERTICAL PHOTOGRAPHY.

It often happens that an excavation site is not broad, but unearthed site features are too complicated to make record maps by hands of investigation members. Bsides ahericopter is comparatively expensive, and a crane is not suitable to conditions of the site location.

I developed a new system for taking appropriate photography in those cases. It consists basically of two metal frame towers , a wire rope stretched between them, and a camera suspended from it. The camera is moved by a guide string along the rope,

taking successive vertical photographs covering sufficient endlaps.

1) The camera : I adopted Hassalblad MK-70(Biogon f;5.6/61.3 mm) in the system. Because with this camera, it is possible to take successive shots, by using a remote control shutter and a film winding equipment.
Cameras using glass plates are unsuitsble, for they must be pulled down after each shot to reload the plate.
A small TV camera is mounted aside the MK-70 to serve as a view-finder. A ground area to be covered is projected in a monitor TV set on the ground. The TV camera with a wideangle lense has alittle broader area coverage than the MK-70, so the difference is adjusted by aframe drawn on the tube of the TV set.

2) The camera mount : A rough appearence is illustrated in figure 1. The framework of the mount is formed of alminium bars.
As the MK-70 loaded with a role- film weghs 3.2kg and the TV camera only 0.8kg, so I set counter weights on the TV camera side to keep balance.
For to keep an optical axis of the camera properly vertical against the flat ground, the camera mountis attached to a bar that is set above its centroid, crossing at right angle with its moving course. Rotation of the mount about ψ axis around this bar, is made free by sockets with ball bearings. Thus so long as the mount is correctly balanced, ψ rotation is to be automaticaly adjusted. Then the center of the cross bar is attached to ametal pipe that moves along the rope, and rotation about ω axis is adjusted by the weight of the equiped itself.
Rotation about κ axis is avoided by giving enough length to the pipe. The mount has a plastic skirt, so that the camera dose not strike the ground directly in case of accident.

3) The towers : They are shown in figure 2. I employed ready made radio ham antenna towers, and made some treatments, as fitting fasting rings and windlasses for the wire rope, and the like. A tower is composed of several mutual fitting units.

A unit is made of three aluminium bars forming a triangular prism fixed by angle braces, and measuers 2.4 meters in length. Three units joined end to end make a tower a little higher than 7 meters, and photo-scale of 1:100 is attained, notwithstanding abending of the main rope by the weight of the camera mount and the rope itself.

3 THE ORIENTATION TEST

Elements of orientation for one of vertical photograph pairs by this system, are shown in table 1. Figure 3 is apart of map plotted from those photograph pairs.

The difference between ck^1 and ck^{11} is due to inequality of enlarging ratio in the photograph pair. For i have to use twice enlarged diapositive for our Stereometrograph type E. This difference exerts a bad influence on bz. An error in by may be caused in the setting of the pictures on the carrier of the plotter. The difference in ψs seems to come from aslanting of the mount toward aremote control cord of the shutter hanged directly down from it. This error can be avoided by making the control cord run along the main rope and climb down the tower to the ground.

4 CONCLUSION

Through several experimental plotting, it is ascertained this system can produce photographs of sufficient quality for practical use, without sever shifts or rotations. But there are still some points to be improved. for instance, the suspension apparatus of the mount is less than perfect, and takes too much time to build up the towers in the site.

In this work, i got useful suggestions from the vertical photograph system demonstrated by prof. KATADA at TEZUKAYAMA Univ.

TAB.1 ELEMENTS of ORIENTATION

ck^1	124.02	ck^{11}	124.98
by	28.74	bx	17.24
		bz	31.47
κ^1	101.61	κ^{11}	101.56
ψ^1	99.99	ψ^{11}	100.71
ω^1	99.98	ω^{11}	99.96

FIG.1 CAMERAS and their MOUNT

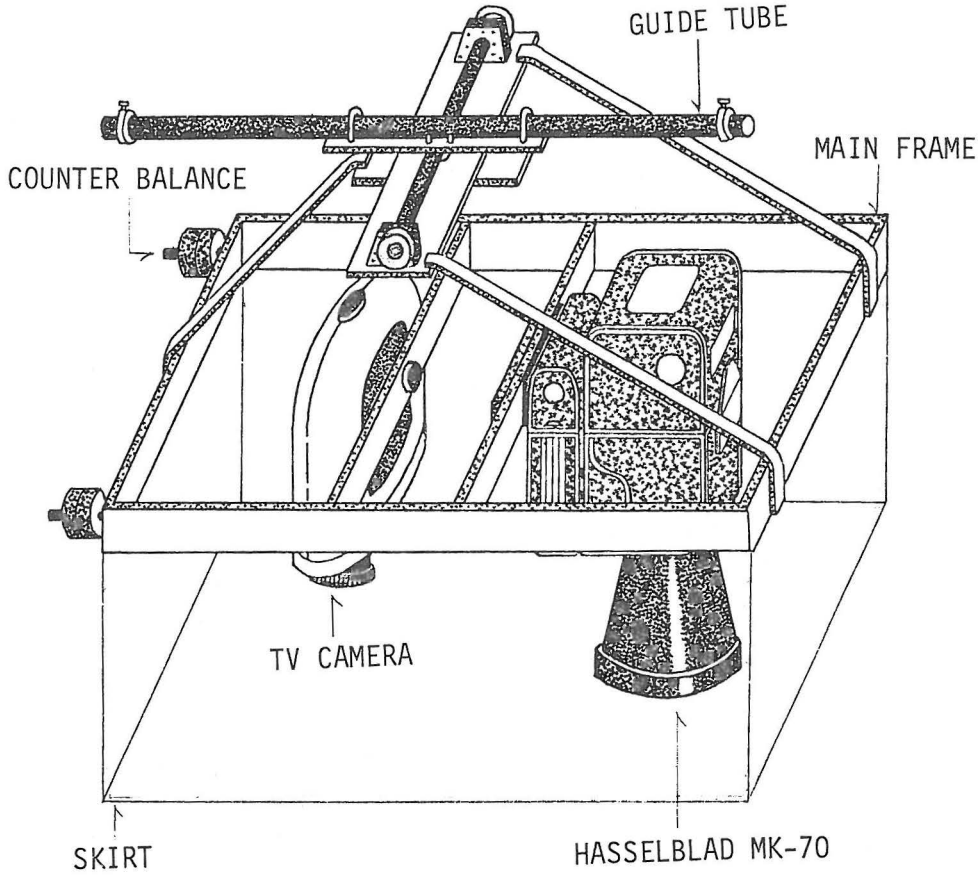
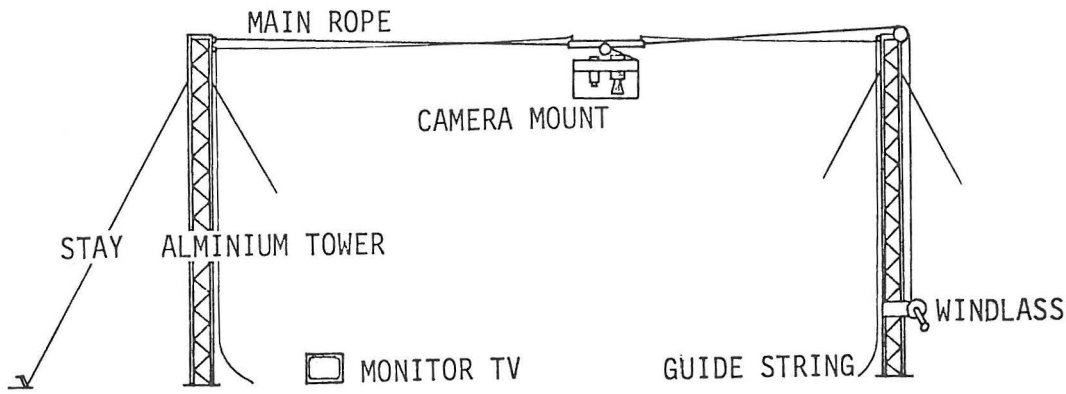


FIG.2 TOWERS



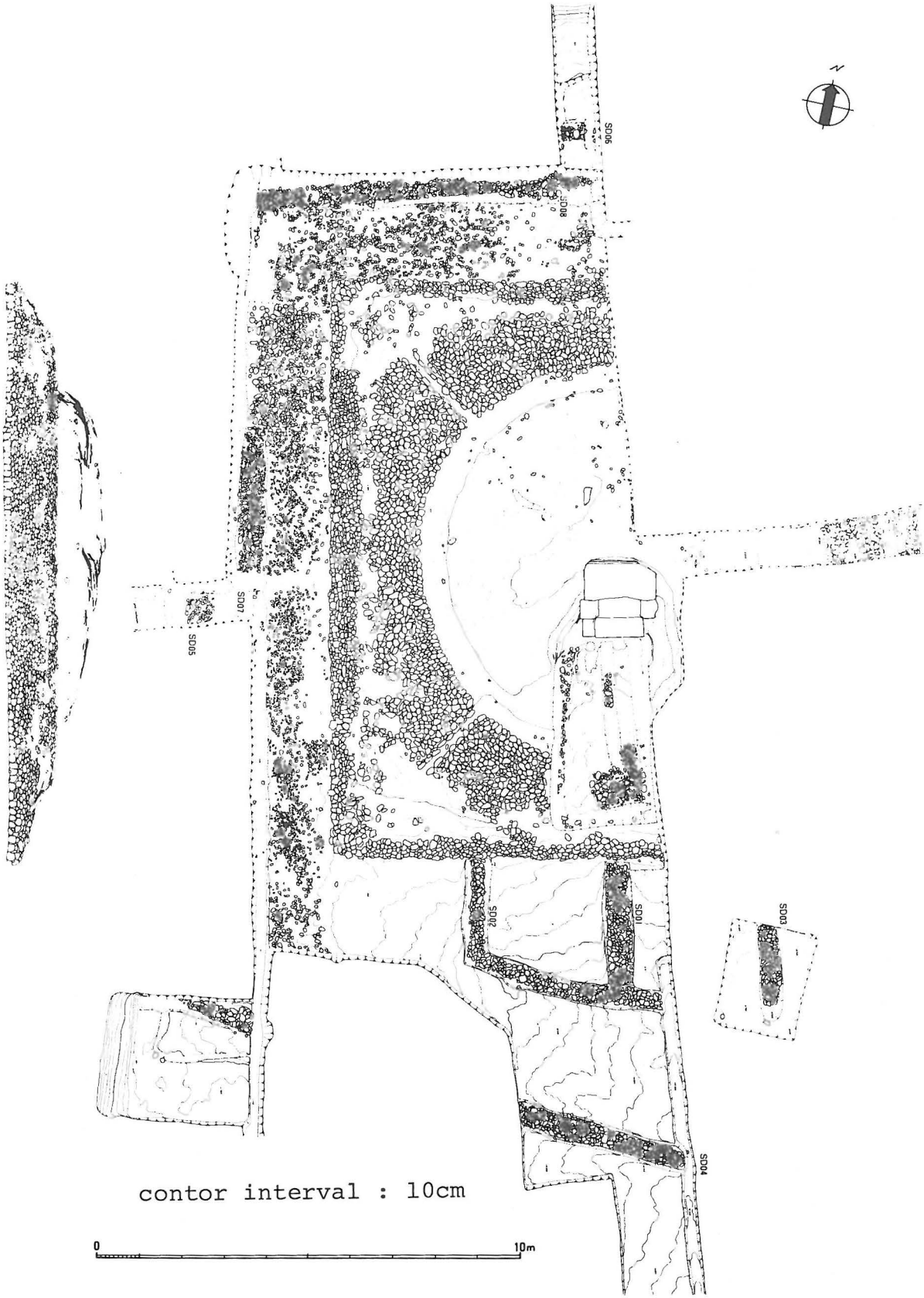


FIG.3 AN EXAMPLE of MAP PLOTTED by NEW SYSTEM

FIG.4 AERIAL PHOTOGRAPH of SAMPLE AREA