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5	Hot Air		
6			
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17 January 1963

MEMORANDUM FOR THE RECORD

Subject : Trip Report - Albuquerque, New Mexico
CA-50 Hot Air Balloon Trials

1. During the period 4-10 January trials of the two-man hot air balloon system were held in Albuquerque, N.M. Weather on the whole was ideal - the reason this area was selected - bad weather moving in terminated trials one day earlier than planned. Representing Raven Industries were:

Ed Yost - Balloon Pilot and Sales Representative
Frank Heidelbauer - Chief, Ground Crew Manager
Gino Mancuso, Ground Handler
Russ Pohl - Company Representative
J.R. Smith - Engineer

Representing TSD were:

TSD/R&D/EB
- C/TSD/R&D/EB
- TSD/OA/CAB

Official^{ly} released by his Commanding Officer to assist in the ground crew was Jesse Spradling, USAF, who had previous balloon experience in an Air Force program with Raven personnel a few years ago. His specialty was as a photographer, but his experience with balloons and knowledge of the local terrain were of great assistance after the injury of Mancuso on the first inflation attempt. Airman Spradling, Mancuso and Heidelbauer were not knowledgeable of the true sponsor in this work, but were advised that the TSD representatives were from ONR.

2. The first day of work was spent in reviewing the equipment and an attempted inflation which was aborted on the injury of Mancuso who inadvertently hurt the fingers of his left hand in the propeller of a small 2-cycle inflation blower. Components of the CA-50 System and characteristics are:



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a. Balloon - 50' diameter by approximately 75' high. Fabric - old type - mylar plastic laminated with nylon; new type - vinyl plastic impregnated nylon. The new material is not subject to delamination, weighs less (110 lbs for the balloon) and rolls into a more compact bundle when deflated. Balloons made of both materials were flown and handled during the trials.

b. Gondola or platform - An aircraft plywood - styrofoam sandwich about 4' by 5', slightly curved along the longer axis. Weighs 40 lbs, suspended from balloon by nylon lines at each corner; carries two men and equipment, two fuel tanks and instruments.

c. Burner - Simple propane burner with pilot light and preheat coils. Weighs 13 lbs., stainless steel construction, has regulator valve, needle valve and blast valve with a quick disconnect fitting to fuel tanks. The burner is supported over gondola in mouth of balloon on a steel bar which also serves as a spacer for the balloon/gondola suspension lines.

d. Fuel tanks - Stainless steel tanks of 22 gal. or 30 gal. capacity are provided. They weigh 37 lbs. and 51 lbs. respectively. Two tanks are carried on the gondola, one at each end, perpendicular to the long axis. They are secured to the platform on cardles with leather straps and interconnected with reinforced flexible high pressure tubing.

an e. Instruments - Three flight instruments are mounted in an aluminum lunch box which is suspended over one of the fuel tanks at one end of the gondola. Weighing 4 1/2 lbs., the instruments contained are a rate of ascent/descent meter, an aircraft altimeter and a pyrometer. The pyrometer is connected by wire to its heat sensing element located a little above the widest girth of the bag when inflated. By indicating the temperature prevailing at the surface of the hot air balloon, the instrument provides a reading which can be used to maintain equilibrium, since it is the difference between the temperature of the gases within the balloon and the atmosphere directly outside that determines the amount of lift of the balloon.

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3. Generally, the balloon can be expected to carry 600 lbs. or two men and equipment for about six hours if 60 gallons of propane fuel are aboard. A crew of about four men are needed to inflate the balloon with more men necessary to control the bag if there is any wind at all. The balloon can ascend rapidly from a small clearing and clear high obstructions under proper circumstances. Within the parameters established by the System's size, weight, fuel capacity, gondola space, etc., its capabilities are directly determined by the operator's skill and the weather.

4. During the trials four free flights of short duration were made, each with two men aboard, one with an additional 95 lbs., of blank paper leaflets which were dropped from various altitudes to observe dispersion. A brief tethered flight was also made to provide one man with limited practice of controlling the balloon. The most difficult aspects of operation appeared to be inflation and landing.

5. Inflation is accomplished by blowing air into the bag through the skirt with a small portable 2-cycle gasoline engine. The blower mounts above the burner which lies on the ground between the gondola and the stretched out balloon. A hoop holds the mouth of the bag open with two men assisting the operation. A portable burner is used to heat the air ahead of the blower. The difficulty occurring more than once during inflation was the opening or vent in the balloon permitting the loss of hot air if not managed properly. This vent is used to aid in controlling the balloon's altitude, primarily in descent. It is normally closed when the balloon is inflated but must be held closed until this condition is nearly attained. Time for a practised crew to unload and set up the system for inflation is about 10-15 minutes. Inflation time also is about the same under average conditions.

6. Launch is achieved after inflation when sufficient lift is developed to carry the payload. By holding the balloon down forcibly, additional lift can be developed before launch so that when the System is released rate of climb will be very rapid and nearby obstacles may be safely cleared.

7. Landing is effected by letting down gradually until the gondola hits the ground. At this moment a careful timing is necessary to prevent dragging of the gondola and its occupants. A squib is fired by means of a pull cord spinning ~~or~~ bicycle generator. The squib cuts a tie off cord at the top of the balloon, permitting it to open wide and exhaust the hot air rapidly. During this operation the balloon acts like a large spinnaker, dragging the gondola. By releasing the appropriate lever the suspension

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lines supporting one side of the gondola are slackened, allowing the curved gondola to drag efficiently not upending or digging in. Occupants remain aboard until stopped by grasping a centrally located line in the gondola. Of the four free flights, two landings were very smooth and two somewhat rough. The first rough landing was due to pilot and crew error resulting in too rapid descent and failure to operate the balloon opening squib circuit at a timely moment. Damage sustained by the gondola in this landing was severe but repairable. The second rough landing appeared to be due solely to mechanical difficulties - with the burner out because of a faulty pilot light an additional blast of hot air was not available to more gently lower the balloon. At touchdown the squib fired but the top of the balloon did not open. After dragging briefly (about 15 yards) the occupants tumbled out and the balloon quickly ascended. It flew another 12 minutes empty until the air cooled sufficiently to drop again. On recovery it was found that this balloon had not been properly rigged at the top tie-off - an excess of protective leather tucked under itself prevented opening of the top. This new balloon had never been previously inflated or test flown - an unnecessary risk indeed.

8. Operational disadvantages noted by the undersigned are listed:

a. Size of crew needed to handle and inflate, time and noise attendant to this operation;

b. Noise and light of burner in operation, (Raven Representatives) stated that the light was difficult to observe at night and may be easily taken for a flickering star). The burner in operation makes a considerable roar similar to that of a large blowtorch or tar-heater;

c. System is completely at the mercy of weather - mostly the wind, both in velocity and direction;

d. Need for skill training of agent user in piloting and navigation - time, area and cost of such training coupled with obvious security problems.

9. Modifications and improvements to various parts of the System were reviewed with Raven personnel upon termination of the trials. These modifications range from safety measures with respect to protective screening of the blower through efforts at more silent and efficient operation

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of the burner to the development of greater reliability and simplicity of operation of various components. Further trials are considered necessary to prove these modifications, develop handling techniques toward the goal of minimum ground crew and inflation time, duration flights, determination of ability to navigate the System practically and feasibility of night operation.

10. The undersigned was impressed with the simplicity of the System and its basic workability. However, the practicability of such a System for infiltration or exfiltration of agents seems questionable. It would seem that few clandestine agents could suffer the uncertainty of destination necessarily accompanying a flight which depends upon the vagaries of the wind. Bulk, time to inflate and noise of operation all mitigate against successful clandestine launchings in any but the most remote areas. Pilot and crew training would invariably be a factor of considerable weight in planning operations and a severe obstacle in many areas of the world. It is suggested that the requesting division's requirements be carefully reviewed and any exceptions or shortcomings noted before final models or specifications for production models are accepted in fulfillment of the requirements.

[REDACTED]
C/TSD/CAB/SD

TRIP CHRONOLOGY5 January

Searched for suitable launch site, laid out System and discussed, repacked. Attempted evening inflation at different launch site, wind caused trouble with five man launch crew (2 inexperienced) one man injured left hand on blower propeller.

6 January

Launched at 0810 from new site. One hour and five minutes flight over eastern end of city, landed hard in suburban area damaging gondola - primarily pilot error although wind carrying into mountains was running out of usable landing area. Yost and []

7 January

Launched at 0840 hrs from new site. One hour and forty-five minute flight uneventful except for inflation difficulties noted with balloon vent. Excellent course prediction and landing. Yost and []

8 January

Launched at 0835 hrs. same site used 7 January. Superior launch with good rate of ascent gained by holding balloon on ground while building up lift. Uneventful flight of one hour and ten minutes terminated when landing area was running out. Drifted towards mountains S and West although efforts made to change direction by changing altitude looking for other winds. Excellent landing. Yost and []

Afternoon: Brief tethered flight at launch site with [] practicing valve and controls on ascent and descent. Est. 20 minutes - uneventful.

9 January

Launched at 0933 after considerable delays caused by malfunctioning valves and equipment problems. New bag used previously not tested or inflated. Sewed bag valve closed because not working properly. Flight made with about 95 lbs. various weights and sizes blank paper leaflets for test drops. Two hours and twelve minute flight terminated because wind carried straight East to mountains when climbing for final leaflet drop.

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Landing difficult and complicated by lack of bag valve (Hoo-Hoo) and burner pilot light out. Dragged personnel at touchdown, dumping out, balloon failed to collapse on firing squib and re-ascended pilotless. Recovered several miles further on after additional twelve minute flight - no damage except minor dent in fuel tank. Balloon failure to collapse caused by improper length of leather shield and improper tying off. Yost and .

Afternoon: Wind prevented a second flight.

10 January

Weather prevented further flying - conference on problems and changes and termination of trials.

CA-50 HOT AIR BALLOON SYSTEM

BALLOON	-	110 lbs.
BURNER	-	13 lbs.
INSTRUMENTS	-	4.5 lbs.
GONDOLA	-	40 lbs.
22 GAL TANKS	-	74 lbs.
30 GAL TANKS	-	102 lbs.
BLOWER	-	7 lbs.
PAYLOAD	-	550- 600 lbs.
CRUISE TIME	-	Avg. 6 hrs.

FUEL - PROPANE - WT. 4-25 lbs./ Gal.
20,000 BTU/lbs., \$.03 -.04 lb.

PLANNED CHANGES

BURNER:

Brass valves instead of stainless steel - sticking
problem from dirt.

Pilot light reliability

Noise and preheat coil holes

Fuel screen in system

Handles on tanks

BALLOON -

Improve vent operating and closing system

Improve skirt ring and pins

'Fool' proof top tie off system

GONDOLA -

Strengthen construction - support for tanks.

Nylon straps for tanks instead of leather

Rope suspension release levers - ease corners to
permit easier release

Improve release lever safety pins

BLOWER -

Install protective screening

Inflation burner mounted on blower.