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EVALUATION OF THE KC-135 AND
U-2 BAILOUT SURVIVAL KIT

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INTRODUCTION

Aircrews flying in the Arctic and subarctic are constantly faced with the possibility after an aircraft incident of surviving at extremely low temperatures without adequate survival equipment. Therefore, the importance of ascertaining the adequacy of survival equipment carried by aircrew members and their knowledge in utilizing this particular equipment is imperative.

The large aircraft usually fly with adequate arctic survival equipment aboard. A successful crash landing is required, however, before this equipment will be available to the crew members in a survival situation. With this in mind, the Laboratory has continued to emphasize the importance of an adequate bailout survival kit, as this is the only equipment the crew member can be relatively sure of having access to once he finds himself down in the Arctic.

The purpose of this field exercise was to evaluate the bailout survival kits carried aboard the KC-135 and the U-2 aircraft. Four test subjects were used in this evaluation; two of them were experienced Arctic survival experts. The eight-day field trip was conducted along Bear Creek near the Yukon River between Bald Mountain and Ruby, Alaska. The monitor of the test program was equipped with supplemental medical equipment, clothing and food supplies in the advent of an emergency.

RESUME OF FIELD TRIP

6 December 1962

The group departed from Eielson AFB at 0900 hours and arrived at Galena AFS at 1130 hours the same day. An H-21 helicopter was waiting at Galena; all equipment and personnel were quickly transferred and the aircraft departed immediately for the site northwest of Ruby.

The helicopter landed near the head of Bear Creek at 1300 hours. The air temperature was recorded at 1330 hours as -35° F, snow depth 10", sky clear, wind east at 1 mph. The monitor's tent was pitched in a clearing approximately 1/4 mile north of Bear Creek. Three of the subjects were each issued a KC-135 bailout survival kit (Appendix A) and the fourth was issued the U-2 bailout survival kit (Appendix B). In addition to the survival kit, each was issued a salvaged parachute. They were instructed to camp alone and out of sight of each other. No other special instructions were given.

The clothing assemblies worn by the subjects were:

KC-135 Test Subjects

T-shirt and shorts
Insulated underwear
Mukluk assembly
Flying suit, CWU-1/P
Jacket, flying MA-1 w/hood
Cap, pile
Gloves, AM-1 w/liners
Mittens, Arctic N4-B

U-2 Test Subject

T-shirt and shorts
Insulated underwear
Mukluk assembly
Suit, partial pressure
CSU-4P
Helmet w/face piece
Gloves, MA-1 w/liners
Mittens, Arctic N4-B

Each man utilized the parachute cloth to construct a type of "A" frame lean-to shelter of single thickness of nylon parachute cloth (Figures 1 and 2). Some subjects used the cloth to form a covering or door at the front of the shelter. Bough beds were made from black spruce. Some subjects removed the snow and placed the boughs on the frozen ground while others placed the boughs on top of the packed snow.

The monitor recorded the temperature inside one shelter an hour after the subject had retired for the night. The subject was inside the MC-1 sleeping bag, with the doorway of the shelter completely closed off with parachute cloth. The temperature inside the shelter was -32.8° F while the outside air temperature was -34.3° F. Temperatures inside the other shelters were recorded with the front of the shelter open and with a fire burning approximately two feet in front of the doorway. Temperatures inside these shelters were usually from three to five degrees warmer than the outside temperature of -35° F.



FIGURE 1

Subject in CSU-4/P clothing assembly and his shelter



FIGURE 2

Subject in front of his A-frame shelter

7 December 1962

Temperature -35° F, wind east at 2 miles per hour

At 0900 hours one subject came into the monitor's tent and reported he had frozen feet. The monitor removed the subject's mukluk assembly and examined his feet. They were not frozen but appeared near the freezing point as the subject had lost all feeling in his feet and was unable to move his toes. His feet were placed inside the monitor's clothing, under his arms for several minutes and later near a wood burning Yukon stove. Approximately two hours had passed before normal control and feeling returned to the subject's feet.

At 1000 hours another subject came to the monitor's tent. He stated he had been cold throughout the night because of the poor insulation qualities of the MC-1 sleeping bag. During the night he had removed his CWU-1/P flying suit and had placed it between his sleeping bag and his bough bed. The flying suit had absorbed moisture from his body and was now more than 50% wet and starting to freeze. An incident of this nature could prove fatal to an already cold-soaked crew member in an actual survival situation. The subject was thoroughly chilled and indicated he felt a better insulated sleeping bag would be necessary to continue the exercise.

By 1100 hours the third subject came into the monitor's tent. This was the subject with the U-2 Survival Kit and wearing the CSU-4/P partial pressure suit. He stated he had been shivering all night long. He had warmed up somewhat but was still very cold. His movements were slow due to the cold as well as the snug fitting CSU-4/P suit.

The fourth subject felt he could continue with the experiment. He spent much of the day improving his bough bed and shelter and gathering firewood. The wind velocity had increased during the day from 2 mph to approximately 12 mph with gusts to probably 20 mph. This man banked the windward side of his parachute cloth shelter with snow for a windbreak. He kept a fire going throughout the day to prevent numbness of fingers and hands while working and as a necessity to prevent chilling during periods of inactivity. At 2300 hours this subject terminated the experiment despite the fact he was in his sleeping bag. He was very cold, shivering extremely hard and had difficulty with his speech. The outside air temperature was -25.6° F with an east wind of 15 to 20 mph. He consumed a full pot of coffee while rewarming and spent the duration of the night inside the monitor's tent.

8 - 13 December 1962

The remainder of the field trip was devoted to constructing various shelters as it was quite obvious that the shelter was of primary importance in this situation. The subjects experimented with emergency shelters constructed from natural materials available in this particular area. Two shelters were constructed from snow, one by making a pile of loose powdered snow 4 1/2 feet high and 8 feet in diameter (Figure 3). After 30 minutes the snow had become firm enough to be hollowed out inside. This type of shelter has proven, in past experiments, to be superior to any other type for protection in extreme cold. Temperatures inside were recorded at +22.0° F while the outside ambient temperature was -22.0° F.

However, snow is not always available during late fall and early winter months. With this in mind, it was decided to experiment with other shelters to determine if another type could be constructed under field conditions that would be comparable to the snow shelter. Two subjects selected a site along the banks of Bear Creek and built a shelter from approximately 95% dead poles and logs, 3% snow and 2% dead grass. It was constructed by standing 5-foot lengths of poles against a dead tree that had broken approximately 3 1/2 feet above the ground but was still attached to the stump portion of the tree. A layer of poles was put in place, with grass along the cracks between the poles and another layer of poles placed over the grass. Several layers of poles and grass were used with some snow being placed over the grass. The finished shelter had walls from two to three feet thick and a small doorway located at the lower end. The shelter was constructed without the aid of a knife or other tools. All snow was removed from the ground inside the shelter, a layer of bark from dead standing black poplar trees was placed on the ground, and dead grass placed over the bark for added insulation (Figure 4).

Two subjects slept in this shelter in the MC-1 sleeping bags. Outside air temperature was -38.2° F at the time of retiring, while inside temperature was -22.0° F at 1945 hours before the door was closed for the night. By 2100 hours the inside temperature was recorded at -7.6° F. During the night the outside temperature rose to +15° F. Both subjects slept comfortably. The following day the doorway was improved and additional dead grass was placed inside the shelter. The temperature warmed to +23° F during the day. Both subjects retired at 2200 hours, one with the MC-1 sleeping bag, the other without a sleeping bag. The subject without the bag slept clothed in his arctic flying clothing with dead grass completely covering him. He felt cool but was able to get approximately eight hours sleep. This type of shelter appears to have excellent insulation qualities and could be used in lieu of the snow shelter in a timbered area prior to an adequate snow fall.



FIGURE 3

Snow hut with subject jumping on the top to show its strength



FIGURE 4

Shelter constructed of grass and logs

SUMMARY

This field trip afforded an excellent opportunity for the subjects and monitor to determine the hazards and problems of surviving in the Arctic under extreme cold. The clothing worn appeared to be inadequate to tolerate -35° to -40° F weather without suitable shelter. The MC-1 sleeping bag proved very inadequate and it should be replaced by more appropriate insulative items or modified.

The shelter is extremely important at these temperatures. Snow affords the best available insulation; A-frame parachute shelters, teepees, etc. are not adequate. Survival is unlikely for more than two or three days unless a snow house or snow packed over the canopy shelter is used. After the first day, lethargy is common so it is most important that the survivor build the right shelter from the beginning. At this time of year there are several simple shelters that utilize snow for insulation (Figures 3, 5 and 6). If no snow is available in timbered country, a structure built of grass and logs appears to offer excellent insulative properties. In extreme cold, it appears that the first thing to do is to build an adequate shelter for the first night. All of the subjects thought they would put up a crude shelter the first night and improve it the following day. However, the first night is extremely critical, and once over the first or second nights, things should become easier.

DISCREPANCIES IN THE SURVIVAL KITS

The following discrepancies were noted in the kits before the exercise:

KC-135 Bailout Survival Kit (MD-1)

- a. First aid kit: All required items were in the kit but were scattered and not packed as a medical kit.
- b. Matches: Were not water resistant type.
- c. URC-4 Radio: An excessive amount of masking tape was used to wrap the battery and transceiver, which resulted in extreme difficulty in opening the package.
- d. Wool socks: One kit contained only one sock. All socks were soiled.

e. Survival gun: One weapon was completely disassembled and most aircrew members would not be able to assemble this weapon without considerable difficulty.

f. Survival knife: Rusty.

U-2 Kit (Bailout)

No discrepancies of the kit were noted.

The following discrepancies of the equipment were noted on the survival exercise:

KC-135 Kit (MD-1)

All subjects considered the MC-1 sleeping bag inadequate at this temperature (-35° to -40° F). The insulation is not adequate for thermal protection; the bag is improperly quilted; the latch will not hold the bag closed and the drawstring frays with use and becomes tangled in the latch so one could get trapped in the bag; the bag is too short for a man over 6'1" in height; and the bag is too small toward the foot and does not provide adequate leg room.

U-2 Kit

a. Although the CSU-4/P is not normally worn during this mission, it is quite similar to the MC-3 or 4 worn by the U-2 pilots. There are no relief zippers present in the MC-3 or MC-4. This necessitates completely removing the outer garments and the partial pressure suit to the knees to relieve yourself, which results in the loss of considerable body heat at -35° to -40° F.

b. Pressure gloves are next to useless to work with. Many tasks just cannot be done wearing the N4-B arctic mittens so one must remove them. The hands quickly become chilled and one is forced to don the arctic mittens, rewarm the hands and then try again with the pressure gloves.

c. The pressure helmet provides adequate head insulation but additional face protection is required.

d. The MC-1 sleeping bag is very inadequate for the reasons stated above.



FIGURE 5

Basic A-frame shelter construction. The parachute and snow will be piled on top of the boughs



FIGURE 6

A modified snow block shelter. The parachute and snow will be piled on top of the sticks

RECOMMENDATIONS

KC-1 Kits (MD-1)

a. The MC-1 bag should be replaced by another with more insulation, or replaced by the down-filled survival clothing. The noted discrepancies should be brought to the attention of the appropriate agency and discrepancies corrected.

b. Closer supervision of the packing and maintenance of these survival kits is required.

c. As little tape as possible should be used to package survival components so minimal effort is required for a survivor to get it unpacked and operational.

U-2 Kit

a. The helmet, including the hard shell, should be left on. The visor can be removed without discomfort to the face. The neck seal should be slit to eliminate constriction.

b. The suit should be unlaced as much as possible. Laces can be cut. If the suit is still too tight, it may be slit, but it must be remembered more body heat will be lost. The CSU-4/P is impermeable and as such keeps one quite warm. Relief openings should be provided in these suits or the survivor should cut appropriate slits for body elimination. The suits should be left zipped up unless there is overheating due to exercise.

c. Do not remove the inner headpress shell at night or if you do, keep it warm. It is almost impossible to don this shell once it becomes cold because the synthetic rubber neck seal becomes too stiff at these temperatures. There is almost the possibility of frostbite due to the metal parts touching the face.

d. Rip the microphone and cord connector out as it only gets in your way.

e. Replace the wool skull cap with a toque which would protect the nose and chin.

f. Carry the MA-1 gloves and inserts to replace pressure gloves.

APPENDIX A

	<u>Kit 1</u>	<u>Kit 2</u>	<u>Kit 3</u>	<u>Auth</u>
Bag, Storage, drinking water, 3 pt cup	1	1	0	1
Box, Match, waterproof	3	2	3	3
Cartridge, jacketed, 22 Hornet	50	50	50	50
Compass, escape (button type)	1	1	1	1
Compass, lensatic (dry type)	1	1	1	1
Container, survival kit	1	1	1	1
File, flat, smooth, 6 inch	1	1	1	1
Cap, wool, knit	1	1	1	1
Kit, first aid, survival, individual	1 ^a	1 ^a	1 ^a	1
Kit, fishing, survival	1	1	1	1
Knife, pocket, general purpose	1 ^b	0	1 ^b	1
Magazine, 22 Hornet, M-4	1	1	1	1
Matches, ordinary, water resistant	66 ^c	66 ^c	66 ^c	66
Manual, survival AFM 64-5	1 ^d	1 ^d	1 ^d	1
Mirror, emergency signal	1	1	1	1
Net, gill, fishing 70 lb test	1	1	1	1
Oiler, 30M-1 carbine with Jan-D-644 oil	0	0	1	1
Radio transceiver, URC-4 w/bty and cable	1 ^e	1 ^e	1 ^e	1
Raft, pneumatic, MB-4 w/sea anchor assy	1	1	1	1
Rations, individual (2 parts)	1	2	2	2
Razor, safety, w/10 dbl edge blades	1	1	1	1
Rifle, survival, M-4, 22 Hornet	1	1	1 ^f	1
Saw assembly, survival (wire saw)	1	1	1	1
Socks, wool, ski	0 ^g	1 ^g	1 ^g	1
Spoon, Jan-F-284	1	1	1	1
Stone, sharpening, type VIII	1	1	1	1
Fuel, compressed, triosane tab box 24	1	1	1/2	1
Water, drinking, canned	0	1	0	1
Wire, snare, brass, 0.025 in. 20 ft. coil	1	1	1	1
Bag, sleeping, MC-1	1 ^h	1 ^h	1 ^h	1

^a All items were in kit but scattered throughout container and not packed as medical kit.

^b Knives were rusty.

^c Matches were not water resistant type.

Appendix A (Cont'd)

- d The manuals were packed in open position causing staples to pull out and pages to become loose.
- e Equipment was in working order; excessive amount of masking tape used, causing prolonged exposure to hands and fingers while unpacking.
- f Screws were completely removed and loose in bottom of kit; bolt was removed from action of one rifle.
- g One kit had a single sock. All were soiled.
- h This item has been highly criticized by all subjects during entire experiment. The following comments were made: Needs more insulation; latch will not hold drawstring in closed position; bag too short; bag too small toward lower (foot) end; poorly quilted, causing insulation to shift; drawstring shroud too light, resulting in frays.

APPENDIX B

Seat Kit Q-198, U-2 Aircraft

	<u>Auth</u>	<u>Recd</u>
Box, Match, waterproof	3	3
Cartridge, jacketed, 22 Hornet 35 grain, M-65 or 45 grain, M-39, Lt. No. 5005	50	50
Cap, wool, knit, size large or medium	1	1
Knife, pocket, general purpose	1	1
Magazine, 22 Hornet, M-4	1	1
Manual, survival, AFM 64-5	1	1
Matches, ordinary, water resistant	66	66
Mirror, emergency signal	1	1
Rations, survival, individual (2 parts) Mfg date, Sep 60	2	2
Rifle, survival, M-4, 22 Hornet S/N 43162	1	1
Socks, wool, ski	1 pr	1 pr
Water, drinking, canned	1	1
Wire, snare, brass 0.025 in. 20 ft coil	1	1