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Directorate of Aircraft Maintenance  
Aircraft Engineering Division

Engineering Report No. P-328  
Maintenance Posture for Quick Start  
12 August 1981

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APPROVED: Specific action by organizations or units will not be taken as a result of this report unless requested by HQ SAC under separate cover.

FOR THE COMMANDER

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Quick Start is an aircraft modification which installed cartridge starters on all engines of the B-52G/H and non-fan KC-135 aircraft. Routine peacetime use of the modification was suspended due to an excessive amount of smoke and toxic gases created by the cartridge exhaust. The SAC Aircraft Engineering Division then investigated respiratory and eye protection for ground crew personnel. As an interim solution, they found that an aircraft firefighters smoke mask connected to a Mine Safety Appliance Corp Type N model sw gas filter canister adequately protects the user. To minimize the crew chief's exposure to the		

smoke-cloud, the Division designed and tested a roll-over chock, evaluated a wireless interphone communication system, and implemented alert B-52 battery engine starts. With these new concepts, response timing is only limited to aircrew checklist items and engine start time.

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1. **PURPOSE:** The purpose of this report is to document LGME's investigation into protecting or removing ground alert maintenance personnel from the hazardous environment associated with full use of the Quick Start modification.

2. **FOREWORD:**

a. Quick Start is an aircraft modification which installed cartridge starters on all engines of the B-52G/H and non-fan KC-135 aircraft. In 1974 routine peacetime use of the modification was suspended due to an excessive amount of smoke and toxic gases created by the cartridge exhaust. Between 1974-76 several tests were conducted to define the content of the toxic environment. These tests concluded the environment within 100 feet of the aircraft using Quick Start is harmful to unprotected personnel for up to 60 seconds after cartridge initiation. The smoke cloud, however, is very dependent upon prevailing weather conditions.

b. At the request of HQ SAC, the Air Force Systems Command did an indepth investigation into a new smokeless, non-toxic cartridge. Their investigation ended in 1978 with the general consensus of industry and Air Force engineers that such a cartridge was not within the "state-of-the-art" to produce. As a result of these findings, LGME initiated this project to provide adequate respiratory and eye protection to alert ground crew personnel, and try to minimize their exposure to the toxic cloud.

c. We performed an exhaustive search through DOD and commercial industry inventories for "off the shelf" protective equipment suitable for the alert environment. We found only one combination of equipment that came close to meeting the established criteria. That combination is an aircraft fire fighters smoke mask (NSN 1660-01-046-5718LS) connected to a Mine Safety Appliance Corp. Type N model SW gas filter canister. This equipment adequately protects the user, but overall performance in the operational alert environment is poor. This equipment must be considered only as an interim solution to the problem. A HQ SAC Statement of Operational Need has been validated and sent to AFSC for better equipment.

d. In an effort to minimize the crew chief's exposure to the smoke cloud, LGME designed and tested a new style aircraft chock. The chock will restrain a parked alert aircraft, and yet, will allow it to safely taxi over. We investigated the feasibility of using a wireless interphone communication system to give the crew chief greater mobility around his aircraft. We were also instrumental in implementing alert B-52 battery engine starts. The protective equipment, and the new concepts and procedures were evaluated during a HQ SAC directed test called Giant Match II.

e. As a direct result of the Giant Match II evaluation, full use of the Quick Start modification was implemented at 10 SAC units on a daily basis. All other SAC units were instructed to order the necessary equipment and be prepared to implement Quick Start procedures at the direction of HQ SAC.

f. By employing the concepts of alert aircraft roll over chocks, wireless interphone, and alert B-52 battery engine starts, the crew chief has a great amount of mobility around his aircraft. Due to the transient nature of the smoke cloud, the crew chief must still be afforded respiratory and eye protective equipment. Also, by employing these new concepts and procedures, alert aircraft response timing is reduced to an absolute minimum. By eliminating all ground crew actions after engine start, response timing is only limited to aircrew checklist items and engine start time.

### 3. CONCLUSIONS:

a. The toxic smoke cloud generated by the use of the Quick Start modification is very dependent upon prevailing weather conditions. Because of this, alert ground crew personnel must be provided respiratory and eye protection.

b. Crew chief protective equipment, currently employed, adequately protects the user, but overall performance in the operational alert environment is extremely poor. Crew chiefs must be properly trained in the use and limitations of the equipment.

c. Better protective equipment, suitable for the alert environment, is desperately needed.

d. Air/oxygen reservoirs, capable of providing 5 minutes of flow to a heavily exerted individual, are too heavy and bulky to be used in the alert environment.

e. Plastic escape hood devices are totally useless in the alert environment. The device rapidly fogs when donned and totally impairs visibility.

f. As of 1981, a smokeless, non-toxic cartridge is not within the "state-of-the-art" to produce within the size limitations of the existing breach.

g. By using alert aircraft roll over chocks, alert B-52 battery engine starts, and a wireless interphone communication system, the crew chief has a great amount of mobility around his aircraft, and alert response timing is reduced.

### 4. RECOMMENDATIONS:

a. ASD/AES should actively pursue development of better protective equipment suitable for the alert environment.

b. The concept of a wireless interphone communication system should still be pursued to completely eliminate all crew chief actions after engine start, and reduce response timing to a minimum.

c. Investigation into a non-toxic cartridge should continue as new technology becomes available.

## 5. DISCUSSION:

a. In 1969, HQ SAC submitted a class V modification request which would allow for simultaneous engine starts on all alert aircraft. The modification, known as Quick Start, was approved and acceptance testing began in early 1974. All B-52G/H and non-fan KC/EC/RC-135 aircraft were modified by 1976. As modified aircraft were delivered to their units, several instances occurred where crew chiefs were overcome by the higher concentration of exhaust gas created by a multiple cartridge firing. As a result, HQ SAC curtailed the use of the Quick Start modification, except when specifically directed by CINCSAC in advanced alert postures.

b. During acceptance testing, in Nov 74, the Boeing Military Airplane Co., and the USAF Environmental Health Laboratory conducted limited sampling tests of the exhaust gas. These tests were performed at Mather AFB and Boeing-Wichita to determine the level of toxic gases generated by use of the Quick Start modification. The tests concluded that toxic exhaust gases exist within 50 feet of the aircraft for up to 30 seconds after cartridge initiation. As a result, the Environmental Health Laboratory recommended that persons required to enter the toxic gas region must be provided respiratory and eye protection. These restrictions were added to the applicable aircraft flight manual checklists as a warning.

c. In 1976, HQ SAC conducted additional testing of the Quick Start modification. The test was called Giant Match and it was conducted in two phases. Phase I was accomplished at Mather AFB, 4-11 Nov 76. Phase II was accomplished at Fairchild AFB, 15-18 Feb 77. The test was conducted by HQ SAC/DOOV (later redesignated DOOA) and complete test results are contained in the Giant Match Final Report (S), dated 1 Jun 77.

d. Giant Match was an exhaustive test of the capabilities of the Quick Start modification. The USAF Occupational and Environmental Health Laboratory (OEHL) participated to perform an indepth air sampling analysis of the toxic gases. Airborne and ground photographic documentation of the test was accomplished by the A. F. Aerospace Audiovisual Services (AAVS). Representatives from many directorates within the headquarters also participated. The primary objectives of the test were to provide baseline timing data (cartridge start to ready to taxi) for Quick Start loaded aircraft, to obtain an indepth analysis of the toxic gases contained in the exhaust smoke, to evaluate "off the shelf" ground crew respiratory protective equipment, and to evaluate and film the effect of the smoke cloud on visibility during ground and cockpit operations.

e. The air sampling analysis showed high concentrations of ammonia, oxides of nitrogen, carbon monoxide, and potential for hydrogen cyanide gases were contained in the smoke cloud. The quantities measured show exposure to the smoke cloud is not lethal, however, it may result in temporary illness. Symptoms such as nausea, headaches, vomiting, and burning of the eyes and nasal passages could result. Thus, the toxic gas cloud environment warning in the aircraft flight manuals was expanded to 100 feet for 60 seconds.

f. Ground crew participants were provided with protective equipment manufactured by the Mine Safety Appliance Co. (MSA). The equipment consisted of the MSA Ultravue full face mask, connected to the MSA Type N, model SW gas filter canister. Although the equipment provided adequate protection, as designed, it was deficient in terms of operational application. The most serious deficiencies noted were lack of ground to cockpit communication, fogging of the face plate, and restrictive breathing through the canister. Because the Giant Match test provided a small sample size, HQ SAC/LGMS conducted an operational test of the protective equipment at several SAC bases. The overall results of this test confirmed the results obtained during the Giant Match test. Consequently, this protective equipment was not adopted for command wide use. At this time, attention diverted to the development of a non-toxic starter cartridge.

g. One recommendation in the Giant Match final report was "representatives from HQ SAC/AC/DO/LG/XO/XP/SG should meet to investigate the requirement for a less toxic cartridge". In 1977 a SAC Requirement of Operational Capability (ROC) was drafted. Simply stated, the ROC contained a threat analysis, as viewed by many HQ SAC directorates, and concluded that full use of the Quick Start modification, on a daily basis, was the only way to combat the threat. It further stated that use of the modification was curtailed due to the toxic environment. It proposed the development of a non-toxic starter cartridge. Anticipating a formal tasking, the Aeronautical Systems Division (ASD) of the Air Force Systems Command began an extensive investigation into the problem. By mid 1978, however, the general consensus of industry and Air Force research engineers was that such a cartridge was not within the "state-of-the-art" to produce within the size limitations of the existing breech. To obtain the same amount of energy as produced by the existing eight pound cartridge, the size of a non-toxic cartridge would have to triple. This would require an additional modification to the aircraft starting system, and addition of a bulge to the engine cowling. Considering the original cost of the Quick Start modification, this additional modification was considered as cost prohibitive.

h. Upon termination of the LGMS protective equipment test, mid 1977, the LGM staff began looking at ways of eliminating the alert crew chief from close proximity of the aircraft. LGME initiated a feasibility study for an "Aircraft Parking Restraint for Quick Start", engineering report number S-096, dated 22 May 78. The purpose of the study was to investigate methods of restraining parked alert aircraft without having to remove chocks prior to aircraft taxi. The study concluded that a lower, different shaped chock will restrain a parked aircraft and will allow the aircraft to safely taxi over with an increased power setting. The 55th Field Maintenance Squadron, Offutt AFB, manufactured a prototype set of the roll over chocks. Initial Operational Test and Evaluation of the chocks was accomplished under this project, however, in Mar 80, a separate project was initiated specifically for the roll over chocks. Complete test results are contained in LGME engineering report number P-372, "Alert Aircraft Roll Over Chocks".

i. In June 1978, when ASD's non-toxic cartridge investigation wound down, LGME initiated this project to re-evaluate alert crew chief duties for operating in the Quick Start toxic environment. The evaluation considered today's needs for ground support equipment and the crew chief in the vicinity of a Quick Start loaded aircraft. Shortly after project initiation, an LGM directorate working group was formed to study the problem and recommend changes. The working group scrutinized all alert crew chief checklist items for before, during, and after engine start. The group agreed, that although the crew chief could not be completely eliminated from the proximity of the aircraft, his exposure to the toxic environment could be greatly minimized. See attachment 1, Minutes of the Quick Start Meeting, 9 Jun 78. The group recommended LGME pursue the following items:

- (1) Alert aircraft roll over chocks
- (2) Wireless interphone communication system
- (3) Aircraft battery engine starts
- (4) Suitable ground crew protective equipment

j. The working group determined that ground-to-cockpit communication was essential for normal alert peacetime exercises. Currently the crew chief is tethered to the aircraft by his interphone cord. Therefore the concept of using a wireless type interphone system surfaced. At about this same time, ASD and the Military Airlift Command (MAC) were beginning an Initial Operational Test and Evaluation (IOT&E) of a wireless interphone system. HQ SAC/XPHV was closely monitoring MAC's program for possible application. Using reduced alert response timing as justification, XPHV was able to obtain permission from ASD to conduct a SAC IOT&E of the system. Overall test results are contained in the IOT&E final report "Aircraft Wireless Interphone System", SAC project 9012, dated Sept 80. Copies of this report can be obtained from HQ SAC/XPB. Since this was a joint XPHV/LGME effort, our results are contained in LGME final engineering report P-371, "Aircraft Wireless Interphone Communication System". For purposes of this report, a brief summary of the test will be discussed later.

k. During the Quick Start modification, the B-52G lead acid aircraft batteries were replaced with nickel cadmium (Ni-Cad) batteries similar to those originally installed in the B-52H. Also, the B-52G and H engine ignition systems were wired directly to the aircraft batteries. The outboard engines (1, 2, 7, 8) are connected to the left essential d-c start bus, which is supplied by the aft battery. The forward battery supplies the right essential d-c start bus, which is connected to the inboard engines (3, 4, 5, 6). The modification also provided the capability to start all engines from a single battery in the event one battery failed. The switching of the start function to the good battery is automatic, and cannot be controlled by the pilot. The Ni-Cad batteries are designed to be reliable down to temperatures of -25°F. In order to use this portion of the mod, operational cold temperature testing was accomplished during phase I implementation of Quick Start. Results are discussed later in the report.

l. When applying the concepts of roll over chocks, wireless interphone, and aircraft battery engine starts, the crew chief can be removed from the close proximity of his aircraft. However, the concentration of the toxic smoke cloud is very dependent upon prevailing weather conditions. On a calm

warm day, the smoke cloud could linger around the aircraft throughout the alert response. Conversely, on a windy day, a responding crew chief may never be exposed to the cloud. Also, in an alert area where several aircraft are parked, a crew chief may not be exposed to the smoke cloud from his aircraft, but could easily be exposed to high concentrations of smoke generated from several aircraft upwind. It is the transient nature of the smoke cloud that prompted our investigation into crew chief protective equipment suitable for the alert environment.

m. We used the following criteria to begin our investigation. First, the equipment must be lightweight and easy to don. Second, it must provide a minimum of five minutes of respiratory and eye protection to a heavily exerted individual. Third, it must be fully operational after prolonged storage at any temperature in a range of -30° to 160°F. Fully operational implies visibility is not impaired due to faceplate fogging. Fourth, it must provide for two way ground to cockpit communication. Fifth, it must provide adequate hearing protection to persons working near operating aircraft jet engines. Sixth, it must have provisions for persons who wear corrective lenses. To expedite procurement of the protective equipment, our investigation primarily focused on readily available, "off the shelf" equipment. Based on this set of criteria, only a few pieces of equipment in the Department of Defense inventory qualified for evaluation. Thus, we expanded our investigation into the commercial market.

n. We contacted several commercial companies that sell protective equipment. Of the companies contacted, only five actually develop and manufacture their own equipment. These companies are:

- (1) Bio Marine Industry Inc.
- (2) Mine Safety Appliance Corp.
- (3) Robert Shaw Safety Products
- (4) Sierra Engineering Co.
- (5) Scott Aviation Corp.

Since our initial contact Sierra Engineering merged with Scott Aviation. The new parent company is Scott Aviation.

o. Bio Marine sent us information on their "Bio Pak" self-contained breathing apparatus. This unit consists of a full face mask, which connects to a large air tank that straps on the user's back. The apparatus is rated for 15 minutes of protection. This was the only unit Bio Marine could offer. Because of the size and weight of the apparatus, we did not perform a formal evaluation of the equipment.

p. Robertshaw Safety Products produces a large line of life support products for military and commercial aviation. Of their product line, we selected a five minute escape device for our first evaluation. The escape device consists of a plastic hood that pulls over the user's head. Air is supplied by a high pressure (5000 psi) rechargeable air reservoir. The air supply is attached to the back of the hood and rests on the user's neckline. The escape hood was tested at Dyess AFB, 4-7 Dec 78. The most serious deficiency with the hood was that it completely fogged and totally impaired visibility within 30 seconds after being donned. Outside ambient air temp

was 40°F. This is a totally unacceptable and unsafe situation for the alert environment.

q. Also tested at Dyess was a different style escape hood manufactured by Scott Aviation. This hood is currently used by the Navy for escape from hazardous atmospheres below the deck of a ship. A plastic hood fits over the user's head, and oxygen is supplied from a solid state oxygen generator (see attachment 2). Like the Robertshaw hood, fogging totally impaired visibility. Also, because of its design, the chemical oxygen generator is hermetically sealed in plastic for storage. The plastic must be removed prior to use. In an alert response environment, the plastic could easily be ingested into an aircraft engine. This also is totally unacceptable in an alert environment. Based on this evaluation, we concluded plastic escape hood devices were not suitable for the alert environment.

r. After several discussions with the sales representatives from the commercial companies, our investigation returned full circle to a full face mask design. At this point in time, the A.F. was just beginning to procure a new style cargo aircraft smoke mask. The mask was specifically designed to protect aircrew members from a chemical/biological war environment. Unlike the MSA full face mask, this new style mask contains a nose cup and deflector baffle to control fogging. It also provides full ground to cockpit communication capability (see attachment 3). The mask is designed to connect directly to the aircraft oxygen system. Before we could fully evaluate the mask, we had to find a compatible fresh air supply to connect to the mask.

s. We first tried to use an aircraft oxygen bail out bottle because it was small and lightweight. The bail out bottle used was a type H2, 22 cubic inch, high pressure (1800-2200 psi) system. Oxygen duration is rated for 10 minutes at a 10-12 liter per minute flow at altitudes above 25,000 feet. On the ground, however, the bail out bottle is useless. When connected to the mask it provided less than one minute of oxygen to a person at rest, and a totally insufficient volume of oxygen to a heavily exerted individual.

t. An alternative source of oxygen we evaluated was the MA-1 aircraft portable (walk-around) oxygen bottle. This is a low pressure (0-500 psi) system that provides 100% oxygen through the A-21 demand regulator. The system is designed to provide 20-30 minutes duration of oxygen at ground level. We conducted an evaluation of the walk around bottle at Offutt AFB, 16-17 Jan 79. We found that the system provided a useful duration of less than 3 minutes to a heavily exerted individual. For this evaluation, the regulator was set to "NORM", which provides oxygen only on demand, and the bottle was fully charged.

u. Since neither oxygen source could provide a minimum of five minutes duration, we again went to the commercial market. Robertshaw Safety Products manufactures a high pressure (5000 psi) air canister which connects to a demand regulator. The complete system is approved by the National Institute of Occupational Safety and Health (NIOSH) as a five minute escape unit from oxygen deficient atmospheres. We obtained a regulator and four

air canisters for evaluation. When connected to the aircraft smoke mask, the canister provided less than five minutes of useable air to a heavily exerted individual. Another major drawback to this air supply is the problem of recharging the canister to 5000 psi. In order to locally recharge the canisters, a booster charging station, built by Robertshaw specifically for their high pressure reservoirs, would have to be procured. For these reasons, this air supply was not considered for further evaluation.

v. We also tested two air respirator systems from Scott Aviation Products. These two systems are rated for 30 and 15 minutes worth of protection. Both of these systems are widely used by military and civilian fire departments. The systems consist of a pressurized air tank connected to a full face mask through a pressure demand regulator. The face mask tested did not have a nose cup deflector; therefore, it exhibited the same deficiencies as the previously tested MSA Ultravue mask. The most serious deficiency, however, was the large size and heavy weight of both air tanks. During the evaluation of the 30 minute system, the air tank knocked the aircraft structure, and physically "hung-up" twice as the crew chief tried to board the KC-135. This is an unacceptable condition for the alert environment. Although the air tank on the 15 minute system is shorter than the 30 minute system, the outside diameters are about the same. Therefore, we concluded that neither system was acceptable and further testing was not accomplished.

w. We also investigated the possibility of using a gas filter with the full face mask. We performed another exhaustive search through the DOD and commercial market inventory. Much to our surprise, only the Mine Safety Appliance Corp. manufactures a filter canister that provides protection against ammonia, carbon monoxide, and hydrogen cyanide. Generally, filters are basically designed to provide protection against particulate matter (i.e. dirt, dust, paint, etc.). For a filter to protect against a gas, an elaborate chemical cleaning system is required. Of the three toxic gases stated above, carbon monoxide is the most difficult to filter. The MSA Type N, model SW filter uses a catalytic filter device to oxidize the carbon monoxide. The filter is also rated as a high efficiency type filter because it stops extremely small particulate matter from passing through the filter. Because of this, a heavily exerted individual has trouble breathing through the filter.

x. In 1978 a pre-launch survivability working group was formed within HQ SAC. The group was chaired by Brig Gen McIlmoyle, then Deputy Chief of Staff for Plans and Policies. The charter of the group was to provide recommendations to CINCSAC on enhancing the survivability of SAC's alert forces. One of their recommendations was to use the Quick Start modification on a daily basis. General Ellis concurred with the recommendation. As a result, an alert force timing working group was formed under the direction of HQ SAC/DOCF. The group consisted of working level people from about 26 different divisions within the headquarters. The charter of this group was to actually implement the use of the Quick Start modification, and explore and implement any other procedures that would reduce alert aircraft response timing.

v. Based on the work LGME accomplished in ground crew protection, the timing working group recommended HQ SAC/DOOA conduct another evaluation of Quick Start capabilities, procedures, and protective equipment. This exercise was named Giant Match II and it was conducted at Wurtsmith AFB, 30 Jan to 2 Feb 79. HQ SAC agencies involved with the exercise were: DOOA, test director; DCCF to evaluate various procedures to reduce response timing; SP to evaluate security police protective equipment; SG to evaluate the effect of using two cartridges on the KC-135 on a daily basis; ICEVG to evaluate aircrew procedures and recommend aircraft dash one changes; LGMS/LGME to evaluate crew chief protective equipment and proposed new procedures. The new procedures included the use of roll over chocks and B-52G battery engine starts. See attachment 4 for the various types of tests accomplished. Complete test results are contained in HQ SAC/DOOA final report "Giant Match II", dated 15 Mar 79.

z. Based on the results of our protective equipment investigation, the new style aircraft smoke mask connected to the MSA type N filter is the only readily available "off the shelf" equipment suitable for the alert environment. The crew chiefs participating in Giant Match II evaluated this equipment during the test. Based on the test results, the equipment combination adequately protects the user from the toxic gas environment, but serious limitations were identified. If the mask is allowed to cold soak in a temperature below +32°F, the exhalation valve will freeze closed, shortly after being donned. When the user is heavily exerted, breathing through the filter is very difficult. The mask provides adequate hearing protection, if properly donned, but ground to cockpit communication is marginal due to high sound interference levels. Although the equipment is not the optimal solution, we found we could tolerate the limitations if the crew chiefs were properly trained. The 4235 Strategic Training Squadron, Carswell AFB, made and distributed to all SAC units, a sound on slide training film, number 5014, on the use and maintenance of the Quick Start protective equipment.

aa. The threat situation in 1979/80 drove the implementation of Quick Start prior to the availability of optimal protective equipment. Because of the limitations listed above, the current equipment combination must be considered only as an interim solution to the problem. Lack of research and development funds prevented us from obtaining equipment ideally suitable for the alert environment. On 4 Aug 80, HQ SAC submitted a Statement of Operational Need (SON) for "Alert Aircraft Maintenance Personnel Protection", number SAC 08-80, to HQ USAF. Unlike the previous 1977 ROC (which essentially "died" in coordination) the SON focused on the safety aspect of exposing ground personnel to the toxic smoke cloud. The Air Staff validated the SON and formally tasked ASD to perform the necessary research and development. As of this writing, ASD has drafted and coordinated with HQ SAC a Product Development Specification and is preparing contractual documents for competitive development of a new mask. We hope ASD will continue to pursue this development effort with vigor.

bb. Based on the Giant Match II final results, the alert force timing working group implemented many of the new test procedures. Shortly after the test, all alert KC-135's were loaded with two cartridges (number 1 and 4 engine position only) for normal daily alert. The Giant Match II final report recommended "a limited implementation may provide the

opportunity for additional evaluation and refinement of Quick Start procedures". Therefore, the actual implementation of Quick Start was accomplished in two phases. Phase I began in June 79, when Fairchild, Griffiss, and Seymour Johnson AFBs began using the modification during normal daily alert. Also employed were roll over chocks and B-52 battery engine starts. During Phase I we validated that the protective equipment could be used in an operational environment. We also determined that the B-52G battery system was reliable in cold weather, if they were charged on a daily basis during preflight. We also determined that roll over chocks were suitable for the operational environment, and were safe to use.

cc. With the experience gained during Phase I, aircraft technical orders and SAC alert force regulations were changed to reflect the new concepts of using Quick Start on a daily basis. Phase II implementation was accomplished in the summer of 80. Seven additional SAC units employed the new Quick Start concepts and procedures on a daily basis. All other SAC units possessing B-52G/H and KC-135 aircraft committed to SIOP alert were prepared to implement Quick Start as the threat situation dictated. Thus, 1980 was the first year the command could safely use the Quick Start modification for training purposes in a peacetime environment.

dd. During Phase II implementation, the aircraft technical orders and SAC regulations were being revised and guidance on Quick Start procedures was not readily available. To help all affected units achieve a smooth implementation, interim instructions were published and distributed. A copy of the "Revised Quick Start Implementation Instructions", dated 20 May 80, is contained in attachment 5. Also during Phase II all affected units were ordered to manufacture and use roll over chocks for normal daily alert. Contained in attachment 6 is the "Alert Aircraft Roll Over Chock" manufacturing instructions, dated 20 Jan 81.

ee. During Giant Match II, the Aircraft Wireless Interphone Communication (AWIC) prototype equipment was not available to SAC for evaluation. A separate test was accomplished at Barksdale AFB, 25-26 Mar 80. Simulated alert response times were recorded for standard configuration and new Quick Start procedures. The actions timed during this test were identical to those timed in Giant Match II. The test concluded a B-52 can save 21 seconds and the KC-135 can save 54 seconds just by using AWIC with the other new procedures. By using roll over chocks (no need to pull chocks clear of tires), battery engine start (no need to disconnect ground power) and AWIC (monitor engine start from wing tip) the crew chief can remain completely clear of the aircraft throughout the alert response. However, the crew chief still has ground to cockpit communication for emergencies. As such, actual aircraft response time is only limited to aircrew checklist items and engine "spool-up" time. An added benefit of AWIC is the mobility the crew chief gains for avoiding the smoke cloud.

ff. During our investigation for suitable protective equipment, we studied many evaluation reports on respiratory/eye protective equipment. One report in particular was most helpful. In 1977 the Federal Aviation Administration performed an indepth study on aircrew and passenger protective breathing equipment. Their results are contained in FAA-AM-78-4. A

copy of this report can be obtained through the National Technical Information Service, Springfield, VA.

gg. It is the authors opinion that full use of Quick Start modification, during peacetime exercises, is here to stay. The optimum solution to the toxic gas problem is a non-toxic, smokeless cartridge which would be compatible with existing engines and starters. This avenue was explored during the past years, but such a cartridge was not within the "state-of-the-art" to manufacture. Optimal protective equipment is not available "off the shelf". We did submit a SON to ASD for better protective equipment, but development and procurement will be several years away.

hh. The intent of this lengthy report is to document, to the best of the author's ability, the many actions and investigations surrounding the use of the Quick Start modification to date. All documents listed in this report support our conclusion and recommendations. These documents should be reviewed in conjunction with this report to obtain a complete historical picture.

6 Atch

1. Minutes of Quick Start Meeting, 9 June 1978
2. Emergency Escape Breathing Device, Scott P/N 802300 Series
3. Firefighters Smoke Mask Assembly
4. Trip Report, 15 Feb 79
5. Revised Quick Start Implementation Instructions
6. Alert Aircraft Roll-Over Chocks

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- 10 - HQ SAC/LGME

MINUTES OF QUICK START MEETING  
9 June 1978

Attendees:

Lt Col Patrick	LGMEs
Capt Connolly	LGMEs
Capt Wallace	LGMST
Capt Barnum	LGMSB
Capt Bartness	LGMM
CMSgt Yingst	LGMEs

1. A film covering Giant Match I, Demonstration 1, and Giant Match II, Demonstrations 1 and 2, was shown.
2. Discussion began with current events.
  - a. The quick start aircraft restraint study conducted by Hq SAC/LGME, S-096, is complete; and the suggested roll over chocks are being manufactured in the 55FMS woodmill. No estimated time of completion as parts are on order with no current status.
  - b. Hq SAC/SGPB has been tasked to look into obtaining a simple and practical gas mask for use by ground crew and late arriving aircrew members.
3. Ground crew checklist items before engine start:
  - a. Remove pitot tube covers.
  - b. Remove engine inlet and exhaust covers.
  - c. Disconnect ground wire.
  - d. Establish interphone communication with cockpit.
  - e. Start MD-3 and apply external power to aircraft (B-52G/H models only).
  - f. Notify pilot he is clear to start engines.
4. Ground crew checklist items during and after engine start:
  - a. Fireguard during engine start.
  - b. Disconnect MD-3 power from aircraft.
  - c. Remove chocks.
  - d. Disconnect interphone cord.
  - e. Marshall aircraft out of stub.

**ATTACHMENT I**

5. The discussion centered around the crew chief functions listed in 4a-d above. The group decided that the crew chief must be in the proximity of the aircraft while starting engines and that for normal day-to-day alert it is essential that the flight crew be in direct communication with the ground. If cockpit instruments malfunction, the flight crew might not be aware of an abnormal engine start or other hazardous conditions such as an external fuel leak or wheel well fire. Suggestions for ground to cockpit communications are listed below.

- a. UHF communication from expediter truck to cockpit.
- b. Handi talki between crew chief and cockpit.
- c. Cordless ground crew headset with aircraft interphone tie in.

6. The 1B-52G & H-1 tech orders require MD-3 power for all engine starts. Battery power may be used on alert if MD-3 power is not available, however, the TO also states, "The battery system may not be dependable at low temperatures." This condition may be totally unacceptable when weighing the purpose of the quick start modification versus having insufficient battery power to start the engines. Suggestions for disconnecting the MD-3 power unit are listed below.

- a. Change the location of the MD-3 power receptacle to an area outside of the smoke cordon.
- b. Design a device (i.e., an electrical plunger) that would be activated in the cockpit to push the power cord out of the receptacle.
- c. Realign the power receptacle at an angle and secure the power cord to a place on the ramp in such a way that the power cord would automatically pull out of the receptacle when the aircraft taxied.
- d. Install an explosive type guillotine to sever the power cord prior to aircraft taxi.
- e. Explore the possibility of installing a small auxiliary power unit on the B-52.

7. Should an emergency arise while the smoke environment exists and the ground crew member must enter the smoke environment, he must be protected by a mask. The group decided that it is imperative a suitable, lightweight gas mask be provided to at least each ground crew member for use during all postures of alert. Without a protective mask, the ground crew would be rendered totally ineffective in handling any emergency in a very short period of time. For normal alert status, mask and cockpit communications are absolutely essential to prevent a rash of mishaps that possibly could lead to the loss of an aircraft and crew.

8. During advanced postures, external power is applied to the aircraft primarily for UHF communication with the Command Post. The battery system is continuously being charged. It may be possible to disconnect external power prior to engine start. Utilizing the battery to start the aircraft

and roll over chocks, the ground crew can remain clear of the smoke environment. However, in case of an emergency (i.e., engine fire, etc.), ground communication with the cockpit is absolutely necessary. A protective mask is also essential for the ground crew so that he can enter the smoke environment to deal with the emergency. A protective mask and ground to cockpit communication is essential to cope with extraordinary circumstances even for advanced alert postures.

RECOMMENDATIONS:

1. For Hq SAC/SG to expeditiously proceed in identifying an easy to don mask for ground crew members which will provide several minutes of protection.
2. Hq SAC/LGME to investigate the feasibility and availability of cordless communication from the ground to the cockpit. This will eliminate the requirement to disconnect the headset from the aircraft and will allow the ground crew much more flexibility of movement to avoid the toxic environment. It would also allow cockpit communication during marshalling.

**(PRELIMINARY)**

**INFORMATION FOR PROPER INSPECTION, STORAGE AND  
USER OPERATION OF EMERGENCY ESCAPE  
BREATHING DEVICE (BDEE), SCOTT P/N 802300 SERIES**

**ATH: 2**

(PRELIMINARY)

INFORMATION FOR PROPER INSPECTION, STORAGE AND  
USER OPERATION OF EMERGENCY ESCAPE  
BREATHING DEVICE (BDEE), SCOTT P/N 802300 SERIES

A. GENERAL

1. Stowage Case

- a. Keep the BDEE in its stowage case for protection until removed for emergency use.
- b. The stowage case cannot be opened without tearing the tamper seal. If the seal is torn, inspect the inner bag for integrity. If it shows no signs of damage, affix a new seal.
- c. The case may be belt-mounted, using the wire-formed belt clip nested in the latch recess, or carried by its shoulder strap.

2. Inner Bag

- a. A three layer laminated inner bag is vacuum sealed over the device. It prevents exposure to atmosphere which could cause loss of efficiency in the chemical beds.
- b. If the bag has lost its vacuum seal, repackage the device in a new bag.
- c. The device may be stowed up to two months in a leaky bag without changing its operating characteristics, provided the device is kept in its original bag and has not been subjected to frequent changes in altitude.
- d. A view port, provided in the stowage case, facilitates observation of the humidity sensitive indicator for detection of a failed bag.
- e. The indicator, in the form of a stripe, is dark blue when the bag seal is normal. A clear-to-light pink color indicates that the bag requires inspection.
- f. A torn Tamper Seal also indicates that the bag should be inspected.
- g. Abuse, or a drop violent enough to tear the Tamper Seal, may damage the bag.

B. USE OF THE DEVICE

1. Training

- a. Even though brief instructions appear on the stowage box, it is important that adequate instruction and training be given to all potential users to assure proper use in an emergency.

### C. DONNING

#### Step 1. Removal of the device from the stowage case.

- a. A single latch, labeled "LIFT", is provided at the top edge of the case. Lift the latch to open the case as shown in figure 1.

**CAUTION: DO NOT CONFUSE THE LATCH WITH THE WIRE-FORMED BELT CLIP.**

- b. Some initial resistance to opening, caused during seal fracturing, may be noted after lifting the latch. Continue to open.
- c. Grasp either end of the bag projecting from the corners of the case and pull the device out of the case as shown in figure 2.

#### Step 2. Opening Inner Bag. (See figure 3)

- a. Identify the edge with the Red Tear Strip.
- b. Grasp as shown in figure 3 to initiate the tear.

**NOTE:** Pre-cut notches and the stiff tear strip facilitate removal of the end.

- c. In the event identity of the strip is lost, a little extra effort on any edge of the bag will start a tear.
- d. Remove the device from the bag.

#### Step 3. Initiating Oxygen Flow (See figure 4)

- a. Pull the release pin clearly marked "PULL TO ACTUATE" on the red tag as shown in figure 4. Pull in the direction indicated; parallel with the housing surface.

(Removal of the release pin allows a spring loaded plunger to strike a primer cap on the oxygen generator initiating gas flow which will be audibly noted by the user.)

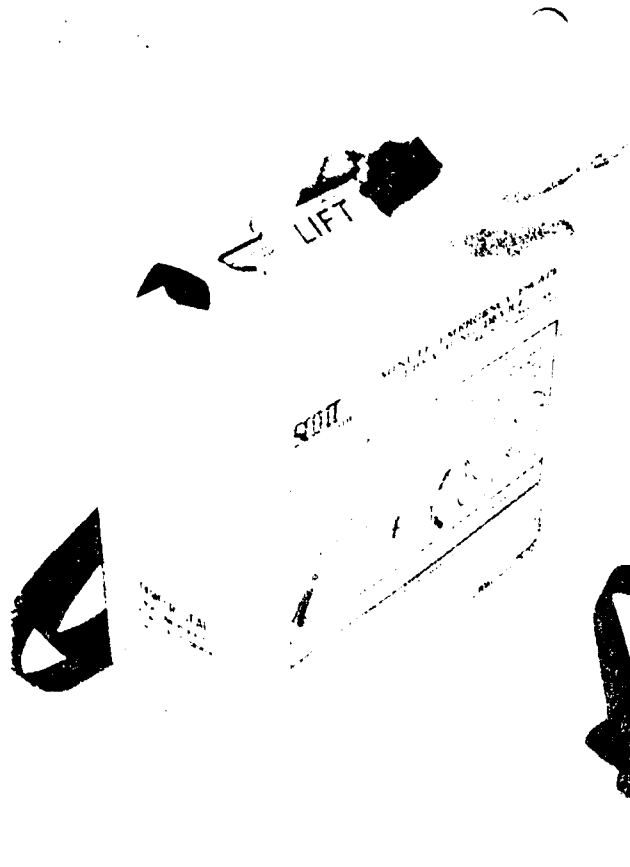


FIGURE 1



FIGURE 2



FIGURE 3



FIGURE 4

Step 4. Donning the Device. (See figure 5).

- a. Hold the device by the open end of the hood, with the recirculating unit away from the user.
- b. Identify the elastic neck seal and the approximate 3-1/2" diameter hole into which the head will be inserted.
- c. Bend forward from the waist as shown in figure 6 and force the head into the hole while grasping the edges of the hood on each side. Use the thumbs to assist in pulling the seal over the face.

NOTE: Users with glasses may find it easier to don the device while remaining in an upright position (see figure 7). Start by placing the chin in the hole and stretching the hole up over the top of the head.

- d. While standing upright, pull down on the front of the hood until the head harness is felt to be tight over the forehead (see figure 8). This will insure maximum stability while being worn.

CAUTION: MAKE SURE THERE IS GOOD CONTACT AT THE NECK SEAL WITH THE NECK. MAKE SURE NO CLOTHING IS TRAPPED IN THE SEAL AND HAIR DOES NOT PROTRUDE BETWEEN THE SEAL AND THE NECK.

D. NORMAL OPERATION

1. It is normal to hear the sound of rushing air in the hood, indicating the oxygen generator is delivering oxygen to the hood.

NOTE: Normal operational duration is 15 minutes.

2. When the noise stops, the device should be removed from the head within a short period of time.
3. Heat build-up within the hood is also a normal condition. Temperatures may reach 110°F inside the hood, depending on the user's activity. This condition may cause some discomfort, but it does not indicate a malfunction.
4. External areas of the housing, particularly in the area of the heat shield, may become hot to the touch.

CAUTION: EXERCISE CARE WHEN TOUCHING THE HOUSING.

E. DOFFING

1. Grasp the hood at the back lower edge and pull forward over the head.

F. DISPOSAL

1. The device cannot be recharged; discard after using.

NOTE: Allow the generator to completely expend before discarding.



FIGURE 5



FIGURE 6



FIGURE 7



FIGURE 8



REPORT OF VISIT	TYPE OF REPORT (Check One)		DATE OF REPORT	PORT
	X	STATE ASSISTANCE VISIT LIAISON VISIT ORIENTATION	15 Feb 79	JMT
TO	PREPARING OFFICIAL		TRIP NO	CATL OF TRIP
FROM (OMB, SIB, etc)	Col Streett		33	30 Jan - 3 Feb 79
ORGANIZATION(S) OR STAFF AGENCY(IES) VISITED	PERIOD OF VISIT (S)		COORDINATION	
Maintenance Feb 79 (379BMW)	30 Jan - 3 Feb 79		OFFICE SYMBOL	LAST NAME
PURPOSE OF VISIT (S)		DISTRIBUTION		
Test Quick start, firefighters smoke mask for crew chiefs, roll-over chocks, battery starts on B-52s and time saved by crew chief not boarding A-135.		LGMS LGM SEE ABOVE DOOV DOCF SP SGPB LGM Kuttross		
RESULTS		ATCH 4		
Eight different tests were run, testing different combinations of quick start/normal start, half-loaded cartridge starts, battery starts/MD-3 starts, roll-over chocks/normal chocks, and crew chief boarding/not boarding the tanker. Details will be in the GIANT MATCH II Test Report from DOOV.				
NAME AND GRADE OF VISITORS	DUTY (Or Title)	UNIT OR AGENCY		
Col Streett	Ch, Acft Engrg Div	HQ SAC/LGME		
LtCol Patrick	Ch, System Br	HQ SAC/LGMES		
Capt Connolly	Project Officer	HQ SAC/LGMES		
Col Schmidt		HQ SAC/DOCF		
LtCol Fagley		HQ SAC/DOCF		
Capt Dade		HQ SAC/DOCF		
Capt Bohnsack		HQ SAC/DOOV		
LtCol Studinka		HQ SAC/DOOV		
Capt Cyphers		HQ SAC/SP		
Maj (Dr) Bishop		HQ SAC/SG		
MSgt Shelly		HQ SAC/LGMS		
NAME, GRADE & TITLE (Team Chief or Visitor)		SIGNATURE		
JAMES K. STREETT, Colonel, USAF Chief, Aircraft Engineering Division		James K Streett		

Demonstration one on the morning of 31 Jan, tested three B-52s and three KC-135s in the normal alert configuration. This was for base line timing data for comparison of the tests to follow. Tests were on the mass parking ramp and started timing with the crews at the aircraft wing tip. A ground evaluator timed each identifiable action of the ground crew and the cockpit evaluator timed the action of the flight crew on this and all succeeding demonstrations. After this first demonstration, all test participants were trained in the use of protective equipment until they were proficient in putting on the masks, testing the fit and plugging into the canister.

The second demonstration, on the afternoon of 31 Jan 79, tested the B-52 with the battery start and roll-over chocks with two-engine cartridge starts. The KC-135s in this demonstration, were loaded with two cartridges (engines one and four) for timing of the part load start.

Demonstration three, in the morning of 1 Feb, tested full quick-start loads on both bomber and tanker with the battery start on the bomber.

The fourth demonstration on the afternoon of 1 Feb, tested full quick-start load on all aircraft, with battery starts and roll-over chocks on the B-52 and with standard chocks and crew chiefs not boarding on the KC-135. After that demonstration, one bomber and one tanker (both fueled to maximum ground handling weight) taxied to a clear area for a test of the roll-over chocks. Both went through a simulated start without brakes set to verify that the roll-over chocks would hold the airplane. The B-52 then tested four engines at 90% without brakes, and the KC-135 tested two engines at 90% without brakes, again to verify the chocks would hold the airplane with half it's engines at high power. Then both aircraft taxied over the chocks with all engines to determine the required power settings. This ranged from 80-85% for both aircraft. The chocks were then carried 200 feet behind the in-board engine pods to find out if the jet blast would pick up and throw the chocks. The chock stayed in place behind both aircraft up to 90% power, at which time it was lifted and flipped end-over-end. The next demonstration on the morning of 2 Feb tested the full, quick start load on all aircraft, with a MD-3 start and roll-over chocks on the B-52 and with roll-over chocks on the KC-135. During these extensive tests, we noted a marked increase in speed of response of the crews, indicating that part of our timing improvement will come from a learning curve. To quantify, the next demonstration repeated the base line demonstration run of the first morning. Following that demonstration was a simulated quick start on all aircraft using the smoke mask and walk-around bottle combination for a comparison between the MSA canister and the walk-around bottle. Following the walk-around bottle demonstration, a test was run at the request of DOCF of a "summer time alert configuration" with no engine plugs in place, with the hatch open and the ladder in place on the KC-135. Following that demonstration, a roll-over chock test was done in a clear area with one tanker down-loaded to the lightest weight that any tanker has on alert. This test repeated the conditions of the roll-over chock<sup>test</sup> of the previous day, to verify that it would not jump the chock with one or two engines at full power. This was demonstrated successfully. As the tanker taxied from its parking spot, a test of the holding ability of the roll-over chock on glare ice was made. We found that the aircraft tire could push the chock ahead of it when attempting to roll-over the chock from a icy parking

spot. When the aircraft wheels got fully up into the ramp of the chock on ice, they tended to reverse rotation and spit the chock forward. A means to increase friction between the bottom of the chock and the ice is needed before we can use the chock as a roll-over chock on glare ice (or ice will have to be cleared from under the chock by chipping and/or use of the HI heater).

The final demonstration, on the evening of 2 Feb, tested B-52 with half quick start lead, MD-3 start and standard checks for half lead timing. The KC-135 for this final demonstration had a full quick start lead, roll-over checks, and crew chief did not board. Throughout the series of demonstrations we found that the smoke mask and MSA canister combination is adequate for crew chief protection from the toxic gases. Difficulty in getting enough air was reported on the early tests. On the later tests, knowing what to expect, the crew chiefs were able to pace themselves and get sufficient air to perform their duties without having to lift the mask. Ear protection from engine noise is marginal. Comments by the ground crew and flight crew were generally good. On the comparison tests between the canister and walk-around bottle, five of six crew chiefs preferred the canister. Mask faceplate fogging was not a problem. Proper care in cleaning and drying of the mask exhaust valve after each use was shown to be necessary, *as* the moisture in the exhaust valve froze it shut after a short exposure at about 15°F. No problems occurred with the battery starts on the B-52, even though batteries were not changed in both successive starts. Temperature during the starts ranged from about 5-20°F. The use of the roll-over checks saved 10-20 seconds of crew chief time and obviated the need for him to go under the KC-135 to remove checks. The checks hold the aircraft where it should and allows taxi-over easily with engines on an alert response. We will work a fix to increase friction under the chock so that it can be used on ice as well as dry pavement. Detailed timing results from these tests will be in the test report prepared by D00V after analysis by NR. Support of the test by Wing was superb. The bulk of the work in response to the test requirements was on OEL. They responded to each requirement quickly and professionally, and deserve commendation for a very successful test series.

DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS STRATEGIC AIR COMMAND  
OFFUTT AIR FORCE BASE, NEBRASKA, 68113



20 MAY 1980

TO: SAC, LGM

SUBJECT: Revised QUICK START Implementation Instructions

See Distribution List

1. Peacetime use of the Quick Start modification on B-52G/H and KC-135(non-fan) aircraft was suspended in 1974. This was due to the high concentration of toxic exhaust gas from the MXU-4/A cartridge. The Commander-in-Chief SAC retained the option to load additional cartridges during higher DEFCONS. Several investigations searching for a nontoxic cartridge or suitable protective equipment during the past six years were unsuccessful.

2. However, in 1978 an interim solution to the peacetime problem was developed and tested. To evaluate the new procedures and equipment in the field, Phase I implementation of Quick Start procedures on a daily basis was accomplished last summer at three SAC units. Phase I was successful and Phase II implementation is planned for the near future. Units will be notified, by message, of exact implementation date. In Phase II, seven additional SAC units will implement Quick Start on a daily basis. All other addressees will have the capability (interim protective equipment) to implement Quick Start as directed by HQ SAC.

3. Phase I was accomplished at Seymour Johnson, Griffiss, and Fairchild AFB's. Valuable insight was gained by their operational experience. The attached instructions are a direct result of their efforts, and should assist you in a smooth implementation. We encourage you to contact these units to establish a cross flow of information.

4. This letter supersedes HQ SAC/LGM letter, 29 May 79, Quick Start Implementation Instructions. Request this information receive wide dissemination to all individuals involved with the alert force. For any further information please contact one of the HQSAC project officers listed on the last page of this package. This is a coordinated LGM, DOT, DO8, DOC, IGF, SGPB effort.

*Robert C. Keith*

ROBERT C. KEITH, Colonel, USAF  
Director of Aircraft Maintenance  
DSC Logistics

2. Atch  
1. Implementation  
Instructions  
2. HQ SAC/LGME Ltr,  
6 Apr 80, w/Mask  
Modification Instructions

DISTRIBUTION LIST

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2 - 8AF/LG/DO Barksdale AFB LA 71110  
2 - 15AF/LG/DO March AFB CA 92508  
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2 - 14AD/LG/DO Beale AFB CA 95903  
2 - 42AD/LG/DO Blytheville AFB AR 72315  
2 - 45AD/LG/DO Pease AFB NH 03801  
2 - 43SW/MA/DO APO San Francisco 96334  
2 - 55SRW/MA/DO, Offutt AFB NE 68113  
2 - NGB/LGM, Wash DC 20310  
2 - 4AD/LG/DO, FE Warren AFB WY 82001  
2 - 19AD/LG/DO Carswell AFB TX 76127  
2 - 40AD/LG/DO Wurtsmith AFB MI 48753  
2 - 47AD/LG/DO Fairchild AFB WA 99011  
2 - 57AD/LG/DP Minot AFB ND 58701

## REVISED QUICK START IMPLEMENTATION INSTRUCTIONS

1. The purpose of QUICK START on B-52G/H and KC-135 aircraft is to reduce engine start time. Last summer, Seymour-Johnson, Griffiss, and Fairchild AFBs implemented QUICK START procedures on a daily basis. In addition to the installation of starter cartridges on all engines, new concepts and procedures were also employed. The combination of these items significantly reduced the overall alert response time at these three units. The new items employed were roll-over chocks, B-52 battery engine-starts and ground crew protective equipment. The purpose of this letter is to share the operational experiences of these three units and reemphasize the equipment limitations. This instruction package, together with the training films that have been distributed, should provide sufficient information for a unit to smoothly implement QUICK START procedures.

2. The new equipment and procedures cannot be expected to immediately reduce reaction time to the optimum. Operational experience has shown integral crew coordination and training are key factors in reducing alert response time. The 4235 Strategic Training Squadron has produced and distributed two video tape training films entitled, QUICK START. The films portray recommended alert response procedures which will prepare an aircraft for flight in a minimum amount of time. Separate tapes were produced for the B-52 and KC-135 weapons systems. We highly recommend all alert aircrews, along with their crew chiefs, view their respective video tape at the alert facility. Contact your Wing Instructional System Manager if the tape is not readily available.

3. A new type of aircraft chock was designed and tested to restrain an EWO loaded aircraft and yet allow the aircraft to safely taxi over it. The purpose is to save the time expended pulling standard chocks clear of the aircraft. All addressees are authorized to use roll-over chocks on B-52G and KC-135 alert aircraft. Normal rated thrust on all engines may be required to taxi-over the chocks. The aircrew should be prepared to reduce power immediately after the aircraft clears the chocks. The chocks are not effective on glare ice or snow packed ramps. Several anti-skid surface designs are currently in work; however, testing has been delayed due to unusually mild winter conditions at the test base. Therefore, the chocks are still restricted from use on icy ramps.

4. The chocks were designed for use on an EWO loaded aircraft. They are not to replace the standard aircraft chocks on non-alert aircraft. The roll-over chocks must be used on "cocked alert aircraft only" and these words stenciled on the top of each chock. The chocks will be placed forward of the number 5, 6, 7, and 8 tires on both the B-52G and KC-135. Standard aircraft chocks will be placed aft of these tires. It is extremely important to ensure the chock is positioned snugly against the tires in order to be effective. A gap between the tire and the chock could allow the aircraft to gain enough forward momentum to inadvertently roll over the chock. The 1B-52G-1 and the 1C-135(K)A-1 were changed to include the use of roll-over chocks.

Attachment 1

5. It was noted, during our testing, that B-52 crew chiefs generally use the interphone connection located in the left forward wheel well. This position allows the crew chief ready access to the forward chocks. Being connected to the wheel well interphone box places the crew chief close to the left forward main landing gear with his back to the tire, a dangerous place to be when the aircraft is ready to roll. When using roll-over chocks, there is no need for the B-52G crew chief to enter the forward wheel well. Therefore, when using the roll-over chocks on the B-52G, the crew chief will use the interphone connection near the external power receptacle. An investigation is in progress to relocate the interphone connection on the B-52H to keep that crew chief out of the forward wheel well area. For the above reasons, use of the roll-over chock is not authorized for the B-52D/H at this time.

6. "Crew arrival" to "ready to taxi time" on a QUICK START loaded aircraft is significantly reduced. Ground crew actions are complete at approximately the same time the aircrew is ready to taxi. The following words of wisdom are provided by aircrews from Seymour-Johnson and Fairchild AFBs: "Each aircraft commander must be aware of where his ground crew member is prior to taxiing. It is imperative that each crew plan their alert action prior to responding to a Klaxon. Briefings for the crew chief take on even more importance than before."

Griffiss AFB shares the following comments with crew chiefs: "Ground crew personnel must be briefed to be especially careful when clearing the aircraft for taxi. The shorter reaction time increases the possibility of inadvertently overlooking ground wires still connected, oil cooler plugs still installed, etc."

Fewer words are better spoken.

7. The B-52G/H electrical system was redesigned during the QUICK START modification. Nickel cadmium batteries were installed on the B-52G and both model aircraft were rewired specifically for QUICK START. DC power for cartridge firing and engine ignition is supplied by a single battery. In this mode, the start buses will be automatically connected to the good battery if one were to fail. The switching function is automatic and cannot be controlled by the pilot. The batteries are designed to be reliable down to temperatures of -25°F. Use of battery engine starts will save the time used to start the external power unit and will improve response timing on those occasions when the external power unit does not immediately start or is slow to accelerate. An external power unit will remain at each alert B-52 for use if the battery start fails, but it will not be connected to the aircraft until needed. The aircraft batteries should be charged on a daily basis during the daily aircraft pre-flight.

8. The full QUICK START cartridge firing produces toxic gases which can be harmful to exposed personnel. The toxic gases are carbon monoxide, oxides of nitrogen and ammonia. Extensive testing has been accomplished to specifically define the concentration of these gases in the QUICK START environment. It is extremely important to note that even under the worst meteorological conditions, the toxic smoke cloud created by full QUICK START

A1-1

is not lethal. Exposure may result in illness, but the effects are not lasting. Symptoms such as nausea, headaches, vomiting, and burning of the eyes and nasal passages can result in the worst case if the crew chief is not protected.

Normally, there should be no significant exposure to the aircrew inside the aircraft, as long as the aircraft windows are kept closed to preclude a chimney effect. The SAC Surgeon has supplied to each unit Bio Environmental Engineer (BEE) a detailed briefing of the toxic environment. We highly recommend this briefing be incorporated into the unit training program to ensure all individuals understand the effects of the toxic environment. Due to the potentially harmful nature of the environment, all close-in personnel who have to remain in the cloud (i.e., crew chiefs and security police) must be afforded respiratory and eye protection.

9. HQ SAC has submitted a Statement of Operational Need for suitable protective equipment to be used in an alert environment. However, the current threat situation has driven the use of QUICK START prior to availability of optimal equipment. This has resulted in the use of interim available equipment for the respiratory/eye protection problem. This interim equipment is an aircraft firefighter's smoke mask with full communication capability, connected to a Mine Safety Appliance, Type N, model SW gas canister. This equipment provides adequate protection but has limitations. A sound-on-slide training film was produced and distributed to all SAC units. This film adequately describes the equipment limitations and the hazards associated with the toxic exhaust gas environment. Two items require additional emphasis. Breathing through the mask/canister combination is restrictive. Individuals using the equipment must become accustomed to breathing through the equipment while heavily exerting themselves before they use it in an actual alert exercise, so they know what to expect. Care must be taken to ensure the mask combination is donned properly. Improper earphone adjustment may negate hearing protection and cause communication problems between the crew chief and aircrew. Improper fit of the nasal cup may cause faceplate fogging.

10. The base BEE will demonstrate the proper procedures for donning and fit checking the mask to the unit training personnel, and will assist them in training the individuals required to use the equipment. All alert qualified crew chiefs will be required to view the sound-on slide training film, and pass a mask donning test prior to assuming alert on a QUICK START loaded aircraft. Once an individual is initially QUICK START qualified for alert duty there is no need to provide him recurring training. Experience has shown, however, that some form of refresher/reinforcement training might be required. The alert force supervisor will determine the extent and type of training required. This training should be provided to the individual at the alert facility.

11. Responsibilities for maintaining the mask assembly and the MSA type N canister. The equipment selected to provide ground crew protection against the toxic cartridge exhaust consist of:

A1-2

a. Mask assembly, oxygen smoke, NSN 1660-01-046-5718LS, P/N 651-475-3.

b. Mine Safety Appliance (MSA) type N model SW, gas canister, NSN 4240-00-177-8733.

This equipment must be maintained, inspected, and repaired IAW applicable technical orders and other related life support equipment directives. Pending incorporation into applicable directives, the following command guidance is provided.

(1) Life support activities will:

(a) Maintain applicable AFTO inspection forms on file for record/control purposes.

(b) Maintain adequate bench stock of replacement parts.

(c) Inspect and clean IAW T.O. 15X5-5-4-1 at intervals not to exceed 30 days.

(d) Maintain a current index, technical order, and publication file.

(e) Annotate the next scheduled inspection due date on the mask.

(2) Using organization (OMS) will:

(a) Requisition initial and replacement mask/canisters. (Units are authorized two masks per alert aircraft plus two spares).

(b) OMS alert branch supervisors will establish procedures for storage, control and issue of mask and canisters within the alert facility.

(c) Crew chiefs are responsible for the daily inspections and cleanliness of the mask while in their possession (reference T.O. 15X5-5-4-1).

(d) Clean (swab) mask after each use.

(e) Deliver mask to life support for cleaning and inspection at 30 day intervals.

(f) Ensure each mask is easily identifiable for QUICK START use to prevent erroneous issue.

(g) Document canister after each exposure to the toxic environment.

A1-3

NOTE: The SAC Surgeon has limited the use of the canister to four exposures to the toxic environment. The canister must be resealed after each use. The alert controller/supervisor will annotate the date the canister was put in service when it is issued to the crew chief. A space is provided on the lower portion of the canister label. After an alert response the crew chief will annotate the date. The alert controller/supervisor will place his initials next to the crew chief's entry. The canister will be taken out of service after its fourth exposure.

(h) Ensure that an effective on-the-job training (OJT) program is conducted for those personnel assigned to QUICK START configured aircraft.

(3) Unit MAs will ensure local OIs are established that will provide maximum protection for the care and storage of QUICK START protective equipment. These OIs should be established as a coordinated MA/DO effort.

(4) Due to unique and limited application of the mask, modification instructions are contained in Attachment 1.

12. The concentration of the toxic smoke cloud is very dependent upon prevailing weather conditions. On a calm, warm day, the smoke cloud could linger around the aircraft throughout the alert response. Conversely, on a windy day, a responding crew chief may never be exposed to the cloud. Therefore, specific rules on when the individual should don his equipment cannot be established. Generally, whenever an individual is to be exposed to the environment, he must be protected. Local conditions may warrant the establishment of local procedures. Ultimately, the user is responsible for exercising good common sense.

13. The failure rate of B-52 and KC-135 starters can be expected to rise due to the increased use of the cartridge mode. The weapon system manager has already been advised of their projected increased usage and will adjust required levels in conjunction with the item manager.

14. Occasionally, interference is experienced between the breech cap and the plumbing associated with the New York Air Brake hydraulic pump on the KC-135 engines. Proper routing of the plumbing will allow sufficient clearances for breech cap installation.

15. Prior to placing an aircraft on alert, all starter systems will be operational. Inspection and wringout of the system should include such items as circuit integrity and proper exhaust duct and cowling fit. AFR 65-110 is being revised to require all starter systems to be operational for alert. Cartridge malfunctions will be handled IAW applicable aircraft technical orders and SACR 55-43.

16. Expansion of the cartridge starting procedure to all engines on the B-52 and KC-135 aircraft increases the potential for damaging engine cowling as a result of cowling/bellows misalignment and cartridge starter malfunctions.

a. Increased emphasis will be required to ensure cowling alignment is checked IAW T.O. 1B-52G-2-2JG-6 and T.O. 1C-135(K)A-2-2JG-5. Drain holes to prevent fuel/oil from puddling in the cowling must be present and unobstructed.

b. There have been several incidents in the past when cowling was damaged on subsequent start attempts following a cartridge "hangfire". Current tech data prohibits subsequent start attempts in either mode until the cause of the malfunction has been determined. On the B-52G starter (P/N 701175C) it is extremely important to inspect the breech dome for cracks before another cartridge start is attempted.

17. The use of full QUICK START during peacetime exercises is here to stay. The optimum solution to the problem is a non-toxic, smokeless cartridge. This avenue has been pursued during the past six years but such a cartridge is not within the present state of the art without redesigning the starter. Optimal protective equipment for the alert environment, is not currently available off the shelf. We have submitted a statement of operation need (SON) to ASD for better equipment, but development and procurement are several years away.

18. GIANT MATCH II was a QUICK START exercise conducted at Wurtsmith AFB in February 1979. New procedures and equipment cited in this letter were tested under simulated alert conditions. We highly recommend the information contained in the GIANT MATCH II final report, dated 15 Mar 79, receive wide dissemination to all personnel involved with the implementation of QUICK START. Direct communications with the SAC project officers concerning any problems or misunderstandings with the procedures and/or equipment is vital for a smooth implementation. SAC project officers are:

<u>NAME</u>	<u>OFFICE SYMBOL</u>	<u>EXPERTISE</u>	<u>PHONE (AV 271-)</u>
Maj Eickhoff	DOTTA	B-52 Ops Tng	4441/4410
Maj Gaines	DO8T	KC-135 Ops Tng	2260/3541
Maj Hamblin	IGFF	Flight Safety	3534/4676
Mr Disbrow	IGFG	Ground Safety	4580/2610
Capt Connolly	LGMES	Aircraft Engrg	3750/6615
CMSgt Yager	DOTTS	Life Support	5302/2048
SMSgt Shelley	LGMSB	B-52 Acft Sys	5001/4561
Major Wallace	LGMST	KC-135 Acft Sys	5401/5402

A1-5

DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS STRATEGIC AIR COMMAND  
OFFUTT AIR FORCE BASE, NEBRASKA, 68113



6 APR 1979

REPLY TO  
ATTN OF LGME

SUBJECT: Firefighter's Smoke Mask Modification Instructions

TO: 68BMW/MAOS      416BMW/MAOA      92BMW/MAOA      22BMW/MAO      509BMW/MAOS  
380BMW/MAOA      93BMW/MAOS      42BMW/MAOK      320BMW/MAOS      307AREFG/MAO

1. An aircraft firefighter's smoke mask (NSN 1660-00-031-3561LS and 1660-01-046-5718LS) connected to a MSA type N, model SW canister will be used by ground crew members in a Quick Start environment. The mask must be locally modified to connect to the canister. Attachments 1 and 2 provide the necessary information to perform this modification. When performing the modification, ensure the work area, mask and associated equipment is kept clean and free of petroleum products.

2. The items required to perform this modification are listed below.

a. Firefighter's smoke mask (NSN 1660-00-031-3561LS or 1660-01-046-5718LS).

b. MSA adapter kit (NSN 4240P84984).

c. Rubber headstrap (NSN 1660-00-292-9017LS).

d. Oxygen hose clamps for 1" O.D. hose.

e. Hose clamp pliers (available from Life Support Section).

Once the mask is modified, it is extremely important that the mask is not placed in service aboard an aircraft until it has been reconfigured to its original condition. Stock numbers and part numbers contained in the attachments were taken from a typical modification. It is possible some part numbers may vary. If this condition exists, please notify the point of contact listed below by telephone.

3. For any additional information or help in modification, please call Capt John Connolly, HQ SAC/LGME, AV 271-3750/4783.

*Robert C. Keith*

ROBERT C. KEITH, Colonel, USAF  
Deputy Director of Aircraft Maint  
DCS/Logistics

2 Atch

1. Modification Instructions
2. Picture

Peace . . . . is our Profession

## MASK MODIFICATION INSTRUCTIONS

These instructions are provided to modify the aircraft firefighter's smoke mask (NSN 1660-00-031-3561LS and 1660-01-046-5718LS) for use by ground crew personnel, requiring aircraft communication, who are exposed to an alert Quick Start environment.

### WARNING

Once this mask is modified for ground use, ensure it is not placed in service on board an aircraft until returned to its original configuration.

For reference purposes, the top of the oxygen hose is that portion attached to the mask. The bottom attaches to an oxygen source (see attached drawing).

#### 1. Removal of the Nylon Pull Cord.

a. At the top of the oxygen hose, expose the hose clamp by sliding the rubber band clamp cover down the hose.

b. Remove the clamp. If clamp is silver color and stamped "Sierra Manufacturing" a special pair of clamp pliers, available from the Life Support Section, may be required.

c. Roll back the top of the hose. This will remove the ridge on the inside diameter of the hose from the groove on the hose connector. Exercise caution to prevent hose damage.

d. Slide the oxygen hose off the connector.

e. Cut the nylon cord from the connector and push it down inside the oxygen hose.

f. Slide the hose back on the connector. Ensure the ridge on the hose inside diameter seats properly into the groove on the connector.

g. Install a new hose clamp on the hose where the rubber ridge is seated in the groove.

h. Slide the rubber clamp cover over the clamp on top of the hose.

#### 2. Removal of the Lower Connector Assembly and Nylon Cord.

a. Expose the lower oxygen hose clamp by sliding the rubber clamp cover up the oxygen hose.

b. Remove the clamp.

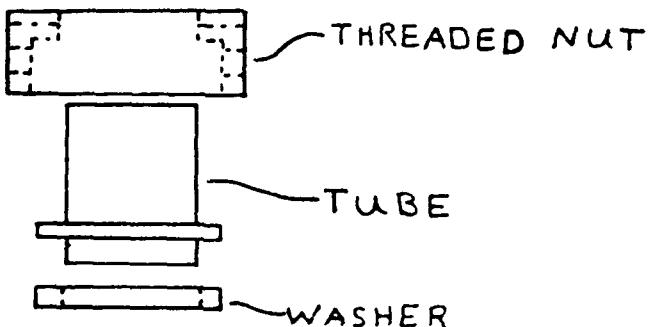
*Atch 2-1*

c. Pull the connector assembly (Sierra part number 232-94A) out of the oxygen hose. The nylon pull cord will also be removed from the hose at this time.

d. Remove the lower rubber clamp cover from the oxygen hose. Untwist approximately six inches of interphone cord from the oxygen hose. Replace the rubber clamp cover on the oxygen hose and extend the interphone cord six inches beyond the end of the hose.

### 3. MSA Connector Assembly and Installation.

a. Assemble the MSA connector kit (manufacturer's part number 84984) by placing the threaded nut over the tube. Place the washer on the tube inside the threaded nut and seat against the flange (see drawing).



b. Insert the MSA connector assembly tube into the end of the oxygen hose.

NOTE: Caution must be exercised during this step to prevent damage to the oxygen hose. The inside diameter of the oxygen hose is smaller than the outside diameter of the connector.

c. Install the hose clamp over the oxygen hose and connector. Clamp tight enough to prevent the connector from rotating in the hose.

d. Slide the rubber band clamp cover over the hose clamp.

#### CAUTION

Ensure the top and bottom hose clamp covers are properly installed. If left on the ribbed portion of the oxygen hose they will cause the hose to collapse when in use.

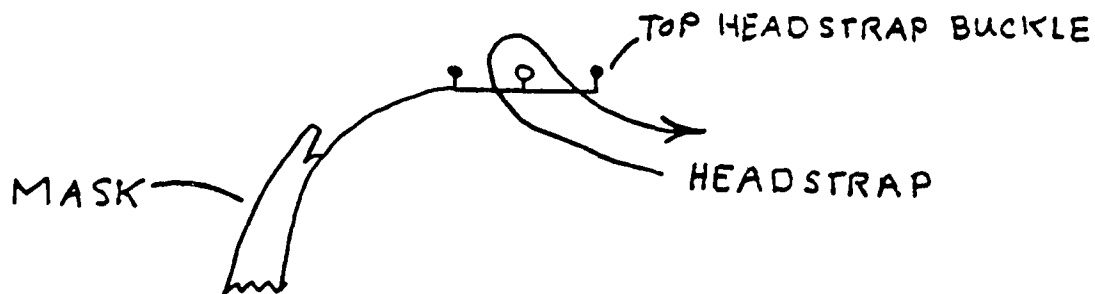
### 4. Headstrap Replacement.

Perform this step only if the mask has cloth headstraps.

a. Remove the cloth headstraps from the mask.

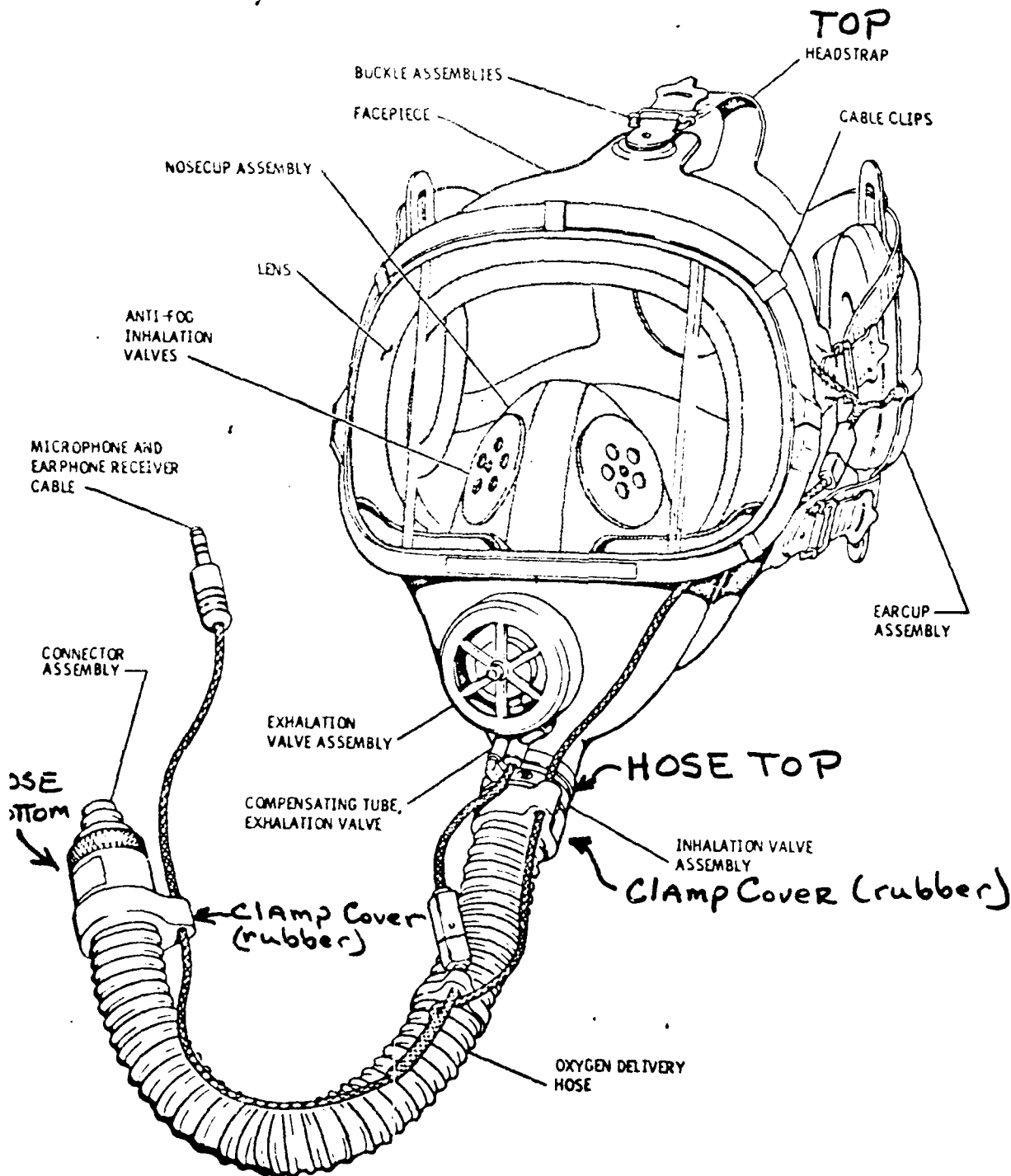
b. Starting with the top buckle, insert the middle strap of the rubber headstrap (NSN 1660-00-292-9017LS) through the bottom of the buckle closest to the mask attach point.

c. Bend the strap over the roller assembly and back through the buckle (see drawing). Exercise caution when bending the tabs on the end of the strap to prevent damage.



NOTE: Typical installation all straps.

d. "Front" is stamped on the earcup. When inserting the straps through the earcup, the "front" side should be pointed toward the face-plate assembly.



2492-1

Figure 1-1. Fire Fighters Smoke Mask Assembly



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS, UNITED STATES AIR FORCE  
1100 AVIATION BUILDING, WASHINGTON, D.C. 20330



REPORT  
NUMBER

LGM

20 JAN 1981

SUBJECT

Alert Aircraft Roll-Over Chocks

See Distribution List

1. Use of roll-over chocks is being expanded to all alert B-52G/H and KC-135 aircraft. Implementation orders and dates will follow under separate message. Locally manufacture, as a minimum, one pair of chocks per alert aircraft using the attached instructions. Also attached is a DD Form 1348-6 with a command assigned stock number for local manufacture.
2. There are three important items to be aware of when using roll-over chocks. First, the chocks are restricted from use on ice and snow covered ramps. During your entire time period for winter operation (where applicable), standard aircraft chocks should be used. Second, the chocks must be placed snugly against the number 5, 6, 7 and 8 tires. A gap between the tires and the chock could allow the aircraft to gain enough momentum to inadvertently roll-over the chock. Standard aircraft chocks will be used aft of these tires. Third, the chocks may shrink or expand due to environmental conditions. The nuts on the ends of the chocks must be inspected for tightness periodically.
3. On B-52G aircraft, the alert crew chief will ~~use~~ use the interphone connection located in the main external power receptacle, instead of the connection located in the left forward wheel well. This is to remove the crew chief from directly in front of the left forward gear, and will protect him from injury in the event the aircraft taxis early. We are seeking modification approval to install an interphone connection in the external power receptacle on the B-52H. Until the aircraft are modified, the chocks will be restricted from use on the H model. Use of the chocks on the B-52D is not planned at the present time.
4. If you have any question concerning the manufacturing instructions contact Capt Connolly, LGME, AV 271-3750. For any other questions contact Capt Nunemaker, LGMST, X-5401 or SMSgt Shelley, LGMSB, X-5001.

*Albert G. Petranick*  
ALBERT G. PETRANICK, Colonel, USAF  
Director of Aircraft Maintenance  
DCS/Logistics



## ALERT ROLL-OVER CHOCK MANUFACTURING INSTRUCTIONS

1. The chocks will be constructed using number 1 common fir 2" x 4" lumber. Number 1 common lumber is essential to minimize splintering and knot dislodgement reducing the possibility of foreign object damage (FOD).
2. The chock will be assembled using 2" x 4"s, cut to the dimensions in Figure A of Atch 1, and laminated together. Total completed length should be 60"  $+0$   
-2".
3. It is recommended that a template be used to ensure each 18" segment is cut to the exact dimensions given. The template should also be used to accurately locate the three bolt holes in each segment.

### NOTE

Correct sizing, and hole location are essential for chock strength and integrity. Surface irregularities will cause stress concentrations under load which could cause splintering or complete failure.

4. After cutting the segment, the sides should be planed parallel to each other and perpendicular to the base. This process is necessary to remove board warpage and surface irregularities. This will also ensure maximum surface contact when the boards are laminated together. Minimum thickness of the segment should not be smaller than 1 1/4" after planing.
5. Drill the bolt holes to 9/16" I.D. This will allow a tight, close tolerance fit for the 1/2" O.D. steel rods. The middle rod centerline should be located 9" from the end and 1 1/2" up from the base. The centerline of the outside rods should be located 5" from the ends and 1" up from the base (see Figure A).
6. Cut two end plates from 1/8" thick steel. The plate should be cut in the same profile as the segment; however, overall dimensions will be smaller. Maximum dimensions are length, 17 1/2"; end height, 1/2"; center height, 2 1/4". Locate as shown in Figure B.
7. The 1/2" O.D steel rods should be 62 1/2" long. Thread both ends (either 1/2" - 13 or 1/2" - 20) to a length of 2 1/2".
8. Insert the steel rods into the segment holes and laminate the segments using a strong wood glue. Install the steel end plates. Overall completed length will be 60"  $+0$   
-2".
9. Prior to tightening the nuts, place the chock on a flat surface and align segments, as necessary, to ensure a smooth tapered surface. Tighten the nuts evenly to compress the laminated segments.

Atch 1

10. Attach an eyebolt to one end of the chock to facilitate a 3/4" O.D. rope.

11. Paint the chock AGE yellow (#13538).

12. Stencil in black on the 2" flat of the chock "FOR COCKED ALERT AIRCRAFT ONLY". Letters should be a minimum of 1" high.

A-1-2

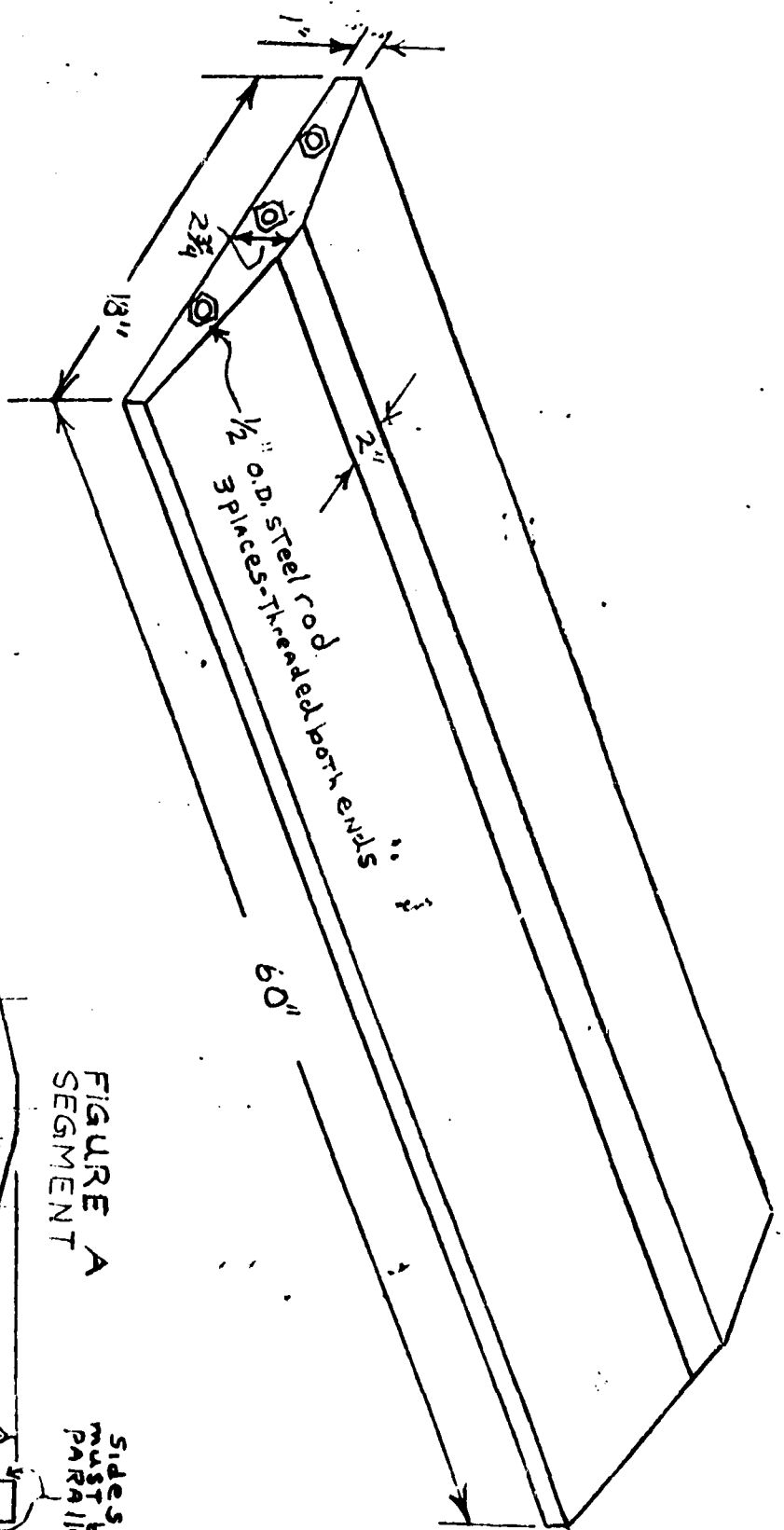


Figure A  
ATTCH. I

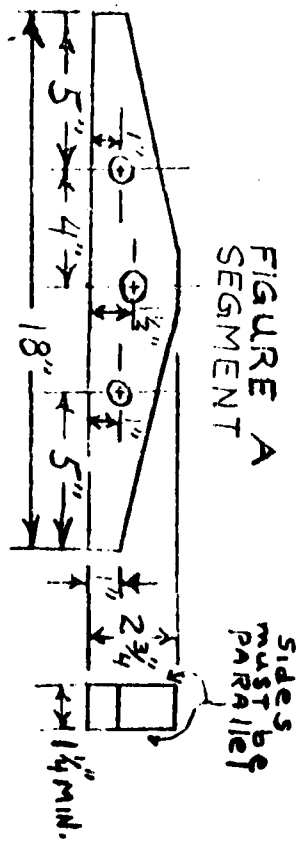


FIGURE A  
SEGMENT

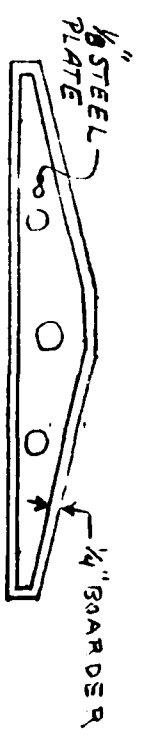


FIGURE B  
END PLATE PLACEMENT