United States
Department of
Agriculture

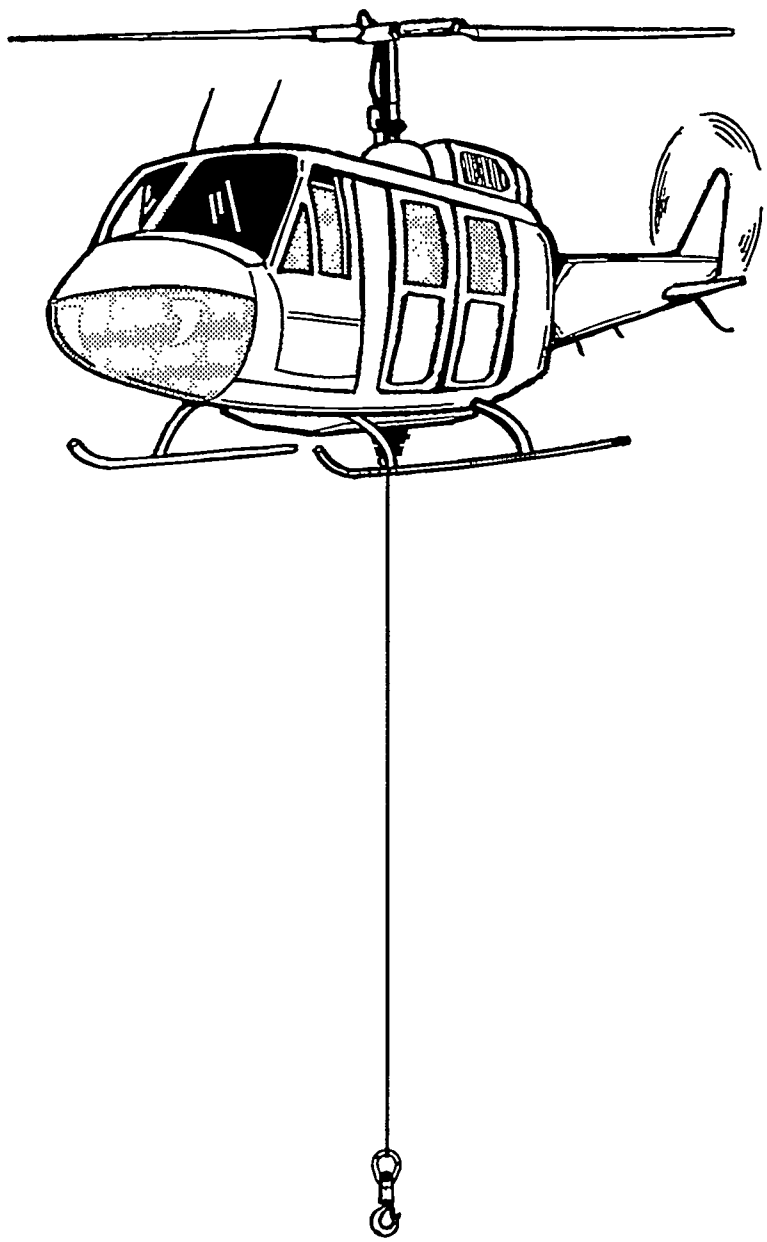
Forest Service

Technology &
Development
Program

5700--Aviation
August 1992
9257 1202--SDTDC

Field Survey of Helicopter External Accessories and Review of Inadvertent Load Releases

Technology and Development Center



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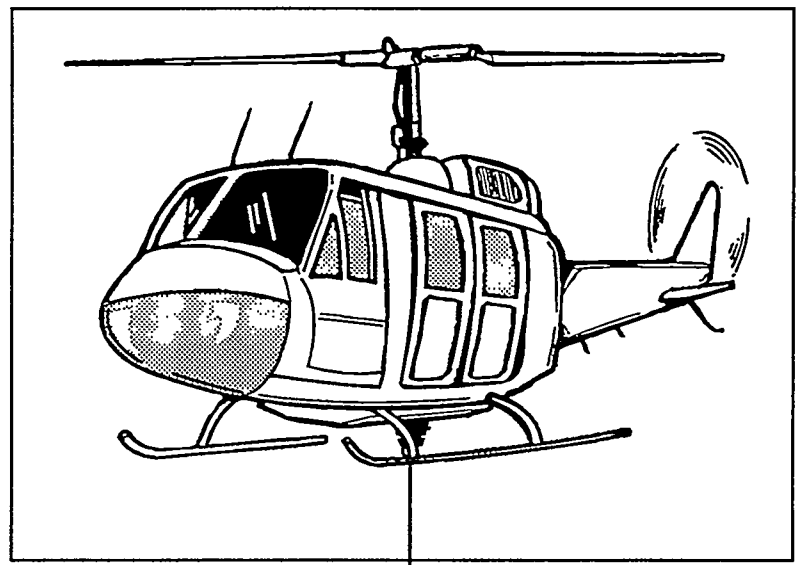

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Helicopter Accessories

August 1992

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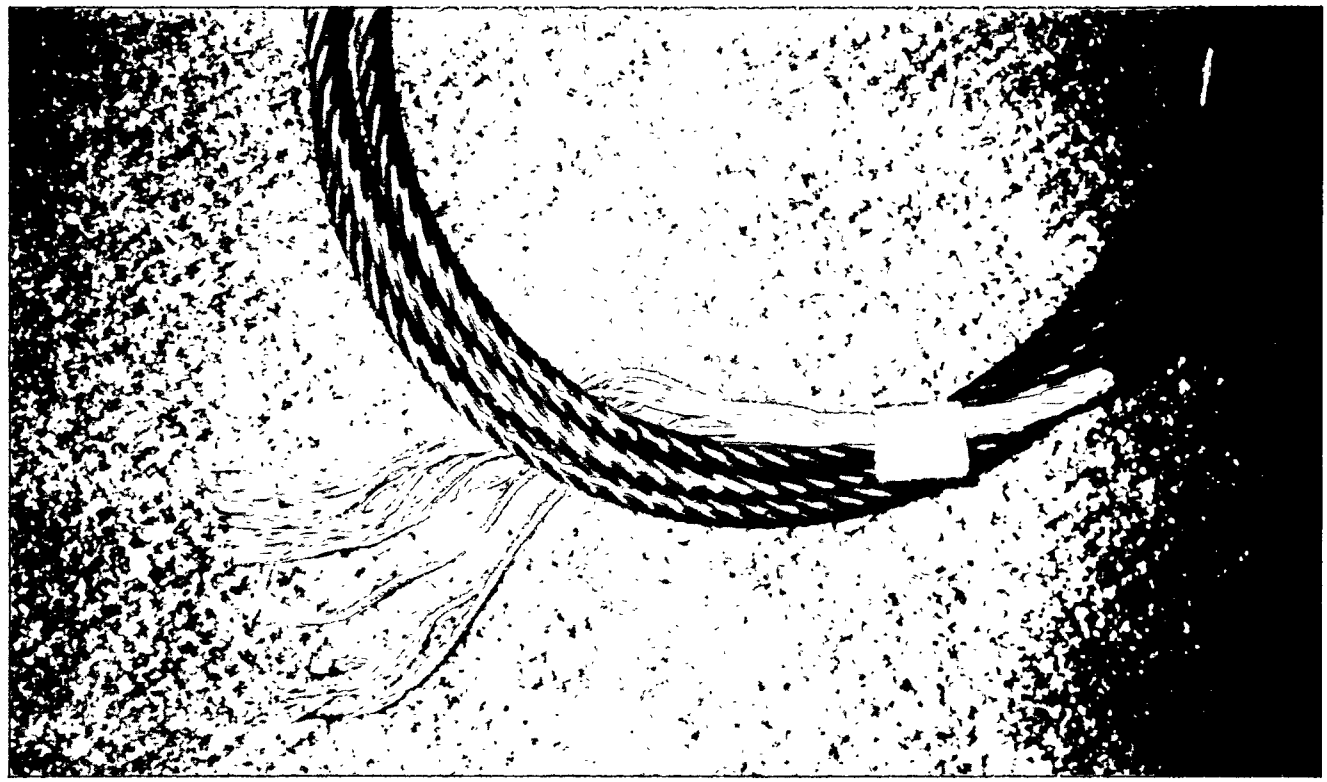

Figure 1.—Leadline swage failure - copper swage.

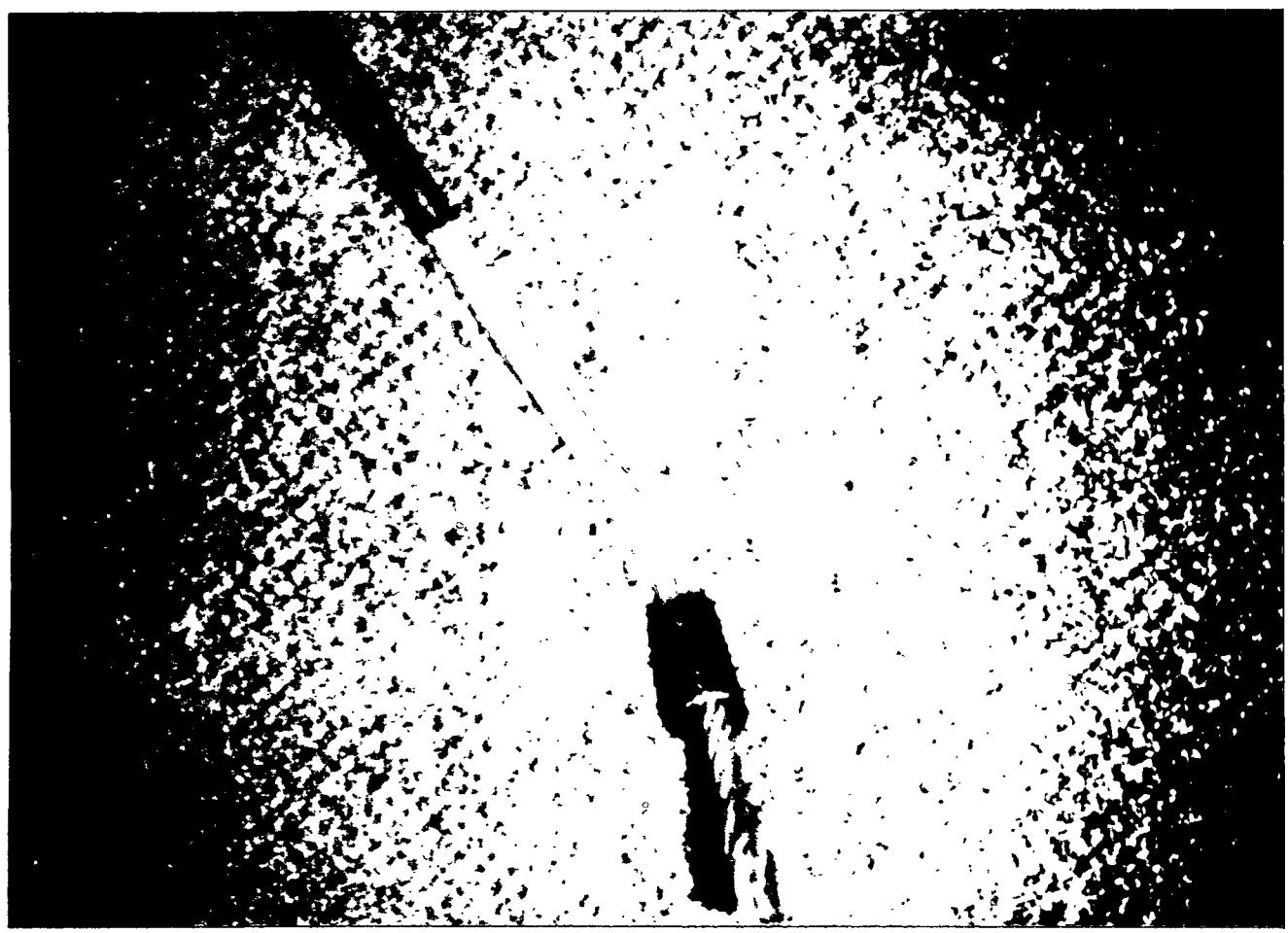

Figure 2.—Leadline swage failure - steel swage.

Introduction

The San Dimas Technology and Development Center conducted a field survey regarding helicopter external accessories problems and failures. This investigation into the effectiveness and reliability of helicopter external accessories was in response to incident reports regarding numerous helicopter external load releases.

Two issues are addressed in this Project Report. The primary item is that of helicopter external accessory failures, while the second issue is the recurrent serious problem of helicopter inadvertent external load releases. For a more in-depth evaluation of the latter, a detailed report, written by Roy E. Keck, Region 4 Aviation Safety Officer, is included as Appendix A. A safety alert letter was written on this same subject by Robert Martin, National Aviation Safety Manager, in February 1991 (Appendix B).

Due to possible overlapping of responses received via survey or incident reports, the exact number of equipment problems reported herein may be high. The exact number of equipment failures is not the principle issue. The main point in question is whether or not there are failure tendencies with certain pieces of equipment.

Background

Thirty-eight responses were received from late summer of 1990 through spring of 1991. The interagency response included information provided by the BLM, National Park Service, Fish & Wildlife Service, all USDA Forest Service regions except R6 and R9, and state and local agencies including Alabama, California, Florida, Maine, Minnesota, Montana, and North Carolina, and one Canadian operator and agency (Canadian Ministry of Natural Resources). The survey asked respondents if they experienced problems or failures of their helicopter external accessories. A copy of the survey is included as Appendix C.

In addition to the survey responses, information was also obtained from 39 incident reports. These incidents occurred from June 1989 through late April 1992 with the majority happening in 1990 and 1991. The reports regarding inadvertently released loads are not <u>all</u> of the incidents that occurred nationally, but rather only those that were received by the aviation program at San Dimas.

Detailed Discussion of Helicopter External Accessories Problems or Failures

The incidents we are aware of are segregated and classified in the following discussions. At the end of each topic a summary and recommendation for the specific piece of equipment involved are given. The last section of this report presents general recommendations for corrective actions.

Leadlines

An incident occurred in November 1991 involving a faulty copper swage (crimp) on a new cable which failed before the 1,800-pound load was lifted from the ground. In April of 1990 a leadline broke while trying to lift a 450-pound load from the ground. Two additional lines with failed swages were received by San Dimas. Photos of these failures are shown in figures 1 & 2.

Additionally, two survey responses indicated problems with leadlines. One reported no failures but some kinked lines had been found. The other found a weak spot in one line prior to use.

Another problem with leadlines is the leadline hook safety latches. These often become bent and/or broken. This was specifically addressed in two survey responses and in one incident report. This problem was also mentioned during interviews of personnel and seen in equipment in fire caches. One such failure is shown in figure 3.

The safety gate for at least some of the leadlines is very similar in design to the safety gates on the swivel hooks. Safety gates are discussed in more depth later in this Project Report.

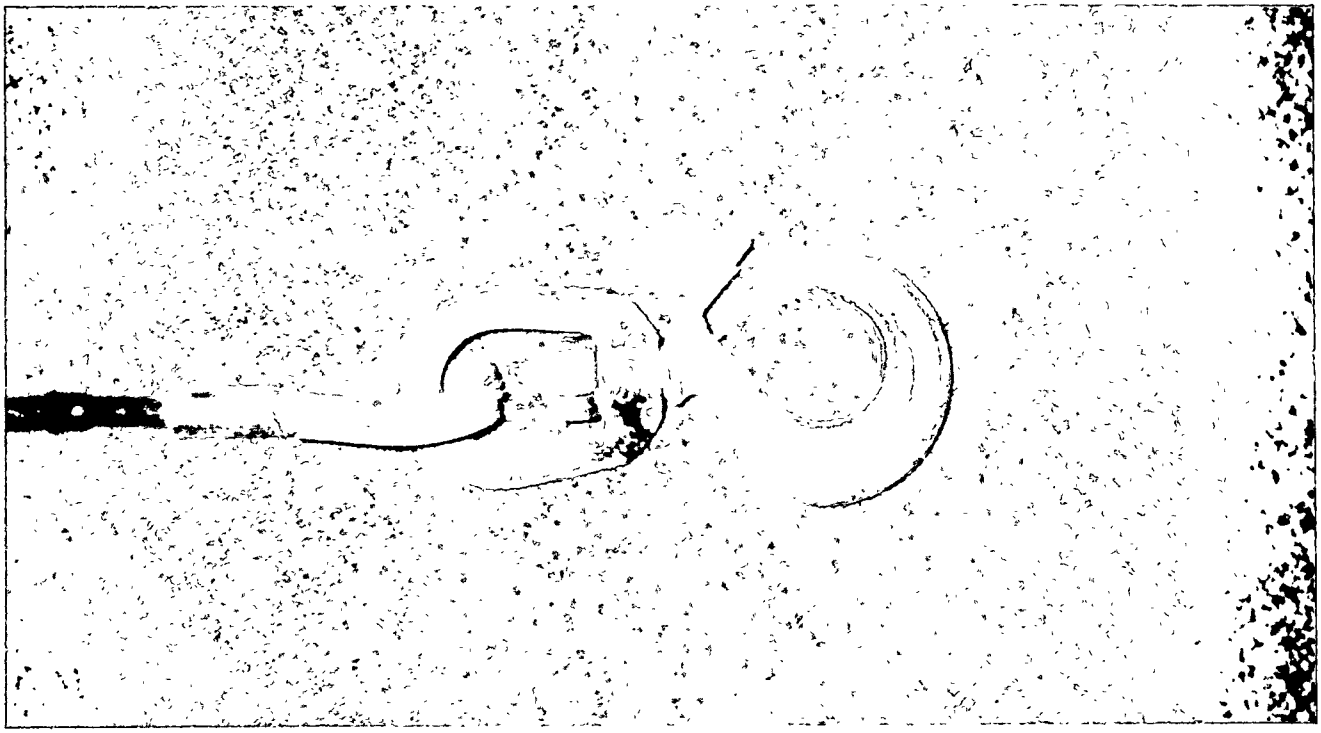

Figure 3.—Leadline hook with failed gate.

Summary and Recommendation—Swage failures should be corrected by proper manufacture, inspection, and testing. We suspect that at least some of the failed leadlines were not proof tested to USDA Forest Service Standard 5100-500e, Accessories, External Loading, Helicopter (FS 5100-500).

The gates are a common mode of failure. A redesign and retrofit of existing gates is probably not practical. As existing leadlines are retired, they should be replaced with lines equipped with hooks which will bear nearly their rated load through 360 degrees, such as the "butterfly" hooks shown in FS 5100-500.

Cargo ("Belly") Hooks

Three survey respondents and five incident reports cited mechanical failures of cargo hooks. These included the entire hook swiveling which apparently allowed the electrical cord to open the safety gate. In aft facing hooks, the clevises have come out. One incident report traced this problem to a faulty bracket. Other failures cited included a broken manual release cable housing, failure of an eye bolt attaching the cargo hook to the aircraft, failed gates from twisting and bending, and hooks not relatching after activation. We think that one probable cause for hooks not relatching was the buildup of dirt and other foreign matter in the hooks. One survey respondent stated that the older style hooks had problems with sheared pins, but all of their present hooks have been upgraded.

A commonly cited problem with cargo hooks is that the emergency manual release cable is not adjusted properly. The pin mechanism has to be properly aligned by the ground crew and the cable needs to be kept properly lubricated. This is a maintenance and inspection issue rather than a mechanical equipment failure, but has been the cause of several dropped loads. Five (13%) of the incident reports reviewed and three (8%) of the survey responses referenced this problem.

Some field personnel speculate that if leadline rings are too large, they can twist off the cargo hook. This has not been confirmed for rings which meet FS 5100-500. This Standard limits the inside diameter to a 4-inch maximim.

Static electricity "spikes" have been blamed for causing cargo hooks to activate. If someone were to cross-wire the system, the problem would occur repeatedly and consistently on the same aircraft and would be identifiable. It is very unlikely that static electricity is the cause of unplanned cargo hook activations. The required electrical leads are 14-gauge wire which can carry up to 15 amps. If it is assumed that the anticipated electrical load of the cargo hook is commensurate with the wire rating, any normal static discharge would not be sufficient to operate this device.

Summary and Recommendation—Cargo hooks seem to be a troublesome area that needs to be addressed. A number of mechanical failures of the cargo hooks could be prevented with frequent inspections and a more regular maintenance program. The emergency manual release cable should be checked regularly for proper adjustment.

Remote Hook Systems

Six survey respondents stated that they had encountered some type of electrical problem with their remote hooks. Most of these problems were minor in nature. These included three solenoid failures in three years of use, pins in the nine-pin plugs had pushed in or had pulled loose too easily, relay failures after many hours of use, "minor" unspecified electrical problems, and a general complaint of "bad wiring."

One survey response stated that the closing gate bolt had come loose numerous times, and that a longer bolt with a lock nut is needed. Another said that gates sometimes stick in the open position. One helitack manager felt that any problems encountered with remote hooks were simply due to improper care of the equipment.

Only one of the incident reports referred to a remote hook. A sling load was released from a remote hook after the electrical cord had been caught inside the cage and apparently opened the gate. This problem was also referred to in two survey responses, which indicated that it could easily happen. However, this is more of a training problem than an equipment problem.

Summary and Recommendation—The remote hooks seem to have minor problems that can be addressed with proper maintenance and training in their proper use.

Cargo Swivels

The most frequently mentioned equipment problem is the failure, either by bending or breaking, of swivel spring-loaded safety gates. Eleven (29%) survey responses and four (11%) incident reports addressed this problem. These gates are also referred to as snaps, keepers, latches, dogs, and clips. In particular the Miller B1-3, 1 1/2-ton capacity swivel is known to have a problem with the safety gate bending, allowing the sling load to twist off the hook. Figure 4 shows a swivel with the gate bent.

It is important to note that a certain amount of twist in the gate is allowable. The problem occurs when the gate is bent out toward the end of the hook allowing hardware to slip off the hook. A more severe failure is shown on the leadline hook of figure 3, where the deformation of the hook from load weight allows the gate to "hop" over the hook. This complete failure mode is easily detected.

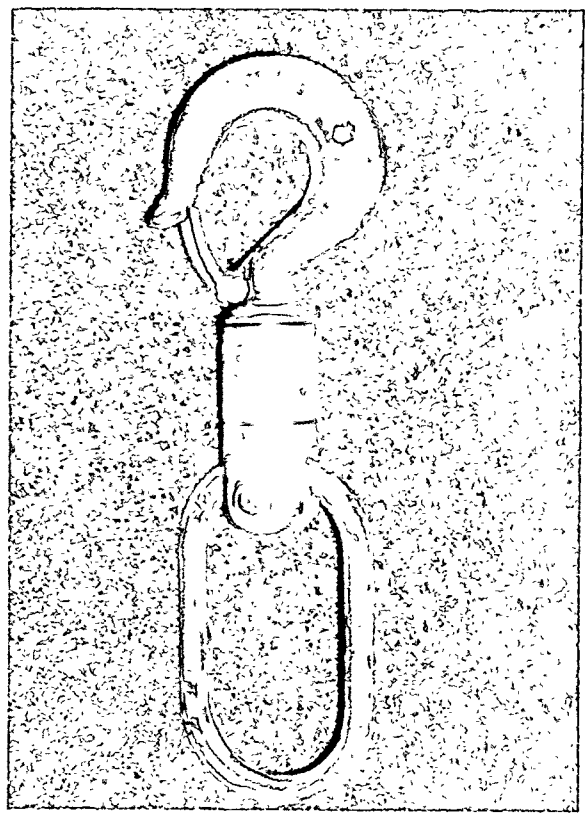

Figure 4.—Swivel with bent gate.

It is not known how many models of swivels exist in the field and whether all swivel hooks have the same design safety gate.

Also mentioned in one incident report and one survey response was that the pin, retained by a snap ring connecting the top ring of the swivel to the body of the swivel, became loose. This particular model of swivel was sold by the Western Fire Equipment Co. in Brisbane, California, and was the model Miller B1-3, 1 1/2-ton capacity.

Summary and Recommendation—Problems with cargo swivels can be addressed with inspections, maintenance, and solving the same safety gate problem that exists with the leadlines.

Multiple Remote Cargo Hook Systems (Carousels)

Only two survey respondents had any specific problems with the carousel hook (figure 5). One complained the system had "lots of failures" (usually a burnt out solenoid), and that the carousel would sometimes not cycle. Another commented the carousel was "not worth the trouble." Two respondents stated they had never used the carousel. It is suspected that many more have never used the system. None of the incident reports reviewed mentioned the carousel hook.

Summary and Recommendation—This system seems to have been seldom used. The lack of use of this piece of equipment may indicate a problem regarding its usefulness. Additional inquiries should be made to determine if a design change is needed, if training and familiarization would be beneficial, or if it is unnecessary and should not be used.

Cargo Nets

Although no failures of cargo nets were found in the incident reports, two of the survey respondents did have some problems with cargo nets. These comments stated that the loops were "frail." Some of the nets have thimbles that are too small and some of the polypropylene nets take an excessive amount of time to open up, according to some survey respondents.

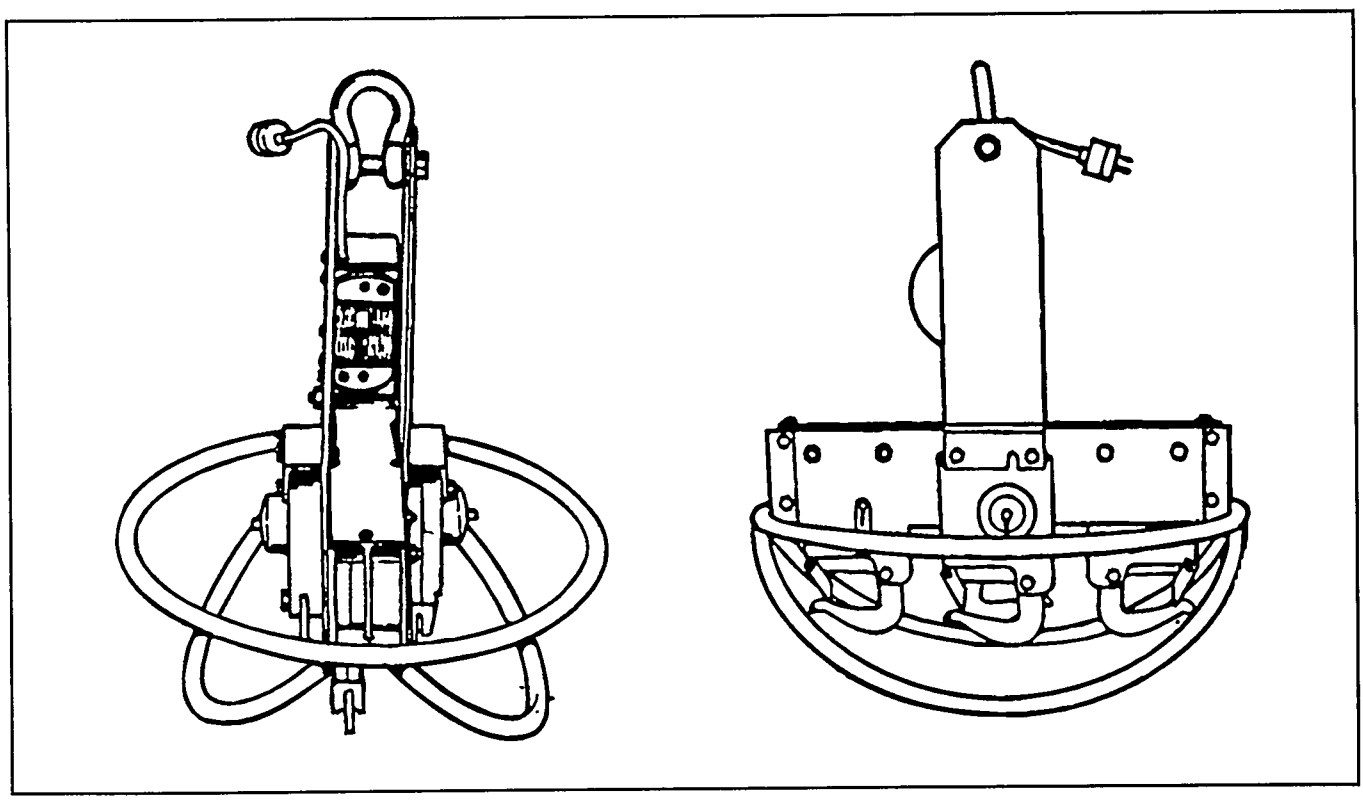

Figure 5.—Multiple remote cargo hook (carousel).

Summary and Recommendation—The problem with cargo nets relates more to their use rather than safety. Perhaps minor redesigns or identifying different vendors are in order to improve this product.

Buckets

Two survey responses and two incident reports mentioned problems with water buckets not releasing water when activated. One of these was due to a loose connection at the splice between the electrical cord and the extension cord (error by ground crew). No reasons were given for the remaining complaints.

In addition to the above, one dump valve cable was reported to have failed at the swage. It was also mentioned in two of the survey responses that problems with buckets leaking had occurred, but these were fixed by re-sealing the bucket seams.

Corrosion of solenoids and of all metal cables and cotter pins was also mentioned. One of the operators stated that the bucket had seen a lot of exposure to salt water and firefighting foam, and that he had replaced all of the components with stainless steel hardware.

Summary and Recommendation—The mechanical failure of the buckets could probably be eliminated with additional inspections and maintenance. Training of the ground personnel is also important. Cable swage failures point to failure to proof test by suppliers.

Slingable Tanks

No problems with slingable tanks (also known as pyramid tanks, Fire-Flex, or blivets) were mentioned in the incident reports reviewed. The most common survey complaint was that the smaller volume tanks roll down hills too easily, if not retained. This problem has been solved by using the tagline bags described in an aviation *Tech Tips* titled "Three Bags For Helicopter Operations: Ping-Pong Ball, Mop-Up Kit, and Tether Line," dated December 1991. Figure 6 shows the "pyramid" shaped slingable tank.

It was also mentioned that crews have had problems with the outlet spouts being pulled out of the Fire-Flex 72 and 132-gallon tanks. This problem has apparently been addressed by the manufacturer.

Summary and Recommendation—There is no need for any action since no problems exist at this time.

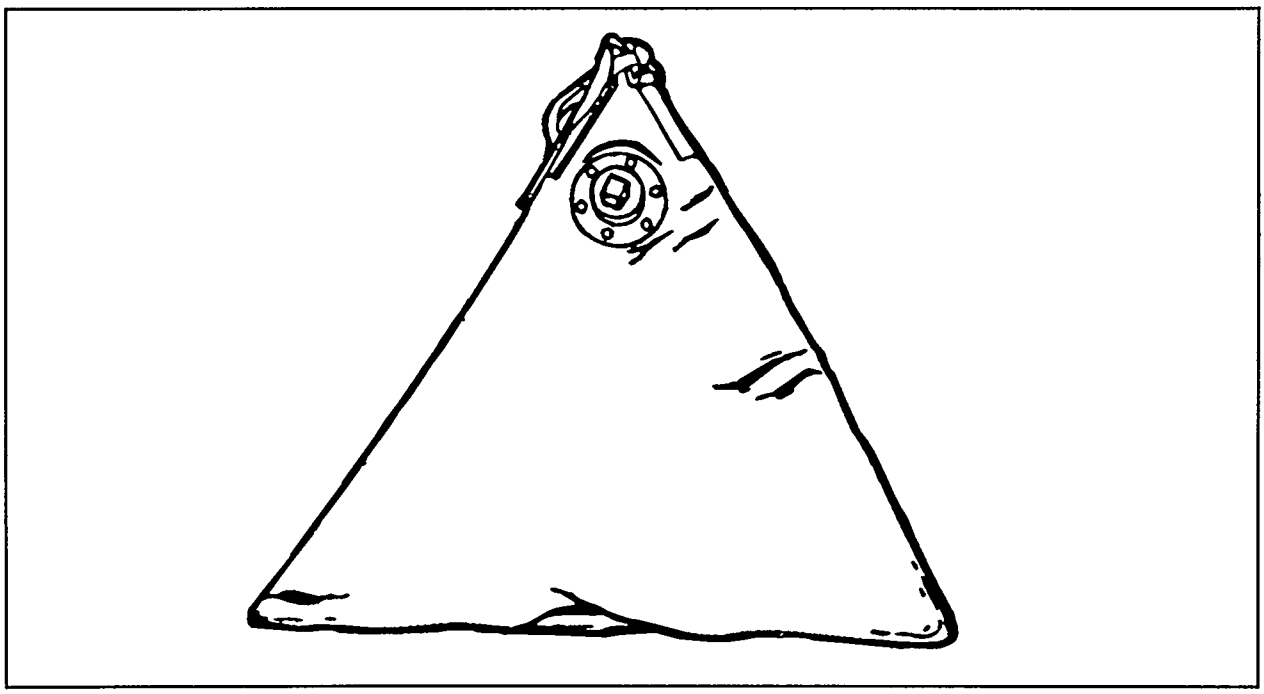

Figure 6.—Slingable tank, less than 160 gallons.

Inadvertent Releases of Helicopter External Loads

Out of the 38 field surveys and 39 incident reports reviewed, a total of 36 helicopter inadvertent external load drops occurred. Table 1 lists the incidents by cause of drop and number of releases for each cause. Problems with the helicopter cargo belly hook were the most common reason with a total of 14 (36% of this sample). As shown in Table 1, seven of the releases were probably due to the cargo hook manual release cable being out of adjustment.

Four drops were due to the entire cargo hook assembly swiveling. This was identified in one report as being due to a broken bracket. Three were due to other failures of cargo hook components.

Eighteen percent of the inadvertent external load releases were attributed to safety latch problems on longlines or swivels. Fifteen percent of the inadvertent releases were due to pilots known to have hit the incorrect cockpit switch. This was followed by 10% due to miscellaneous ground crew errors other than any mentioned above. These included such errors as mis-communications between ground crew and pilot or improper use of hardware. No reason was known for the remaining 13% of the inadvertent external load drops.

Table 1.—Inadvertent External Load Release Data

Drop Reason	Number of Incidents Out of 39	Percent of Total
Cargo hook manual release cable out of adjustment	7	18%
Cargo hook assembly swiveling	4	10%
Broken cargo hook components	3	8%
Total cargo hook related reasons	**14**	**36%**
Swivel hook safety latch failure	4	10%
Failed safety latches on longline hooks	3	8%
Total safety latch (swivels and leadlines) failures	**7**	**18%**
Pilot hit wrong switch	**6+**	**15+%**
Unknown	**5**	**13%**
Ground crew error	**4**	**10%**

Conclusions Regarding Inadvertent Releases

We understand that many helibases may already be employing some or all of the following recommendations:

1. With 18% of the inadvertent external load releases attributed to the cargo hook manual release cable being incorrectly adjusted, it is obvious that this is an urgent training and alert item.

2. The maintenance of cargo hooks should include frequent cleaning to prevent dirt build up.

3. Frequent and periodic inspection of external equipment is an important aspect of operational safety. Helicopters are given routine inspections and so should the support equipment.

4. Swivel hook gates and any other hook gates manufactured in the same stamped manner need to be inspected. A redesign to improve the strength, guarding against known modes of misuse, or purchase of an existing improved hook/gate is warranted.

5. Additional training of ground personnel regarding the use and care of external equipment associated with helicopters is recommended.

6. Although it may not be realistic, standardization of release controls for different helicopters could be of great help to pilots.

7. Installing a guard on the release switches could help prevent inadvertently hitting the wrong button. Apparently, this has been done with success on CDF helicopters.

8. Additional training of pilots and helicopter managers could help eliminate accidental releases. Such factors should not only include cockpit and mission familiarization, but also improved communications and understanding of effects of workload and human factors.

9. Quality assurance programs are needed to insure swages are correct at the time of manufacture. The current proof test required by FS 5100-500 must be enforced on all helicopter external accessories.

10. There is some indication that some leadlines are equipped with rings which are inappropriately sized for some belly hooks. We realize that the National Helicopter Operation Specialists Committee is currently studying this problem.

Appendix A

Reply To: 5720 Date: December 7, 1990
Subject: Unplanned Helicopter External Load Releases
To: Nels Jensen, National Aviation Operations Officer

In recent years there has been a noticeable increase in the number of unplanned helicopter cargo hook load releases in the Forest Service. In Region 4 alone, there were 16 of these occurrences in 1990. I believe this is a serious problem that should receive priority attention by the Washington Office. Rob Harrison, San Dimas Technology Equipment Development Center, is aware of the problem and is anxious to work toward a solution.

To discover exactly why the drops are occurring, most of the Regions and the Washington Office provided a total of 137 cargo drop incident reports covering the previous 5 years. Although some records did not extend back that far, the reports received were very representative and contained useful information.

To analyze the incident report data, each incident was categorized under one of the following headings:

a) Pilot inadvertent releases (unintentionally hitting the release switch or wrong switch)

b) Pilot intentional releases (releases due to down drafts or flying into dangerous situations where there was an immediate need to reduce weight)

c) Electrical malfunctions (problems with the cargo hook/bucket electrical system)

d) Mechanical malfunctions (problems with the cargo hook system hardware)

e) Undetermined cause of releases (reason for drops unknown).

In the analysis process, it was discovered that a large number, 39 percent of unplanned cargo hook releases, was the result of mechanical problems associated with the manual release system and cargo hook assembly. Sixty-one percent of the mechanical problems were identified with the medium-size helicopters which are almost always Call-When-Needed ships. The incident reports did not always provide the full nature of the problem, but it appears that some parts of the cargo hook assemblies were worn out. This means that helicopter operators are not providing adequate cargo hook assembly service and maintenance, and that compliance with service bulletins may be neglected. It also suggests that Forest Service and Department of Interior aviation inspectors need to place increased emphasis on cargo hook inspections.

During the recent helicopter contract re-write conference, it was mentioned that maybe the operators should completely disassemble and overhaul the cargo hook system every two years as per manufacturer's instructions. Depending on how much the hook is used, that suggestion may be excessive.

Pilots inadvertently caused 33 percent of the unplanned releases by simply hitting the wrong switch or activating the cargo release switch instead of pressing the radio transmitter button or the bucket gate switch. Some of the drops occurred when the pilot accidentally hit the release switch while moving his hand about the cockpit.

Thirteen out of the 137 incident reports indicated that the pilots intentionally dropped the cargo load or water bucket because of turbulence, down drafts, snagging the bucket on underwater objects (logs), or hanging up the sling load in the trees. On several occasions the pilot dropped the whole load because the water bucket gate did not open to release the water. It appears that a reemphasis on pilot judgement and planning, as it applies to sling operations, would be appropriate.

Except for some weather phenomena (considered acts of God), all causative factors for accidents and incidents fall under the category of either human error or mechanical failure. Sixty-one percent of the problems were attributed to human error. The pilots account for 48 percent and another 13 percent is the result of ground crews not properly assembling the long line, installing the cargo hook wrong, maladjusting the manual release system, or improperly loading the cargo nets.

It appears that a large portion of the human error problem could be addressed by an evaluation of the cockpit design, giving attention to type of switch, switch location, switch guards, etc. There seems to be very little standardization of switches, which contributes to the problem as it relates to the pilot inadvertent drops. For example, four unplanned drops occurred from one helicopter in the 1990 fire season on the first flight after the relief pilot came on duty. This suggests that the pilots may not have been totally familiar with the various switches related to the cargo system in that specific helicopter.

For a listing of how each occurrence (cargo drop) was treated under the five categories above and the most recurring mechanical deficiencies, please refer to the enclosure.

Recommendations:

1. San Dimas Development Center should complete a comprehensive study of the unplanned cargo hook release problems identified in the incident reports. Human engineering and cockpit design should be an important part of this study to include the types of switches related to external load operations, how they are guarded, and their locations. Nonstandardization of these items appear to be a contributing factor in pilot inadvertent cargo hook releases.

2. Because there have been significant numbers of pilots intentionally dropping cargo loads due to weather related factors such as down drafts, turbulence, down wind situations and environmental conditions, helicopter pilots should receive increased emphasis on planning of sling load operations.

3. During the annual inspections of contract helicopters, the Forest Service inspector should place increased emphasis on a thorough inspection of the cargo hook assembly to include compliance with all manufacturer's service bulletins. Helicopter contracts should require the operators to maintain each helicopter cargo assembly in the best possible conditions. It has also been suggested that operators be required to pay for operations associated with unplanned drops.

4. Helicopter ground crew training should stress sling load and water bucket operations. Proper long line assembly should be emphasized along with proper hook-up procedures.

5. Helicopter operators must train their mechanics to be very familiar with the cargo hook assembly. Since the incident reports indicated several discrepancies in the maladjustment of the manual release system, insufficient torque on the hook lateral binder, and the hook improperly installed, there is a need for improved personnel performance associated with the maintenance of cargo hook assemblies, especially on the medium-size helicopters.

Although this is not a complete analysis of the whole problem, it does identify some of the causes for unplanned drops. Hopefully, this brief study will help, in some way, to provide a starting point to resolve the issue. If I can be of assistance, please call on me.

ROY E. KECK
Region 4 Aviation Safety Officer

Categories Of Unplanned Cargo Hook Releases By Specific Type Helicopter And Load

Inadvertent Drops By Pilot

Type Helicopter	Load	No. Of Events	Cause of Release
B 206 B III	B	10	Pilot hit hook release button instead of radio transmitter button. Pilot hit hook release button instead of water bucket gate button. Pilot got switches mixed up. Pilot accidentally bumped cargo hook release button.
B 206 B III	S	9	
S-58T	B	2	
500D	S	4	
B 212	B	4	
B 212	S	2	
SA 315 B	S	2	
UH-1	B	6	
B 205 A	B	2	
B 206 L III	S	2	
B 206 B III	H T	1	
S-62 A	S	1	
B 206 L-1	S	1	

B = Water Bucket
S = Sling Load
H T = Heli-Torch

Intentional Release By Pilot

Helicopter Type	Load	No. Of Events	Cause of Release
B 206 B III	B	1	Snagged Log-Bottom Of Lake
B 206 B III	S	1	Turbulence
B 206 L III	B	5	Down Drafts
B 206 B	S	1	Improper Sling Loading
B 212	B	2	Down Drafts
S-64	B	1	Encountered Collective Bounce
B 206 B III	H T	1	Hit Snag
B 214	B	1	Water Would Not Release
500 D	S	1	Net Entangled In Trees
500 D	S	2	Buffeting Of Load
500 C	S	1	"Bad Air"
B 204 B	B	1	Low Rotor RPM Alarm
B 206 L III	H T	1	Hydraulic Failure
500 D	B	1	Water Would Not Release
B 206 B	B	1	Bucket Snagged On Tree
Blackhawk	S	1	Net Hung Up In Trees

B = Water Bucket
S = Sling Load
H T = Heli-Torch

Mechanical

Helicopter Type	Load	No. Of Events	Cause of Release
B 206 B III	S	1	Frayed Manual Release Cable
B 206 L III	B	1	Broken Safety Latch - Bottom Of Long Line
S-58T	B	3	Missing Spring In Hook Assembly
B 212	B	4	Worn Parts In Hook Swivel Assembly
B 212	B	1	Failed Hook Safety Latch
B 204	B	2	Helicopter Hook Swivel Assembly Failed
B 205 A	B	1	Maladjusted Clevis
SA 316 B	S	1	No Swivel Used
SA 315 B	S	2	Swivel Malfunctioned
B 206 B III	S	1	Maladjusted Manual Release Cable
UH-1	B	3	Faulty Release Mechanism
B 205 A	S	1	Double Sling Nets-1 Came Off
BV 107	S	1	Cargo Strap Failed
B 206 B III	S	1	Hook Failed
UH-1	S	2	Improperly Installed Hook
SA 316 B	H T	1	Barrel Latch Pin Failure
SA 315 B	S	1	Hook Keeper Not Fully Engaged
500 D	S	1	Long Line Improperly Assembled
B 206 B III	S	1	Cargo Hook Lock Knob Not Lined Up
B 204 B	S	1	Insufficient Torque On Hook Lateral Binder

Mechanical - Continued

Helicopter Type	Load	No. Of Events	Cause of Release
S-55T	S	1	Manual Release Cable Housing Cracked
B 206 B III	S	1	Insufficient Slack In Manual Release Cable
B 206 B III	H T	1	Faulty Design Of Pear Shape Ring
S-62A	S	1	Manual Release Cable Looped Over Support Cable
B 206 B III	B	1	Broken Clip On Manual Release Cable

B = Water Bucket
S = Sling Load
H T = Heli-Torch

Electrical

Helicopter Type	Load	No. Of Events	Cause of Release
UH-1	S	1	Electrical Release Not Armed
B 206 L-3	S	1	Crewman-Faulty Hook Up
SA 315 B	S	3	Electrical Plug Disconnect
B 206 L-3	B	1	Ground Wire Loose
500 D	B	1	Water Gate Would Not Open
B 212	B	1	Remote Hook Switch Failure
B 206 B III	H T	1	Insufficient Slack In Electrical Cable

Undetermined

Helicopter Type	Load	No. Of Events	Possible Cause of Release
B 212	B	3	Unknown
Unknown	H T	1	Unknown
B 206 B	B	1	Unknown
UH-1B	S	1	Unknown
B 206 L-3	B	2	Unknown
SA 316 B	S	1	Turbulence On Flight
UH-1F	B	2	Unknown
B 204	B	6	Suspect Mechanical Malfunctions
206 B III	B	3	Suspect Mechanical Malfunctions
S-55T	B or S	1	Suspect Mechanical Malfunctions

Since the most recurring mechanical problems were associated with the manual release system, hook assembly, and ground crew errors, a specific summary of these categories is provided.

Manual Release System

1. Frayed manual release cable
2. Maladjusted manual release cable
3. Faulty mechanical release mechanism
4. Insufficient slack in manual release cable
5. Manual release cable looped over support cable
6. Broken clip on manual release cable

Hook Assembly

1. Missing spring in hook assembly
2. Worn parts in hook swivel assembly
3. Failed cargo hook safety latch
4. Failed hook swivel assembly
5. Swivel malfunctioned
6. Hook failure
7. Hook keeper not fully engaged
8. Insufficient torque on hook lateral binder

Ground Crew Errors

1. Maladjusted clevis
2. No swivel used
3. Maladjusted manual release cable
4. Cable hook installed improperly
5. Hook keeper not fully engaged
6. Improper longline assembly
7. Cargo hook lock knob not lined up
8. Insufficient torque on hook lateral binder
9. Insufficient slack in manual release cable

Appendix B

Subject: External Load Inadvertent Releases (General) WO 91-01

There has been a notable increase in the number of external load inadvertent releases from helicopters in flight. This trend carries the potential of causing serious injury to persons on the ground. To reduce this trend we are soliciting the help of all persons involved with helicopter operations.

The three basic causative factors are:

1. Pilots. Pilots inadvertently activating the wrong switch in the cockpit, such as triggering the cargo release switch rather than the radio transmit switch. This factor accounts for 40% of the releases.

   SOLUTION: Pilot mentally preparing for sling load operations and, where appropriate, refamiliarization and/or training with cockpit switches.

2. Mechanical. Most mechanical problems are attributed to the manual release systems having maladjusted and/or frayed cables. However, worn and missing cargo hook parts have also contributed to this problem.

   SOLUTION: Improved maintenance and service of the cargo hook systems by the helicopter contractors. The National Standard Helicopter Contract has been modified to reflect improvement in this area; however, prudent observation by those working with the helicopter in the field is advisable.

3. Ground Crews. Ground crews improperly assembling long lines, not using swivels, and using poorly maintained supplemental equipment.

   SOLUTION: Reemphasize the significance of the proper care and use of external load equipment for helitack crews and helicopter management modules.

All helicopter personnel should exercise caution during external load operations to ensure adherence to established standards and procedures. We must pay attention to the details if we expect successful helicopter operations. The best policy is to slow down and expect the unexpected.

ROBERT MARTIN
National Aviation Safety Manager

Subject: External Load Inadvertent Releases (Pilot) WO 91-02

Helicopter pilots accidentally triggering the wrong cockpit switch has been identified as the single most frequently encountered causal factor associated with external load inadvertent releases. Trend analysis indicates that this factor is becoming increasingly more common. Many of these releases occur when the pilot accidentally activates the aircraft (belly) hook switch rather than the equipment/remote hook switch; or, the cargo release switch rather than the radio transmit switch.

Pilots are encouraged to contemplate the following questions prior to engaging in external load operations.

1. How long it has been since you worked with an external load? Consider your external load currency and proficiency. Has it been awhile?

2. How long has it been since you worked with an equipment/remote hook? Has your most recent external load activity involved a lot of aircraft (belly) hook work? If so use caution, you might expect there to be a tendency to activate the belly hook rather than the remote hook.

3. Have you changed aircraft models and/or ships with switches in different locations? Standardization has proven to help reduce mishaps, but, in many cases, standardization has not been achieved.

WHAT CAN YOU DO? Our statistics indicate that we drop very few helitorches. We believe this is due to the pilot getting "practice" with the correct switches during the preparation and check-out phase of the equipment, thereby reducing the chance of selecting the incorrect switch when performing the actual mission. If it's been awhile since you worked external load or remote hook, refamiliarize yourself with the location and function of the different external load switches. Take time to build muscular memory by practicing while on the ground and/or making a few practice drops at the helibase prior to departing on an external load mission. When in flight get yourself mentally prepared before reaching your destination by reviewing which switch you'll be activating. This allows you to be methodical before you get in the high workload environment.

MINIMIZE THE CONSEQUENCES! The best policy is to slow down and expect the unexpected. Things other than a pilot accidentally activating the wrong switch have caused inadvertent releases. There have also been cases where cables and external loads have been intentionally released. Prepare yourself for the time when things don't go as planned.

1. Avoid flying directly over areas where people and equipment are located.

2. When you are hovering and a crewperson is on the ground attaching a load to your cable, practice the "draping" technique. This may be accomplished by laying several feet of the cable end on the ground and either hover your helicopter back or hover off to one side while keeping the ground person in sight.

PRACTICE GOOD JUDGEMENT! Take a moment to think before you key the mic switch. This is most critical during the approach and departure phase of flight. Work with your ground and on-board personnel and request them to refrain from asking questions or making requests during this critical phase of flight.

ROBERT MARTIN
National Aviation Safety Manager

Appendix C

Helicopter External Accessories Survey
23 July 1990

If any of your responses to the following questions are positive, please describe type of incident and frequency. Also include make and model of helicopter and any photos or other descriptive information. Please send any failed hardware, if possible.

1. Has your organization experienced any problems or failures of leadlines (i.e., swage or splice failures or dropped lines)? If so, please describe.

2. Have you had any problems or failures of cargo hooks (i.e., failed gates)? If so, please describe.

3. Have you had any failures or other problems with single remote hook systems? If so, please describe.

4. Have you had any failures or other problems with carousel hooks? If so, please describe.

5. Have you had any failures or problems with other accessories such as nets, buckets or slingable tanks? If so, please describe.