

Report of Accident Investigation

1. Board Members:

Kellie Williams, President, RFO Safety Manager

Ray Lo, RFO Safety Specialist

Dennis Bradley, USACE Helicopter Subject Matter Expert (SME)

Able Betancourt, DOE Lineman SME

2. Accident Information:

Classification: C

Date of Accident: 11 January 2018, 1350

Name: Cameron Alley (Lineman 1)

Employer: ARC American, Inc. (ARC)

Occupation: Lineman

Prime Contractor: Fluor

Subcontractors: ARC – Lineman; High Line Helicopters (HLH)

Injuries: Broken bones & torn ligaments in hand; several surgeries required. A disability is not anticipated at the time of the investigation.

Name & Project Location: Grid Repair Puerto Rico, Contract: W912DY-18-F-0003; Caguas Area Line 50800 (18.24153, -65.81926)

3. Description: On 11 January 2018, two Fluor Subcontractors: ARC American, Inc. (ARC) and High Line Helicopters (HLH) were tasked with the repair of monopoles (90' transmission line poles) in the Caguas area. Two of the monopoles (poles) were known to have beehives above 20 feet; ARC had attempted to repair these poles two previous times but were unsuccessful due to swarming bees. Mr. Cameron Alley (Lineman 1) and Mr. Russell Marion (Lineman 2) volunteered to perform long line (helicopter using a line to fly linemen or equipment) operations on the two monopoles with beehives. A MD500 helicopter piloted by Mr. Jason Lowry (Pilot) was used to long line the crew and provide air support during the operation. The following sequence of events provides a detailed description which is based on statements and interviews.



Monopole Structure



MD500 Helicopter

SEQUENCE OF EVENTS

8 January 2018

Pilot of MD500 arrived at landing zone (LZ) in Las Piedras, Puerto Rico. He participated in the ARC tailboard (meeting where operations and safety are discussed prior to the start of operations), where according to the quality assurance (QA) report, hook/ ladder safety procedures were discussed with the crew and pilot.

11 January 2018

0700 – Lineman 1 and Lineman 2 left hotel Verdanza, San Juan and drove to LZ.

0800 – Lineman 1, Lineman 2 and Pilot arrived at the LZ. Pilot shutdown aircraft and removed, inspected and attached all gear to be used for daily tasks. Tailboard was postponed due to hard rain. During the rain Lineman 1 and Lineman 2 waited in the truck and discussed the tasks.

0900 - Lineman 1, Lineman 2 and Pilot gathered together and had a tailboard where they reviewed all tasks for the day and discussed concerns. Pilot was scheduled to support three different crews on three different structures. After a verbal confirmation that there were no questions about the tasks, the meeting ended and tailboard sheets were signed.

Pilot then returned to the aircraft to begin final checks before start up. While returning to the aircraft, he was stopped by a lineman that was tasked with doing ladder work. The lineman asked Pilot how to properly rig his ladder. He told the lineman to speak to another lineman to address any and all questions he had regarding specific ladder rigging.

After the tailboard Lineman 1, Lineman 2 and Pilot, discussed internally how they were going to operate for the day.

(NOTE: The pilot had flown with the crew for about a week, but his credentials had not been submitted in RMS nor did the Fluor Site Safety & Health Officer (SSHO) know that he was on the project.)

0930 – Lineman 1 and Lineman 2 donned their PPE (including bee suits) and put black electrical tape in the shape of a plus (+) on the top of the suits to facilitate head communications with the helicopter pilot. This is the first time either of them had ever had to wear a bee suit.

(NOTE: It is not typical for lineman to wear a bee suit, but attempts to control the bees (spray and plug the bee hole) were unsuccessfully.

1000 – MD500 piloted by the Pilot long lined six workers to Location 1. Lineman 1 and Lineman 2 were the last crew to fly out because the work they were performing occupied the helicopter. They were long lined in with an A-frame (structure used to transport personnel). Lineman 2 was long lined on the ladder to the first pole. Then the pilot returned to the LZ and flew Lineman 1 via the A frame to the 1st pole. Lineman 1 maintained control of the handheld radio during the entire day. He was the lineman that had radio contact with Pilot.

(NOTE: This is the first time that Lineman 1 and Lineman 2 had flown in with the ladder.)



Ladder hooks & Lanyard

Grapple & A-frame

(NOTE: A frame is used to carry personnel while a grapple is used to move cable and equipment. Positive safe connection, required by fall protection standards for personnel cannot be obtained using a grapple.)

The MD500 stayed with Lineman 1 and Lineman 2 helping them pull the transmission cable into place and move the ladder and lineman, as necessary. The MD500 returned to the LZ numerous times exchanging the A-Frame and the grapple depending on the next task. Lineman 1, Lineman 2 and Pilot successfully completed the task at Location 1.

According to the interview with Lineman 2, the grapple was used to move the ladder and Lineman 1 during the work at the first pole. The use of the grapple to move personnel is against company policy and Federal regulations because it does not provide a positive connection required for fall protection. Lineman 2 was surprised with this action and stated that he attempted to communicate this with Lineman 1.

(Note: According to interviews with ARC, both linemen have limited experience with long line work; Lineman 1 - 3 months and Lineman 2 - approximately 7 months.)

After completion of work on the first pole, Pilot long lined Lineman 2 and Lineman 1 to the second pole. The task at the second pole was to connect the cables to their respective insulators. This required multiple ladder and lineman moves using the A- frame for personnel and the grapple for line pulls and equipment. There were issues on this pole. The bees swarmed every time the helicopter was near. After two insulators were installed on the top and bottom arms, the linemen realized that they were the wrong insulators, so they sent for the correct ones and replaced them. Lineman 1 was moved to the middle arm via the A-Frame, but the location of the cable and proximity to a second pole made its movement difficult. During the interview, Lineman 2 stated that it was very tense when they were trying to move the cable. The pilot had a problem with the grapple getting hung between the cable and the pole and it was difficult to unhook. Pilot decided that the ladder needed to be moved so he moved Lineman 1 and the ladder via the A-Frame to the top right static arm. Lineman 1 decided that this was still

not a safe location and asked Pilot to move him to the top arm on the opposite side of the pole and Pilot complied. Pilot then moved the cable with the grapple to the top of the middle arm.

(NOTE: The crew did not take a break between poles and according to interviews, they were not able to drink water because of the bee suites. The helicopter caused the bees to swarm and the linemen did not want to risk getting stung because they lifted the hood of the suit to drink the water. The bee suits were soaked with perspiration when retrieved at the end of the day and the tape on the top of Lineman 1's suit was balled up.)



Lineman 1 & Lineman 2 on Pole 2
11 January 2018

1350 – Time of accident. According to eye witnesses the ladder was situated on the top arm on the left side of the pole. Lineman 1 was stationed on the ladder while Lineman 2 was on the middle arm on the right side of the pole. Pilot once again presented the grapple to Lineman 1 and he attached it to the lanyard on the ladder. One of the safety chains on the ladder was still connected to the arm as Pilot began lifting the ladder. We believe that Lineman 1 communicated with Pilot to stop lifting the ladder while he unlatched the safety chain. The assumption is that Pilot noticed Lineman 1's actions and began to lower the ladder. At this point the board concludes that the hooks on the ladder rested on the top of the arm and the grapple continued in a downward motion which caused it to slip off the lanyard causing Lineman 1 and the ladder to fall to the ground.

The pilot immediately returned to the LZ, radioed “man down” and requested emergency services. Lineman 2 proceeded down the pole to check on the condition of Lineman 1. Lineman 1 was subsequently evacuated via ambulance to the LZ where he was medevac’d to a medical facility.

4. Conclusion: Environmental, materiel and human factors were evaluated to determine the direct and indirect causes of the accident. It is the opinion of the Board that the following are the direct and indirect causes of this accident.

- A. DIRECT CAUSE:

- 1) **Human Error**: The individual’s failure to follow the written procedures for the transport of human cargo by both the helicopter pilot and both lineman resulted in Lineman 1’s fall from the helicopter. The use of a grapple hook for human external cargo (HEC) is not allowed in HLH safety manual. Lineman 2 observed this procedure being violated while working on the first pole but did not stop work. Lineman 1 and Mr. Lowery both violated this procedure at least two times on poles 1 and 2.

Recommendation: The contractor should update all written procedures with strict prohibitions against the use of the grapple for human external cargo. The contractor should require a safety stand down for all workers to include subcontractors for training or retraining in the correct safety practices for long lining. All training shall be documented in accordance with the requirements of EM 385-1-1.

- B. INDIRECT CAUSES:

- 1) **Environmental Factors**. Bee nests located in both poles required Lineman 1 and Mr. Marion to wear a bee suit. Neither lineman had worn a bee suit before this operation. The suit can cause a decrease of lineman’s visual acuity, mobility and dexterity and hinder communications. It also increases the probability for heat stress/fatigue and does not allow for the lineman to hydrate while on the poles.

Recommendations: When introducing new PPE, the contractor must conduct a hazard assessment on the PPE and ensure that the proper controls are in place for the worker. This is required to be documented on an Activity Hazard Analysis (AHA) in accordance with EM 385-1-1. Anytime the contractor introduces a new piece of PPE, workers should be training in the proper use and limitations of the PPE. Contractor needs to ensure the safety requirements are followed by all workers as required by EM 385-1-1 and stated in the contractor’s APP.

- 2) **Human Factors. Leadership**. Pilot did not accomplish his duties of pilot in command. In accordance with the HLH safety manual it states: 1) Pilots will accomplish the duties of pilot-in-command. 2) A Pilot shall exercise final responsibility and authority for the safety of personnel, aircraft and equipment during flight operations. 3) Develop an operating plan for the task to be performed. 4) Change job/safety briefing. Report new or previously unknown hazards to safe flight. In the pilot’s witness statement he stated that a lineman had some concerns about the use of the grapple and the pilot did not address the question but referred him to another lineman.

Recommendation: Contractor should conduct a Safety Stand down and discuss roles and responsibilities with all subcontractors to ensure that they understand their role in safety. Each worker should be familiar with the requirements in their plans.

- 3) **Human Factors. Leadership.** Fluor management did not enforce the health and safety requirements as per Fluor's Accident Prevention Plan (APP) and EM 385-1-1. The accident prevention plan states under 6.4 responsibilities: Program manager, Project manager, Construction manager, Health, Safety and Environmental (HSE) Professional, Site Safety and Health Officer (SSHO) are all responsible to ensure compliance with the accident prevention plan. An example of this management failure are the subcontractors' non-compliance with Fluor's heat stress plan, fatigue management plan, and fall protection plan.

Recommendation: Fluor management needs to be accountable for all subcontractors and ensure that all of the plans and procedures in the APP and requirements of EM 385-1-1 are followed.

- 4) **Human Factor: Standards Failure.** The connection point that was chosen by the lineman and accepted by the pilot did not provide a positive fall protection connection point. This is required by Fluor's Fall Protection Plan, Section 07.1 and EM 385-1-1, 21.1.07. Fluor's FPP states, "Personal Fall Arrest Systems, 100% Fall Protection is required when climbing or working on poles, towers, or similar structures" and EM 385-1-1, 21.1.07. b. states "...when using lanyard with two integrally connected legs for 100% tie off, attach only the snap hook at the center of the lanyard shall be attached to the fall arrest attachment element of the harness (D-ring)."

Recommendation: It is recommended that each subcontractor review their respective Fall Protection Plan and standard operating procedures for fall protection and ensure that they are in full compliance with 29 CFR 29 CFR 1910.140 or 29 CFR 1926.502 and EM 385-1-1. A competent person (CP) as defined by EM 385-1-1 should develop the FPP.

- 5) **Human Factor: Standards Failure.** The contractor did not complete a hazard assessment or provide training for the use of the bee suit. The use of this bee suit introduced operational issues and the hazards of the suit were not included in the AHA for the activity.

Recommendation: When introducing new PPE, the contractor must conduct a hazard assessment on the PPE and ensure that the proper controls are in place for the worker. This is required to be documented on an Activity Hazard Analysis (AHA) in accordance with EM 385-1-1. Anytime the contractor introduces a new piece of PPE, workers should be training in the proper use and limitations of the PPE. Contractor

needs to ensure the safety requirements are followed by all workers as required by EM 385-1-1 and stated in the contractor's APP.

- 6) **Human Factor: Standards Failure.** No documented standard for using "head signals" as a form of communication, submitted AHA and FAA standards only recognize the use of hand signals and two way communications. The use head signals by the placing of black tape in the shape of a plus (+) on the top of the lineman's helmet to communicate with the pilot is a recognized industry standard, we feel this this method contributed to the accident since there were communication issues during the incident.

Recommendation: Recommend that the lineman use wireless communication devices to afford them a hands-free environment while still maintaining communications with the helicopter.

- C. CONTRIBUTING FACTORS: It is the opinion of the Board that the following factors could have contributed to the occurrence of this accident.

- 1) **Pressure from management to increase productivity.** Employees interviewed expressed pressure from their management that work was not conducted fast enough. This pole had been worked on twice before and there was a sense that they of urgency from the workers.

Recommendation: Pressure whether real or perceived impacts the performance of the workers and adds stress to the worker. These concerns need to be communicated to the contractor's management and should be addressed. Management needs to discuss with site workers.

- 2) **AHA for HLH Flight Operations has not been updated for this activity.** It does not have Pilot as the pilot, does not identify the use of ladders as transport or associated hazards, identify bees and associated hazards they present or the hazards that the bee suites introduced.

Recommendation: Contractor's SSHO is responsible for ensuring that each activity has an associated AHA that accurately reflects the tasks and hazards. Site worker are required to review the AHA prior to the start of that task to determine the hazards and the associated controls.

- 3) **Critical Lift plan does not identify the use of a ladder for transport of a human.** It only discusses the use of the A frame.

Recommendation: Contractor should review documents to ensure that correct procedures for task are discussed and communicated to the site workers.

- 4) **Fatigue Management.** Fluor was not implementing the Fatigue Management Plan outlined in their Accident Prevention Plan. The Fatigue management plan states that an employee must receive 2 consecutive days off for every twelve consecutive days worked or 1 day off for every 6 days worked.

Recommendation: The contractor's SSHO is responsible for ensuring that each worker comply with the fatigue management plan in the APP.

D. PRESENT BUT NOT CONTRIBUTING

- 1) The investigation team identified that the lineman's use of the ladder as an anchor point is inadequate as it relates to OSHA's fall protection standards in 29 CFR 1910.140 or 29 CFR 1926.502. The OSHA requirement for a fall protection anchor point is 5000 lbs, the Hastings Ladder Model No. 13033 has a load limit of 1000 lbs which does not meet this standard. The ladder was also used as fall restraint with the lineman's positioning device which requires an anchor of 3000 lbs.

Recommendation: The contractor's fall protection CP is responsible for ensuring that all fall protection is compliant with OSHA and USACE fall protection requirements.

(NOTE: It is the opinion of the Board that this incident was directly related to the incorrect procedure for carrying a lineman with a helicopter. Based on our finding it is our recommendation that the contractor notify National Transportation Safety Board (NTSB).

Signatures:

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E.M.1231335940

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Kellie Williams, PR RFO Safety Manager

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Dennis Bradley, Helicopter SME

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Able Betancourt, Lineman SME

Appendix A
Persons Interviewed:

- 1).Russell Marion, ARC Lineman (lineman 2)
- 2).Dennis Earman, Fluor Site Safety & Health Officer
- 2)Marcus Burkhardt, Fluor Designated Representative for Caguas Area
- 3)Domonic Duchon, ARC Forman for Lineman 1 & 2
- 4)Jose Alevera, ARC Equipment Operator
- 5)Bonnie Knopf, ARC Safety
- 6)Johnny Hill, ARC Field Safety
- 7)Rueben Eicher, ARC Vice President
- 8)Dave Garen, HLH President (via phone)
- 9) Ken Zalaskus, HLH Vice president
- 10) Violbi Merced Collazo, Bystander

Appendix B
Written Statements

1. Russ Marion, ARC Lineman (lineman 2)
2. Cameron Alley, ARC Lineman (lineman 1)
3. Marcus Burkhart, Fluor Designated Representative for Caguas Area
4. Jason Lowry, HLH Helicopter Pilot
5. Carmon Romero, Fluor, DR for Caguas Area
6. Lisadro Diaz Ramos, Bystander
7. Violbi Merced Collazo, Bystander
8. Jacqueline Fontanex, Bystander