HURRICANE HUGO

Electric Power Restoration

St. Kitts -- September 27 - October 16, 1989

Nevis -- October 3 - November 16, 1989

Montserrat -- November 17, 1989 - January 9, 1990

by

LLOYD ELECTRIC CO.
Wichita Falls, Texas

Under Contract to OFDA/W

Contract No. SPO-0000-C-00-0002-01

Administered By

USAID/Bridgetown

Regional Development Office

for the Caribbean

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on

February 8, 1990

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1. INTRODUCTION

Hurricane Hugo developed in mid September of 1989. By the time Hurricane Hugo had arrived in Lesser Antilles of the Caribbean, the storm had intensified into a Force 4 hurricane. Hugo's path passed through the Leeward Islands on September 17th and 18th, causing extensive destruction to structures, power and communication systems, and agriculture on several of the islands. The most serious damage occured on the islands of Guadeloupe, Antigua, Montserrat, Nevis, St. Kitts, Saba, Martinique and St. Croix. An Office of Foreign Disaster Assistance (OFDA) team, headed by Paul Bell, was in position on Antigua, anticipating Hugo's arrival.

During the initial response, the OFDA team coordinated emergency services, including medical services. Paul Bell and his team distributed food, medical supplies and plastic sheeting for temporary roof repairs to the islands of St. Kitts, Nevis, Montserrat and Antigua. The operation was based out of the U.S. Embassy in Antigua.

Jim Baird, Chief Engineer of RDO/C, aided OFDA by providing an evaluation of damage to the infrastructure of the various islands. Mr. Baird recognized the extensive damage to the electrical systems of the affected islands and determined a priority need for power restoration. OFDA called on USAID/Jamaica to lend the help of Hurricane Gilbert restoration crews which were still employed in Jamaica under USAID/Jamaica funding. Jamaica Mission Director, William Joslin, agreed to a temporary suspension of the Jamaica Hurricane Reconstruction Project involving the Lloyd Electric Company, Inc. and Jamaica Public Service Company (JPS). JPS agreed to suspend the Lloyd Electric work in Jamaica so that emergency assistance could be quickly sent to the hurricane damaged islands. In fact, JPS also sent a 9 man team of their best linemen to Antigua on September 30, where they worked with other restoration crews for a month.

On September 20, 1989, OFDA/W funded travel for Richard Harrell and Jay Carter from Jamaica to Antigua for the purpose of

making a power system damage evaluation and to prepare preliminary planning for providing power restoration assistance. Jay Carter, a contract Engineer with USAID/Jamaica, had, as Project Manager, coordinated the activities of the USAID power restoration teams with JPS during the 1988/89 Hurricane Gilbert power system restoration. To facilitate suspension of the Jamaica work, the movement of Lloyd Electric crews to the Leeward Islands, the expediting of agreements with local utility and government offices, and to generally support and monitor the Lloyd Electric operations, RDO/C contracted Jay Carter to act as Project Manager for the duration of the Lloyd Electric contract with OFDA. Richard Harrell, a Journeyman Lineman employed by Lloyd Electric as Superintendent, supervised the Lloyd Electric operation during power system rehabilitation in the aftermath of Gilbert.

On September 22nd, Dean Moody, an Engineer of the USAID/Bridgetown RDO/C office, arrived on Antigua to further assist with damage evaluation and with the planning stages of Hugo restoration. Mr. Moody as the RDO/C Project Officer for this activity has monitored the field activities, provided liaison between RDO/C and the OFDA/W offices, the island governments and utilities and provided guidance and support to Project Manager, Jay Carter.

Evaluations of system damage began with a survey of Antigua on September 21st, followed by visits to St. Kitts and Nevis on September 22 - 23. An evaluation of damage on Montserrat took place on October 10, 1989.

2. INITIAL EVALUATIONS

The damage evaluation of Antigua was made on September 21, 1989. The overall damage to Antigua was very moderate. There were areas of substantial destruction on the island, especially on the south and west sides, but overall, Antigua had only incidental damage. Damage to the electrical system was a 20 - 30% overall loss. The destroyed power lines were largely the result of

decayed poles and improper use of poles under joint-use agreements with telephone and cable television companies. The wind loading resulting from hanging numerous large size cables on poles which were not designed for such use, caused long sections of the power lines to be blown over on the ground and into the roads.

On the evening of the 21st, Lloyd Electric was advised that the donor nations of the USA, Great Britain, and Canada had met in Barbados and an agreement was reached on areas of assistance. This agreement assigned to the United States responsibility for assisting with the electrical restoration on the islands of St. Kitts and Nevis. Great Britain accepted the same responsibility for Antigua and the British colony of Montserrat.

Evaluation of St. Kitts began on September 22, 1989. Lacking sufficient time for an evaluation tour, a meeting was held with the Department of Electricity Manager, Mr. P. H. L. Huggins; Disaster Coordinator, Mr. Ray Johns; the Prime Minister, and other Ministry officials. The housing damage was moderate. Only 5% were totally destroyed and 30 - 50% had roof damage.

Infrastructure damage was mostly to the electrical system. The damage to the system was moderate; probably a 20% overall loss. Most system damage was on the west and north coast. Also damaged were the phone and cable television systems which were attached to the power poles. Water service was non-functional to most of rural areas because of the electric power outage. The roads were blocked but suffered very little permanent damage.

The economic damage to St. Kitts appeared minimal. Damage to structures was mostly to houses; most businesses suffered very little damage. Tourism was suspended briefly, resulting more from adverse publicity than actual damage. Some hotels were out of power but that problem was quickly remedied.

The evaluation team visited Nevis the following day, September 23rd. Housing had suffered more destruction on Nevis than on St. Kitts. The damage was still in the moderate range with probably 15% destruction of houses and a 40 - 50% loss of roofs.

The infrastructure had taken a major loss with the electrical system being approximately 60% destroyed. The phone system was destroyed along with the electrical system in most areas, as was the cable television. Food storage was an immediate problem because of lack of refrigeration. The water system was not working because of the electric power outage. To alleviate this situation, the Canadian International Development Agency (CIDA) rushed emergency power generators to the pumping stations.

The damage to the Nevis economy was fairly serious. Three of the eight significant hotels were destroyed. Tourism was essentially lost for the 1989/90 holidays because of no electricity and adverse publicity. A large construction project, the Four Seasons Hotel, was discontinued for two weeks and work was carried on at a reduced rate for the following month.

The evaluation of Montserrat, On October 10, 1989, concluded that the island was severely damaged in all sectors. The housing damage probably exceeded 30% totally destroyed and an additional 40% extensively damaged. At least 90% of the houses had significant roof damage and more than half of the houses had roofs that were totally lost.

Infrastructure damage, mostly in the area of the electric power system, was also severe. Ninety percent (90%) of the power lines were destroyed. The telephone and cable television systems fell with the power line structures. Refrigeration for food and medical supplies was non-existent. The water system was non-functional because of the power system outage. Generators were used to provide 70% of the water supply until mid-December.

Along with the housing and infrastructure destruction came the loss of a tourism-based economy. There would be very little tourism for the remainder of 1989, and only an incidental tourist trade in the early season of 1990. The vacation villas on which the tourist industry depends had been damaged and none were to have electricity until December. Montserrat previously had some agriculture production from truck farms and banana fields and all were a total loss. The harbor pier also was destroyed during the storm and that caused significant problems to the shipping industry and to restoration activities which needed lumber, roofing, furniture, glass and appliances in large quantities.

The need for immediate assistance to aid in electric power system restoration was apparent on all three of these islands. Electricity was necessary to begin restoring the economy. Tourism, light manufacturing, and retail operations all require electrical power. The humanitarian need was readily apparent because electricity is necessary for the water system, medical facilities, food storage and residential electrification.

Timely restoration would require skilled linemen who were trained and experienced in the use of hydraulic equipment and productive construction techniques and power line materials.

The British supported contractor British Electric Industries (BEI) was on Montserrat but without line equipment. The Montserrat Electricity Department requested immediate assistance from Lloyd Electric crews and tenative plans for providing such assistance were prepared. However, the British Government felt that further assistance would not be needed or at least this was the impression received in OFDA/W.

3. PRELIMINARY ARRANGEMENTS FOR POWER RESTORATION ASSISTANCE

Because of the recognition of a need for assistance on St. Kitts and Nevis, OFDA/W, by telephone, verbally expressed their intent of negotiating a contract with the Lloyd Electric Company,

Lloyd Electric personnel currently employed in Jamaica would be mobilized for a move to St. Kitts as soon as possible. Adequate equipment would be mobilized by Lloyd Electric in the U.S. and transported to St. Kitts by Air Force C5A Galaxies. The intent was to have the equipment arrive simultaneously with the Lloyd Electric personnel from Jamaica.

Carole Siegel, the OFDA/W Procurement Officer, immediately began negotiations with Robert Lloyd to formalize the above arrangements with a contract. The Contractor, Lloyd Electric, acted quickly and within 48 hours located the best equipment available on such short notice. Lloyd Electric actually mobilized the equipment prior to receiving a formal Letter of Intent from OFDA/W in order to meet the U. S. Air Force C5A flight schedules to St. Kitts.

Mobilization plans to respond to the needs of St. Kitts and Nevis were undertaken in Jamaica and in Wichita Falls, Texas. Plans called for thirty-two (32) personnel with complementary equipment to be divided into six crews. The organization was as follows:

4 crews with the primary function of pole replacement were manned and equipped as follows:

4 men, one being a foreman, on each crew
1 digger derrick for each crew
1 support vehicle for each crew

2 crews with the primary function of conductor replacement were manned and equipped as follows:

5 men, one being a foreman, on each crew
2 aerial lifts (bucket trucks) for each crew
1 support vehicle for each crew

Additionally, there would be five (5) support personnel with the operation:

1) Superintendent, using one light vehicle
2) Mechanic, using one light truck
3) Material expeditor, using one light truck
4) Administrative Aide, using one light truck
5) Secretary - Timekeeper.

The logistical requirements for the arrival of the operation were outlined to Paul Bell, the OFDA team leader. Alejandro James, assistant to Mr. Bell, made most of these arrangements. Mr. James' handling of this matter was excellent. Mr. James visited St. Kitts and made lodging arrangements which included providing three meals per day, arranged so that a twelve hour per day work schedule could begin at 6:00 a.m.; hotel space or housing to consist of comfortable airconditioned accommodations, single rooms when/where available; and laundry service for large quantities of very dirty clothes. Mr. James also arranged with Dade County, Florida, an OFDA/W contractor, for the installation of a UHF radio system and for first aid training.

Movement of personnel from Jamaica was carried out in four groups due to non-availability of sufficient number of commercial airline seats on any given day. The first group left Jamaica on September 27th and the last group left on October 2nd and arrived on St. Kitts on October 3, 1989.

Mobilization of equipment was accomplished by two USAF C5A flights. The first flight was on September 29th and the second flight was on September 30, 1989. The C5A's delivered the following equipment from Texas and Georgia to St. Kitts.

5 digger derricks
4 aerial lifts (bucket trucks)
2 pole trailers
4 crew cab pickups
1 Chevrolet Luv pickup
2 - 40 foot vans for tolls and material storage

Approximately $80,000 of tools and material arrived with the equipment.

Ten men (two crews and equipment) were moved by barge and ferry to Nevis on October 3, 1989.

Plans from the beginning were to move as quickly as possible to restore power on St. Kitts and move all forces on to Nevis where more time was needed to acquire construction materials.

Material for power restoration was available on St. Kitts and Lloyd Electric supervision was on St. Kitts, all of which resulted in cleaning up the St. Kitts problems in a short period of time.

4. POWER RESTORATION ACTIVITIES ON ST. KITTS

Before Hurricane Hugo, St. Kitts had a reasonably well maintained and adequately designed power system. The 11 KV primary backbone was a ring feeder that circled the entire island. It was routed through cane fields so there were few bushing, access, or 'danger' tree problems. The significant weakness of the power system was the use of Wallaba poles. These poles are not properly treated with preservatives, resulting in early butt decay problems. Wallaba is also a brittle wood causing even the good poles to often break during hurricane force winds.

Hurricane Hugo inflicted an estimated 20% loss of the electric power distribution system on St. Kitts. Many of the poles simply fell in the soft soil of the cane fields. Many conductor ties broke and the wire only had to be retied. The system overall, received moderate or less than moderate damage.

There were several contributing factors to the damage of the St. Kitts system. Wallaba poles, decayed poles, inadequate setting depths, and inadequate guying all contributed to avoidable losses. Telephone and cable television, with their additional cross section and with inadequate guying, caused a great deal of the structure failure.

The restoration requirements varied greatly on this small island. The hurricane was apparently more intense on the west and north sides of St. Kitts. In those areas, pole loss amounted to about thirty percent (30%).

An additional 20% of the conductor was down, and 80% of the service cables were damaged. The east side of the island had

minimal damage with only 10% of the poles down and probably 30% of the service drops damaged.

Southern St. Kitts, including Basseterre, also suffered minimal damage in the range of 10% pole failure, 20% of the conductors down, and 30% of the service cables down.

When Lloyd Electric began restoration, the power system of the capital city of Basseterre was already 90% functional. On the eastern side of St. Kitts, an area of light damage, restoration was underway with local forces. In western St. Kitts, the 11 KV line was repaired to the isolating switch at Palmetto Point, near the village of Challengers.

On October 1, 1989, a Restoration Plan was formulated from a basic plan provided by the Department of Electricity Manager, Mr. P. H. L. Huggins and Mr. Royden Benjamin, Special Minister for Communications and Youth Activities. After discussion and some modification, an agreement to provide worker safety and timely restoration was reached. Under this agreement, Lloyd Electric was to be responsible for restoration of the primary 11 KV feeder on the west side of St. Kitts from Palmetto Point north toward a point to be determined by job progress. Lloyd Electric was to restore secondary circuits after the primary ring was completed. The Department of Electricity (D of E) would be responsible for restoration of primary and secondary circuits on the east side of the island, from Cayon to a point also to be determined by job progress. D of E would also restore the secondary circuits on the western side of St. Kitts as Lloyd Electric restored the primary lines.

Lloyd Electric restored all of the 11 KV primary lines between Palmetto Point, near Challengers, to Dieppe Bay Town, in northern St. Kitts. This was approximately eighteen (18) miles. Ninety-five (95) new poles were erected and 75 existing poles were either plumbed or reset. One hundred and forty (140) spans of conductor were replaced.

This restored electricity to several communities including:

Challengers	50 residences
Old Road Town	150 residences
Verchilds	50 residences
Sandy Point Town	1,000 residences
Newton Ground	150 residences
St. Paul's	200 residences
Dieppe Bay Town	200 residences

This restored electricity to approximately 1,800 residences. Commercial consumers restored included an electronics manufacturer, four hotels, Romney Manor (textile shop), four service stations, and numerous small shops.

After restoration of the 11 KV primary lines, Lloyd Electric restored the secondary circuits and service drops in the communities of Newton Ground, St. Paul's and Dieppe Bay Town.

The restoration of power to St. Kitts was expedited by several circumstances. Ray Johns, St. Kitts' Disaster Coordinator, was very helpful. In general, the line trucks had access to the line and the digging for pole holes was fast because the soil was not extremely rocky. The arrangements of the D of E proved most valuable. In the first instance, Mr. P. H. L. Huggins had a good basic plan worked out and then demonstrated the flexibility of his plan to suit the work methods of Lloyd Electric. The D of E furnished a liaison team of retired employees to aid Lloyd Electric in material acquisition, in obtaining directions, and in providing coordination between Lloyd Electric and D of E field personnel. Many of the poles that were needed were already moved by D of E from Stores and spotted on the right of way near the broken poles that were to be replaced prior to our arrival. A convenient fueling depot was arranged and fuel was furnished by D of E. A convenient staging area was also arranged. The point most appreciated was that the St. Kitts D of E observed the safety agreement between Lloyd Electric and the D of E without exception.

St. Kitts removed any obstacles that could hinder the production of Lloyd Electric during restoration. Lloyd Electric was provided a very positive work situation which benefited the people of St. Kitts.

Lloyd Electric started restoration work on St. Kitts on October 3, 1989 and finished restoration and departed for Nevis on October 16, 1989. Restoration work on St. Kitts took thirteen (13) calendar days, or eleven (11) work days. This represents 176 total man days for the restoration phase on St. Kitts. Power was 95 % restored to St. Kitts in less than thirty (30) days after Hurricane Hugo.

5. RESTORATION OF ELECTRICAL SERVICES FOR NEVIS

The electrical system serving Nevis appears to have been a very poorly maintained system for many years. The design of the system lacked strength due mainly to inadequate guying. The quality of workmanship used in the original construction of the lines was very poor. The right of way had not seen any maintenance for twenty (20) years. The lines were generally routed through palm groves and wooded areas with no consideration being given to danger trees. In many areas there were no vehicle access routes to the pole sites because of both terrain and brush. The conductor was old and brittle. In many cases, the attachment ties were incorrectly made and utilized inadequate material.

Their poorly maintained system sustained severe damage during Hurricane Hugo. Approximately 50% of the poles were down and an additional 20% of the conductor was on the ground. Eighty (80%) percent of service lines were no longer attached.

The extreme loss of power lines was caused by poor maintenance. A very high percentage of the poles were seriously decayed and had needed replacement for years. Wallaba poles which

are prone to decay and have little resilience, were used throughout the system. The design had minimal guying which accounted for many structure failures. Proper pole depth was rarely observed; poles commonly were set three (3) feet in the ground. Guy anchors were installed at three (3) feet depth and less. Even though the line structure was in this weak condition, telephone and cable television lines had been attached without structural upgrading. This additional cross section increased wind loading but was rarely supported by guying dedicated to the added load. The power line conductor was old and brittle. The power lines had numerous splices, many of which were due to previous line breakages. Lines were frequently tied to the insulators with wire unsuitable for conductor attachment. The attachment ties had never been maintained and many ties were probably broken before the arrival of Hurricane Hugo.

Required restoration was extensive. Charlestown, where only a few Wallaba poles were utilized, had only a 20% pole loss. Eighty (80%) percent of the services were broken away from their points of attachment. In the fringe areas of Charlestown, the incidence of structure failure increased proportionately with the use of Wallaba poles. In the rural areas, where structures were constructed almost exclusively of Wallaba poles, loss was in the range of sixty (60%) percent. Nearly 80% of the conductor was down and very near 100% of the service lines were torn down.

The Nevis Department of Electricity (D of E) had restored service to the downtown Charlestown area before the Lloyd Electric operation arrived on October 3, 1989. This was a small and easily restored area. The D of E had begun to restore service to the remainder of Charlestown.

Prior to the arrival of the balance of the Lloyd Electric personnel from St. Kitts on October 17th, there did not appear to be a general plan for power system restoration. The Lloyd Electric superintendent having found a workable restoration plan developed in St. Kitts, hoped the same would be true for the

D of E on Nevis. However, this was not the case and due to transportation difficulties between the islands of St. Kitts and Nevis, no real plan was put in place until Harrell's contingent arrived on October 17th. In any event, work assignments given to Lloyd Electric crews prior to the arrival of Harrell on Nevis seemed to be directed toward restoration of power to certain houses rather than to power system restoration.

The basic work plan formulated by Lloyd Electric on October 19th was to restore the primary system, then to repair the secondaries. To accomplish this objective, the operation was divided into two equal operations. The Nevis D of E and a local contractor were to begin restoration of the secondary distribution lines on the poles previously erected by Lloyd Electric for the primary lines.

The operation on the south side of the island was housed at Old Manor Hotel and staged from the Market Shop Police Department grounds. This operation began restoration southward from Charlestown with the objective of reaching Whitehall. Among the major objectives was restoration of power to water wells and pumping stations. After completing the primary line to Whitehall, restoration of secondaries was undertaken where need was indicated.

When the balance of the Lloyd Electric crews arrived at Nevis on October 17th, the 10 men working there since October 3rd had already restored all of the outlying areas of Charlestown. On October 18th, the overall plan for use by all the Lloyd Electric crews was implemented.

In restoring the 11 KV primary system, Lloyd Electric erected an estimated 400 poles and plumbed 200 other poles. Five Hundred and Fifty (550) spans of primary conductor were positioned back on the insulators. This restored an estimated 35 miles of primary lines. Replacement or repair was needed in every mile of the system. Estimates place 6,000 of the 10,000 people of Nevis

residing outside of Charlestown. Therefore, Lloyd Electric returned electrical service to over 6,000 people by restoring the 11 KV primary system.

Secondary restoration was provided to all tourist hotels except one, all the tourist villas, clothing and crafts manufacturers, restaurants and the construction site of the Four Seasons Hotel, which is the largest building project ever undertaken on Nevis.

The D of E helped Lloyd Electric with the restoration efforts in several areas. The restoration plan and the agreed upon safety procedures were followed. Nevis government provided secure staging area convenient to our work. Lloyd Electric was also provided with fueling depots convenient to our work. The local contract crew hired by the D of E was productive and cooperative. The Ministry of Communications and Public Works provided the use of two bull dozer tractors to clear brush and construct access roads.

Restoration was hindered by a shortage of materials. There were few materials at the start of restoration and few materials were procured during the restoration period. Hardware was difficult to salvage from the existing lines because of corrosion. A pole shortage caused Lloyd Electric to reuse substandard Wallaba poles by cutting off the decayed butts and resetting the shortened poles. Eventually poles had to be pulled from less important lateral lines for use in the primary feeder. The new poles did not arrive until a week before we left. There was a shortage of transformers that prevented restoration of power for several weeks in some areas. The needed materials had arrived on St. Kitts, but were not released to Nevis because of payment requirements.

Repair parts, particularly hydraulic hoses, were not available on Nevis. Time and travel expense were incurred in acquiring repair parts.

The severity and duration of Hugo's wind would have caused a lot of distruction on an electrical system in any state of repair. Fallen trees damaged the line in many instances. Corrugated metal roofing hit the conductor and tore down adjacent poles.

The failure rate of the Wallaba poles in the system accounted for some of the losses. A pole maintenance program would have reduced losses significantly. Guy anchors, using logs instead of manufactured metal plates, failed when the anchor rods pulled through the decayed wooden anchors.

Telephone and cable television cables presented large cross sections and caused poles to break from extreme wind loading. Telephone and cable television guying was non-existent.

In the Old Towne area, what poles and conductors were left after the hurricane were completely destroyed during the road clearing operations. The conductor was cut, sometimes every 20 feet to clear the roads. Poles that simply fell across the road were cut up for road clearing. The poles with conductor attached were shoved into wooded areas with front end loaders, making conductor recovery nearly impossible.

Restoration was for an essentially totally destroyed electrical system. Plymouth was the area of least destruction. The pole loss there was about eighty (80%) percent. The tourist villa area assigned to be restored by Lloyd Electric had power distribution system losses of 100% in Old Towne, 80% in Olveston, and 70% in Woodlands. The rest of the island had losses ranging from a low of 70% to 100% in many areas.

Lloyd Electric did not arrive on Montserrat until November 18th, after St. Kitts and Nevis were restored to service. The island probably had 25% of the service restored prior to Lloyd Electric arrival. The British contingent of the British Electrical Industry (BEI), MONLEC, and the contractor, Triple W,

from Trinidad and Tobago had restored most of the services in central Plymouth. MONLEC was restoring the remainder of the services to Plymouth and to nearby areas. Triple W was just beginning to work in Salem and BEI was restoring the primary in two directions. One group was working eastward from Plymouth to the Airport area and the other group was working northward to Salem. None of the secondary lines had been restored past the Belham Bridge or outside of Plymouth city limits to the east or south.

Great Britain had contracted BEI, the same utility group that assisted in the Hurricane Gilbert Restoration in Jamaica, to provide the major part of restoration. The supervisory staff of BEI was experienced in hurricane restoration. Brian Chappelow and Tony Pringle had a well organized effort underway and BEI provided most of the material for restoration and a great deal of the planning. BEI also brought with them electrical inspectors who were responsible for the inspection of the consumer wiring. The total BEI contingent was approximately 35 men.

MONLEC and the British provided a restoration plan which had BEI restoring the 11 KV primary from Belham Valley Bridge northward to Cudejo Head and eastward from Plymouth to the Airport. The Irish team, which had been working on Antigua, was to restore the 11 KV primary line southward from Plymouth to St. Johns. MONLEC was responsible for restoration of secondary circuits and services in the Plymouth area. Triple W was restoring secondary lines and some primary lines in the Salem area.

Lloyd Electric was requested to concentrate on restoration of the low voltage (LV) distribution system of Old Towne, Olveston, and Woodlands. This area had an extensive distribution system which served approximately 400 vacation villas. Ninety percent (90%) of Montserrat's tourism income is derived from rental of the villas in these subdivisions. The only tourist hotel, The Vue Pointe, is located in Old Towne. The LV system was on the paved streets of the subdivisions so everything was easily accessible for Lloyd Electric digger derricks and bucket trucks.

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restored to service at the termination of the USAID/RDO/C - OFDA funded contract. However, Woodlands was 100% restored to service on January 16, 1990 by Lloyd Electric crews working under the MONLEC contract.

The restoration of the LV system to the three tourist subdivisions involved the erection of approximately 500 poles, replacement of 800 spans of conductor, and reinstallation of 400 service cables. Lloyd Electric put an estimated 20 miles of 4 wire secondary, or the equivalent of 80 miles of conductor, back into the air.

The restoration of electrical service allowed tourism to start again during the holidays. Seventy percent (70%) of the useable villas had power before Christmas. The Vue Pointe Hotel, the major tourist hotel of Montserrat reopened on December 23, 1989.

The well conceived and organized plan from BEI and MONLEC was a very positive factor for restoration. The plan put Lloyd Electric trucks where they could best be utilized. A general attitude of cooperation between BEI and Lloyd Electric worked to the benefit of both operations. Material availability contributed to a productive situation. The British Development Division (BDD) financed the procurement of much of the material with MONLEC also purchasing significant amounts of materials. Even though poles and materials ran short, the operation never was without material long enough to stop effective production. The Montserrat Public Works Department assisted Lloyd Electric with mechanical repair equipment facilities which helped the operation a great deal.

Some counterproductive situations were encountered during the Montserrat project. A conductor and conductor sleeve shortage was the major problem. The existing conductor had been cut into short lengths to facilitate road clearing. Replacement conductor had not arrived and compression sleeves were not available. The linemen had to make nearly one thousand hand wrapped splices in order to replace the conductor for the Old Towne circuits. Such

The digging was difficult because of volcanic rock. An air compressor was procured and shipped. It reached Antigua where it was lost in shipment.