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INFORMATION SYSTEMS AT NORTHROP GRUMMAN SHIP SYSTEMS SECTOR: THE HURRICANE KATRINA RECOVERY

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ABSTRACT

On August 29th, 2005, Hurricane Katrina slammed into the Gulf Coast causing massive damage throughout Louisiana and Mississippi. Northrop Grumman's Ship Systems sector's facilities in New Orleans, Louisiana, and Pascagoula and Gulfport, Mississippi as well as most of the firm's 20,000 employees located in the Gulf were directly impacted by the storm. One data center was destroyed and a second put out of commission for several days. Employees' homes were destroyed and those surviving the storm and their families scattered to safe harbors in neighboring states. Some would never return. Communication to and within the impacted areas was severely disrupted, and the near complete failure of other elements of public infrastructure further delayed the recovery and increased the chaos and suffering. This case looks at Katrina as a very real example of a business continuity disruption that far exceeded the assumptions built into the business continuity plan. It illustrates the essential role that public communication infrastructure plays in disasters such as these, and the risks associated with assuming that communication systems and other public infrastructure will be available in times of cataclysmic failure. The case also demonstrates the unique nature of leadership in a crisis, the problems of pulling together and providing resources to a work force necessary to respond to a crisis, and the unique problems of reassembling, almost from scratch, the necessary information technology infrastructure¹.

Keywords: business continuity planning, hurricane, data center, Katrina, recovery, disaster, leadership, communications, public infrastructure

Editor's Note: A teaching note is available from the authors to faculty listed in the MISRC-ISWorld Faculty Directory.

¹ Immediately following Hurricane Katrina, Northrop Grumman Corporation called upon its suppliers AT&T, Cisco, EMC, Hewlett Packard, IBM, KST Data Inc., Nextel/Sprint, Oracle, RIM, Skycasters, Sun Microsystems, et al, whose prompt responses in providing equipment and services contributed to the swift recovery and restoration of telecommunications, infrastructure and network services to the shipyards.

I. INTRODUCTION

Nearly a year after Hurricane Katrina severely disrupted his organization, Tom Shelman, Vice President, Information Technology Solutions and CIO of Northrop Grumman Corporation, reflected on the storm:

I'm not as concerned about another storm like Katrina; we are far more ready today than we were last year. We have satellite dishes and phones ready to fly in; we could set up communications in half, maybe a tenth, the time. Our new data center consolidation plan will ensure our data will be safe from natural disasters, such as earthquakes or hurricanes. More importantly, our business continuity plan is now squarely focused on our people as well as our systems.

But the Gulf Coast region was hurt badly by Katrina, and the recovery was hampered by inadequate communications. I believe people lost lives due to the loss of these communications. Today, I'm worried that we, as a nation, are not doing enough to protect our public communications infrastructure. In addition to natural disasters, terrorism and cyber warfare are also a reality and must be dealt with accordingly.

II. NORTHROP GRUMMAN SHIP SYSTEMS SECTOR

In August, 2006, Northrop Grumman Corporation provided global aerospace and defense products and systems to U.S. and international customers. Northrop Grumman's businesses included systems integration, defense electronics, information technology, advanced aircraft, shipbuilding, and space technology. Northrop Grumman employed more than 120,000 people located in 50 states and 25 countries. Fueled by acquisitions, including Westinghouse Electric, Logicon, Litton Industries, TRW, FDC, Teledyne Ryan, and others, company revenues had grown from \$7.6 billion in 2000 to over \$30.7 billion in 2005 (see Exhibit 1).

Two of Northrop Grumman's eight business sectors were in ship construction (see Exhibit 2). Together, the Newport News and Ship Systems sectors accounted for \$5.7 billion of the company's 2005 revenue. The Newport News sector, headquartered in Newport News, Virginia, built nuclear aircraft carriers and submarines. The Ship Systems sector produced a variety of ships for the U.S. Navy and U.S. Coast Guard including destroyers, amphibious assault ships, amphibious transport dock ships, and Coast Guard cutters. In August, 2005, the Ship Systems sector employed more than 20,000 people, primarily at three Gulf Coast facilities. The first, in Pascagoula, Mississippi, is by far the largest private sector employer in the state. It, and a second facility in neighboring Gulfport, employed more than 13,000 workers. The third facility is located 124 miles west of Pascagoula, in Jefferson Parish, Louisiana, 14 miles west of New Orleans. In August 2005, the New Orleans facility was the largest private sector employer in Louisiana, with approximately 6,400 workers. This New Orleans facility had been an independent yard until acquired by Litton Industries in 1999. In 2001, Northrop Grumman acquired Litton and, in so doing, took over both shipyards. That same year, it also acquired the Newport News shipyard.

III. INFORMATION SYSTEMS AT NORTHROP GRUMMAN

Another Northrop Grumman business sector, Information Technology, accounting for \$5.2 billion in sales in 2005, offered a wide variety of IT services to the marketplace. The sector also was responsible for Northrop Grumman's internal information systems. Tom Shelman, as vice president and CIO, headed that arm of the sector, Information Technology Solutions.

Northrop Grumman's many acquisitions created a diverse assortment of IT systems and architectures. By 2006, CIO Shelman had overseen the consolidation of the IT operations from 17 different merged companies.

For each merger, Shelman's team targeted a checklist of savings opportunities – software consolidation, telecom contracts, and so on. Attention to costs had paid rich dividends; IT costs as a percentage of revenues had declined from 3.7% in 1998, when Shelman arrived at Northrop Grumman, to 2.4% in 2005 – a savings of more than \$1 billion. The route to these savings lay in sharing IT services across business units. The IT Solutions organization reflects Shelman's strategy for, and success in, deriving shared services. His leadership team, the IT Solutions Policy Council, included CIOs for each of Northrop Grumman's eight sectors, the majority at the VP level (e.g., Electronic Systems, Information Technology, Integrated Systems, Mission Systems, Newport News, Ship Systems, Space Technology, Technical Services, and the corporate office), as well as functional vice presidents (e.g., ERP Integration, Strategy, Architecture and Integration), each of which provided services to the sectors in a shared services model. In addition, Council members included those from Business Management, Communications, Human Resources, Information Security, Process Excellence, and Shared Services Operations. Also on the Council were executives with "dotted line" responsibility to Shelman. This latter group reported directly to corporate functions (e.g., Procurement, Legal, Audit) that supported IT Solutions and its internal customers.

IV. INFORMATION SYSTEMS IN NORTHROP GRUMMAN SHIP SYSTEMS SECTOR

Jan Rideout had joined Ship Systems as the sector's CIO in 2001, shortly after the Litton buy-out. She reported to Shelman, and, by a dotted line, to Philip Teel, the President of Ship Systems. In August 2006, the nine direct management reports in her Information Technology Solutions program office group were each responsible for IT solutions for a particular program within the Ship Systems sector. A dotted line connected her to six managers responsible for various support functions (e.g., Human Resources, Information Security, Project Management). These managers and their teams directly reported back to the functional VP's within Shelman's group (e.g., Information Security, Shared Services Operations) or the Information Technology sector (e.g., Procurement, Legal).

In 2005, Shelman had outsourced most of the responsibility for desktop support and data center operations to the Commercial, State, and Local (CSL) group, a commercial business group within Northrop Grumman's IT sector. The transfer had occurred in November, 2005. In so doing, Shelman refocused his group from IT support to that of an IT enabler of business strategy. Ken Lehman, group director of Shared Services Operations within Shelman's group, was the liaison between the IT sector and CSL. J.D. Longmire, who reported directly to Lehman and indirectly to Rideout, was the Ship Systems liaison to CSL. Longmire had dotted line responsibility for four managers from CSL who provided IT operations support to the Ship Systems sector.

V. PREPARING FOR THE STORM

Hurricanes, and preparing for them, are familiar to almost everyone in the Gulf Coast. Camille struck the Mississippi coast in 1969 with winds of more than 190 miles per hour. Camille devastated properties along the Mississippi shoreline and left hundreds dead. Four years previously, Betsy had wrought similar destruction around New Orleans, causing an estimated \$10 billion in damages in the Southeastern United States and the Bahamas, and leaving 76 people dead. On average, a category three or higher hurricane struck both Louisiana and Mississippi about once every ten years; weaker, but still dangerous, storms occurred far more frequently.

All threatening storms involve much preparation. Jan Rideout knew the drill well. For instance, in September, 2004, Hurricane Ivan had threatened the Gulf Coast, and with it, the Ship Systems' facilities in Pascagoula, Gulfport, and New Orleans. Following the firm's well-established business continuity plan, Rideout's team shut down most IT operations. They backed up data from servers in New Orleans and Pascagoula, prepared generators for emergency power, took

down 350 servers, and draped them with Visquine². Only the servers supporting email and Blackberry devices were left running. Fortunately, Ivan passed well east of Pascagoula; damage was minimal other than the disruption from a power outage and loss of work associated with the evacuation and the inaccessibility of systems taken down in preparation for the storm.

In July, 2005, Rideout and her team made similar preparations for Hurricane Dennis, but again were spared when the hurricane passed to the east³. Six weeks later, on Friday, August 26th, while at a meeting in California, Rideout and J.D. Longmire, her Network and Telecommunications Manager, learned that Katrina was targeting Mississippi and Louisiana. On Thursday, the storm had passed over Florida, taking eleven lives. Rideout and Longmire returned to Pascagoula on Saturday, comfortable in the knowledge that her team had taken all necessary precautions. Data backups were normally sent to Iron Mountain, a provider of data backup storage services. For this storm, backups were also sent to Dallas. A new generator had recently been installed in its own secure generator house and was adequately fueled. On the Saturday prior to the storm, the servers were taken down for 45 minutes and then brought back up on generator power. The new sheltered generator allowed one rack of servers to be left running, including several Exchange Servers as well as those hosting an extranet supporting the development of a new ship.

With preparations completed, Rideout began to think about her personal safety, as she described:

On the Saturday evening before the storm hit, my husband, David, and I discussed evacuation plans. Having driven 10 hours to Tennessee (with our three dogs in the pickup truck) just six weeks before to escape Hurricane Dennis, we were both reluctant to do the journey again.

We considered staying at a local motel, but when we awoke on Sunday morning the storm was looking too dire for us to remain in the area. I went online and found a hotel in Bainbridge, in Southwestern Georgia, that would take our dogs. By 11 a.m. we were fighting the traffic driving east (Rideout, 2006).

VI. KATRINA LANDFALL

On Monday morning, August 29th, 2005 at 6:10am CDT, Katrina came ashore near the Mississippi-Louisiana line. A storm surge, higher than 30 feet in some places, battered the entire Mississippi coast; hurricane force winds were felt 200 miles inland. In Mississippi, Katrina left 239 dead and destroyed 65,000 homes (Barbour, 2006).

New Orleans dodged Katrina's full force, but five hours after landfall, massive flooding poured through broken, inadequately constructed levees, devastating much of the city, and neighboring parishes. Although 1.3 million people had previously evacuated, over 1,100 Louisianans died, most victims of drowning. The floodwaters, rapidly rising up to 18 feet and covering 80% of New Orleans, trapped many in their homes; tens of thousands were pulled to safety from rooftops.

In Louisiana, the flood displaced more than 780,000 people, caused major damage to over 200,000 homes, put a quarter of a million people out of work, shuttered 18,000 businesses, and dramatically decreased the population of New Orleans. A year after the storm, 60% of the businesses in New Orleans remained closed (Eaton, 2006). Across the impacted area, Katrina left five million people without power, 85,000 families living in hotel rooms, and an estimated 118

² Heavy duty plastic sheeting.

³ Because of the direction of the wind emanating from a hurricane, the most damage from a Gulf hurricane typically occurs to the east of the hurricane's eye.

million cubic yards of debris to be carted away, six times that strewn by Hurricane Andrew, previously the most destructive U.S. hurricane (Chertoff, 2006).

VII. WAKE-UP CALL

On Monday, August 29th, 2005 Tom Shelman went to bed, certain from televised news reports that the Ship Systems facilities in Pascagoula, Gulfport, and New Orleans had been impacted by the storm. Before going to bed, he had tried to call Rideout but had been unable to get through. Neither could he reach anyone else in the region.

At 6:00 Tuesday morning, his home and cellular phones both began to ring. Shelman described the next hour:

It was my boss. He'd been in touch with Philip Teel, the President of the Ships Systems sector. The message he received from personnel at the yard was that it was bad, very bad. Ships had been damaged, and there was extensive damage to the yard and the neighboring communities. That meant there were about 20,000 employees and perhaps another 60,000 dependents at risk. That was all we knew. The message to me was, "do whatever it takes."

During my hour and a half commute to work into Dallas, I thought about what to do. At first, it was a helpless feeling. What could we do? Money was not the issue, and I had plenty of people from other regions to address the problem. I called my admin and asked her to contact my desktop technician and have him turn my conference room into a command center - network and phone connections, PC's, and telephones. I also told her to get my staff together and to contact anybody who was out of town and tell them to be ready.

VIII. COMMUNICATIONS BLACKOUT

The storm left Pascagoula and neighboring Gulfport in a virtual communications blackout, as J.D. Longmire described:

My wife and I evacuated to Atlanta. On Monday evening the Dallas folks began to call searching for news. Pascagoula was blacked out. There was no public data or voice and pretty much no cellular. We knew we had lost all of network and communications. But we didn't know how much damage there had been to our infrastructure.

When I finally got to the shipyard I was not prepared for the devastation, both to the coast and the shipyard. Our data center was virtually destroyed by the surge and the wind. But one of our core communications rooms was in another building. It had survived. In fact, a lot of our core communications infrastructure had survived.

Longmire soon realized, however, that while much of the core communications had survived, the components of the network outside of that building had not. The local area network was destroyed and much of the metropolitan area network was destroyed or significantly damaged. Links to the wide area network were also gone. "Gulfport was completely unconnected," he recalled.

By Tuesday morning, that disconnect was all too apparent in Dallas. While they had been able to get through to some people who had left the region or were located in adjacent communities, IT Solutions management in Dallas was unaware of what had happened. Tom Shelman described the situation:

We had only very limited communications through our Washington office. We had to get eyes and ears on the ground quickly. Early on Tuesday morning, we found out that Trent Lott field [the local airport] was open but only from dawn to dusk. We had a small window to work with if we were to get someone in and out that day. Jimmy Morales was sitting across the table, and he said, "If you can get me in there, I will go." We really had no idea as to the conditions we would be flying into, yet no matter how bad it was, Jimmy was still willing to go due to his extensive military experience and willingness to help.

IX. EYES AND EARS ON THE GROUND

Morales was IT Solutions' Director of Infrastructure Enterprise Services and a Colonel in the Army Reserves. He had 24 years military experience and had served in both Iraq and Afghanistan. Morales described his initial involvement with the recovery effort:

Because of my background, I was an obvious choice to make the trip. I stay very mobile; my shots are in order, my will is written, my duffel bag packed with provisions. I told Mr. Shelman the only things I needed were a digital camera and a satellite phone.

A few hours later, Morales and another IT Solutions employee, Dwayne Fields, flew out of Dallas' Love Field on one of Northrop Grumman's corporate jets to Pascagoula, Mississippi. The pilot, unsure of the conditions on the ground, made a pass to confirm the viability of the landing field before landing. Two network engineers from the Pascagoula IT Solutions group met the plane and brought Morales and Fields to the shipyard.

The plan for the two men had been to drop off the supplies, survey the damage, and fly out in one day. Delays on the ground made that impossible. Morales called Dallas to report that the data center was gone; he asked for additional satellite phones and walkie-talkies.

Fields returned to Dallas the following morning, bringing with him digital images that provided the Dallas command center with a rich, but horrific, understanding of the magnitude of the disaster.

X. PASCAGOULA AFTER THE STORM

Gary Broome was one of two software engineers assigned to help get out the Ship Systems sector's payroll. His condominium was 1,100 feet from the coast. A longtime resident, he had never evacuated his home, having weathered Hurricane Camille and several lesser storms. He had intended to ride out Katrina as well, but when the Sunday morning news reported category five winds⁴, he checked into a motel room two miles north of the shoreline. After the storm passed, Broome made his way back to his home. As he drove, his initial optimism faded:

As I drove towards the beach, I initially saw about as much standing water as was typical after a heavy rain. The houses looked pretty good along the road, though I would learn later, that most had been flooded. Then, as I drove closer to the shore, I saw houses knocked off their foundations. The front door to my own house was busted in and there was a water line 54 inches above the floor. One of my couches was lying on the other. The upstairs, fortunately, was dry. Still, the magnitude of the storm didn't really sink in until I started driving around the next day. People were already pulling furniture, carpets, and insulation out of their

⁴ On the Saffir-Simpson scale, a category five hurricane has sustained winds of greater than 155 miles per hour. Katrina made landfall in Florida as a category one hurricane (74-95 mph) and on the Louisiana and Mississippi border as category three (111-130 mph).

houses a mile and one half from the shore. From my transistor radio I was hearing reports of devastation up and down the coast.

Broome returned to his small motel room that night and for 51 nights thereafter. For 43 of those nights, the sector's payroll master joined him, his own home destroyed by the storm.

The damage to the Gulf Coast, from New Orleans to Pascagoula and beyond, was extensive. The storm surge had lifted several giant casino barges off their moorings, and they had floated ashore. Some ended up a quarter-mile or more from their docks. Several had crashed into other buildings or landed on roadways. The new Hard Rock Casino, scheduled to open the following week, experienced massive damage. Hundreds of beautiful homes along the Gulf, including that of U.S. Senator Trent Lott and the historical home of Jefferson Davis, were gone or badly damaged. Also gone, or severely damaged, were more modest homes, such as Broome's located in the blocks just north of the shoreline.

The home of Jan Rideout, located on a secluded back bay, was another casualty. Tuesday morning, when Rideout awoke in a tiny Georgia motel room, she began to plan what to do next. Her BlackBerry was out of range and she could not reach members of her team by phone or e-mail. She called Tom Shelman in Dallas; he offered to send a company plane to pick up Jan, her husband, and their pet dogs. Early Tuesday evening, they arrived in Dallas, where Rideout reported for duty at the IT Solutions command center.

Rideout described the pain of losing her house:

By late Tuesday, I was able to get a call through to one of my immediate staff who lived near me. He had been evacuated from his home early Monday morning before the water rose too high and was in a local shelter. Talking to him brought the reality of my situation home. He informed me, as gently as possible, that it was very likely that the area I lived in was completely destroyed. I sank to the floor in despair. If what he was saying was true, I had just lost everything I owned (Rideout, 2006).

Her husband, returning the next morning on a Northrop Grumman corporate jet, confirmed their loss. All that remained of her house were its foundation piers. Far worse, she had learned that one of her employees had died in the storm, as had several close neighbors. Another employee and her family had been forced to swim to safety, spending several hours in the floodwaters.

Rideout would take the next two days off to deal with the emotional turmoil of the losses. As she described, and like many other displaced Ship Systems employees, Rideout required time to deal with the tragedy:

I tried to stay in touch but knew I wasn't capable of being in charge. Tom was really good about that. By Friday I started coming in. By Saturday I told Tom, this was my sector and I needed to be in charge again.

XI. DAMAGE AT THE PASCAGOULA YARD

The Pascagoula shipyard was extensively damaged. There were watermarks in parts of the yard that were up to 27 feet in height. Most of the scores of small buildings that housed the yards' project management and engineering personnel were washed away. These buildings, which usually were moved about the yard as a ship progressed through various construction phases, had always presented logistical challenges, as J.D. Longmire explained:

Shipbuilding is much like construction. There are a series of mobile offices, holding from one to 30 people. As the ship moves through the yard, the mobile office moves along with it. Each contains phones, computers, and so on, all of

which must be rewired as the building moves. There were 175 of these buildings in the yard.

None survived the storm. Their remains, as well as phones, computers, blueprints, reports, pipes, and power and communications lines lay scattered across the yard or had been washed away in the Gulf of Mexico. The USS Kidd, a guided missile destroyer under construction, had suffered damage to its hull. A week after the storm, Northrop Grumman reported that “a number of major shipyard assets, such as cranes and most fabrication facilities at all the Ship Systems sector facilities, appear to have survived the hurricane.” Nevertheless, fabrication equipment, such as lathes and drill presses, had been destroyed or badly damaged, as had material lying about the yard. Hundreds of vehicles owned by the yard or its employees had been flooded and tossed about by the surge. Jimmy Morales characterized the damage:

I saw evidence of a 25 plus feet tidal surge through the area in conjunction with torsional damage. This resulted in a combination of random twisting of I-beams among buildings that [otherwise] remained untouched, and the severe damage of anything that took electricity to make it work. If it had an electric motor and took on water, it was problematic bringing it back on line -- especially if salt got into it. For example, newer electronic cranes would not function without extensive repair; the older mechanical cranes still functioned with little or no repair required.

Brian Anderson had been the Network and Telecommunications Lead at the time of the storm; he was one of the first IT employees back into the shipyard. He described the horrific damage to the yard’s information technology:

I couldn’t get to the shipyard Monday as the roads were blocked. As I drove in Tuesday, I could see the transmission lines were down; I knew it was bad. There had been ten to twelve feet of water in the data center. Our UPS⁵ boxes were fried, and there was an awful smell. Much of the technology had been under water with the humidity and corrosive air taking out the rest. The yard, consisting of some 675 acres, held a variety of communications rooms and buildings. Most of that was gone as were our fiber connections.

Damage to the Pascagoula information technology infrastructure was extensive; 1,500 desktop and laptop computers were lost⁶ as were 189 servers, 600 data input devices, 300 printers, and hundreds of two-way radios. The storm surge had pushed at least one monitor nearly a mile away from its point of origin. The Pascagoula data center was immediately condemned. Damage to the yard’s network, including routers, switches, and fiber and copper wiring, was immense.

The most pressing issue facing Northrop Grumman and Ship Systems management was not technology, but people. That meant finding them, and then doing what was possible for their safety and welfare, and that of their families. Many had evacuated, some with no houses to return to; others were in shelters, staying with friends or relatives, or living in motels. Many were dealing with the loss of loved ones, neighbors, pets, and houses. Stores and restaurants had been washed away, and food, fuel, ice, drinking water, and other essentials were in short supply. Many survivors had only the clothes they had evacuated in. The heat, humidity, refuse, decay, and shortage of clean water made the spread of disease a very real threat. The public communication and power infrastructure was in complete disarray with land and cell phones generally inoperable. Finding out who was alive, who needed help, who was still in the area, and who was available to work, was a massive communication challenge.

⁵ Uninterruptible Power Source.

⁶ Of approximately 6,000 computers in the facility.

XII. DAMAGE IN NEW ORLEANS

The damage at the New Orleans facility was less foreboding. While much of New Orleans had been flooded when the levees broke, this facility, located west of the city, had suffered only minor damage from the wind and flooding. Although one building had been lost, there was relatively minor damage to the shipyard and, initially at least, the servers that had been left running continued to operate. Lonnie Frazier, a software engineering unit manager at the New Orleans facility, was one of the first to get back in the yard after trying unsuccessfully to evacuate from his home in Thibodaux, Louisiana, in Lafourche Parish, some 50 miles west of the shipyard. He described his experience:

Next time I'll leave on time! We left Sunday morning, only to turn around due to traffic. That night we had close to 100 mph winds; the power went out about 2:30am and my kids were scared. Monday my land phone line was working, but only for incoming calls. Later that morning, I happened to notice the light on my BlackBerry blinking. It was Ken Lehman in Dallas, asking how we were doing. Later they asked if I could get to the plant. I tried Tuesday morning, but the police turned me back.

Our phone still worked on Tuesday. But, the BlackBerry was down, so I knew our server was gone. Our people in Dallas had been able to get through to the ride-out team⁷ at the yard; they reported the data center roof was still on and the generators working – but they couldn't tell us what happened to the servers.

The challenges Frazier faced in New Orleans were caused more by failures in public infrastructure and concerns about lawlessness than by the storm itself. On Wednesday, after conferring with the parish police, management had received approval for Ship Systems people to pass through police lines. Frazier was one of the first to get back in, subject to a 6pm to 6am curfew at the parish line. In the first few days, only authorized individuals with business interests were allowed into the parish. Frazier made that trip each day, returning at nightfall to a home overrun—not by water—but by friends and relatives. At one point, the Fraziers were housing 35 people who, when finally able to make daylight visits to their own houses in Orleans or Jefferson Parish, used the Frazier home as their staging area.

Reaching the yard on Wednesday, Frazier and the other IT personnel discovered that the air conditioning in the server room had gone out. It was 140 degrees in the room and the equipment locker was probably hotter. Three phone lines were working, but only for incoming calls. The T3⁸ communication lines coming into the yard also were working. Several days later, communications went out, apparently because cars had been running across downed communications lines that, prior to the storm, had hung, redundantly, on either side of the highway.

Given the reports of violence in New Orleans, yard management, concerned about vandalism, had brought in additional security. Because of those concerns and a shortage of food, water, and supplies, several people from the New Orleans IT Solutions office were relocated to Dallas.

XIII. MANAGING THE RECOVERY

As Shelman began to organize the recovery from the Dallas command center, it became obvious to him that the mission was not what he had anticipated a day previously. He recalled:

First, you think this is about restoring computer systems, but it's actually about putting our employees' lives back in order. I now understood our mission was not

⁷ A "ride-out" team is assigned to remain on the premises and ride-out the storm.

⁸ A T3 line is able to transmit up to 44.7 Mbps.

about recovering data centers or computers, it was about 80,000 lives. That was our mission, and I reminded people about it several times a day. People responded tremendously to that call to arms. There was literally a line out my door of our employees, our suppliers, and people from other divisions, asking what they could do to help. We sent them off to find things. Where can we get gas? What's a route to get it in? Where can we get generators, satellite dishes, food, even underwear for our people on the ground? I even had people coming to me in tears because they wanted to help and hadn't been assigned a task yet.

Ken Lehman, Group Director of Shared Services Operations, described the environment in Dallas during the first few days of the recovery:

There was a real sense of urgency and excitement with some of us, putting in twenty-hour days. People look to the leadership in times like this. Everybody wanted, and needed, everything at once. And what they needed may be quite different than what was in our business continuity plan. We had to keep a cool head and overcome obstacles quickly.

It boiled down to making decisions quickly. Large corporations can easily find themselves going into analysis paralysis in their normal operations. Most of that went out the window as we worked to solve problems at what we soon were calling "hurricane speed."

While Northrop Grumman management was universally supportive of the recovery effort, Shelman had experienced a push back from some quarters as he made decisions outside of his normal authority. He described one telling moment:

I got an IT manager from our Pascagoula facility on the line and asked him if he could help us assess the data center damage. His house had been flooded, and he and his family were living in the second floor and had a generator. He said he thought that if he took the gasoline from his lawn mower, he would have enough gas to make it to the shipyard, but asked if he could fill up his own car at the yard and bring some back for his generator. He also said they were running short of food, and asked if it were possible to get food as well. I told him we'd take care of him.

Someone from another area of the company gave me a little push back for exceeding my authority. I got on the phone to my boss and told him I was calling with two possible purposes, either to resign so I could sell my stock to provide food for those people or get his 'go ahead' to feed them. He said, 'I want you to do everything you can. Do what you would do if they were members of your own family.'

Mary Ellen Bradshaw, Communications and Internal Operations Director, reflected on the role Tom Shelman had played in the early days of the recovery:

Tom steered our focus to 'what can be accomplished' instead of 'what we can't do.' It was too easy at the time to talk about all of the things that went wrong...Tom directed the conversations to 'what is going right...what more can we do.'

XIV. RECOVERY AT PASCAGOULA

After making an initial damage assessment, Jimmy Morales remained in Pascagoula. He spent the first and subsequent nights in the future *Forrest Sherman*, a nearly fully completed guided missile destroyer that, at the time of the storm, was moored at the Pascagoula facility, in the final stages of customer acceptance. With provisions, fuel, and power, it provided sleeping quarters, a

dining hall, and, for a few days, office space for the Ship Systems sector's management team as they developed and executed the recovery plan.

The ship would be Morales' home for a month. There he would take on a variety of responsibilities; some were related directly to restoring the sector's IT capability; others, often far more urgent, involved recovering essential infrastructure—for the yard and its employees and their families. Early on, he was involved in preparing orders for humanitarian relief supplies including 40,000 pounds of ice, recreational vehicles for people to sleep in, power generators, fuel, food, and so on. Shelman offered to send Morales additional manpower, but Morales declined most of it, preferring to rely on people already in the region. He explained his reluctance:

I didn't want to bring in people that would put further pressure on the life [support] systems. Initially there was little clean water and a risk of disease. I didn't want us bringing in people without proper immunization or increase the burden of more people to feed, house, and find fuel.

Morales focused his activities on the needs of the IT Solutions primary customer, the Ship Systems sector, and its president, Philip Teel. As Morales explained, this was not business as usual:

Mr. Teel understood that everything we were bringing in would eventually be on his nickel. We were doing things for him, and spending money on things and in ways that we usually wouldn't do. Normally, we relied on the customer for clean power, air conditioning, food, security, and so on. But, those things were no longer in place, and his people were busy with other priorities: finding employees, getting everyone back to work, cleaning up the shipyard--all this, while most were worrying about their families and houses. We were doing anything we could not to burden the customer and his people. We also had to be aware of the customer's priorities. For instance, when we did get generators in, they were initially employed for non-IT related activities--getting the water pumps functioning, supporting the firehouse, supporting the medical facility.

Material to assist in the recovery began to arrive Tuesday morning. Three Northrop Grumman corporate jets, a helicopter, and a cargo plane made a total of 75 flights into the area. They ferried supplies in, and on return flights, brought shipyard people back to Dallas. More than 700 IT Solutions employees were involved in the recovery, in one way or another. For instance, 32 of them drove fully provisioned RV's into the area, providing homes for key personnel.

XV. LIFTING THE FOG

Little could be accomplished without effective communication tools. The sector's communication infrastructure had to be quickly replaced. Among other support items that the first planes brought in were 30 satellite phones. Philip Teel, the president of Ship Systems and the IT Solutions primary customer, would quickly allocate these to key personnel.

One early challenge was ensuring the satellite phones were operational, as Morales explained:

When I brought the phones in, I explained their limitations. You need to be outside and in line-of-sight with a satellite; if you are calling someone else on a satellite phone, they too must be within range of the satellite. Still, we continued to get complaints that the phones were not operating properly. I had to explain the operating limitations several times to personnel unfamiliar with the phones.

The satellite phones provided a quick, but expensive and inconvenient solution. Some employees found that they could pin each other from their BlackBerrys.⁹ The IT Solutions employee who had to swim out with her family, for instance, had brought her BlackBerry with her in a plastic bag. The Navy also continued to provide assistance via satellite. None of these approaches, however, offered a robust communications solution. By September 4th, a satellite dish had been erected in the Gulfport facility, providing necessary bandwidth for both voice and data. Voice Over IP (VOIP) phones began to arrive and were connected via the satellite dish. Ken Lehman described the reaction back in Dallas as the fog began to lift:

The first time we heard people's voices over VOIP it was almost like the first time we heard our astronauts from the moon. We all got emotional.

The satellite opened communications pathways to the outside. Walkie-talkies were also brought in for communication within the shipyard. Together, they provided the necessary communications tools for carrying out the clean up of the shipyard, the primary task of the returning sector employees for the first two weeks after the storm. But the real work of the shipyard had to quickly begin again¹⁰, and with it came requirements for other kinds of communications.

One major task was rewiring the many new semi-portable buildings that were located throughout the shipyard. A plan had already been in place to move to a wireless solution for those buildings, but its implementation was still several years away. Now, wireless offered a quick and fairly inexpensive replacement for the yard's destroyed communications infrastructure. More than 120 mobile offices were brought to the yard; they were connected to the network via wireless technology, thus providing both data and voice connectivity.

No work could be done, however, without employees. To reach its employees, Ship Systems initially relied on the press, public broadcasting, a Web site, and toll free call-in numbers. In the month following Katrina, the company authored nearly twenty media advisories, primarily intended for their employees (see Exhibits 3 and 4). Press releases directed employees to look at the company Web site and call in to the corporate emergency help line. By September 4th, six of the IT sector's help desks had been transformed into hurricane call centers and were providing 24-hour disaster relief. The help desk would log more than 26,000 calls; the company's Hurricane Katrina Web site experienced over 67,000 hits.

XVI. BRINGING UP THE DDG 1000 EXTRANET

A major project at the Pascagoula shipyard was development work related to DDG 1000, a new class of destroyer. On September 14th, two weeks after Katrina landfall, the Navy would conduct a flag-level critical design review for the DDG 1000 project. Despite the hurricane, the review was on schedule. An extranet had been deployed to provide support for personnel from the Navy, Ship Systems, and various other suppliers to work together on the system. For the convenience of its far-flung users, the servers supporting DDG 1000 had been left running prior to the storm, with last-minute incremental backups transported to a vault several miles inland. Like the other servers in the Pascagoula data center, these servers had been flooded; while any updates since the last backup were lost, the backups in the vaults had not been damaged; they were retrieved and flown to Dallas. Now the system had to be recreated in preparation for the review.

Shawn Richardson, a Systems Administrator Level II at Ship Systems, was one of those assigned to get the extranet running. He had relocated to Dallas as he described:

⁹ Pinning, or pin-to-pin, allows BlackBerry users to communicate with each other directly by keying in the eight digit identification number of one another's BlackBerry.

¹⁰ The Pascagoula shipyard reopened for normal operations on September 12th, two weeks after the hurricane had struck.

My wife and I had evacuated to a friend's house in Jackson, Mississippi. The call came in on Tuesday that the data center was gone and that it would be helpful if I could come to Dallas. The next day my wife went to stay with her family, and I drove to Dallas. Three of us arrived there at 3pm on Wednesday and we hit the ground running. We did nothing but work. In two weeks, I worked 220 hours. I hate to admit it, but it was the most fun I have ever had as an IT person. We had seven days to stand the system up¹¹. With help from folks from other sectors, we did it in six.

The DDG 1000 extranet recovery and review had been successful, but Richardson and his colleagues' work had just begun. Getting other servers and critical applications working was an immediate requirement. Many essential applications were up and running almost immediately (see Exhibit 5 for application recovery status as of September 10, 2005). Many of these had been previously migrated to the Dallas mainframe, but there were still challenges in making them operational. One crucial application was payroll.

XVII. MEETING PAYROLL

Gary Broome's job at Ship Systems was payroll, a responsibility he shared with another software engineer, and several people from the finance office. On Tuesday afternoon, several of them met at a house in Pascagoula. Broome recalled:

It was now clear to us how serious this was; people would need money now more than ever before. We had joked about what we would do if the big one came and wiped out our operations in Pascagoula and New Orleans. 'Go to Dallas,' we had said with a laugh. Well here it was, and we knew that was exactly what we had to do. Early the following morning, Wednesday the 31st, we met to fly to Dallas. Two of our guys were down at the shipyard and we sent someone down to kidnap them. Then we flew out of Trent Lott field. When we walked off the corporate jet in Dallas later that morning, I was still wearing my shorts, t-shirt, and sandals.

Fortunately, the payroll application had been previously migrated to a Dallas mainframe. Broome and the crew logged on to the system and began running the various computer jobs related to payroll. Since they did not have the actual hours of labor that many employees had worked the previous week, they had to do a variety of workarounds; workarounds that would later need to be accounted for or reversed.

The following morning, checks in hand, they returned to Pascagoula; the checks were distributed on Friday, only one day late.

All employees were given two weeks of pay plus, for those who were able to work, additional pay for hours worked on cleanup and recovery operations. Northrop Grumman also established an assistance fund for employees enduring hardships. Many employees also donated accrued vacation days to those still unable to work¹².

Payroll checks were helpful, but food, fuel, and materials soon were in short supply; so too was cash, as Broome explained:

¹¹ He refers to the extranet supporting the DDG 1000 project.

¹² By October 13th, 2005, a Northrop Grumman corporate press release announced that 12,500 employees from its Ship Systems sector had returned to work, 3,400 employees were on approved leave, 3,400 others had contacted the company, and 500 remained unaccounted for.

People got their checks but, if they were not direct deposited, it was hard to find a place to cash them. And, if you had money in the bank, you could only withdraw \$200 a day. I was fixing my place up; on some days I could have used a \$1,000 or more for construction materials. Building supplies were also in short supply. Many days I would go to Lowe's or Wal-Mart more than one time, looking for something. You had to be there when things came in or you didn't get them.

XVIII. REBUILDING THE DATA CENTER

While many Ship Systems applications had been migrated to a Dallas data center over the previous years, 189 servers lay destroyed in the Pascagoula yard. The sector's business continuity plan had called for the Pascagoula and New Orleans data centers to serve as emergency back-ups for one another¹³. This was now impossible. The Pascagoula data center would need to be recreated, but in Dallas, not Pascagoula.

Northrop Grumman already had a facility in Dallas big enough for the new data center; it would need to be outfitted with necessary technology. The day after the storm, suppliers were contacted, as Shelman recalled:

I called the suppliers on Day One and told them, 'You know what you've sold us for that facility. Reorder it all.' We wanted to get those orders in quickly. Our contracts with the suppliers call for guaranteed hot shipments, but if the damage was as widespread as I feared, the suppliers would be looking at a huge backlog of orders. How could they fill everyone's demand?

Pallets of servers soon began to arrive and fill the huge room that would become the new data center. People, temporarily reassigned from other sectors, had joined Richardson and several others now relocated from the Gulf Coast. Vendor personnel also rolled up their sleeves and pitched in. Chris Morrison, a Primary Systems Analyst, was one of those who had relocated to Dallas. He described his involvement in the recovery:

I got the call Wednesday, asking me to come to Dallas. We had returned to our house and found it uninhabitable. We got on the corporate plane and flew to Dallas. At first, there was a lot of confusion—what needed to be restored, and in what order. We got some hardware up and running pretty quickly, and then began to load the systems. But lot of the knowledge required to get us running hadn't been documented or, if it had, the documentation was in a flooded drawer in Pascagoula. It had to be retrieved from people's heads or recreated. Assumptions we made about certain things being available, things like licenses, product keys, and so on, proved unrealistic. We needed stuff we had never even thought of.

The need to quickly get systems up created new problems as Morrison described:

The servers came in before the racks, so we assembled them on portable tables. When the racks arrived, after the systems had gone live, we had to wait for an outage window to rack them. But, engineers were working in three shifts of 12 hours. There were very few outage windows. Cable management was a mess; we had cables spilling out of the back of the racks rather than going through cable management arms. For reliability, we also needed servers on redundant networks but, because of the need to get us working, we left that work for later. Our servers also had to eventually be configured so systems administrators in

¹³ Northrop Grumman business continuity planning guidelines at the time required that data centers designated as backup sites be at least 100 miles distant from the site they were backing up.

Pascagoula could remotely manage them. Again, that work mostly had to be done after the fact, and during outage windows. And, as more and more systems came online, we began fielding more and more of the usual maintenance requests.

That meant long hours and Sundays in the data center. In December, most of the people who had relocated to Dallas from the Gulf Coast returned home. Morrison and Richardson, who had little to return to, had stayed on in Dallas with their families. Nearly a year after the hurricane, they were still dealing with some aspects of the recovery and still working long hours and six-day weeks.

XIX. NEW ORLEANS RECOVERY

The IT damage in New Orleans was less severe and the recovery less complicated. Lonnie Frazier and his colleagues quickly got three AC units back up in the server room, all powered by generators. Fuel was not an issue, as they had recently filled their in-ground fuel tanks; a vessel in the port was also fully fueled with diesel fuel. Extra fuel capacity had even proven useful in trading with the power company for new transmission poles.

At their request, the Dallas command center sent in network and telecommunications support in the first few days. Also in the first week, a caravan of vehicles arrived with essential supplies including satellite phones; by September 3rd, a satellite dish had been flown in and installed at the yard. The New Orleans office also had been piloting with Voice over IP (VOIP) prior to the storm, as Frazier explained:

We had about thirty purple boxes in a back closet for this VOIP project that we were trying out within IT. We were having some problems getting them configured and, within a minute or two, Dallas had someone on the line to help us. We couldn't configure them to go through the local PBX, so, while we were still on the phone, the folks up in Dallas gathered their IP phones and started configuring them for us. The next day they sent them down--we all had a Dallas exchange.

XX. CONCLUSION

For Tom Shelman, the primary lesson from the Katrina experience revolved around people:

I woke up that day thinking it was about computers and systems, but a few hours later, I knew it was more about the people. I had never lived though hearing stories of people living out of their car, having their home washed away, or using their last gas to drive to the shipyard rather than to power the generator that was supporting their family. I had never witnessed the real power of people in this way. No one said that's not my job. People offered to drop everything...and did...to go help their fellow employees. It was an honor to lead them through the recovery, to show them that our company really supports them above and beyond the paycheck, and to realize that taking care of our employees is [the] most important [thing] to achieve full recovery of operations--which we accomplished two weeks from the day the hurricane struck.

ACKNOWLEDGEMENTS

We would like to thank the many people at Northrop Grumman who gave up their time to help us document this one small slice of the Herculean recovery effort they each contributed to.

REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that

1. these links existed as of the date of publication but are not guaranteed to be working thereafter.
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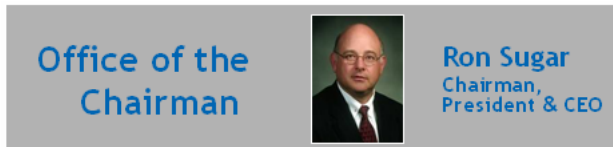
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EXHIBIT 1: NORTHROP GRUMMAN CORPORATION FINANCIALS

(\$ in million, except per share)	2005	2004	2003	2002	2001	2000
Revenue	\$30,721	\$29,853	\$26,396	\$17,206	\$13,012	\$7,618
Operating margin as percentage of revenue	7.1%	6.7%	5.9%	8.1%	7.9%	14.4%
Income from continuing operations	1,383	1,093	808	697	459	625
Diluted earnings per share form continuing operations	3.81	2.99	4.32	5.72	5.17	8.82
Cash from operations	2,627	1,936	798	1,689	817	1,010
Net debt	3,540	3,928	5,539	8,211	5,024	1,296

EXHIBIT 2: NORTHROP GRUMMAN BUSINESS SECTORS



Eight Operating Sectors

Electronic Systems	Information Technology	Mission Systems	Integrated Systems	Technical Services	Newport News	Ship Systems	Space Technology
Radar Systems C4ISR Electronic Warfare Navigation & Guidance Military Space Homeland Defense Naval Systems	C4ISR Government IT Infrastructure Science & Technology Information Security/Assurance Enterprise Solutions Homeland Security	Command, Control and Intelligence Digitized Battlefield ICBM Systems Management Missile Defense BMC3 Defense Software Application Development Information Warfare	Large Scale Systems Integration C4/ISR Unmanned Systems Airborne Ground Surveillance / C2 Naval BMC2 Global / Theater Strike Systems Electronic Combat Operations	Provides Life Cycle Solutions & Foundations for Long Term Technical Services Logistics Support Provide Support Services for Northrop Grumman OEM Products	Naval Systems Integrator Nuclear Aircraft Carriers Nuclear Submarines Fleet Maintenance	Naval Systems Integrator Surface Combatants Amphibious Ships Auxiliary Ships Patrol Craft Marine Composite Technology	ISR Satellite Systems Missile Defense Satellite Systems MILSATCOM Systems Environmental & Space Science Satellite Systems Software Defined Radios Directed Energy Systems

EXHIBIT 3: PRESS RELEASE ON AUGUST 30TH, 2005

NORTHROP GRUMMAN UPDATING EMPLOYEE WORK SCHEDULE INFORMATION AFTER HURRICANE KATRINA

Editor's Note: Due the scarcity of landline telephone service and electricity in the area, Northrop Grumman requests that you share the work schedule updates and information hotline number contained in this advisory on your regular broadcasts. Our company and its employees appreciate your assistance in sharing this information. Thank you.

PASCAGOULA, Miss., Aug. 30, 2005 - Northrop Grumman Corporation announces the following work schedule updates for its employees in the Gulf Coast region:

PASCAGOULA / GULFPORT - Both facilities will be closed on Wednesday, Aug. 31. All maintenance, security, test and trials, manufacturing services, resource recovery, yard cleaning, production supervision, ship management and transportation shift employees of the Pascagoula facility should report to work if at all possible. No Gulfport facility employees should report at this time. Personnel should bring their own food and potable water if feasible as shortages currently exist at the facilities. Access to the area may be restricted by regional authorities. Prior to departure, reporting personnel should ascertain whether the facilities will be accessible. An announcement will be made on Wednesday, Aug. 31 with regard to employee work schedules for the remainder of the week after more complete assessments are made of the operational status and material condition of the facilities in Pascagoula and Gulfport.

NEW ORLEANS / TALLULAH - Both facilities will be closed on Wednesday, Aug. 31. All maintenance shift personnel should report to work if at all possible. All reporting personnel should bring their own food and potable water if feasible. Access to the area may be restricted by regional authorities. Prior to departure, reporting personnel should ascertain whether the facilities will be accessible. An announcement will be made on Wednesday, Aug. 31 about employee work schedules for the remainder of the week.

If necessary, additional adjustments in facilities operations and employee work schedules for the Ship Systems sector will be announced to regional media, and posted on the Northrop Grumman Corporate Information Line, 1-800-995-4318, Option 7.

EXHIBIT 4: PRESS RELEASE ON SEPT 2ND, 2005

MEDIA ADVISORY -- SEPT. 2 UPDATE ON NORTHROP GRUMMAN GULF REGION EMPLOYEE WORK SCHEDULES

Editor's Note: Due to the scarcity of landline telephone service and electricity in the area, Northrop Grumman requests that you share the work schedule updates and information hotline number contained in this advisory on your regular broadcasts. Our company and its employees appreciate your assistance in sharing this information. Thank you.

PASCAGOULA, Miss., Sept. 2, 2005 -- Northrop Grumman's Ship Systems sector is in recovery mode. Critical supplies for recovery of operations and support to personnel have flowed into company facilities over the last 24 hours. All facilities are making progress in damage assessment, clean-up and restoration of capabilities. Of highest priority are the direct support of company personnel and the restoration of shipbuilding operations. The sector is experiencing progress in virtually all areas to bring its operations on-line.

As needed, over the weekend updated information for facilities operations and employee work schedules will be announced to regional media, posted on the company homepage (northropgrumman.com) and updated on the company Information Line (800) 995-4318.

Northrop Grumman announces the following work-schedule and Ship Systems payroll updates followed by benefits and relief information for employees in the Gulf Coast region.

PASCAGOULA / GULFPORT:

- Both facilities will be closed for normal production through Monday Sept. 5.
- For Gulfport, maintenance personnel should report to work over the weekend for 7 a.m. to 6 p.m. shifts.
- For Pascagoula, the following employees should report to work over the weekend, if possible, for 7 a.m. to 6 p.m. shifts: all facilities and ship cleaners, facilities engineering, security, test and change-order electricians, test and trials, safety, production supervisors, crafts supervisors, manufacturing services, resource recovery, yard cleaning, production supervision, ship management, inside and outside machinists, carpenters, rigging, production control, and transportation shift employees.
- Reporting personnel should bring their own food and potable water if feasible due to current shortages.
- An updated announcement will be made over the weekend about work schedules for next week.

NEW ORLEANS / TALLULAH:

- Both facilities will be closed for normal production through Monday, Sept. 5.
- Maintenance and security shift personnel should report to work if possible. Reporting personnel should bring their own food and potable water due to current shortages and should be prepared to stay overnight.
- Access to the area may be restricted by regional and national authorities. Reporting personnel should ascertain prior to departure whether the facilities will be accessible.
- An updated announcement will be made over the weekend about work schedules for next week

NORTHROP GRUMMAN INFORMATION TECHNOLOGY EMPLOYEES

- Northrop Grumman IT sector Gulf Coast employees who have not checked in with their supervisors should do so immediately or contact the IT sector's HR customer care center at (800) 604-4890 or HRCustomerCareCenter@ngc.com.
- Internal Information Services¹⁴ employees in the Gulf Coast region should expect to work remotely, or be available for possible transport. IIS employees should call (972) 946-9330 or mechelle.callahan@ngc.com.

Company Payroll Update

The company has taken steps to provide compensation to the sector work force this week. Employees with direct deposit were paid. Live checks were distributed to Pascagoula and Gulfport employees today. New Orleans is waiting for improved security conditions in the region before distributing checks. Personnel who did not receive checks today should monitor the company information line at (800) 995-4318. The company is pursuing an alternate approach with Western Union. Updates will be provided as available.

Operational branches of Hancock Bank and Wal-Mart stores will cash payroll checks as follows:

¹⁴ Internal Information Services was renamed as IT Solutions in March, 2006.

-- Hancock Bank is open Friday, Saturday, Sunday AND Monday from 9 to 4.

-- Wal-Mart stores will cash checks under these conditions:

- Must be a preprinted payroll check
- You must bring state-issued ID
- The limit is \$1,000 per employee in a seven day period

and you will pay a \$3 service fee

Company Benefits Center & Savings Account Line to Remain Open Labor Day Weekend

-- The Northrop Grumman Benefits Center will be open Saturday through Monday to provide assistance with health issues, including prescription refills or medical pre-certifications and pension-related inquiries, including check replacement. Representatives will be available from 9-5 Eastern Time all three days. Please call (800) 894-4194.

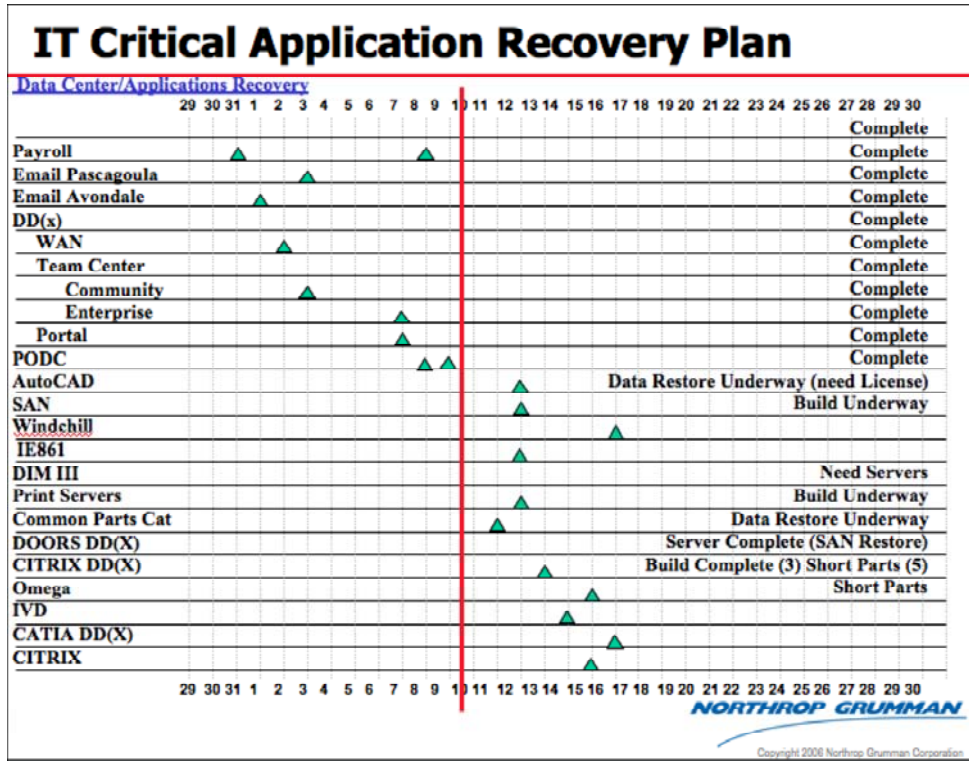
-- Savings Account Line representatives can respond to questions regarding savings plan loans or hardship withdrawals. Representatives will be available from 9-5 Eastern Time all three days. Please call (800) 676-7211.

Northrop Grumman Employee Disaster Relief Fund Available

Direct assistance to Northrop Grumman employees impacted by Hurricane Katrina will be provided through the new Northrop Grumman Employee Disaster Relief Fund, established by The Northrop Grumman Foundation. Affected employees may apply for funds by calling toll free (888) 642-5645.

As needed, over the weekend updated information for facilities operations and employee work schedules will be announced to regional media, posted on the company homepage (northropgrumman.com) and updated on the company Information Line (800) 995-4318.

EXHIBIT 5: RECOVERED APPLICATION STATUS ON NOVEMBER 10TH, 2005



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