

Emergency Response Facility

CIS

a Catalyst for Change

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Emergency Response Facility as
a
Catalyst for Change

by
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A THESIS IN ARCHITECTURE

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Table of Contents

Abstract	4
Theoretical Basis	5
Architectural issues	7
Potential design response	10
Facility Program Description	11
Facility Analysis	13
Issue – Circulation	13
Case Studies	16
Fire station no. 1 – Plano, Texas	16
Station No. 4 – Lexena, Kansas	17
Spatial Analysis	18
Adjacency matrix	59
Contextual Description	61
Contextual Issues	63
Wind resistance	63
Flood resistance	67
Site analysis	70
Space Summary	71
Space summary	73
Bibliography	76
Bibliography	78

A b s t r a c t

Statements

Thesis Statement:

Architecture can be a tool to educate people on social issues. It can be used as a catalyst to promote new ideas, and instigate actions from the general populous. In this instance, it can show that through the use of new ideas and technologies, people can be safe in a devastating hurricane without having to evacuate.

Facility Statement:

The project is an Emergency Response Facility in New Hanover County, North Carolina. It will function as a four company fire station most of the time. It will have approximately 60 employees in 24,000 SF of space.

The New Hanover County area has the distinction of having been hit by more devastating hurricanes than anywhere else in the United States. Surprisingly enough though, the region does not have a single facility to help in search and rescue missions after one of these monster storms.

The prime directive is to make this facility functional at ALL times, even if just about every other structure has been destroyed. In order to achieve this goal, it is necessary to implement some new ideas about how to construct hurricane resistant buildings, which will act as a catalyst to educate the industry on hurricane design.

This is the reason that this facility is not only an Emergency Response Facility, but also a set of government offices on disaster research. In creating a single building for the policy makers and the policy enforcers, it is believed that the public will more easily see the progress being made in disaster research, specifically hurricane resistant design.

Context Statement:

The contextual response should be to minimize the effects of a hurricane on the facility itself. The building should also be easily distinguished from the other buildings in the area by articulating the technologies that drive the design.



Theoretical Basis

1875

1875

1875

1875

1875

1875

Architectural Issues

Appearance

Goal:

Make the building appear as though it can survive a hurricane

Performance Requirement #1:

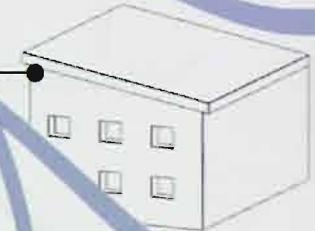
Opacity

The building will appear to more resistant to high winds if opaque materials are used.

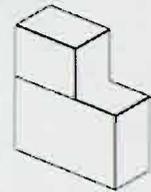
Apparatus bay doors need to look secure.



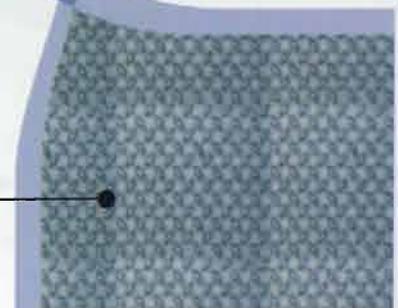
"Small" windows should be used. This doesn't necessarily mean to literally make windows small. One way glass could be used to make building appear as though it has less windows.



Heavy looking materials should be used.



Materials that are perceived to be strong such as steel or concrete should be used and expressed on the exterior.



Architectural Issues

Appearance

Goal:

Make the building appear as though it can survive a hurricane

Performance Requirement #2:

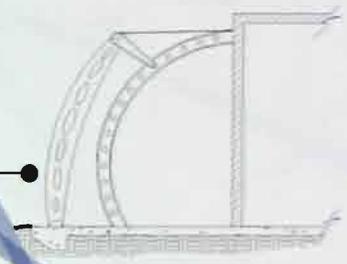
Articulated connections

The structural connections of the building should be articulated and expressed to the exterior of the building.

Expose all hurricane resistant connections.

Enhance the visual appearance of the connections. This will mean that each connection will need to be designed to tie in with the overall design of the building.

Use color to draw attention to the connections.



Architectural Issues

Appearance

Goal:

Conceal damage that does afflict the building.

There is bound to be cosmetic damage to the building after a hurricane. These flaws should be concealed.

Performance Requirement #1:

The use of impact absorbent materials.

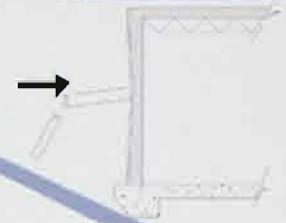
Materials that absorb the forces from missile impacts should be used.

Performance Requirement #2:

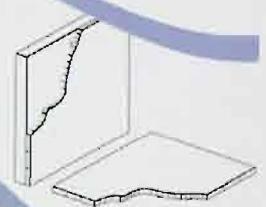
Color of materials

The colors of the materials should be carefully chosen so as to reduce the appearance of the damage.

Use materials that will deform rather than break upon the collision of a missile. In other words the facade should "dent".



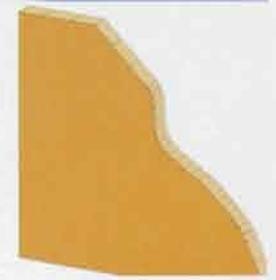
If a material does break, then it should break as one piece so as to reduce the size of rubble piles.



Light colors should be used because they show damage less readily.



Materials that are consistent in color throughout should be used.



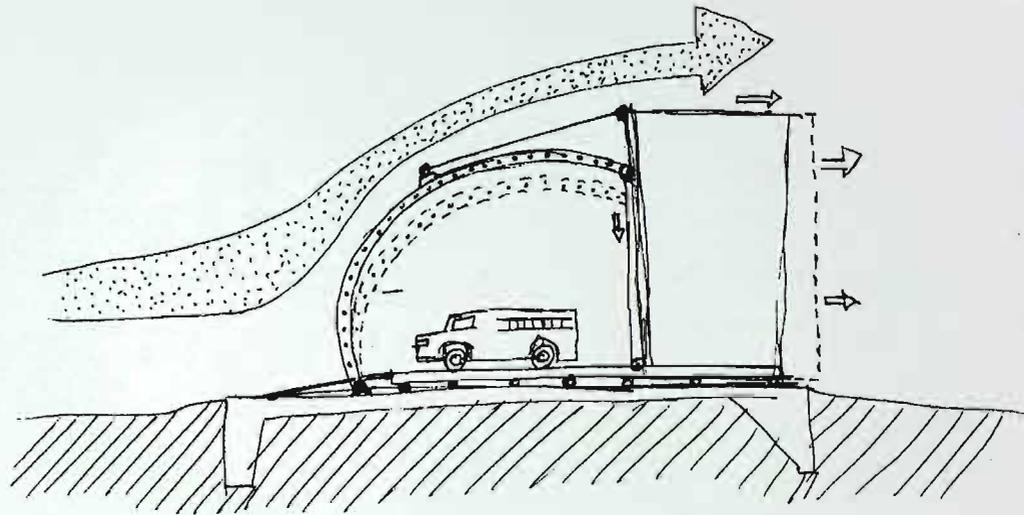
Potential Design Response

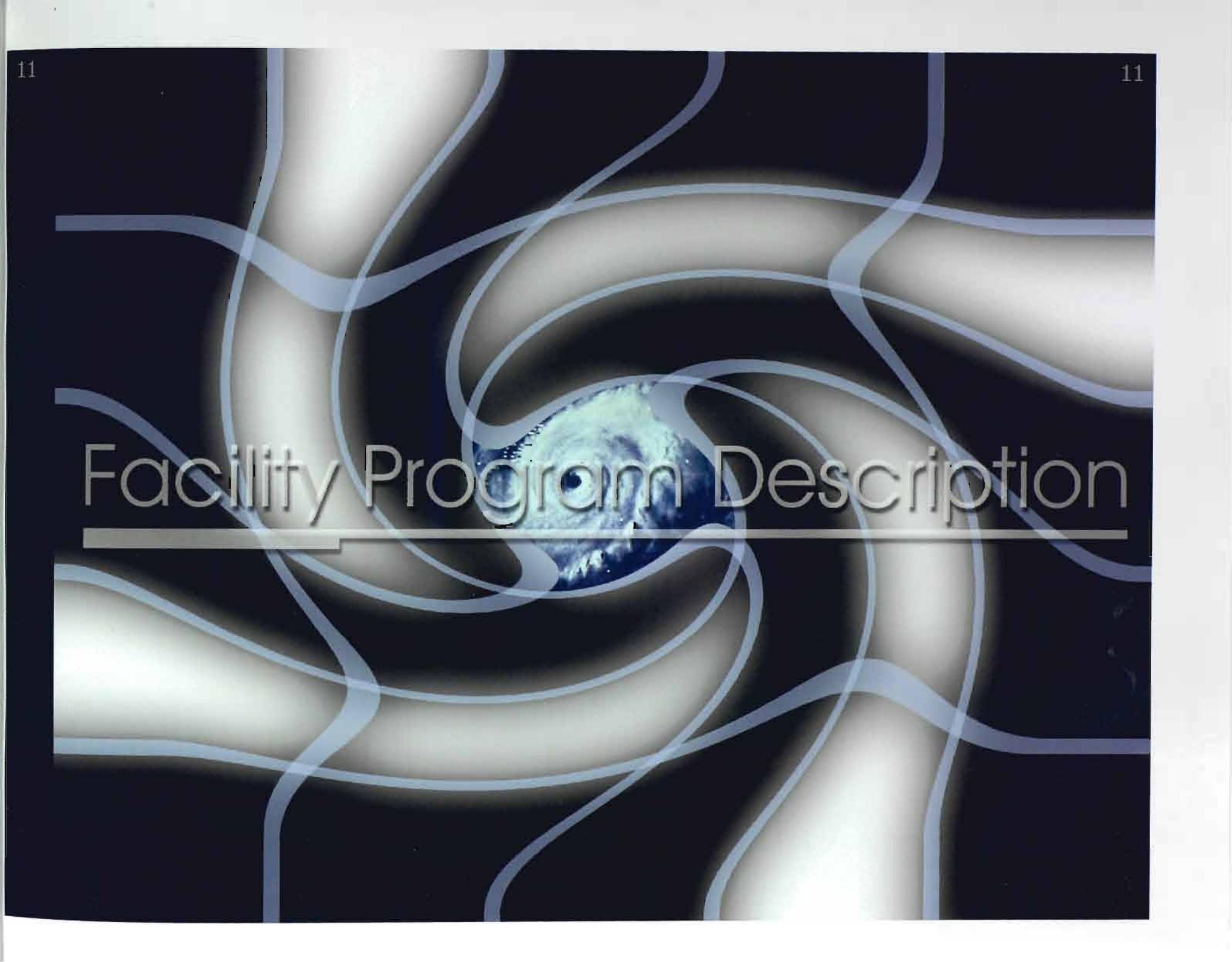
Dynamic Machine-building

The application of dynamically moving parts in the building will not only add visual interest but will also create a unique solution for canceling the forces due to wind. By allowing the building to "flex" a few inches in any direction, it will not collapse under the enormous pressures imposed by hurricane force winds.

This flexing will require pin joints at many key points in the design. In addition the entire building could be on a "roller" system similar to that found in earthquake resistant buildings. To keep the building from being blown right off its foundation, there will be key structural elements that will remain stationary and resist the wind. Elastic cables could be tied to these structural elements to stop the motion from the wind at a certain predetermined distance.

By incorporating this radical design approach, the designer hopes to part from the myth that in order to survive a windstorm, one must be in a concrete bunker under the ground. This design response would show that the same could be accomplished with a much lighter, skeletal structure.



A central image of the Earth is surrounded by a complex, abstract pattern of glowing blue, wavy lines that create a tunnel-like effect. The lines are semi-transparent and overlap, giving a sense of depth and movement. The background is dark, making the glowing lines and the Earth stand out.

Facility Program Description

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud.

The second part of the document outlines the specific procedures for recording transactions. It details the steps involved in the accounting cycle, from identifying the transaction to posting it to the appropriate ledger account.

The third part of the document discusses the importance of reconciling accounts. It explains how regular reconciliations help to ensure that the books are balanced and that any discrepancies are identified and corrected promptly.

The fourth part of the document discusses the importance of maintaining accurate records of all assets and liabilities. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud.

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Facility Analysis

Issues: Circulation

Goal:

Achieve maximum temporal efficiency in circulation for the personnel.

It is of extreme importance that the personnel circulation patterns are extremely efficient, because in times of emergency, seconds can mean the difference between life and death.

Performance Requirement #1

Areas of primary adjacency must be grouped together.

There are several spaces that must be near each other in order to reach maximum efficiency.

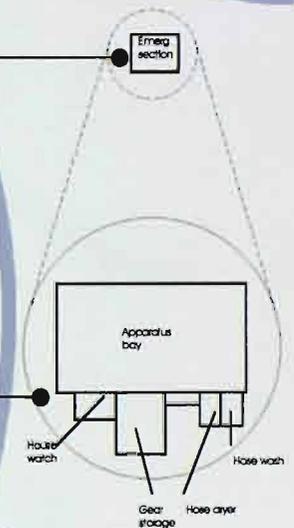
Performance Requirement #2

There will be differing scales of adjacency.

This will make communication and teamwork between different disciplines possible.

Various general areas need to be grouped together.

Certain individual spaces need to be near each other.



Facility Analysis

Issues: Circulation

Performance Requirement #3

The facility will be "two" fire stations.

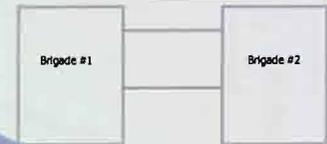
The two brigades shall be divided into separate apparatus bays with common areas between them. This will effectively reduce the distance to the apparatus bays from other areas of the building.

Performance Requirement #4

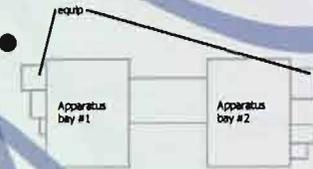
Informal communication will be promoted.

By having only one of each of the common spaces for both of the brigades, communication between the brigades will be heightened. This will allow the brigades to exchange "war stories" and learn from each other's mistakes.

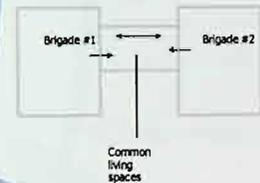
Each two company brigade will have it's own apparatus bay and crew quarters.



Each apparatus bay will have its own equipment and supplies.



The two brigades will share common living facilities.



Facility Analysis

Issues: Circulation

Goal:

Achieve maximum efficiency in circulation for the vehicles

It is of extreme importance that the vehicle circulation patterns are extremely efficient, because in times of emergency seconds can mean the difference between life and death.

Performance Requirement #1

The emergency vehicles must be able to egress without running into any obstructions.

This will help prevent vehicular accidents.

Performance Requirement #2

The emergency vehicular circulation patterns must not interfere or cross the personnel circulation patterns.

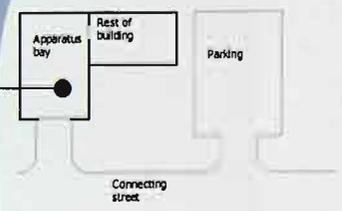
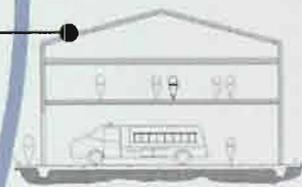
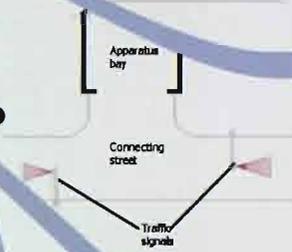
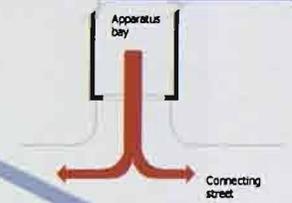
This will eliminate accidents as well as speed response.

Direct vehicular access to the adjacent street.

A system should be implemented to warn oncoming traffic on the adjacent street that an emergency vehicle is about to exit.

Emergency vehicles should be on a different floor level than the major personnel spaces.

The employee parking lot should be distant from the apparatus bay.



C a s e S t u d i e s

Fire Station No. 1

This is the new main fire station and Fire administration complex for Plano, Texas, a suburb north of Dallas. It skillfully departs from the local vernacular of mostly vacant storefronts, while still hinting at it through the gable shapes. It has been designed as two wings, the fire station and the administrative wing. The administrative wing is angled from the fire station to take advantage of site circulation issues. The main public entrance to the building is between the fire station and the administrative wing where the two grids collide. ("Fighting Fire with Fire", p39)

- Project:** Fire Station No. 1 and Administrative Building
- Client:** City of Plano, Texas (Fire Department)
- Architect:** Phillips Swager Associates, Dallas
- Completed:** 1994
- Size:** 28,000 SF
- Cost:** \$2.6 million

Exterior view of apparatus bay doors



Interior view of lobby



Floor plan



Exterior view of entrance



C a s e S t u d i e s

Station No. 4

This is a new fire station for Lexena, Kansas. This fire station is designed as one story with multiple access points to the apparatus bays from the living quarters. The most difficult part of designing this fire station, according to the architect, was to keep the apparatus bays from becoming an overpowering element. They kept this from happening by layering the forms and materials and by even giving the mechanical equipment on the roof its own unique form. It has the apparatus bays on one side of the building and the living quarters on the other. The main public entry is in the living quarters section of the facility. (Landecker, p.48-51)

Project: Lexena Fire Department Station No. 4

Client: City of Lexena, Kansas (Fire Department)

Architect: Shaughnessy Fickel and Scott Architects, Inc., Kansas City, Missouri

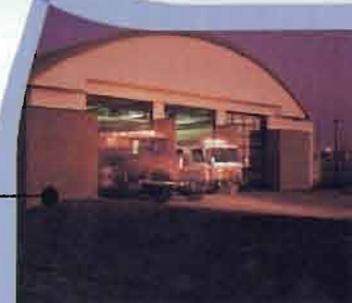
Completed: c. 1991

Exterior view of apparatus bay doors

Interior view of apparatus bay

Floor plan

Night time view of apparatus bay doors



Spatial Analysis

Apparatus Room

Space: Apparatus Room

Activities: Movement of personnel to vehicles from adjacent spaces
Movement of emergency vehicles to and from emergency situations
Cleaning of vehicles
Minor maintenance
Emergency drills
Educational tours

Character: minimal, efficient space

Users: Firefighters
Vehicle operators
Maintenance personnel

Total Occupancy: N/A

Adjacency: centrally located to minimize distance from dormitory, administrative, and recreation areas

Equipment: Firefighting apparatus
Protective clothing storage

Size: two (2) two company rooms at 2850 SF each. Total of 5700 SF. (Department of the Army, p. 4-5)

Spatial Analysis

House Watch

Space: House watch

Activities: Receives incoming emergency calls from the dispatch and sounds the emergency alarm within the facility
Coordinates vehicle movement into and out of the apparatus room from the adjacent public street

Character: Comfortable, bright space

Users: House watchman
Fire chief

Total Occupancy: 1

Adjacency: Apparatus room
Visual connection to overhead doors

Equipment: Desk with chair
Tack surface
Counter with alarm and data automation equipment
Water closet
Lavatory

Size: two (2) house watches at 154 SF each for a total of 308 SF (Department of the Army, p. 4-16)

Spatial Analysis

Public lobby

- Space: Public lobby
- Activities: First impression of facility to public
Waiting area for public for such things as fire prevention seminars, etc.
- Issues:
- Character: Dignified space
- Users: General public
- Total Occupancy: 2
- Adjacency: house watch
- Equipment: comfortable seating
coffee table
end table with lamp
information booth
- Size: 300 SF

Spatial Analysis

Gear Storage

Space: Gear storage

Activities: storage and work space for fire extinguisher operations and general equipment maintenance including spare parts and materials

Character: utilitarian space

Users: Fire fighter
Vehicle operator

Total Occupancy: 2

Adjacency: Apparatus room
Exterior

Equipment: Work bench
Storage palette
Hose rack
Storage cabinet
Recharge set
Scale
Air compressor

Size: two (2) gear storage areas at 321 SF each for a total of 642 SF
(Department of the Army, p. 4-20)

Spatial Analysis

Medical supply

Space: Medical supply

Activities: Storage of medical supplies on wall shelving

Character: Utilitarian space

Users: Firefighters
Rescue personnel

Total Occupancy: N/A

Adjacency: Apparatus room

Equipment: wall shelving

Size: two (2) medical supply storage areas at 50 SF each for a total of 100 SF (Department of the Army, p. 4-25)

Spatial Analysis

Chief's suite

Space: Chief's suite

Activities: Administrative office and sleeping quarters for the active chief of the department.
Routine activities include sleeping, eating, if desired, and other day to day activities.
Management of the fire fighting and dispatch centers within the facility

Character: Comfortable, pleasant, professional space

Users: Fire chief of New Hanover County

Total Occupancy: 1

Adjacency: Open to dining area
Near training area
Access to apparatus room

Equipment: Desk with chair
Chair
Bookcase
Filing cabinet
Bed
Locker
Low table
Lavatory
Water closet
Shower

Size: 305 SF (Department of the Army, p. 4-21)

Spatial Analysis

Recreation room

Space: Recreation room

Activities: Relaxation area for all on call staff within the facility
Designated as the social living space.
To be for games, television, and other similar activities

Character: Comfortable, pleasant, fun, bright space

Users: All on call staff

Total Occupancy: up to 24

Adjacency: Other administrative functions
Convenient access for visitors

Equipment: Table with chairs
Sofa
Television
Low table
Armchair

Size: 456 SF (Department of the Army, p. 4-7)

Spatial Analysis

Dormitory

Space: Dormitory

Activities: designated as the area for sleeping shifts and individual needs

Character: Comfortable, pleasant, private space

Users: All overnight on call staff

Total Occupancy: 1

Adjacency: Access to apparatus room
Physical separation from apparatus room.

Equipment: Bed
Locker
Desk with chair
Shower
Lavatory
Water closet

Size: 18 units at 163 SF each for a total of 2934 SF (Department of the Army, p. 4-5)*

*10 SF was added to the Army Corps of Engineers figures for added comfort. 55 SF was added to accommodate a private bathroom. 8 SF was added to accommodate a small closet.

Spatial Analysis

Kitchen

- Space: Kitchen
- Activities: Preparation of meals and snacks for center personnel
- Character: Modest, utilitarian, bright
- Users: All staff on a rotational basis
- Total Occupancy: N/A ?
- Adjacency: Dining area
- Equipment: Sink with disposal
Dishwasher
Range with hood
Refrigerator (one for each shift group)
- Size: 220 SF (Department of the Army, p. 4-13)*
- *30% more space added to accommodate four companies.

Spatial Analysis

Dining

Space: Dining

Activities: Eating of meals and snacks
Informal interaction by the facility's
personnel

Character: Cheerful, bright, comfortable

Users: All staff

Total Occupancy: up to 24

Adjacency: Kitchen
Open to recreation room

Equipment: Tables with chairs

Size: 312 SF (Department of the Army, p. 4-15)*

*56% more space added to accommodate four
companies.

Spatial Analysis

Locker room

Space: Locker room

Activities: Storage of personal items and
protective clothing

Character: Simple, modest, efficient

Users: Firefighters
Rescue personnel

Total Occupancy: 24

Adjacency: Shower room
Apparatus room

Equipment: lockers
benches

Size: Men: 375 SF
Women: 187 SF
Total: 562

Spatial Analysis

Shower room

Space: Shower room

Activities: Washing after an emergency call or drill

Character: Simple, modest, efficient

Users: Firefighters
Rescue personnel

Total Occupancy: 24

Adjacency: Locker room

Equipment: showers
towel racks

Size: Men: 250 SF
Women: 72 SF
Total 322 SF (AGS v.2.0, p. 799)

Spatial Analysis

Training room

Space: Training room

Activities: Training firefighters in classroom setting

Character: Bright, private

Users: Firefighters
chief

Total Occupancy: 24

Adjacency: Convenient to fire prevention office
Storage accessible from training room

Equipment: Tables with chairs
Lectern
Chalkboard
Projection screen

Size: 480 SF for training room and 30 SF for storage for a total of 510SF (Department of the Army, p. 4-17)*

*Square footage increased to accommodate six (6) more tables.

Spatial Analysis

Linen storage

Space: Linen storage

Activities: Storage of all linen goods associated with the center, such as sheets, towels, table cloths, etc.

Character: utilitarian

Users: All staff

Total Occupancy: N/A

Adjacency: central location within living sector

Equipment: wall shelving

Size: 40 SF (AGS v. 2.0, p.786)

Spatial Analysis

Laundry room

Space: Laundry room

Activities: washing of linens and garments

Character: utilitarian

Users: All staff on rotational laundry duty

Total Occupancy: 2

Adjacency: Centrally located within living sector
Linen closet
Mechanical room

Equipment: Benches
High shelf two (2) ft deep for folding
Sink
Four (4) washers
Four (4) dryers

Size: 180 SF (AGS v. 2.0, p.784, 816)

Spatial Analysis

Public restrooms

Space: Public restrooms

Activities: Sanitary and personal hygiene functions

Character: Pleasant, clean

Users: All staff

Total Occupancy: Men - emergency area: 6
Women - emergency area: 2
Men - office area: 6
Women - office area: 6

Adjacency: Emergency area: near living sector
Office area: centrally located

Equipment: Water closets
Urinals (men)
Lavatories
Paper towel dispenser
Coat hooks
Purse shelf (women)

Size: Men - emergency area: 150 SF
Women - emergency area: 104 SF
Men - office area: 150 SF
Women - office area: 210 SF
Total: 614 SF (AGS v. 2.0, p.486, 801)

Spatial Analysis

Weight training room

Space: Weight training room

Activities: Physical training activities of center personnel including use of universal weight training machines

Character: brightly lit, stimulating

Users: All on-call staff

Total Occupancy: Up to 8

Adjacency: Shower room
Near dormitory, but isolated due to noise

Equipment: Weight training equipment
Wall mirror
Stretch rails

Size: 450 SF (Department of the Army, p. 4-19)*

* 125% more space added in order to accommodate four (4) companies and added equipment

Spatial Analysis

General storage

Space: General storage

Activities: Miscellaneous gear and equipment is stored here. For example, air compressor, extras hose, and scales

Character: utilitarian

Users: Maintenance personnel
Fire fighters
Vehicle operators

Total Occupancy: 2

Adjacency: Apparatus room

Equipment: Wall shelves
Wall hooks
Work bench

Size: Two (2) general storage areas at 300 SF each for a total of 600 SF (Department of the Army, p. 4-20)

Spatial Analysis

Hose dryer

Space: Hose dryer

Activities: After return from and operation, the wet hose will be hung up in this space where an automatic dryer will dry the hose to prevent mildew and rot.

Character: utilitarian

Users: Maintenance personnel
Fire fighters
Vehicle operators

Total Occupancy: N/A

Adjacency: Apparatus room

Equipment: Hose drying machine

Size: Two (2) dryers at 60 SF each for a total of 120 SF (Department of the Army, p. 4-24)

Spatial Analysis

Hose storage

Space: Hose storage

Activities: Storage of clean, dry hose for use in future operations

Character: utilitarian

Users: Fire fighters
Vehicle operators

Total Occupancy: N/A

Adjacency: Apparatus room
Hose dryers

Equipment: Hose hooks

Size: Six (6) hose storage areas at 100 SF each
for a total of 600 SF

Spatial Analysis

Hose washer

Space: Hose washer

Activities: Washing of hose after use

Character: utilitarian

Users: Fire fighters
Maintenance personnel

Total Occupancy: N/A

Adjacency: Apparatus room
Hose dryers

Equipment: Hose washing machine

Size: Two (2) hose washers at 100 SF each for a total of 200 SF

Spatial Analysis

Refueling area

Space: Refueling area

Activities: Fueling emergency apparatus for readiness in the event of an emergency

Issues: Must be well ventilated

Character: utilitarian

Users: Apparatus operator
Maintenance personnel

Total Occupancy: 2

Adjacency: Quickly accessible to apparatus room but physically separated

Equipment: fuel pumps

Size: 350 SF

Spatial Analysis

Vehicle Maintenance

- Space: Vehicle maintenance
- Activities: Repair and upkeep of emergency vehicles
- Issues: Must be able to accommodate at least one emergency vehicle
- Character: utilitarian, well lit
- Users: Apparatus operator
Maintenance personnel
- Total Occupancy: 2
- Adjacency: Near apparatus room
- Equipment: fuel pumps
- Size: 800 SF

Spatial Analysis

Conference room

Space: Vehicle maintenance

Activities: general meetings by various personnel to discuss tactics, budgets, schedules, duties, and operations

Issues: Sound reverberation should be limited
Distracting patterns and elements should be avoided
Presentation and other focal areas need to be emphasized though spot lighting
Good ventilation

Character: professional, dignified

Users: All facility personnel

Total Occupancy: 24

Adjacency: Near office spaces

Equipment: Conference table
Chairs
Sink
LCD video projector
Storage cabinet
Storage closet
Side table
Motorized projection screen

Size: 744 SF (AGS v. 2.0, p. 794)

Spatial Analysis

Fire investigation office

- Space: Fire investigation office
- Activities: Branch of fire prevention division which conducts investigations on fires to determine the cause
- Issues: Open plan configuration desirable for interaction between investigators.
- Character: professional, bright, cheerful
- Users: Fire investigators
Fire chief
Chief fire investigator
- Total Occupancy: 6 including secretary
- Adjacency: Chief fire investigator's office
- Equipment: Desks with chairs
File cabinets
Computers
Printers
Telephones
- Size: 1200 SF (AGS v. 2.0, p. 6, 793, 808)

Spatial Analysis

Chief fire investigator's office

Space: Chief fire investigator's office

Activities: office work and decision making of the chief fire investigator

Character: professional, dignified

Users: Chief fire investigator

Total Occupancy: 3

Adjacency: Fire investigation office

Equipment: Desk with chair
Guest chairs
Credenza
Bookcase
Computer

Size: 150 SF (AGS v. 2.0, p. 793)

Spatial Analysis

Fire prevention coordinator's office

Space: Fire prevention coordinator's office

Activities: office work and decision making of the fire prevention coordinator

Character: professional, dignified

Users: Fire prevention coordinator

Total Occupancy: 3

Adjacency: Fire investigation office

Equipment: Desk with chair
Guest chairs
Credenza
Bookcase
Computer

Size: 150 SF (AGS v. 2.0, p. 793)

Spatial Analysis

Personnel office

- Space: Personnel office
- Activities: Concerned with staffing the emergency response center and all other fire stations in New Hanover county
- Character: professional, dignified
- Users: Personnel manager
- Total Occupancy: 3
- Adjacency: In office sector
- Equipment: Desk with chair
Guest chairs
Credenza
Bookcase
Computer
- Size: 150 SF (AGS v. 2.0, p. 793)

Spatial Analysis

Project Impact office

Space: Project Impact office

Activities: Development of mitigation strategies
for the county
Development of relief effort
strategies

Issues: Open plan configuration desirable
for interaction between
thinkers

Character: professional, bright, cheerful

Users: Personnel manager

Total Occupancy: 6 including secretary

Adjacency: In office sector

Equipment: Desks with chairs
File cabinets
Computers
Printers
Telephones

Size: 1200 SF (AGS v. 2.0, p. 6, 793, 808)

Spatial Analysis

Project Impact coordinator's office

Space: Project Impact coordinator's office

Activities: Decision making of Project Impact coordinator

Character: professional, dignified

Users: Personnel manager

Total Occupancy: 3

Adjacency: Project Impact office

Equipment: Desk with chair
Guest chairs
Credenza
Bookcase
Computer

Size: 150 SF (AGS v. 2.0, p. 793)

Spatial Analysis

Director's office

- Space: Director's office
- Activities: coordination of all departments within the facility
- Character: Executive, professional, dignified
- Users: Facility director
- Total Occupancy: 4
- Adjacency: In office sector
- Equipment: End table
Lounge chair
Armchairs
Desk with chair
Computer
Credenza
Coffee table
Sofa
Executive storage unit
- Size: 300 SF (AGS v. 2.0, p. 793)

Spatial Analysis

Copy room

Space: Copy room

Activities: Reproducing of documents

Character: utilitarian

Users: All office personnel

Total Occupancy: 2

Adjacency: In office sector

Equipment: Copy machine
Storage
Table w/ office supplies

Size: 100 SF

Spatial Analysis

Office supply storage

Space: Office supply storage

Activities: Storage of office supplies

Character: utilitarian

Users: All office personnel

Total Occupancy: N/A

Adjacency: In office sector

Equipment: wall shelving

Size: 26 SF

Spatial Analysis

Emergency rescue operations center

Space: Emergency rescue operations center

Activities: Coordination of mass rescues in
the event of a natural disaster
Communications with dispatch
room for directions on relief
efforts
Communication with city officials
for updates on ongoing efforts

Character: Hi-tech, efficient

Users: Command operators
Fire chief
Facility director

Total Occupancy: 10

Adjacency: Dispatch room
Isolated from all other spaces,
but near office sector

Equipment: Computers
Tables with chairs
Writable walls
Television monitor

Size: 1900 SF (AGS v. 2.0, p. 6, 793, 808)

Spatial Analysis

Operations Center
conference room

Space: Operations Center conference room

Activities: Meetings to discuss plans of action
in times of disaster

Character: professional, dignified, hi-tech

Users: Emergency rescue operations center
staff
Mayor
Government officials

Total Occupancy: 30

Adjacency: Operations center

Equipment: Conference table
Chairs
Sink
LCD video projector
Storage cabinet
Storage closet
Side table
Motorized projection screen
Video monitors
Video cameras (for video
conferencing)

Size: 816 SF (AGS v. 2.0, p. 794)

Spatial Analysis

Care flight helicopter
landing pad

Space: Care flight helicopter landing pad

Activities: Traffic of rescue helicopters primarily
in times of natural disaster

Character: utilitarian

Users: Government officials
Mayor
Pilots
Air traffic controller
Rescue personnel

Total Occupancy: N/A

Adjacency: Easily viewed from house watch

Equipment: Helicopter

Size: 2200 SF

Spatial Analysis

Boat storage

Space: Boat storage

Activities: place to store emergency boats in
non emergency situations
Entrance and exit of emergency
boats in times of extreme
flooding
Maintenance of boats

Character: utilitarian

Users: Apparatus operators
Firemen
Maintenance personnel

Total Occupancy: N/A

Adjacency: Easily accessible to apparatus
room

Equipment: Tools

Size: 2200 SF

Spatial Analysis

Mechanical equipment

Space: Mechanical equipment

Activities: Endose HVAC equipment, water heater, electrical panels, and telephone backboard

Character: utilitarian

Users: Maintenance personnel

Total Occupancy: N/A

Adjacency: Laundry room
Exterior

Equipment: HVAC equipment
Electrical panels
Telephone switchboards

Size: 258 SF (Department of the Army, p. 4-25)*

*Additional square footage added to accommodate additional building area

Spatial Analysis

Janitor's closet

- Space: Janitor's closet
- Activities: Storage of mops and cleaning supplies and provision for service sink
- Character: utilitarian
- Users: Janitorial staff
- Total Occupancy: N/A
- Adjacency: None
- Equipment: wall shelving service sink
- Size: 24 SF (Department of the Army, p. 4-25)

Spatial Analysis

Emergency generator

Space: Emergency generator

Activities: Provides emergency power in the event of a power outage

Character: utilitarian

Users: Maintenance personnel

Total Occupancy: N/A

Adjacency: Mechanical equipment

Equipment: emergency generator

Size: 100 SF

Spatial Analysis

Parking

Space: Parking

Activities: storage of vehicles when occupant is in facility

Character: Green, well lit

Users: All occupants

Total Occupancy: N/A

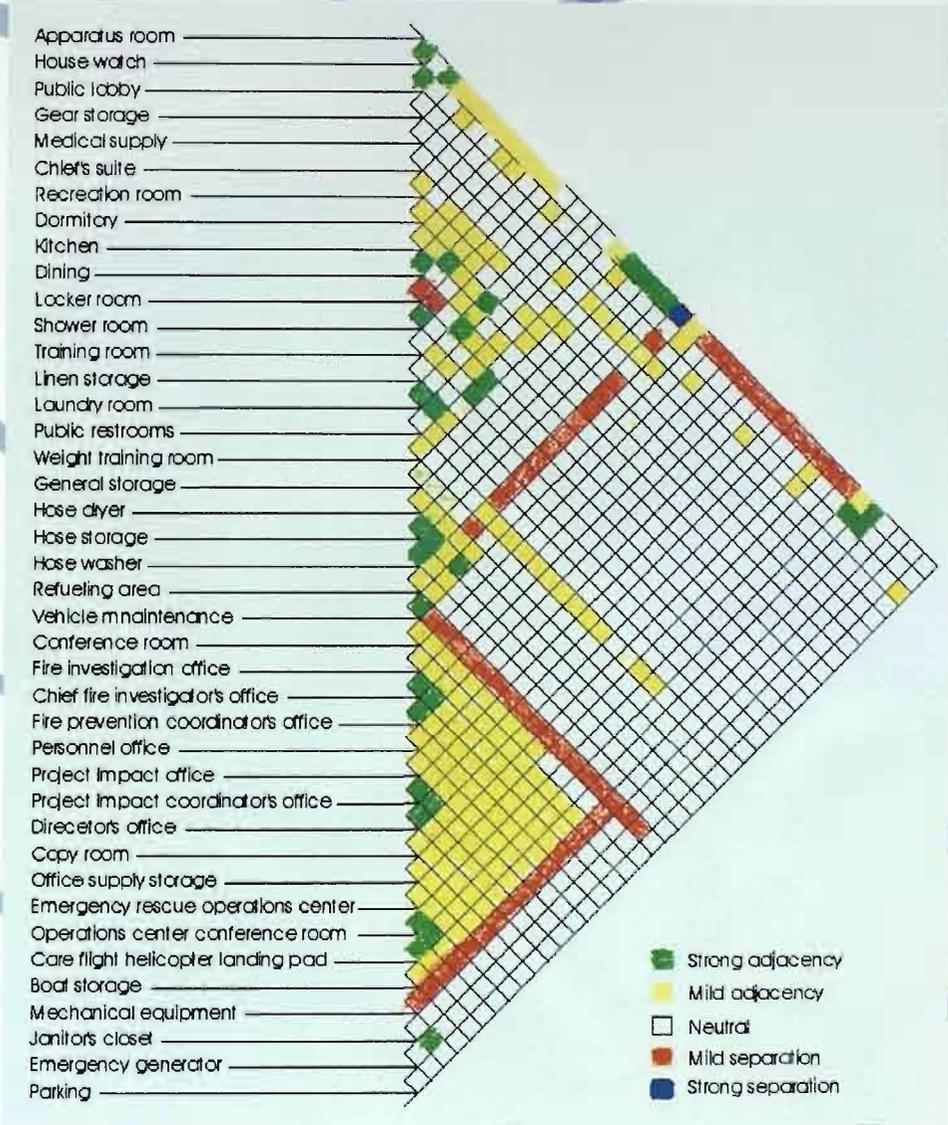
Adjacency: Back of facility but separate from apparatus bay driveways

Equipment: Halogen lighting ballasts

Size: 57 employee spaces + 5 public spaces = 62 spaces

Spatial Analysis

Adjacency Matrix





Contextual Description

There is a very small amount of

water

in the ground

Contextual Issues

Issue: Wind resistance

Goal:

Minimize the forces due to the wind. This is the most straightforward way of reducing the damage to the facility during a hurricane

Performance Requirement #1:

Minimize the surfaces that are exposed to the wind

Since the majority of the wind loads during a hurricane are in the horizontal direction it stands to reason the minimizing the surfaces that are exposed to these winds would reduce damage.

Performance Requirement #2

The application of aerodynamic principles

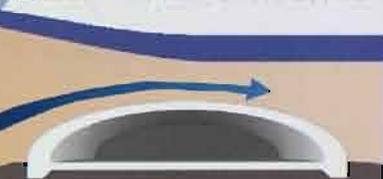
If the wind cannot push against an object then it cannot destroy it. The principles of aerodynamics require that as much wind be directed around an object as possible, therefore alleviating damaging forces.

By keeping the vertical surfaces to a minimum the wind has less surface area to act on (Melaragno)

The building must be low to the ground so there is little vertical surface area for the wind to act upon (Melaragno)

Acute angles will effectively cut the wind around the building (Melaragno)

Sloping walls redirect the wind up and over the structure (Melaragno)



Contextual Issues

Issue: Wind resistance

Goal:

Minimize differences in pressure between the inside and outside.

Pressure differentials are a cause of roof and wall failures, so it stands to reason the equalizing the pressure would reduce the damage.

Performance Requirement #1:

'Holes' in the building

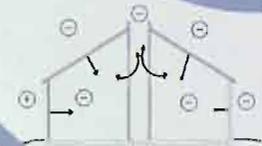
Rather than having an air tight building envelope, holes should be provided to allow air to escape. This will help to equalize the pressures.

Performance Requirement #2

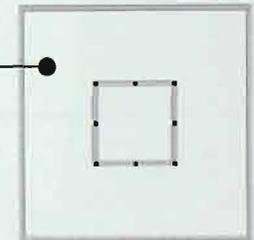
'Smart Vents'

Computer controlled sensors could detect a change in atmospheric pressure, which in turn would actuate a series of pumps to expel air from the building.

An open 'chimney' will equalize pressures (Gandemer, p. 1405)



A courtyard open to both the inside and outside may help to maintain pressure equilibrium



Contextual Issues

Issue: Wind resistance

Goal:

Minimize damage due to missile impacts

Missiles driven by winds in excess of 100 mph are a major factor in building damage and loss of life in a hurricane. Therefore, it is imperative to minimize the effects of these missiles.

Performance Requirement #1:

Rigid exterior envelopes

Through the use of rigid material on the exterior of the building missile penetration will be minimized.

Performance Requirement #2

Absorbent exterior materials

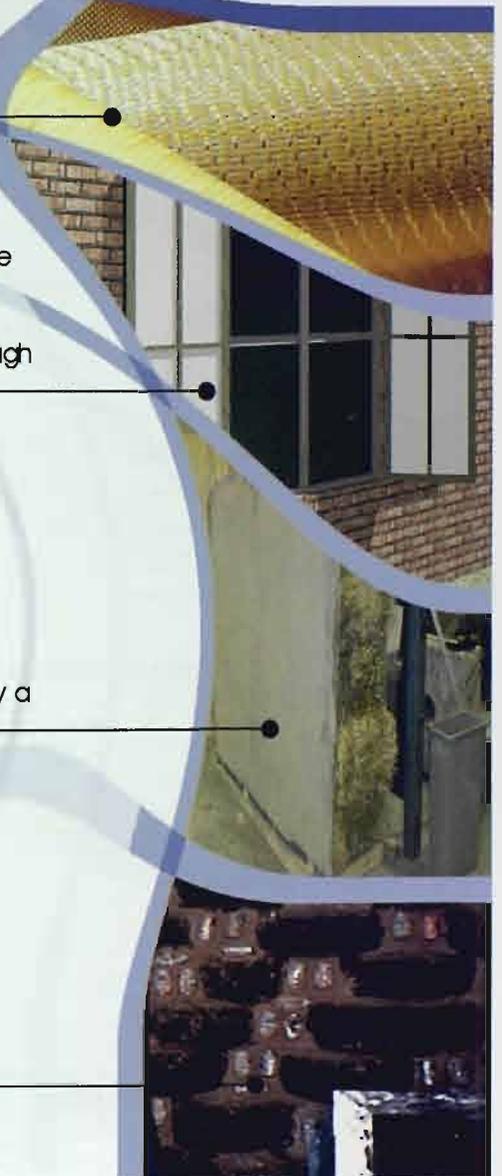
The use of materials that will absorb the energy from a missile impact could prove to be a life saver in a hurricane.

Kevlar or Nomex sheathing in the exterior walls will prevent missile penetration.

Debris resistant shutters which are closed during a hurricane, either manually or automatically, will prevent debris from entering through windows

Straw bales can absorb a good amount of the energy produced by a missile impact.

Tires are an excellent absorbent material.
(www.slip.net/~kent/earthship)



Contextual Issues

Issue: Wind resistance

Goal:

Minimize the number of new missiles generated

If fewer new missiles are generated then there will be fewer missiles to cause to this facility and neighboring facilities.

Performance Requirement #1:

Use of monolithic building materials

Unlike modular building materials such as brick and un-reinforced CMUs, monolithic building materials will not break up to become missiles in a hurricane.

Performance Requirement #2

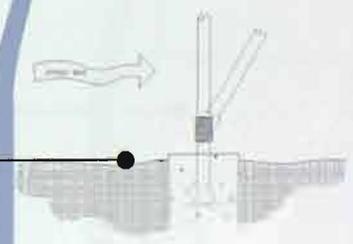
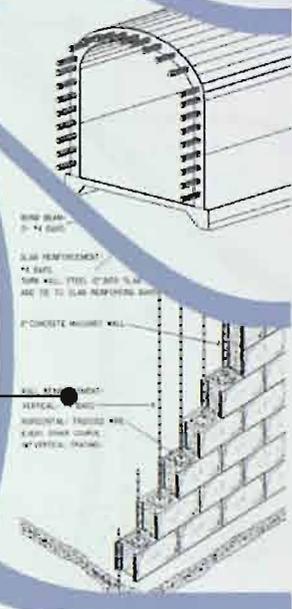
Use of collapsible rather than breakable site features.

Collapsible site features may fall, but they will not snap off and become damaging missiles. Instead they will simply collapse or bend.

Extruded reinforced concrete shells will not break apart during a hurricane.

Properly reinforced CMU walls will act as one solid piece and will not break apart in hurricane force winds.

Site features such as flagpoles and signs would have built in failure points so they would bend rather than break



Contextual Issues

Issue: Flood resistance

Goal:

Minimize the amount of water inside the building.

If less water is inside the facility, then it stands to reason there will be less damage due to flooding.

Performance Requirement #1:

Elevate building above flood plane

The most obvious way to minimize the water inside the building is to place the building so that it is above the flood plane

Performance Requirement #2

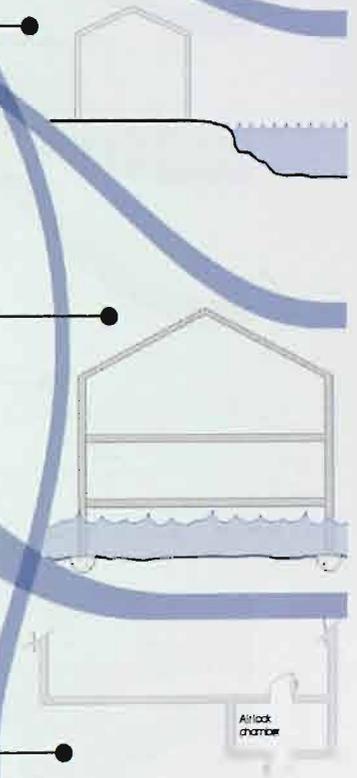
Make the building envelope water tight

If the building envelope is water tight, no water will enter the building to interrupt the critical services within.

A site that is naturally above the flood plane should be chosen

The building is artificially raised to a level above the flood plain.

Airlocks will prevent water from entering at the doorways.



Contextual Issues

Issue: Flood resistance

Goal:

Make provisions for periodic flooding

If the facility is planned for periodic flooding then even in the event that the facility does flood, it should not interfere with the critical operations of the facility.

Place all critical functions on the upper floors.

Place all critical functions on an area of the site that is above the flood plane

Performance Requirement #1:

Place critical functions where they will not flood

Placing the critical operations of the facility where they will not flood will minimize the effects of the flood and allow the facility to operate.

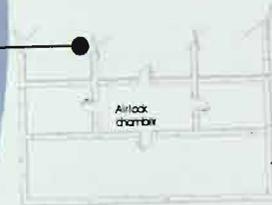
Airlocks to individual spaces will prevent water from entering at the doorways.

Performance Requirement #2

Make individual spaces water tight.

Making the most critical spaces in the facility water tight while allowing the rest of the facility to flood will allow the facility to continue to operate, and will keep construction costs down

Building techniques and technologies found in the ship building industry could be employed to create a water tight enclosure.



Contextual Issues

Issue: Flood resistance

Goal:

Make provisions for expelling excess water.

If the water is extracted at a rate equal to or faster than the rate of flooding, the facility will remain dry.

Performance Requirement #1:

Pump water out of the facility

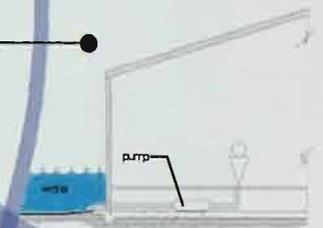
Pumping the water out of the facility will allow it to operate while there is extensive flooding.

Performance Requirement #2

Use pressure differentials to keep out water.

If the pressure inside a space under water is higher than the pressure the water is exerting on it, then no water will infiltrate the space.

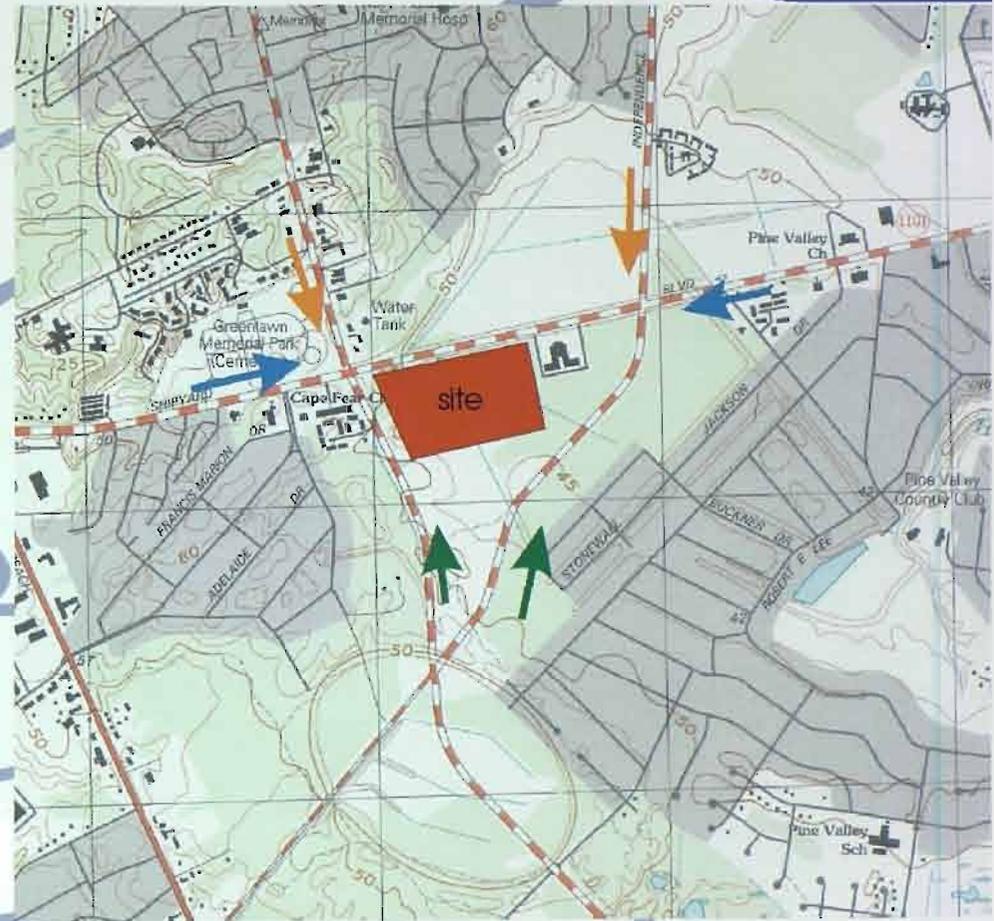
Use air pumps to pump air into areas which are under water. This will cause positive pressure thus keeping the water out.



Site Analysis

The site is situated in a triangle between Shipyard Blvd running east and west, 17th St. running southeast and northwest, and Independence Blvd. Running southwest and northeast. This gives the facility tremendous access to the entire county.

The location is only about 1 minute from downtown Wilmington, and it is one of the highest spots in the county at 50 ft above sea level.



-  Primary access
-  Secondary access
-  Tertiary access

A graphic design for a 'Space Summary' page. The background is dark blue with a complex pattern of glowing, overlapping, wavy lines in shades of light blue and white, creating a sense of depth and movement. In the center, a small, detailed image of the Earth is visible, showing continents and oceans. The title 'Space Summary' is written in a large, light-colored, sans-serif font across the middle of the page, with a thin horizontal line underneath it.

Space Summary



Space Summary

Spatial Description	Area (SF)	Quantity	Total area (SF)	Total Users	Reference page
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Emergency spaces					
Apparatus room	2,850	2	5,700	N/A	
House watch	154	1	154	1	
Gear storage	321	2	642	4	
Medical supply	50	2	100	N/A	
Locker room - men	375	1	375	18	
Locker room - women	187	1	187	6	
Shower room-men	250	1	250	18	
shower room-women	72	1	72	6	
General storage	300	2	600	4	
Hose dryer	60	2	120	N/A	
Hose storage	100	6	600	N/A	
Hose washer	100	2	200	N/A	
Refueling area	350	1	350	2	
Vehicle maintenance	800	1	800	2	
Care flight helicopter landing pad	N/A	1	N/A	N/A	
Boat storage	2,200	1	2,200	N/A	
	Net area		12,350		

Living spaces					
Chief's suite	305	1	305	1	
Recreation room	456	1	456	24	
Dormitory	163	18	2,934	18	
Kitchen	220	1	220	1	
Dining	312	1	312	24	
Linen storage	40	1	40	N/A	
Laundry room	180	1	180	2	
Weight training room	450	1	450	8	
	Net area		4,897		

Space Summary

Spatial Description	Area (SF)	Quantity	Total area (SF)	Total Users	Reference page
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Public spaces					
Public lobby	300	1	300	4	
Public restroom - emergency area - men	150	1	150	6	
Public restroom - emergency area - women	104	1	104	2	
Public restroom - office area - men	150	1	150	6	
Public restroom - office area - women	210	1	210	6	
Net area			914		

Office Spaces					
Station conference room	744	1	744	24	
Fire investigation office	1,200	1	1,200	6	
Chief fire Investigator's office	150	1	150	3	
Training room	510	1	510	24	
Fire prevention coordinators office	150	1	150	3	
Personnel office	150	1	150	3	
Project Impact office	1,200	1	1,200	6	
Project Impact coordinator's office	150	1	150	3	
Director's office	300	1	300	4	
Emergency Rescue Operations Center	1,900	1	1,900	10	
Operations center conference room	816	1	816	30	
			0		
Copy room	100	1	100	2	
Office supply storage	26	1	26	N/A	
Net area			7,396		

Space Summary

Spatial Description	Area (SF)	Quantity	Total area (SF)	Total Users	Reference page
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Auxiliary Spaces

Mechanical equipment	258	1	258	N/A	
Janitor's closet	24	1	24	N/A	
Emergency generator	100	1	100	N/A	
Net area			382		

Summary of Space Allocations

Net Square footage

Net area = 25,939 SF

Total Usable Area*

Total Usable Area = net square footage / 1.3 = 19,953 SF

Gross Square Footage**

Gross Area = Net Area x 1.2 = 31,126 SF

*Total usable area is considered the area allocated specific for an individual within a particular space. No consideration is given to needed circulation space, and therefore it is considered 30% less than the net area.

**Gross area takes into consideration a space allocation for the various interior and exterior walls, and is therefore factored as being a 20% greater area than the net area.



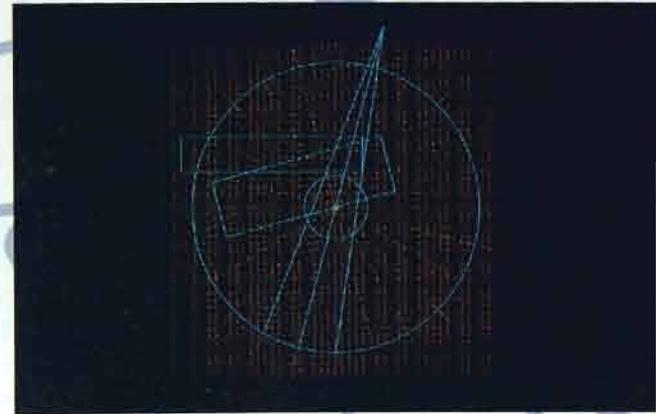
Conclusion



C o n c l u s i o n

Conceptual Basis:

The conceptual basis of the form of the building was that of a weather vane. The vane was abstracted into a two dimensional plane and then worked into a three dimensional form.



The conceptual basis of the function of the building was that of maximum circulation efficiency. This resulted in the entire design being based around a central circle or the "pivot" of the wind vane.

C o n c l u s i o n

Issues:

Circulation

This issue was addressed well by completely separating the apparatus bay and other fire fighting areas from the office areas. This resulted in the building being arranged into an emergency wing and an office wing.

Education

I accomplished the goal of providing the public with education about hurricane resistant design in several interesting ways. One, I incorporated a giant video screen into the design overlooking the intersection which would display weather patterns and other interesting weather related stories. Two, there is a classroom for seminars as well as a large space for larger presentations, which doubles as a group shelter in times of emergency. Three, the building technologies and materials are displayed prominently on plaques throughout the building.

Structural Rigidity

This goal was accomplished by combining traditional construction technologies with unconventional materials. The structure is basically a steel frame with part of it being a braced frame system and part being a moment frame. The remaining portions are shear wall construction. This demonstrates that a building can be made resistant to high winds with the using the local work force. The building becomes unconventional in its exterior materials. The exterior is panelled in kevlar and carbon fiber which are both extremely light and rigid materials. These materials are perfect for deflecting missile impacts during a hurricane, and they preserve the lightness of the design.

Flooding

Flooding was addressed initially by selecting a site which is in the highest part of the county. Once the soil type was examined it became apparent the during a downpour the soil would not be able to drain at a sufficient rate and short term flooding would occur. This problem was solved by creating two playa lakes for the runoff water to collect before it is channeled away.

C o n c l u s i o n

Spatial Hierarchy:

The most important spaces in this design of course are the emergency related spaces. Thus these spaces were given priority during the design process. This resulted in these spaces having the best access to the street and to each other. The offices were then placed in such a way as to not interfere with the operations of the emergency spaces, yet remain reasonably close.

Controlling factors:

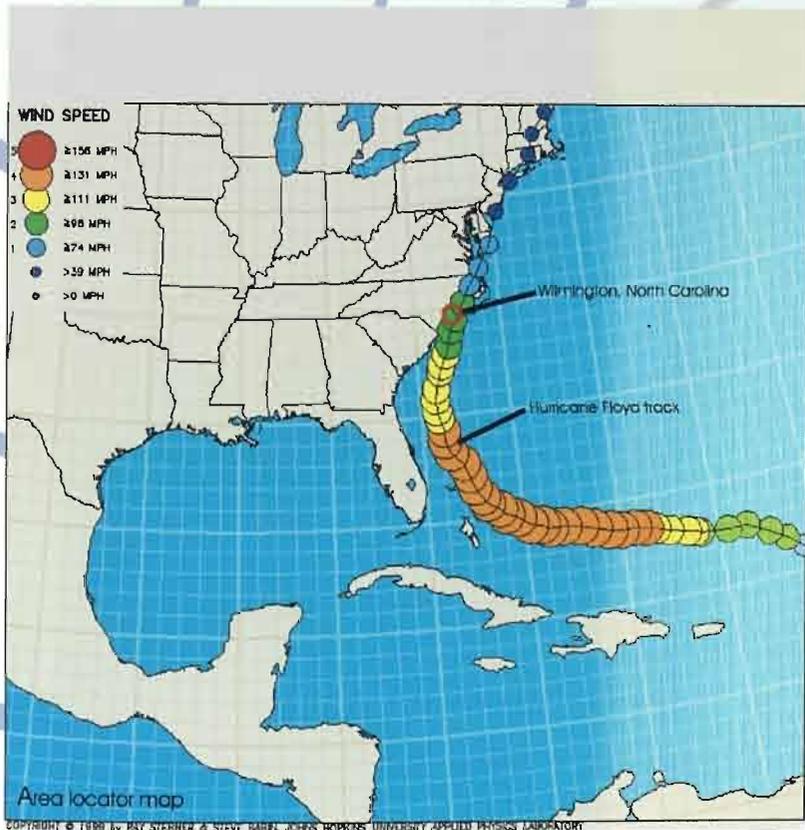
The controlling factors in this design are the circulation patterns. The building followed these patterns and then was developed into a unified whole once the patterns were refined.

Compelling aspect:

To myself as the designer of this thesis, I feel that the most compelling aspect of this design is that it shows that a designer is free to think outside the box when it comes to hurricane design. This building is not conventional and is a vision of the designer which through technological advances can be made to be hurricane resistant. One place where the building does not appear to be resistant is in the large cantilevered "needle" portion of the building. This was done first to complete the visual harmony of the design, but second to demonstrate that designers have latitude in designing highly specialized buildings.

Conclusion

Documentation:



Conclusion



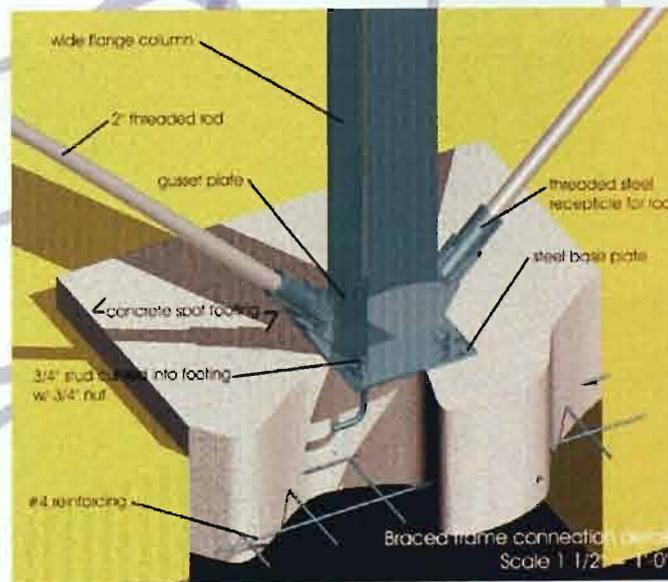
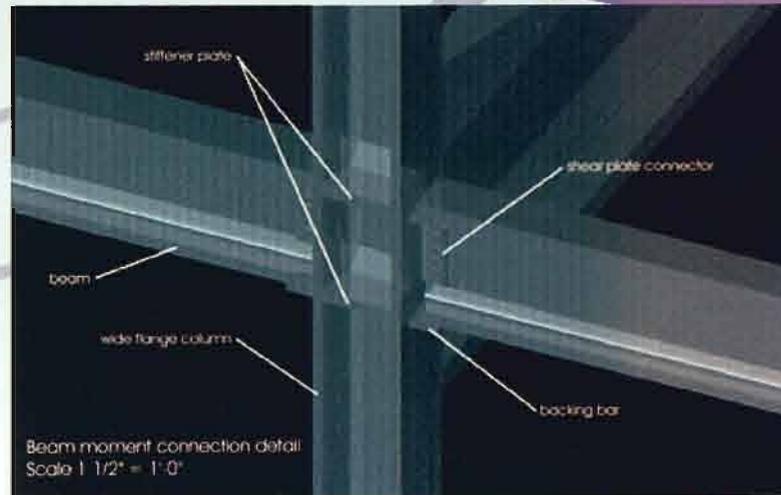
Conclusion



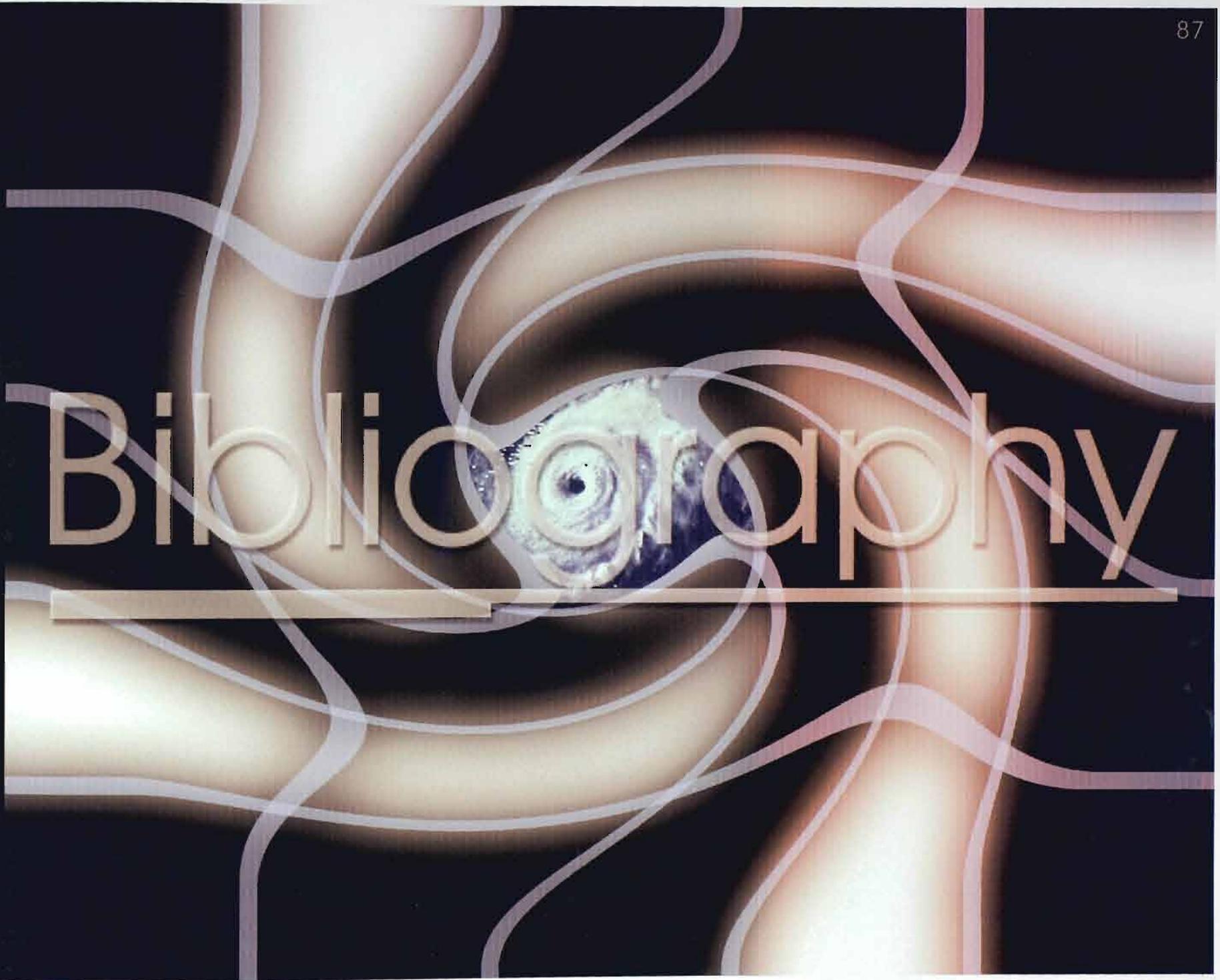
Conclusion



Conclusion



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