بسم الله الرحمن الرحيم
Space Technologies Role in Disaster Management and Mitigation

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Mother Nature is Playing a Vital Role in Our Daily Lives and Activities.

Humans, Animals and Trees are Facing Serious Threat and Great Challenges from Natural Disasters.

Natural Disasters are Everyone’s Enemy.
Disasters by Their Nature are Unpreventable Natural Events expose:

- Life to the Risk of Injury or Death
- Private Property and Agricultural to be Damaged or Destroyed.

Government Agencies should have Long and Short Term: Predicting, Monitoring, Forecasting for Management, Making Scenarios of Analysis, Strategies for Mitigation, Preparation of Coordinated Risk Assessments for regions vulnerable.

Informing the Public at Real-Time Before, During and After the Crisis.
Before the Era of the Computer and Communication and Information Technologies.

Natural Disasters and Calamities have Been Striking and leaving Untold Suffering in Their Wake.
Natural Disaster is an Occurrence Inflicting Wide Speed Destruction and Distress to Life and Properties.
Natural Disasters are The Result of:

Earthquakes, Floods, Tropical cyclones, Volcanic Eruption,

Landslide, Drought, Desertification, Sand and Snow Storms

Deforestation and Tidal Waves.

Also there are Man Induced Disasters

Pollution of The Atmosphere and The Water,

Deforestation, Arsenal Fires and Oil Spill.
Earthquake is a Violent Shaking of Earth’s Surface and occurs when energy stored in rocky layer underneath Earth’s surface is released in elastic waves.

Most earthquakes happen near the boundaries of tectonic plates, either plates were spread apart or where crunch or grind together.

Earthquake can completely devastate a region within seconds of time causing huge damage of life, change in the geological features and damage man-made structure.

Earthquake have a vital impact on human and animal life.
EARTHQUAKE SEVERE DAMAGE TO LIFE & PROPERTIES
TECTONIC PLATES MOVEMENT CAUSES EARTHQUAKE

Active Volcanoes, Plate Tectonics, and the "Ring of Fire"
Desertification is the Expansion and Shrinking of Desert due to:
Climatic Changes, and Human Influence or Both.

Result from Poor Farming Practices & Excessive Cultivation,
Human’s Influence by Removing Vegetation, Harsh Grazing,
Collection of Firewood,
Excessive Use of Surface or Groundwater Supplies
Industry and Domestic Use, and
Stress on The Ecosystem Beyond Its Tolerance Limit.

Mass Starvation and Degradation of the Biological Environment

Desertification is Responsible for:
The Deaths of Humans and Animals and
Disruption of Other Lives,
DESERTIFICATION AFFECT ON THE ENVIRONMENT
Drought is the Lack or Insufficiency of Rain for An Extended Period of Time that Causes Considerable Hydrological Imbalance.

It occurs When Evaporation and Transpiration Exceed Precipitation for a Considerable Period.

Drought is Divided Into Four Different Disciplines Meteorological, Agricultural, Hydrological and Socio Economic.

Causing Hydrological Imbalance and Consequently Water Storages, Crop Damage, Stream Reduction and Depletion of Ground Water and Soil Moisture.

Drought is the most Serious Physical Disaster to Agriculture in Nearly Every Part of The World.

By Coping with Desertification we can Cope with Drought
DROUGHT CAUSES HYDROLOGICAL IMBALANCE ENVIRONMENT
**Oil Spill** is the leakage of petroleum onto the surface of a large body of water or discharging oil from pipelines or tankers. The oceanic oil spills is a major environmental problem. The affect of accidental oil spills is very considerable in both economic and ecological terms. Oil spill is very hazardous for marine environment in both ways physically and chemically.
REDAR IMAGES SHOWING OIL SPILL

Bird Covered by OIL
**Flood** is a high flow of water stage in which water overflows its natural or artificial banks onto normally dry land such as river inundating its floodplain.

Topography, soil conditions, and ground cover play a major role in the cause of uncontrollable floods from excessive rainfall over a brief period of time.

Flash flood can occur at any place on Earth where there are thunderstorms repeatedly moving over the same area, or heavy rains from hurricanes and tropical storms.

**Flash Flood is one of the most devastated leading causes of large scale fatalities all over the world.**
FLOODS AFFECT CITIES
AGRECALURAL LANDS
**Landslide** is the movement of a wide range of downward mass of earth or rock on unstable slopes.

The causes of this downward movement happen by:

- A variety of erosion from rivers, glaciers, heavy monsoon.
- Rock and soil slopes weakened by saturation from snowmelt.
- Removal of vegetation to create homes and power lines & skiing slopes.
- Logging and natural or manmade wild fire.

Landslides also could occur in conjunction of major earthquakes or flash floods.

*It causes heavy loss of life and properties every year.*
LANDSLIDE IN SCIENCE AND IN REALITY
Tropical Cyclones are the general term for all circulating weather systems.

- Hurricane (the North Atlantic Ocean, the Northeast Pacific Ocean)
- Typhoon (the North West Pacific Ocean)
- Cyclone (the Indian Ocean)

They are usually accompanied with maximum sustained surface winds and very severe rainstorm.

They are one of the most destructive weather systems on the Earth.

They cause high number of death and damages to environment property in the world every year.
MONETRING AND ANALYSIS OF TROPICAL CYCLONES
Deforestation is the cutting down of trees in a large area of the forests or from fires (either natural or manmade).

Deforestation contributes to an array of environmental damages besides loss of biodiversity.
CUTTING TREES

WOOD LOGGING

FOREST FIRES CAUSE GREAT DAMAGE TO LIFE AND PROPERTIES SEVERE EFFECT ON THE ENVIRONMENT
Sand Storms are Caused by Strong Winds Blowing Over Loose Soil or Sand and Picking Up so Much of That Materials.

At Certain Time of The Year in Desert Regions, Sand Storms Become More Frequent. Due to The Strong Heating of The Air Over the Desert Causes The Lower Atmosphere to Become Unstable.

This Instability Mixes Higher Winds in The Middle Troposphere Dawn Word Producing Stronger Winds At The Surface.

This is Causing Lack of Feasibility
RIYADH SAND STORM 10 / Mar /2009  
RED SEA SAND STORM
*Tidal Wave* is a wave that moves fast (200 miles/hour) and up to >300 meters high.

It causes from hurricanes, underwater earthquakes and astronomical conditions.

Resulting severe flooding, destruction of coastline and human life and properties.
TIDAL WAVE CAUSING FLOODS & DAMAGE TO COASTALLINES
IMAGES SHOWING THE MOVEMENT OF TIDAL WAVE IN TWO DIRECTIONS FROM INDONESIAN TSUNAMI 2004
Can Space Technologies Play A Vital Role in Management and Mitigation of Natural Disaster?

For a Long Time Controlling and Eliminating Natural Disaster was Absolutely a Great Challenge, But to Day with The Development of Space and Observation Technologies is It Going to be Far Better to Cope with Disasters and Minimize the Losses of Life and Properties.

Almost All Satellites are Launched in Order to Provide Services to Fulfill the People's Need.
Communication Satellites (COMSAT) have Potential Use as Source of Information and Awareness.

It have Special Potential to be used in The Poorer rural and Most Devastated Areas.

Modern COMSAT and DB Networks and Services have disseminate information in real time around the Earth.

This Contribution will Lead us to Prosperity and Saving Life and Properties.
Global Navigation Satellite System (GNSS) are A Constellation of Satellites in Different Orbital Planes and Transmit Signals that can be Detected by Any One with GPS Receiver to Locate his Position.

They are used to Track Fishing Vessels, Vehicles Transporting Goods or Hazardous Materials and for Navigation Almost Every Where in World.

They became A New Global Utility with Increasing Benefits to People’s Daily Life.
NAVIGATION SATELLITE

GNSS POLAR ORBITS

GPS RECEIVER
Meteorological Satellites are Either Polar or Geostationary Orbiting. They are Imaging The Earth to Measure Temperature, Moisture and Solar Radiation in The Atmosphere.

They Record Atmosphere and Ocean Temperature at Different Altitudes and Depths, Gauge Rainfall for Forecasting Droughts. Spot Forest Fire and Map Ocean Currents. They Carry Search and Rescue Transmission Equipment COSPAS/SARSAT.

These Satellites Provide Before and At The Time of The Disaster Warning of Impending Storm, Assessing Their Intensity and Close Tracking and Monitoring Their Movement.

These Routinely Activates are Enabling The Decision Maker to Take the Appropriate Precautionary Measurements In Time.
Earth Observation Satellites (EOS) are an eye using either optical or radar sensors to collect information about our Earth at different spectral, spatial and temporal resolutions.

EOS observe land surface, oceans and atmosphere from space to predict changes in the environment over time. They have global coverage with essential tool for many applications.

Future EOS (Optical and Radar) constellations will make observation of any part of the world almost in real time. The radar satellites provide images day and night and penetrate cloud cover.

EOS images are good tool for mitigation because it helps to do studies of areas before and after the disaster. Their images provide great saving in budgeting and time.
EOS OPTICAL and RADAR (PASSIVE or ACTIVE)
<table>
<thead>
<tr>
<th>Satellite</th>
<th>Origin</th>
<th>Status</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CBES1 &amp; 2</td>
<td>Brazil/China</td>
<td>Operational</td>
<td>Brazil and China Joint Earth Observation Satellite Programme 20m/5m Multispectral</td>
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<td></td>
<td></td>
<td>120 Km</td>
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<td>26 days</td>
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<td>Sun-synchronous near-polar orbit</td>
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<tr>
<td>CBES 2B</td>
<td>Brazil/China</td>
<td>Operational</td>
<td>Brazil and China Joint Earth Observation Satellite Programme 20m Multispectral / 2.7m Pan</td>
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<tr>
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<td>133 Km</td>
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<td>26 days/133 days</td>
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<td></td>
<td></td>
<td></td>
<td>Sun-synchronous near-polar orbit</td>
</tr>
<tr>
<td>LANDSAT 7</td>
<td>USA</td>
<td>Operational</td>
<td>Enhanced Thematic Mapper (ETM) 8 Channels</td>
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<td></td>
<td></td>
<td></td>
<td>30m (visible, NIR &amp; IR), 15m (PAN Band 8) and 60m (TR Band 6)</td>
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<td></td>
<td></td>
<td></td>
<td>185 km swath width</td>
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<td></td>
<td></td>
<td>16 days revisit</td>
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<td></td>
<td></td>
<td></td>
<td>Sun-synchronous near-polar orbit</td>
</tr>
<tr>
<td>SPOT 1, 2 &amp; 4</td>
<td>France</td>
<td>Operational</td>
<td>10m pan / 20m multi-spectral</td>
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<td></td>
<td></td>
<td></td>
<td>60 km swath width</td>
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<td></td>
<td></td>
<td>1-2 day revisit depending on latitude</td>
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<td>Sun-synchronous near-polar orbit</td>
</tr>
<tr>
<td>SPOT 5</td>
<td>France</td>
<td>Operational</td>
<td>5m (PAN), 2.5m (Supermode), 10m (visible &amp; NIR), 5m (Supermode)</td>
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<td>Swath 60km</td>
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<td>3-5 day revisit depending on latitude</td>
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<td>Sun-synchronous near-polar orbit</td>
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<tr>
<td>IRS 1C/D</td>
<td>India</td>
<td>Operational</td>
<td>5.8m Pan / 23m multi-spectral</td>
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<td>70 km swath width</td>
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<td>5 day revisit with off-nadir viewing</td>
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<td>Sun-synchronous near-polar orbit</td>
</tr>
<tr>
<td>CartoSat 1/2</td>
<td>India</td>
<td>Operational</td>
<td>2.5m Pan / 1m Pan</td>
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<td></td>
<td></td>
<td></td>
<td>30 km swath width / 9.6 km swath width</td>
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<td></td>
<td></td>
<td>Sun-synchronous near-polar orbit</td>
</tr>
<tr>
<td>RADARSAT-1</td>
<td>Canada</td>
<td>Operational</td>
<td>8-100 m C-Band Synthetic Aperture Radar</td>
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<td></td>
<td></td>
<td>50-500 km swath width</td>
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<td></td>
<td>2-5 day revisit depending on latitude / Mode</td>
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<td></td>
<td>Sun-synchronous near-polar orbit</td>
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<td></td>
<td>Less than 48 hr programming</td>
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<tr>
<td>Satellite</td>
<td>Country</td>
<td>Status</td>
<td>Imaging Parameters</td>
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<tr>
<td>EROS-1A</td>
<td>Israel</td>
<td>Operational</td>
<td>2 m pan&lt;br&gt;12.5 km swath width&lt;br&gt;1.5-5 day revisit depending on latitude&lt;br&gt;Sun-synchronous near-polar orbit</td>
</tr>
<tr>
<td>IKONOS-2</td>
<td>USA</td>
<td>Operational</td>
<td>1m pan/4m multi-spectral&lt;br&gt;11 km swath width&lt;br&gt;1.5-5 day revisit depending on latitude&lt;br&gt;Sun-synchronous near-polar orbit</td>
</tr>
<tr>
<td>QUICKBIRD</td>
<td>USA</td>
<td>Operational</td>
<td>60 cm pan/2.5 m multi-spectral&lt;br&gt;16.5 km swath width&lt;br&gt;1-5 day revisit depending on latitude&lt;br&gt;Medium-inclination non sun-synchronous orbit</td>
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<tr>
<td>NOAA-16</td>
<td>USA</td>
<td>Operational</td>
<td>1.1 km&lt;br&gt;4 times/day&lt;br&gt;Sun synchronous polar orbit</td>
</tr>
<tr>
<td>FengYun1&amp;2</td>
<td>China</td>
<td>Operational</td>
<td>Two 5-channel scanning radiometers&lt;br&gt;1.1 km (visible), 4 km (IR)&lt;br&gt;3200 km swath width</td>
</tr>
<tr>
<td>ENVISAT</td>
<td>European Space Agency</td>
<td>Operational</td>
<td>Sensor system- ASAR&lt;br&gt;30x30m, 150x150m, 1000x1000m&lt;br&gt;100/400 km swath width; 35 days revisit</td>
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<td>Sensor System MERIS&lt;br&gt;300/1200m&lt;br&gt;1250 km swath width; ~3 days revisit</td>
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<td>Sensor system AATSR&lt;br&gt;1000X1000 m&lt;br&gt;500 km swath width; ~6 days revisit</td>
</tr>
</tbody>
</table>

SCRS is THE ONLY RS CENTER RECEIVING & PROCESSING GeoEye HIGH RESOLUTION DATA (50cm) in MIDE astrology.
Even it is Extremely Difficult to Control and Extinguish Natural Disaster, but all the above Described Satellite Systems Show they can have A Vital Role in Monitoring, Imaging, Collecting, Communicating and Forecasting various Information about the Causes of Natural Disaster.

These Satellite Applications play an Affective Role in Natural Disaster Assessment, Management and Mitigation in Very Short Possible Time.
SAVING OUR EARTH

In the Last Twenty Years many World Summit Meeting were Held for Climate Stability, Fight Hunger and Provide Good Prosperity of Life.

-- EARTH SUMMIT RIO DA GENERO BRAZIL 1992
  -- KYOTO PROTOCOL KYOTO JAPAN 1997
  -- MILLENIUM SUMMIT NEW YORK USA 2000
-- SUSTAINABLE DEVOLOPMENT SUMMIT JOHANNESBURG SA 2002
  -- INFORMATION SOCIETY TUNIS 2003
  -- INFORMATION TECHNOLOGY GENEVA SWISS 2009
  -- FOOD SECURITY ROMA ITALY 2009
-- CLIMATE CHANGE TREATY COPENHAGEN DENMARK 2009

All These Summit and Treaty’s Agendas Call to Protect Earth’s Environment. So We are Encouraged to find Solutions for That.

THE SOLUTIONS ARE:

-- WORLD COOPERATION
-- USING SPACE TECHNOLOGIE
-- PUBLIC AWARENESS
-- RESEARCH and DEVELOPMENT
Therefore the Space Technologies can and will Play Vital Role in Management and Mitigation of Natural Disaster.
Space Capabilities in The Kingdom of Saudi Arabia (KSA)
KSA is a Prominent Member of the Major International Organizations Dealing with Space activities and Space Related Matters

ITU, WMO, UNCOPUOS, UNDP, ARABSAT, most COMSAT, EOS METEOSAT Providers etc.

KSA has Two Major Teleport and Gateways for Mobile Satellites
The Presidency of Meteorology and Environment (PME) has a Major Receiving Station for Meteorological Satellites at Jeddah.

PME was Designated as the Central Agency Which is Responsible for Environmental Protection, Monitoring Pollution of All Kinds and Establishment of Different Environmental Standards.

PME has the Regional Environmental and Drought and Meteorological Center (REDMC) Responsible to give Seasonal Forecast and Monthly Predication in Early Warning, Temperature, Rain Fall, Vegetation Index and Special Reports.

PME task is the Improvement of Safety, Health and Human Welfare of the Citizens of KSA by the Provision of Services in Meteorology, Climatology and Environmental Protection.
After Royal Decree was Signed to Join COSPAS/SARSAT
The Space Research Institute (SRI) at King Abdulaziz City for Science and Technology (KACST) is The Responsible Organization in The Fields of Space Technology at KSA. The Royal Decree of 1983 at which Stated KACST to Build Receiving Station for EOS. KACST at 1986 established The Saudi Center for Remote Sensing (SCRS).

SCRS is Considered to be One of The Most Well Known Established Center in The World. SCRS conduct Research, Pilot and Full Scale Projects in The Applications of Remote Sensing in Different Areas and held seminars and training sessions to promote their use.
THE AREA COVERAGE of

RIYADH EOS GROUND RECEIVING STATION AT KACST
The Geographical Information Applications Center (GIAC) was Established at SRI for The Purpose of Adopting Advanced Technologies to Develop Technical Capabilities to Perform Application Researches in The Field of Geographical Information Systems and to Develop Models for Various Applications in GIS.

It is One of The Best in The Region and with The State of art Equipments and Software Programs. GIAC Beside his Performance in Building, Analyzing and Planning for The Use of GIS Technologies in Updating Maps and Producing Digital Maps is Signing Contracts with Many Ministries, and Public and Private Sectors.
THE GIS LABORATORY
SRI has also built laser ranging facility.
The Saudi Arabian Laser Observatory (SALOR) was established in 1995.
The data collected from laser ranging have many applications.

Detection and monitoring of tectonic plate motion, crustal deformation and earth rotation and polar motion.

Monitoring of the millimeter-level variations in the location of the center for mass of total earth system (Solid Earth-atmosphere-ocean).
LGS
GROUND STATION
Saudi Arabia

LASER GEODYNAMICS SATELLITE
LAGEOS 1 - 2
Ministries, Governmental and Private Agencies in The Kingdom of Saudi Arabia and The Region have been Using these Latest Space Technologies to Provide Safety and Prosperity to Their People.
RECOMMENDATION

-- **Governments** should Establish A National Center for DMM
-- **Government** should Encourage and Support Research in DMM
-- **Satellites Owners and Ground Receiving Stations** should
-- Acquire and Process Data and Information to Affected Area
-- Establish Early Warning Center to Disseminate Information
-- **UNCOPUOS, FAO and WMO** should
-- Establish Data Base of High and Low Resolution Data to
-- Fight Hanger and Fame, Help in DMM and Provide Expertise List
-- Develop Programs of Training in Various Fields DMM
-- **National, Regional and International Governments** should
-- Cooperate in Disaster Management and Mitigation (DMM)
CONCLUSION

Since Polar / Geostationary METEOSAT Provide Data continuously By the Hour about The Weather Conditions like (ALNina / ELNino) Affect and Enabling Appropriate Precautionary Measures to be Taken in Time.

Where Multimedia COMSAT can Relay The Information to Alert Concerned Agencies and The Public to Take Precautions to Avoid The Disaster.

Also The High Resolution Data from Optical / Radar EOS and GIS Provide More Detailed Information about The Area Before / After The Disaster.

Beside Mobile COMSAT with GPS Provide Services in Rural and Non accessible Areas.

SPACE TECHNOLOGIES PLAY VITAL ROLE IN DMM
Thank You