



15 Jun 22



“4 IR” “TECHNOLOGIES” IN “GEOINT”



What is 4 IR ?

The disappearing of boundaries between biological, physical and digital worlds

CAVEAT

Disappearance of upto 800 million jobs by 2030

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

UNCLASSIFIED

What is Geoint?

GEOINT is composed of information layers, which answer such questions as...

- ❖ Where am I?
- ❖ Where are the friendlies?
- ❖ Where are the enemies?
- ❖ When might they move?
- ❖ Where are the non-combatants?
- ❖ Where are the obstacles, natural or man-made, and how do I navigate among them?
- ❖ What is the environment?
- ❖ What does it mean?
- ❖ What is the impact?

UNCLASSIFIED

THE UNITED STATES OF AMERICA



BOUQUET OF TECHNOLOGIES

- ✓ **AI**
- ✓ IoT
- ✓ Block Chain
- ✓ **Robotics**
- ✓ **UAVs/ Drones**
- ✓ Autonomous Unmanned System
- ✓ **Swarm** of Intelligent Machines
- ✓ Social Media
- ✓ Hypersonic
- ✓ Nano Technology
- ✓ Quantum Computing
- ✓ Satellite/ Space Communication
- ✓ Undersea System
- ✓ Stealth Meta Materials
- ✓ Information & Big Data Analytics
- ✓ Cognitive Neuroscience
- ✓ Additive Manufacturing
- ✓ 3D & 4D Printing
- ✓ Energy & Propulsion
- ✓ Directed Energy Weapon
- ✓ Cyber Capabilities
- ✓ Metaverse
- ✓ Extended Reality (Augmented, Virtual & Mixed Reality)

✓ Technology Tsunami - Integrated & Analytics



✓ Evolution of a Digital Ecosystem



✓ Reorganize, Realign & Restructure



Geospatial KNOWLEDGE Infrastructure

✓ Range of Technologies - Smart leveraging, culture of military enterprise and defence innovation

✓ Estimated Value of Data By 2025.....

5.8 % of EU GDP !!!!



ROBOTICS and ARTIFICIAL INTELLIGENCE

DRONES FOR

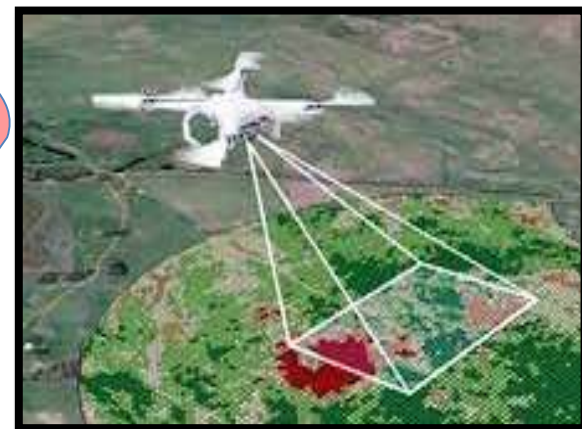
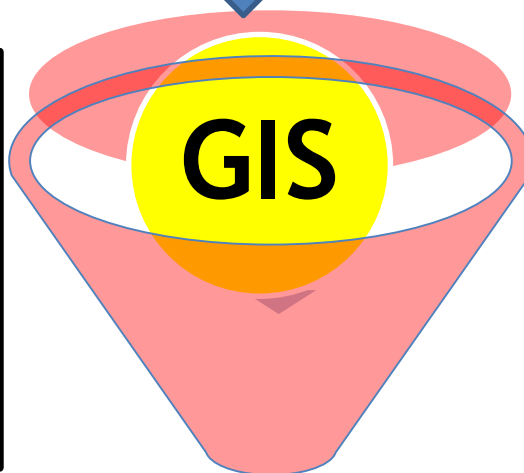
“SURVEILLANCE” AND “SECURITY”

PEACEFUL USE

OFFENSIVE USE

You See.....

What Drone Sees



A diagram at the top of the slide shows two dark blue rounded rectangular boxes. The left box contains the text 'UAV' and the right box contains 'GIS'. A thick red double-headed arrow connects the two boxes, pointing from the UAV box to the GIS box and back. In the top-left and top-right corners of the slide, there are faint, circular logos of the Indian Air Force.

UAV

GIS

An Emerging Dynamic Duo ...

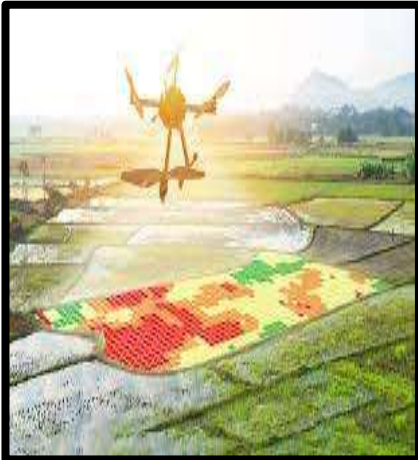
- *To fill GIS users Craving for high quality real time imagery*
- *Inevitable for GIS & Drone Technology to Collide !!!!*
- *Drones Supercharge GIS Management*



USAGE

Factors

- ✓ Range
- ✓ Size
- ✓ Cost
- ✓ End Use



Domains

- ✓ Remote Sensing
- ✓ Weather Monitoring
- ✓ Gas Exploration
- ✓ Precision Farming
- ✓ Survey
- ✓ Image Analysis
- ✓ Cartography
- ✓ Archeology
- ✓ Geology
- ✓ Waste Management
- ✓ Asset Management
- ✓ Damage Assessment
- ✓ Banking

What We Hear

Bombs & Missiles



Battlefield Dominance



GIS USE IN DRONES



✓ Drone Technology Technical Shift in last 15 years

✓ Crucial in **development** of modern GIS applications



✓ **Maintain** Upto Date GIS Data



✓ Lowered Cost of Collecting Geospatial Data

✓ Easier Collection of Spatial Data In Dangerous Environments



Drones VS Aircrafts.....



Aspects In Favour

- ✓ Cost Savings
- ✓ Fuel Savings
- ✓ Hovering Capability
- ✓ Quick Deployment
- ✓ Human Involvement - Minimal
- ✓ Environment Friendly
- ✓ Access Small Places
- ✓ Cover Large Area

Landfill Project In USA

- ✓ Reporting of Waste Material Volume Quarterly
- ✓ Cost to fly a contractor over the landfill & do a volumetric compliance inspection - **\$ 10,000**
- ✓ Cost of using Drone - **\$300**



GIS USE IN DRONES



- Payload**
- ✓ EO / IR
 - ✓ Multispectral
 - ✓ Hyperspectral
 - ✓ Barometers
 - ✓ LIDAR



- Functions of GIS (DATA)**
- ✓ Capture
 - ✓ Transfer
 - ✓ Storage
 - ✓ Query
 - ✓ Analysis
 - ✓ Presentation

- Software Used**
- ✓ ArcGIS
 - ✓ Apple Maps
 - ✓ Google Maps
 - ✓ Here Maps
 - ✓ Openstreet Maps
 - ✓ Bing Maps
 - ✓ QGIS

- Components of GIS (INTEGRATION)**
- ✓ Hardware
 - ✓ Software
 - ✓ People
 - ✓ Methods



Final Word



Ability of GIS to display complex geospatial information in a meaningful way

and

UAVs ability to collect requisite data quickly & inexpensively

make these



Two technologies - Outstanding Combination



FEW DRONES RELEVANT TO MAPPING AND SURVEY



IDEA FORGE - NINJA



THETA - LOTUS and FALCON



Drones for Surveillance & Security.....

Aspects In Favour

- ✓ Situational Awareness
- ✓ Repetitive Tasks
- ✓ Efficiency
- ✓ Hazardous Environment
- ✓ Live Feed + Recorded Data
- ✓ Coordinated Response
- ✓ 24x7- Day / Night
- ✓ HD Imagery

AI

Return On Investment

- ✓ Global Market for Commerce Applications - > \$ 100 Billion
- ✓ Security is ranked 4th after Infra, Agriculture & Transport
- ✓ 1 in 10 Companies with revenue > \$50 Million use drones for security purposes



AI BASED TARGET RECOGNITION

Gen Qasem Soleimani, Quds Force Cdr



HOW US REAPER DRONE ASSASSINATED TOP GENERAL

1 Iranian general Qasem Soleimani arrives by plane at Baghdad Airport



2 General is escorted from airport by Iraqi allies in a two-car convoy



3 Convoy is targeted by a US MQ-9 Reaper drone controlled remotely



4 At least two missiles are launched at the convoy, killing Soleimani and others



Nuclear Scientist - Iran

HOW WAS FAKRIZADEH ASSASSINATED?



AI ASSISTED REMOTE KILL

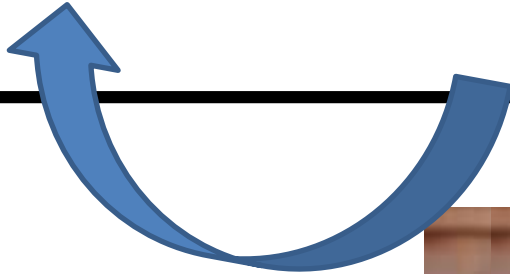
- ✓ 7.62mm Sniper Machine Gun
- ✓ Activated by Sniper >1000 miles away
- ✓ Iranian's called it as "Killer Robot"
- ✓ No injuries to wife & kid - 25 cm away



RELEVANCE OF AI



**“AI is the future of not only Russia, but of all mankind and whoever becomes the leader in this sphere will become the Ruler of the World !!”
2017**



“

Mark my words –
A.I. is
far more
dangerous
than nukes.

Elon Musk

BILLIONAIRE TECH
ENTREPRENEUR





Crystal Gazing - Drones.....



- **Global Drone market size (\$14 Billion in 2020) to expand at a compound annual growth rate of 57.5% from 2021 to 2028 to reach \$ 279 Billion**
- **Geospatial Market Size - \$ 9 Billion to \$ 38 Billion (2027)**

➤ **Volume Demand - 689.4 thousand units in 2020**

➤ **More than 70% of global civilian drone market is supported by China ; 1200 drone manufacturers in 2020**

➤ **Asia Pacific to witness highest growth in 2021-2028**

➤ **Military Drones will be a huge world market**



Why Drones Are Chosen Means.....



Drones are sort of the perfect weapon for a country that doesn't want to go to **war**. If only – there's no **fingerprint**.

There's no direct involvement. There's human beings killed on the other end. You never see them. You don't have to worry about them. You don't have to meet their widows. It's sort of an **antiseptic warfare**.



~ Mark Shields

“Useful **tool for politicians** – gives tangible results without meaningful human engagement...”

We were never so close as now to **Clausewitzian Concept**
“*The war is continuation of politics by other means*”



MILITARY USE OF DRONES/SWARM

DRONES / / RPA *WITH AI* -

+

GEOINT

“SUCCESS STORIES”

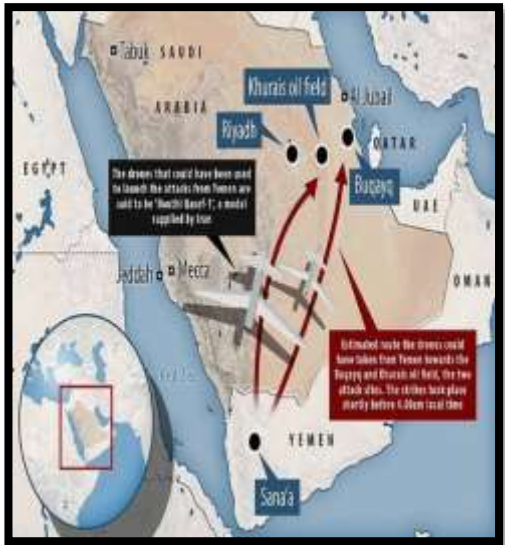


HOW DID OIL ATTACK BREACH SAUDI DEFENSES ??

SAUDI DEFENSE BREACH (14 SEP 2019)

- ✓ 19 Drones ; ABQAIQ & KHURAIIS - ARAMCO
- ✓ Achievement
- ✓ Halved the country's global oil output
- ✓ Failure of state of art missile defense system
- ✓ Billions Expenditure on US PATRIOT SAM - Ineffective

<u>19 STRIKES</u>
<u>Storage Tanks</u>
14
<u>Oil Processing</u>
<u>Trains</u> 03



“FIRST EVER ATTACK OF THIS NATURE BY NON STATE ACTORS WHICH SURPRISED THE WORLD’S LARGEST MILITARY SPENDER PER CAPITA”



OPERATION SPRING SHIELD - IDLIB (2020)

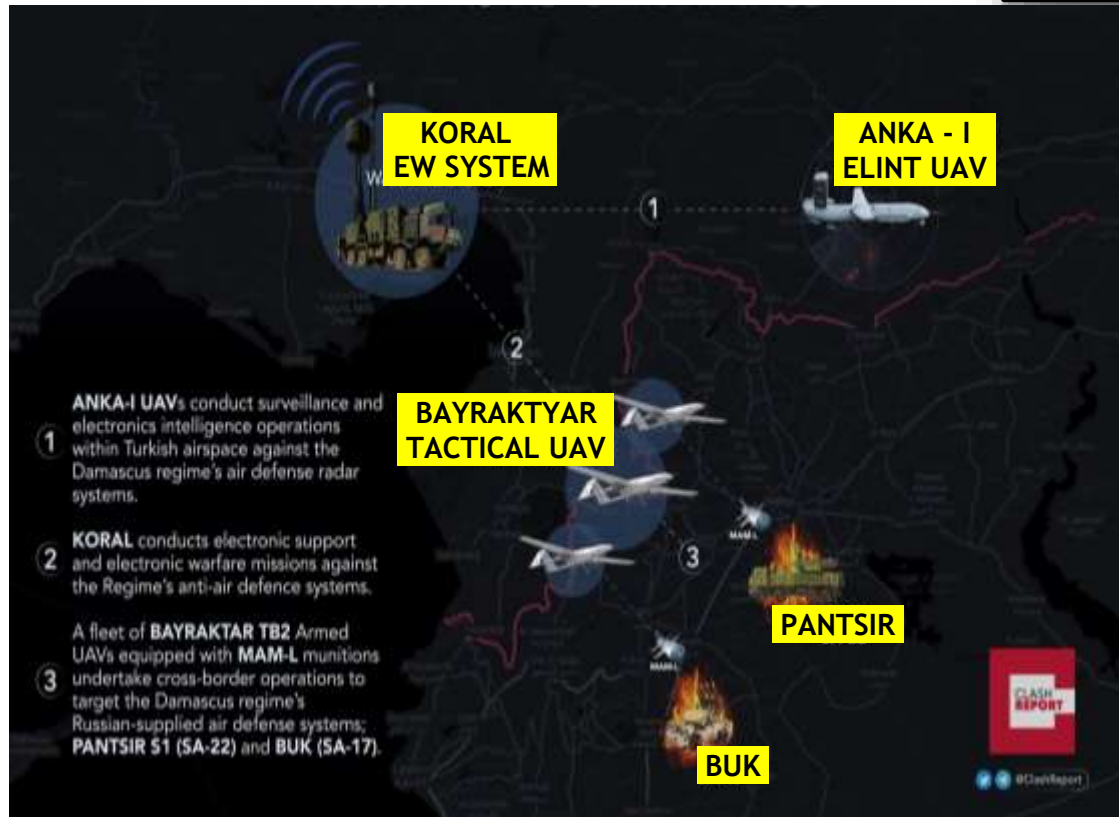


✓ Trigger 35 Turkish soldiers killed by Syria
(27 Feb 20)

DESTRUCTION IN ONE NIGHT

(> 200 Targets)

- ✓ 05 Helicopters
- ✓ 23 Tanks
- ✓ 23 Artillery Guns
- ✓ 03 Pantsir & BUK
- ✓ 309 Syrian Soldiers



COST OF REPLACEMENT

- ✓ Turkey Lost 19 Baryaktar (\$ 48 Million)
- ✓ Russia Lost 08 Pantsir (\$112 Million)

Established

- ✓ Turkey as a "Drone Super Power"
- ✓ "Machines Replacing Humans" - Revolution in Remote Warfare



AZERBAIJAN'S VICTORY OVER ARMENIA (2020)

DRONE FLEET

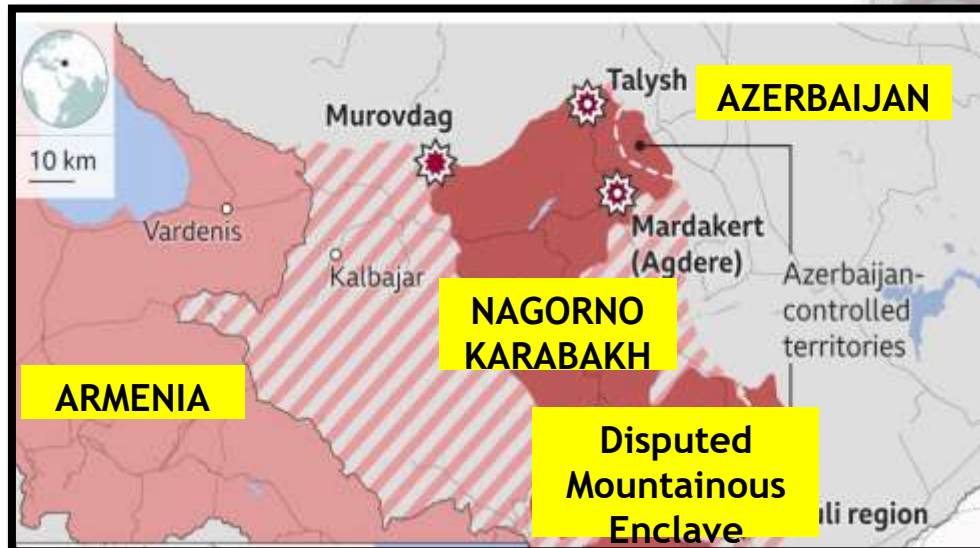
- ✓ Turkey - Bayraktar, KARGU
- ✓ Israel - Orbital, Haroop, Heron, Thunder, Hermes

DIFFERENCE IN APPROACH

- ✓ Azerbaijan - Used Caspian sea oil wealth to buy Drones
- ✓ Armenia - \$100 Billion for 06 Russian Jets (**NO USE !!**)

ARMENIA LOSSES

185 x Tanks, 90 x AFVs, 182 x Arty Guns, 73 x Multiple Rocket Launchers, 26 x SAM, 05 x S300s, 14 x Radars/ Jammers, 01 x SU-25, 04 x Drones, 451 x Military Vehicles



Established

- ✓ “End of Era” of traditional tanks
- ✓ Limited effect of “Camouflage & Dispersion”
- ✓ “Dronization” of War vs Network Centric Warfare (AI)



ISRAEL'S OPERATION IN GAZA - WORLD'S FIRST **AI & DATA** **WAR** ?? - **OP GUARDIANS OF THE WALLS** (2021)

CONDUCT

- ✓ Heavy reliance on AI, Big Data, Super Computing & Machine Learning - **ALCHEMIST**, **GOSPEL**, **DEPTH OF WISDOM**
- ✓ First Time creation of Multi Disciplinary Control Center (IDF + Shin Bet)

ALCHEMIST (Unit 8200)

- ✓ **AI & ML** program to alert troops (**EW**) for possible attacks by Hamas/ PIJ
- ✓ Dynamic & updating system with every field unit commander on a user friendly **tablet**
- ✓ Multi **Sensor** Data Fusion (HUMINT, SIGINT, VISINT, **"GEOINT"**) - **BIG DATA** - AI based prediction (location & time) |





GOSPEL (Unit 8200 & Unit 9900)

Unit 9900

GEOINT

- ✓ 1000's over the years & 100's in Real Time
- ✓ AI based change detection

Unit 8200

- ✓ Text, Image & Audio analysis
- ✓ AI based object classification



Mil Wing Brigade HQ of Hamas

Used AI to generate recommendations for troops in the Research Division of Military intelligence



Used to produce quality targets (detect launch positions & key personal)



PRECISE AIR STRIKES

Achieved

- ✓ One Single Precision Strike (**Computer Vision based on ML**)
 - ✓ Killed **BASSEM ISSA** (Brigade Commander for Gaza city) - in tunnel, under high rise building, surrounded by six schools & medical clinic +
 - ✓ **JOMAA HAHLA** (Cyber & Missile Tech Chief), **JEMEL ZEBDA** (Head of Projects Development Department) +
 - ✓ **13 members of Hamas**
- ✓ Detected 14 rocket launcher location next to a school (**AI Based Change Detection**)
- ✓ Destroyed 40% of 100's of Km of metro tunnel network of Hamas (**Computer Vision + Big Data**)



- ✓ **Never Done Before** - >1000 targets, >1000 bombs, >100 tons of explosives, 160 air strikes, 230 targets neutralized, >150 operatives killed
- ✓ **X Factor** - Intelligence used as a service at tactical level
- ✓ First operation in military history where **human machine relations** were put to test
- ✓ **Amount of Data collected** - Gaza strip photographed 10 times a day

MOST ACCURATE & PRECISE MILITARY OPERATION

IN MODERN MILITARY HISTORY

Commented as “Astounding Achievement”

by critic John Oliver



DRONE SWARMING - FIRST TIME IN INDIA



ARMY DAY 2021

- ✓ **75** x Heterogeneous Drones
- ✓ **04** x Class of Drones
- ✓ Offensive & Defensive capability Demonstrated

TECHNOLOGY EXISTING

- ✓ Autonomous Operation
- ✓ Mesh Network
- ✓ **AI Enabled**
- ✓ Distributed Intelligence
- ✓ Auto Target Recognition (ATR)
- ✓ Edge Computing (On board Computer)
- ✓ Swarming Algorithm (python, C#)
- ✓ Multi Mission Load Carriage Capability





Govt Initiatives.....



➤ **Finance Minister (Budget Speech 2022) - “ Drone-As-A-Service (DrAAS)” Startups is need of the hour**

➤ **Prime Minister - 100 Kisan Drones for Spraying Pesticides in country; (Manpower Shortage, Crop Assessment, Land Records Digitization)**

➤ **Product Linked Incentive (PLI) - Sell Drones worth 100 Cr; Component Purchase Cost- 60 Cr; Profit - 40 Cr is Value Addition; Incentive is 20% over Value Addition (8 Cr) ; Effective : 2021-22 for 3 x FYs with Roll Over Benefit; Allocations - 120 Cr**

➤ **Drone Rules 2021 - Aircraft Rules 1937, Insurance & Compensation, Flight Clearances, Ban on Import**



Govt Initiatives.....



Bharat Drone Mahotsav (May 2022)

- ✓ **> 70** participants
- ✓ Award of drone pilot **certificates**
- ✓ Display of **Drone Taxi Prototype**



Drone Shakti Scheme

- ✓ Promotion of Drones through Start Ups
- ✓ Skilling at ITIs (Industrial Training Institutes)

End State

- ✓ Major Drone Hub in the world by 2030
- ✓ Industry to grow to over 30,000 Cr (Next 3 Years)
- ✓ Generate > 5 Lakh Jobs



To Conclude.....



*We need to distinguish between **transformative** and **disruptive** technologies. For any technology to be disruptive, it must bring about some **fundamental** change in the ends - ways-means matrix...*

*Technologies by themselves are not **disruptive**. It is their **cumulative impact** on the character of war that makes them so...!!!*

*~ Gen MM Naravane,
PVSM, AVSM, SM, VSM, ADC
EX Chief of Army Staff*



INTERESTING FACTS !!!



PLA - THOUSAND TALENTS PLAN

NATIONAL UNIVERSITY OF DEFENSE TECHNOLOGY (NUDT)

- ✓ Recruited **10** professors from abroad including one from Univ of New South Wales - Super Computer Expert
- ✓ Chinese Academy of Military Engineering and Physics - recruited **57** overseas scientists in 2020 to include scientists from the US Los Alamos National Laboratory
- ✓ Prof Jian Wei Pan - Phd under Prof Anton Zeilinger in **Quantum** in **Austrian** Heidelberg University, sponsored by PLA. *Designed world's first Quantum Satellite* - now working on the Quantum Radar
- ✓ PLA has established **160 defense laboratories** in Chinese Universities in addition to military institutions and defense companies

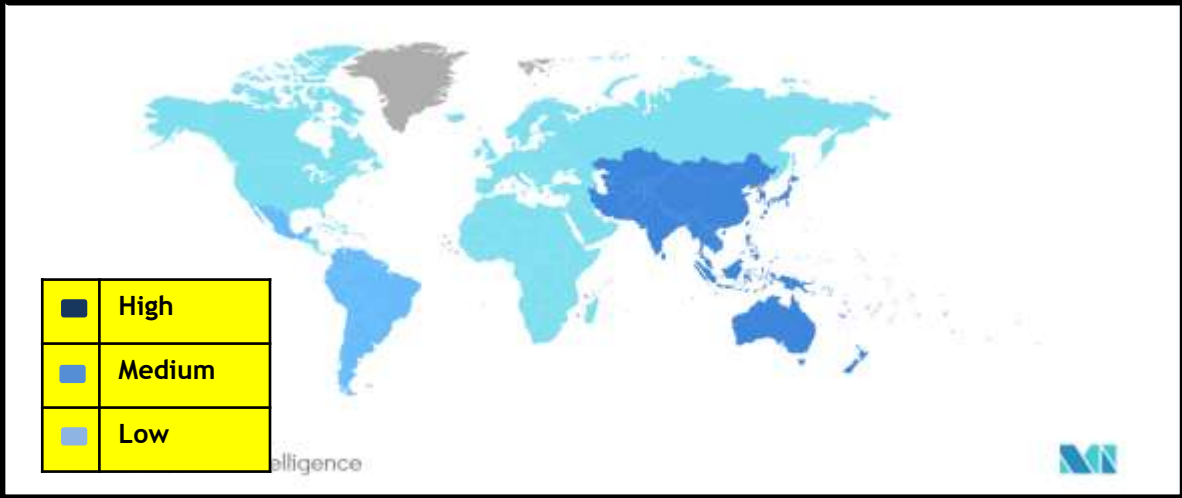


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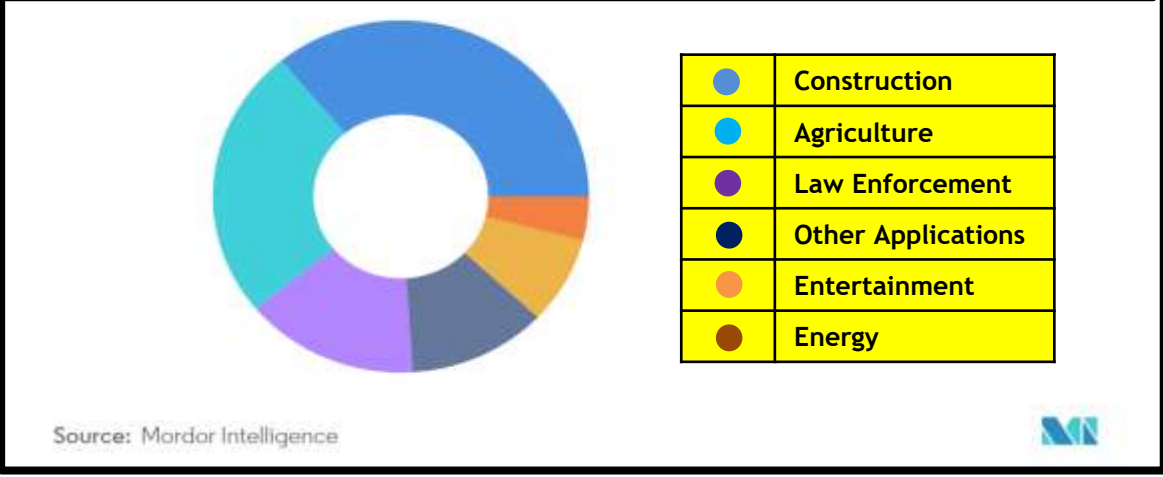


Statistics.....

DRONES MARKET GROWTH RATE BY REGION (2022-27)



DRONES MARKET : REVENUE (%)





Govt Initiatives.....



Bharat Drone Mahotsav (May 2022)

- ✓ *Promotion of Drone technology; good governance; ease of living*
- ✓ *> 70 participants*
- ✓ *Award of drone pilot **certificates***
- ✓ *Display of **Drone Taxi Prototype**- Made In India*

Drone Shakti Scheme

- ✓ *Promotion of Drones through Start Ups*
- ✓ *Skilling at ITIs (Industrial Training Institutes)*

i Drone

- ✓ ***ICMR** accorded approval for drone based vaccine delivery in **remote** areas*
- ✓ *North Eastern States and Telangana*