

THE HINDU ANALYSIS

9 MAY 2025



INDIA'S AIR DEFENCE SYSTEM



SUBCONTINENT'S CHALLENGE

The Subcontinent's challenge

It is in the interest of both India and Pakistan, and South Asia, that the current hostilities do not escalate into a full-scale military conflagration



Sanjaya Baru

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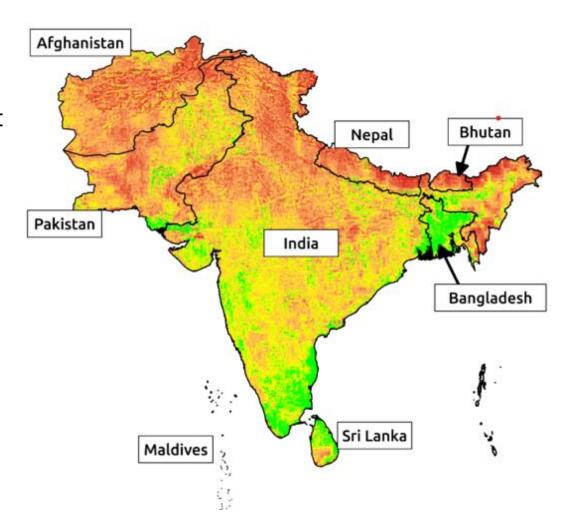
The Indian political brandoths: we will the ravill ever happen. That was the point of

Context

- India has conducted a series of air strikes under Operation Sindoor in response to the terror attack in Pahalgam, targeting terror camps not only in Pakistanoccupied Kashmir (PoK) but also inside Pakistan.
- This marks a sharp escalation in India's counter-terror response and has triggered fears of a prolonged India-Pakistan conflict with wider implications for South Asia's regional peace and economic stability.

Strategic Context and Regional Security

- India's recent actions signal a decisive shift from reactive to proactive counter-terrorism, targeting camps in both PoK and Pakistan—marking the operationalization of a new cross-border engagement threshold.
- Mutual Destruction and Limitations of War A fullscale war is unlikely to be sustained by either India or Pakistan without grave economic and human costs, making prolonged escalation strategically irrational for both sides.
- ☐ South Asia suffers from a chronic shortage of visionary political leadership that can transcend historical animosities and foster a stable regional development framework.



South Asia's Developmental Dilemma

- India's belief in decoupling economic rise from neighbourhood disputes has worked so far, but prolonged conflict risks derailing growth and increasing vulnerabilities.
- Pakistan's Destabilisation Strategy may not benefit India as weakened Pakistan may see economic sabotage through prolonged hostility as a strategic objective, potentially dragging India into a war of attrition that hampers development.
- ☐ Unlike previous wars, current geopolitical alignments may not exert timely diplomatic pressure to deescalate hostilities, increasing the risk of prolonged conflict.

INDIA-PAKISTAN RELATIONS

INDIA-PAK WAR 1947

After partition, Pakistan tribal army entered Kashmir. Maharaja of Kashmir signs a treaty of accession with India.

INDIA-PAK WAR OF 1965

A brief war breaks out after Pakistan's operation Gibraltar. Ends in a ceasefire.

INDIA-PAK WAR OF 1971

Another Indo-Pakistan war ends in defeat for Pakistan. Creation of Bangladesh.

SIACHEN CONFLICT 1984

The Indian Army seizes control of the Siachen Glacier.

KARGIL WAR 1999

Terrorists backed by Pakistani forces occupy Kargil peaks. India repulses the attack.

PARLIAMENT ATTACK 2001

Pakistan backed terrorists attack Parliament on December 11, 2001.

26/11 MUMBAI ATTACK 2008

Terrorists from Pakistan enter Mumbal through sea and attack public.

SURGICAL STRIKES 2016

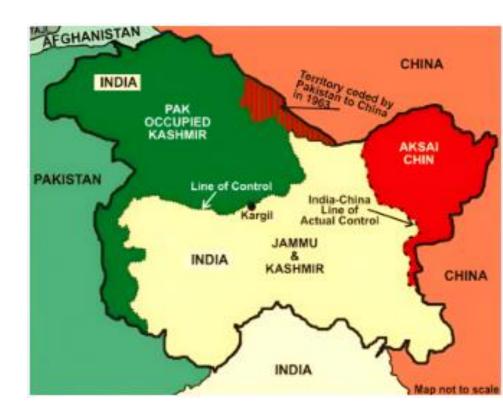
India carries out surgical strikes against terror camps in Pok in response to Uri attack

ARTICLE 370 REVOKED

India revokes Article 370 which granted special status to J&K, Pakistan takes the matter to UN

The Abandoned Peace Framework

- ☐ The last serious peace initiative—the Manmohan-Musharraf formula (2000–2007)—sought LoC recognition and joint mechanisms, but has since been abandoned without an alternative.
- Despite aggressive rhetoric, major powers like the US, Russia, and China effectively endorse the LoC as the de facto international border—a position rejected by hawks on both sides.
- India's "neighbourhood-first" policy has gradually turned into a cost-imposition model, which although assertive, creates long-term strategic and diplomatic pushback from neighbours.



HOW AIR DEFENCE SYSTEM WORK

How Air Defence Systems work

Key to India's thwarting of Pakistani aerial attacks along the western border has been the success of Indian air defences. These are complex military hardware-software systems that work to take out threats such as enemy aircraft, unmanned drones, or missiles before they can cause any damage. Here's what air defence systems constitute, and why they are critical to modern warfare

AR RIN SPASIFITA

SETTING THROUGH THE PROPERTY OF THE PROPERTY O Dramaday morning targeted air defence sysas in a runtiber of locations in Pakistan

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HOW THEY WORK

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ov rangefinders. More often than out, an oir defence sysorn is not just dealing with a single threat it has to identify and track multiple, for-sowing threats in complex and chattered

prominents, which may also racinde The accuracy of tracking is crucial for ef-tionly noutubeing favors my without ar-

INTERCEPTION: Once the throat has a detected and tracked, it count be nescting tracking and intercepting artial salverif. Here, the specifics of the threat - its - throats, superior communication and deciingo, typo (what kind of missile) aircraft), soon-making capabl pred, str. — determine the ways in which fortive air defence. ston-making capabilities are crucial for an el-

andefences work. All these three expects of an air differes. HOW THEY INTERCEPT orn have to work ingetter as a cogostshole. This requires what in military pail-





Frequency (RF) needer of the HARPY

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positive acquisition is made, the sitering sensor transforms into a

raided wou post ready to attack the

arget it has just revealed," the IAFs

The IAI chains that bandreds of

buttle-tested IGARCP lotering remetions have proved highly effective

in combat, "delivering 96% of minutes.

"Once the wide-arrange an upots as

identify and acquire the target. Once a

targeting performance

Weapon debris in American district Thursday morning. India repulsed Pakintani aerial attacks overnight. (Right) The Golden Temple thiring a blackout Thursday. (1)

ALL ABOUT IAI HAROP: LOITERING MUNITION THAT INDIA USED TO STRIKE PAK

It is understood that India deployed Israeli-made IAI HAROP drones against Pakistani air defence systems on Thursday

LOTTERING MUNITION leyel another the brack Acrosmac infustries, the HAROP is a lottering munition that combines characteristic of a typical unreasured aerial vehicle (UW) and a missile. Equipped with an explicate payload

lattering manifestrary are not to larger in the six — the WARDP harvan endurance of over nine hours - before identifying and crashing into a specific target Such a mode of operation has capped these waspens the pseudoscol suicide" or "kamikage" drawn.

The advantage of lottering manitions like the BAROF is that they can be launched without having to pre-identify targets, unlike older procession-guided viewpous that launched. The drone's camera allows the operator to visually scan an area. and zero in on a surget that is

"Independent of real-time intelligence, HAROP is uniquely capable

Revend the technical capabilities of de-

Depending on the challenger they have

secupions to newtraline aerial thacuts. These



ening time-critical high-value refocutable targets," the IAI's brockness on the weapon states

Note that the HARDP can function autonomously, or with a sometoly designated area, and upon locating a target, place an attack route and pursues it from any direction, either in a shallow or a steep dive.

Notably, the HARDFix resilient against Electronic Warfary [EW], and morane from Global Navington. Satellite System (GNSS) (againing

among the most world, se-

The M has been a fore-runner in the elopment of lottering munitions. In the 1980s, it introduced the HARPY, a "Rev and forget" missile that could be launched without prior intelligence towards the general direction of the

The HARDF today is deployed to hant high-solur targets like unmarrant artest every in the air, and then arre in a surface sensels, command posts, supply depots, tanks, and air defense systems the surget. The BASPY was specifically optimised for Suppression of Energy Air It is faunched from canisters mounted e tracks or usual years), and can be deglayed from diverse termina and

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climb-quickly to altitude and neutralise an ... any of the Solubor So-15s, Mild-29s, MAI combat with cannot, society, a suite of vimanifrance and bosond-visual-rance rate. Today, SAMs are the broad-and-bratter of

FRONTER AIRCRAFT: Intercepture are graded various of which is still in service falleting that take on attack memorary aircraft. With the limiture Art Force — were declicated. especially bourbers. These agile aircraft care intercoptons, Latest fighter aircraft flavor be unsurabled at a nonerot trends, and they "realized in capabilities" field in can deploy

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Several highly suphisticated EW sys torns are in use today. These can onerate From both Land and air, including from upo-custored EW aircraft, such as the US Navy Booking EA-186C Carpeller, the EW version of the EW-18 Super Humon.

TAKING DOWN ADS

Entablishing air supertoriny allows as Air loce to operate with a degree of impurity. and without free of attribute in bombing, setical six support paratrosp insention, or sup-

To establish alcounterforms over enems territory, the energy's air defence systems basets be neglialized. Suppression of Farmy Air Debraces (SDAIT) coverance extranect express a defendes with residues. DW benche URG coverground attacks. An analysis published to 2005 found that a quarter of American (SEAD): American Patrary Novely's

Given the role of air superiority in pra-cating a protective umbivella for ground forces talking down grappy air defeating also lays the ground for deeper ground attacks ☐ India thwarted Pakistani attacks, targeted multiple Pakistani air defence systems, reportedly neutralising one in Lahore.

☐ Air defence systems are crucial in modern warfare for protecting against enemy air strikes, and disabling them exposes a nation to aerial attacks, as seen in Pakistan's inability to inflict damage on India.

Air Defence System Operations

☐ The main goal of an air defence system is to eliminate aerial threats such as enemy fighter aircraft, drones, and missiles.

Key Operations of Air Defence

Detection

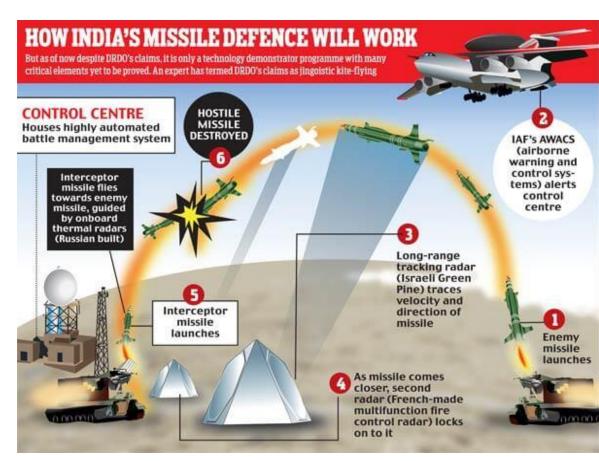
Radars (and sometimes satellites) identify incoming threats by emitting electromagnetic waves, which bounce off objects like aircraft and return to receivers, helping determine their distance, speed, and type.

Tracking

After detection, threats are continuously tracked using radar and other sensors (infrared cameras, laser rangefinders). This process helps manage multiple threats in real-time and avoids friendly fire.

Interception

■ Based on the threat's nature (type, range, speed), air defence systems launch appropriate countermeasures to neutralise it.



Methods of Interception in Air Defence Systems

1. Fighter Aircraft (Interceptors)
☐ Engage and neutralise enemy aircraft, especially bombers, before they can strike.
☐ Equipped with cannons, rockets, visual- and beyond-visual-range missiles, and electronic warfare (EW) systems.
□ Indian Examples: MiG-21 Bison, MiG-29, Su-30MKI, HAL Tejas, Dassault Rafale.
2. Surface-to-Air Missiles (SAMs)
☐Primary weapon in most modern air defence systems, safer and more versatile than aircraft.
□ Heavy Long-Range SAMs: Fixed/semi-mobile; e.g., S-400 (targets hundreds of km away).

□ Short-Range (MANPADS): Man-portable; effective against drones, helicopters, low-flying jets.

☐ Medium-Range SAMs: Mobile, quick-launch; e.g., Akash, Barak.

3. Anti-Aircraft Artillery (AAA)

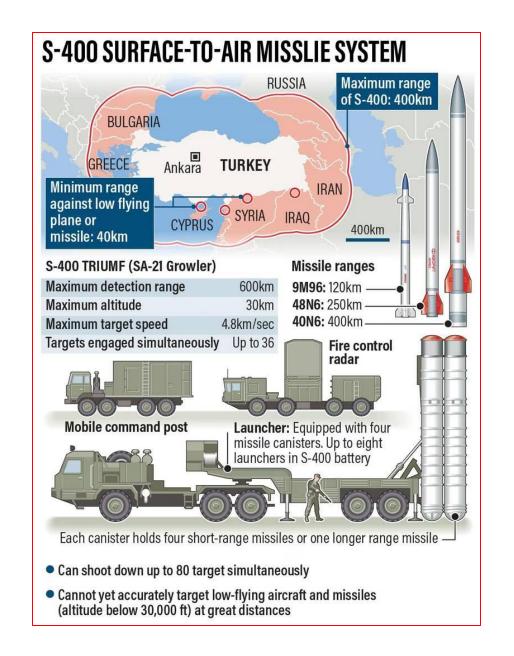
- Once dominant, now a secondary but still valuable defence against low-altitude threats.
- Fires over 1,000 rounds per minute; shells explode at preset altitudes, creating shrapnel fields.

4. Electronic Warfare (EW)

• Neutralise threats without physical destruction by manipulating the electromagnetic spectrum.

Methods:

- Jamming enemy radars and targeting systems.
- Disrupting guidance of missiles and drones.
- Confuses and misguides incoming threats, reducing their effectiveness.



1. Akash Indigenous area defence missile system

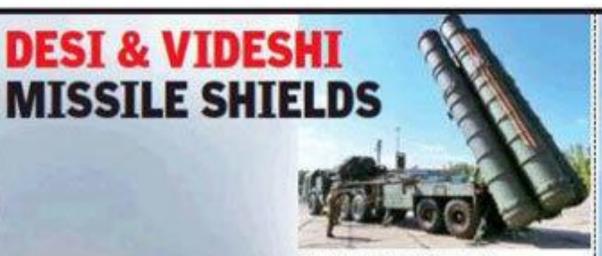
RANGE: 25 KM

- ➤ IAF inducting 15 squadrons of Akash-1 & two systems for Rs 10,900 crore
- Army has inducted 2 regiments for Rs 14,180cr (Two more Akash-2 regiments from Dec 2018 onwards)

3. Spyder Israeli low-level quickreaction missile system

RANGE: 15 KM

- ➤ IAF inducting 4 Spyder systems
- DRDO developing 30-km range QR-SAM system



2. S-400 Triumf
Rs 39,000-crore deal with Russia
to be inked this year

RANGE: 400 KM

- 1st missile unit in 24 months after contract. All 5 in 54 months
- China inducting S-400 batteries under \$3 billion inked in 2014

5. Ballistic Missile Defence

- Indigenous project to develop 2-tier BMD shield
- Phase-I (interceptor missiles with 4.5 Mach speed) for 2,000-km range enemy missiles
- Phase-2 (interceptor missiles with 6-7 Mach speed) for 5,000-km range missiles
- Will take 2 years for Phase-I to be deployed

4. Barak-8 Joint DRDO-Israeli Aerospace Industries project RANGE: 70-KM

- ➤ IAF to get initial nine medium-range SAM squadrons for Rs 10,076 crore
- ➤ Navy to get it for its frontline warships for Rs 2,606 crore (initial cost)
- 14 warships fitted with older Barak-I systems (range 9 km)

DECLINING MMR IN INDIA

MMR shows a declining trend, reveal latest data

The highest MMR is seen in the 20-29 age group and second highest in the 30-34 age group; the maternal mortality ratio in a region is a measure of the reproductive health of women

Bindu Shajan Perappadan NEW DELHI

he Maternal Mortality Ratio (MMR) in India declined to 93 per lakh live births in 2019-21 from 97 in 2018-20. and 103 in 2017-19, show the latest data released by the Office of the Registrar-General and Census Commissioner of India.

The data show the highest MMR occurs in the 20-29 age group, and the second highest in the 30-34 age group.

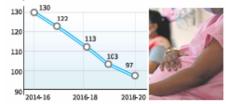
Several States, including Madhya Pradesh (175), Assam (167), Uttar Pradesh (151), Odisha (135), Chhattisgarh (132), West Bengal (109), and Haryana (106), have high MMRs.

The Registrar-General arrives at estimates on fertility and mortality using the Sample Registration System, one of the largest demographic sample survevs in the country.

The MMR is a measure of the reproductive health of women in a region.

Drop in maternal death rate

The chart shows the Maternal Mortality Ratio (MMR), which is the number of maternal deaths during a given period per 100,000 live births



Source: Office of the Registrar General, India

Every day in 2023, over 700 women died of preventable causes related to pregnancy, says WHO

One of the key indicators of maternal mortality is the MMR, defined as the number of maternal deaths during a given time period per 100,000 live births during the same time period as reported.

The UN's Sustainable Development Goals (SDGs) aim at reducing global MMR to to less than 70 per 100,000 live births.

Many women in the reproductive age span die from complications during and following pregnancy and childbirth, or abor-

"Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the dura-Join FREE Whatsapp Channel https://whatsapp.com/channel/0029Van2VRb6RGJOKH6oBd0F

tion and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes," according to the World Organization Health (WHO).

The data state that maternal deaths, being a rare event, require prohibitively large sample sizes to provide robust estimates.

The WHO notes that every day in 2023, over 700 women died from preventable causes related to pregnancy and childbirth.

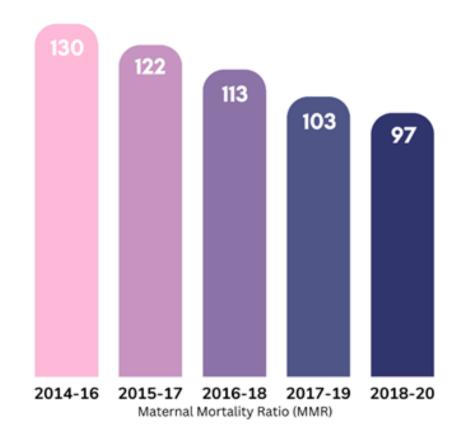
"A maternal death occurred almost every 2 minutes in 2023. Between 2000 and 2023, the MMR...dropped by about 40% worldwide. Just over 90% of all maternal deaths occurred in low- and lower-middle-income countries in 2023. Care by skilled health professionals before, during and after childbirth can save the lives of women and newborns," the WHO said.

CONTEXT

- ☐ The Maternal Mortality Ratio (MMR) in India declined to 93 per lakh live births in 2019-21 from 97 in 2018-20, and 103 in 2017-2019, according to the latest data released by the Office of the Registrar General and Census Commissioner of India.
- ☐ India has made notable progress in improving maternal health, as reflected in the latest Maternal Mortality Ratio (MMR) statistics.
- ☐ This sustained reduction highlights the combined efforts policies, healthcare government infrastructure improvements, increased and awareness of maternal health services.

Understanding the Maternal Mortality Ratio

- ☐ The Maternal Mortality Ratio (MMR) is a critical indicator of the reproductive health of women in a country.
- ☐ It is defined as the number of maternal deaths per 100,000 live births during a specific time period.
- ☐ Maternal death is classified by the World Health Organization (WHO) as the death of a woman during pregnancy or within 42 days of the termination of pregnancy, from any cause related to or aggravated by pregnancy or its management.
- ☐ The Sustainable Development Goals (SDGs) set by the United Nations aim to reduce the global MMR to less than 70 per 100,000 live births by 2030. India's declining trend is a positive step toward achieving this target.



Major Causes of Maternal Death

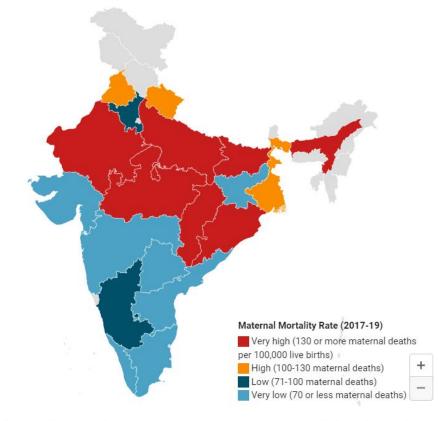
deaths globally.

☐ According to the WHO, more than 700 women globally die every day due to preventable causes related to pregnancy and childbirth. In 2023 alone, maternal deaths occurred almost every two minutes worldwide. Key factors contributing to maternal deaths in India include: Complications during pregnancy and childbirth ☐ Unsafe abortions Lack of timely medical intervention Inadequate access to skilled healthcare professionals ☐ Low- and lower-middle-income countries, including

parts of India, account for over 90% of maternal

Seven states have very high maternal mortality

India's maternal mortality ratio (MMR) has improved from 113 in 2016-18 to 103 in 2017-19. The ratio has worsened in West Bengal, Haryana, Uttarakhand and Chhattisgarh.



MMR is defined as the number of maternal deaths during a given time period per 100,000 live births during the same time period. Sustainable Development Goals (target 3.1) says the global maternal mortality ratio should be less than 70 per 100,000 live births by 2030

Maternal Health Schemes under NHM

NHM is central to India's maternal health initiatives through its comprehensive RMNCAH+N strategy—covering Reproductive, Maternal, Newborn, Child, Adolescent Health and Nutrition.

- 1. Janani Suraksha Yojana (JSY): Launched in 2005, it provides cash incentives to promote institutional delivery among BPL, SC, and ST women to reduce maternal and neonatal mortality.
- 2. Pradhan Mantri Matru Vandana Yojana (PMMVY): Offers Rs.5,000 maternity benefit for the first live birth, with an additional incentive under PMMVY 2.0 for a second girl child to promote positive behaviour.
- 3. Janani Shishu Suraksha Karyakram (JSSK): Ensures free delivery (including C-section), diagnostics, medicines, transport, diet, and blood for pregnant women and sick infants in public health institutions.
- **4. Surakshit Matritva Aashwasan (SUMAN):** Launched in 2019, it guarantees free, respectful, and quality maternal and newborn healthcare with zero service denial.
- 5. Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA): Provides fixed-day, free antenatal care on the 9th of every month, focusing on high-risk pregnancies; over 5.9 crore women examined till March 2025.



Thank you

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