

Teammates Turn Rivals For The Grand Prize: Salah Leads **Egypt** Against A **Senegal** Side Spearheaded By Mane

THIS TIME FOR AFRICA

Yaounde: Egypt or Senegal? Or maybe a more absorbing question for world soccer fans: Mohamed Salah or Liverpool teammate Sadio Mane?

Sunday's African Cup of Nations final in Cameroon will centre on two of the continent's biggest stars, now global stars, when Salah's Egypt try to reclaim their lost glory against Mane's Senegal, who are seeking a first title and the right to finally call themselves the best in Africa.

The two forwards will be on opposing sides at the Olembe Stadium in Yaounde and while their teams are playing for bigger rewards, there will be significant focus on who wins the personal battle between the club mates.

One of them is set for unrestrained joy and his first major title with his country. One is set for more misery. Salah lost in the final with Egypt in 2017, and Mane was inconsolable after Senegal lost in the final in 2019.

Mane partly predicted the match-up in a video he posted on social media at the start of the African Cup. He was cheekily addressing Liverpool teammates Salah and Naby Keita of Guinea when he said he knew he was going to face one of them in the final, he just didn't know which.

"Unfortunately I can't play against two teams in the final so I have to play against one," Mane said. "Which of you?"

Turned out to be Egypt after the North Africans took the hard road to the final, beating Ivory Coast on penalties in the round of 16, Morocco in extra time in the quarterfinals and hosts Cameroon in another shootout in the semifinals.

Touchline ban for Egypt coach Queiroz

That game against Cameroon saw Egypt coach Carlos Queiroz given a red card for his angry protests against some of the referee's decisions and he will be banned from the touchline for the final.



AFRICA CUP OF NATIONS

HEAD-TO-HEAD RECORD:

1986 Group A: Senegal 1 Egypt 0

2000 Group C: Egypt 1 Senegal 0

2002 Group D: Senegal 1 Egypt 0

2006 Semifinal: Egypt 2 Senegal 1

It's turned out to be an ideal climax for the African Cup and its attempts to attract more attention than usual. They will be watching in Merseyside, said Liverpool manager Jurgen Klopp.

"They (Salah and Mane) are superstars there so the pressure they had on their shoulders was massive, and how they deal with it, I'm really proud of them," Klopp said. "We will watch it, definitely."

Both players lived up to their big reputations at the African Cup.

One of them will also end up being part of a landmark moment for their country at the African Cup. **AP**

EGYPT
Popular name: Pharaohs
Rankings: 6 Africa, 45 world
Captain: Mo Salah; Coach: Carlos Queiroz (POR)
Semifinal: Cameroon 0-0 aet (won 3-1 on penalties)
Scorers: 2 - Salah; 1 - Abdelmonem, Mahmoud Trezeguet
Best placings: Champions 1957, 1959, 1986, 1998, 2006, 2008, 2010
SENEGAL
Popular name: Teranga Lions
Rankings: 1 Africa, 20 world
Captain: Kalidou Koulibaly; Coach: Aliou Cisse
Semifinal: Burkina Faso 3-1
Scorers: 3 - Mane 1 - Diallo, Diedhiou, Dieng, I. Gueye, Kouyate, Sarr
Best placings: Runners-up 2002, 2019

CHELSEA WILL TRAVEL TO ABU DHABI WITHOUT COVID-INFECTED TUCHEL

London: Chelsea manager Thomas Tuchel tested positive for the coronavirus, preventing him from attending Saturday's FA Cup match against Plymouth and putting doubts on whether he can go to Abu Dhabi for the Club World Cup.

Tuchel will not be on the flight on Saturday night. Thursday would appear to be the earliest he can leave isolation under English guidelines. Chelsea play their Club World Cup semifinal on Wednesday. The final and third-place game is on Saturday. **REUTERS**

BENGALURU MOVE TO 3RD IN INDIAN SUPER LEAGUE

Bambolim: Bengaluru FC turned on the style in an impressive second half to beat Jamshedpur FC 3-1 and move into third place in the Indian Super League. Down a goal inside the first minute, the Blues clawed their way back through Sunil Chhetri (55'), before Brazilian Cleiton Silva showed up with a brace (62', 90+4'). **TNN**

Olympic 100m champ Jacobs wins on return

Berlin: Olympic 100m champion Lamont Marcell Jacobs marked his long-awaited return to the track with victory in the 60m at the Berlin indoor meet on Friday, while pole vault star Armand Duplantis agonisingly missed out on breaking his own world record. Italian sprinter Jacobs won in a time of 6.51sec in his first appearance since stunning the sport at the Tokyo Games in August. Jacobs, the European champion over 60m, had said on the eve of the event that he had come to Berlin "just to win". He was as good as his word, seeing off Ivory Coast's Arthur Cisse (6.60sec) and Jimmy Vicaut of France (6.61sec) at the finish.

Bulls overcome LeVert's 42 points to defeat Pacers:

Nikola Vucevic scored a season-high 36 points and grabbed 17 rebounds and the visiting Chicago Bulls overcame a sizzling performance by Caris LeVert in a 122-115 win over the Indiana Pacers on Friday. DeMar DeRozan scored 31 points and Javonte Green added 16 for Chicago, which began a stretch of four games in five nights by shooting 54.4 percent. The Bulls outscored Indiana 70-54 in the paint and won for the fifth time in their last seven games. LeVert was 19-of-26 shooting and led the Pacers with a season-high 42 points, including 28 in the first half.

China seek 9th title, S. Korea eye maiden triumph in women's Asian Cup final:

China would look for an unprecedented ninth title while Korea seek their maiden triumph when the two continental heavyweights square off in the summit clash of the AFC Women's Asian Cup in Navi Mumbai on Sunday. China and Korea have defeated two-time defending champions Japan and another title favourite Australia, respectively, en route to the grand finale at the DY Patil Stadium. History favours China as they have won the tournament seven times on the trot from 1986 to 1999 before adding another one in 2006. They have also been in the top four in every edition from 1986 till now. **AGENCIES**

Narrow escape for top teams

HAMMERS NEED TWO STOPPAGE-TIME GOALS TO SEE OFF KIDDERMINSTER; CHELSEA STRUGGLE TO BEAT PLYMOUTH; UNITED NOT SO LUCKY AGAINST BORO

London: When the FA Cup game entered stoppage time, **West Ham** were facing a humiliating loss to sixth-tier side Kidderminster.

Alex Penny had scored in the 19th minute for the National North division's third-place team who were outplaying the millionaires from London who are only point away from the Champions League places. Only Declan Rice's equaliser forced the game into extra time to prevent West Ham from being on the receiving end of the biggest upset in the 150 years of the competition. Then to avoid a penalty shootout at the 6,000-capacity central England stadium, it took Jarrod Bowen scoring in stoppage time of extra time to recover a 2-1 victory against the team 113 places lower in the English league system.

It was a struggle too in London for European champions **Chelsea**,



needing to come from behind to eliminate third-tier Plymouth 2-1 in extra time at Stamford Bridge.

Manchester City overcame an early wobble as Riyad Mahrez struck twice to help them ease past second-tier Fulham 4-1. **Everton** thrashed fellow EPL side Brentford 4-1 as Frank Lampard got off to a strong start in his first game as manager.



HIT HARD: (On top) United's Anthony Elanga was racially abused after missing the 16th penalty of the shootout against Boro; (L) Sixth-tier side Kidderminster's players are understandably disappointed

Rangnick baffled by handball goal as Man Utd exit on penalties

Manchester: Manchester United manager Ralf Rangnick was left cursing a change to the handball rule while his Middlesbrough counterpart Chris Wilder hailed the magic of the FA Cup as the 12-time champions suffered a shock fourth round exit on penalties on Friday. **AGENCIES**

Host China clinches its first gold of Beijing Winter Games

Beijing: Host nation China secured its first gold medal on Saturday as dazzling performances on snow and ice nudged the political drama that has dominated the Beijing Olympics toward the sidelines. "You can always trust China" began trending in posts on social media platform Weibo after its short track skaters won the mixed team relay, an event making its debut at the Olympics and that the country has dominated in international competition.

The golden dream was almost cut short in the semi-final when the United States crossed the finish line ahead of the hosts, only to be disqualified along with the Russian Olympic Committee, after a lengthy video review. "My heart was almost jumping out of my throat!" wrote "egg's heartbeating diary" on Weibo. Six gold medals were up for grabs on Saturday as athletes overcame pandemic obstacles to shine on the world's stage, even as political storylines continued to swirl around the Games.

Norway's Johannes Thingnes Boe, forced to isolate from his team mates because of a Covid-19 close contact, proved there were few Winter



Wu Dajing of China (front), Jordan Pierre-Gilles of Canada (middle) and Shaolin Sandor Liu of Hungary during the Short Track Speed Skating Mixed Team Relay Final at the Beijing Olympics on Saturday

Games shows quite effort by his. A blistering skiing effort by the beloved biathlete brought his team back from the dead to triumph. An upset in the men's freestyle moguls saw Walter Wallberg of Sweden pip Canadian Michael Kingsbury for gold.

Dutch Irene Schouten came from behind in the 3,000 metres speed skating to beat Italian Francesca Lollobrigida, a great-niece of 1950s film star Gina Lollobrigida. Urša Bogataj sparked Slovenian joy when she won the women's normal hill ski-jump gold. Her compatriot Nika Kriznar claimed bronze as Germany's Katharina Althaus had to settle for silver. Norway nabbed the first gold medal at the Games when Therese Johaug powered to victory in the women's skiathlon race. **REUTERS**

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Sousa beats Ymer, faces Ruusuvuori in the final

Kumaraswamy.K
@timesgroup.com

Pune: Joao Sousa moved to Barcelona at the age of 16 and started training at the BTT tennis academy, where Francisco Roig, a key member of Rafael Nadal's coaching staff, became his

mentor. For the following six years, the Portuguese had the opportunity to learn from one of the game's top minds and also had the occasional opportunities to practise with the Spanish legend himself. Needless to say, the 32-year-old Portuguese has imbibed the never-say-die fighting spirit of the Mallorcan.

There was an ample display of it on Saturday as he came back from the brink to defeat Sweden's Elias Ymer

and move into the final of the Tata Open Maharashtra. Sousa, with a career-high rank of 38 in early 2019, saved three match points to stop the giant-killing run of qualifier Ymer 5-7, 7-6 (4), 7-5 in three hours and 13 minutes.

In the final, the World No. 137 will take on Finland's sixth seed Emil Ruusuvuori, who subdued Poland's Kamil Kajchazak 6-3, 7-6 (0) in the other semifinal of the \$494,000 ATP 250 Series event.

For Sousa, reaching the first Tour final in nearly four years couldn't have come at a better time. "It feels amazing. The last two years have been really tough as I had a foot injury and my ranking dropped to almost out of the top-200," he said.

Aditi makes cut at Drive On Champs

Fort Myers (US): Aditi Ashok fired two birdies in the last four holes to make the cut at the LPGA Drive On Championship. Aditi, who shot 72 in the first round, was starting at the possibility of an early exit when she was 1-over for the second day after 14 holes. Aditi birdied the sixth and then holed a clutch putt on the ninth, her 18th and final hole of the second round.

Seamus Power sets 36-hole record at Pebble: Even for being located next to the ocean, the iconic finishing hole at Pebble Beach is short for par 5s by modern standards. That didn't keep Seamus Power from taking an iron off the tee with his wedges Friday with a 4-foot birdie. **AGENCIES**

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CRYPTIC CLUES

Across

- 1 Consider changing gear on the way (6)
- 4 Possibly call in or ring bells (8)
- 9 I set about some fish (6)
- 10 Descriptive of who has been singularly successful (4-4)
- 12 Survey the scene (8)
- 13 Do real results come from such a trial? (6)
- 15 House cover (4)
- 16 Four voices in noisy combination (10)
- 19 He has an interest in conversion schemes (10)
- 20 A force retreats to a distance (4)
- 23 Fingerprint expert? (6)
- 25 They're out of the frying pan into the soup perhaps (8)
- 27 All being well, it should be empty (8)
- 28 Released and spread around (6)
- 29 Memorable industrial action (8)
- 30 Fat, it is said, of the land (6)

Down

- 1 Decorate from top to bottom or bottom to top (7)
- 2 Heartless girl loving to be elegant (9)
- 3 Kitchener's formula for success? (6)
- 5 They are the ones in suits (4)
- 6 Sneak in late (8)
- 7 Set out for a holiday (5)
- 8 Unnecessary loss of a point irritates (7)
- 11 Tale a hundred tell (7)
- 14 You may take work home from it (7)
- 17 Bound to go wrong? (3,6)
- 18 Oral application for beauty treatment (8)
- 19 Light-headed games? (7)
- 21 Remainder of a new rise now owing (7)
- 22 Big shock absorber (6)
- 24 A hard question for one, a sitter for another (5)
- 26 Leading sea power (4)

QUICK CLUES

Across

- 1 Kidnap (6)
- 4 Frivolous (8)
- 9 Recompense (6)
- 10 Five-line comic verse (8)
- 12 Leave harbour (3,2,3)
- 13 Belvedere (6)
- 15 Mere display (4)
- 16 Explode in rage (3,4)
- 19 Lose an opportunity (4,3,3)
- 20 Large-scale (4)
- 23 Make certain (6)
- 25 Outline of film plot (8)
- 27 Winding (8)
- 28 Ungainly stooping gait (6)
- 29 Adversary (8)
- 30 Regard as likely (6)

Down

- 1 To the point (7)
- 2 Stop work and strike (4,5)
- 3 System of roadblocks (6)
- 5 Wild animal's den (4)
- 6 Seven Sisters star cluster (8)
- 7 Similar (5)
- 8 Become airborne (4,3)
- 11 Rescue from danger (7)
- 14 Trustworthy (7)
- 17 Timely (9)
- 18 Top of the bill (4,4)
- 19 Distinguished conductor (7)
- 21 Kind of needlework (7)
- 22 Entry of many people (6)
- 24 A fight (5)
- 26 Total destruction (4)

SOLUTIONS TO LAST WEEK'S CROSSWORD

CRYPTIC

C	O	R	A	C	L	E
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QUICK

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The Times of India

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*Other winners will be announced on www.toicrossword.com

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Losing hair?
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INDIA AND THE ATOMIC AGE

By K. C. KHANNA

THE late Dr. Homi Bhabha had thought of the application of atomic energy to power production a year before the Hiroshima bomb and 12 years before the world's first nuclear station at Calder Hall began to supply electricity to a British grid. At his initiative the Tata Institute of Fundamental Research was established at Bombay way back in 1944 to explore the mysteries of the atom.



me has at last begun to pay off.

RADIATION

In the so-called "gamma" garden at Trombay, molecular biologists proudly show the visitor a mutant variety of rice called TR-1, induced by controlled radiation. For four consecutive years TR-1 has undergone field trials at 26 locations in Maharashtra, Madras, Hyderabad and Mysore. Grown with normal inputs of water and fertilizer, it has yielded 21.5 per cent higher grain than the parent variety. Experiments with a groundnut, distinguished by its "giant" pod, have been even more encouraging. Similar improvements are being attempted in maize, watermelon, sorghum, cotton, brinjal, tomato, and in the true Bhabha spirit, in lots of flowers.

Again at BARC, experts at the neighbouring radioisotope laboratory, are blazing a new trail by directing the fabrication of equipment for a new isotope dispensing centre to be set up in Kabul. The product of this laboratory, almost 350 in number, include some of the sophisticated isotopes in use—vitamin B-12, labelled radioactive cobalt, and serum albumin, labelled with active iodine-131. Some radio pharmaceuticals, e.g. for cancer and leprosy, are also being developed. Australia, Ceylon, C. East Germany, France and the Philippines.

Inside the compound, the Division has conducted experiments to fix the dams at P. lum, repair the fissures in the B. dam, detect cracks in the concrete used by the industries all over India to BARC for val engineering, and the movement of the dam.

The Division about Rs. 1 lakh exchange and fite from domestic sal ards this is good laboratory that ce Rs. 10 lakhs to b gretable that on India are among rest, 250 or so, facilities to handl cal isotopes. If th ties, the annual o ratory could be st

and nuclear tech- niques are the two modern ones that is trying to har- nulfarious de- eds. What has was Jawaharlal a which encour- nent to science

Not Just For Prestige

recent launching of the Indian satellite, "Aryabhata", into space has forth both praise and criticism. An economically backward country like India, it is said, cannot afford sophisticated space technology. L. K. mentions some positive aspects of satellite payloads, like TV, the use of solar energy and earth resources surveys which could accelerate agricultural development.

nd adopt the run similar velds, India hen these the ad- ound in is figu- They natic the i a w-

will begin this August but the SLV-3 is far off.

Rocketry has been our weak point. The gap between proven development and the SLV-3 technology is quite large. The SLV-3 itself will be a modest effort but has already taken a long time and is now expected to go up in 1978. Certainly, it will be years later than 1979 (the earlier target for us to have a launcher, SLV-synchronous) that could send a 1,200-kg. satellite to a 40,000 km. circular orbit.

The domestic satellite communications system remains on paper because of "financial constraints" as the Planning Commission found it too ambitious in its present form. The development of an indigenous communications satellite is yet to begin. Work should have already begun on the next scientific satellite. The space activity can be sustained only through interfaced on-going programmes. It is time to think of what we will do when we have the SLV-3 in 1978.

Though over the years, considerable experience has been gained in the development of rocket loads, not much thought was given earlier to the fabrication of satellite payloads. It is now preliminary work is being taken to build facilities.

her urgent task is the de- of a spaceworthy solar stem on which hardly has been done. Solar ty not always be avail- from foreign sources. worthy tape-recorder a had to be import- that has been stri- strong electronics er of years.

s context that Dr. ai, architect of In- gramme, had em- "we cannot have pace research in dustry or antiquat- f management and There is a totality ation, he had said. f slippage has one re. Whenever, port has been made scaling up the tur- ple, the intention p and fabricate a in the first attempt e that went up t.

commitment and essary to avoid to maintain n this sophisticated eed is a clear- can spell out the nd the projects in ar which helped the space plan 2 and a fresh look t long-term plan urage the govern- lowing a now-on- y in future. In piecemeal approach y.

WE HAVE JOINED SPACE CLUB

First Rocket Fired Successfully

RESEARCH CENTRE IN 18 MONTHS

"The Times of India" News Service

TRIVANDRUM, November 21.

INDIA today fired the first rocket successfully at 6-25 p.m. off the Kerala coast and joined the international space club for a peaceful probe of outer space.

Both the firing and performance of the two-stage unguided rocket was completely successful and according to expectation.

Immediately after the firing from the Equatorial Sounding Rocket station of Thumba, 15 miles from here, Dr. H. J. Bhabha, Chairman of the Atomic Energy Commission, said India would launch her own rocket within the next 18 months.



also cleared the rocket range of all vessels.

The communication system worked very well. The rocket programme was to study movement in the higher atmosphere. The programme in Kerala inspired Mr. Sujanapriyan of Trivandrum to appeal to Mr. Nehru to select him as India's first spaceman to go in a rocket. He wrote to Mr. Nehru about a month ago and sent copies of his request to the President, the Governor of Kerala and the Chief Minister of the State.

WORKERS WATCH LAUNCHING
Workers in the area went about their work quietly as the rocket went up. Some of them sat in groups and watched the rocket go up. Some others were busy listening to appeals over loud-speakers urging them to support particular candidates in the panchayat elections.

The two most anxious men waiting with invites near the launching pad were Dr. H. J. Bhabha and Dr. Vikram Sarabhai, Chairman of the Indian Committee for Space Research. They were jubilant at the result attained with the first rocket. Dr. Sarabhai commented: "Beginner's luck."

The Governor, Mr. V. V. Giri, army and naval officers and top ranking officials were present to witness the country's first rocket go up.

P.T.I. addy, Dr. Sarabhai told pressmen that the rocket was assembled and launched entirely by Indian personnel. **Madurai:** Mr. R. S. Mani, officer-in-charge of the Physical Research Laboratory, Kodakkanal, told P.T.I. that no photographs of the sodium vapour, emitted by the rocket could be taken owing to bad-weather conditions prevailing at Kodakkanal. "It is extremely cloudy and nothing could be seen from here," it was raining at Kodakkanal all through the day, he said.

SHIPS WARNED OFF AREA

The rocket weighed 1,600 pounds and travelled at a speed of 2,400 miles an hour. India's aircraft-carrier, INS "Vikrant", sent out aircraft to warn off ships and other vessels from the sea. Two ships of the Indian Navy

Cheap production of A-power possible in 1970s

By A Staff Reporter

INDIA would be in a position to produce nuclear power at a cost of only 1.5 paise per kilowatt-hour (k.w.h.) by the end of the 70s through an accelerated programme of production with "fast-breeder reactors" if the Government adopted a definite nuclear policy, Dr. Vikram A. Sarabhai, chairman of the Atomic Energy Commission, said in Bombay on Thursday.

Dr. Sarabhai told newsmen that the Planning Commission, in its Fourth Plan recommendations for 1969-74, had made no provision for the establishment of any new atomic-power project. The present "stop-go" policy, he said, appeared to arise from ignorance or fear. If the investment in the last 15 to 20 years was to pay dividends early, there should be no hold-back at this crucial period.

Capital investments on nuclear-power stations were costly but, in the long run, were more economic than hydro-electric or thermal-power stations.

Dr. Sarabhai said India was among the seven countries highly developed in nuclear-power technology. If we faltered at any stage, we would have failed to live up to the hopes of the late Dr. Homi J. Bhabha, founder of India's atomic energy programme.

Quick decision-making was essential to ensure that the rate of nuclear-power generation was doubled to 2,000 mw. before 1980, once the 1,000-mw. output was achieved by the middle of 1972. "Already we are late, but we can bridge the gap if we work fast now," he said. What was needed was the "go ahead" signal. The original schedule was for the generation of 1,000 mw. by 1970 — 400 mw. at Tarapur, 400 mw. at Rana Pratap Sagar and 200 mw. at Kalpakkam.

Dr. Sarabhai said he realised that the Planning Commission had to look to the difficult resources problem before deciding on priorities of expenditure. "In my opinion, power, whether it be nuclear, thermal or hydro-electric, deserves a higher priority," he said. He felt that the quick development of power would give an optimum multiplier of the national economy.

Dr. Sarabhai said the total power cost per k.w.h. at the Tarapur Atomic Power Station and the Rajasthan Atomic Power Station worked out to 4.72 paise per k.w.h. each against the total cost of 6.64 paise per k.w.h. for power generated from a typical new thermal station using coal.

FUEL COST

The cost per kw. installed at Tarapur was Rs. 1,850 against Rs. 3,150 at Rajasthan, which used the Candu-type reactor but the fuel cost at Rajasthan was only 0.34 paise per k.w.h. against 1.63 paise per k.w.h. at Tarapur. This was because Tarapur used fuel enriched uranium, which had to be imported, while Rajasthan used natural uranium.



Dr. Sarabhai emphasised that there were 31 nuclear-power reactors in 18 countries, generating a net output of 11,395 m.w.e. An additional 101 reactors were under construction. These would generate between 53,682 m.w.e. and 54,888 m.w.e. of power. Thus, there would be 182 reactors which would have a total net output of 65,077 m.w.e. to 66,283 m.w.e. The trend was now towards "fast breeder" reactors.

Apart from the low generating cost, a major advantage of the "fast breeder" reactor was that plutonium, which is obtained as a by-product from our first generation of nuclear-power reactors, now being built, could be used as fuel for fast reactors, which could breed additional plutonium or Uranium-233 by using depleted uranium, which is also a low-cost by-product of our first-generation reactors, or thorium, which is plentiful in India.

THREE STAGES

The need for importing expensive fuel would be obviated. The technology, therefore, for the breeder system, had to be developed early so that sufficient expertise was available as soon as plutonium became available for starting the fast-reactor programme.

Thus, India's nuclear-power programme would consist of three stages: (1) Building of heavy-water moderated reactors; (2) Utilising the plutonium from Stage-1 reactors in fast breeders until suitable thorium-uranium reactors were available; and (3) Running Stage-2-type breeders on a thorium feed to produce Uranium-233 and run the second type of breeders on a thorium-uranium cycle.

Dr. Sarabhai stated that the first unit of the Rajasthan Atomic Power Station at Ranapratapagar was expected to be ready by 1971 and the second in 1973. Civil works had reached an advanced stage for the third atomic power project at Kalpakkam.

Satellite launched from Soviet station

India enters space age

"The Times of India" News Service

NEW DELHI, April 19.

THE first Indian satellite was shot into space today ushering India into the space age.

All instruments on board the 360-kg. satellite were functioning normally and the launching was completely successful, an official announcement said.

The satellite is circling the globe every 96.41 minutes at an altitude of about 600 km.

ON SOVIET ROCKET

The scientific satellite, "Aryabhata" named after the fifth century astronomer and mathematician, was launched from a cosmodrome in the USSR with the help of a Soviet rocket carrier at Plesetsk.

Ground tracking stations at Sriharikota near Madras and Bears Lake on the outskirts of Moscow indicate that the satellite, which is expected to remain in orbit for about six months, is functioning normally. Monitoring of the satellite is accomplished by sending radio commands from these stations.

The diamond shaped satellite has been designed and built by the Indian space research organisation (ISRO) at its Indian scientific satellite project (USSP) in Bangalore. This 26-cm. diameter and 34-cm. high satellite is 147 cm. in diameter and 111 cm. high. It carries instruments to conduct experiments for the detection and study of X-rays from outer space; to investigate neutrons and gamma rays emanating from the sun; and to detect and study the presence of suprathermal electrons and ultraviolet background at the F-region of the ionosphere.

It is the presence of ionosphere which has made long-distance radio communication around the globe possible.

The data being transmitted to ground stations is expected to bring in new information on outer space, the sun and the earth's atmosphere. The satellite obtains energy from solar batteries. Thermal regulation of the satellite is achieved through a passive thermal control system. The data from the scientific experiments are recorded by onboard tape-recorders and are transmitted to the ground stations at Sriharikota and Bears Lake by a radio telemetry system upon sending commands.

President Ahmed called the launching a "very important milestone in our march towards scientific and technological self-reliance" and expressed gratitude to the Soviet Union "for the significant role it had played in the happy and successful culmination of this remarkable project."

The Prime Minister, Mrs. Gandhi, hailed the launching as an "important event in our continuing efforts to harness the benefits of science and technology for national development."

She congratulated the chairman of the space commission, Dr. Satish Dhawan, and his colleagues on their remarkable achievement. The Prime Minister also thanked the Soviet Union "for its valuable assistance during the project and for making available the launching facilities."

SPECIAL STAMP

The posts and telegraphs department commemorated the historic event by announcing the issue of a special 25-paise stamp which would be sold tomorrow morning at all philatelic bureaux in the country.

An official announcement here said the successful launching of the satellite "is the result of joint work envisaged in the agreement for scientific collaboration between the Indian space research organisation and the USSR academy of sciences signed on May 10, 1972."

It added: "The collaboration and technical assistance offered by the Soviet scientists and specialists helped the Indian space research organisation to plan and prepare the satellite in such a short period."

In a statement, Dr. S. Dhawan declared that "our plans of using space science and technology for national tasks are now nearer to being translated into reality. The difficult task of designing and constructing a spacecraft and establishing the ground stations within less than three years was made possible."

He praised the "dedicated hard work of Prof. U. R. Rao, the project director, and his team, and Dr. Y. J. Rao and his group at Sriharikota with the excellent help and advice of the scientists and engineers of the USSR academy of sciences."

He also mentioned the "contribution made by many other national organisations, especially in the aircraft and electronic industries in the construction of the satellite and the ministry of communications for assistance in establishing the communication links."

During every orbit, the path of the satellite will be slightly shifted because of the earth's rotation. As a result the very high frequency signals transmitted by the craft can be monitored by a particular ground station during four of the 16 daily orbits. When the satellite passes over the Sriharikota and Moscow stations its transmitter can send taped information to earth at a speed ten times faster than the rate at which it was recorded. In other words, all the information the tape-recorder collects during a 40-minute recording can be conveyed to ground stations in just four minutes.

NATIONAL EFFORT

The satellite is the result of a truly national effort. During its fabrication the ISRO freely used the infrastructure of the nation's industry both in the public and private sectors. The major establishments among them are: Bhabha Atomic Research Centre, Bharat Electronics, Central Machine Tool Institute, controllerate of inspector electronics, Electronics Corporation of India, Hegde and Golay Ltd., Hindustan Aeronautics, Indian Telephone Industries and the National Aeronautical Laboratory. Many small-scale industries also made significant contributions.

Aryabhata, after whom the satellite is named, was born at Usumapur, near Patliputra (now Patna) in 476 A.D. His first famous work, "Aryabhatiya", was written when he was just 23 years old. Among his important contributions was in determining the physical parameters of celestial bodies such as the diameter of the earth and moon.

ARYABHA

Saturday, April marked down as day in the brief history of this country's post-independence scientific and technological endeavour. "Aryabhata", quixotically called the great Indian fifth century astronomer, is now orbiting sending out vital information on subsequent interpretation, will fundamentally alter our view of the universe. A warm welcome to all space scientists participated in this for they have shown the snicker from others, that the satellite is the heaviest any nation in its to go into space; ed, non-duplicate on board, special aeronomy in which scientists are right front; programmes well-coordinated the space research and related group we seeking from it it is the first step certainly be a long we need reassured little-publicised f though economic veloped, technology as good as any. the need for moi on the structure of the sun, the st us our very suste physical condition per atmosphere larger extent t thought affect ter and on such end mical puzzles as ground radiation neutron stars, a called 'black hole'.

The significance on-board experin be overstressed, their usefulness, benefit the counl premature quest alas the first that lay mind; it may pared with Ru mous retort (w asked him about basic research); value of a new-be have to begin so time, and we h just that. Aryabh runner of severa ments that will to our own c meteorological, e and applications we get more spec the electrical field sphere, ultraviole the heat budget atmosphere, f plied later f such crucial tain to the logy and energy.

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