



# NavIC based Timing Applications in India

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**9<sup>th</sup> December, 2019**

**ICG-14, Bengaluru**

- ❑ Timing solution finds its uses in various infrastructures of national importance like
  - Electric power distribution
  - Communication network
  - Satellite earth stations
  - Financial transactions time stamping
  - Time Metrology
  - Scientific research
  - Industrial Control and monitoring
- ❑ Accuracy and data format depends on application.
- ❑ Time formats: 1PPS, IRIG, NTP, PTP and NMEA.

- ❑ NavIC System Time start epoch is 00:00 on Sunday August 22nd 1999 (midnight between August 21st and 22nd).
- ❑ At the start epoch, NavIC System Time was ahead of UTC by 13 leap seconds. (i.e. IRNSS time, August 22nd 1999, 00:00:00 corresponds to UTC time August 21st 1999, 23:59:47).
- ❑ IRNSS system time is given as 27-bit binary number composed of two parameters:
  - Week Number (10 bits) appearing in the first sub frame
  - 17bit Time of Week Count (TOWC) in all four subframes.
- ❑ TOW count value ranges from 1 to 50400 to cover one entire week.
- ❑ System Time maintained by NavIC ground segment using ensemble of AHM and Caesium clocks.
- ❑ NavIC Time is maintained within few ns of UTC(NPLI).

# NavIC Timing Receiver

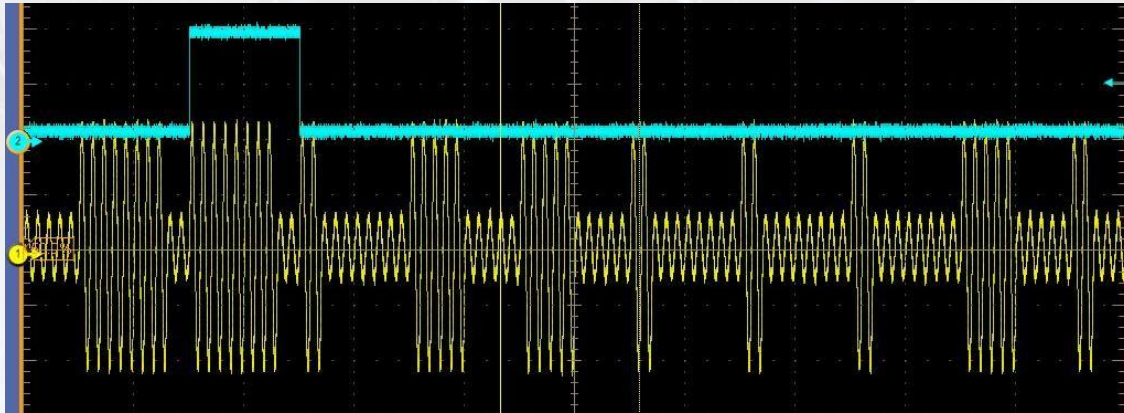
- Inhouse development of NavIC Timing receiver at SAC/ISRO.
- To cater to need of indigenous time scale for national infrastructure.
- Receiver is compatible with existing GPS based timing receivers.
- Dual frequency NavIC processing: better accuracy.
- Introduction in phased manner.
- Enabling industry to introduce NavIC system time in their Timing products.

# NavIC Timing Receiver



- ❑ Tri-band receiver with L5 & S signals of NavIC and L1 signals of GPS C/A and GAGAN.
- ❑ Time solution is obtained from NavIC Dual Frequency (L5+S) processing.
- ❑ Outputs: IRIG, Disciplined 10 MHz and 1PPS signals.
- ❑ Configurable IRIG Time Code formats -A/B/G XXX
- ❑ 1- $\sigma$  timing accuracy of 15 ns.
- ❑ 10 MHz output stability is of the order of  $10^{-12}$  when locked to NavIC system time.

# NavIC Timing Receiver



IRIG-B120 Output Waveform aligned to 1 PPS signal



Receiver Timing output to Standard IRIG B120 Time Code Reader

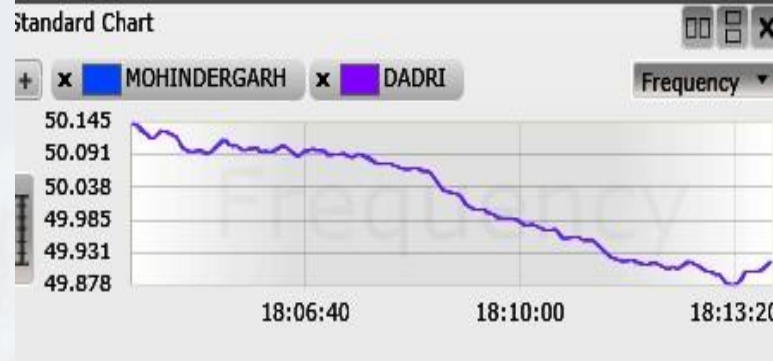
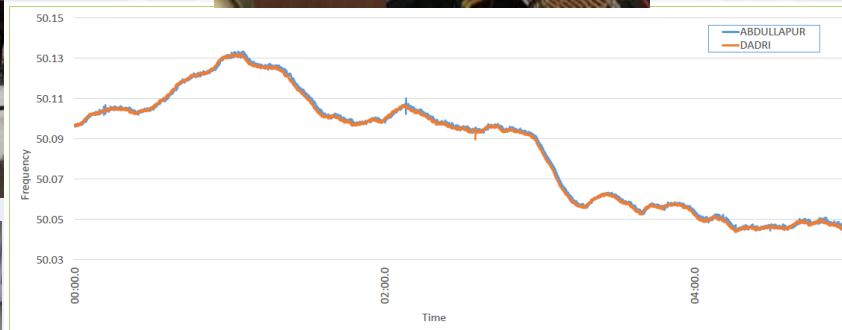
- ❑ Currently all stations are using Phase Measurement Unit (PMU), which are synchronised across the grid using GPS receiver timing output.
- ❑ As a pilot testing, NavIC Timing Receivers are installed at five power grid sites geographically spread across India.
- ❑ Receivers are used for time stamping of power grid phasor measurements for Power Grid control, measurements and monitoring applications.
- ❑ IRIG-BXXX Time Code format interface with PMU.
- ❑ Each site has different make and interface of PMU.

# NavIC Timing Receiver in Powergrid





# NavIC Timing Receiver in Powergrid



# Low Cost Timing Receiver



- Small size, Low cost and Low Power Timing receiver using NavIC receiver module.
- Configurable IRIG Time Code formats - A/B/G XXX.
- 1PPS disciplined 10MHz output.



Receiver Timing output to standard IRIG B120 Time Code Reader

# NavIC NTP Server

- ❑ NTP server with NavIC Time reference established at SAC/ISRO, Ahmedabad
- ❑ Synchronization of the computers of Intranet.
- ❑ Time server for Centre for Railway Information System (CRIS) over Internet.
- ❑ This is in operation as 24x7 service.



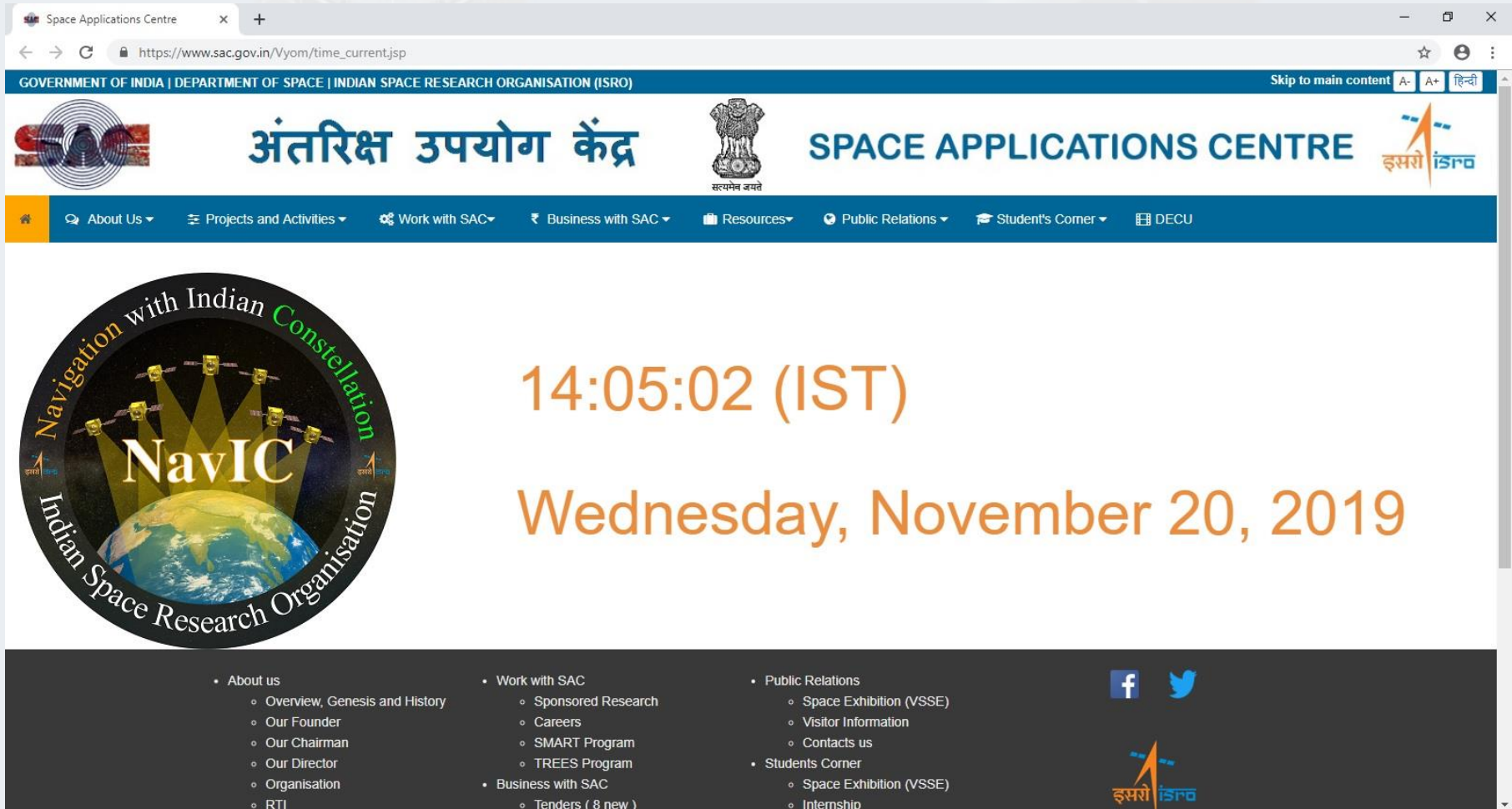
**In house developed NTP server**



**NTP server Implementation on Raspberry PI**

# NavIC Time on Webpage

[https://sac.gov.in/Vyom/time\\_current.jsp](https://sac.gov.in/Vyom/time_current.jsp)



The screenshot shows a web browser window displaying the Space Applications Centre (SAC) website. The page header includes the Government of India, Department of Space, and Indian Space Research Organisation (ISRO) logos. The main content area features a large circular graphic for NavIC (Navigation with Indian Constellation) and a digital clock showing 14:05:02 (IST) on Wednesday, November 20, 2019. The footer contains a navigation menu with links to various sections like About us, Work with SAC, Public Relations, and Students Corner.

**Navigation with Indian Constellation**  
**NavIC**  
**Indian Space Research Organisation**

**14:05:02 (IST)**  
**Wednesday, November 20, 2019**

- About us
  - Overview, Genesis and History
  - Our Founder
  - Our Chairman
  - Our Director
  - Organisation
  - RTI
- Work with SAC
  - Sponsored Research
  - Careers
  - SMART Program
  - TREES Program
- Business with SAC
  - Tenders ( 8 new )
- Public Relations
  - Space Exhibition (VSSE)
  - Visitor Information
  - Contacts us
- Students Corner
  - Space Exhibition (VSSE)
  - Internship

# NavIC Clock



- ❑ Time display at public establishments.
- ❑ Accurate and stable clock.

