NavIC based Timing Applications in India

Kalpesh Borsadiya

Indian Space Research Organization (ISRO)

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□ 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

❑ 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-σ 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
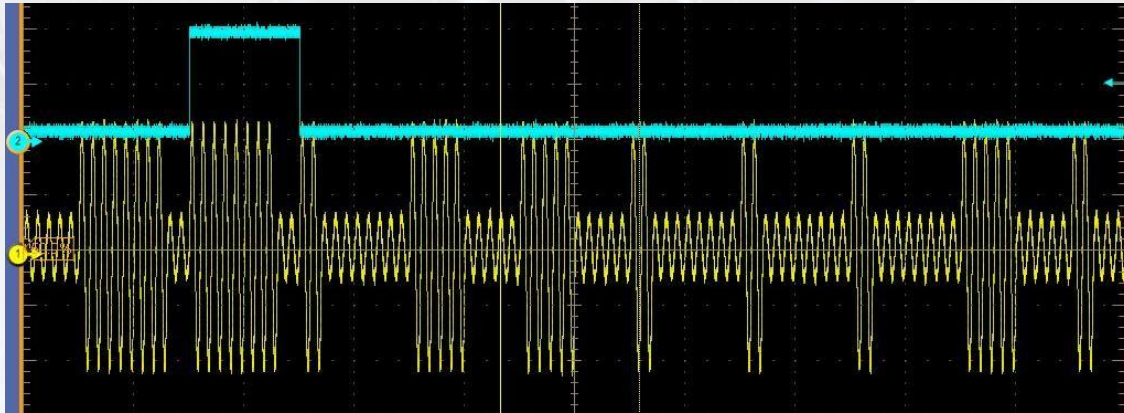
IRIG-B120 Output Waveform aligned to 1 PPS signal

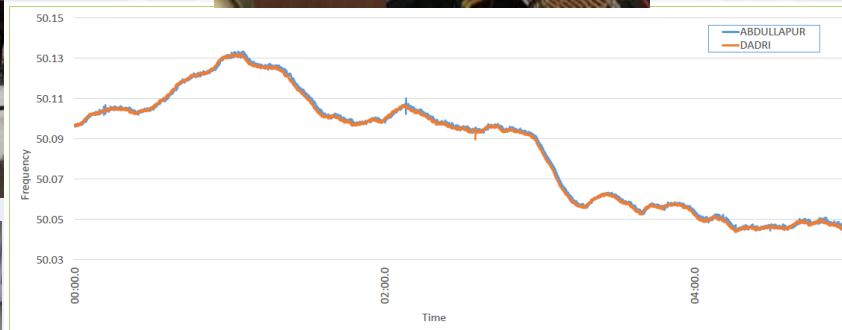Receiver Timing output to Standard IRIG B120 Time Code Reader

- ❑ 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
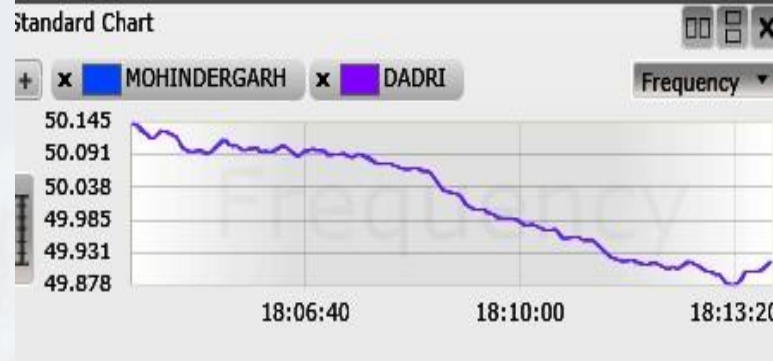
Low Cost Timing Receiver

- 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.
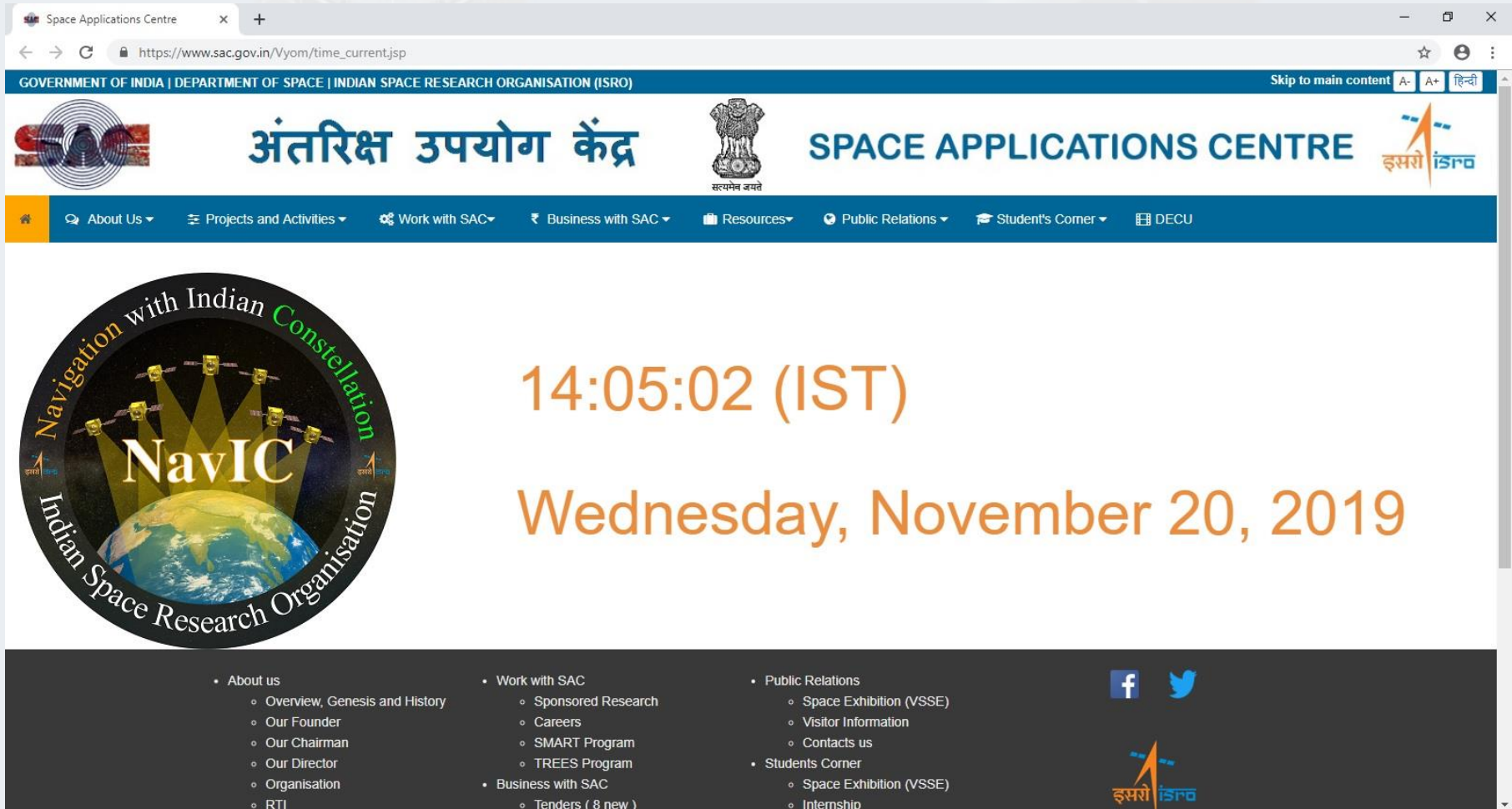
In house developed NTP server

NTP server Implementation on Raspberry PI

NavIC Time on Webpage

https://sac.gov.in/Vyom/time_current.jsp

NavIC Clock

❑ Time display at public establishments.

❑ Accurate and stable clock.

Thank You