



RDSO Welcomes

All the
Distinguished Dignitaries
On

1st ROUND TABLE CONFERENCE



Agenda

SN	Identified Research Areas
1	Development of reliable solutions for prevention of accidents on unmanned level crossings.
2	Reduction in Noise Level.
3	Reliable Technological solution to detect rail/weld failure.
4	System required for assisting the driver to run the train during foggy weather.
5	Improvement in the efficiency of the operations, especially to improve turn-around time of coaches/wagons.
6	Suitable on-board & way-side health monitoring system for predictive maintenance of Rolling Stock.

Agenda

SN	Identified Research Areas
7	Improving the efficiency of the operations.
8	Gas Turbine Locomotive.
9	Feasibility of using satellite based system for monitoring of Railway Tracks and other Assets.
10	Complete waste management with zero discharge philosophy.
11	Clean, Waterless & odourless Toilet Systems for IR.
12	Improved interior of coaches.
	Other Areas of Research <u>Communication based train control system, Elimination of power cars, Wi-fi on trains & Fuel efficiency of diesel locomotives</u>



AREA OF RESEARCH

Development of reliable solutions for prevention of accidents on unmanned level crossings

- **Project**

- Advance Warning System to Pre-Warn Road Users about Approaching Train at Unmanned Level Crossing

- **Concerned Directorate**

- Telecom Directorate (*Sh.D.N.Tiwari, ED; 9794863010*)

- Signal Directorate (*Sh.Mukesh Mehrotra, ED; 9794863024*)

Problem Definition

- There are about 15000 UMLCs, constituting more than 50% of total level crossings on Indian Railway
- Accidents occur at UMLCs due to inadequate precautions by the road users who fail to observe mandatory sign boards, signals and basic traffic safety rules.
- Elimination or manning of UMLC is the long term solution.
- Till such time, a system to pre-warn the approach of train at UMLCs is required, which should be :
 - Vandal-Proof
 - Least possible Power Consumption due to poor availability of reliable power supply at level crossing gates
 - Maintenance free, highly reliable & error free as to be installed in mid-sections

AREA OF RESEARCH

Reduction in Noise Level

- **Project**
 - Noise Level Reduction in Cabs of Locomotive
- **Concerned Directorate**
 - Motive Power Directorate (*Sh.C.M. Rao, ED; 9794863004*)

Problem Definition

- IR is developing high horse power diesel locomotives
- Recently developed 5500 hp loco has issues of high noise – in cab as well as around
- In a study by RDSO team in TKD shed, it was observed that the maximum noise in the drivers cab ranged from 86.6 dbA to 99.0 dbA.
- Central Pollution Control Board through Environment Protection Act 1986
 - prescribed a noise level of range of 55 to 75 dBA during day time and 45 db to 70 dBA at night.
 - If noise level exceeds 95 dB(A), exposure not to exceed 4 hours
 - If noise level exceeds 97 dB(A), exposure not to exceed 3 hours
- Need for ways to reduce noise
 - At source level
 - In cab (use noise absorbing material for paneling etc. or any other method).

AREA OF RESEARCH

Reliable Technological solution to detect rail/weld failure

- **Project**

- Reliable Technological solution to detect rail/weld failure

- **Concerned Directorate**

- **Track Directorate** (Sh. S.K.Pandey, ED; 9794863015)

- **M&C Directorate** (Sh. C.Sengupta, Dir.; 9794863184)

Problem Definition

- Rail/welds in service are subjected to cyclic fatigue loading.
- Rail/ Weld breaks occurs either due to abnormal temperature variations and/or unfavorable operating conditions.
- Timely detection of in-service Rail/ weld Break before passage of a train is essential to prevent unsafe operating conditions and accidents
- Present system:
 - USFD testing of Rails/ welds for detection of defects
 - Visual inspection by manual patrolling in cold weather as rails are more prone to fracture at low temperatures
- Need of development of reliable technical solution:
 - To identify fracture prone rails/welds
 - To detect already failed rail/weld and communicate to approaching train driver and control room

AREA OF RESEARCH

System required for assisting the drivers to run the train in all weather conditions with special emphasis during foggy weather

- **Project**

- Image Assistance System for Train Drivers
- Fog vision system

- **Concerned Directorate**

- Electric-Loco Directorate (*Sh.A.K Singhal, ED; 9794863130*)
- Motive Power Directorate (*Sh.C.M. Rao, ED; 9794863004*)

Problem Definition

- Provision of fencing all along the track not feasible making intrusion of any kind (person/cattle/wild animal) frequent phenomena.
- Trespassing of road users at Manned/Unmanned level crossings.
- Breakdown/Infringement of Heavy Vehicles such as truck, tractor trolleys, bus etc. over the railway track.
- Falling of boulders, big rocks etc. obstructing the track in Ghat sections prone to natural disasters such as Konkan Railway, K-K section etc.
- In present system, Driver uses his judgment under such conditions. In absence of any reliable technology, this judgment can be prone to failure.

Improved vision for train drivers during foggy conditions

- Severe Impairment of Train operations in Northern India during foggy weathers.
- Special Drives are launched to enhance safety during fog leading to cancellation/diversion/modification of train routes.
- Speed is traded off with train safety leading to very reduced train running speed under sever foggy conditions.
- In the present system, the driver has to rely on his judgment to steer the trains in the foggy conditions.
- **We envisage an Image Based System (e.g. a smart screen mounted on the windshield may be similar to aircrafts) which could relay the view outside the cab accurately and effectively for a better and informed decision of the driver.**

AREA OF RESEARCH

Improvement in the efficiency of the operations, especially to improve turn-around time of coaches/wagons

- **Project**

- **Development of Indigenous High Speed Camera Based Vehicle Inspection System**

- **Concerned Directorate**

- **Research Directorate** (*Sh.D.K.Agarwal, ED; 9794863022*)

- **Carriage Directorate** (*Sh.Sanjay Kumar, ED; 9794863026*)

- **Wagon Directorate** (*Sh.Sanjay Kumar, ED; 9794863026*)

Problem Definition

- **Current Status:**

All types of vehicle are inspected manually

- Near the station when the train enters into platform.
- At stations/ yards/washing line/depots/etc. when the vehicle is at rest

- **Shortcomings:**

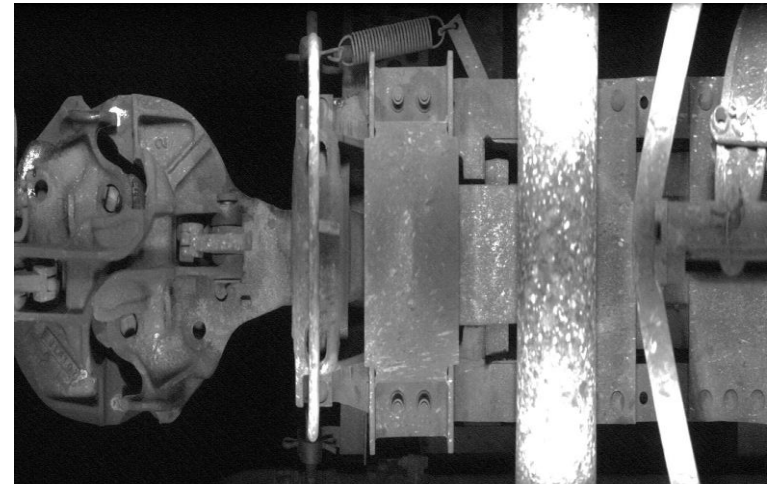
- Defect is not known in advance, hence remedial action takes time
- Train Examiner has to stand in sun/rain, day/night.

- **Outcome Desired:**

- Machine based Inspection when the vehicle is at normal speed and 30-40 km ahead of major maintenance stations
- Communication to stations/ yards/washing line/depots/etc. in advance, before the train arrives

Problem Definition (Contd.)

- Requirements :
 - High speed high quality image acquisition and processing
 - Intelligent algorithms for automatic defect detection of processed images
 - All weather (if possible, as this system is proposed for replacement of manual inspection)
 - Report files/Image (*highly compressed*) for easy transmission by GPRS



AREA OF RESEARCH

Suitable on-board & way-side health monitoring system for predictive maintenance of rolling stock

- **Project**
 - Development of Indigenous Acoustic Bearing Detector
- **Concerned Directorate**
 - Research Directorate (*Sh.D.K.Agarwal, ED; 9794863022*)
 - Carriage Directorate (*Sh. Indrajit Singh, ED 9794863011*)
 - Wagon Directorate (*Sh.Sanjay Kumar, ED; 9794863026*)

Problem Definition

- **Current Status:**

Monitoring of bearing en-route is done by :

- Between stations by gateman/gangman when the bearing has already become hot and emanating smoke/flame
- Near the station by train examiner when the vehicles are at slow speed
- By touching the bearing cover at stations/ yards/washing line/depots/etc. when the vehicle is at rest
- By using handheld infrared temperature recorders at stations/ yards/washing line/depots/etc. when the vehicle is at rest

- **Shortcomings:**

- Defect detection quite late, when the bearing is already hot and might be in damaged condition
- Depends to a large extent on human judgment

Recent Trends in Automatic Detection of Defective Bearing

- **Hot Axle-box Detector:**
 - Uses infrared sensors along the track to detect **already warm/hot bearings**
 - Thus it is again a reactive technology where a human is replaced by a machine but failure during service is not avoided.
- **Acoustic Bearing Detector:**
 - Uses microphones along the track to capture noise of passing vehicles, filters out bearing noise and detects bearing with defect much in advance of failure
 - Predictive technology where the machine is able to prevent failure during service.
- **Need to develop indigenous Acoustic Bearing Detector**

AREA OF RESEARCH

Improving the efficiency of the operations

- **Project**
 - **Development of Hollow Axle**
- **Concerned Directorate**
 - **Wagon Directorate** (*Sh.Sanjay Kumar, ED; 9794863026*)

Problem Definition

- **Why hollow axle?**

- The gross wt. of a wagon is fixed due to limitations of load per axle that can be borne by track.
- To maximise pay load, the tare wt. need to be kept as low as possible.
- Presently, solid forged axles are being used in all freight stocks.
- If hollow axles can be developed, saving of approximately ½ tonne per wagon in tare wt. and payload capacity increase.
- Each ½ tonne gain in payload capacity leads to extra revenue of about Rs.50,000/- per year per wagon.

- **Requirement**

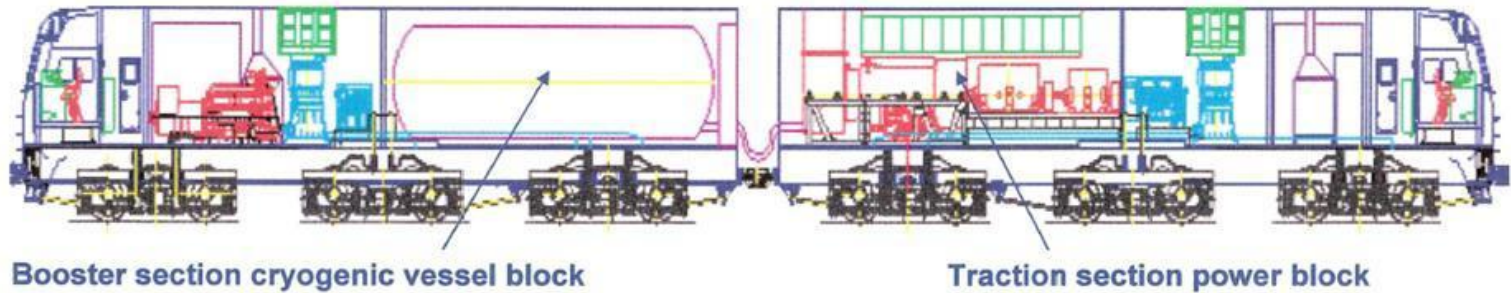
- Development of Solid Model of the universal hollow axle, FEM analysis, soft validation vis-à-vis international standard, protocol for manufacture, inspection, service etc.

AREA OF RESEARCH

Gas Turbine Locomotive

- **Project**
 - Development of LNG Based Gas Turbine Locomotive
- **Concerned Directorate**
 - Engine Development Directorate
(*Sh.R.N. Misra, Sr.ED; 9794863007*)

Gas Turbine Locomotive



Twin Loco Concept



Problem Definition

- High cost of diesel in India & dwindling fossil fuel reserves
- Large Natural Gas reserves in India:
 - Sufficient for 80 years at present consumption
 - More Economical
 - Environmental friendly
- One high powered GTL in operation in Russia
- Need for Detailed Project Report (technical & economic) encompassing following critical areas:
 - Availability and pricing of Natural Gas
 - Suitability of gas turbine technology for traction purposes
 - Noise pollution

AREA OF RESEARCH

Feasibility of using satellite based system for monitoring of Railway Tracks and other Assets

- **Project**

- Mapping of Post Flood River configuration & Development of effective flood control measures

- **Concerned Directorate**

- Structures Directorate (*Sh.H.L. Suthar, ED; 9794863226*)

Problem Definition

- Rivers change course due to floods and other reasons every year.
- Damage to Railway assets e.g. Track, formation and bridges.
- Requirement :
 - Remote sensing data collection of few years for a particular river.
 - Analysis of Remote Sensing Data to find out the feasibility of prediction in changes in river course on short term as well as long term.
 - Preventive Measures to control floods and damage to embankment or bridge.
 - Suggest methodology to be adopted for working out changes & measures taken.

AREA OF RESEARCH

Complete Waste Management With Zero Waste philosophy

- **Project**

- Waste Management on Indian Railways

- **Concerned Directorates**

- Carriage Directorate (*Sh. Indrajit Singh, ED 9794863011*)
- Research Directorate (*Sh.D.K.Agarwal, ED; 9794863022*)
- Works Directorate (*Sh.Sanjay Kumar, ED; 9794863026*)

Problem Definition

- Waste is generated :
 - At stations
 - At yards
 - In trains;
 - Presently no scientific waste disposal mechanism exist.
 - It is either allowed to degrade itself or mixed with sewage system without any treatment.
 - It is shifted from one place to another
- Requirement :
 - Identify the source, type and quantity of waste generated
 - Suggest waste treatment, disposal and re-cycle mechanisms
 - Passenger and environmental friendly
 - Easy to use and adapt.
- Need for a holistic method of Waste Management (Zero waste principle) by “Reduce, Recycle & Reuse”

AREA OF RESEARCH

Clean, Waterless and Odourless Toilets for IR

- **Project**
 - Vacuum/Zero Discharge Toilet
- **Concerned Directorate**
 - Carriage Directorate (*Sh. Indrajit Singh, ED 9794863011*)

Problem Definition

- Only open discharge toilets in IR coaches from the time they were introduced.
- Issues with open toilets:
 - Corrosion of rails as well as coach parts
 - Filth at platforms and on wayside
 - Foul smell
- Bio-toilets (jointly developed with DRDO) introduced in 2010
 - Retention, process(by bacteria) and discharge type
- Need to develop zero discharge toilet (such as vacuum toilet) suitable for deployment on IR
 - Require evacuation en-route and at terminals
 - Possibility of recycling the water for flushing purpose
 - No odour
 - Should not choke and become non-functional (*passenger are habitual to throw all sorts of waste such as cups, plastics, diapers etc. in toilet*)

AREA OF RESEARCH

Improved interior of coaches

- **Project**
 - Improved interior of coaches
- **Concerned Directorate**
 - **Carriage Directorate** (*Sh. Indrajit Singh, ED 9794863011*)

Problem Definition

- The vision of world class interiors which meets rising expectations and aspirations of citizens of India is in prime focus in designing new passenger coaches and also in rehabilitation of existing coaches in use on Indian Railways.
- The requirements are:
 - Better aesthetics
 - Ergonomically designed to suit Anthropometric data for Indian population.
 - Availability of material in India
 - Fire-proof

OTHER AREAS OF RESEARCH

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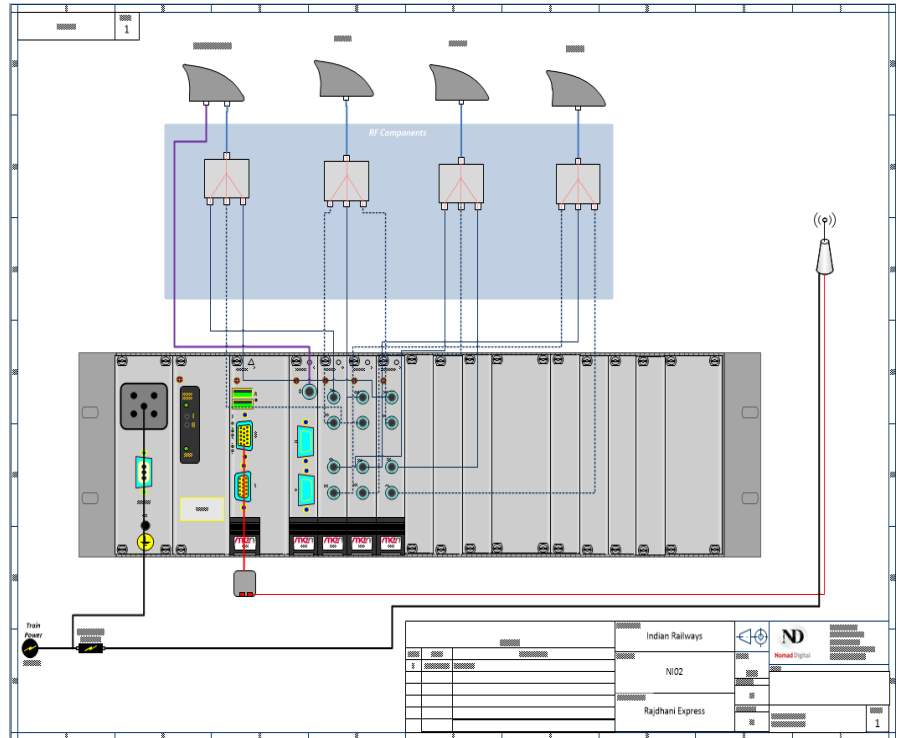
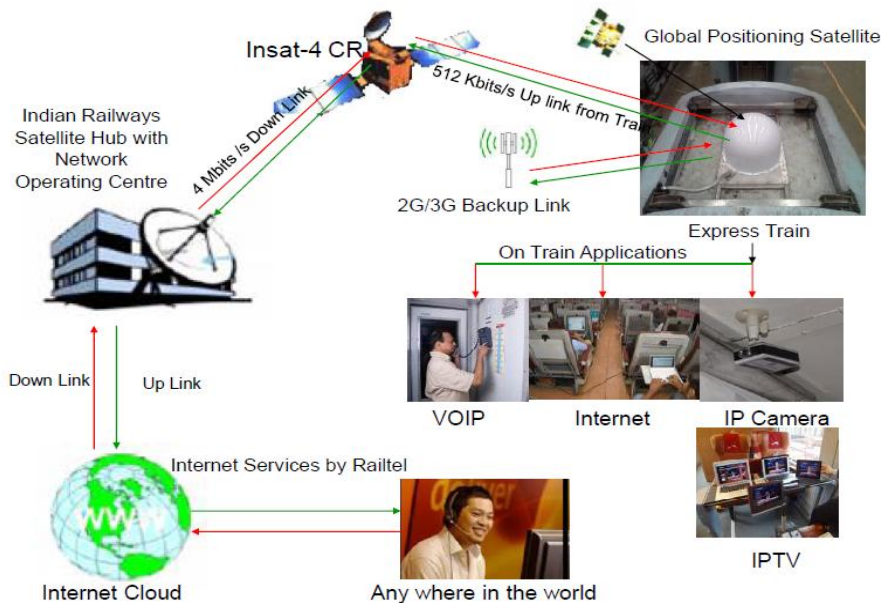
- **Communication based train control system**
 - Only imported, only in metros,
 - Required for mainline trains
- **Elimination of power cars**
 - Two powers car in rajdhani, Shatabdis etc.
 - Train length limited due to loop length limitation
 - Removal of two power cars leads to throughput increase of 8% by passenger carrying coaches
 - Options
 - Head on generation – Power supply from locomotive
 - Self generation by Permanent Magnet lightweight alternators
 - Trainsets – Power supply from pantographs

OTHER AREAS OF RESEARCH (Contd.)

- **Wi-fi on trains**

- Using Satellite – costly
- using 2G/3G Aggregation Method - unreliable

Network for Broadband on Trains



OTHER AREAS OF RESEARCH (contd.)

- **Fuel efficiency of diesel locomotives**
 - Auxiliary Power Unit (APU).
 - ACES with APU.
 - Fuel Cell assisted APU.
 - Automatic Engine Start & Stop (AESS).
 - Multi Gen set Loco.
 - Hybrid (Fuel Cell + Battery) Loco.
 - EFI and CReDI technology in fuel injection system

THANK YOU

