

Welcome to the third edition of NCCAR's "CarTech"...

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www.nccar.us

NCCAR is open for business and available to clients. The past few weeks have been busy hosting a wide range of clients from fuel economy specials such as Edison2 (Progressive Automotive X-Prize team), UUC Motorsports, Werkstatt to the National Auto Sports Association.

We have ample capacity for more users both during the week and at weekends. Sharing or exclusive use are options.



Our access road is complete, operations building finished and the outdoor IT system taking shape. Site and facility enhancements now include a four acre paddock / parking area (RV hook ups are in progress); site access controls in place; track safety systems implemented and office /garages available for lease.

"Early bird" rates are currently in place.

This issue includes a series of features on the IT system going into NCCAR and an interview with the man behind the design and implementation, John Bass, Director of ITng Services at NC

State University. We envisage multiple uses for high-speed data sharing combined with very accurate position definition from the



on-site GPS base station. For example, secure vehicle-to-vehicle data sharing; vehicle-to-infrastructure communications; advanced navigation development; malicious software evaluation / prevention etc etc.

The objective is to put in place the "tool box" that is open for development and only limited by user imagination!

I hope you enjoy this issue.

Simon Cobb



NCCAR is open to clients

The road course is complete with added safety systems, the buildings are finished, available and rather splendid plus the advanced IT system is



video streaming from in-car cameras.

So, if you want to witness a great place to conduct testing, just get in touch and arrange a visit!



being implemented. Finishing touches to this phase are the prove out of fast data transmissions across 155 acres and live



Client Garages & Offices Available.....



- ◇ Client garages
- ◇ Client office (above garage)
- ◇ Client suite

We have a superb working environment for your needs. A wide range of accommodations are available for clients that need a temporary or permanent base at NCCAR. From 2,200 SF double bay office / garage self contained units (as shown in the two upper left photographs and below) to single or double office suites (lower left photograph).

Office / garage units include furnished office space for up to six workstations; full bathroom; galley kitchen; two store rooms and a technician lab. Garage space of approximately 1,000 SF is accessed by double high



opening roller doors. Large secluded external yards of similar dimensions provide convenient parking for trailers and quick change development space. All garages have multi-channel secure Wi-Fi, cordless phones, full and independently controlled HVAC, compressed air and ample electrical supply.

On the second floor of the Operations building there are



six co-located generous office suites. These furnished suites can be leased individually or grouped together.

Complementing these work areas are two large conference rooms; a spacious two

storey lobby with elevator and a continental café.

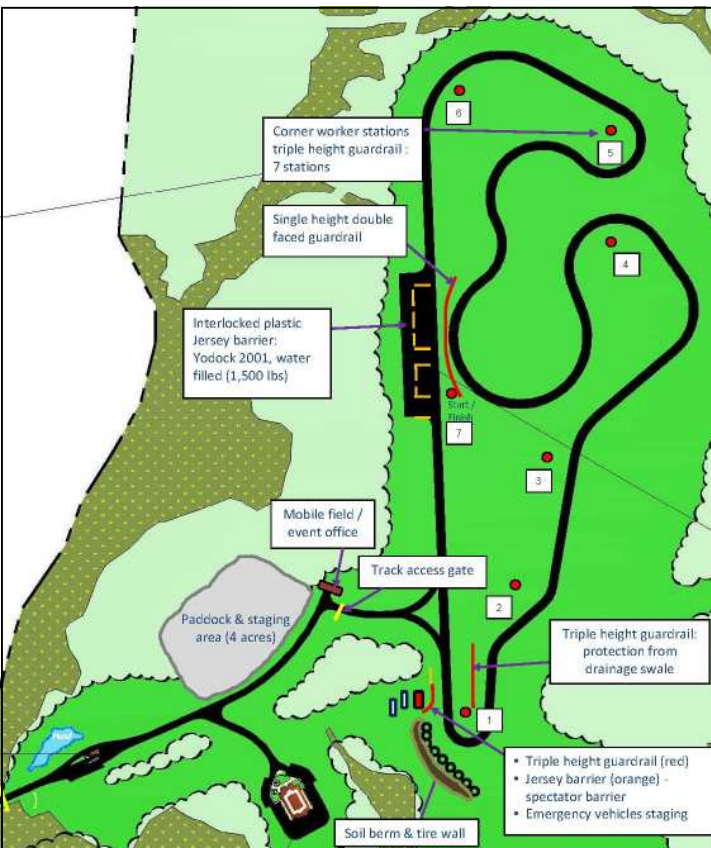
The first floor conference room has large double door access to permit vehicle entry from the two large outside display pads (shown below).



There is ample parking around the building for cars, trucks and semi-trucks.

Facilities are available to lease from daily to permanent. Rates are negotiable.

So, get in touch now to secure an excellent place to conduct business in beautiful North Carolina surroundings and less than two miles from Interstate I95.



NCCAR Safety Systems....

NCCAR has invested in a variety of safety systems to ensure that users and vehicles are protected as effectively as possible. Four key features have been implemented:

1. Triple height guardrails in critical safety areas
2. Plastic inter-connecting and water filled jersey barriers (Yodock)
3. Earth berms fronted by tire walls / conveyor belt
4. Corner / flag stations for larger events

Guardrails are positioned in locations to prevent difficult situations becoming dangerous. The plastic barriers are more adaptable and facilitate easy re-positioning to create staging areas, garage bays, auto-test features or chicanes. The interconnecting Yodock barriers weigh 1,500 lbs when water filled and

hence provide a robust but compliant barrier to unintended deviations.

Emergency response vehicles are staged at the southern end of the two mile track with good visibility and proximity.

The schematic to the left illustrates the positioning of features as used for larger multi-vehicle events.

The large stone surfaced paddock is located close to the track entry and will soon have Wi-Fi, RV hook-ups and public announcement facilities. In addition, an access road will be constructed to connect the stubbed road (identified by the mobile office location) with the south western corner of the vehicle dynamics area (VDA). Spectators for public events can be restricted to two safe viewing locations.



Designing a "state of the art" IT System

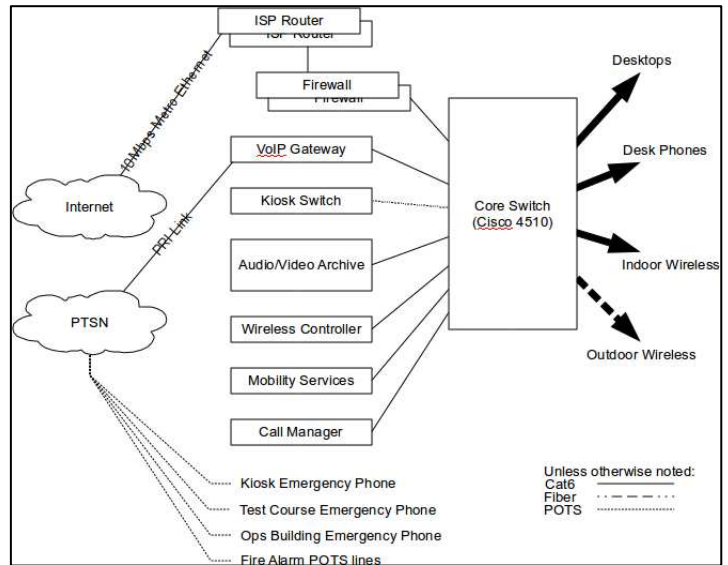
What's the process for achieving the latest in IT technology at a green field site?

A very good start is meeting Dennis Kekas of NC State University! Dennis is the Vice Chancellor of Partnerships at Centennial Campus (and formerly a Division Director of IBM's Networking Division) and the man behind the Centennial Networking Lab (CNL). When he refers you to NCSU's ITng Director John Bass, any IT anxiety disappears. John was able, through long-time contact Wayne Clarke (recently retired from Cisco), to get NCCAR into the top of the IT architecture team at Cisco Systems. Cisco specified a fully integrated voice/data; video; access control and asset tracking system with leading edge resolution and multi-channel

encrypted security, whilst still scalable as NCCAR's demands grow.

No other IT provider could supply such an integrated system. And, not many integration partners had the expertise to install such a diverse system either. Internet-work Engineering (IE) were the selected partner for this task. Following system design discussions between ITng, Cisco and IE there were site visits to evaluate the physical and topographical aspects of the NCCAR site. From there onwards the IT system was defined by bill of materials and is currently being implemented with a fully functioning outdoor system expected later this year

This project receives support from the US Department of Energy and the Golden LEAF Foundation.



NCCAR IT System Architecture Schematic

Getting High Speed Internet Service Provision (ISP) into NCCAR

NCCAR started life as green field site and hence had no ISP or telephony services. The aerial photograph to the right shows the routing of the fiber services from the west of Interstate I95 along the access roads and into NCCAR. Through the guidance of ITng services, NCCAR was able to procure Century Link ISP services through MCNC. This North Carolina non-profit organization delivers research technology services through the North Carolina Research and Education Network (NCREN), a state-wide broadband network. Their fiber-optic infrastructure provides internet, video, data and computing network services to North Carolina's K - 20 community and to many of North Carolina's medical

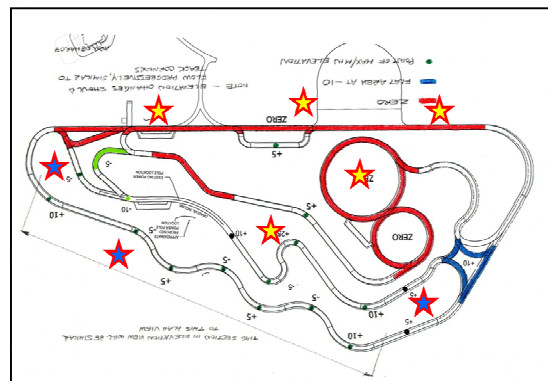
and research institutions, now including NCCAR.

The ISP service is currently 10 Mbps (scalable up



to 50 Mbps) and recent iPerf testing with ITng has confirmed the high quality duplex transmissions we require for our clients and operations.

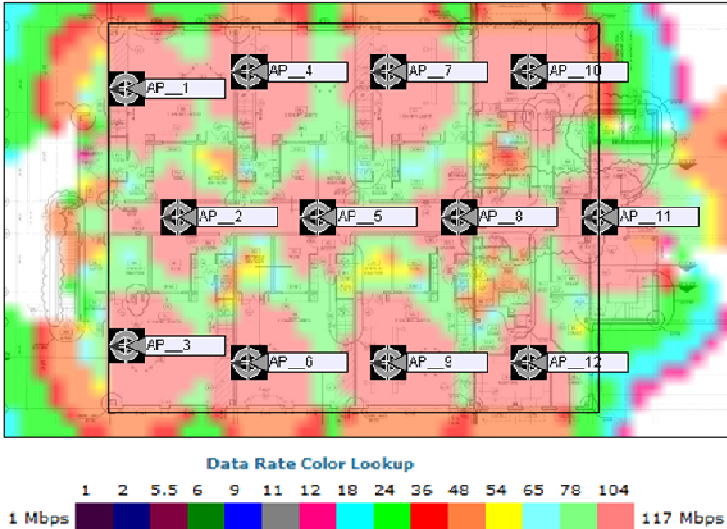
Next steps are expanding the service from indoor to the full 155 acre site - see the articles on page 4. After that, we move onto Phase 1B expansion!



- ◇ Aerial photo showing fiber routing into NCCAR
- ◇ Phase 1B IT expansion plan

Indoor High Speed Integrated IT Implementation at NCCAR

Data Rate Map for 802.11b/g/n



The elegant aspect of NCCAR's IT infrastructure is that it can accommodate up to ten different client groups by means of encrypted voice/data communications. Thereby, even competing OEM's or race teams can safely communicate in the knowledge that their IPR and processes remain secure and private whilst at NCCAR. The schematic to the left illustrates the Wi-Fi coverage and remarkable transmission speeds (up to 117 Mbps) within the Operations building. A total of twenty access points (AP) populate the building, six of which are

high power units designed for the high ceilings and structural interference of the garage bays. Wireless phones will also be a feature of the system to the extent that they can be used anywhere on site! The Cisco wireless controller has the intelligence to offload data flows to adjacent AP's when approaching overload, moving around or signal loss. All in all, access to your VPN or internet data will be very easy, convenient and fast whilst based at NCCAR.



- ◇ Above: Indoor Wi-Fi coverage map
- ◇ Below: Outdoor AP tower locations

“Another trend is ad-hoc wireless networking in automobiles”

Outdoor IT Infrastructure—High Speed Site-Wide Wi-Fi & Video



Why build a massive “state of the art” outdoor high speed Wi-Fi point –to-point mesh at NCCAR? Well, it allows a very wide range of capability and development potential. Our industry contacts have told us from the beginning that rapid and robust deployment of data is crucial to efficient development. Hence, what better than to place all activities inside a high-speed data network capable of fast handover and throughput with minimized latency issues. The implementation involves the installation of six directly connected access point towers around the NCCAR site. Each tower houses a high power access point transmitter/receiver and a pan-tilt-zoom (PTZ) high resolution video cam-

era, plus a 20 Amp power receptacle at the base. Analysis by IT integrator Internetwork Engineering specialists resulted in the optimal positioning of the towers around the site to ensure data speeds of up to 54 Mbps (for Phase 1A and for the future Phase 1B expansion). NCCAR has also teamed up with the Geodetic Survey department of the North Carolina Department of Environment & Natural Resources to install a CORS networked GPS base station. This capability allows vehicle or asset tracking / positioning to within 10 mm horizontally and 20 mm vertically across or site. Positioning data will be freely available over the NCCAR Wi-Fi mesh network.



- ★ ➤ Pole –mounted Wi-Fi access points
- ★ ➤ Operations Building Wi-Fi “Hot Spot”
- ➤ Additional transformer

Interview with John Bass of NCSU's ITng Services

What is your background in IT systems and implementation, especially in the educational field? I started as a network engineer in the late 80's at NC State University (NCSU). After earning my master's degree, I began working at MCNC in a commercial network test lab. That operation moved to NCSU after a couple of years and eventually became the services operation of the Institute for Next Generation IT Systems (ITng Services for short). ITng Services has been active in supporting K12 IT innovation, network and computing security research and healthcare systems. There is also an emerging focus in energy IT and transportation IT systems.

How did you get involved with NCCAR's IT implementation? Simon Cobb of NCCAR and Dennis Kekas, executive director of ITng met to discuss potential collaboration projects. NCCAR's need for a "state of the art" system to carry the facility into the future of automotive IT systems was voiced. Dennis introduced me to Simon and we began brainstorming how to not only build a system that meets NCCAR's requirements but also build relationships with technical leaders in the IT industry such as Cisco Systems.

Who are ITng Services and what do you offer? ITng Services is a service center of the ITng Institute at NCSU. We provide services as part of NCSU's research, extension and education mission. We focus on emerging IT technologies and how they can be integrated into existing IT systems. Cloud computing, wireless networking, open systems and software design,

application deployment, and systems testing are areas of expertise.

Seeing new technologies develop at a research university is very rewarding. This visibility gives ITng Services a unique opportunity to further develop and package these technologies for use in the industry as well as develop best practices for deploying these technologies.

Is there much interaction between NCSU, ITng Services and the IT industry? This interaction is where the value lies. A great example of this interaction is our work with NCCAR. ITng Services was able to help NCCAR work with Cisco Systems to identify a network integrator to implement an IT network to satisfy NCCAR's immediate needs. In designing this network ITng Services was able to build in capability to support future IT technologies that would be of interest to the automotive industry. In addition, the relationship with Cisco was extended to investigate NCCAR's role in potential product testing necessary for Cisco's future product development.

What sort of work goes on? In addition to the type of work described above, ITng Services also develops technology. An example is an IT services broker software project that leverages both commercial and local cloud infrastructure. This software project called Opus is developed by ITng Services, open sourced, and hosted at <http://www.fedorahosted.org/opus>.

With the rise of electronic interfaces and communications in automobiles, how do you see the future of IT in transportation? What might be some surprising outcomes? There are

several trends that will push the automotive and IT industries into further collaboration. Autonomous features such as automated parallel parking and defensive braking are making their way into mainstream cars. This trend will only continue as software and hardware systems advance along with the market's growing acceptance of these new capabilities.

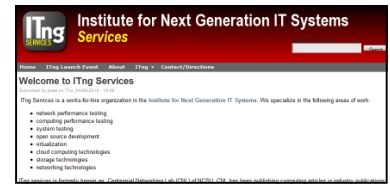
Another trend is ad-hoc wireless networking in automobiles. This will allow cars to form networks to transmit and receive data from each other to determine driving conditions, communicate emergencies, connect to the internet, and so on.

Along with autonomous features and ad-hoc networking is the ever increasing amount of useful sensors such as accelerometers, cameras, positioning and environmental sensors in everyday products such as cellphones, laptops/netbooks. This creates an interesting opportunity to 'crowd-source' an enormous amount of data that can be translated into actionable information. This data and information can be carried by ad-hoc automotive networks and fed into autonomous systems to create a safer and more productive transportation experience.

How will malicious software affect automotive systems and communications?

With increased capability comes an increased opportunity for malicious actions. Fortunately, the automotive industry is positioned to take advantage of the security lessons learned during the tremendous growth of the internet.

Is "hacking" of cars and trucks likely to be as big a concern as with conventional personal



- ◇ NC State University's Next Generation Services webpage
- ◇ Centennial Networking Lab
- ◇ John Bass re-calibrating his transport

computer systems? Just about any system can be hacked with enough time, effort, and deception; and the more complex the system, the more potential for hacking. The motivation to hack systems is greatly increased if multiple systems can be exploited simultaneously. This accessibility is made available by network connectivity. The increase in autonomous features, communication capabilities, and their market demand means that security is of great importance.

How do think NCCAR might be well positioned to help industry? Having a testing facility that is proficient in IT technology and automotive technology will be absolutely necessary for the future of the automotive industry considering emerging IT technology trends.

Interview with NCCAR Board Member Dr. Fred Gallasch (GM — retired)

How did you get involved with NCCAR? *Being a graduate of NCSU, I have returned numerous times to talk to students and faculty about marketing and product development especially in the auto industry. During one of these meetings I was introduced to a group at the start of the NCCAR initiative. My automotive background and industry experience were important to focus the initiative and move it forwards from the concept stage.*

Give our readers an insight into your automotive interests? *I'm a car guy who has over 30 years experience in the car business. I had assignments in R&D, Chevrolet marketing and product planning, Corvette development, market research, and aftermarket sales. Given such interests, I have been accumulating Corvettes for 35 years with 7 now in my collection. I am particularly proud to be a recent inductee into the Corvette Hall of Fame.*

What is your favorite vehicle and why? *I like all vehicles and can admire them for how manufacturers sought to meet customer needs. I lean towards performance vehicles and would say that Corvette is my favorite.*

Explain what is happening in the Detroit area and how it is managing through this unprecedented business upheaval? *Things are tough in Detroit, but as always, Detroiters are tough. Chrysler and GM will never be as big as before and Ford must handle its debt. The cancelation of dealerships will have long term impacts on sales volumes and brand loyalty.*

How will the US auto industry fare in the new world market, especially regarding China's emergence as the dominant market? *GM is*

probably situated best to take advantage of the expanding Chinese automobile market. Ford and Chrysler have much to do. Chinese vehicles sold in the US will be a significant threat. Americans are slowly accepting the "new" Asian brands and this should increase as more products with US customer characteristics and better quality enter the US. While focus seems to be China, one should also pay attention to India.

How do you think the suppliers will survive in this new environment? *There are and will be fewer suppliers. Suppliers must learn to survive with lower and uncertain volumes. Suppliers need to find aftermarket and non-automotive uses for their products and capacities. Suppliers will see increased competition from China and India, especially in the parts aftermarket. Suppliers should build their brands and product quality. American suppliers should generally compete on technology and quality. They will find it difficult to compete on price with the new Chinese and Indian suppliers.*

Is there evidence that the US automotive market recession is over? *Recent profit announcements by Ford, Chrysler, and GM suggest optimism. However, future sales will be impacted by product constraints brought about by new fuel economy standards and large investments in "green" vehicles for which there is very uncertain demand. You might see some increased demand by enthusiasts as they try to buy the "last" performance vehicles before regulations impact their performance and availability.*

There is a definitive shift towards embracing electric drive and battery electric vehicles. How do you think the market and governments will react? Can they be successful? *You should recognize that much of the push for such vehicles is government driven. While some hybrid vehicles have been reasonably successful, they are being bought by early adopters. The public is fairly uninformed about true costs of such vehicles especially if government subsidies disappear. Other important costs to consider are equipping homes with adequate electrical service and replacement of battery packs. Having said this, regulations and government mandates will drive development of these vehicles in spite of uncertain demand.*

Can you predict how the private transportation market will change over the next 25 years? *Wow, if I could do this, I would be rich! Clearly, electrics and hybrids will increase in numbers. There will be a push for people to use more public transportation. Some areas may be off limits to private vehicles. Vehicle functionality will change as fuel economy and emissions laws take effect. The US manufacturers will see their markets shared with many competitors, especially low volume and Asian/Indian manufacturers.*

What advantages do the southern US states still have to automotive companies? *Southern states offer much better weather, highly educated workforce, lower land/development costs, and opportunities for non-union shops. For example, North Carolina is aggressive and very capable in meeting the needs of the next generation of industrial and product development needs of the Industry.*



"Wow, if I could do this, I would be rich!"

So...., what do you do in your spare time? *I am frequently asked to speak at car enthusiast events. I gave keynote addresses at the Southeastern Automotive Forum held at NCSU and the INTC2006 conference of the Association of Non-woven Fabrics Industry. As I did last year, I will represent NCSU by awarding the Park Scholarship to one of our local high school graduates. Also, I was elected and served ten years as trustee of the Village of Franklin, MI and am now serving a four year term as president. We have accomplished major capital improvements while lowering taxes and maintaining our fund balances.*

The NCCAR Story—The Next Steps...

Several large projects head the list of “next steps”. Firstly, completion of our outdoor IT infrastructure; secondly, pushing the message about NCCAR beyond the USA; thirdly, we are pushing hard for funding to build Phase 1B features.

The NCCAR board gave the go-ahead for copper and fiber implementation and tower installation in early June. The system of Wi-Fi access points and PTZ cameras will be fully installed by October at which point field testing will commence.

Spreading the NCCAR message started in June with a marketing campaign targeting the motorsport fraternity and will be closely followed by information on the IT system capabilities.

In parallel, NCCAR is working with the North Carolina authorities to provide full service support to foreign automotive OEM's and suppliers. That is, NCCAR is able to help clients with shipping, customs, road licensing and insurance of prototype vehicles for testing on US roads.

Phase 1A is good, but we are keen to finalize the de-

sign of Phase 1B features.

We want to hear from users and experts on what they think we should build next?

Please just get in touch.

I look forward to hearing from you!

Thanks,

Simon Cobb

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Keep watching the NCCAR website for updates!

www.nccar.us



“This is the newest & most advanced location for vehicle development & testing in mainland USA”

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Enabling Technologies for the Transportation Industry

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