WHITE PAPER – THE DEPLOYMENT OF INTELLIGENT TRANSPORTATION SYSTEMS – ASPECTS OFTEN MISSED.

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The deployment of the ITS (Intelligent Transportation Systems) can sometimes be a struggle in practice because there is insufficient focus on the "intangible" aspects of the Systems Integration process before, during, and after deployment. Some of these items may be addressed at some level, but when the deployment team is stretched for resource, skills, and experience, the items listed below often are the first to suffer, which results in an overall deployment experience less than expected for all parties.

The **Systems Integration** process needs to have tasks allocated for:

1) **Project Management**. This is far more than just the management of the contracts to deploy equipment, which is hard enough anyway. The overall System Deployment plan needs to have items for the human engineering aspects that we have listed below. We see a lot of focus on managing the "civil engineering" style procurement contracts, but not a lot of focus on the intangible Systems Engineering functions. The Human Engineering aspects are kind of "tacked on" to some of the procurement contracts, but it often proves difficult, or impossible, to effectively get these aspects done.
    a. **Vision Statement**: The primary stakeholders need to articulate a clear vision of the effects that the ITS deployment is supposed to achieve. "The Traffic Management Center and associated Intelligent Transportation System deployment will improve traffic flow to reduce travel times; reduce the risk and severity of a vehicle accident to the motorist, and improve the availability of traffic information to the public in the XXX Area" is an example of a vision statement. Note that it does not include anything about pedestrians, or rail-road interface, and so when the System Goals are established, these items will not be covered.
    b. **Overall System Goals in terms of Stakeholder Expectation**. The System Goals should be established in measurable and testable terms. This is often very difficult to do, and metrics can be difficult to obtain. However, even the attempt to reduce goals to measurable terms is a good exercise in trying to keep track of stakeholder expectation. In the example Vision Statement above, the system goals will be expanded to include language such as:
        i. Peak period travel time from AA to BB will be reduced by 8% by implementing Ramp Meter Control.
        ii. The time to clear a non-injury accident from the Travel Lane will be reduced by 20%.
    c. **Overall Communications Flow and Jurisdiction Management**. The operation of an Intelligent Transportation System includes the cooperation and input from many agencies, including IT departments, Emergency Responders, Traffic Engineering and others. The flow of information to all the parties involved can be quite complex, and needs to be planned in advance. This will lead to effective Standard Operating Procedures, and

use of the system. Likewise, all the different jurisdictional issues need to be resolved, and where the overlaps of the different responders, law enforcement and other agencies occur.

d. **Method of Contract**. Often the supply of the material for an ITS system is procured under a “Civil Engineering” type of contract, which is essentially adversarial in nature. This type of contract can work well for the supply on material, devices and other “things”, but this method of contract does not work well for the procurement of the services described in this white paper. These services are much better procured under a consulting or other cooperative style of contract.

e. **Standards Selection**. The selection of appropriate standards (such as NTCIP) is fairly well understood by the consultants as part of the equipment procurement process. What is less well understood is how to carry out the effective testing of equipment and services in accordance with these standards. Also not well understood is how the selection of standards makes the planning process much simpler, as various smaller projects can be undertaken, with a high level of confidence that all the projects will work together if they are all implemented against the same standards.

f. **Planning**: The planning process is often implemented in a way that does not lead to successful deployment. This occurs when the planners try to develop a “Master Plan” encompassing all the detail needed to execute projects. Often this does not work very well, as there is little guidance in the planning on how to implement multiple smaller projects, that will work together. This involves a different sort of planning, with an emphasis on architectures, resources planning, human engineering, and standards, and the linking of funding to adhering to the adherence to this sort of plan. This is the subject of another white paper.

2) **Human Engineering**. The system’s success or failure will depend on the execution of the Human Engineering aspects of the system deployment, including:

a. **Operations Plan**: There needs to be focus on planning the operational side of the system deployment, including staffing levels, allowance for leave/sick, the HR function (ongoing recruitment), ongoing training, skills developments, job descriptions, job performance review, staff appraisals against measurable objectives, and so on. Traditionally there is a significant of staff turn over in these kinds of centers, and all that needs to be part of the plan.

b. **Maintenance Management**: An ITS system can be a complex technology environment. It is critical to plan for Maintenance Management, and in fact see this so important, that a section is allocated to it below.

c. **Setting-to-work**: The setting to work phase of complicated ITS system is a multi-year project on its own. It needs to be dealt with as a project, and includes configuration, training, developing policies and procedures, and so on. It is one thing to be able to put a message on a sign, and it is a whole different topic about “what to say”. Just this topic could be the subject of this discussion paper on its own. Traditionally, the difficulty of effectively managing and executing the setting to work process is underestimated by all stakeholders and participants.

d. **Expectation Management**: The various stakeholders have all kinds of expectations going into an ITS project, and it is important to have a process for managing these expectations.
e. **Risk Management**: This is a topic all of its own. It is common to have technology risk, manpower risks, skills resources risks all coming into play. What is not common in ITS deployment contracts is to see any process for identifying and managing these kinds of risks. The "civil engineering method of contract" method of managing risk, which is to impose penalties, withhold money, etc., simply does not work in the technology environment.
f. **Measure of Effectiveness (MOE)**: It is common to see ITS deployment contacts without any planning to see "Does the System Work? Is it worth it? What does the public think? Does it really save time/money? Does it do what we thought it would do? Does it improve Emergency Response? Does it reduce the duration of Incidents? How is all this going to be measured?" Just the process of designing MOE studies, to measure how well the System Goals are being achieved really helps focus what is important to get done.
g. **Configuration Management**: The configuration of an ITS system can be enormously complicated, with thousands of parameters to make it work. These parameters are continually being refined/changes/added to as maintenance happens, new devices are added or operational strategies executed. This requires a significant resource during the life of the system going forward, and is an activity that need to be planned and provided for the ITS system to be successful.
h. **Human Resource Management**: The resources from the contractors, the consultants and the public sector agencies are very thinly spread, with a lot of stress in all sections of the deployment. The skills and experience availability, skills transfer, and deployment also needs to be recognized and managed. This is much more than the "system training" that is normally called out in the deployment contracts.

It should be noted that very typically in this kind of deployment that the technical capability and capacity of the ITS system far outstrips the capability and capacity of the operational (human) infrastructure that is charged with operating the system. The stakeholders need to very carefully manage the human engineering aspects to ensure that failure in this aspect of the system deployment does not cause the overall system to be perceived as a failure.

3) **Maintenance:** The typical ITS system can include complicated technology which will require significant skill and organizational infrastructure to maintain, to keep availability levels at a level that operational people will consider acceptable. An infrastructure (private or public) needs to established that as a minimum addresses the following needs: (these are just bullet points. The issue of maintenance is a separate topic by itself)
   a. **IT (Information Technology):**
      i. Network Administrator: This is the administration and maintenance of the computer network that connects all the client workstations, and well as the network that connects the servers to all the field devices.

ii. Database Administrator: This is the administration of all that data that is accumulated into the database. It includes backup, disaster recovery, and report writing activities.

b. Maintenance Supervisor (Field Equipment)

i. Electronic Technicians: These technicians need to maintain the electronic equipment deployed in the field, including signs, cameras and sensors. Adequate planning of preventive maintenance, as well as procurement of spares, is required.

ii. Electrical Technicians: These technicians need to maintain the power infrastructure to the field devices.