QUARTER 2 2005

ANIMAL VEHICLE CRASH MITIGATION USING ADVANCED TECHNOLOGY

SPR 3(076) & Misc. Contract & Agreement No. 17,363

for

Oregon Department of Transportation
Research Unit
200 Hawthorne SE, Suite B-240
Salem OR 97310

and

Federal Highway Administration
400 Seventh Street SW
Washington, DC 20590

and

Alaska Department of Transportation and Public Facilities, and the Departments of Transportation of California, Indiana, Iowa, Kansas, Maryland, Montana, Nevada, New Hampshire, New York, North Dakota, Pennsylvania, Wisconsin, and Wyoming

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April 2005

Task 1: Identify potential advanced technology systems 100%
This task is complete

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Task complete

Task 4: Implement and test systems 80%

General

The TAC meeting is to be held on 13 and 14 June in Big Sky, MT.

MT site (Yellowstone)

1. WTI continued to investigate the cause for the false positives in zone 1, but we could not identify the source of the problem.
2. STS is planning to come out to the site 1-9 May to investigate the cause for the problems in detection zone 1. They will also test the modem.
3. WTI provided answers to questions of Yellowstone NP with regard to the purpose of the upcoming TAC meeting and the status of the system.
4. WTI tried to set up a meeting with representatives of Yellowstone NP to discuss the future of the site and the equipment, but their schedules did not allow for a meeting. Marcel Huijser (WTI) and Lloyd Salsman (STS) would have given presentations to YNP representatives about the current status of the system.
5. WTI and STS did set up a meeting with MDT representatives for Fri 6 May 2005 to discuss the wishes and expectations of MDT with regard to the site and the equipment.

PA site

1. Oh Deer has not been in touch after their contract was terminated.

Task 5: Collect post-implementation site data 30%

Task 6: Evaluate system effectiveness, acceptance and performance 2%

Task 7: Produce final report 90%
Reliability tests were added to the report (see monthly report from Feb 2005)

Additional Work / Issues
The actual co-ordination between all the organizations and people involved for the MT (Yellowstone) site as well as the Pennsylvania site continues to be much more labor intensive than anticipated.

Marcel Huijser

Monthly report Animal-vehicle pooled fund study

May 2005

Task 1: Identify potential advanced technology systems 100%
This task is complete

Task 2: Locate potential study sites 100%
Task complete

Task 3: Document existing site conditions 100%
Task complete

Task 4: Implement and test systems 80%

General

We identified a 1994 newspaper article about the first Swiss system (see attachments) through a contact in Switzerland (Christa Mosler). The attachment contains a translation. A copy of the original article (in German) is available on request. This is in response to the request from KS DOT (see previous monthly report).

MT site (Yellowstone)

6. WTI (Marcel Huijser), STS (Lloyd Salsman) and MDT (Ross Gammon and Kevin Bruski) met on Fri 6 May to discuss the wishes and expectations of MDT with regard to the site and the equipment. The notes of the meeting are in attachments.
7. Yellowstone NP still did not have time to meet with WTI and STS to discuss the future of the site and equipment. Instead WTI sent Yellowstone NP a list with questions about their wishes and expectations (see attachments).
8. After asking, Yellowstone National Park informed WTI that they will not attend the TAC meeting on 13/14 June.
9. STS found the problem with detection zone 1. It was caused by a broken bracket in detection zone 0, just south on zone 1. The misaligned signal from zone 0 caused false detections in zone 1. In addition, zone 9 was found to have an all but broken wire. These problems were fixed by STS. Radio contact with station 3, and remote access with modem are still not entirely satisfactory.

PA site

2. Oh Deer has not been in touch after their contract was terminated.

Task 5: Collect post-implementation site data 30%

Task 6: Evaluate system effectiveness, acceptance and performance 2%

Task 7: Produce final report 85%

Additional Work / Issues

The actual co-ordination between all the organizations and people involved for the MT (Yellowstone) site as well as the Pennsylvania site continues to be much more labor intensive than anticipated.

Marcel Huijser

Translation of a newspaper article in “FRIDOLIN", published 13 October 1994. This system was the installed in 1993 in the canton [province] Glarus between the two villages Schwanden and Elm.
Translated by Marcel Huijser

Foreign countries show interest in unique animal detection system along Sernftalstrasse (Sernftal street)

Convincing argument: not one accident since its installation

The animal detection system that has been operational since February 1993 in Warth, on the road Schwanden - Elm, proved itself a hit: not one accident since that time. In Warth, where up to 50 red deer cross the busy road every day in spring and winter, the enormous danger was convincingly reduced. No wonder that there is great interest in this system. A delegation for safety and animal protection from the Dutch government visited the site last week.

When animal and cars collide the consequences are always fatal: always for the animals, often for the people inside the vehicle. 12,000 wild animals are hit in Switzerland. Often agonizing and perishing animals, wounded or dead drivers – and on top of that property damage of more than 10 million Franks (Swiss Franks) per year. Promising measures that decrease these sad numbers are therefore met with broad interest, not just in Switzerland.

The animal detection system in Warth, which after 18 months of operation could qualify as proven, is such a measure. The system (with integrated drastically reduced speed limit when danger is present) is the only one of its kind in Switzerland.

The same dangers and problems also in The Netherlands

Last Thursday’s visit of the system by the Dutch delegation is probably the prelude of additional similar “pilgrimages” to Warth in the near future. In addition, Sweden and Norway (just to name two) have become aware of this project in Sernftal. This was a temporary solution. A situation that game warden Ruedi Hauser now wants to end by giving definitive approval.
What the Dutchmen in Warth wanted to see, and did see, was the solution to an apparently widespread fundamental problem: Drivers are numbed as a result of “sign post saturation” and often ignore warning signs, even if these signs are right in front of them and they can’t miss them. The combination of warning and law in Warth is new, (up to now) one if its kind and: it functions!

Know everything: if 30 km/h is required, then with good reason
The animal detection system was developed by Calonder Energy AG, Dietikon/Chur. “The only good one” claims Giacomo Calonder, director of the firm. He bases this not on the system itself, but on the type deployed in Sernftal that includes warning signs and speed reduction. For example, as a system in its home county proves, warning signs alone are not sufficient. A system deployed in Trin-Mulin (without speed reduction) was able to reduce the accidents, but failed to reach the ultimate goal “zero”. In contrast, no accidents have occurred in the last 18 months in Warth. Everybody knows: the system is only activated when there is a real danger of collisions, compliance with the then activated advisory speed limit reduction to 30 km/h is in your very own interest. The experiences of the county police confirm: even speed devils, not usually sensitive to maximum speed limits, take the one in Warth seriously. Since this kind of drivers [“species”] act similar in each country, the Dutch delegation seemed fully convinced by the demonstration in Warth.

[Photo text] The animal detection system in Warth triggered great interest and many questions from the Dutch visitors. Game warden Ruedi Hauser and Giacomo Calonder of the manufacturer of the system provided advice and answers.

Future MT site and equipment

2 June 2005

By: Marcel Huijser

Hello,

Over the last six weeks WTI-MSU has been communicating with representatives of the Montana Department of Transportation (MDT) and Yellowstone National Park (YNP). We were interested in hearing their wishes and expectations relating to the future of the research site along Hwy 191 in Yellowstone National Park and the equipment. It has taken longer than we had hoped, but we now have sufficient information to evaluate our options. In addition I have asked STS for ball-park numbers for different modifications and upgrades. While STS has these numbers ready I have not received them yet.

I have attached the notes from the meeting with MDT representatives, the list of written questions to YNP, the recent response of YNP, as well as the questions for STS. I have summarized the situation and our options below:

Future research site

YNP has asked WTI-MSU to remove the current system before 15 September 2005. YNP is not interested in modifications to the current system that would address the blind spots that were discovered in March 2005. YNP is also not interested in replacing the current system with a "next generation system" that would have much reduced power requirements and size, especially for the solar panels, batteries, and the cabinets. YNP stated their rationale in the attached letter. The research site will be abandoned before 15 September 2005.

MDT has stated that they will help WTI-MSU remove the equipment from the Yellowstone site as long as WTI-MSU coordinates the activities with YNP. We need to investigate what MDT would be able to do and what WTI-MSU would be responsible for. For example, we may need

a. A bucket truck: to remove the antenna's, beacons, solar panels and signs;
b. A small crane to remove and load the 7 metal posts;
c. A machine to remove the 7 concrete foundations;
d. A truck to load the poles, foundation and equipment on.

Furthermore, we will need:

a. Traffic control (people and signs);
b. Qualified personnel to dismantle the system and package fragile equipment.
c. Qualified personnel to coordinate the removal of the phone connection and phone line pole and equipment with 3-rivers phone company.
d. Qualified and experienced personnel to meet the requirements for topsoil and vegetation from YNP. Eagle Rock Timber may help out here, I have told them about the upcoming

system removal already. Eagle Rock Timber installed the poles and foundations and they have experience with working inside the park.

e. A location to deliver the equipment. If the location is far away, perhaps out-of-state, commercial drivers may have to be hired.

We will need to write the tasks and responsibilities up, including a potential scope of work for Eagle Rock Timber so that they can provide us with a quote. It would probably be best to discuss this in general terms during the TAC meeting on 13/14 June and then meet shortly thereafter to discuss and document the details.

We will probably need to modify the agreement between ODOT and WTI-MSU and change the end date for the project from 30 June 2005 to 15 September 2005. I hope that MDT and WTI-MSU can share the costs for system removal and transport by dividing the tasks and that we will not need to ask for additional funding.

Future equipment

The reliability tests between January and March 2005 showed that the system detects elk reliably. If it was not for the two known blind spots in the system, the warning signs and signals could have been attached and we could have started to evaluate the effectiveness of the system. This leads us to the following options regarding the equipment:

Store the equipment in a storage location.
I do not think this is a preferred option as the equipment may simply lie there for many years. It is only a matter of time before it may damaged and/or thrown away. In addition, some of the materials are a hazard (e.g. batteries) and need to be stored in a place that meets certain conditions and that is certified.

Sell or donate the equipment to the Indiana Toll Road Division or STS.
There is a lack of spare parts for the system in Indiana. This system is the same as the one in Yellowstone NP and has been in operation since last fall as well. Here, the signs have been attached and the system is believed to function well. The Indiana Toll Road Division or STS may be interested in the equipment for spare parts. I think this may be a good use of the equipment.

Sell or donate the equipment to other individuals or organizations.
The solar panels may be especially desirable. However, I expect very few people would be interested in the other equipment.

Re-install the system at another location:

1. Another roadside location in MT or the location that was abandoned by Oh Deer in PA, or perhaps the location that an animal detection is planned for in CA.
   This requires thorough analyses of the terms and conditions:

   a. Is the system reliably enough to justify reinstallation elsewhere?

Note: the brackets for the sensors will have to be replaced as they break as a result of great temperature fluctuations.

b. The site should have a history of collisions with large animals (e.g. deer, elk or moose).
c. The site should preferably be located in an area where many large animals (e.g. deer, elk or moose) are known to cross the road (daily movements or seasonal migration).
d. The DOT should have full jurisdiction over the site and equipment. A clear agreement would have to be in place with regard to ownership and responsibility for operation and maintenance.
e. The warning signs need to be modified so that people are aware that there can be animals on or near the road even if the warning signs are not activated. For example the text “wildlife crossing, next 1 mi, when flashing” may need to be replaced with the text “wildlife crossing, use extra caution when flashing, next 1 mi”. However, current signing regulations do not allow for such a modification in MT.
f. Length road section. The road section has to be at least 805-1609 m (0.5–1.0 mi) long.
g. There should be no or very few access roads.
h. The situation should be such that very few people stop on that location. This minimizes the risk of vandalism or theft of the equipment.
i. Potential restrictions for poles and equipment close to the road in the right-of-way. Note: poles and equipment are not allowed close to the road on the PA site. The typically have to be 40 ft from the edge of the pavement.
j. The topography and vegetation of the site should preferably be as simple as possible; e.g. straight road section, line of sight for all communication equipment, no curves or steep slopes, grass-herb vegetation in right-of-way that can be mown when needed, no trees close to the road or sensors. Note: the current system may not be suitable for the PA location as the vegetation at 40 ft from the road is abundant and high, and PennDOT prefers not to mow this zone.
k. Changes in road or landscape. The road and surrounding landscape should not be scheduled to undergo major changes within the certain number of years; e.g. 5-10 yrs. Major changes, other than the installation of the animal detection system, would confound the results of a potential evaluation and it may also result in shifts in animal movements. Then the system may no longer be in the right location.
l. The site should not usually have great snow depth (i.e. less than 2 or 3 ft) to avoid burying the sensors which are typically at 4 ft.
m. The dimensions of the system, including solar panels should not be a concern at the site.
n. Travel costs. The site should preferably be close to where DOT personnel responsible for operation and maintenance is located.
o. Power. The site should allow for solar power.
p. Remote access to the data and system should probably use a satellite link rather than depend on cell phone or a land based phone line.

q. Pull-out. The site should preferably have a safe pull-out location for installers and maintenance personnel.
r. There should be a thorough site survey with surveying equipment to verify full coverage of the sensors at the right height and to ensure that the poles and equipment are located at the right locations.
s. Should there be an evaluation of the reliability of the equipment after it has been installed?
t. Should the equipment be evaluated for system effectiveness (driver response and / or potential animal-vehicle collision reduction) and opinions of the traveling public?
u. Who will pay for transport, re-installation, and potential evaluation of the system on the new location?

2. The test bed in Lewistown MT.
   We may prefer to test “next generation” technology as this project aims to set standards for the future.

Notes of meeting with MDT
Fri 6 May 2005
Present: Kevin Bruski and Ross Gammon (MDT) and Lloyd Salsman (STS) and Marcel Huijser (WTI-MSU).

We discussed the status of the system and MDT's wishes and expectations after 30 June with regard to the site and the equipment. I've summarized our findings below.

MDT would prefer to keep the system in its current location is we can either modify the current equipment or upgrade it to a "next generation system". However, before assuming responsibility for ownership and maintenance MDT wants the system to be:

1. Reliable.
a. MDT wants to have remote access to the system to check on the functioning on a regular basis. Should we fail to get the current modem to work on the phone line we should discuss satellite access. I am willing to look into project funds if we need to follow that route.
b. MDT also wants the current brackets to be replaced with a different type as about 40% have broken. We can talk about project funds for this issue too.
c. Improve the radio link with station 3 to reduce the chance of missed detections. This may have been addressed by Lloyd last week. However, I don't have data on the potential improvement yet.

2. Not a liability concern.
a. This is a difficult topic. We know of blind spots due to design errors in zone 8 and B. The other blind spots we found (see reliability report) are probably not real, or they were caused by radio errors from station 3. In short, MDT's request would involve more sensors and poles in zone 8 and B. This is likely to be a substantial cost, something that we may have to find additional funds for.
b. Fix any other known problems that may affect the reliability of the system.

3. Acceptable to Yellowstone NP
I still hope to talk to YNP representatives about their wishes and expectations. However, Yellowstone NP is likely to be most concerned about:
a. landscape aesthetics. This would require an upgrade to a "next generation system" with reduced power requirements and much reduced solar panel size and reduced cabinet sizes (smaller batteries). To reduce the power the communication system probably has to be redesigned.
b. Reliability: blind spots, missed detections (station 3). They want to make sure their "guests" (=travelers on 191) are provided with accurate and reliable info.
c. MDT accepting responsibility for operation and maintenance. This would make the "circle" complete. Yellowstone NP has been uncomfortable with the current situation where responsibility for operation and maintenance is somewhere in a gray zone between WTI-MSU and MDT.

E-mail to Yellowstone National Park

11 May 2005

-----Original Message-----
From: Huijser, Marcel
To: 'Christie_Hendrix@nps.gov '
Cc: 'Bob_Seibert@nps.gov '; 'Julie_Hannaford@nps.gov '; 'Craig_McClure@nps.gov '; 'lori_gruber@nps.gov '; 'Bonnie_Gafney@NPS.gov '
Sent: 5/11/2005 4:42 PM
Subject: questions for Yellowstone NP

Hello Christie,

I would like to ask Yellowstone National Park about their wishes and expectations regarding the animal detection system along Hwy 191. I would like to use this information to formulate strategies and options for the future of the site and the equipment after the current end date of the project (30 June 2005). I hope to send the info on the position of the Park to the funders well before the upcoming TAC meeting on 13/14 June 2005. I hope to send it by the end of next week (20 May).

I would have preferred to ask these questions in person in a face to face meeting, as this would have allowed for more and better interaction. However, the schedules of Yellowstone NP representatives did not allow for that. Instead I have formulated my questions in the attached document. I have also anticipated potential questions of the Park and have provided the answers to these questions at the end of the attached document. Nevertheless, please feel free to ask me additional questions should they come up.

I have cc-ed other Park employees on this e-mail as you may want to share your opinions and experiences.

Note: when answering these questions, please tell us what the Park thinks and expects. Please do not assume that MDT, STS or WTI-MSU will or will not take certain actions. It is important to us that we obtain a clear and unbiased insight in the thoughts and expectations of the Park, and the Park alone. That is the only way we can formulate strategies and options for the future of the site and the equipment, and reach an agreement that is acceptable to all project partners.

Many thanks and best wishes, Marcel
<<questions for Yellowstone NP.doc>>

Attachment of e-mail to Yellowstone National Park

From Marcel Huijser
11 May 2005

Regarding: animal detection system along Hwy 191

Questions for Yellowstone National Park:

1. During the last TAC meeting (Dec 2004) Wayne Brewster expressed his doubts that the system would ever "work" and detect elk reliably. WTI-MSU has collected data on system reliability between Jan-Mar 2005 that shows that the system detects elk reliably, especially in the area where elk cross the road most (see the report attached to Feb progress report). What does the Park think about the tests and the reliability of the system now?

2. During the last TAC meeting (Dec 2004) Christie Hendrix and Wayne Brewster expressed the concern of the Park with regard to the dimensions of the system and landscape aesthetics. What does the Park think about a "next generation system" that would much reduce the size of the solar panels and other equipment? Note: I have described the size reductions of a next generation system in the "potential questions section" below.

3. Does Yellowstone NP see a future for the current system at its current location after 30 June 2005? If so, under what conditions (including potential modifications to the current system)? If not, what are the precise reasons, preferably in order of importance?

4. Does Yellowstone NP see a future for a "next generation system" at the current location after 30 June 2005? If so, under what conditions? If not, what are the precise reasons, preferably in order of importance? Note: I have described what a "next generation system" would look like below. Note: please contact me or STS if you have additional questions on a "next generation system".

5. If the Park wants the current system to be removed and if the Park is not interested in a “next generation system” on the current location, what are the requirements for system removal? I assume that we will follow the same or similar guidelines that were provided for system installation, but there may be additional specific requirements for system removal.

6. What does the Park think about the application of animal detection systems, with the CURRENT state of the technology, in general? Does the Park think animal detection systems are a potential mitigation measure for animal-vehicle collisions inside National Parks? If so, why? If not, what are the precise reasons, preferably in order of importance?

7. What does the Park think about the application of animal detection systems on the LONG TERM (2nd or 3rd "next generation systems")? Does the Park think "next generation" animal detection systems could be a potential mitigation measure for animal-vehicle collisions inside

National Parks? If so, why? If not, what are the precise reasons, preferably in order of importance?

8. What does the Park see as viable or acceptable mitigation measures for animal-vehicle collisions inside National Parks? How does the Park see the future? What are the potential research needs of the Park with regard to this issue?

9. Are there any additional issues the Park would like to discuss with WTI-MSU or MDT with regard to the animal detection system?

Potential questions that the Yellowstone National Park may have:

1. Is the system reliable?

Yes, based on comparisons with snow tracking data the system detects elk reliable, especially in the area where they cross the road most (see the reliability report attached to the monthly report from Feb 2005). There is no indication of abundant false positives. However, there are two known "blind spots" on the west side of the road, i.e. in parts of zone 8 and B. If animals cross in these areas they are not detected by the system and "false negatives" result. This can only be addressed through additional poles and sensors. In addition, some radio reports from station 3 did not come through to the master station because there is no direct line of sight and because the master station had to "listen" to a "weak" message immediately after listening to a "very strong" message. This issue may have been solved after STS's visit last week, but I don't have data to prove that yet. However, the bottom line is that the animal detection system is able to detect elk reliably; the concept of detecting large animals was indeed confirmed.

2. Can we improve the reliability of the system?

Yes, we can improve the reliability of the system by addressing the blind spots in parts of zone 8 and zone B. This would require additional poles and sensors in those areas. The radio communication of the current system seems quite reliable, especially now that the radio link with station 3 seems to have been improved. However, the concept of the communication system could be altered to make it even more reliable. However, this would require substantial additional funds. STS will give estimates on what these improvements and upgrades may cost. I hope to have these numbers available by the end of next week (20 May 2005).

3. Can we improve the landscape aesthetics?

Yes, we can improve the landscape aesthetics of the system through:

a. Upgrading the communication system. This would lead to 90% reduction in power requirements for the poles with sensors. This would lead to a need for much smaller solar panels. However, the poles that have beacons (4 in total) will continue to need at least the current size solar panel, unless we adopt a new sign technology that requires much less power when the beacons flash. However, I am not quite sure if that new technology has been accepted yet by FHWA or MDT.

b. As a result of the reduction in power requirements we can also reduce the number and size of the batteries. Currently the batteries take up most of the space in the cabinets. STS estimates that they could fit the batteries and circuit boards in slightly larger sensor tubes and get rid of the cabinets altogether.

c. We could potentially mount the much smaller solar panels on the sensor tubes rather than on high poles. On the other hand this may increase the chance of vandalism or theft.

d. Relocation of the poles with solar panels further into the right-of-way and make them less visible to travelers. This may be an option, especially for the poles that have beacons and that may continue to require relatively large solar panels.

4. Will MDT accept responsibility for ownership and maintenance?

Yes, but only if certain conditions are met. Kevin Bruski and Ross Gammon (MDT) stated on 6 May 2005 that MDT would accept responsibility for ownership and maintenance if the system is:

Reliable. a. MDT wants to have remote access to the system to check on the functioning on a regular basis. Should we fail to get the current modem to work on the phone line we will discuss satellite access. b. MDT also wants the current brackets for the sensors to be replaced with a different type as about 40% have broken. c. Improve the radio link with station 3 to reduce the chance of missed detections. This may have been addressed by STS last week. However, I don't have data on the potential improvement yet.

Not a liability concern. a. This is a difficult topic as there are no guarantees that the system will always detect all large animals under all circumstances at all locations. However, we do know of blind spots due to design errors in zone 8 and B, and these can be considered a liability issue. The other blind spots we found (see reliability report) are probably not real, or they were caused by radio errors from station 3. In short, MDT's request would involve more sensors and poles in zone 8 and B. This is likely to be a substantial cost, something that we may have to find additional funds for; and it would require the explicit permission of Yellowstone National Park. b. Fix any other known problems that may affect the reliability of the system. I don’t know of any other factors at this point.

Acceptable to Yellowstone NP. This is for Yellowstone NP representatives to formulate.

5. What would the research benefits be of keeping the system in place longer (updated or not)?

a. Reliability. WTI-MSU has acquired substantial data on system reliability since the system started to detect large animals reliably (Since Nov 2004). Even though more data are always better, I think that we have obtained a "satisfactory" amount of info on system reliability. Therefore WTI-MSU does not consider the need for more and better data on reliability a primary reason to keep the system in place.

b. System effectiveness. As the signs are not attached and the beacons are unplugged, no data on system effectiveness have been collected. Now that the system seems to detect large animals reliably we could attach the signs and plug in the beacons to start data collection on system effectiveness. System effectiveness has 2 components:

1) Driver response through reduction in vehicle speed. We would need to cover about 1 year (incl. a winter) with vehicle speed measurements as it may take a couple of months for people to learn to trust the system, and drivers are also more likely to respond when road- and weather conditions are poor. Thus we would need to include at least 1 winter period. To address this question, WTI-MSU estimates the system needs to be in place until May 2006 (with signs attached and beacons plugged in).

2) Potential reduction in animal-vehicle collision numbers. Even though the location was selected based on the relatively high number of elk-vehicle collisions, the absolute numbers are relatively low. The 10 yr average was 5-6 elk hits per year on the 1 mi road section. However, the collision numbers may vary greatly from year to year, even if there are no changes in elk population size. However, there have been substantial changes in the herd size and also in the behavior of the elk (e.g. as a response to the presence of wolves). It is unlikely that we would be able to collect enough data within a couple of years to show/prove a significant reduction in collisions, even if there is one, and even if we not only do a comparison in time (before - after system installation) but also a comparison in space (treatment – control road sections). On the other hand, this is the problem with almost all animal detection systems. We rely on meta-analyses for multiple systems from multiple sites to acquire enough data for reliable analyses. In that sense, every system that detects animals reliably and that has its driver warning part activated is extremely valuable. From a research perspective we should do everything possible to acquire as much data as we can from these individual systems, including the one along Hwy 191 in Yellowstone NP. To address this question, WTI-MSU estimates the system needs to be in place (with signs attached and beacons plugged in) as long as possible, at least 1.5- 2 yrs. Then the data could be combined with data from other locations for meta-analyses.

c. System acceptance. As the signs are not attached and the beacons are unplugged, no data on system acceptance by the public have been collected. Now that the system seems to detect large animals reliably we could attach the signs and plug in the beacons to start data collection on system acceptance. We would need to cover about 1 year (incl. a winter) as it may take a couple of months for people to learn to trust the system. To address this question, WTI-MSU estimates the system needs to be in place until May 2006 (with signs attached and beacons plugged in).

Response letter of Yellowstone National park

United States Department of the Interior

NATIONAL PARK SERVICE
PO Box 168
Yellowstone National Park
Wyoming 82190

IN REPLY REFER TO:

N2219(YELL)

MAY 3 1 2005

Mr. Stephen Albert
Western Transportation Institute
416 Cobleigh Hall
Montana State University
Bozeman, Montana 59717-3910

Dear Mr. Albert:

Western Transportation Institute (WTI) employee Dr. Marcel Huijser has asked us to provide written comments on the disposition of WTI's Highway 191 Animal Detection System project. As you may recall, park representatives shared our concerns about the system at the December 2004 Technical Advisory Committee Meeting (TAC) in Bozeman, and informed the TAC that we would like the system removed from the park by June 30, 2005. We would like to thank you for meeting with us in December 2004. The meeting was enlightening and helped us better understand how this project compared to other animal warning systems and animal-vehicle crash mitigation projects. As one WTI staffer stated at the meeting, "animal detection systems are not an off-the-shelf technology." We concur with this statement, as the current system has not met our minimum expectations. We think that it is in the best interest of the park and visitors for the system to be removed as scheduled.

Though the system does appear to be detecting and logging animal crossings, it isn't consistently reliable in warning drivers of animals in the roadway. Blind spots exist where animal crossings are not being detected and the system has experienced periods of significant downtime. Though Dr. Huijser has worked diligently to consult with the system's manufacturer to get them to repair malfunctions, their response time is still slow, at best. The detection system is highly visible and many complaints have been received regarding its perceived unsightliness. Furthermore, adding additional equipment to fix system blind spots cannot be justified until we know that these improvements have been tested elsewhere and will be effective.

While Yellowstone National Park is very supportive of the development and the use of any technology that reduces property damage, human injuries, and wildlife deaths, the current system on Highway 191 is not meeting those goals and may never meet those goals. The system is still primarily in a research and development phase and there is no indication that it will be functioning consistently enough in the near future to merit keeping it in place. Moreover, reviews of recent publications suggest that animal warning systems installed on highways may not be very effective at changing motorist behavior or reducing speeds – this concerns us.

Recognizing that it may take some time to coordinate the removal of the equipment, we are willing to allow WTI and its partners to take additional time, beyond the June 30, 2005, end date, to remove the equipment, but it should be removed entirely and the sites rehabilitated by September 15, 2005. If you so choose, you may continue to conduct research with the system until the removal date. As previously

discussed with Mr. McGowen and Dr. Huijser, the cement that was used to support large posts must also be removed and holes filled according to park vegetation management guidelines (enclosed). Please pay particular attention to Topsoil Removal, Pg 3; Topsoil Handling, Pg. 4; and, Topsoil Placement, Pg. 7

Please keep us informed if, at some point in the future, another animal warning system is developed, tested, and proven effective at reducing accidents. Though the current system has not worked to our satisfaction, it is possible that improved technology will be available in the future and may be appropriate in a national park setting.

Thank you for the opportunity to be a part of this important research.

Sincerely,

/s/

Suzanne Lewis
Superintendent

Enclosure

cc: (w/enclosure)
Dr. Marcel Huijser
John Blacker

E-mail to STS

11 May 2005

-----Original Message-----
From: Huijser, Marcel
To: 'terry.wilson@sensor-tech.com'
Cc: 'dwambach@state.mt.us'; 'morton73@cox.net'; 'randy.moore@sensor-tech.com'; 'roger.werre@sensor-tech.com'
Sent: 5/11/2005 11:49 AM
Subject: quotes

Hello Terry,

Lloyd Salsman and I met with MDT (Kevin Bruski and Ross Gammon) last Fri to discuss the status of the system and MDT's wishes and expectations after 30 June with regard to the site and the equipment. I've summarized our findings below. In addition, I've formulated questions on the costs of improving different aspects of the system (way down below). I need this info on relatively short term (e.g. by the end of next week). This will allow me to inform the funders before they meet in MT on 13/14 June. This may give them the opportunity to think about additional funding that may be required before the actual meeting. Note: at this time it is more important to get "ball park numbers" rather than official quotes.

Before assuming responsibility for ownership and maintence MDT wants the system to be:

1. Reliable.
a. MDT wants to have remote access to the system to check on the functioning on a regular basis. Should we fail to get the current modem to work on the phone line we should discuss satellite access. I am willing to look into project funds if we need to follow that route.
b. MDT also wants the current brackets to be replaced with a different type as about 40% have broken. We can talk about project funds for this issue too.
c. Improve the radio link with station 3 to reduce the chance of missed detections. This may have been addressed by Lloyd last week. However, I don't have data on the potential improvement yet.

2. Not a liability concern.
a. This is a difficult topic. We know of blind spots due to design errors in zone 8 and B. The other blind spots we found (see reliability

report) are probably not real, or they were caused by radio errors from station 3. In short, MDT's request would involve more sensors and poles in zone 8 and B. This is likely to be a substantial cost, something that we may have to find additional funds for.
b. Fix any other known problems that may affect the reliability of the system.

3. acceptable to Yellowstone NP
I still hope to talk to YNP representatives about their wishes and expectations. However, Yellowstone NP is likely to be most concerned about:
a. landscape aesthetics. This would require an upgrade to a "next generation system" with reduced power requirements and much reduced solar panel size and reduced cabinet sizes (smaller batteries). To reduce the power the communication system probably has to be redesigned.
b. Reliability: blind spots, missed detections (station 3). They want to make sure their "guests" (=travelers on 191) are provided with accurate and reliable info.
c. MDT accepting responsibility for operation and maintenance. This would make the "circle" complete. Yellowstone NP has been uncomfortable with the current situation where responsibility for operation and maintenance is somewhere in a gray zone between WTI-MSU and MDT.

We talked about providing estimates for upgrades before. However, now I have more specific questions and I would like to distinguish between different components. Can you please provide me with cost estimates for the following:

1. Functional remote access to the system that would allow us to download data regularly and in a reliable manner from a remote (office) location. This may be achieved with the current modem over the phone line, or though satellite communication.

2. Replacement of all brackets with ones that will not break so easily.

3. Improvement of radio links to reduce missed detections. Note: this may have been achieved after Lloyd's visit last week already. Please provide data/argumentation.

4. Addressing the blind spots in zone 8 and zone B. This would probably require extra poles and sensors. Please provide an estimate for the current technology.

5. Fix any other known issues that may affect th reliability of the system.

6. A full upgrade of the system at its CURRENT location that would address:
a. landscape aesthetics: smaller solar panels and cabinets, perhaps relocation of some poles with solar panels further away from the road to reduce their visibility from the road.
b. blind spots: additional poles and sensors in zone 8 and B. In addition, we may want to change the location for some of the other stations or increase the number of stations elsewhere too.
c. more reliable communication system (eventhough the current one may be acceptable already). This should reduce missed radio reports and improve the quality of the radio messages for the stations that do not have a line of sight with the master station.
d. Reliable remote access.
e. New brackets

7. A full upgrade of the system at a DIFFERENT location that would address:
a. landscape aesthetics: smaller solar panels and cabinets, perhaps relocation of some poles with solar panels further away from the road to reduce their visibility from the road.
b. blind spots: additional poles and sensors in zone 8 and B. In addition, we may want to change the location for some of the other stations or increase the number of stations elsewhere too.
c. more reliable communication system (even though the current one may be acceptable already). This should reduce missed radio reports and improve the quality of the radio messages for the stations that do not have a line of sight with the master station.
d. Reliable remote access.
e. New brackets
Note: I don't expect you to include costs for removal, transportation and re-installation).

8. A partial upgrade of the system (see above) for 1 detection zone on a DIFFERENT location (i.e. the test bed in Lewistown MT). This would require 1 pair of sensors and a master station minimal equipment).
Note: I don't expect you to include costs for removal, transportation and re-installation)

Monthly report Animal-vehicle pooled fund study

June 2005

Task 1: Identify potential advanced technology systems 100%
This task is complete

Task 2: Locate potential study sites 100%
Task complete

Task 3: Document existing site conditions 100%
Task complete

Task 4: Implement and test systems 80%

General

1. The TAC meeting was held in Big Sky, MT on 13-14 June. The notes of the meeting and the proposed course of action are in attachment A.
2. STS and WTI-MSU provided cost estimates for different options of how to proceed with the effort. These cost estimates are included in attachment B.

MT site (Yellowstone)

10. Lloyd Salsman (STS) successfully installed a modem for the land-based phone line.
11. STS has been in contact with RADS on a daily basis over the telephone. However, after a couple of weeks there was a failure on the logging memory, but the detectors continued to operate. The connection to the land-based phone line may be sensitive to lightning strikes.
12. On 14 July WTI-MSU removed and reinstalled the memory card. STS tried to restart the data logging through the modem, but the procedure failed. This may be due to a bad memory card; it may have been damaged as a result of a lighting strike. However, the system still detects animal movements and is functional. We will now install a new memory card.
13. Detection zone 1 seems to have false positives as a result of re-growth of a shrub. If the system is kept in place we will ask Yellowstone NP for permission to trim the shrub again.
14. STS has been in contact with a company that provides remote control and automated warning systems for ITS applications: http://www.vikoninternational.com This may help DOT's with the operation of the system.

PA site

3. Oh Deer has not been in touch after their contract was terminated.

Task 5: Collect post-implementation site data 30%

Task 6: Evaluate system effectiveness, acceptance and performance 2%

Task 7: Produce final report 85%

Additional Work / Issues

The actual co-ordination between all the organizations and people involved for the MT (Yellowstone) site as well as the Pennsylvania site continues to be much more labor intensive than anticipated.

Marcel Huijser

ATTACHMENT A: TAC MEETING NOTES

Animal-Vehicle TAC Meeting
Monday June 13, 2005
3:30 – 6:30 PM

Welcome by Marcel

In attendance (in person):

- Pete Hansra (CA)
- Jaime Reyes (IA)
- Sedat Gulen (IN)
- Alisa Babler (KS)
- William Branch (MD)
- Deb Wambach (MT)
- Kevin Bruski (MT)
- Allen Covlin (ND)
- Jay Van Sickle (NV)
- Felix Martinez (OR)
- Jon Fleming (PA)
- Richard Stark (WI)
- Bill Gribble (WY)
- Kyle Williams (NY)
- Lloyd Salsman (STS)
- Marcel Huijser (WTI-MSU)
- Amanda Hardy (WTI-MSU)
- Steve Albert (WTI-MSU, came in later on Mon)
- Silvia Harrington (WTI-MSU)
- Paris Hodgson (WTI-MSU, attended on Tue)

AJ Nedzesky (FHWA) is on the phone
Richard Stark (WI) is the only one new attending in person
Clint Adler (AK) and Greg Placy (NH) could not make it, unfortunately
Yellowstone NP is not represented, unfortunately

Presentation Marcel on system reliability

Since December 2004 meeting we have done reliability tests, the animal detection part is functional and the driver warning was only connected since December until January 26. The system has 2 substantial blind spots.

We collected reliability data between January 27 – 31st and February 26 to March 5th. 55% of all detections were clearly related to animal crossings with 5% errors. 29% of the detections were classified as "unclear". These are not necessarily false detections though.

We did snow tracking with the approach and leave, then the tracks were erased. Snow tracking also revealed parallel movements, which, based on the interpretation of the detection data alone, would have been classified as "unclear". We tracked 53 Elk, 14 Coyote and 1 Wolf crossings. 72% of all elk crossings could be related to a "clear animal crossing" in the detection data. Of all "clear animal crossings" in the detection data 80% could be related to animal snow tracks (elk, coyote or wolf).

The substantial blind spots are the result of a design error. The blind spots result from curves and slopes, causing the beam to shoot too high (over the animals' head) in some locations.

The median was 48 detections per 24 hrs, translating into a maximum of 2:24 hr flashing lights per day, based on the assumption that all detections are at least 3 min apart. However, in reality, the detections are highly clustered, resulting in fat less than 2:24 hr/day flashing lights. The snow tracking showed that a minimum of 72% of the large animals (elk) that crossed the road were detected by the system.

Questions and discussion:

Relatively small numbers of tracks detected in the blind spots; animals don't like the approach (steep, boulders). The solution, is more poles or additional detectors or reconfiguration or fencing or other barrier to divert animals.

MDT crash data is not completely accurate. For this road section we also rely on data from Yellowstone NP. However, these data have not been made available yet.

The posted speed limit is 55 MPH but the measured average vehicle speed was 68 MPH.

Presentation Lloyd Salsman: on modifications to the MT System

There have been modifications to the Montana system.

Explanation of the technology and the lay-out of the system; the sensors, the study site, remote access, all weather performance and is rugged. The system has transmitter / receiver stations and a master receiver station. 4 poles have beacons.

The detection process is influenced by the environment, vegetation, and noise levels. There were some initial problems. Setting specific signal signatures for large mammals was one of the most important changes to the system. This allows to filter out false positives caused by various smaller animal species (incl birds), vegetation and vehicles.

2nd Generation system would ideally include changing the communication system. The stations would only call in after a detection rather than continuous polling by the master station. This leads to 90% power requirement reduction and improved radio link performance.

More Discussion:
RE the software, program and compiler

Presentation Marcel on changes to report

Changes to report – Update financial contributions and expenditures, update sites North America and Europe; all review chapter to front of report; Different aspects in MT and in PA work now split into different chapters, reliability tests added, system acceptance added, project environment added, list contact details vendors added.

Update MT site: blind spots. Yellowstone National Park: no modifications, no next generation system and no more research and need to have the system removed by September 15th.

Update PA site: the system has been removed and there has been no further contact with Oh Deer.

Patent – submitted by Oh Deer. However, Swiss article from 1994 may make that patent invalid.

Discussion / Questions about recent work and draft report / comments

- Finish the Report, remaining chapters (modifications to system and Cost /Effect benefit /cost)
- Project was Research and development rather than just evaluation
- Need to have more focus on areas where we can develop 2nd generation, next steps, we are so close
- Need to focus more on the development of the system for the whole report
- The TAC prefers to focus on the benefits of what we learned with the two study sites in MT and PA rather than relying heavily on what we have learned from other locations, many of which are located in other countries.
- Five years of research that have lead to more research – add to the report results versus expectations – in the executive summary
- We now have more tools for the tool box
- The cost of the animal detection system is currently relatively high, but once the systems are mass produced the costs should come down substantially.
- It is important that future projects do not have project partners that can are not invested in the project but that can nonetheless terminate the project.

- Do effectiveness evaluation study (if possible)
- Need to have a real-world site to work with.
- A letter needs to be send from the TAC/FHWA to Yellowstone NP to keep the system in place
- We are out of money now – need to arrange for finances first
- Find more money, new project (current one ends 30 June 2005), decide on lead state
- Relocate the system to Lewistown? Perhaps we need 2nd generation system there… new equipment, set standards for the future.
- Relocate the system to elsewhere in MT? This will be explored by MDT.

ATTACHMENT A: NOTES TAC MEETING
Animal-Vehicle TAC Meeting
Tuesday June 14, 2005
8:00 – 11:30 AM

Group discussion: Benefits from project

Accomplishments of project thus far:

- This project provided a forum for 15 DOTs and FHWA to share experiences and to direct research related to the reduction of animal-vehicle collisions, specifically with regard to a relatively new mitigation measure; animal detection systems. The 15 DOTs and FHWA learned that animal-vehicle collisions are a growing problem in many states and that many states face similar problems. While some mitigation measures have already proven to be effective, the effectiveness of other measures is disputed or, in the case of animal detection systems, insufficiently known. There is a need for a wide variety of potential mitigation measures to choose from as the local conditions and requirements vary between locations that require mitigation measures. The states learned from each others experiences and discussions, including topics such as the hidden costs of animal-vehicle collisions; disposal costs ($30-80 per carcass), worker compensation, potential exposure to contagious diseases, and legal concerns (wildlife management regulations, solid waste regulations).
- The DOTs and FHWA learned that some animal detection systems can reliably detect large animals and that, depending on road and weather conditions, signing and other factors, drivers can reduce vehicle speed and animal-vehicle collisions can be substantially reduced. This information was not generally accessible before the start of the project.
- The DOTs and FHWA learned that there currently are no standards for the reliability and other performance criteria for animal detection systems. There are also no standards available for warning signs and signals. Generally accepted minimum criteria for animal detection systems and signing standards are needed however, especially with regard to potential liability in case of an animal-vehicle collision after system installation.
- The project resulted in one animal detection system prototype (STS, MT site) that detects large animals reliably. However, due to design errors, there are two substantial blind spots in the road section covered by the system. The concept of the technology has proven to work though.
- The project resulted in concrete ideas to design and build a second generation system (by STS) that would have much smaller dimensions (landscape aesthetics, reduced power requirements, reduced costs for solar panels) and that would have a more reliable and robust communication system. Hence the project gave direction to the improvement of an experimental animal detection system.
- The DOTs and FHWA learned that animal detection system projects should still be approached as research projects rather than deployment projects. It is essential to clearly formulate the goals and expectations of an animal detection system project and stress that they relate to research, rather than deployment alone.

- The DOTs and FHWA learned that studies in a real roadside environment are essential, but that they can also be challenging and complex.
- The DOTs and FHWA now have access to up to date information related to experiences with regard to system planning, design, installation, operation and maintenance and evaluation from all known locations throughout North America and Europe. This includes detailed information with regard to the experiences on the two study locations and two experimental animal detection systems selected for this project in MT and PA. The lessons learned have been documented and will greatly benefit future animal detection system projects.
- The DOTs and FHWA now have access to the contact details of vendors of animal detection systems throughout North America and Europe. This makes it easier to identify and contact vendors that have shown to be able to produce a reliable and/or effective animal detection system.
- The DOTs and FHWA learned that animal detection systems have the potential to become a proven and cost-effective mitigation measure that can be added to their "toolbox". However, further research is required before animal detection systems can be deployed and expected to become operational and effective shortly after system installation.
- The DOTs and FHWA learned what questions still need to be addressed before animal detection systems may qualify as a proven and cost-effective mitigation measure.
- The DOTs and FHWA learned that there is great interest from the public with regard to animal-vehicle collisions and that media attention, particularly with regard to animal detection systems, has been great and generally favorable.

Benefits of continuing the project (at the current location or elsewhere in MT):

- If the blind spots of the system at the MT site are addressed, if the brackets for the sensors are replaced, and if the communication links, especially with station 3, are improved, and if MDT accepts ownership of the system and responsibility for operation and maintenance, and if Yellowstone NP approves these efforts, then the warning signs and signals can be attached/activated. This would allow for the collection of system effectiveness data, including potential reduction in vehicle speed and potential reduction in animal-vehicle collisions as a result of the activated warning signs and signals. In addition, we would be able to interview drivers with regard to their opinion of and experiences with the animal detection system. This would allow us to not only collect data on the reliability of the experimental animal detection system, but also on its effectiveness. Hence we would be able to do what was originally intended; fully investigate the reliability and effectiveness of the experimental animal detection system and make recommendations for future research and deployments, particularly with regard to this experimental animal detection system.
- Data on system effectiveness for animal detection systems are currently extremely scarce. However, these data are essential to further investigate whether animal-detection systems in general are effective in reducing animal-vehicle collisions and whether they should indeed be considered as a potential mitigation measure, regardless of the exact technology and vendor.

- More data on the costs for operation and maintenance are needed. This would allow for a better insight in the cost-effectiveness of animal-detection systems and how they compare to other mitigation measures.

Costs of discontinuing the project (at the current location or elsewhere in MT):

- An experimental animal detection system that detects large animals was developed but not tested with regard to system effectiveness. The problem of animal-vehicle collisions is still present and growing though, and we are still in need for more and effective mitigation measures to choose from as local conditions and requirements for problem locations vary. The results for animal detection systems thus far are encouraging and plea for continued efforts rather than the abandonment of the effort. Should the effort nonetheless be abandoned, one could consider the money spend thus far as a loss; not because the concept of animal detection systems in general or the experimental animal detection system failed to work, but simply because we failed to fully pursue the research that is required.
- Data on the effectiveness of animal detection systems are extremely scarce. The field of animal detection systems has a great need for more and better data on the effectiveness of animal detection systems under a variety of conditions. These data can only be acquired by having reliable animal detection systems in place in real roadside environments and by collecting data on system effectiveness. Reliable animal detection systems that are operational with the warning signs and signals attached, and that are monitored for system effectiveness are extremely scarce. The removal of any reliable animal detection system from a real roadside environment is a serious loss and delays the further development and application of animal detection systems. In this case, the abandonment of the further evaluation of the experimental animal detection system at the MT site has the potential to block further research and deployment of animal detection systems in the US for the coming years or longer.

Presentation and discussion (Marcel Huijser): future of the MT site and equipment:

Note: Currently the equipment is owned by the TAC; i.e. owned by the 15 Dots as a group. The TAC is able to decide on the future of the equipment.

Note: STS (Lloyd Salsman) stated that STS will support the system in the future.

Strategy

1. Explore whether the TAC/FHWA can convince Yellowstone NP to be open to a discussion aimed at keeping the system in place at its current location. KS DOT took the lead for this effort on Fri 17 June 2005, and Yellowstone NP has agreed to such a meeting.
2. Explore whether the TAC members would be able and willing to finance a continuation of the effort. This would lead to a new contract and new terms and conditions for the

project partners. An overview of the cost estimates of the different options has been provided to the TAC/FHWA (see table in attachment).

3. Decide whether there would be sufficient funds available to continue the effort, and for what options (and budgets) (see table with options and budgets in the attachment).
4. If there are indeed sufficient funds available to continue the effort, meet with Yellowstone NP. STS (Lloyd Salsman) and WTI-MSU (Marcel Huijser) would be available to provide information during the meeting. The discussion would be aimed at convincing Yellowstone NP to keep the system in place (either with modifications to the current system or with an upgrade that would address landscape aesthetics, depending on what option or options can be financed (see table with options and budgets in the attachment). Parallel to this effort a letter may be sent by the FHWA on behalf of the TAC to the Department of the Interior with a copy to Yellowstone NP.
5. Decide whether the effort will be continued or not and develop a new project description, budget and organization. Note: ODOT is willing to continue being the lead state if the system stays at its current location.

Should we have the finances to continue the effort, but should the talks with Yellowstone NP fail, the TAC would like to reinstall the system at another location in MT.

Notes for potential relocation to another site in MT:

- The MDT representatives will explore whether such an effort would indeed be supported by MDT. The system may be reinstalled at fence ends, e.g. on Bozeman Pass. If the system is relocated MDT may want to consider becoming the new lead state.
- The material would probably have to be stored temporarily before re-installation. The batteries will need to be replaced after they are disconnected from the solar panels. They classify as chemical waste and need to be disposed off appropriately. WTI-MSU has agreed to store the equipment temporarily until reinstallation elsewhere. Note: circuit boards and other electronics will have to be handled and stored according to specifications by STS (moisture, electrostatic). Note: the dimensions of the storage facility will have to match those of the system.
- The TAC would be interested in reinstalling the present technology only, not a more expensive system upgrade (fundamental changes to the communication system, reduced power requirements, reduced size solar panels, new electronics).

Should the effort be discontinued (remove equipment from its current location and no reinstallation elsewhere in MT), then the equipment will be offered to the Indiana Toll Road Division. The rational is that the parts from the MT site could be used as spare parts or for the installation of along another road section and that all equipment and expertise with regard to this technology (this generation) would be concentrated in one location. This would benefit the logistics for problem identification, operation and maintenance.

Note: STS would want to use 2nd generation system as soon as possible, but prefers limited testing in a controlled access environment first.

Note: reinstallation of the system in PA was not recommended as the location is too far away from vendor and researchers. Reinstallation of the system in CA was not recommended either as the system may not meet the local conditions.

Presentation future alternatives by Steve Albert

Even if the system is removed and not reinstalled elsewhere we may want to keep the TAC together as a forum and platform. Depending on the level of funding incidental research or literature reviews with regard to animal-vehicle collisions and mitigation measures could be undertaken.

Alternatives:

- Do Nothing, TAC members go their separate ways
- Technology Transfer only – WTI to maintain a database
- Select projects evaluations and develop an overall program and assessment and user requirements
- Maintain knowledge and move forward with new alternatives and next steps

Presentation on IN system by Sedat Gulen

- 6 mi treatment (with animal detection system) and 6 mi control
- The # of deer killed is monitored and analyzed per month
- Too early to say whether the system is effective, but the peak months for collisions are are March – June and October – November
- The system (same as on the MT site) is working fine
- Sign flashes when animal is present and the sign can only read at this point “Animal Present when Flashing”
- It is an expensive project, but the amount remains undisclosed.
- The study will continue for another 4-years

ATTACHMENT B: COST ESTIMATES

see separate file

Alternatives	Description	Cost ($1000)	Considerations
1. Existing system in-place, no modifications	Existing system in YNP with WTI conducting research only. All contacts with Yellowstone NP and STS will go through MDT directly, including problem ID and problem solving. WTI 3 yr evaluation (2 month site presence per year (grad student), 1 month analyses and report per year) ($15k per year) TAC meets once per year ($15k/yr)	$90k	System reliability fo years TAC meetings in B However, system w accepted by MDT b blind spots and brac have not been addre a result the signs wi attached, and theref **system effectivenes not be evaluated, c system reliability. not really an optio**
2. Existing System with minor modifications at current location	Modifications to the system to solve the blind spots, brackets and relocation of master station. Existing system in YNP with WTI maintaining its current level of effort and dealing with all contacts with Yellowstone NP, STS and MDT **for the first 9 weeks** (end of modifications**). From then on all contacts with Yellowstone NP and STS will go through MDT directly,** including problem ID and problem solving. WTI: First 9 weeks ($15k). 3 yr evaluation (2 month site presence per year (grad student), 1 month analyses and report per year) ($15k per year) TAC meets once per year ($15k/yr)	$252k (=$105 k + $137k +$10k)	System effectivenes reliability evaluatio years TAC meetings in B Fix blind spots, and equipment at new lo ($10k, installation contractor). Replace brackets, relocate m station, remote acce satellite. These elem add up to $137k (ST +$10k for installatio contractor. Note: STS would ch $8k /week for addit monitoring and add problems rather tha price. The modifica would take about 9
3. Next generation installed at current location	Purchase and install smaller more context sensitive design. Existing system in YNP with WTI maintaining its current level of effort and dealing with all contacts with	$353 (=$138 k +	System effectivenes reliability evaluatio years TAC meetings in B

	Yellowstone NP, STS and MDT **for the first 8 months** (end of upgrade**). From then on all contacts with Yellowstone NP and STS will go through MDT directly,** including problem ID and problem solving. WTI: First 8 months ($48k). 3 yr evaluation (2 month site presence per year (grad student), 1 month analyses and report per year) ($15k per year) TAC meets once per year ($15k/yr)	$215k)	Full upgrade of syst much smaller dimer ($215k). The upgra take about 6-8 mon
4. Existing System with minor modifications installed elsewhere in MT	Modifications to the system to solve the blind spots, brackets. WTI maintaining its current level of effort and dealing with all contacts with Yellowstone NP, STS and MDT **for the first 15 weeks** (end of reinstallation and modifications**). From then on all contacts with Yellowstone NP and STS will go through MDT directly,** including problem ID and problem solving. WTI: First 15 weeks ($23k). 3 yr evaluation (2 month site presence per year (grad student), 1 month analyses and report per year) ($15k per year) TAC meets once per year ($15k/yr)	300k ($113k + $137k+ $50k)	System effectivenes reliability evaluatio years TAC meetings in B Site survey and inst equipment at new lo ($50k, installation contractor). Replac brackets, remote ac satellite. These elen add up to $137k (ST +$50k for installati contractor. Howeve depending on the su costs there may be a increase or decrease costs. Note: STS would cl $8k /week for addit monitoring and add problems rather tha price. The modifica would take about 9
	The below options could be added to the above alternatives or as a stand alone.		
a. Increased technology transfer only	Maintain existing literature and project database ($20k/yr) Provide information on website in coordination with Deer-Vehicle Clearinghouse ($15k/yr) For 3yrs	$105	Expectations need t more clearly define option

b. Selected project evaluations only	TAC to identify nationally significant projects that need evaluation Select for evaluation one project per year ($50k)	$150k	
c. Program development and assessment only	Identify user requirements Establish a DOT standard and specification Develop a Concept of Operations Conduct patent search	$175	

L:\PROJECT DATA\428563_Animal_Vehicle_Pooled\Phase II Alternatives for ODOT and TAC .doc

STS stated: All of the items were bid as Rough Order of Magnitude (ROM), stand alone tasks. Should several tasks be done in parallel there could be some cost savings. All travel costs were estimated. The terms of these developments are based on time and materials. STS will bill for fixed daily rates while on site. STS reserves the right to make changes to these estimates based on changes in scope or timing of the tasks.