PACIFIC STATES MARINE FISHERIES COMMISSION
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Minutes
PIT Tag Steering Committee
July 12, 2004

Attendees: Ann Setter (ODFW), Doug Marsh (NOAA Fisheries), Ed Buettner (IDFG), Charles Morrill (WDFW), Carter Stein (PSMFC), Don Warf (PSMFC), Dave Marvin (PSMFC), John Tenney (PSMFC), Sean Casey (Digital Angel), Jon Mueller (Digital Angel), Bill Kemp (Digital Angel), Zeke Mejia (Digital Angel), \Sandy Downing (NOAA Fisheries), Earl Prentice (NOAA Fisheries), Dean Park (Biomark), Steve Anglea (Biomark), Dennis Schwartz (USACE), Peter Lofy (BPA), Jamie Swan (BPA)

1. Update on TX1400SGL Tag Development and Production Schedule by Digital Angel

Digital Angel (DA) provided a status update on development of an interim tag for optimizing performance of the Bonneville Corner Collector High-Q flume system. Highlights follow:

- DA announced that new tag components now ready larger antenna, larger glass encapsulation vial, updated components

- DA described the various trade offs in wire gauge: maximum size (35 and 36 microns) of wire but still must fit within glass encapsulation This means the new tag is slightly larger diameter up from 2.07 to 2.223 and industry standard Nominal length of current super tag is 12.1 mm and wiring is 25 microns.

- DA is building a process to assemble new tags. One million dies plus additional equipment have been procured in expectation of large number of tags required (600 to 700 thousand tags available by Sept '04). Tag production is on schedule at current time.

- Earl asked how DA is testing new tags
    - Temp cycling
    - Pressure testing
    - Shake, vibration and shock
    - Sealing/leakage
    - Readability - tested in Spain and @ factory, again in Minneapolis,
    - Reading range
    - Tag size – length, diameter, weight

- DA addressed the schedule of testing. At initial start up, all tests are performed. But after that, on some fixed time schedule. DA tests components of each lot purchased to assure quality. Tag components go through many QA checks in manufacturing process

- Testing is done, in part, to identify step where most fall out occurs. QA efforts are concentrated here -- each machine in the process has some specified tolerances. Yields from each machine in the process are checked. If results are out of expected tolerances or specs, the machine is adjusted.

- DA expects to be able to ship 92 to 95 % of tags manufactured.

- DA discussed Ferrite for the tags. Issues include some variability in the ferrite parameters including electrical parameters, length and diameter tolerances. DA mentioned that in extruded tags permeability does vary because of compactness of materials. Again, new materials, new processes…

- DA said that the manufacturing target specification for tags is +/- 2 kHz -- within these limits tag performance is essentially unchanged.

- DA said that they are still making some super 12 tags but in smaller quantities. DA is not manufacturing SGL tags for companion Animals. In addition, the Super 12 tag is still a marketable product?

- DA said they were testing TX1400ST and TX1400SGL tag at the full size mock-up antenna in Minnesota their facility.

- DA said that a pilot run of 150 tags would be delivered by the end of the week and a, test run of 6,000 would be ready by the end of August. After that, then go with full production. The final schedule is still to be worked out.

- Sandy said that the tag qualification tests will need 50 of the 6 K tags for community testing (Carter thinks this is low by one or two orders of magnitude).

- How much will DA raise the bar for the new SGL versus the ST tags? DA says they're not sure – maybe 50, 75 100 %? DA will be working on this issue.

- Zeke in answer to Ann's questions: SGL tag with three types of ferrite -- take best two of three for testing. A decision has not been made on best choice for ferrite. DA may be using the same manufacturing technology as in super 12 tag for the "Final" tag as a more consistent, better manufacturing process because of more automation. In addition, the ST tags have a better QA process. Zeke is hoping for some measured improvement. He said he would be very happy with 10 to 20 % improvement.

- Tag is currently being tested at the DA Minneapolis facility. The tag does read in the middle of the 16' x 16' antennae, in the dry. DA asked if anyone wanted to come out to the facility to witness the final tests prior to going to the Bonneville High-Q Prototype Test Facility.

2. Update on High-Q Efficiency Test Plan

- Still goal of 60 % detection of PIT Tagged fish in the High-Q corner collector flume at Bonneville
- Dennis reported that the Corps and BPA are still finalizing the test schedule.
- The Corps "One Page Summary" is completed. The study is intended to quantify detection efficiencies. Dennis will send a copy of the "One Page Summary" to Carter.
- Tags for the tests will be provided by BPA and are not to be included in High Q PIT tag detection efficiency test proposal budgets.
- The Corps would like to try one or two tag types. Kim & Dennis are leaning toward testing only one tag – e.g. the best tag that comes out of the DA evaluation at the Bonneville High-Q Prototype test facility. PTSC needs to weigh in.
- There are still many questions about the High-Q detection efficiency tests. Where will release of test fish occur? Who's driving test – i.e., what is the test supposed to prove? How many fish should be used, and when will that information be available?
- The test process is funded through BPA but the proposal evaluation and selection will be run through the COE process and not the NWPCC Fish & Wildlife Program process.
- Due to interference on the PIT Tag by the Radio Tags, "double tagging" radio tags and PIT tags will not be acceptable for the detection efficiency tests.
- There was some observed damage to the walls in HI-Q Prototype antenna, but the working assumption is that walls will hold up.
- Pending tests at the Bonneville Corner Collector High-Q Prototype Test Facility, a Go/No go decision will be made by August 15, 2004.

3. Additional Requirements for new tag deployment

- The new SGL tag is 2.23mm outside diameter compared with 2.07mm outside diameter for the older "BE" or "ST" tags. Therefore, ***thin walled needles are required*** to inject the SGL tags. The SGL tags are approximately 12.6mm long and are about 5% heavier than the ST tags.
- The community has an investment in NON-thin walled needles.Doug Marsh reported that he has approximately 10K of the thick wall needles. ODFW reports having approximately 4K.
- It is likely that the transition to the SGL tag type in not an 'all or nothing' proposition like that which was required when the Basin switched tag and reader systems to the ISO based standards in 2000. Rather, the introduction of the SGL tag type is more likely to be like the transition from the BE tag types to the ST tag type. During this transition, there was (and still is) a mix of tag types being delivered to, or used by, marking projects. Since an abrupt

change in tag types may not be likely, it is possible that these investments in thick walled needles may be safe.

- The PTSC will communicate required changes to the PTAGIS community as plans are firmed. BPA asked that they be included in this communication.

- The PTSC needs to update the PIT Tag Marking Procedures Manual to specify “Thin Walled Needles”, and to suggest part numbers and manufacturers.

- DA has distributed a new version of firmware for all readers in the Basin (FS1001, FS1001A, FS2001F, FS2001F-ISO). This firmware is required in order to read SGL tags that include an enhanced ‘compression’ algorithm. This Firmware fixes a side-effect incorporated into the reader as testing was conducted for the new ISO systems in the late 1990’s. The SGL tags are readable by non DA readers.

- PTSC members asked if the ST tag will still be available. Especially if the larger tag size of the SGL precludes marking of smaller fish – epecially Chinook in headwater reaches of higher elevation streams. DA seemed to indicate that they could meet the Basin needs.

4. Tag Qualification Tests -- Impacts on existing juvenile and adult separation by code systems?

- Sandy will send out the Tag Qualification proposal this week. This proposal details the testing methodology to be used to “Qualify” the use of any new tag (including the SGL) in the Basin.

5. PIT Tag Forecast Process

- BPA staff complains that the paperwork required to transfer dollars for PIT Tag between Fish and Wildlife PIT Tag Marking Projects into the Tag Purchase project code is to burdensome. They are considering changes to the existing process that has been in place for a dozen years.

- BPA is having a critical meeting today to determine what they can / can not do. Peter Lofy and Jamie Swan will advise Carter on Tues or Wednesday of this week.

- The NWPCC is reviewing F&W 2005 program budget this week. BPA said that price changes (even ball park) are critical to their budget process -- esp. SGL tags and preloaded needles -- how much of an increase?

- PTSC members did not agree that any change from the existing process would be good at this time.

6. PTSC to decide on a site or installation priorities for PIT Detectors on Adult Return Flumes from Fish and Debris Separators at dams

- PTSC decided via e-mail that the priority for installation of a PIT detector is at John Day rather than Little Goose or Lower Granite Dam due to logistical difficulties and Basin research requirements.

7. Proposal for Generation 2 PIT Tag Reader Field Tests at Production Facilities -- PTSC to "Approve" Field Testing Plan

- Due to lack of time PTSC did not conclude this discussion.

8. Follow Up on USFWS Biological Effects of Tag Encapsulation Materials study

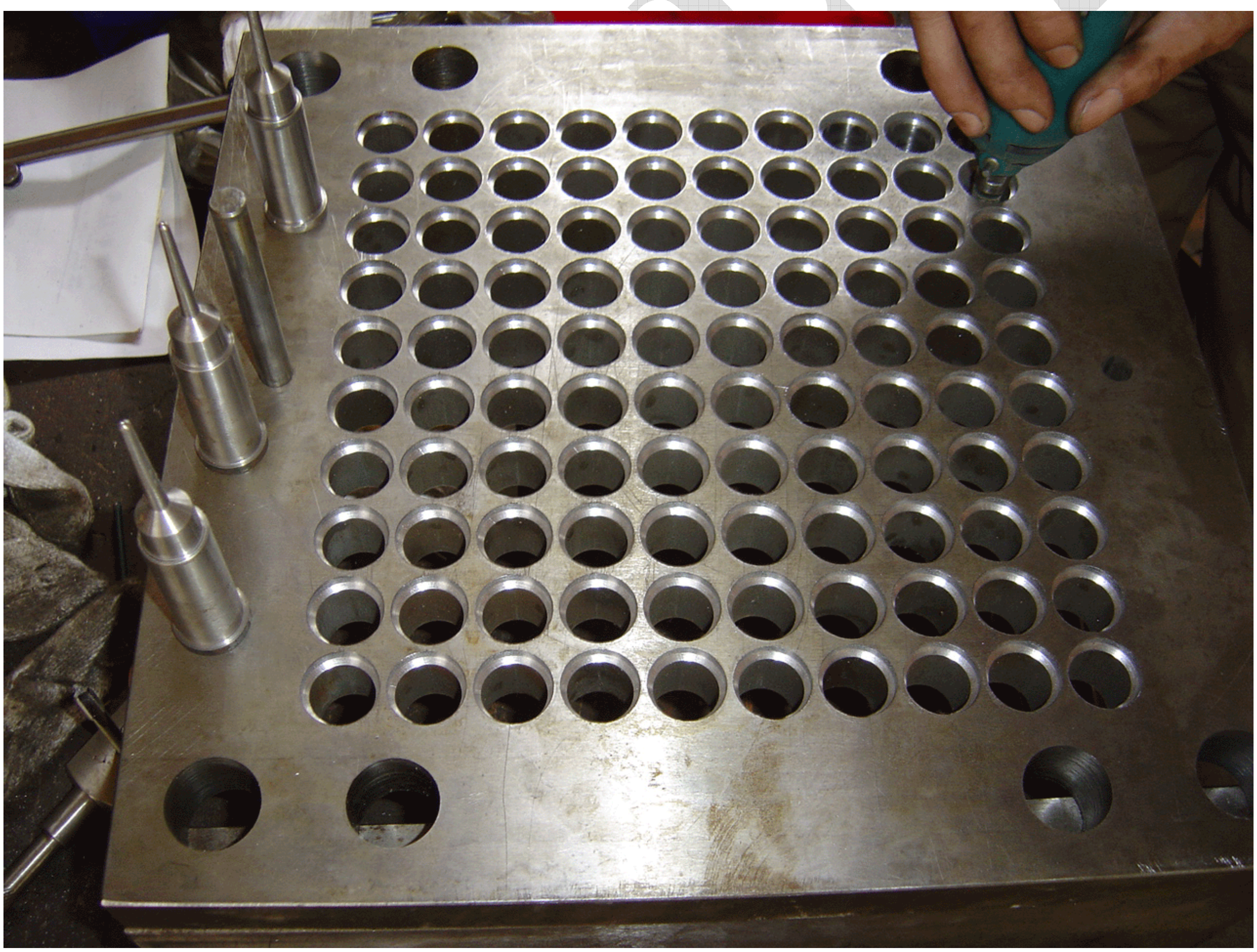
- Due to lack of time PTSC did not conclude this discussion.

9. Proposed Switch Gate at McNary – PTSC to decide to tecommend support from FPAC

- Due to lack of time PTSC did not conclude this discussion.

10. Progress on Pre-loaded syringes (See photo)

The following photo shows the status of this effort:



Nbr	Agenda Item	Person	Reference
1	Update on TX1400SGL Tag Development and Production Schedule	Zeke Mejia Digital Angel	Email requestion Tag Status; Email Master Contract mod for New Part Number
2	Update on High-Q Efficiency Test Plan	Dennis Schwartz & Kim Fodrea BPA / Corps	See Item 4 in May 2004 PTSC Meeting Minutes
3	Additional Requirmenets for new tag deployment: Thin Wall Syringes - Sean New Reader Firmware - Sean What else? PTSC to discuss and plan how to inform "Community".	Sean Casey Digital Angel	Email of Tag Diameter; Email of Software Changes
4	Tag Qualification Tests -- Impacts on existing juvenile and adult separation by code systems? PTSC to provide technical direction and to develop schedule and resource plan for tag evaluation.	Sandy Downing NOAA Fisheries	Proposed SGL Tag Evaluation Plan SuperTag Evaluation Comparison;
5	PIT Tag Forecast Process	Carter Stein PSMFC	Minutes from BPA PTAGIS Digital Angel May 18, 2004 Meeting Text Description of BPA's proposed changes Exisiting and Proposed Processes
6	PTSC to decide on a site or installation priorities for PIT Detectors on Adult Return Flumes from Fish and Debris Separators at dams	Carter Stein PSMFC	Proposed Alternatives
7	Proposal for Generation 2 PIT Tag Reader Field Tests at Production Facilities -- PTSC to "Approve" Field Testing Plan.	Jon Mueller Digital Angel	Proposed Plan
8	Follow Up on USFWS Biological Effects of Tag Encapsulation	Tom Hoffman USFWS	Email from Joe

	Materials study		Zydlewski to Tom Hoffman
9	Proposed Switch Gate at McNary -- PTSC to decide to recommend support from FPAC.	Dave Marvin PSMFC	Proposal

MINUTES FROM MAY 18, 2004 MEETING WITH BPA COTRs

Re: NWPCC Project 199008001 - PIT Tag Distributions

Attendees: PSMFC: Carter Stein, Renee Barrett;
Digital Angel (DA): Sean Casey;
BPA: Jamie Swan, Peter Lofy

1. The meeting was called to reconcile discrepancies in the 2003/2004 PIT Tag Forecast numbers. The original forecast was based upon input from Fish and Wildlife Program (FWP) sponsors, which PSMFC solicited. The forecasts were then compiled into a spreadsheet by PSMFC. Subsequently, various FWP projects were added, changed, or deleted, resulting in a change to the forecast as budget amounts and contract renewals were approved by BPA.

2. Carter Stein outlined the Tag Forecast and Distribution system that has been in place since 1998 (Reference the "2004 PIT Tag Specification Document"). The key steps in the process are:
   (a) The project sponsors' forecast tag usage by FWP project;
   (b) FWP projects are approved;
   (c) FWP projects request tags via the PIT Tag Distribution Request Form (PDRF).

   The Tag Distribution and Inventory (TDI) process was implemented in 1998 and provides a tight coupling of tagging and release data to tag deliveries. Based on the TDI information, it is possible to determine tags in fish that are detected at dams; however, no tagging and release information has been submitted to PTAGIS. TDI can track various models or types of tags from multiple vendors to multiple projects. BPA is very happy with the great job that PSMFC is doing with TDI, and BPA technical personnel continue to recommend that this function reside at PSMFC.

3. Jamie Swan explained it is very time consuming for BPA to make the various internal accounting transactions tracking the movement of PIT tag funds, from a project using PIT tags to the project which purchases PIT tags. She explained there is an accounting system called "Supply Inventory Pool" at BPA that is set up to make on-going purchases and could be used for this process. It would allow BPA to purchase tags directly from DA, (and place them "in-inventory" without attributing the cost to a specific project), rather than PSMFC purchasing tags from DA as has been the case since approximately 1990.

   Peter provided the following background:

   Previously, this was not required to be tracked "by project" in BES (Bonneville Enterprise System - BPA's financial software/system). The main problem is that the current system requires that payments for tags be attached to an individual project at purchase when BPA pays an invoice (before the tags are distributed). In the mean time, the actual number actually distributed may differ from the number purchased “for the project”. If BPA Fish and Wildlife is allowed to use a Supply Pool Method, the costs would not be attached to the project until the tags are distributed, accurately reflecting costs at distribution. This will eliminate “re-distribution” of costs within BES by Jamie now required each and every time the forecast does not match the actual distribution.

4. Renee Barrett reported that the actual time it takes for PSMFC to issue the purchase order and pay for tags is insignificant when compared to the forecasting, receiving, and distributing process for PIT tags.

5. Tracking delivery of individual tags to specific FWP projects would still need to be performed by the TDI system. Another interface would have to be established between BPA and PSMFC to track BPA orders, DA deliveries to PSMFC, and verification of DA invoices to BPA prior to payment for tags.

   Jamie said BPA personnel may be required to physically inventory shipments upon arrival. She will have to check on how this might be done when BPA is not the shipping destination. It may be possible that BPA can verify delivery of shipment over email correspondence.

6. Carter pointed out the key problem for this task is the "Approval" process. PSMFC charges no overhead for tag purchases and the actual ordering process takes only about 20 minutes. The PTAGIS project (199008000) has provided resources for tag purchasing and distribution since 1990. Carter further suggested that Columbia Fish and Wildlife Authority (CBFWA), Northwest Power Conservation Council (NWPCC), and BPA could approve the "Master Tag Forecast" once per year (possibly the September NWPCC meeting). This would minimize the amount of time that BPA spends issuing transactions described in No.3, above.

   The following was provided as additional information for these minutes by BPA:

   Use of the Supply Inventory Pool, better tracking of the few projects that make up the bulk of the volume and the ability to complete more frequent orders will assist all parties in tracking “changes” to the 12-month tag use projection. Use of the Supply Inventory Pool will reduce Jamie’s workload because she will not have to designate project funding sources until the tags are shipped. More frequent ordering will make it less likely BPA will “over order”. It would be nice if we could get the Council, CBFWA and BPA to help in this process, but we also need to look to the sponsors for feedback. They need to let us know as soon as they know their needs change (either increases or decreases). How’s this instead of your next 5 lines??

After reading through this again, I am feeling more comfortable that Carter sees this as addressing #3 instead of it being "the solution to all of our problems"

ask for a certain number of tags but often they do not request the full amount when tagging. We need to be careful in thinking that the above suggestion is going to solve all of our concerns. We also need to be frugal with estimates because if for some reason the tags are going to keep on being upgraded every year or two we do not want to be stuck with a bunch of tags, Jamie)

7. Sean Casey reinforced the point that it is imperative for DA to know how many tags to build four to six months before tags are required for marking fish. Digital Angels major North American customers are Biomark, Inc., U.S. Army Corps of Engineers and BPA. The reason for the long lead time is the time required for raw materials and necessary scheduling of production facilities to build the tag orders.

   Because of the complexity of the manufacturing lead time schedules, it is important to coordinate purchases in a strategic fashion. Generally, this means fewer, larger orders placed at the right time.

   Peter mentioned that last year when BPA "cancelled" about one-fifth of the expected numbers of tags which was very disruptive (it caused a two million dollar swing in Digital Angel financial accounting forecasts). Production had to be "re-scheduled". It would cause unacceptable disruption for Digital Angel if this were to occur again. All parties agreed that we would work to prevent this in the future.

   Furthermore, with the advent of the new PIT tag required for use at the High Q Corner Collector at Bonneville Dam, it would be advantageous to attempt to phase out the Super Tag in time for introduction of the new Enhanced Glass tag.

   BPA also points out that Digital Angel generally keeps 200,000 tags on hand for "emergencies". However, Sean indicated this will be less during transition from one tag type to another, to facilitate transition as soon as would be feasible. Sean acknowledged that biologists will want new tags when available, and that DA will try to accommodate that (within reason, as PSMFC/DA inventory is drawn down). New tags will not be distributed until the BPA-purchased inventory has been exhausted.

   Sean indicated that DA might find quarterly orders acceptable. However, he mentioned that we had done this before, but the current process has settled on two to three times per year. He reiterated the importance of monitoring the forecast for the entire year.

8. The group agreed that it would be good to begin the PIT Tag Forecasting process in July. The same general format will be used as in the past, with the addition of requesting minimum and maximum number of tags required. Forecasts will be mailed to FWP sponsors by July 12, then due back to PSMFC staff by August 9. The forecasts will be compiled into a draft of the "Master Tag Forecast" by August 16. The draft can be adjusted based upon CBFWA, NWPCC and BPA input. The resulting Forecast would be ready for the approval by CBFWA, NWPCC, and BPA. Jamie informed the group that John Rowan (BPA) has to make the decision on whether to move in this direction and she would find out within the next week or two.

   BPA suggested that Project Sponsors be required to provide PSMFC an update whenever a funding decision (or an indication that funding is likely to be denied or approved). Additionally, any action that substantially affects the project's forecast should be relayed to PSMFC as soon as it is known

9. BPA will decide whether or not to modify the DA master contract to purchase tags direct from DA or to continue to utilize PSMFC's TDI process. Carter pointed out that changing the purchase point would imply changes in other parts of the procurement, payment, and inventory / delivery process. These procedural changes should be planned well in advance of any change, so that the new system interfaces could be developed. Jamie agreed that if BPA decided to change the process, BPA would commemorate the decision in writing and describe the mechanism to be used to communicate purchases and receipt of tags. Carter reiterated that any change in the status quo should be well planned out in order not to break the existing TDI infrastructure.

10. Carter suggested that other than changing the forecast letter to request expected, minimum and maximum tags, no additional changes be made in the existing forecast, purchasing, or distribution process. The key is to change the "Approval" process.

Minutes submitted by Carter Stein, PSMFC
May 26, 2004

BPA's June 29th Comments incorporated July 6

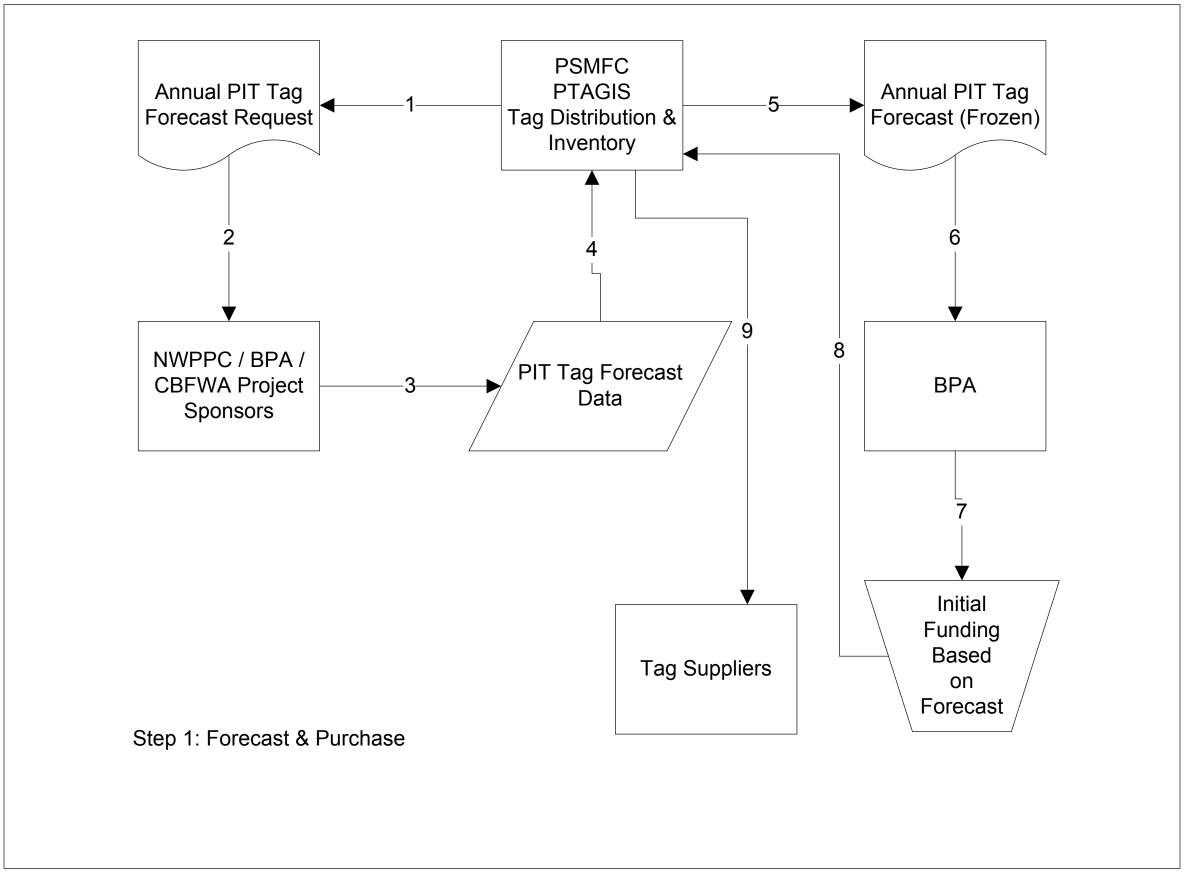
crb

PTAGIS Tag Distribution and Inventory

TDI_Process.vsd	6/26/03	Y:\doc\Misc_Stuff\Visio_Models\TDI\

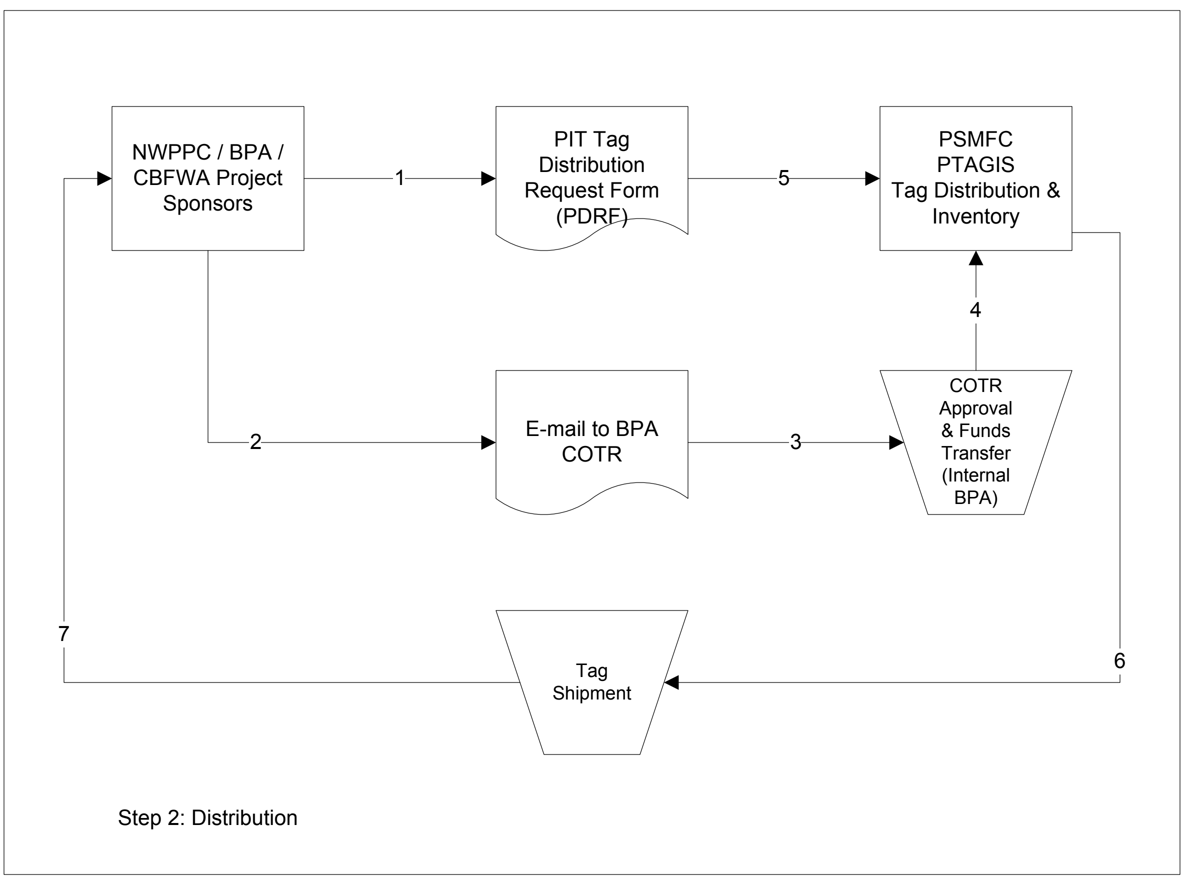
Step 1: Forecast & Purchase

1. 11/1/03: PSMFC Prepares Annual PIT Tag Forecast Request.
2. 11/4/03: Forecast Request is sent to Project Sponsors.
3. 11/4-14/03: Project Sponsors provide quarterly PIT tag forecast on forecast form.
4. 11/14/03: Project Sponsors submit quarterly PIT tag forecast to PSMFC.
5. 11/15-20/03: PSMFC prepares aggregate forecast.
6. 11/20/03: Aggregate forecast is transmitted to BPA
7. 11/20/03: BPA prepares funding for all or part of aggregated forecast.
8. 12/1/03: BPA transmits funding approval for tag purchases.
9. 12/1/03: PSMFC purchases tags.

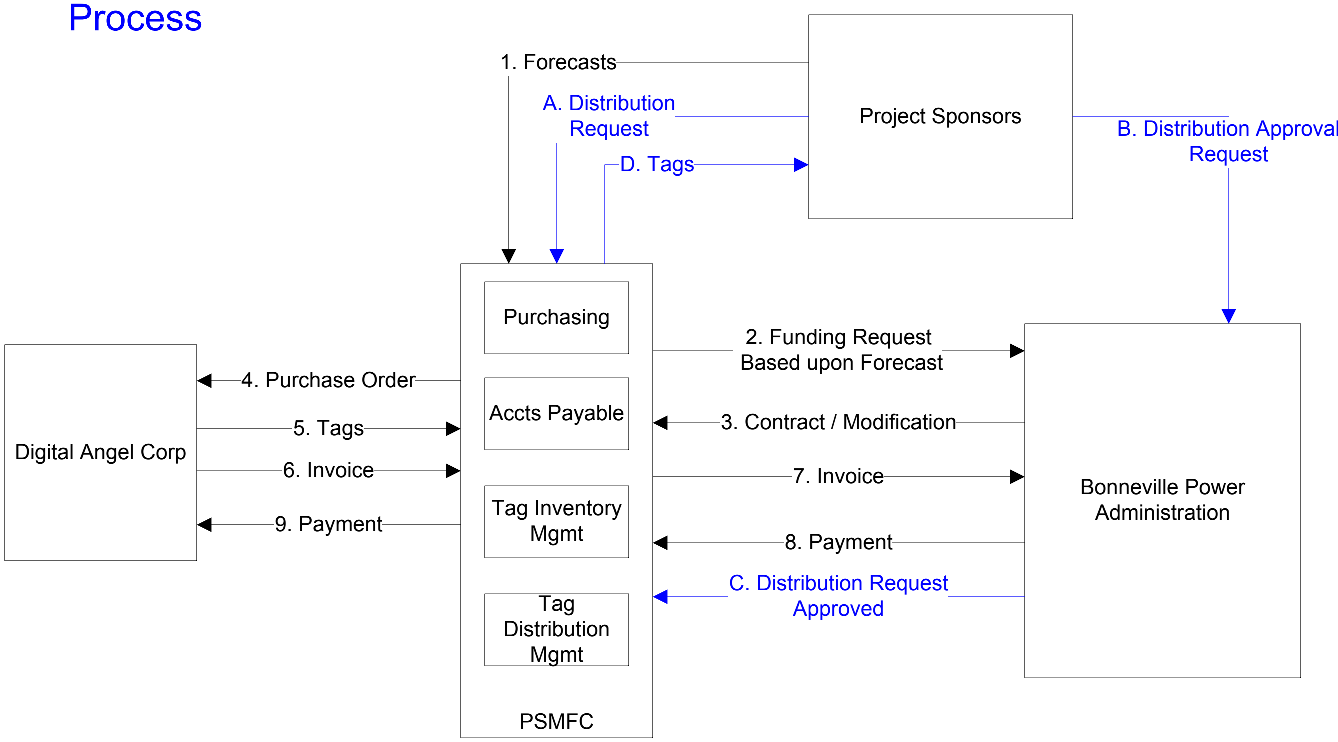


Step 2: Distribution

1. 30 days before tags required: Project Sponsor, or authorized agent, submits online PDRF form.
2. 30 days before tags required: Project Sponsor informs BPA of distribution request and PDRF number.
3. 25 days before tags required: BPA COTR initiates BPA Internal process to transfer project funds to appropriate accounts.
4. 20 days before tags required: BPA COTR notifies **pit_tdi@psmfc.org** that funds are available.
5. 15 days before tags required: PSMFC Processes PDRF.
6. 5 days before tags required: PSMFC schedules tags for shipment.
7. Tags are shipped .

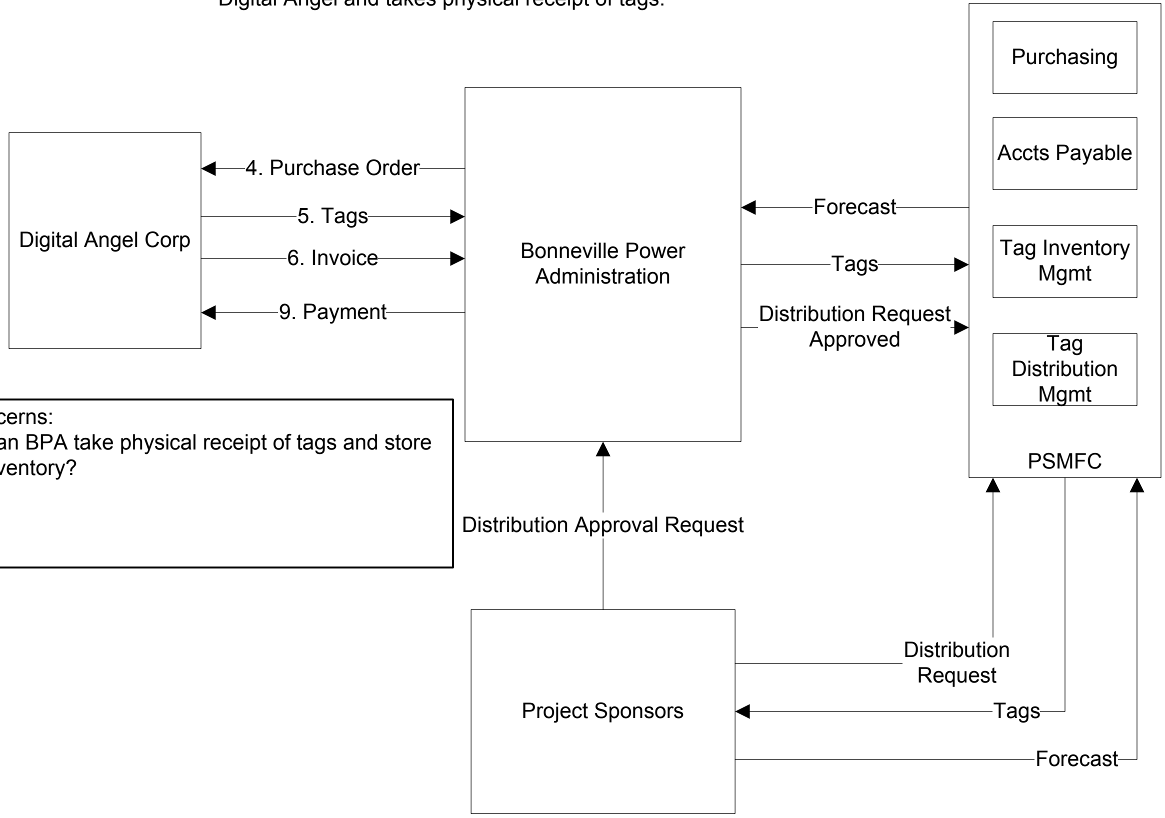


Existing Process



Alternative 1

1. Same process as existing process, except that BPA Orders tags directly from Digital Angel and takes physical receipt of tags.

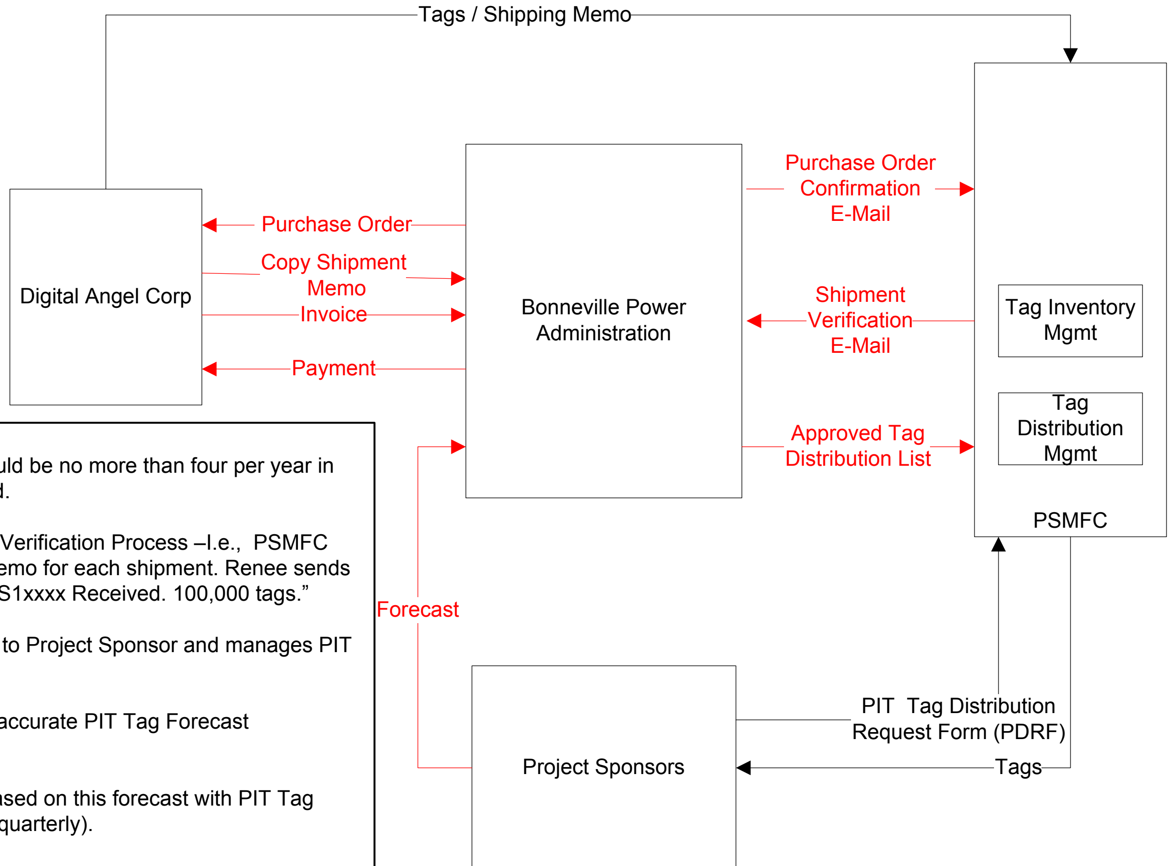


Concerns:
1. Can BPA take physical receipt of tags and store in inventory?

Alternative 2

Features:

1. BPA Purchases tags directly from Digital Angel – Tags shipped directly to PSMFC.
2. BPA generates tag forecasts directly from Project Sponsors and COTRs
3. BPA prepares “Approved Tag List” and shares with PSMFC & PTSC



Concerns:

1. The number of Purchase Order should be no more than four per year in order to minimize transaction overhead.

2. Minimize requirements of Shipment Verification Process –I.e., PSMFC sends BPA confirmation of shipping memo for each shipment. Renee sends Jamie e-mail: “Digital Angel Shipment S1xxxx Received. 100,000 tags.”

3. BPA issues Tag Forecast Requests to Project Sponsor and manages PIT Tag Forecast and Purchase.

4. Project Sponsors provide BPA with accurate PIT Tag Forecast requirements.

5. BPA would coordinate purchases based on this forecast with PIT Tag Steering Committee periodically (e.g., quarterly).

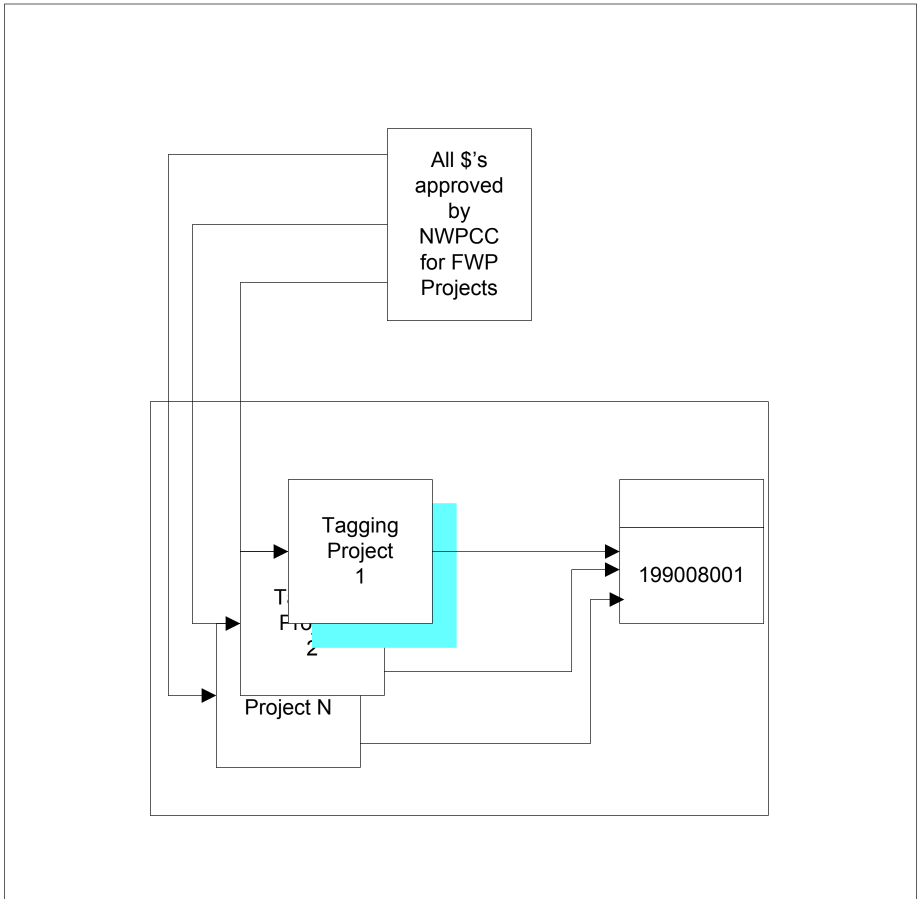
6. Fish and Wildlife Program Projects will loose flexibility to tag fish during periods when contracting issues delay signed agreements.

7. Is it in the scope of the Department of Energy to manage the purchase and distribution of PIT tags.

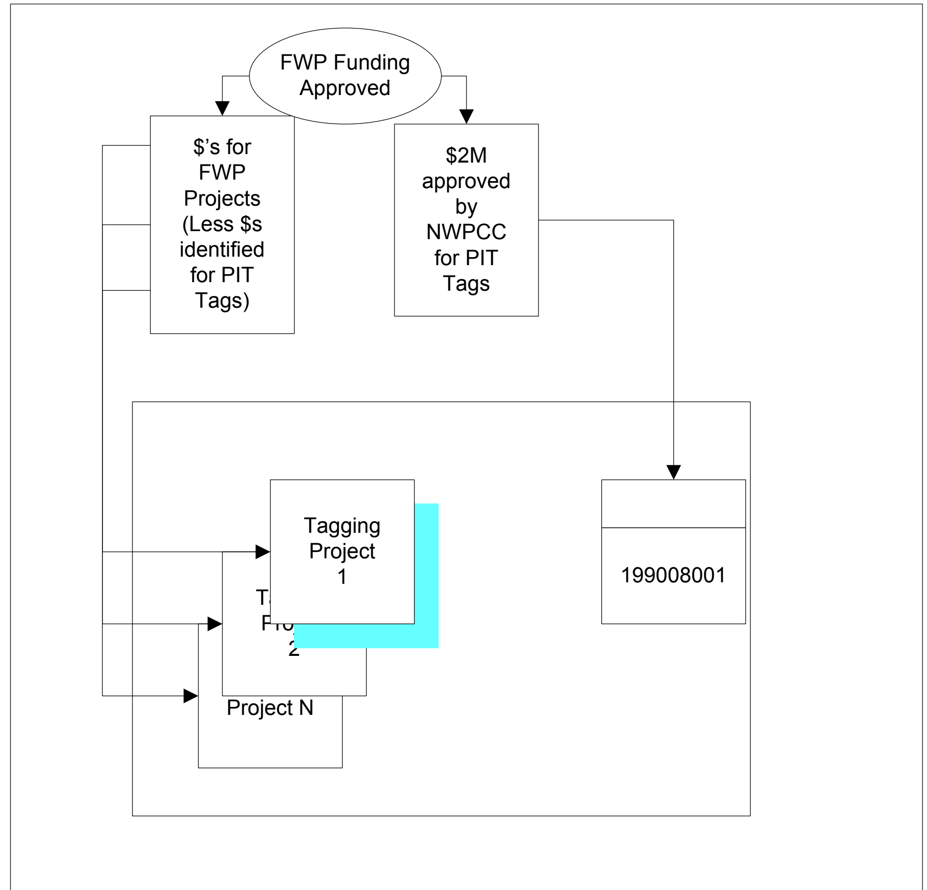
8. Can the problem of funding 199008001 from various FWP projects be solved at a fiscal policy level rather than though existing process mechanisms?

9. The “Approved Tag Distribution List” should be complete by the beginning of the fiscal year. If not, then PDRF should be sent to BPA for Approval.

BPA Internal Process



Existing?



Better?

1. Requires $'s to be transferred from FWP Project # To "Tag Bank" (199008001).

2. Can not do only one time per year, because every FWP Project contract may not be executed (i.e., they have different performance periods).

1. Requires change to BPA's fiscal accounting?
2. How do we separate Tag costs from other project costs?
3. Need a policy that FWP Project that don't use PIT Tags that were budgeted, forfeit or transfer to back to "Tag Bank" for subsequent use by "Approved" projects. This is the current de-facto 'policy'.

Return-path: <SCasey@DigitalAngelCorp.com>
Received: from mn-mail.digitalangelcorp.com
(host-65-126-81-85.digitalangelcorp.com [65.126.81.85])
by ldapcluster.psmfc.org
(iPlanet Messaging Server 5.2 Patch 1 (built Aug 19 2002))
with ESMTP id <0I0L005RJ73V7Z@ldapcluster.psmfc.org> for carters@ims-ms-daemon
(ORCPT carters@psmfc.org); Fri, 09 Jul 2004 06:35:56 -0700 (PDT)
Received: by MN-MAIL with Internet Mail Service (5.5.2657.72)
id <NYB6A3ZA>; Fri, 09 Jul 2004 08:42:13 -0500
Content-return: allowed
Date: Fri, 09 Jul 2004 08:42:13 -0500
From: Sean Casey <SCasey@DigitalAngelCorp.com>
Subject: RE: Status of McNary Adult PIT WA Ladder?
To: Sean Casey <SCasey@DigitalAngelCorp.com>,
"'Fodrea, Kimberly - KEWR-4'" <kafodrea@bpa.gov>,
Zeke Mejia <ZMejia@DigitalAngelCorp.com>
Cc: "'Van Leuven, Kristi - TLP-4'" <kjvleuven@bpa.gov>,
"'carters@psmfc.org'" <carters@psmfc.org>
Message-id: <E2FEB5CAE401A14B95D6EE3F9D6BAADC234431@MN-MAIL>
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Zeke please provide a production schedule. I think we were at about 650,000 by the end of Sept., so this should fit well with fall marking. Please correct me if this is not correct.
I have contacted Carter in the past to get forecasts. I believe Jamie is the contact at the BPA if the procurement system changes.

Sean

-----Original Message-----
From: Sean Casey
Sent: Friday, July 09, 2004 8:16 AM
To: Sean Casey; 'Fodrea, Kimberly - KEWR-4'; Zeke Mejia
Cc: 'Van Leuven, Kristi - TLP-4'; 'carters@psmfc.org'
Subject: RE: Status of McNary Adult PIT WA Ladder?

Hi All,

In a conversation with Zeke, Digital Angel will be providing the TX1400SGL only. This is in anticipation of a GO decision on the Hi-Q. The tag was announced in March. Zeke has 1 million pieces, so there should be no problem getting though the fall. Per our contract to provide all ISO PIT Tags to the BPA, this tag does qualify and therefore is contractually correct. Regardless of a Go-No Go, this is the tag that will be provided as we can not inventory two sets of tags. Please contact Zeke with any test data required. Obviously an amendment for the tag will have to proceed the first order.

Should you wish to use the TX1400ST, please contact Zeke as to the possibility of building/proving this tag and what the price will be.

As far as the tag procurement from Digital Angel, it is really late in the game to implement effectively. Since I will be out of town, please contact

Zeke. Zeke, please reference the meeting minutes from the BPA/ PSMFC meeting. Perhaps Carter can provide the latest minutes if there is discussion on this mater. Peter Lofy and Jamie Swan are the BPA rep.s for this activity.

I will be out on the river the next month, so contact Zeke regarding any of the above issues.

Take care,

Sean

Return-path: <SCasey@DigitalAngelCorp.com>
Received: from mn-mail.digitalangelcorp.com
(host-65-126-81-85.digitalangelcorp.com [65.126.81.85])
by ldapcluster.psmfc.org
(iPlanet Messaging Server 5.2 Patch 1 (built Aug 19 2002))
with ESMTP id <0I0200JRPNEVS5@ldapcluster.psmfc.org> for carters@ims-ms-daemon
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Date: Tue, 29 Jun 2004 08:19:49 -0500
From: Sean Casey <SCasey@DigitalAngelCorp.com>
Subject: FW: [Fwd: Conference call]
To: "Carter Stein (carters@psmfc.org)" <carters@psmfc.org>
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This message is in MIME format. Since your mail reader does not understand this format, some or all of this message may not be legible.

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Carter,

Here is the specification on the tag diameter. Folks will have to make sure that their needle I.D. exceeds this number.

Take care,

Sean

REF: Concern of glass vial diameter al sealing.

It has been agreed with Elcan that they will test the finished transponders to ensure that the specified max. outside diameter does not exceed 2.23 mm.

Zeke Mejia
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Return-path: <SCasey@DigitalAngelCorp.com>
Received: from mn-mail.digitalangelcorp.com
(host-65-126-81-85.digitalangelcorp.com [65.126.81.85])
by ldapcluster.psmfc.org
(iPlanet Messaging Server 5.2 Patch 1 (built Aug 19 2002))
with ESMTP id <0I0400LXZN5XMY@ldapcluster.psmfc.org>; Wed,
30 Jun 2004 08:03:36 -0700 (PDT)
Received: by MN-MAIL with Internet Mail Service (5.5.2657.72)
id <NYB6AGRM>; Wed, 30 Jun 2004 10:09:42 -0500
Content-return: allowed
Date: Wed, 30 Jun 2004 10:09:36 -0500
From: Sean Casey <SCasey@DigitalAngelCorp.com>
Subject: Software changes
To: "Anthony Carson (anthonyc@biomark.com)" <anthonyc@biomark.com>,
"Carter Stein (carters@psmfc.org)" <carters@psmfc.org>,
"Darren Chase (chase@psmfc.org)" <darren_chase@psmfc.org>,
"Dave Marvin (dave_marvin@psmfc.org)" <Dave.Marvin@ptagis.org>,
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"Earl Prentice (earl.prentice@noaa.gov)" <earl.prentice@noaa.gov>,
"John Tenney (john@psmfc.org)" <john_tenney@psmfc.org>,
"Kim Fodrea (kafodrea@bpa.gov)" <kafodrea@bpa.gov>,
"Sandy Downing (Sandy.Downing@noaa.gov)" <Sandy.Downing@noaa.gov>,
"Scott Livingston (scottl@psmfc.org)" <scott_livingston@psmfc.org>,
"Scott McCutcheon (scottmc@biomark.com)" <scottmc@biomark.com>
Cc: Zeke Mejia <ZMejia@DigitalAngelCorp.com>
Message-id: <E2FEB5CAE401A14B95D6EE3F9D6BAADC23440D@MN-MAIL>
MIME-version: 1.0
X-Mailer: Internet Mail Service (5.5.2657.72)
Content-type: multipart/alternative;
boundary="----_=_NextPart_001_01C45EB4.414B1882"

This message is in MIME format. Since your mail reader does not understand this format, some or all of this message may not be legible.

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Content-Type: text/plain

Hi All,

We have modified the software for the FS1001, FS1001A, FS2001-F, and FS2001-ISO readers. The reason for this is that the previous decode algorithm had an extra check for some of the unused bits based on a tag containing all zeros that was used in the very first competition for the juvenile reader and is not compatible with the compressed tags we will be using this year. This is not a valid condition. The change is 2 lines of code in the same location of the algorithm, used on all readers, that are not needed. There are no functionality or performance changes. This change was also made the the Multiplexer code which is yet to be released.

The TX1400SGL- Interim Glass Tag IS compatible with ISO readers, and the readers will still read all tags. It has been verified on the ISO pet readers and with the latest code change.

Per the software change procedure, we have sent all the code versions to PSMFC and Biomark for sign-off. The Hex software files maybe placed on PSMFC and Biomark web sites with the VbFlash program to assist users in the update.

Zeke will be sending samples to PSMFC and Biomark of the TX1400SGL tag for the software checkout. Carter and Dean, could you please send Zeke the address and contact person for the tag delivery?

FYI, The new TX1400SGL tag codes begin with 3D9.257xxxxxxx

Take care,

Sean

Directed By Pacific States Marine Fisheries Commission

Gen-2 Reader Prototype Field Testing
(Proposed Locations).

Version 1

09 July 2004

Prepared for: PIT-Tag Steering Committee

PTAGIS

PIT Tag Information Systems
Columbia Basin | ptagis.org

Prepared by: PTAGIS Project for PIT Tag Steering Committee

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1. INTRODUCTION

1.1 *Purpose of Document*

The purpose of this document is to define the most suitable location(s) to evaluate the Gen-2 prototype reader currently under development by Digital Angel Corp (DA).

1.2 *References*

1) Ref #1; Digital Angel Corp.
2) Ref #2; Pacific States Marine Fisheries Commission. PTAGIS

2. PROJECT SUMMARY

Below are 3 proposed locations that would exercise the Gen-2 reader's ability to adapt to different antenna sizes/geometry, cable lengths, and the readers ability to "Auto Tune" therefore exposing the reader to "Real World" conditions.

The schedule for these very preliminary field tests has not been determined. Per Digital Angel, they could be ready to perform these tests anywhere between July 19th and August 15th, 2004.

The duration of these tests are expected to last not more than about 3 day's per facility to complete and it is unknown as of now whether or not DA will take full advantage of the proposed test sites.

3. PREREQUISITS

Prior to any field testing of the Gen-2 reader at any of the below production interrogation sites, it will be required that the communications between DA's Gen-2 reader and the PTAGIS prototype data collection software be tested even though the preliminary field testing of the Gen-2 reader does not include communications and data collection.

4. FIELD TESTING LOCATIONS

4.1 *Test Location # 1. McNary Dam. (MCJ), Juvenile Fish Facility.*

Monitor Name: **Full Flow Bypass**. Coil I.D sequence for this monitor, 01,02,03,04

Advantages of choosing this location:

- The Full Flow Bypass pipe is 36 inches in diameter.
- The average antenna cable length is ~ 35 ft. (This an average length compared to other installations utilizing the FS-1001A reader).
- During the summer months, the temperature at this location can swing from ~ 40-102 degrees Fahrenheit or above. Good burn-in for the G-2 reader.
- High volumes of PIT-tagged juvenile fish and a low to moderate volume of adult fish.
- Flow rate thru system ~ 6-8 ft per/s
- Fish orientation passing thru the PIT-tag monitors should be at a relatively ideal for optimal detection. (Not sure about this).
- System is equipped with "Field Clamps" or "Concentrators" This practice of clamping the RF field has proven to be effective in improving the detection efficiency where fish grouping is an issue.
- Close proximity to the PTAGIS O@M office

- Detection efficiencies for the new reader would be easily determined due to the serial monitor configuration.
- Ability to perform “Stick Tag” due to flume accessibility.

4.2 *Test Location # 2. Prosser, Chandler Canal Facility, (PRJ).*

Monitor name: Sample room. Coil I.D sequence for this monitor, 51, and 52.

Advantages of choosing this location:

- The Sample Room monitor pipe is 4 “ pipe
- Antenna cable length is < 20 ft.
- Would test the reader’s ability to compensate for very small in diameter antennas with minimal spacing between the antenna and the shield box.
- Close proximity to the PTAGIS O@M office.
- Can perform “Stick Tag” tests due to flume accessibility.

4.3 *Test Location # 3. Bonneville Dam, (BO3) Wash. Shore Ladder.*

Ladder Location: Weir # 34. Coil I.D sequence for this weir 17, 18

Advantages of choosing this location:

- Transceivers in weir 34 have antenna cable lengths are in excess of 70 ft and are greater than or equal to any other antennas on the river system. Opportunity to test the G-2 reader on a 24”x24”orifice antenna.
- With the fall Chinook run coming in the late summer, the reader will be exposed to high volumes of PIT-tag fish transiting the ladder.
- Unable to perform “Stick Tag” tests. These antennas are submerged orifices.

I was unsuccessful in getting PIT tag budget information on FWP Project Proposals from CBFWA. Tom Iverson said that that information is best gotten from BPA.

Do either of you see any pitfalls in implementing "Alternative 2" discussed below?

Background:

Existing:

Procurement: In the existing process, PSMFC operates project 199008001 which is a tag purchase place holder. The attached PDF (PitExisting.PDF) shows that PSMFC collates tag forecasts and generates a budget request from BPA to procure tags for FWP PIT tagging projects, based upon that forecast. PSMFC purchases PIT tags from the vendor and records the tags in inventory using the Tag Distribution and Inventory System (TDI -- this is a system component of the PTAGIS project 199008000). PSMFC does not charge overhead on tag purchases.

Distribution: When FWP projects require tags, they submit at 3-part paper form to PTAGIS, and at the same time, send e-mail to BPA COTR's to approve that tag purchase. BPA sends approval for the FWP project sponsor tag requests to PSMFC. PSMFC then distributes the tags in TDI.

Proposed (see Alternative 2):

Procurement: BPA is proposing to eliminate PSMFC's role in tag procurement and to do that work in-house. See the attached PDF, PitAlternative2.pdf. The new process eliminates the need for FWP 199008001. Instead, BPA issues a PIT tag forecast request to Project Sponsors, and creates an "Approved Tag Distribution List" that will be transmitted, periodically, to PSMFC. This list will be used to purchase PIT tags from the vendor. However, the vendor would ship the tags to PSMFC and the PTAGIS project would record the tag shippments in the PTAGIS TDI inventory.

Distribution: Tag distribution would procede as in the existing process. Except, since BPA has pre-approved projects on the "Approved Tag Distribution List", there is no need for Project Sponsors to request approval for tag distribution.

In this system it is much easier for BPA to control PIT tag purchases and the usage of PIT tags by FWP projects.

Concerns:

1. As FWP programs are being cut, does BPA have staff resources to perform any additional work required?

2. Is BPA sufficiently involved in the PIT Tagging projects to assure that tags are available for marking projects?

3. How much additional effort is required to plan, implement and transition to a new proposed purchase and distribution model?

4. See notes in associated PDF files.

PIT-TAG ENHANCEMENT STUDY

Preliminary Report
(Sanitized Version)

BPA Project 1983-319-00
New marking and Monitoring Techniques for Fish

Prepared by The Digital Angel Corp.

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1. Introduction:

This is a preliminary report on the PIT-TAG ENHANCEMENT STUDY meant to provide information to help with the "GO, NO GO" decision for the PIT-TAG HIGH FLOW project.

2. Statement of Work Tasks status and findings:

1. The encapsulation: Different Bio-compatible plastics materials.

The encapsulation materials will play an important part of the study as an effective encapsulation technique will provide at the greatest space for the electronic module assembly which is the limiting factor in the enhancement.

A materials search was performed for United States Pharmacopoeia (USP) Class VI implantable material to identify different substances that might be suitable as encapsulation material, see append A. UPS Class VI material was selected to help insure fish bio-compatibly and acceptance in the Basin. This list was then narrowed to three candidates, Encapsulation Material -1 (EM-1), Encapsulation Material -2 (EM-2), and Encapsulation Material -3 (EM-3) based on requirements from the PIT-Tag Requirements Document, see appendix B.

Low volume encapsulation techniques were then developed for the three materials and approximately 350 Super 12 PIT-Tag assembles were encapsulated in each of the three materials for bio-compatibility testing in fish and for environmental testing.

In addition, glass vials that will fit in a 12 gage thin wall needle with an inside diameter more then 20% larger then the vials used for the current Super Tag have been developed. This will allow for a larger tag assembly with improved performance over the current Super 12 tag.

See appendix B, Preliminary PIT-TAG Encapsulation Material research report.

2. The Antenna Cores: Various alloys besides ferrite types.

For the antenna cores we typically use ferrite materials, but the investigation will also include different alloys with less Coercivity and greater permeability.

A Antenna Core Material search, based on frequency and permeability, was performed to identify the most promising commercially available antenna core material. Samples of the more promising materials were obtained for testing. See appendix C for a list of tested samples.

Unfortunately, samples of the same dimensions (size) were not readily available from the various venders for a direct performance comparison. However, a review of the data sheets for each vender's material was performed to initially rank the materials. The data sheet for Antenna Core Material -1 (ACM-1) indicated it was the most promising of the various materials. The next closest material was Antenna Core Material -2 (ACM -2). Again, material samples of the same dimensions could not be obtained for a head-to-head comparison of the materials. However, a smaller size sample of the ACM-1 out performed the ACM-2 in similarly wound tag virtually insuring it is the superior material.

The following "alloys" were investigated to determine there suitability as tag antenna cores.

1.- Antenna Core Material -3
2.- Antenna Core Material -4
3.- Antenna Core Material -5
4.- Antenna Core Material -6
5.- Antenna Core Material -7
6.- Antenna Core Material -8
7.- Antenna Core Material -9 (ACM-9)
8.- Antenna Core Material -10

While the proprieties of these materials looked promising, difficulties in forming ridged rods that could subsequently be wound as tag antennas made these materials impractical for all but one material.

The single rod of ACM-9 produced some promising results however; manufacturing problems have prevented testing to date.

3. The antenna wires and winding processes.

The antenna winding techniques also play an important part and this will be studied in close correlation with the antenna cores.

Given a fixed tag assembly size and core material there is an optimal antenna core size, wire gage, winding length & layers ratio for maximizing tag performance.

Initial tests were performed to determine how much influence these different variables have on tag performance. These tests will be used as a guide for producing performance curves for core size, wire gage and winding length & layers. These curves will then be used to determine the overall optimal combination of all variables for the different size options for both glass and composite encapsulated tags.

Variations in core material configurations were also tested to determine the viability of a novel antenna core material design.

In addition, tests of three currently available FDX-B silicon dies were performed to determine the best performing chip.

See appendix D for test results.

4. Sealing for the encapsulation with liquid compounds, Micro-flame, and laser.

The sealing of the PIT tag is also very important for the reliability. Different methods will be tested including the use of laser sealing especially for glass encapsulation.

The current sealing method is with an open flame. Laser sealing promises a more controlled process with less heat absorption by the tag assembly allowing for a larger tag assembly which will improve the tag performance.

Preliminary tests have been preformed with Laser sealing. See appendix F for a comparison between the current flame sealing and laser sealing.

To date no suitable liquid compound for sealing tags has been identified.

Note: Photographs comparing the flame sealed and laser sealed tags were not available as of the printing of this report.

5. **Performance tests with large antennas including optimization.**

The performance tests and optimization work will be done on large antennas of various sizes under conditions that represent the real field conditions.

All testing to date had been performed on three antennas of size 3'x12', 4'x5', and 6'x7'. Testing will be performed using the Full Scale High Flow antennas located in Minnesota at the Digital Angel facility as development of that system progresses.

6. **Reliability tests: Temperature, vibration, shock, pressure and leakage.**

The final best performing prototypes will undergo all qualifying tests of the present transponders which include extreme and medium temperature cycles, vibration in X, Y, and Z axis, shock and pressure.

Environmental tests will be performed when the first run of "plastic" encapsulated tags are available.

3. Conclusions:

Three commercially available USP class VI materials have been identified that are potential candidates for encapsulating PIT Tags. Through proper encapsulation techniques these materials should allow for a larger tag assembly over glass encapsulation and produce better performing tags.

Glass vials have been developed that will fit in a 12 gage thin wall needle that have an inside diameter more then 20% larger then the vials currently used for the Super 12 Tag. This will allow for a larger tag assembly and will improved performance over the current Super 12 tag.

Environmental tests will be performed on all tags as they become available.

The best commercially available Antenna Core Material has been determined to be ACM-1. One of the “alloy” materials investigated still holds some promise as a better performer.

Initial tests confirm there is an optimal antenna core size, wire gage, winding length & layers ratio for maximizing tag performance that requires further investigation. In addition, tests indicate that a novel antenna core material configuration only marginally reduced the performance of a tag making a performance enhancing novel tag configuration possible.

In initial tests with laser sealing proved to be a very controlled process which will reduce the heat transferred to the tag assembly and reduce the end cap tolerance allowing for a larger tag assembly which will improve tag performance.

4. Go Forward Plan:

1. Short Term:

The High Flow detection system to be located at Bonneville Dam will require an improved tag by the 2004 tagging season. However, the development of a tag encapsulated in a material other than glass and the promised performance improvements is at least two years out.

As an interim solution we are proposing the development of an improved glass encapsulated tag that would be available by August 2004 to improve the reading efficiency of the High Flow system. A new glass vial has been developed that fits in a standard 12 gage injection needle but allows for a tag assembly with a 20% larger diameter. Using a laser to seal the glass vial will allow for a longer tag assembly of approximately 0.5 mm. This increase in the tag assembly size in combination with an improved silicon die, Antenna Core material and optimized core size, wire gage, and winding length and layers ratio should result in a substantially improved tag over the current Super 12 tag. Existing production techniques would be employed to minimize the risk of meeting the schedule.

This schedule would require the tag optimization be completed by the end of the year to allow the production personnel enough time to workout the mass production process and equipment modifications necessary to meet the August 2004 schedule.

2. Long Term:

The development of a tag encapsulated in a material other than glass (composite tag) is at least two years out and acceptance in the Basin my take additional time. However, this tag configuration has the potential to greatly improve the performance of any size tag by maximizing the tag assembly size. In addition, further improvements in the glass encapsulated tag could be investigated that would be too risky for the short term solution.

Fish bio-compatibly tests will start on the three UPS Class VI candidate materials initially identified and will begin in November at the Abernathy Fish Hatchery located in Washington State.

For the remainder of 2003 most efforts will be focused on the short term improved glass tag to ensure tag availability for the 2004 tagging season. Once the development phase is complete the production group will take over and the development of the composite tag will continue.

Initially, rigorous environmental testing will be conducted on each of the composite materials to ensure the tags are durable enough to replace the current tag. Environmental testing will include temperature, pressure, shock and vibration, chemical exposure, and UV exposure.

The low volume encapsulation techniques developed for the fish tests are very labor intensive and are not suitable for mass production. The next phase of the development will be to investigate mass production techniques for the candidate materials that pass the environmental testing and develop cost effective mass production techniques.

Once cost effective mass production techniques have been worked out for the remaining candidate materials, producibilty, durability, and cost of the tag will be evaluated and the best over all tag selected.

Appendix A Tag Encapsulation Material Search

- **19 USP Class VI classified materials were identified as possible candidates for encapsulating tags.**

Appendix B Preliminary PIT-TAG Encapsulation Material research report

- **This report outlines the need and identifies many of the problems with encapsulating a PIT-TAG. The report goes on to outline an approach to solving this problem and makes preliminary recommendations for possible materials and concludes with a number of possible fabrication processes to be investigated. Much of this report is proprietary however, included in the report is the Next Generation PIT Tag Requirements Document which is not proprietary and is included in the following pages.**

Next Generation PIT Tag
Requirements Document

Prepared by DIGITAL ANGEL COPRORATION
490 Villaume Ave.
So. St. Paul, MN 55075
Ph. 800-328-0118   Fax 800-328-4565

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1. General PIT Tag Requirements:

Length	12.60mm Maximum	
Diameter	2.223mm Maximum, See Note 1	
Weight	0.1 gram in air, See Note 2	
Storage Temperature	-90° to 85° C	
Operational Temperature	-20° to 70°C	
Temperature Shock	TBD	
Pressure	4.37 to 2000 psia, See Note 3	
Vibration	Set to 90 for 30 Minuets, See Note 4	
Shock	40g/11mS, 3 Shocks, See Note 5	
Bump	60g/11mS 100 shocks/axis See Note 5	
Life	7	years for Salmon
	20	years for pets
	100	years for humans

Note 1: Must pass through a thin wall 12 gage injection needle.
Note 2: Lighter is better but, must be negatively buoyant in freshwater.
Note 3: 4.37 psia is the pressure at 30,000 ft.
Note 4: Setting for FMC Syntron J-1, 60Hz, 50 watt vibration table.
Note 5: Shock and Bump tests in accordance with IEC 60068-2-27:87 along the axis perpendicular to the longitudinal axis of the tag.

2. Plastic Encapsulation Requirements

a. Fluid Permeability

The encapsulating material must keep the tag assembly from becoming contaminated by the surrounding fluids for the life of the tag. The following are pressure extremes and tag implant locations for Fish, Pets, and Humans:

Fish
- 10.1 to 2000 psia (10,000ft to 4500ft underwater)
- Peritoneal (organ) cavity

Pets
- 8.3 to 17.5 psia (15,000ft to 6ft underwater)
- Subcutaneous tissue around the neck

Humans
- 4.4 to 104 psia (30,000ft to 200ft underwater)
- TBD

b. Compatibility with Tag Assembly

The encapsulation material must not aversely react with the various components that makeup the tag assembly, principally the silicon die, ferrite material, wire coil antenna, and various glues.

See section *4. Tag Assemble* for details

c. Durability

The encapsulation material must be durable enough to survive routine shipping, handling (TBD), and injection through a 12 gage injection needle via a metal plunger.

Additional General Guidelines:

Must survive a 3ft fall onto concrete, any axis
Must survive bulk packaging and air and ground transportation
Must survive bulk vibration test, see General Tag Requirements
Note: Bulk packaging is 10,000 lose tags per bag

d. Hardness/Flexural Strength

The encapsulation material must be hard and strong enough to prevent almost all flexing of the tag assembly in any direction under normal use (TBD) as this could permanently damage the tag assembly. It is likely the ferrite material will be brittle and easily cracked.

Pass/Fail Criteria TBD

e. Coefficient of Thermal Expansion

The coefficient of thermal expansion must be similar to that of the components of the tag assembly (TBD) such that no damage to the tag assembly, material separation, or cracking of the encapsulation material occurs when the tag is subjected to temperature and pressure extremes.

f. Biocompatibility

Must be suitable for animal and human implantation
Preferably USP Class VI Compliant

g. UV Tolerance

Must be able to withstand exposure to direct sunlight for 60 days

h. Chemical Environment Tolerance

The encapsulation material must be able to withstand prolonged exposure to the following environments:

Fish	Peritoneal (organ) Cavity Serum, see Note 1
Pets	Subcutaneous Tissue in Cats and Dogs (TBD)
Humans	Subcutaneous Implant (TBD)
Fresh and Salt (sea) water	

Note 1: Fish peritoneal cavity serum is expected to be very similar to mammalian serum with no large proteins and a PH value between 6.5 and 8.5.

The encapsulation material must be able to withstand limited exposure to the following environments:

EtO (Ethylene Oxide) Gas Sterilization, see Appendix C
Alcohol Sterilization
Clove Oil (Eugenol, 4-allyl-2-methoxy-phenol) anesthetic
MS222 (3-aminobenzoic acid ethyl ester) anesthetic
Avian digestive track, see Note 2

Note 2: Tagged fish will be eaten by various bird species. The tag must survive being passing through a bird's digestive track and subsequently expelled and covered by guano for an extended period of time.

i. Sterilization Compatibility

The encapsulation material must be able to withstand the following sterilization processes:

EtO (Ethylene Oxide) Gas Sterilization, see Appendix C
Alcohol Sterilization

j. Maximum Thickness

Preferably not more than 0.2 mm

3. Glass Encapsulation Requirements

a. Dimensions

Outside Diameter	2.20 +/-0.01mm
Inside Diameter	1.85 +/-0.03mm
Sealed End Thickness	0.65 +/-0.05mm

b. Sealing Compatibility

The glass must be compatible with a sealing process that does not adversely affect the tag assembly or assembly glue. Most notably would be the heat transferred to the assembly and glue.

Laser or Gas Flame

c. Biocompatibility

Glass must be suitable for animal and human implantation
Preferably USP Class VI Compliant

d. Durability

The glass must be durable enough to survive routine shipping, handling (TBD), and injection through a 12 gage injection needle via a metal plunger.

Additional General Guidelines:

Must survive a 3ft fall onto concrete, any axis

Must survive bulk packaging and air and ground transportation
Must survive bulk vibration test, see General Tag Requirements
Note: Bulk packaging is 10,000 lose tags per bag

e. Strength

The glass must be hard and strong enough to withstand breaking under normal use (TBD).

Pass/Fail Criteria TBD

f. Tag Assembly Glue

The glue is necessary to hold the tag assembly in place within the glass capsule and to provide longitudinal support for the assembly itself. The glue must not adversely react with any of the assembly components or produce excessive gas once the tag is sealed.

Type	TBD
Viscosity	TBD
Min. Fill Percentage	70% Coverage of Assembly
Elasticity	TBD
Max. Curing Time	TBD

4. Tag Assembly

a. Complete Assembly

Maximum Size

Plastic Encapsulation	Length	12.10mm
Diameter		1.80mm
Glass Encapsulation	Length	10.90mm
	Diameter	1.72mm

Note: See Appendix A

b. Antenna Core

Material	Iron (Fe_2O_3), Nickel (NiO), Zinc (ZnO) based ferrite
Metallized Pads	Silver (Ag)

Size and Tolerances

Plastic Encapsulation	Length	TBD
	Diameter	TBD
Glass Encapsulation	Length	TBD
	Diameter	TBD

Magnetic Properties of Material at 134.2 kHz

Initial Permeability	(μ_i)	2500 - 4500

Flux Density	(B)	≈5000 gauss
Residual Flux Density	(B_r)	1000-1300 gauss
Coercive Force	(H_c)	≈4 A/m
Loss Factor	($\tan \delta/\mu_i$)	3-4
Temperature Coefficient of μ_i		0.5-1.0 %/°C
Curie Temperature	(T_c)	200° C
Resistivity	(ρ)	200 - 300 Ω cm
Power Loss Density	(P)	100-120 mW/cm^3 @ 134.2 kHz–1000G-100° C

Metallization for Direct Die and Wire Bonding Required

c. Wire

Min. Sustainable Temperature (Insulation) UL Class F Insulation		155°C
Gage and Tolerances		TBD
Min. Tensile Strength		TBD
Chemical Compatibility	Solubility per	NEMA MW1000, 3.51.1.1
Solderability		NEMA MW1000, 3.13.1.1
Mechanical Values		NEMA MW1000, 3.4.1.1
Insulation Material		Modified Polyurethane
Bonding Glue		Polyvinylbutyral

Note: See Appendix B for additional details

d. Silicon Die

Dimensions	1500 x 1100 x 21 μm

e. Die Bonding Glue

The die bonding glue must not adversely react with the tag assembly and must be compatible with the assembly glue and/or the plastic encapsulating material.

Glue	Loctite 3446 epoxy

Note: See appendix D for specification

Appendix C Antenna Core Material Sample List and datasheets

- **5 Antenna Core Materials from 4 different vendors were identified as suitable candidates.**

- **Of the 5 materials one stood out as the best overall candidate based on the material datasheets and testing.**

Appendix D

Ferrite and Silicon Die Tests

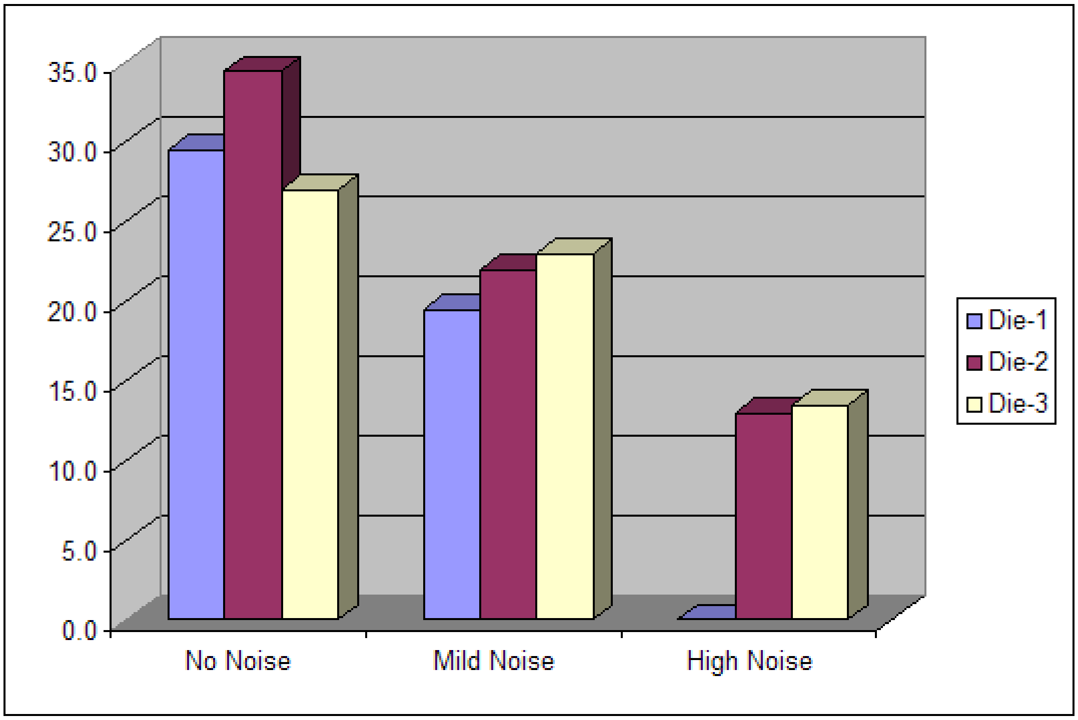
Die Comparison Tests
Length and Diameter Ratio Tests
Wire Gage Test
Tag Assembly Test
Novel Antenna Core Material Configuration Test

Die Comparison Tests **(6' x 7' Antenna, very sensitive system)**

This test compares three currently available FDX-B dies for both turn on sensitivity and noise immunity.

Read Range in inches with Matched L (.8 x 8 Antenna Core Material -1)

Raw Data	No Noise	Mild Noise	High Noise
Die-1	29.5	19.5	0.0
Die-2	34.5	22.0	13.0
Die-3	27.0	23.0	13.5



Results: Die-2 and Die-3 performed similarly but had different strengths. Die-3 performed best in "noisy" environments due to its high signal modulation but, did poorly in a low noise environment because it requires a high H field density in order to turn. Die-2 did well in the noisy environments and was best in low noise environments.

Conclusion: Die-2 and Die-3 perform similarly in a noisy environment but Die-2 performs much better in a low noise environment.

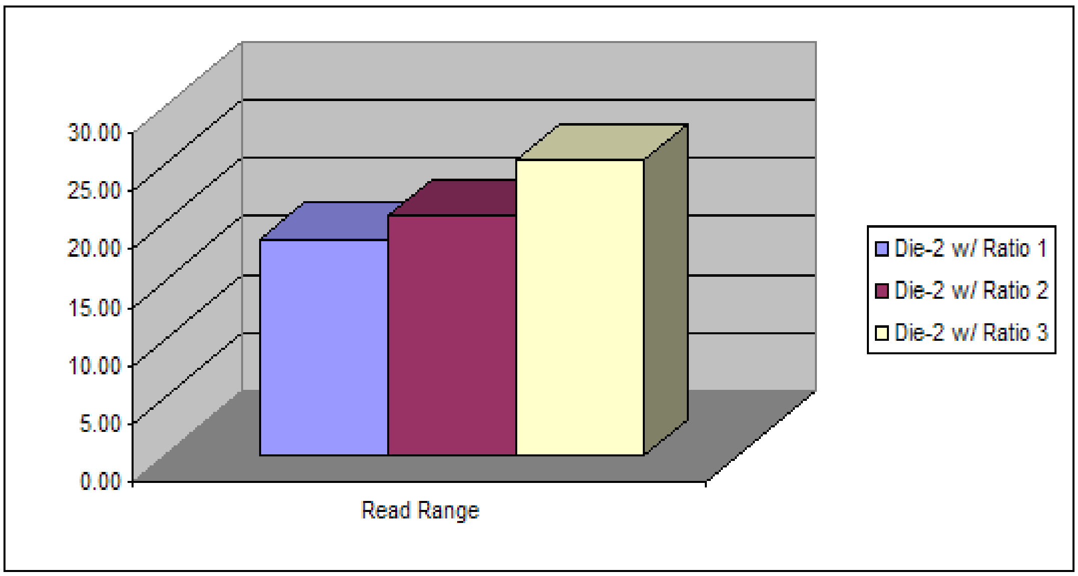
Length and Diameter Ratio Tests

The volume of Antenna Core Material in a tag has a direct effect on the performance of the tag. However, permeability of an antenna core is affected by the length to diameter ratio which has a direct effect on performance. The permeability increases as the length to diameter ratio increases and so should the performance of the tag. This test quantifies the effect of small changes in ferrite volume and the length to diameter ratio on read range.

This test was performed on a 3'x12' slot antenna.

Length:Diameter Ratio Tests

Raw Data	Read Range
Die-2 w/ Ratio 1	18.50
Die-2 w/ Ratio 2	20.50
Die-2 w/ Ratio 3	25.25



Note: The length of the Antenna Core Material is directly proportionally to it volume since the diameter for each sample is the same.

Conclusion: Small variations in the length:diameter ratio of the antenna core have only minor effects on read range with respect to the antenna core volume.

Wire Gage Test

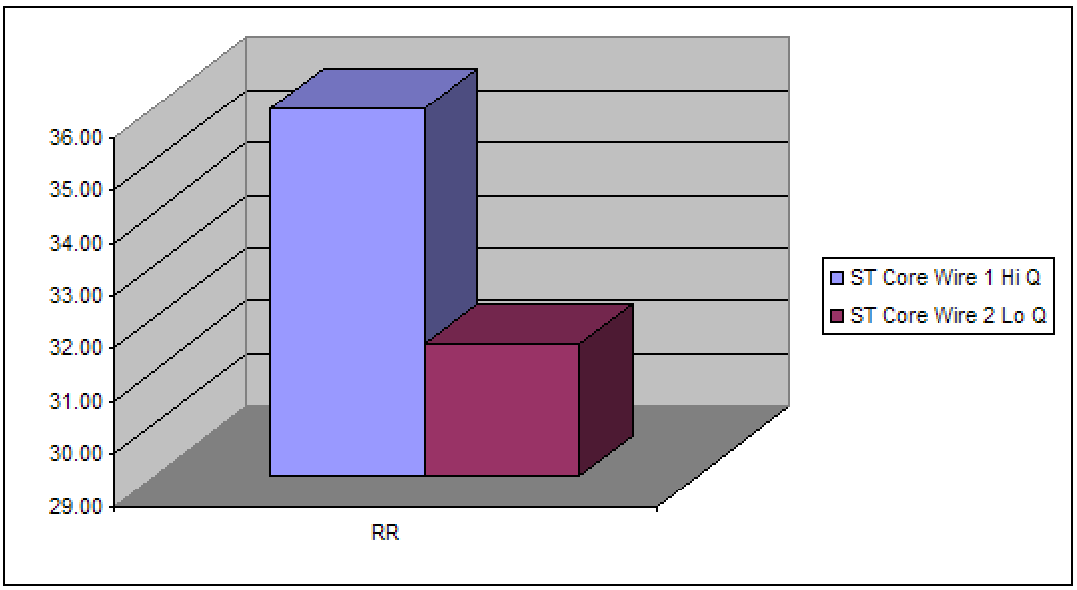
The gage of the wire used to wrap an inductor as has a direct effect on the Q and therefore the read range of a tag. This test quantifies the effect on read range of two different wire diameters on a common Antenna Core.

This test was performed on the 6'x7' foot antenna.

Antenna Wire Gage Test

* Both tags ST Core material
* All tests with the same die
* Q's & L's measured with in house SRS at 100kHz

Raw Data	RR
ST Core Wire 1 Hi Q	36.00
ST Core Wire 2 Lo Q	31.50



Conclusion: As predicted, the wire gage has a measurable effect on the performance of a tag.

Tag Assembly Test

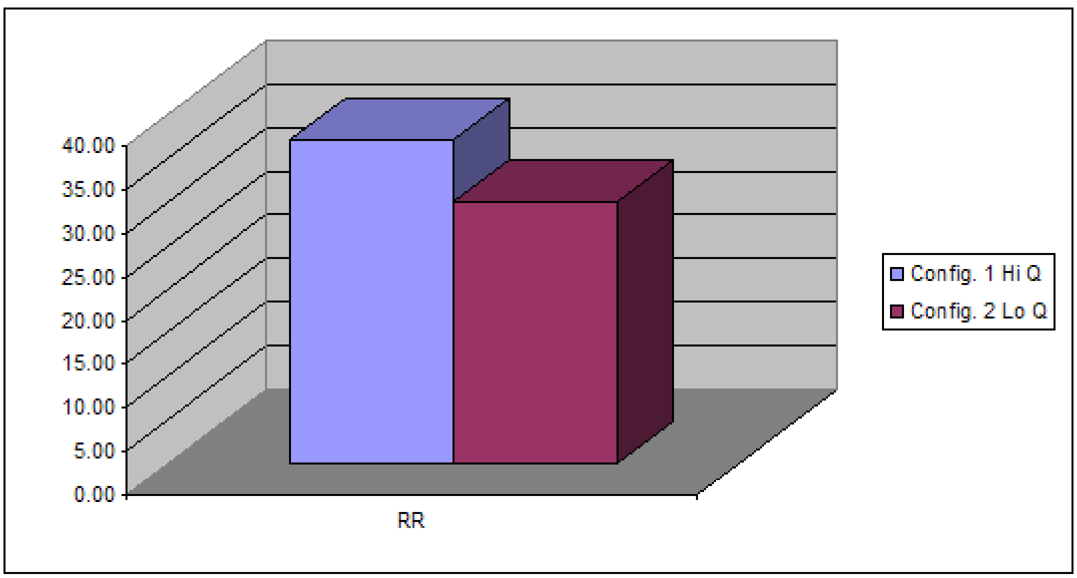
This test compares two tag assembles that will fit in a 12 x 2.2 mm glass tag vial that have different gage wire and antenna core sizes.

Tag Assembly Test

Antenna Core Size VS Wire Gage

* Both tags ACM-1
* All tests with the same die
* Q's & L's measured with in house SRS at 100kHz

Raw Data	RR
Config. 1 Hi Q	37.00
Config. 2 Lo Q	30.00

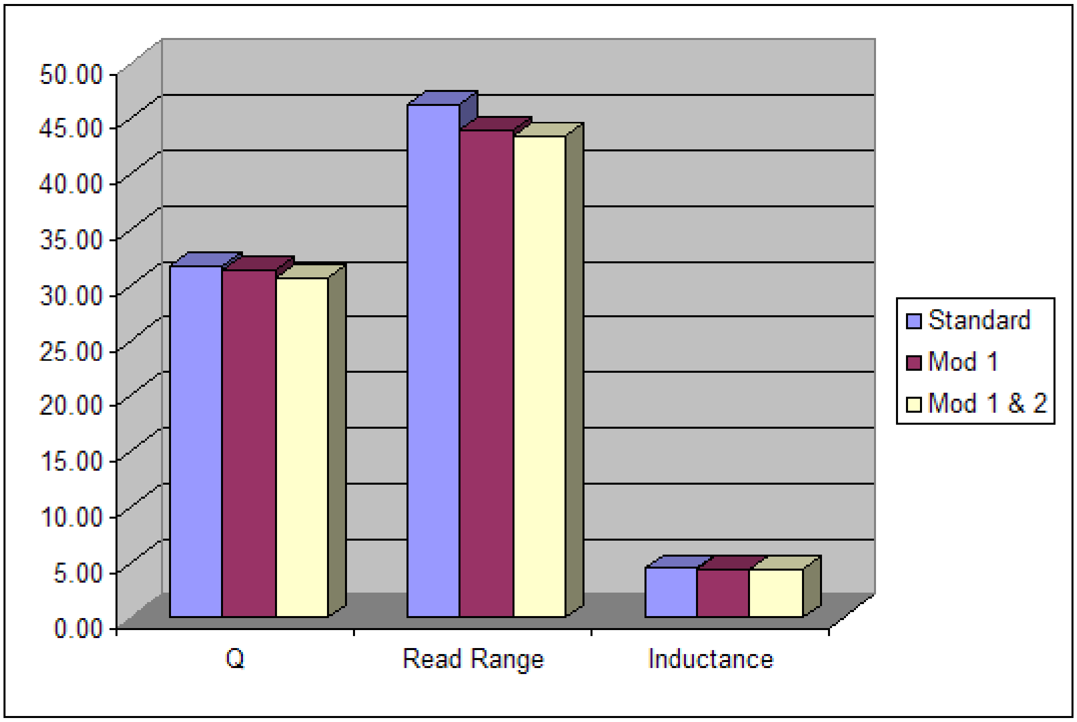


Conclusion: There is an optimum balance between antenna core size and wire gage.

Novel Antenna Core Material Configuration Test

Novel Antenna Core Material Configuration

Tag/Ferrite	Q	Read Range	Inductance
Standard	31.70	46.25	4.50
Mod 1	31.40	44.00	4.35
Mod 1 & 2	30.60	43.50	4.43



Conclusion: This novel configuration of an antenna core should produce a high performing tag.

Winding Length and Number of Layer Test

Test results are not available at this time.

Appendix F Laser Seal and Flame Sealing Comparison

The photograph comparing laser sealed and flame sealed tags was not available as of the printing of this report.

PIT-TAG ENHANCEMENT STUDY

Preliminary Report
(Sanitized Version)

BPA Project 1983-319-00
New marking and Monitoring Techniques for Fish

Prepared by The Digital Angel Corp.

490 Villaume Ave.
So. St. Paul, MN 55075

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1. Introduction:

This is a preliminary report on the PIT-TAG ENHANCEMENT STUDY meant to provide information to help with the "GO, NO GO" decision for the PIT-TAG HIGH FLOW project.

2. Statement of Work Tasks status and findings:

1. The encapsulation: Different Bio-compatible plastics materials.

The encapsulation materials will play an important part of the study as an effective encapsulation technique will provide at the greatest space for the electronic module assembly which is the limiting factor in the enhancement.

A materials search was performed for United States Pharmacopoeia (USP) Class VI implantable material to identify different substances that might be suitable as encapsulation material, see append A. UPS Class VI material was selected to help insure fish bio-compatibly and acceptance in the Basin. This list was then narrowed to three candidates, Encapsulation Material -1 (EM-1), Encapsulation Material -2 (EM-2), and Encapsulation Material -3 (EM-3) based on requirements from the PIT-Tag Requirements Document, see appendix B.

Low volume encapsulation techniques were then developed for the three materials and approximately 350 Super 12 PIT-Tag assembles were encapsulated in each of the three materials for bio-compatibility testing in fish and for environmental testing.

In addition, glass vials that will fit in a 12 gage thin wall needle with an inside diameter more then 20% larger then the vials used for the current Super Tag have been developed. This will allow for a larger tag assembly with improved performance over the current Super 12 tag.

See appendix B, Preliminary PIT-TAG Encapsulation Material research report.

2. The Antenna Cores: Various alloys besides ferrite types.

For the antenna cores we typically use ferrite materials, but the investigation will also include different alloys with less Coercivity and greater permeability.

A Antenna Core Material search, based on frequency and permeability, was performed to identify the most promising commercially available antenna core material. Samples of the more promising materials were obtained for testing. See appendix C for a list of tested samples.

Unfortunately, samples of the same dimensions (size) were not readily available from the various venders for a direct performance comparison. However, a review of the data sheets for each vender's material was performed to initially rank the materials. The data sheet for Antenna Core Material -1 (ACM-1) indicated it was the most promising of the various materials. The next closest material was Antenna Core Material -2 (ACM -2). Again, material samples of the same dimensions could not be obtained for a head-to-head comparison of the materials. However, a smaller size sample of the ACM-1 out performed the ACM-2 in similarly wound tag virtually insuring it is the superior material.

The following "alloys" were investigated to determine there suitability as tag antenna cores.

1.- Antenna Core Material -3
2.- Antenna Core Material -4
3.- Antenna Core Material -5
4.- Antenna Core Material -6
5.- Antenna Core Material -7
6.- Antenna Core Material -8
7.- Antenna Core Material -9 (ACM-9)
8.- Antenna Core Material -10

While the proprieties of these materials looked promising, difficulties in forming ridged rods that could subsequently be wound as tag antennas made these materials impractical for all but one material.

The single rod of ACM-9 produced some promising results however; manufacturing problems have prevented testing to date.

3. The antenna wires and winding processes.

The antenna winding techniques also play an important part and this will be studied in close correlation with the antenna cores.

Given a fixed tag assembly size and core material there is an optimal antenna core size, wire gage, winding length & layers ratio for maximizing tag performance.

Initial tests were performed to determine how much influence these different variables have on tag performance. These tests will be used as a guide for producing performance curves for core size, wire gage and winding length & layers. These curves will then be used to determine the overall optimal combination of all variables for the different size options for both glass and composite encapsulated tags.

Variations in core material configurations were also tested to determine the viability of a novel antenna core material design.

In addition, tests of three currently available FDX-B silicon dies were performed to determine the best performing chip.

See appendix D for test results.

4. Sealing for the encapsulation with liquid compounds, Micro-flame, and laser.

The sealing of the PIT tag is also very important for the reliability. Different methods will be tested including the use of laser sealing especially for glass encapsulation.

The current sealing method is with an open flame. Laser sealing promises a more controlled process with less heat absorption by the tag assembly allowing for a larger tag assembly which will improve the tag performance.

Preliminary tests have been preformed with Laser sealing. See appendix F for a comparison between the current flame sealing and laser sealing.

To date no suitable liquid compound for sealing tags has been identified.

Note: Photographs comparing the flame sealed and laser sealed tags were not available as of the printing of this report.

5. Performance tests with large antennas including optimization.

The performance tests and optimization work will be done on large antennas of various sizes under conditions that represent the real field conditions.

All testing to date had been performed on three antennas of size 3'x12', 4'x5', and 6'x7'. Testing will be performed using the Full Scale High Flow antennas located in Minnesota at the Digital Angel facility as development of that system progresses.

6. Reliability tests: Temperature, vibration, shock, pressure and leakage.

The final best performing prototypes will undergo all qualifying tests of the present transponders which include extreme and medium temperature cycles, vibration in X, Y, and Z axis, shock and pressure.

Environmental tests will be performed when the first run of "plastic" encapsulated tags are available.

3. Conclusions:

Three commercially available USP class VI materials have been identified that are potential candidates for encapsulating PIT Tags. Through proper encapsulation techniques these materials should allow for a larger tag assembly over glass encapsulation and produce better performing tags.

Glass vials have been developed that will fit in a 12 gage thin wall needle that have an inside diameter more then 20% larger then the vials currently used for the Super 12 Tag. This will allow for a larger tag assembly and will improved performance over the current Super 12 tag.

Environmental tests will be performed on all tags as they become available.

The best commercially available Antenna Core Material has been determined to be ACM-1. One of the “alloy” materials investigated still holds some promise as a better performer.

Initial tests confirm there is an optimal antenna core size, wire gage, winding length & layers ratio for maximizing tag performance that requires further investigation. In addition, tests indicate that a novel antenna core material configuration only marginally reduced the performance of a tag making a performance enhancing novel tag configuration possible.

In initial tests with laser sealing proved to be a very controlled process which will reduce the heat transferred to the tag assembly and reduce the end cap tolerance allowing for a larger tag assembly which will improve tag performance.

4. Go Forward Plan:

1. Short Term:

The High Flow detection system to be located at Bonneville Dam will require an improved tag by the 2004 tagging season. However, the development of a tag encapsulated in a material other than glass and the promised performance improvements is at least two years out.

As an interim solution we are proposing the development of an improved glass encapsulated tag that would be available by August 2004 to improve the reading efficiency of the High Flow system. A new glass vial has been developed that fits in a standard 12 gage injection needle but allows for a tag assembly with a 20% larger diameter. Using a laser to seal the glass vial will allow for a longer tag assembly of approximately 0.5 mm. This increase in the tag assembly size in combination with an improved silicon die, Antenna Core material and optimized core size, wire gage, and winding length and layers ratio should result in a substantially improved tag over the current Super 12 tag. Existing production techniques would be employed to minimize the risk of meeting the schedule.

This schedule would require the tag optimization be completed by the end of the year to allow the production personnel enough time to workout the mass production process and equipment modifications necessary to meet the August 2004 schedule.

2. Long Term:

The development of a tag encapsulated in a material other than glass (composite tag) is at least two years out and acceptance in the Basin my take additional time. However, this tag configuration has the potential to greatly improve the performance of any size tag by maximizing the tag assembly size. In addition, further improvements in the glass encapsulated tag could be investigated that would be too risky for the short term solution.

Fish bio-compatibly tests will start on the three UPS Class VI candidate materials initially identified and will begin in November at the Abernathy Fish Hatchery located in Washington State.

For the remainder of 2003 most efforts will be focused on the short term improved glass tag to ensure tag availability for the 2004 tagging season. Once the development phase is complete the production group will take over and the development of the composite tag will continue.

Initially, rigorous environmental testing will be conducted on each of the composite materials to ensure the tags are durable enough to replace the current tag. Environmental testing will include temperature, pressure, shock and vibration, chemical exposure, and UV exposure.

The low volume encapsulation techniques developed for the fish tests are very labor intensive and are not suitable for mass production. The next phase of the development will be to investigate mass production techniques for the candidate materials that pass the environmental testing and develop cost effective mass production techniques.

Once cost effective mass production techniques have been worked out for the remaining candidate materials, producibilty, durability, and cost of the tag will be evaluated and the best over all tag selected.

Appendix A Tag Encapsulation Material Search

- **19 USP Class VI classified materials were identified as possible candidates for encapsulating tags.**

Appendix B Preliminary PIT-TAG Encapsulation Material research report

- **This report outlines the need and identifies many of the problems with encapsulating a PIT-TAG. The report goes on to outline an approach to solving this problem and makes preliminary recommendations for possible materials and concludes with a number of possible fabrication processes to be investigated. Much of this report is proprietary however, included in the report is the Next Generation PIT Tag Requirements Document which is not proprietary and is included in the following pages.**

Next Generation PIT Tag Requirements Document

Prepared by DIGITAL ANGEL COPRORATION
490 Villaume Ave.
So. St. Paul, MN 55075
Ph. 800-328-0118   Fax 800-328-4565

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    Bond Coat Specifications .... **Error! Bookmark not defined.**
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    EtO Sterilization Process Cycle Parameters .... **Error! Bookmark not defined.**
Appendix D .... **Error! Bookmark not defined.**
    Die Bonding Glue Specification .... **Error! Bookmark not defined.**

1. General PIT Tag Requirements:

Length	12.60mm Maximum
Diameter	2.223mm Maximum, See Note 1
Weight	0.1 gram in air, See Note 2
Storage Temperature	-90° to 85° C
Operational Temperature	-20° to 70°C
Temperature Shock	TBD
Pressure	4.37 to 2000 psia, See Note 3
Vibration	Set to 90 for 30 Minuets, See Note 4
Shock	40g/11mS, 3 Shocks, See Note 5
Bump	60g/11mS 100 shocks/axis See Note 5
Life	7 years for Salmon 20 years for pets 100 years for humans

Note 1: Must pass through a thin wall 12 gage injection needle.
Note 2: Lighter is better but, must be negatively buoyant in freshwater.
Note 3: 4.37 psia is the pressure at 30,000 ft.
Note 4: Setting for FMC Syntron J-1, 60Hz, 50 watt vibration table.
Note 5: Shock and Bump tests in accordance with IEC 60068-2-27:87 along the axis perpendicular to the longitudinal axis of the tag.

2. Plastic Encapsulation Requirements

a. Fluid Permeability

The encapsulating material must keep the tag assembly from becoming contaminated by the surrounding fluids for the life of the tag. The following are pressure extremes and tag implant locations for Fish, Pets, and Humans:

Fish
- 10.1 to 2000 psia (10,000ft to 4500ft underwater)
- Peritoneal (organ) cavity

Pets
- 8.3 to 17.5 psia (15,000ft to 6ft underwater)
- Subcutaneous tissue around the neck

Humans
- 4.4 to 104 psia (30,000ft to 200ft underwater)
- TBD

b. Compatibility with Tag Assembly

The encapsulation material must not aversely react with the various components that makeup the tag assembly, principally the silicon die, ferrite material, wire coil antenna, and various glues.

See section *4. Tag Assemble* for details

c. Durability

The encapsulation material must be durable enough to survive routine shipping, handling (TBD), and injection through a 12 gage injection needle via a metal plunger.

Additional General Guidelines:

Must survive a 3ft fall onto concrete, any axis
Must survive bulk packaging and air and ground transportation
Must survive bulk vibration test, see General Tag Requirements
Note: Bulk packaging is 10,000 lose tags per bag

d. Hardness/Flexural Strength

The encapsulation material must be hard and strong enough to prevent almost all flexing of the tag assembly in any direction under normal use (TBD) as this could permanently damage the tag assembly. It is likely the ferrite material will be brittle and easily cracked.

Pass/Fail Criteria	TBD

e. Coefficient of Thermal Expansion

The coefficient of thermal expansion must be similar to that of the components of the tag assembly (TBD) such that no damage to the tag assembly, material separation, or cracking of the encapsulation material occurs when the tag is subjected to temperature and pressure extremes.

f. Biocompatibility

Must be suitable for animal and human implantation
Preferably USP Class VI Compliant

g. UV Tolerance

Must be able to withstand exposure to direct sunlight for 60 days

h. Chemical Environment Tolerance

The encapsulation material must be able to withstand prolonged exposure to the following environments:

Fish	Peritoneal (organ) Cavity Serum, see Note 1
Pets	Subcutaneous Tissue in Cats and Dogs (TBD)
Humans	Subcutaneous Implant (TBD)
Fresh and Salt (sea) water	

Note 1: Fish peritoneal cavity serum is expected to be very similar to mammalian serum with no large proteins and a PH value between 6.5 and 8.5.

The encapsulation material must be able to withstand limited exposure to the following environments:

EtO (Ethylene Oxide) Gas Sterilization, see Appendix C
Alcohol Sterilization
Clove Oil (Eugenol, 4-allyl-2-methoxy-phenol) anesthetic
MS222 (3-aminobenzoic acid ethyl ester) anesthetic
Avian digestive track, see Note 2

Note 2: Tagged fish will be eaten by various bird species. The tag must survive being passing through a bird's digestive track and subsequently expelled and covered by guano for an extended period of time.

i. Sterilization Compatibility

The encapsulation material must be able to withstand the following sterilization processes:

EtO (Ethylene Oxide) Gas Sterilization, see Appendix C
Alcohol Sterilization

j. Maximum Thickness

Preferably not more than 0.2 mm

3. Glass Encapsulation Requirements

a. Dimensions

Outside Diameter	2.20 +/-0.01mm
Inside Diameter	1.85 +/-0.03mm
Sealed End Thickness	0.65 +/-0.05mm

b. Sealing Compatibility

The glass must be compatible with a sealing process that does not adversely affect the tag assembly or assembly glue. Most notably would be the heat transferred to the assembly and glue.

Laser or Gas Flame

c. Biocompatibility

Glass must be suitable for animal and human implantation
Preferably USP Class VI Compliant

d. Durability

The glass must be durable enough to survive routine shipping, handling (TBD), and injection through a 12 gage injection needle via a metal plunger.

Additional General Guidelines:

Must survive a 3ft fall onto concrete, any axis

Must survive bulk packaging and air and ground transportation
Must survive bulk vibration test, see General Tag Requirements
Note: Bulk packaging is 10,000 lose tags per bag

e. Strength

The glass must be hard and strong enough to withstand breaking under normal use (TBD).

Pass/Fail Criteria	TBD

f. Tag Assembly Glue

The glue is necessary to hold the tag assembly in place within the glass capsule and to provide longitudinal support for the assembly itself. The glue must not adversely react with any of the assembly components or produce excessive gas once the tag is sealed.

Type	TBD
Viscosity	TBD
Min. Fill Percentage	70% Coverage of Assembly
Elasticity	TBD
Max. Curing Time	TBD

4. Tag Assembly

a. Complete Assembly

Maximum Size

Plastic Encapsulation	Length	12.10mm
Diameter		1.80mm
Glass Encapsulation	Length	10.90mm
	Diameter	1.72mm

Note: See Appendix A

b. Antenna Core

Material	Iron (Fe_2O_3), Nickel (NiO), Zinc (ZnO) based ferrite
Metallized Pads	Silver (Ag)

Size and Tolerances

Plastic Encapsulation	Length	TBD
	Diameter	TBD
Glass Encapsulation	Length	TBD
	Diameter	TBD

Magnetic Properties of Material at 134.2 kHz

Initial Permeability	(μ_i)	2500 - 4500

Flux Density	(B)	≈5000 gauss
Residual Flux Density	(B_r)	1000-1300 gauss
Coercive Force	(H_c)	≈4 A/m
Loss Factor	($\tan \delta/\mu_i$)	3-4
Temperature Coefficient of μ_i		0.5-1.0 %/°C
Curie Temperature	(T_c)	200° C
Resistivity	(ρ)	200 - 300 Ω cm
Power Loss Density	(P)	100-120 mW/cm^3 @ 134.2 kHz–1000G-100° C

Metallization for Direct Die and Wire Bonding Required

c. Wire

Min. Sustainable Temperature (Insulation) UL Class F Insulation		155°C
Gage and Tolerances		TBD
Min. Tensile Strength		TBD
Chemical Compatibility	Solubility per	NEMA MW1000, 3.51.1.1
Solderability		NEMA MW1000, 3.13.1.1
Mechanical Values		NEMA MW1000, 3.4.1.1
Insulation Material		Modified Polyurethane
Bonding Glue		Polyvinylbutyral

Note: See Appendix B for additional details

d. Silicon Die

Dimensions	1500 x 1100 x 21 µm

e. Die Bonding Glue

The die bonding glue must not adversely react with the tag assembly and must be compatible with the assembly glue and/or the plastic encapsulating material.

Glue	Loctite 3446 epoxy

Note: See appendix D for specification

Appendix C Antenna Core Material Sample List and datasheets

- **5 Antenna Core Materials from 4 different vendors were identified as suitable candidates.**

- **Of the 5 materials one stood out as the best overall candidate based on the material datasheets and testing.**

Appendix D

Ferrite and Silicon Die Tests

Die Comparison Tests
Length and Diameter Ratio Tests
Wire Gage Test
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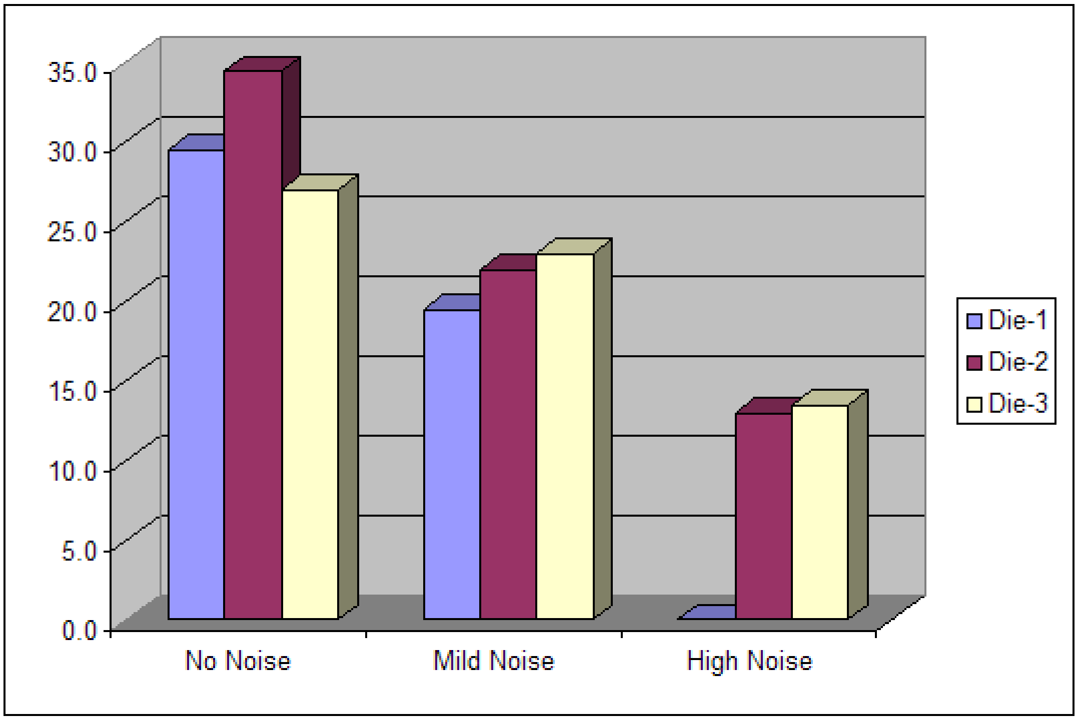
Novel Antenna Core Material Configuration Test

Die Comparison Tests (6' x 7' Antenna, very sensitive system)

This test compares three currently available FDX-B dies for both turn on sensitivity and noise immunity.

Read Range in inches with Matched L (.8 x 8 Antenna Core Material -1)

Raw Data	No Noise	Mild Noise	High Noise
Die-1	29.5	19.5	0.0
Die-2	34.5	22.0	13.0
Die-3	27.0	23.0	13.5



Results: Die-2 and Die-3 performed similarly but had different strengths. Die-3 performed best in "noisy" environments due to its high signal modulation but, did poorly in a low noise environment because it requires a high H field density in order to turn. Die-2 did well in the noisy environments and was best in low noise environments.

Conclusion: Die-2 and Die-3 perform similarly in a noisy environment but Die-2 performs much better in a low noise environment.

Length and Diameter Ratio Tests

The volume of Antenna Core Material in a tag has a direct effect on the performance of the tag. However, permeability of an antenna core is affected by the length to diameter ratio which has a direct effect on performance. The permeability increases as the length to diameter ratio increases and so should the performance of the tag. This test quantifies the effect of small changes in ferrite volume and the length to diameter ratio on read range.

This test was performed on a 3'x12' slot antenna.

Length:Diameter Ratio Tests

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Die-2 w/ Ratio 1	18.50
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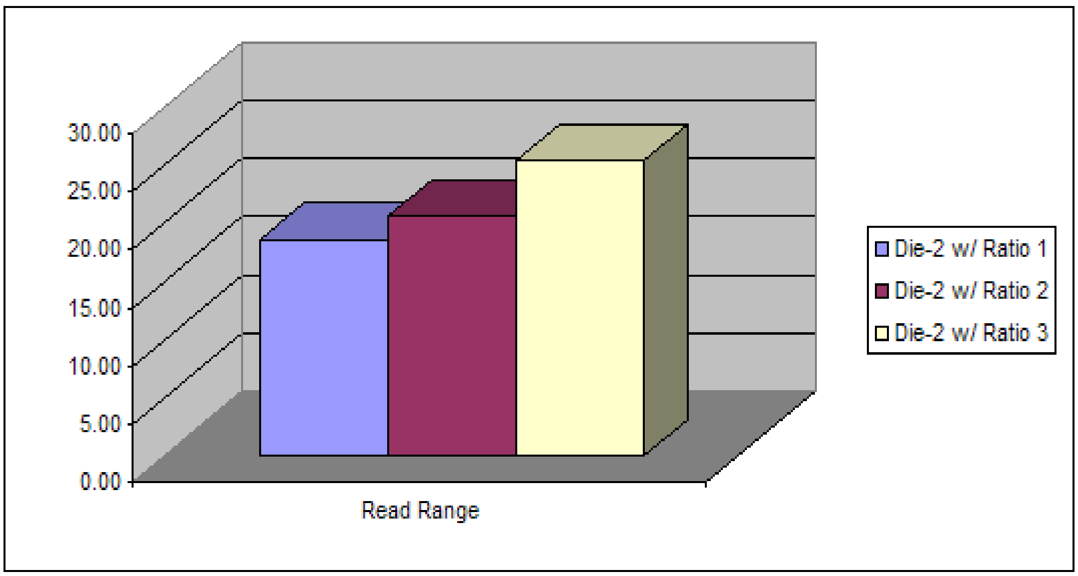


Note: The length of the Antenna Core Material is directly proportionally to it volume since the diameter for each sample is the same.

Conclusion: Small variations in the length:diameter ratio of the antenna core have only minor effects on read range with respect to the antenna core volume.

Wire Gage Test

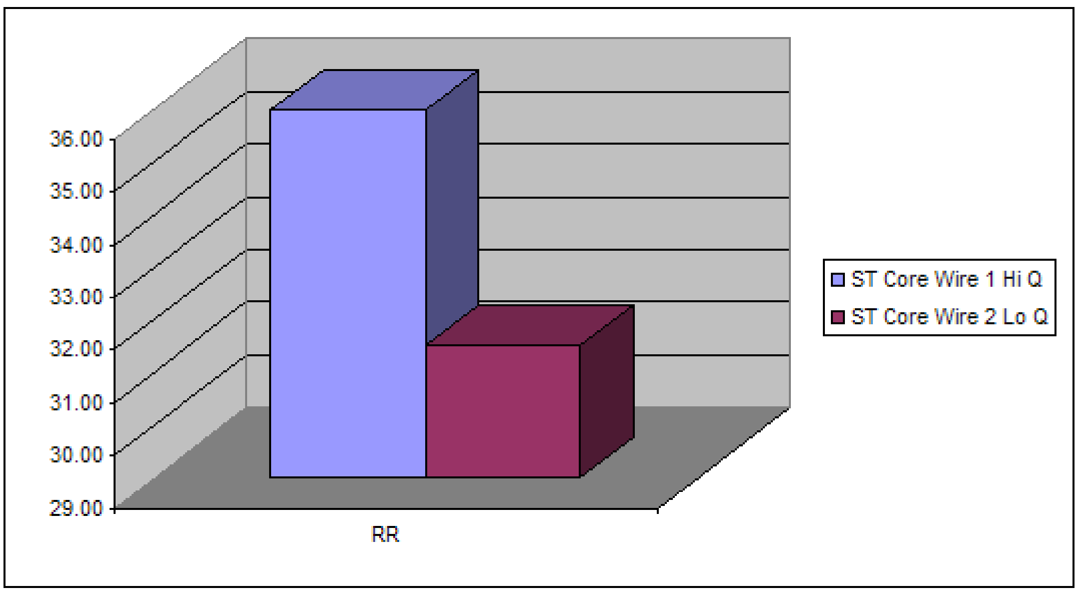
The gage of the wire used to wrap an inductor as has a direct effect on the Q and therefore the read range of a tag. This test quantifies the effect on read range of two different wire diameters on a common Antenna Core.

This test was performed on the 6'x7' foot antenna.

Antenna Wire Gage Test

* Both tags ST Core material
* All tests with the same die
* Q's & L's measured with in house SRS at 100kHz

Raw Data	RR
ST Core Wire 1 Hi Q	36.00
ST Core Wire 2 Lo Q	31.50



Conclusion: As predicted, the wire gage has a measurable effect on the performance of a tag.

Tag Assembly Test

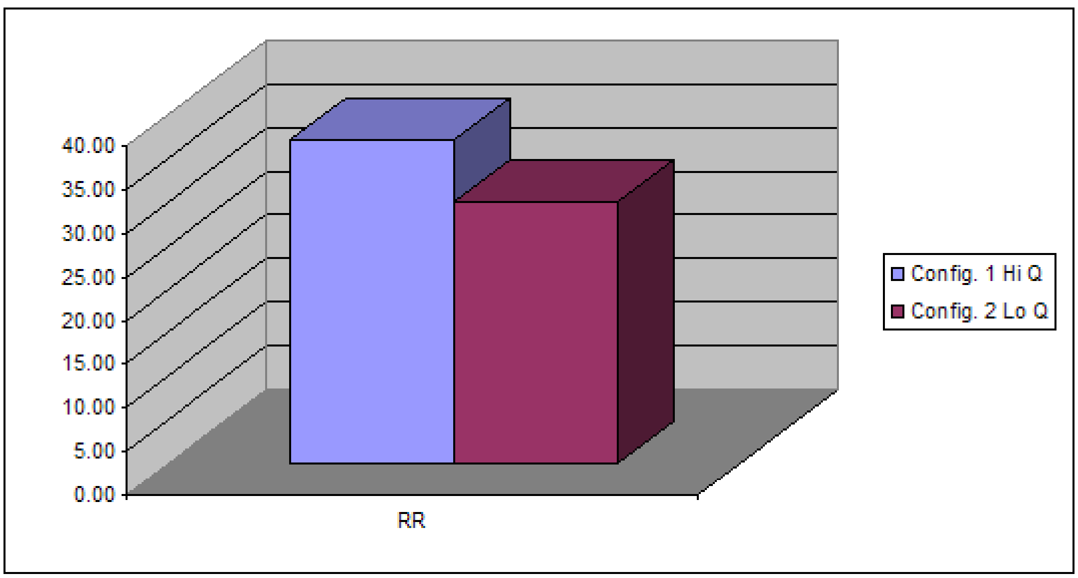
This test compares two tag assembles that will fit in a 12 x 2.2 mm glass tag vial that have different gage wire and antenna core sizes.

Tag Assembly Test

Antenna Core Size VS Wire Gage

* Both tags ACM-1
* All tests with the same die
* Q's & L's measured with in house SRS at 100kHz

Raw Data	RR
Config. 1 Hi Q	37.00
Config. 2 Lo Q	30.00

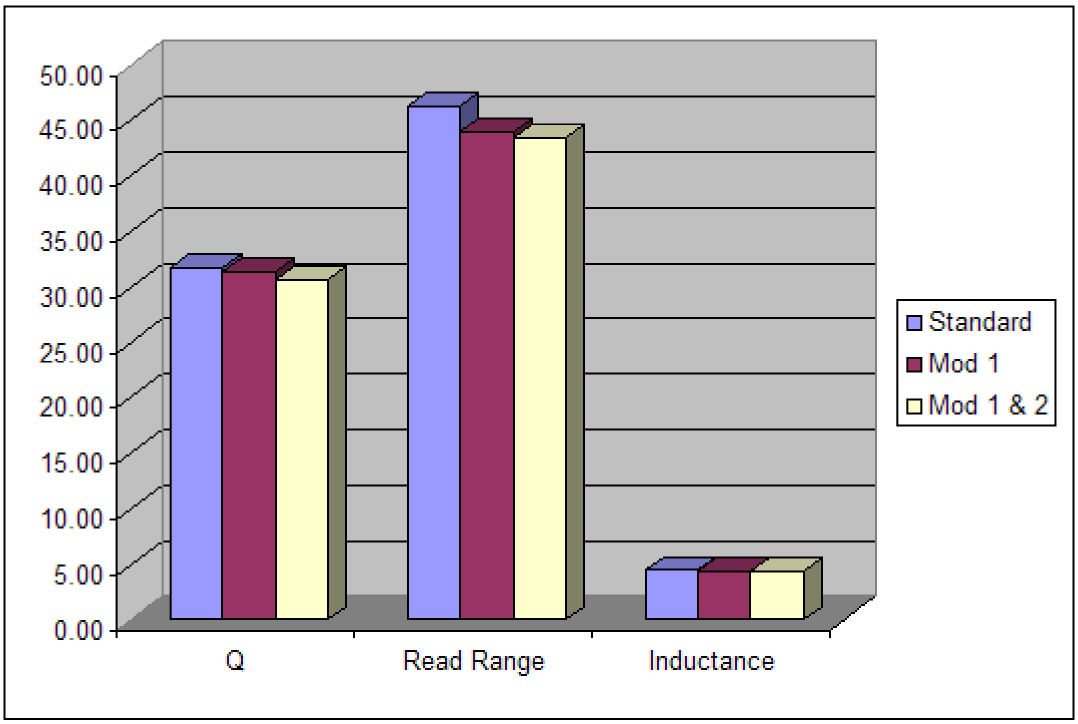


Conclusion: There is an optimum balance between antenna core size and wire gage.

Novel Antenna Core Material Configuration Test

Novel Antenna Core Material Configuration

Tag/Ferrite	Q	Read Range	Inductance
Standard	31.70	46.25	4.50
Mod 1	31.40	44.00	4.35
Mod 1 & 2	30.60	43.50	4.43



Conclusion: This novel configuration of an antenna core should produce a high performing tag.

Winding Length and Number of Layer Test

Test results are not available at this time.

Appendix F Laser Seal and Flame Sealing Comparison

The photograph comparing laser sealed and flame sealed tags was not available as of the printing of this report.

Directed By Pacific States Marine Fisheries Commission

Proposed New Monitor Locations at Adult Separator Exits

Version 0.1

1 July 2004

Prepared for the:

PIT Tag Steering Committee

PTAGIS

PIT Tag Information Systems

Columbia Basin | ptagis.org

Prepared by:

PTAGIS Project

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1. INTRODUCTION

1.1 *Background*

In 2002 a new 4-coil monitor was installed on the 36" full flow pipe that feeds the juvenile fish facility at McNary Dam. Later that year a comparison was made between this new monitor and the existing monitors at the juvenile fish facility. The comparison revealed that the juvenile fish facility monitors had slightly less total detections than the full flow monitor.

It was then noted that one possible source of tagged-fish leakage could be at the separator's adult exit pipe. A temporary 2-coil monitor was then installed on this pipe that confirmed the leakage. Earlier this year the temporary monitor was replaced with a standard stationary monitor.

Since the leakage has been proven at McNary, it has been proposed that other facilities should have this same pipe monitored.

1.2 *Purpose of Document*

The purpose of this document is to provide information about possible locations for a new monitor leading from the separators at Lower Granite Juvenile, Little Goose Juvenile or John Day Juvenile. PSMFC is currently budgeted for one new monitor.

1.3 *Document Revisions*

1.3.1 Original Draft, July 1, 2004

Version 0.1 is the original submittal of this document, prior to approval. The document shall be reviewed, revised if necessary, and approved by the PTAGIS Program Manager. Subsequent to its approval, the document version shall be denoted 1.0.

2. PROJECT SUMMARY

The goals and objectives of this project are to choose a location, then install a new separator adult exit pipe monitor at either Lower Granite, Little Goose or John Day during the PTAGIS 2004 fiscal year.

3. LOWER GRANITE DAM

The Lower Granite Dam juvenile fish facility has the same separator adult exit system as Little Goose and McNary except that a 15" x 15" aluminum flume is used instead of a PVC pipe. Because of this, the installation of a new monitor would have to wait until the facility is down for the season.

The installation of the 2-coil monitor would consist of:

- Fabricating a fiberglass 15" x 15" x 48" tube with flanges.
- Fabricating an aluminum shield to fit the tube.
- Cutting the existing flume and adding flanges.
- Installing the fiberglass tube / shield assembly in the flume.
- Installing a 30" x 30" x 8" electrical enclosure for the transceivers.
- Wrapping the antennas and wiring into the existing electrical and communication systems.

- Adding modems to the High Speed Interface Panel.
- Updating all PTAGIS web tools.

Figure 1: Proposed locatmion of an adult exit monitor at Lower Granite JFF

4. LITTLE GOOSE DAM

The Little Goose Dam juvenile fish facility has the same separator adult exit system as McNary, which uses PVC pipe. If chosen, the new monitor could be installed during the season as no fish passage would be impacted.

The installation of the 2-coil monitor would consist of:

- Fabricating an aluminum shield to fit around the pipe.
- Installing the shield assembly onto the pipe.
- Installing a 30” x 30” x 8” electrical enclosure for the transceivers.
- Wrapping the antennas and wiring into the existing electrical and communication systems.
- Adding modems to the High Speed Interface Panel.
- Updating all PTAGIS web tools.

Figure 2: Proposed location of an adult exit monitor at Little Goose JFF

5. JOHN DAY DAM

The John Day Dam juvenile fish facility has a dry separator that should allow only adult fish to be passed into the adult separator exit pipe. It also has a gate located just after the separator on this pipe that is manually operated to divert adult fish to the adult fish holding tank located in the lab. Sometimes (there is no system to actually determine when), the fish are then hand scanned for PITtags. Locating a monitor on this pipe would be redundant to the periodic lab hand scanning. If chosen, the new monitor could be installed during the season as no fish passage would be impacted.

The installation of the 2-coil monitor would consist of:

- Fabricating an aluminum shield to fit the PVC pipe.
- Installing the shield assembly onto the PVC pipe.
- Installing a 30” x 30” x 8” electrical enclosure for the transceivers.
- Wrapping the antennas and wiring into the existing electrical and communication System.

- Updating all PTAGIS web tools.

Figure 3: Proposed location of an adult exit monitor at John Day JFF

6. RESEARCH REQUIREMENTS

Robert Wertheimer (Corps of Engineers, Portland District Fish Field Unit) and Bill Bosch (Yakama Nation Fisheries Department) were contacted and solicited for their recommendations and priorities for new PIT tag detector installations at Adult Return Pipes. Messrs. Wertheimer and Bosch are involved with the two largest research programs in the Columbia Basin involving detections of PIT-tagged adult salmon and steelhead.

Mr. Wertheimer unambiguously chose the Adult Return Pipe at the Lower Granite JFF (GRJ) as the top priority for a new detector, citing the large numbers of kelts that fall back at this location. Mr. Wertheimer did not identify any alternative locations for adult detector installations, even when informed that detectors could not be installed at Lower Granite during the current juvenile fish passage season.

Mr. Bosch's study is focused on the survival of reconditioned steelhead kelts originating from the Yakima River Basin. His priorities are for additional detection capabilities at locations downstream of the Yakima River. He identified the Adult Return Pipes at

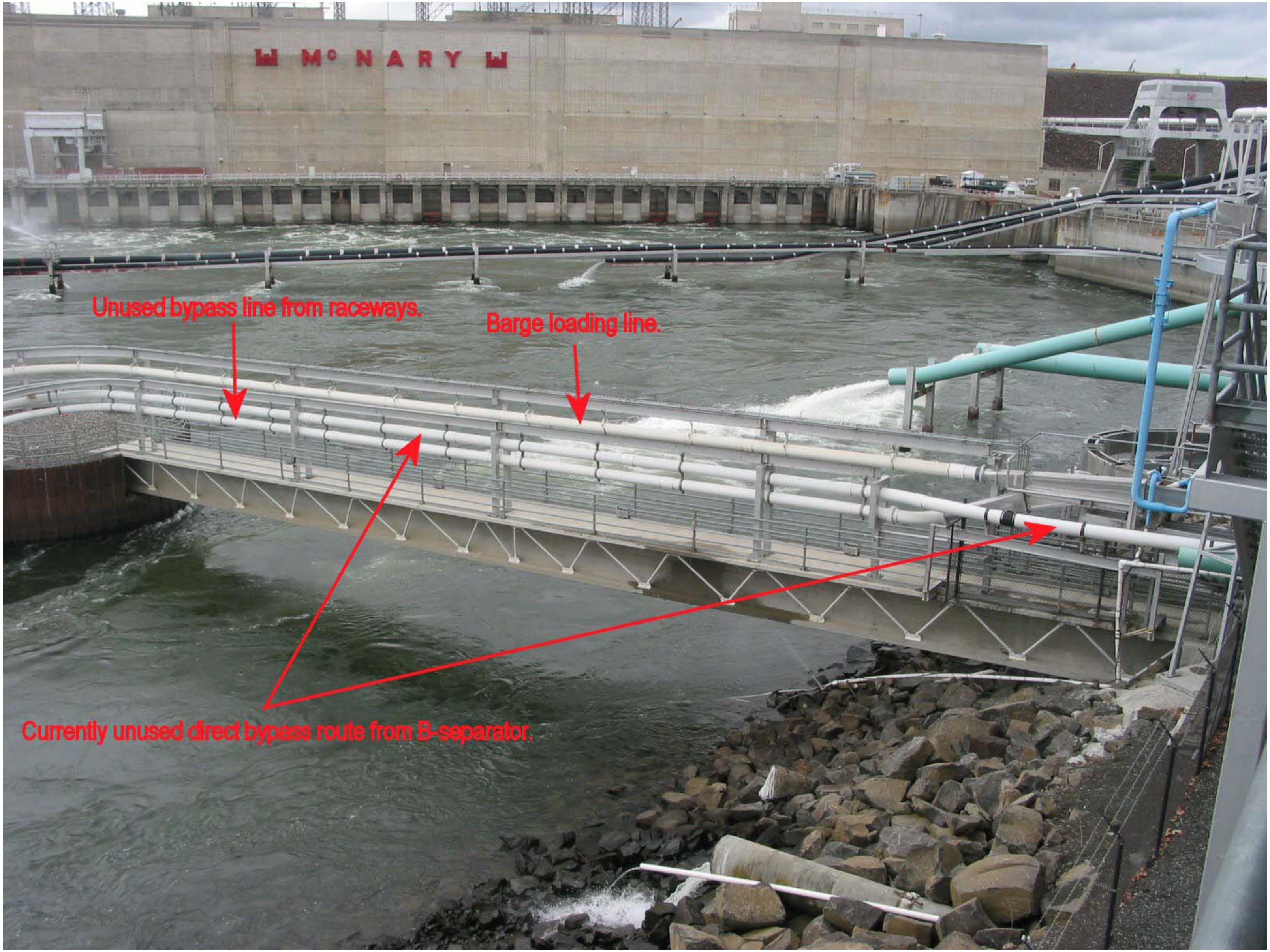
Bonneville Dam Powerhouse #2 (B2J) and John Day Dam (JDJ) as the preferred locations for new PIT tag detectors.

Currently, a common line is used at MCJ to bypass “B”-side fish back to the river (through the River-1 Exit PIT tag monitor). This occasionally causes conflicts in the routing of both PIT-tagged and non-tagged fish. A second, unused, line could be used to put all PIT tagged fish, destined for bypass, directly into the River-1 Exit line downstream of the barge-loading switch gate.

Fish exiting the B-separator encounter a switch gate that can route them to the raceways, or back towards the river, where they encounter this (static) gate that routes them though a pipe that joins into the raceway exit manifold, and ultimately are disposed either to a barge, or out through River-1 Exit. The bottom pipe from the static switch gate is not used, but could be used to bypass directly to the river.

This is a close-up of the static gate.

This shows the routes of the two available pipes downstream of the static switch gate as they loop around under the West Raceway banks at McNary.



The barge loading line is currently used. The direct bypass line is unused.

The direct bypass line passes through a dryer and necks down to 4 inches.

X-Mozilla-Status: 1001
X-Mozilla-Status2: 00000000
Return-path: <SCasey@DigitalAngelCorp.com>
Received: from mn-mail.digitalangelcorp.com
(host-65-126-81-85.digitalangelcorp.com [65.126.81.85])
by ldapcluster.psmfc.org
(iPlanet Messaging Server 5.2 Patch 1 (built Aug 19 2002))
id <0HUG00401YKCYQ@ldapcluster.psmfc.org>
(original mail from SCasey@DigitalAngelCorp.com) for carters@ims-ms-daemon
(ORCPT carters@psmfc.org); Fri, 12 Mar 2004 07:37:49 -0800 (PST)
Received: from mn-mail.digitalangelcorp.com
(host-65-126-81-85.digitalangelcorp.com [65.126.81.85])
by ldapcluster.psmfc.org
(iPlanet Messaging Server 5.2 Patch 1 (built Aug 19 2002))
with ESMTP id <0HUG00MI2ZF0B0@ldapcluster.psmfc.org> for carters@psmfc.org;
Fri, 12 Mar 2004 07:37:48 -0800 (PST)
Received: by MN-MAIL with Internet Mail Service (5.5.2657.72)
id <GR3DSJ9G>; Fri, 12 Mar 2004 09:41:53 -0600
Content-return: allowed
Date: Fri, 12 Mar 2004 09:41:53 -0600
From: Sean Casey <SCasey@DigitalAngelCorp.com>
Subject: Master Contract
To: "Kim Fodrea (kafodrea@bpa.gov)" <kafodrea@bpa.gov>
Cc: "Carter Stein (carters@psmfc.org)" <carters@psmfc.org>
Message-id: <E2FEB5CAE401A14B95D6EE3F9D6BAADC23429E@MN-MAIL>
MIME-version: 1.0
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Content-type: multipart/alternative;
boundary="Boundary_(ID_quf8uvfPTiKgA7nc7rTTBg)"

This message is in MIME format. Since your mail reader does not understand this format, some or all of this message may not be legible.

--Boundary_(ID_quf8uvfPTiKgA7nc7rTTBg)
Content-type: text/plain

Good Morning Kim,

I hate to bother you with this, but it would be good if you could start the process of changing the master contract to include the new tag. Information is below:

Part #   Description
Price

TX1400SGL   134.2 kHz Interim Glass Improved Transponder $2.25 Each.
(9/1/04- 9/30/07)

(TX1411SGL   Note: This tag is improved for the Bonneville
for 100/ Pkg.)   Hi-Q Corner Collector (may only be
used for 1 year depending on future
tag development).

This is also what was recently sent to the ACOE- Walla Walla.

Sorry for the bad timing!
Take care,Sean

Return-path: <Thomas_Hoffman@r1.fws.gov>
Received: from salmo.psmfc.org (salmo.psmfc.org [199.170.103.6])
 by ldapcluster.psmfc.org
 (iPlanet Messaging Server 5.2 Patch 1 (built Aug 19 2002))
 with ESMTP id <0I0L005LHRYW7Z@ldapcluster.psmfc.org> for carters@ims-ms-daemon
 (ORCPT ptsc@psmfc.org); Fri, 09 Jul 2004 14:06:32 -0700 (PDT)
Received: from reedi.psmfc.org (reedi.psmfc.org [205.230.28.71])
 by salmo.psmfc.org (8.12.10+Sun/8.12.2) with ESMTP id i69L6JSU009884
 for
 <@salmo.psmfc.org:ptsc@psmfc.org>; Fri, 09 Jul 2004 14:06:19 -0700 (PDT)
Received: from fw0hub1.irm.r9.fws.gov
 (fw0hub1.irm.r9.fws.gov [164.159.176.242]) by ldapcluster.psmfc.org
 (iPlanet Messaging Server 5.2 Patch 1 (built Aug 19 2002))
 with ESMTP id <0I0L005L3RYI7Z@ldapcluster.psmfc.org> for ptsc@psmfc.org
 (ORCPT ptsc@psmfc.org); Fri, 09 Jul 2004 14:06:19 -0700 (PDT)
Date: Fri, 09 Jul 2004 14:06:15 -0700
From: Thomas_Hoffman@r1.fws.gov
Subject: Re: [Fwd: Re: PIT Tag Steering Commmittee (PTSC) Conference Call --
]
To: Carter Stein <carters@psmfc.org>
Cc: Schwartz Dennis E NWP <Dennis.E.Schwartz@nwp01.usace.army.mil>,
 earl.prentice@noaa.gov, Jon Mueller <JMueller@DigitalAngelCorp.com>,
 "'Fodrea, Kimberly - KEWR-4'" <kafodrea@bpa.gov>, ptagis <ptagis@psmfc.org>,
 ptsc@psmfc.org, sandy downing <sandy.downing@noaa.gov>,
 'Sean Casey' <SCasey@DigitalAngelCorp.com>,
 Zeke Mejia <ZMejia@DigitalAngelCorp.com>
Message-id: <OF85362873.105DEA0D-ON88256ECC.0073A65B@irm.r9.fws.gov>
MIME-version: 1.0
X-Mailer: Lotus Notes Release 5.0.8 June 18, 2001
Content-type: text/plain; charset=us-ascii
X-MIMETrack: Serialize by Router on FW0HUB1/FWS/DOI(Release 5.0.12 |February
 13, 2003) at 07/09/2004 03:19:47 PM

Hello All!

I got a message from Joe stating that he has been working on the document and expects it to be done shortly. I have not actually talked to him yet, but he asked for people to please be patient. I hope that means it's coming sooner than later. That's all I know for now. Please keep me informed as to the topics of the conference call. Thanks!

Tom Hoffman
Fishery Biologist
U. S. Fish and Wildlife Service
Columbia River Fisheries Program Office
1211 SE Cardinal Ct., Suite 100
Vancouver, WA 98683
360-604-2500
thomas_hoffman@fws.gov

Northwestern Division- Corps of Engineers
ANADROMOUS FISH EVALUATION PROGRAM
RESEARCH SUMMARY

STUDY CODE: BPS-P-00-?

TITLE: B2 Corner Collector PIT Tag Antenna Efficiency Evaluation

FISH PROGRAM FEATURE: CRFMP-Bonneville-Powerhouse 2

BIOP MEASURE: 193 and numerous others related to measuring reach survival in the lower Columbia

The juvenile bypass systems at Bonneville currently have PIT detection, which is critical to reach survival estimates and Biological Opinion performance measurements. However, with the Bonneville corner collector operating, most of the fish that would have been detected in the bypass system are expected pass via the corner collector. Therefore, having detection in the new Bonneville Corner Collector is critical to reach survival estimates and measuring progress toward BiOp performance standards. A subcommittee of the federal RME Hydro Work Group made recommendations regarding PIT sampling needs associated with the B2CC. That body recommends that the PIT detection system being designed for the corner collector be able to detect approximately 60% of the PIT tagged smolts passing through it. The rationale for this recommendation follows.

With respect to smolt survival monitoring needs, the goal is to provide survival estimates with acceptable precision. NMFS representatives and others on the committee have recommended that the standard error (SE) of the estimate of MCN-BON survival for yearling chinook and steelhead should be near 0.05. We considered combinations of detection probabilities needed at Bonneville Dam and at down-river sampling sites (trawl and predaceous bird recoveries) to meet the 0.05 SE target. Dr. Smith conducted analyses that guided the RM&E's decision. Because we wanted to ensure the precision target had a high likelihood of being met across a broad range of Bonneville operating conditions, we analyzed both a high- and a low-flow scenario. By focusing on the 0.05 SE target it appears that the goal would be met under most expected conditions if about 60% of fish passing through the corner collector were detected.
BPA and the Corps have jointly developed a detection system for the Corner Collector with this 60% detection efficiency goal. The system will be installed prior to the 2005 migration season. An evaluation is needed in 2005 to determine whether the detection efficiency goal has been met.
Under the current PIT-tag MOA between BPA and USACE, BPA is the fiscally responsible party to fund the electronics evaluation of the B2CC PIT tag detection system and has asked that this research proposal be incorporated into the U.S. Army Corps of Engineers Northwestern Division's Anadromous Fish Evaluation Program (AFEP) research planning for 2005 for the purpose of obtaining regional input to the study design and review of proposals.

OBJECTIVES:

1. Evaluate and quantify the detection efficiency of the newly-installed PIT Detection System at the B2 Corner Collector. Research will be focused towards one or both of the following objectives:
   a. Quantify detection of PIT tagged spring chinook yearlings passing through the corner collector* using one or possibly two newly developed glass tag types.
   b. Quantify detection of PIT tagged fall chinook subyearlings passing through the corner collector* using one or possibly two** newly developed glass tag types.

   *The intent is to determine how many of the PIT-tagged fish passing through the corner collector are detected by the PIT-tag detection system. This research does <u>not</u> include the objective of quantifying how many fish enter the corner collector. Corner collector passage efficiency is included under a different research one-pager (See Study Code: SBE-P-00-7, Evaluations and Studies of Fish Passage Efficiency at Bonneville Dam.)

   **One or two types of tags will be evaluated. These tags will be provided to the researcher by BPA. Proposals should clearly state the number of tags necessary for the evaluation.

SCHEDULE: 2005- 2006