EXHIBIT 1

From:
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To:
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SUMMARY

I am a self-employed Electrical Engineer with a U.S. Government contract * to do design and evaluation engineering in a fish identification and locating project. The system employs a passive radio frequency transponder that is injected into the fish. When the tagged fish pass by the interrogation antennas, the transponder is energized and a unique identification code is returned to the interrogator. I designed and installed systems to read the transponders in juvenile fish as they pass through dams in the Columbia River Basin. These existing systems operate as "low powered communications" devices at 400kHz. The fixed stations at the dams are regulated by the NTIA, but portable units which are sometimes used off government property are certified according to Part 15, subpart C of the CFR.

The research projects utilizing the passive integrated transponder (PIT) tags have yielded valuable data on how to improve the outmigration of juvenile salmon and to reduce juvenile mortality at the dams. The present systems have limited range, and have not been used extensively for returning adult salmon. The range could be extended significantly if permission can be obtained from the regulatory agencies(FCC and NTIA) to increase the emissions to levels requiring licensing. Since the first systems were installed, several new transponder manufacturers have introduced improved transponders which operate most efficiently at or about 125 kHz. Since the CFR permits licensed radiolocation from 110 to 130 kHz (Part 90, Subpart F) on a secondary basis, a change to licensed operation at 125kHz is being considered.

In order to do the testing necessary to determine the system design and configuration, I am requesting an experimental license to operate a prototype system at my engineering lab, with the intent of applying for a radiolocation license upon completion of the first phase of the experimental work, in about six months.

*Contract No. 50ABNF400026
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DESCRIPTION OF THE SYSTEM

Figure 1 of this exhibit shows a block diagram of the system. A 1 mHz crystal oscillator followed by a divide-by-8 circuit provides a stable transmit frequency. This signal is filtered to remove harmonics and feeds a linear power amplifier through a control gate. There is no modulation on the transmit signal other than the on-off keying of the continuous wave signal, which may occur at rates of 5 to 50 pulses per second. The power amplifier drives a series tuned (tuning capacitors are in series with the loop) transmit antenna through a matching transformer. The transmit antenna is only a very small fraction of a wavelength (wavelength at 125 kHz is 2400 meters, orabout 1.5 miles) so the radiation resistance is very small, and almost all the power from the power amplifier is dissipated as resistance heating. The current circulating in the antenna resonant circuit creates a strong local magnetic field, which provides power to the transponder, or PIT tag.

The tag includes a loop antenna, wound on a small ferrite slug, which provides the power and a stable frequency signal for operating the integrated circuit containing the control circuitry and ID code memory. The tag usually creates a new signal frequency and data clock by dividing the original transmitter frequency by some integers. The new signal frequency is then modulated by the data contained in the memory to form a modulated return signal containing the ID code.The power involved in this return signal is vastly below the levels regulated by the FCC.

The signal generated by the tag is sensed by a tuned receive loop antenna, fed to an amplifier and filter, and then demodulated by some kind of analog to digital converter (the present experimental system has a phase locked loop used as a frequency shift key (fsk) or phase shift key (psk) detector) and fed to a microcomputer for decoding and conversion to ASCII encoded hex characters for transmission to the host computer.

CALCULATION OF EFFECTIVE RADIATED POWER

The transponder, or tag, is energized by inductive coupling from the transmit antenna. A fairly high value of magnetic field strength, of the order of 5 to 50 amperes per meter is required. If this were generated by a plane wave, the radiated power would be excessive. The range required for useful operation of the tag is at most a few meters, and in most cases under 1 meter. The field is generated by a high current circulating in a resonant circuit formed by the transmit loop and series capacitors. The amount of power required is thus a function of the Q of the coil, and very efficient coils can be made to operate in air, requiring small amounts of power. When the transmit coil is operated under or near water, as is the case for the fish locating system, currents are induced in the water and the support structures for the flumes, which requres power from the antenna.

The radiation from a electrically small loop can be calculated by calculating the radiation resistance of the loop, then multiplying this by the square of the current in the loop.

The radiation resistance is as follows;

$N := 15$ number of turns

$D := 2$ diameter of loop in meters

$\lambda := 2400$ wavelength at 125 kHz

$$R := \left[19000 \cdot N^2\right] \cdot \left[\frac{D}{\lambda}\right]^4$$

Henry Jasik: "Antenna Engineering Handbook" pp.6-2, McGraw-Hill, 1961

$R = 2.062 \cdot 10^{-6}$ ohms

The power, for 10 amperes current in the loop, is 10x10x2.062E-6=.2062 milliwatts.

It has been noted that the magnetic field can cause currents to flow in nearby water and metallic structure which could substantially increase the effective radiation resistance. I am therefore requesting an experimental license for up to 1 watt. I will measure the field strength at 300 meters and report the value as soon as I have permission to operate.

EXPECTED CONTRIBUTIONS
The population of most species of salmon in the Columbia River Basin has been in decline for decades. There are many contributors to this decline, including loss of habitat, water pollution, commercial and sportfishing, water diversion for consumer and agricultural use, and hydroelectric dams. The dams interfere with the migration of the salmon between the sea and the spawning streams in the upper reaches of the rivers. The National Marine Fisheries Service is involved in the task(among others) of performing research with the broad objective of fashioning recommendations to reverse the decline in population through improvement in migration conditions. One objective of the National Marine Fisheries Service is to restore threatened or endangered fish stocks. To achieve this objective, real time information regarding fish movement is required.

The existing conditions are that most juvenile salmonids must pass the dams either through the spillways, through the turbines, or through "bypass" systems installed at the dams specifically to divert fish from the turbines, where mortality is high. Typically, the spillways are near the surface of the water, a region not favored by the fish. In addition,there is substantial economic incentive for minimizing the spillway flow since lost water means lost power generation revenue. The path through the turbines causes considerable fish loss, enough so that the loss is alarming if compounded through many dams. There is thus considerable incentive and even pressure to improve the bypass conditions.

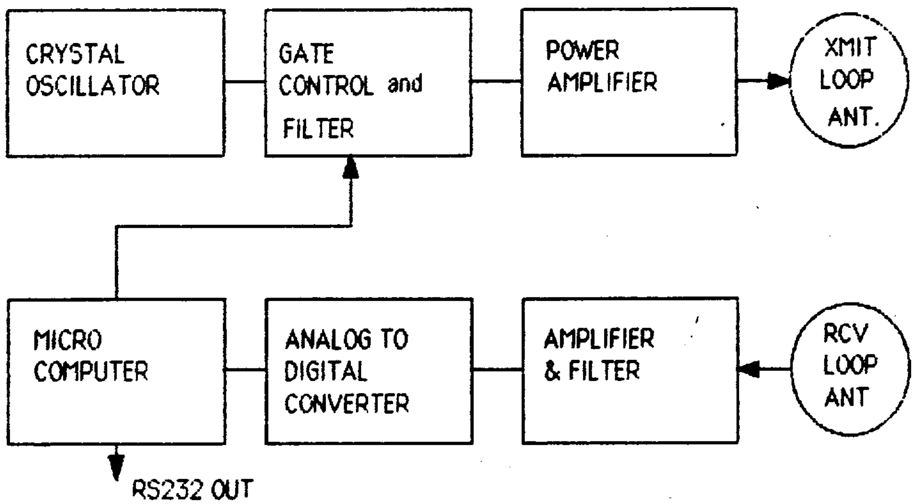
During the past ten years, a program to obtain information on juvenile salmon using the PIT tag has been implemented.. The program has yielded valuable data and insights on improvement of conditions for the small salmon as they migrate out to sea.

The returning adult salmon also face obstacles in their migration, even though dams in the current migration paths have fish ladders which at least make migration possible. The PIT tag technique has not been used extensively in studies of returning adult salmon, primarily because the range of the existing systems does not allow use in the larger passageways and flumes used by the adult salmon.

The objective of my present work is to improve the read range of the PIT tag system so that adult fish can be interrogated in fish ladders. The data obtained from these new systems will be used in both research and management of the Columbia Basin fisheries resource.

In order to increase the range of the system, the field strength and thus the power must be increased substantially, which requires that the stations be licensed.

FIGURE 1 OF EXHIBIT 1



1. The crystal oscillator is a .02% 1 mHz crystal oscillator, followed by a divide by 8. to obtain 125 kHz.
2. The gate control provides a means of turning the signal to the power amplifier on and off. A filter is included to remove harmonics from th e125 khz signal.
3. The power amplifier will be an Electronic Navigation Industries model 1040 L. modified to limit the output power to 250 watts. After some experiments, the power amplifier will be changed to a less expensive class D or E amplifier.
4. The microcomputer provides decoding of the return signal from the transponder, control of the gate for the transmitter, and output of the decoded transponder to an external device. Motorola 68705 and Intel 87C51 have been used in the past, but a faster, larger version will be required for this extended range system. The choice has not been finalized.
5. The analog to digital converter section may be simply an amplitude detector or a phase locked loop followed by a comparator, or it may be a high speed ADC with fast fourier transform capability. depending on the transponders chosen for the system.
6. The amplifier and filter stage will also depend on the transponder.
7. The loop antennas will be multi-turn tuned loops up to 1 meter by 2 meters. The receive antenna is wound with multi-turn side lobes which act to cancel out the reception from the transmitter. while enhancing the return signal from the transponder, as shown schematically below.