Alternative Concept of Operations Summary Description and Analysis

PRESENTED BY

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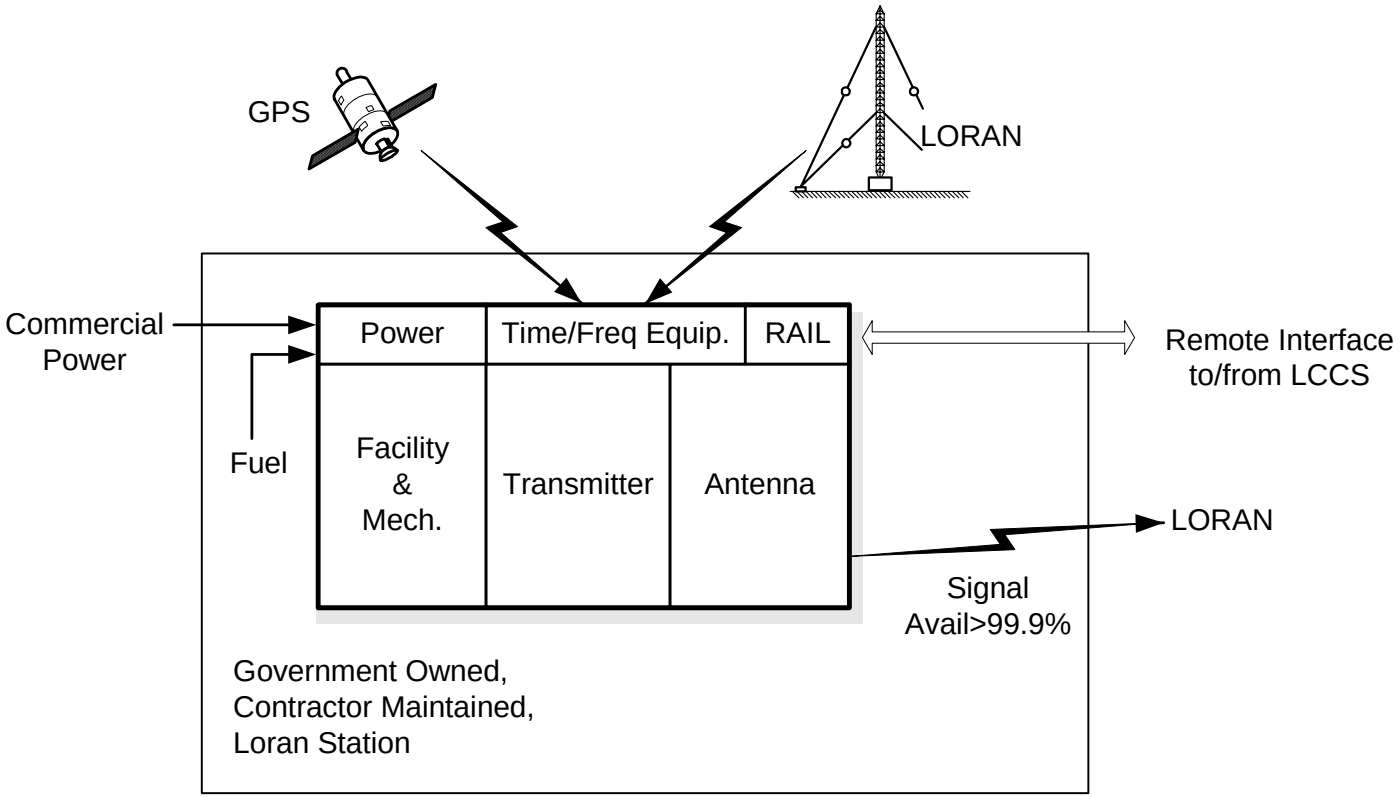
Overview

- Purpose:
  - Describe and analyze an alternative concept of operations (ACO) for recapitalizing, modernizing, and operating the US Loran-C/eLoran (i.e. enhanced Loran) system that will provide the required level of service at low cost.
- Requirement:
  - Maintain conformance to all present Loran-C signal standards.
  - Modernize system for use in maritime Harbor Entrance and Approach (HEA) and aviation Non Precision Approach (NPA) as per FAA report "Loran's Capability to Mitigate the Impact of a GPS Outage on GPS Position, Navigation, and Time Applications" of March 2004 (prepared for Department of Transportation)
- General Approach:
  - Direct conversion of site maintenance to reduce billets.
  - Consolidation of system owner functions.
  - Alternative system maintenance model.
  - Redefinition of unmanned sites to reduce cost.
- Summary:
  - The concept results in a cost effective capitalized, modernized and expanded eLoran system for which:
    - $13.8M is required to complete Alaska Loran-C recapitalization.
    - $44.7M is required to modernize Loran-C to eLoran at the 24 existing sites, and if required, to add 3 new eLoran sites.
    - Annual cost of operating the modernized eLoran is reduced to $11.5M.

ACO — Framework for Future Operations

- The system remains a federally provided radionavigation service.

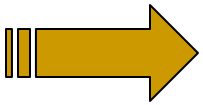


ACO — Direct Conversion of Site Maintenance

- What is meant by Direct Conversion in this analysis?
  - In the simplest sense, it is replacement of "blue-suit" USCG personnel with a contractor work force.
  - The concept is done both internationally with Loran, and USCG does it with the NDGPS (Nationwide Differential GPS.)
  - All present Loran transmitter sites in CONUS can be direct converted immediately. In Alaska $13.8M of additional recapitalization funds are needed.
  - The system will still be a federally provided radionavigation service as ownership of assets, integrity of information, system control, and archiving will properly remain as government functions.

Present Staffing Level

	Billets	Sites
Alaska	101	6
CONUS	86	18
System	106	4
Total	293	



Proposed Staffing Level

	FTEs	Sites
Alaska	20	6
CONUS	24	21
System	20	1
Total	64	

Note: Full Time Equivalents or FTEs will likely be a mix of billets and contractors.

ACO – Consolidation of System Owner Functions

- There are 4 System sites including Operational Commands at NAVCEN (Alexandria, VA) and Petaluma, CA; a depot and repair maintenance facility at the Electronics Logistics Center (ELC-Baltimore); and System Engineering at the Loran Support Unit (LSU) in Wildwood, NJ.
- The modernized eLoran architecture significantly reduces the need for "control" of the system by watch standers.
  - Timing control is performed automatically at the Loran sites by steering all system clocks to a common time scale.
  - Shift to local control also improves reliability as watch stander error is eliminated.
  - The function of System Area Monitors changes from control to measurement.
  - There are two Loran Consolidated Control Systems, one each at Petaluma and Alexandria. Given performance monitoring and logging capabilities at the transmitter sites, one LCCS-like system site should be sufficient. A second LCCS (if required) could be co-located at a Loran site.
  - NAVCEN has operational expertise and LSU has system expertise. Only one is needed to support eLoran. Overseas Loran systems already use unattended sites and the organization with system expertise ensures overall performance.

ACO – Alternative System Maintenance Model

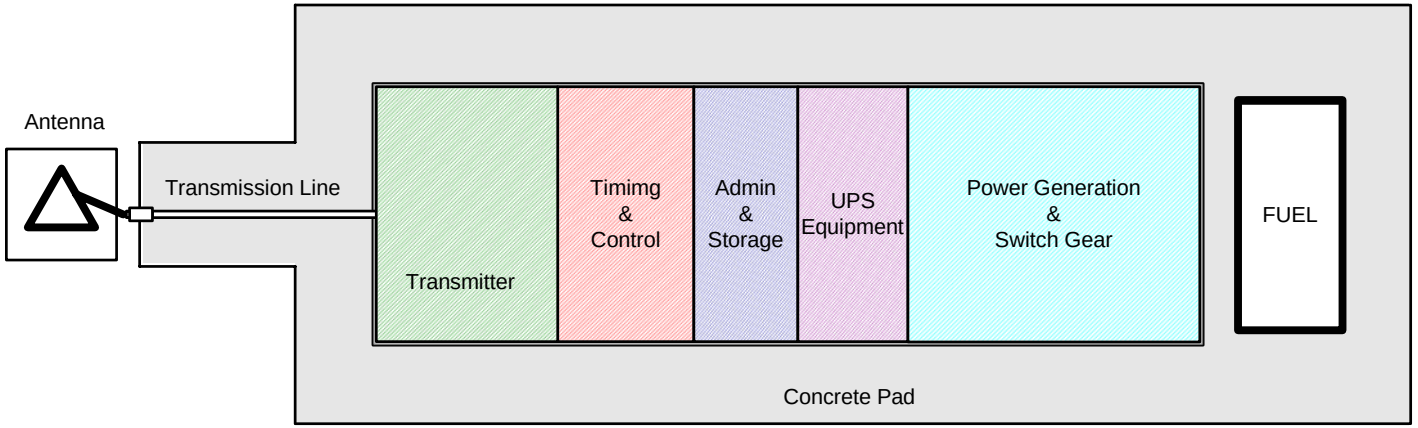
- The USCG performs both preventative and corrective maintenance at sites. It also maintains a training center at Petaluma, CA. The USCG also maintains a Loran facility at the ELC-Baltimore where both warehousing and repair are performed.
- However, modernized stations now use commercial equipment with extended (up to ten year) warranties transferring the risk from the government to the supplier. Loran sites are in a "replace the box" mode but maintenance organizations are designed to "fix the box."
- Today, depot level NSSX spares are stored at the point of manufacture. Transport and handling is significantly reduced saving time and money.
- Alaska can handle the CONUS model with contractor availability of:
  - Base or site operations.
  - Specialized transport.
  - Power generator service and repair.
  - Tower inspection and service.

ACO – Redefinition of Unmanned Sites

- Loran Transmitter sites unattended today include Norway (2 sites at Vaerlandet and Berlevag since 1994),France (2 sites at Lessay and Soustons since 1984), and Germany (Sylt since 1993.)
- The USCG, at Loran Station Jupiter, FL, in a series of tests known as the Prototype Automated Loran System (PALS & ALS) successfully demonstrated concept of unattended operation in 2001.
- USCG in its System Times Magazine (Spring 2004) outlined strategies to minimize Total Ownership Cost. Several of the identified opportunities have already been realized by USCG. More can be pursued.
- The USCG operates the NDGPS unattended with maintenance performed by a contractor. The sites, including the Ground Wave Emergency Network (GWEN) conversions, use shelterized electronics including Low Frequency transmitters (with back-up diesel generators) connected to 300 ft towers.

Source: Article by James A. Arnold, FHA in "Public Roads" Sept/Oct 2001

ACO – New Facility Concept

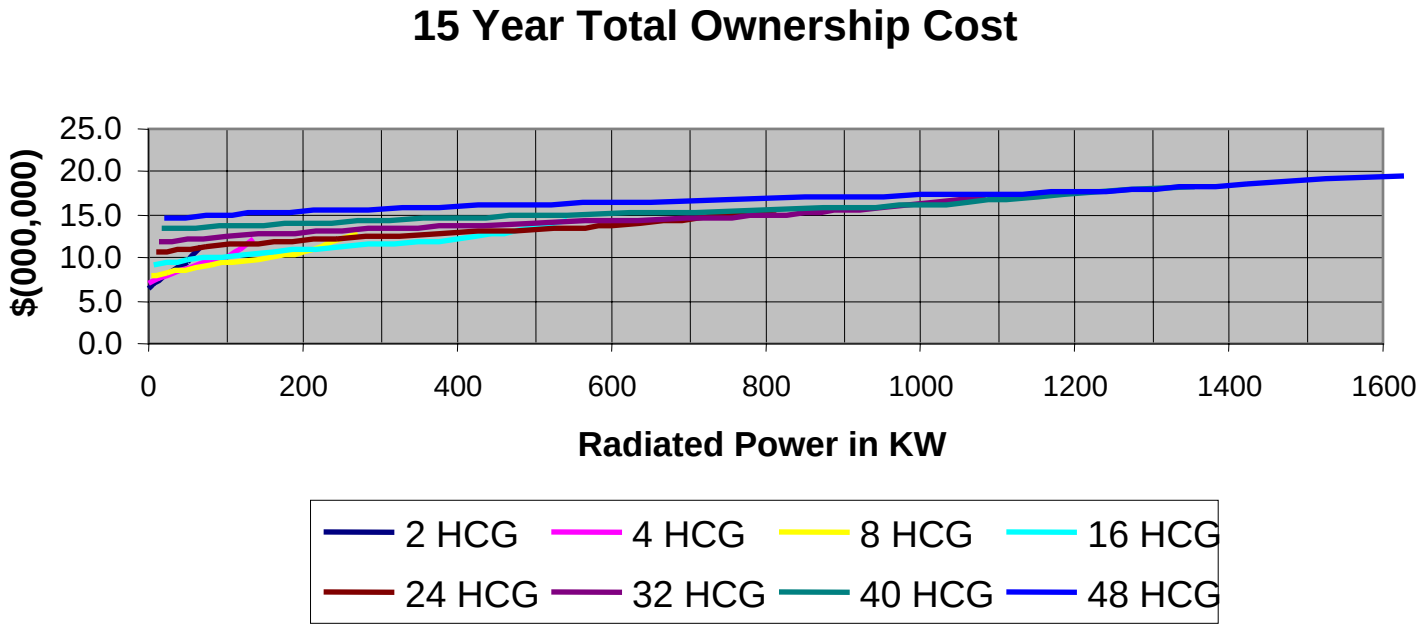


Simplified diagram above shows proportional space requirements only. Features include:

•Standard ISO shelters (military grade) suitable for all Alaskan environmental and transportation constraints and modular based on transmitter size or power constraints.
•Design equally appropriate for both arctic and desert environments.
•Economic efficiencies with “assembly in place” in factory and alleviates short Alaskan building season.
•Comparable approach and space efficiency to remote Jan Mayen, Norway (at 71deg N) facility, also having permafrost conditions.

ACO – New Facility Concept

- Right-sizing a Loran site is done by using cost models that minimize 15-year Total Cost of Ownership. The tradeoff for a desired signal strength is a comparison of transmitter output power versus antenna height. The chart below is the Total Ownership Cost (in millions) of a new site in the southern US versus radiated power. Each curve is a product of transmitter size (expressed in NSSX Half Cycle Generators) with antenna heights ranging from 150 to 800 feet.



ACO – Cost Analysis – Summary Cost

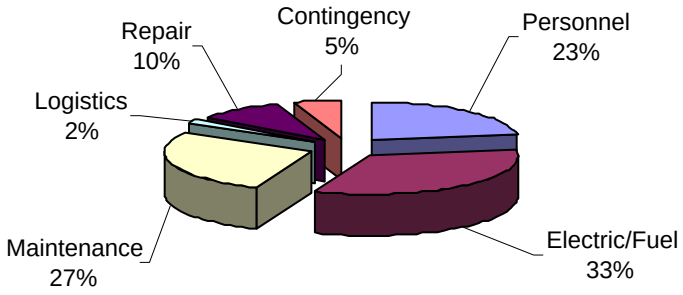
eLoran System Summary Costs

Capital Outlay and 15 Year Operating Expense
(in millions)

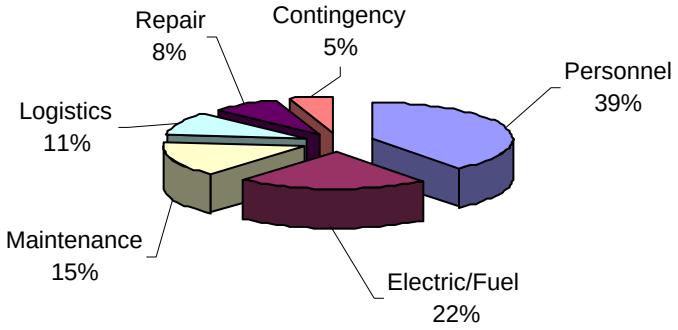
	CONUS		ALASKA		Expansion		Total Cost
Capital							
Recapitalization	$0.00		$13.75		$0.00		$13.75
Modernization	$19.95		$2.20		$0.00		$22.15
Expansion	$0.00		$0.00		$22.50		$22.50
Subtotal		$19.95		$15.95		$22.50	$58.40
Operation and Maintenance							
Transmitter Sites	$70.72		$45.53		$0.00		$116.25
Expansion Sites	$0.00		$0.00		$9.90		$9.90
Maintenance Sites	$14.25		$7.53		$0.00		$21.78
SysPerfMon Sites	$24.23		$0.00		$0.00		$24.23
Subtotal		$109.20		$53.06		$9.90	$172.16
Total 15 Year Cost		$129.15		$69.01		$32.40	
Annualized 15 Year Cost		$8.61		$4.60		$2.16	$15.37
Annual Cost of Operation and Maintenance		$7.28		$3.54		$0.66	$11.48
Percentage of Annual Oper & Maint		63%		31%		6%	100%

Cost Analysis – O&M

CONUS Loran Sites O&M Cost Breakdown



Alaska Loran Sites O&M Cost Breakdown



- Transmitter Site Notes
  - Some maintenance costs prepaid in equipment warranty agreements.
  - Logistics includes travel for preventative and corrective maintenance.
  - A new site is assumed (for this analysis) as Port Clarence is moved to Nome.
  - Personnel at accessible sites is based on caretaker concept.
  - Personnel at remote sites based on lighthouse keeper concept with new minimal facilities for habitability.
  - The nature of maintaining Alaskan sites and equipments suggests that having a forward presence by an experienced Alaskan contractor is appropriate. Further, and as has been suggested by USCG, existing resources for the most remote station Attu exist at nearby Eareckson Air Force Station on Shemya.

ACO – Summary

- The US Congress and taxpayers have invested $160M in the recapitalization and modernization of Loran.
  - The recapitalization was necessary in part because the assets had originally been contemplated to be terminated at the end of 2000.
  - The modernization is a response to the question “What future role could Loran play in the position, navigation, and timing infrastructure?” and in particular is geared towards permitting users of the system the capability (alternate to GPS) to perform aviation non-precision approach, and maritime harbor entrance and approach as well as continuing to provide precise time.
  - Expansion will be the result of commitment to eLoran as enduring back-up to GPS.
- Many of the decisions on how to recapitalize the system were made prior to the final recommendations on what modernizations were needed and were prudently conservative.
- Still unrealized in the recapitalization is the potential de-manning of the stations by USCG thereby providing significant cost savings to their stated annual operation and maintenance cost of $27M.
- Implementing ***all*** recommendations will result in a modernized eLoran system with an operating cost of $11.5M per year.

ACO – Industrial Firms and Agencies Contacted

Industrial Firms Contacted	
Name	**Location**
Alaska Native Corp	
Chugach McKinley	Anchorage, AK
Battery Backup	
APC Government Division	Kingston, RI
Building Hangers	
US Buildings	Deerfield Beach, FL
Communications	
Mackay Communications	Raleigh, NC
AT&T Alascom	Alaska
Diesel Power	
Generac Power Systems	Waukesha, WI
Simplex	Springfield, IL
Core Engineering Solutions	Herndon, VA
Electric Rates	
Energy Information Administration	www.eia.doe.gov
Electrical Power	
Iannuzzi Contracting & Consulting Inc.	Andover, MA
Environmental Control Units	
Wenslau Engineering	Pasadena, CA
Fire Protection	
Fenwal/ASSI	Peabody, MA

Industrial Firms Contacted	
Name	**Location**
Loran Stations	
Lorsta Jan Mayen	Norway
Lorsta Vaerlandet	Norway
Control Center Brest	France
Shelter Manufacturers	
Gichner Shelter Systems	Dallastown, PA
AAR Cadillac	Wood Dale, IL
Alkan Shelter	Fairbanks, AK
Towers	
Stainless Inc.	North Wales, PA
Swager Communications	Fremont, IN
Austin Insulators	Ontario, Canada
Sabre Towers	Sioux City, IA
Radian/Rohn/LeBlanc & Royal	Oakville, Ontario
Tower Engineering Corp.	Seattle, WA
Tower Inspection Inc.	Muskogee, OK
Transportation	
Hageland Aviation	Nome, Alaska
Northern Air Cargo	Nome, Alaska
Penn Air	Anchorage, Alaska
Era Aviation	Anchorage, Alaska