TDA Syncrolift Study

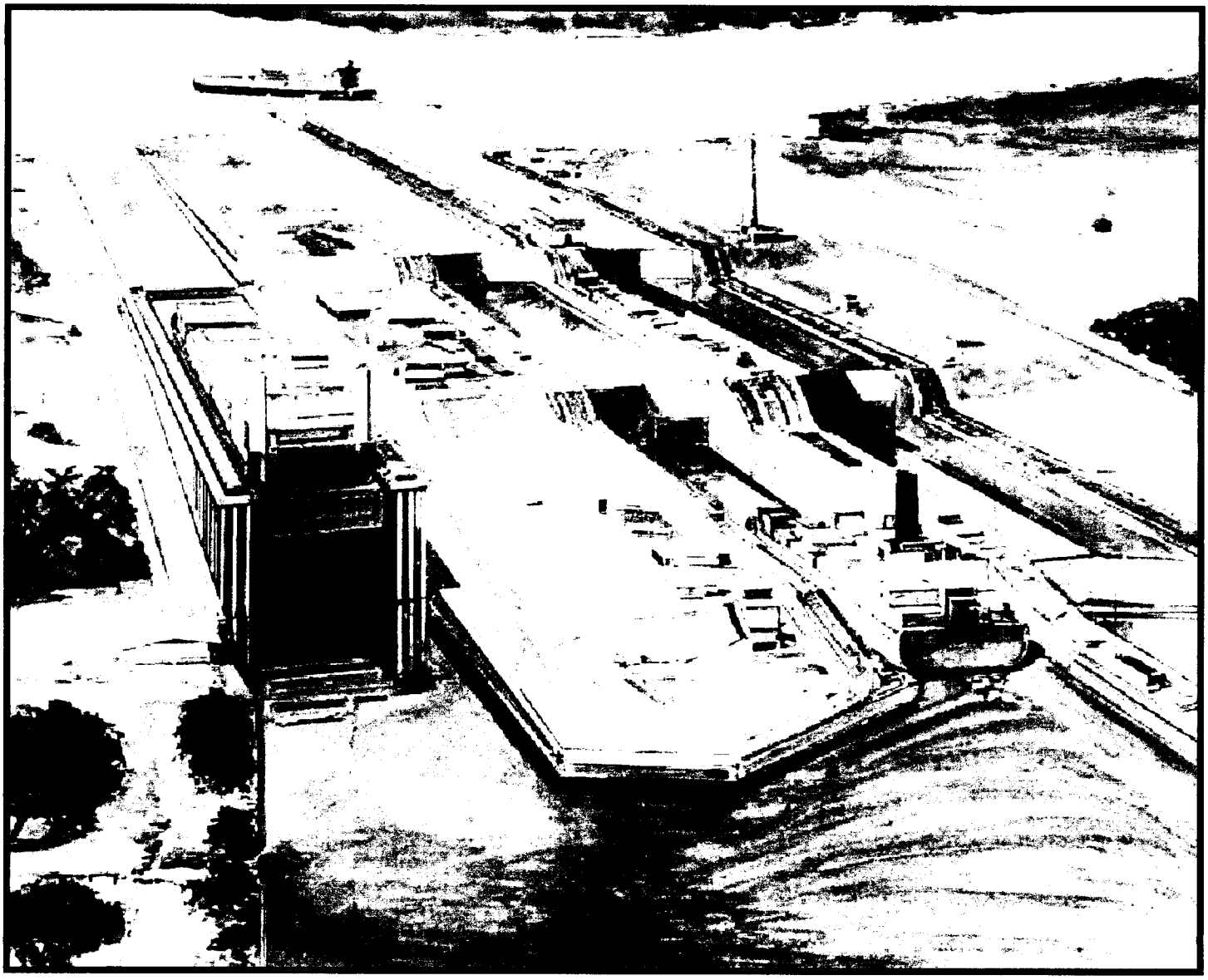
Estudio del Sincro-Elevador de TDA

Syncrolift, Inc.

Febrero del 2000

Resumen Ejecutivo

SYNCRO LIFT



TDA Syncrolift® Study Progress Report

Phase I Results

February 2000

Executive Summary

Introduction

In March 1999 Syncrolift, Inc. began a $1.2M study to assess the feasibility of using Syncrolift shiplift technology to design a chamber-type shiplift that could be used to provide additional capacity in the Panama Canal. The lift would be designed to efficiently handle the smaller vessels, which use the same amount of water as large vessels – but pay far lower fees. This report covers the Phase I study results including: system design parameters, chamber sizing and selection, system performance analysis, hydrodynamic testing, wire rope testing, and saltwater mitigation measures.

Proposed Dimensions

The system principal dimensions are:

	Maximum Size Vessel	Chamber Interior	Chamber Gate Sections
Length (m)	192.0	198.1	242.0 (overall)
Beam (m)	25.3	26.5	28.3
Draft (m)	9.3	10.1	12.6

Projected Throughput

Based on data provided by the PCC for the years 1995 – 1998, the proposed system would be capable of servicing 49.2% of the vessels transiting the Canal while saving 70% of the water compared to the existing locks. Annual transits which could have been accommodated by such a lift ranged from 6,600 (47.0% - 1998) to 7,700 (51.7% - 1995). In order to maintain the PCC target Canal Waters Time (CWT) of 18-20 hours for smaller vessels, a practical limit for the system would be approximately 7,000 transits per year (47.0%).

Hydrodynamic Testing

Results from the hydrodynamic model tests conducted at the University of Michigan were in agreement with the full-scale measurements taken by the US Army Corp of Engineers in April-1999. Vessels entering at reasonable speeds are expected to generate a temporary 0.60 – 0.90m rise in water level (surcharge) at the closed end of the chamber as the entering vessel restricts the area for exiting water. The same phenomenon occurs as the vessel exits the chamber – the exiting vessel restricts the area for entering water, causing a temporary decrease in the chamber water level (drawdown). For the structural design of the chamber, both the surcharge and the drawdown can easily be accommodated within the design process. Phase II of the

study will analyze the dynamic effects of vertical and horizontal accelerations on the chamber and the implications for the structural design.

Wire Rope Performance

Wire rope performance has been one of the primary design considerations since proposing a Syncrolift type chamber-lift for the Panama Canal. To resolve this issue, Syncrolift is working with Bridon, International to determine the fatigue performance of wire rope under these conditions by conducting full-scale rope tests. Bridon is using a specially designed rope that includes a plastic compound integrated into the rope during the manufacturing process. The plastic keeps the strands from fretting against one another as the rope is worked, and provides a better rope topography to reduce contact stresses and wear at the sheave groove. The result is a rope whose fatigue performance is outperforming traditional all-wire rope construction by a factor of five for smaller diameter ropes. While the results are extremely favorable, the length of time required for testing has also extended the overall program. Testing will continue with larger diameter ropes to confirm existing fatigue performance projections.

Saltwater Mitigation

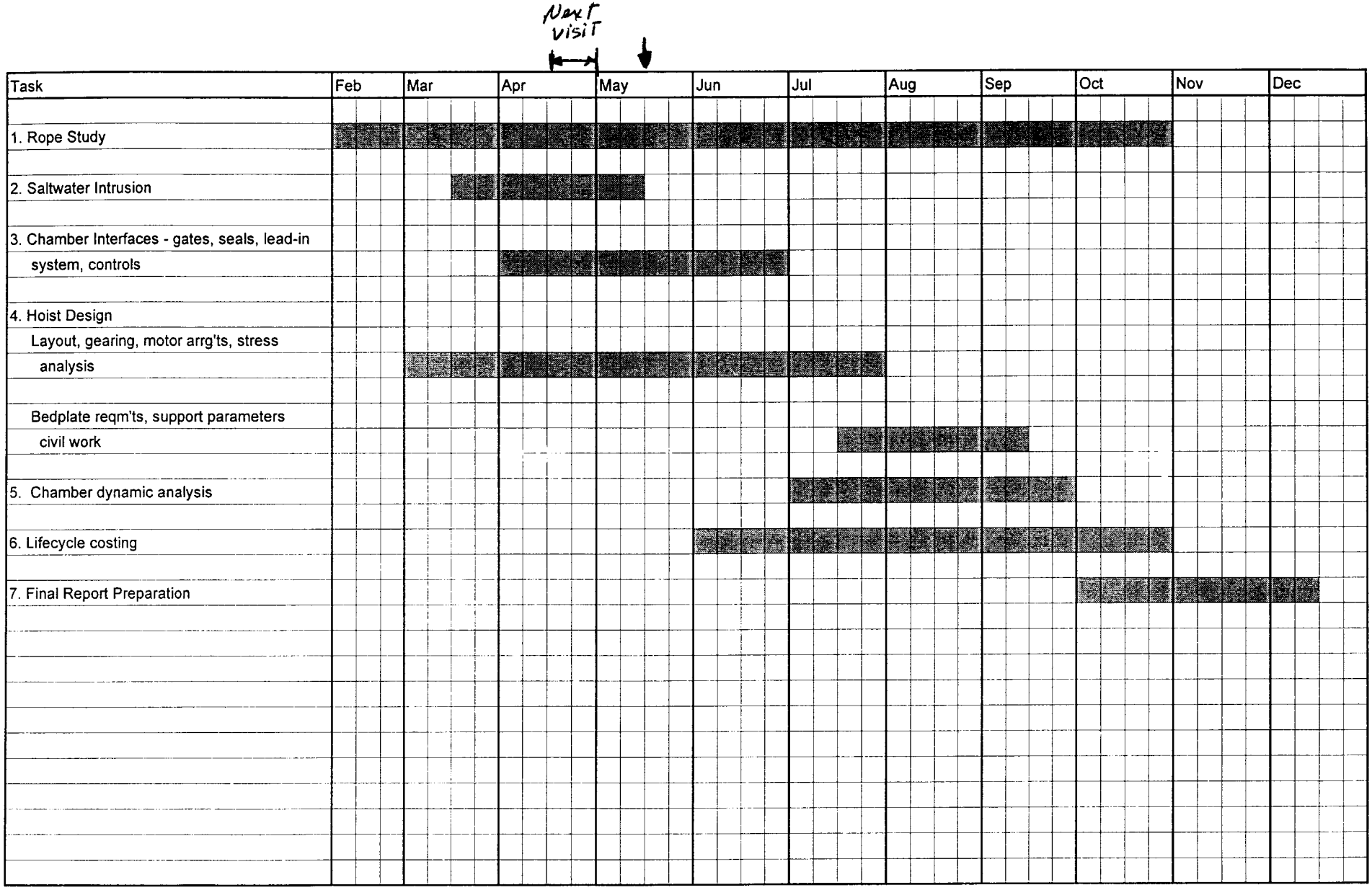
Another area of concern about adding Canal capacity is its effect on the salinity levels in Lake Gatun, which is the primary source of drinking water for most of Panama. A study by the US Army Corps of Engineers Waterways Experiments Station (WES) determined that a Syncrolift system, unmitigated, would raise the salinity of Lake Gatun beyond the allowable standards for drinking water within 5-7 years from the start of operations. To mitigate this unacceptable situation, a saltwater exchange system has been incorporated that will drain saltwater from the bottom of the chamber through ports located in the gate recesses, while freshwater flows in through entrance ports, or a partially opened gate, at the top. The saltwater would be removed without any intrusion into Lake Gatun or Gaillard Cut. Although some freshwater will be used during regular operations, the system still offers a 70% freshwater savings compared to the existing locks. The saltwater exchange system will be numerically modeled and validated during Phase II of the study.

Way Forward

Phase II of the study will continue through 2000, building on the results of Phase I with continued analysis of the chamber, including the gates and saltwater mitigation system, plus the preliminary design of the hoist. Syncrolift will also provide life-cycle cost estimates and work with a PCC-selected third party to review the civil foundation requirements and design. All work is expected to be complete by the end of 2000.

TDA-Syncrolift Study

Phase II Schedule



Conclusions

Based on the progress to date, the Syncrolift system is an effective means of providing additional capacity for the Panama Canal. Sized to handle almost 50% of the existing traffic, the Syncrolift system is nearly equivalent to adding another full-size lane, but with a shallower draft that would not be affected by el Niños, or other conditions where freshwater is in short supply. Despite the freshwater usage for mitigating saltwater intrusion, the Syncrolift system is still the most effective alternative for conserving freshwater, offering a 70% savings over the existing locks.

To confirm the Syncrolift system as a practical alternative to traditional locks, there are several assumptions from Phase I that should be validated through further study.

1. Approach Channels – Because the Syncrolift system depends on two-way operations for its efficiency, the channel layouts and operating procedures should be considered and discussed to realistically determine their impact on vessel processing times, and to ensure practical implementation.

2. Saltwater Intrusion – The saltwater mitigation system should be modeled to determine the effect on processing times and validate freshwater usage assumptions. This will be done during Phase II of the study.

3. Lift/Lower Times – The current model lifts and lowers at the same speed. Further investigations should determine if the system can lower at a faster rate, and the associated impact on vessel processing times.

Phase II of the study will provide information regarding lifecycle costs and civil requirements, plus additional work on the design of the hoists, chamber, and gates. Once complete, there should be sufficient information to conclusively determine the feasibility, and viability, of proceeding with a Syncrolift system design to provide additional capacity to the Panama Canal.