



# TRANSITIONING FROM COBALT TO IMRT THE GUATEMALA EXPERIENCE

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2nd Virtual Roundtable on Strengthening the Coordination of International Programmes and Organisations involved  
in the Adoption of Alternative Technologies to Radioactive Sources in Support of Radiological Security

27 April, 2021



# GENESIS OF PROJECT

## Radiotherapy at the Instituto de Cancerología and Hospital Dr. Bernardo del Valle S (INCAN)

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### Introduction

From February 17 to 19 we visited the INCAN cancer institute in Guatemala as part of a Washington University in Saint Louis (WUSTL) and INCAN collaborative effort. A second visit took place on March 7 to evaluate the guidelines and treatment protocols. The collaboration was mediated by Josepina Ramirez who spends 50% of her time as a Public Health Division faculty at WUSTL and the rest in Guatemala, and Eduardo Chantre, a cancer surgeon at INCAN. The focus of this report will be the INCAN facility, where we spent most of our time, although we were also able to briefly visit two radiotherapy private practices: La Asociacion and Hope.

The Instituto de Cancerología de Guatemala provides comprehensive cancer services to the low-income population in Guatemala. For comparison, Guatemala has 63% of the area of the state of Missouri. In 2011 the population in Guatemala will reach an estimated 13.8 million inhabitants (1.6 times the population of Missouri), with a yearly cancer incidence of 119 new cancer cases per 100,000 inhabitants.

Guatemala is divided into 22 departments. All radiotherapy services are centralized in Guatemala City. There are 4 facilities: Instituto INCAN, which is the only public facility, and Hope, La Asociacion, and La Esperanza that treat private patients. Both Hope and La Asociacion are owned by 21st Century Oncology, and La Esperanza is independently owned. There are 8 radiation oncologists in Guatemala, most of which were formally trained in Missouri, Spain. There are 7 radiation oncologists at INCAN, all of whom work at the La Asociacion private practice. Asociacion has one 15-View Linear Accelerator with OBI. Hope has one Varian Trilogy with OBI and a ProtonBeam BOM unit, and La Esperanza has 2 Varian linear accelerators and one OBI unit.

The La Asociacion private practice where all INCAN physicians enter has physical facilities, technology, staffing, and supplies similar to most US small private clinics. Our physical, non-financial, and non-radiation oncologist staff the clinic. Treatment planning is with Eclipse, and can deliver 3D, IMRT, IGRT, and stereotactic treatments to the brain treating more than 100 cases the previous day.

INCAN treats approximately 120 patients per day, while La Asociacion treats 70. Because of the uncontrolled nature of cancer activity, the patients bring that burden over, for example the San Marcos departmental cancer rates #17 in (right map below), may have to travel up to 12 hours through a river to receive treatment being conditions to reach INCAN.

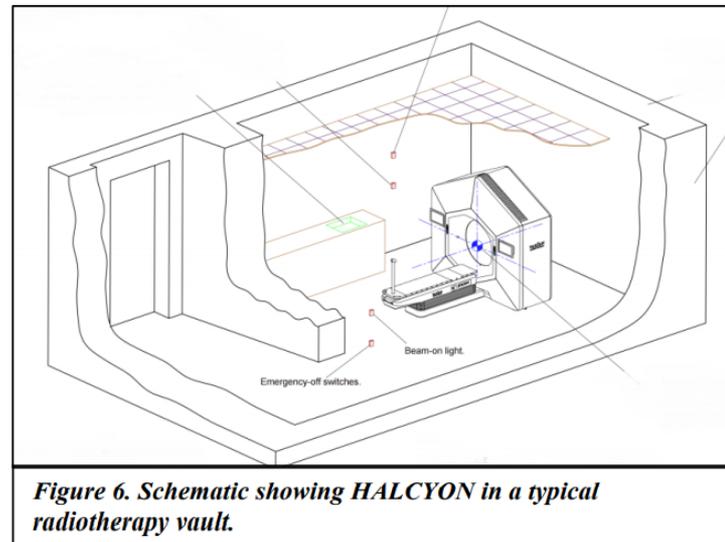


INCAN (marker in the center of Guatemala). Distance to center of Guatemala 235 miles, as #17 in the above map, and San Marcos #17.



Guatemala's 22 Departments. Guatemala City is #17 in the above map, and San Marcos #17.

In addition to Spanish, the official language, a total of 23 Mayan Languages, and two non-Mayan Amerindian languages: Xinka and Ch'orti are spoken in Guatemala.



**Figure 6. Schematic showing HALCYON in a typical radiotherapy vault.**

2015 INCAN Radiotherapy Evaluation Report  
José García Ramírez & Hiram Gay

2017 Sasa Mutic proposes implementing the Halcyon at INCAN, a secret Varian project few were privy to

# TRANSITIONING TO IMRT

From Co-60 to linear accelerator



Cirrus



Varian Halcyon 2019

# PROVIDING STATE OF THE ART RADIOTHERAPY EQUIPMENT IN THE REFERRAL CANCER HOSPITAL LIGA/INCAN IN GUATEMALA

GRANT / COOPERATIVE AGREEMENT NUMBER: **AID-ASHA-G-17-00006**

Objective	Estimated # Months	Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
		Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept
<b>Specific Objective 1 - Purchase and install Varian Halcyon system at LIGA/INCAN</b>	15																								
Site preparation design and regulatory approvals	3																								
Site preparation	3																								
Purchase Halcyon	3																								
Shipment, installation and acceptance testing	3																								
System commissioning and clinical training	2																								
Clinical deployment and rampup	4																								
<b>Specific Objective 2 - Develop LIGA/INCAN as a radiation therapy center of excellence demonstration site</b>	18																								
Specification and outline of diseases specific treatment protocols	3																								
Creation of training materials	6																								
Clinical training and preparation for clinical deployment	6																								
Clinical deployment and quantification of implementation metrics	3																								
Monitoring of clinical deployment and preparation of publications on the program model	6																								

2018 2019

2020

# TRANSITIONING TO IMRT



# STAKEHOLDER ROLES

Stakeholders	Role
<ul style="list-style-type: none"><li>• LIGA</li><li>• INCAN</li><li>• WashU</li><li>• Varian</li><li>• USAID</li><li>• NNSA</li><li>• Ingeniería y Física Médica Exrad S. A. de C. V.</li><li>• Golden Security Services (GSS)</li><li>• Guatemala Government</li></ul>	<ul style="list-style-type: none"><li>• Bunker renovation and bunker funding</li><li>• Clinical implementation</li><li>• System commissioning and clinical training</li><li>• Halcyon installation and subsidy</li><li>• Equipment funding</li><li>• Cobalt removal</li><li>• NNSA subcontractor, Picker and Theraton source moving and exportation</li><li>• NNSA subcontractor, move Cirus French source to national graveyard CENDRA</li><li>• Radioactive source permits (use, storage, transportation, exportation)</li></ul>

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

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## Co-60 Teletherapy



Cirus

April 2019

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

## Co-60 Teletherapy



Picker V90



April 2019

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

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## Co-60 Teletherapy



Theratron 780

April 2019

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

- Transportation permit
  - Cirus – until MAY 2021
  - Picker and Theraton – until OCT 2021
- Exportation permit
  - Picker and Theraton – until JUL 2021
- Temporary storage permit
  - for the previous 3 sources – until NOV 2021



# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

## Brachytherapy



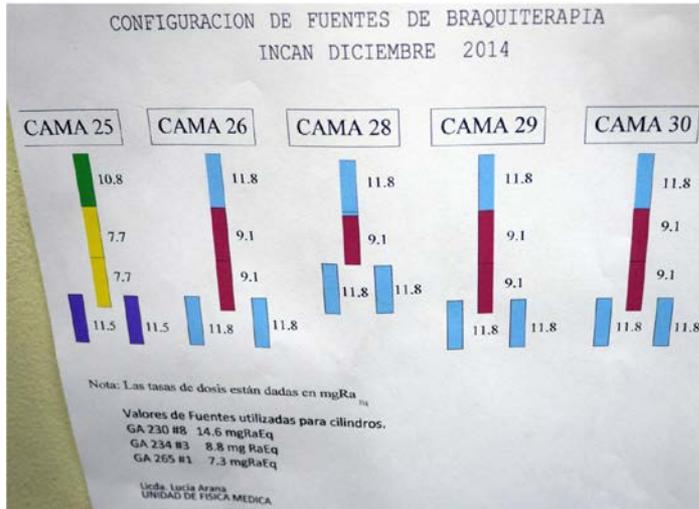
Cs-137 Curietron MDR  
not in use



SagiNova Co-60 HDR  
2018 - present

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

## Brachytherapy – Low Dose Rate (LDR)



27 Cs-137 LDR sources still in use > 20 years old



Rubber gloves are used to hold the Henschke applicator ovoids, and the tandem and ovoid configuration.

# TRANSITIONING TO IMRT

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## 2D to 3D Simulation



Huestis 2D simulator

CT 3D simulator 2021

# PENDING TASKS

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- Expatriation of radioactive sources: Co-60 teletherapy units, Cs-137 Curietron
- Inauguration of new CT simulator
- Transitioning brachytherapy from LDR/HDR to HDR exclusively
- Electronic Medical Record (EMR) system
- Increase funding for INCAN: government funding and fundraising

# LESSONS LEARNED

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<b>Onsite Visit</b>	<ul style="list-style-type: none"><li>• Photographs</li><li>• Native Language Speaker</li></ul>
<b>Project Manager</b>	<ul style="list-style-type: none"><li>• Ensure regular communication</li><li>• Keep track of project milestones</li><li>• Understanding of funding mechanism(s)</li></ul>
<b>Institutional Leaders</b>	<ul style="list-style-type: none"><li>• Leadership support from each partner site</li><li>• Vision of overall project goal and realistic objectives</li></ul>
<b>Language</b>	<ul style="list-style-type: none"><li>• At least one member fluent in local language</li></ul>
<b>Team Buy-In</b>	<ul style="list-style-type: none"><li>• Team member buy-in critical to successful execution of project activities</li></ul>

# LESSONS LEARNED

<b>Local Champion(s)</b>	<ul style="list-style-type: none"><li>• At least one local champion at each institution to engage local team members</li><li>• Can engage local and partner institution leadership</li><li>• Fully paid by the institution with competitive salary without conflicts of interest with private practices</li></ul>
<b>Institutional governance</b>	<ul style="list-style-type: none"><li>• Understanding institutional governance provides key insights to successfully complete joint projects</li><li>• For this partnership, the OSI is governed by two entities, the league (LIGA) that manages the finances and INCAN (hospital) that runs the radiation oncology department</li></ul>
<b>Cultural intelligence</b>	<ul style="list-style-type: none"><li>• Cultural familiarity can make a difference between a project failing or succeeding</li></ul>



SITEMAN

Children's



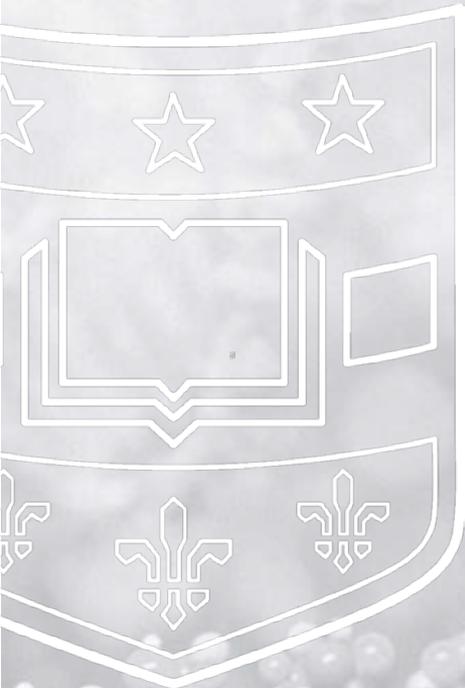
**SITEMAN**  
CANCER CENTER



Washington  
University in St. Louis  
SCHOOL OF MEDICINE

**BJC** HealthCare

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 **Washington**  
University in St. Louis  

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SCHOOL OF MEDICINE

Radiation Oncology

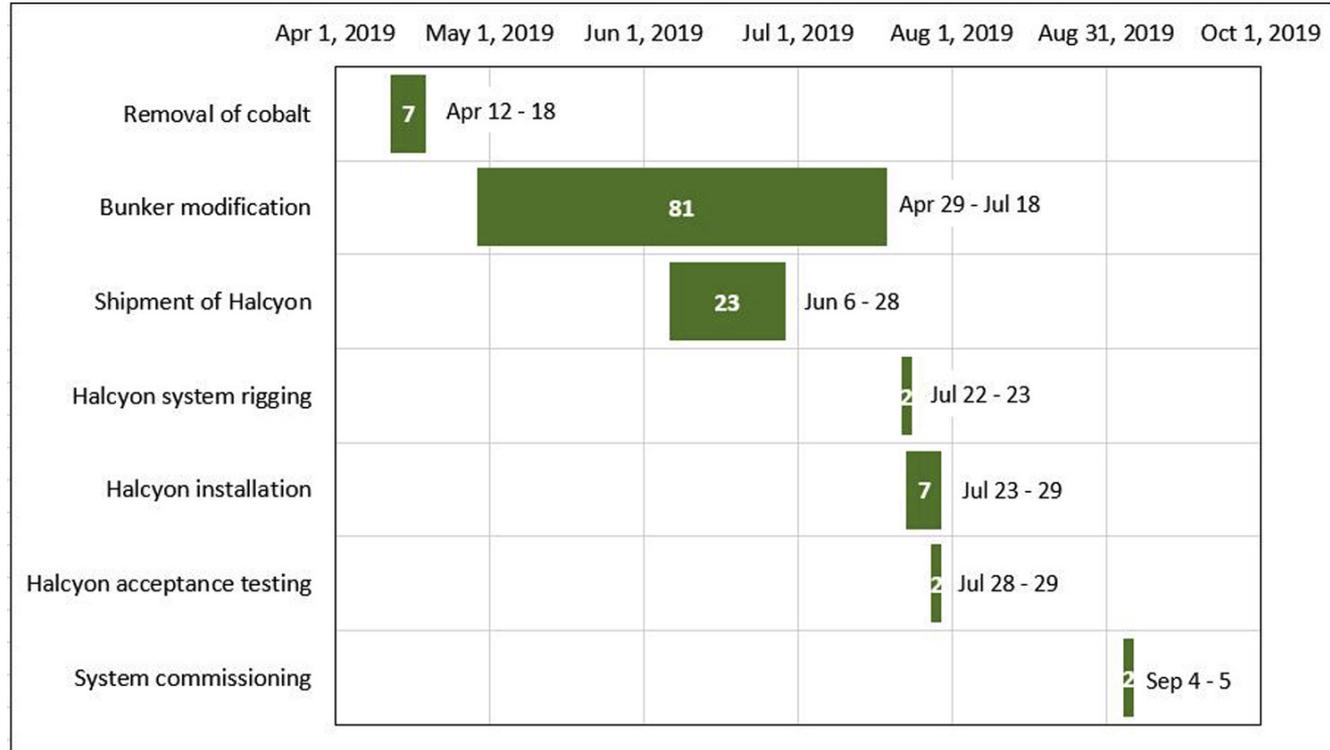
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[@WashURadOnc](https://twitter.com/WashURadOnc)

# BUNKER MODIFICATION AND EQUIPMENT INSTALLATION



# MILESTONES

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- **Purchase of Halcyon, October 2018 – January 2019:** completed.
- **Site preparation design and regulatory approvals, October 2018 – April 2019:** The Cobalt was moved to another room by a Mexican company, Ingeniería y Física Médica Exrad S. A. de C. V.
- **Site Preparation, May 2019 – July 2019:** The room renovation was completed on July 18.
- **Shipment, installation, and acceptance testing, June 2019 – August, 2019:** The Halcyon arrived in Guatemala on June 28 and installation and acceptance testing was completed on July 29.
- **System commissioning and clinical training, April, August - September, 2019:** Completed in September.
- **Develop disease site specific protocols at (USO) specific for the Halcyon (July, 2019 – September, 2020):** protocols have been shared and will continue to be exchanged.

# MILESTONES

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- **Clinical deployment and ramp-up (August, 2019 – September 2020):** completed.
- **Create training materials (September – September, 2020):** materials have been developed and shared, and will continue to be created after the project ends.
- **Deploy the training materials and clinical protocols for use at LIGA/INCAN (July – September, 2020):** this is a continuous process.
- **Clinical Deployment and preparation of implementation metrics (January, 2020 – September, 2020):** This is ongoing.
- **Monitoring of clinical deployment and preparation of publications on the program model (April – September, 2020):** One manuscript is published in a peer reviewed journal; three posters will be presented at the American Society for Radiation Oncology. Collected data is being analyzed and prepared to publish.

[Taking Guatemala From Cobalt to IMRT: A Tale of US Agency Collaboration With Academic Institutions and Industry.](#)

Velarde A, Najera KD, Gay H, Powderly WG, Mutic S, Green J, Michalski JM, Henke L, de Falla V, Laugeman E, Catu M, Hugo GD, Cai B, van Rheenen J. Int J Radiat Oncol Biol Phys. 2020 Aug 1;107(5):867-872. doi:

10.1016/j.ijrobp.2020.04.001.PMID: 32698977

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

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Security keypad - 2015

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

Sources no longer in use

## TELETERAPIA

No	Radioisótopo	Marca	Modelo	Serie	Actividad máxima a noviembre 2018 (Bq/Ci)
1	Co – 60	Picker	1373-B	S/B 120	12.33 TBq / 333 Ci
2	Co – 60	Theratron	NPTT	S/N T – 15Z1	24.38 TBq / 658 Ci
3	Co – 60	CIS-BIO	CIRUS	90129	21.08 TBq / 570 Ci

## BRAQUITERAPIA

Fuentes de Cesio-137 EN DESUSO contenidas en el equipo CURIETRON CUPJCS 5A No. 029 Casa matriz: CIS Bio International	
Modelo CSM-40	Actividad (mCi) al mes de noviembre de 2018
T473	474.89
T474	469.19
T424	467.29
T423	464.44
T476	462.54
T472	461.59
T471	456.84
T477	440.70
T422	440.70

# SCOPE OF THE RADIOACTIVE SOURCE PROBLEM

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## Brachytherapy - Low Dose Rate (LDR)



Treatment bed and  
shielding



“Cesium implants radiation restricted area  
no trespassing by unauthorized persons”