Energy Technology Entrepreneurship

Pedro T. Santos – Founder/Director

Hicor Technologies, Inc.
COMPANY INTRODUCTION
Conventional vs Multiphase Production
## Compressor Types and History

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1667</td>
<td>Origin of pump</td>
</tr>
<tr>
<td>1689</td>
<td>Origin of centrifugal compressor</td>
</tr>
<tr>
<td>1769</td>
<td>Single acting steam engine patent</td>
</tr>
<tr>
<td>1791</td>
<td>First gas turbine patent</td>
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<tr>
<td>1814</td>
<td>Invention of valve (for brass instrument)</td>
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<tr>
<td>1860</td>
<td>Invention of piston ring (for steam engine)</td>
</tr>
<tr>
<td>1890</td>
<td>Invention of practical ball bearing</td>
</tr>
<tr>
<td>1892</td>
<td>First reciprocating compressor</td>
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<tr>
<td>1895</td>
<td>Invention of practical valve for compressor (Hoerbiger)</td>
</tr>
<tr>
<td>1899</td>
<td>First practical centrifugal compressor</td>
</tr>
<tr>
<td>1935-1945</td>
<td>Various screw compressor concepts tested</td>
</tr>
<tr>
<td>1950’s</td>
<td>Significant growth of reciprocating compressors</td>
</tr>
<tr>
<td>1952</td>
<td>First installed rotary screw compressor</td>
</tr>
<tr>
<td>1968</td>
<td>First commercial high-speed air-cooled separable compressor, Ariel (current industry standard)</td>
</tr>
</tbody>
</table>
Company Timeline

**2009**
- **NOV 2009**
  - Launched in Boston by two MIT students

**2010**
- **MAY 2010**
  - Technology concept conceived
- **NOV 2010**
  - First prototype build

**2011**
- **APRIL 2010-OCT 2011**
  - Funding from business competitions and grants
- **MARCH 2011**
  - Funded by Mertz Holdings
- **MAY 2010-APRIL 2011**
  - Funding from business competitions and grants

**2012**
- **MARCH 2011**
  - Proof of concept for complete compressor achieving near isothermal conditions (Unit 1)
- **DEC 2011**
  - Funding by Energy Ventures and Chevron
Company Timeline

2012
- AUG 2012-DEC 2013
  Second prototype engineered and tested (Unit 2)
- SEPT 2012
  Houston office and lab established

2013
- JULY 2013-NOV 2014
  Third prototype engineered and tested (Unit 3)

2014
- AUG 2014 - CURRENT
  Pre-production unit engineered and tested
  (Units 4 and 5)

2015
- Q3 2015 – Q3 2016
  Field package design and build

FIELD TRIALS
September 2016
Unit 1
CONCEPT DESIGN
2011-2012
Confirm Technology
Large compression ratios while maintaining low temperatures with liquid injection and atomization

Unit 2
WORKING PROTOTYPE
2013
Confirm Components Design and Manufacturing Processes
All the components are designed for manufacture and assembly and the product performs to basic specifications

Unit 3
WORKING PRODUCT
2014
Product Performance Verification
Steady performance at varying test conditions of pressures and speed combinations maintaining constant operating temperatures and flow rates

Units 4&5
DURABLE PRODUCT
2015
Confirm Field-worthiness and Durability
Performance to specified field maintenance interval cycle

Product Evolution

Current State
Sept 2016 and on
FIELD UNIT
Lab Buildout – October 2012 to Present

Then:

Now:
Testing Video

OsComp Systems
May 1, 2014
Compressors in the Energy Industry

**Upstream**
- Wellhead compression
- Onshore gathering, gas injection, CO2 injection
- Offshore platforms and floating structures

**Power Generation**
- Fuel gas boosting
- Syngas, vent gas, nitrogen, CO2 and other air separation applications in integrated combined cycle natural gas facilities

**Midstream**
- Pipeline compression and transmission
- CO2 storage and transmission

**Petrochemical**
- Polyethylene and polypropylene manufacturing
- Booster and boil off gas service

**LNG / LPG / GTL**
- Gas compression / liquefaction
- Post-regasification compression into pipelines
- Boil off gas service

**Refinery**
- Hydrogen compression for hydrocracking, hydrotreating, desulfurization and other processes
- Hydrogen plants
- Flame, vent and coker gas service
Large Addressable Market

- $40B Compressor Market
  - Screw: 28%
  - Reciprocating: 39%
  - Centrifugal: 32%

- $18B Hydrocarbon Compressor Market
  - Process/Special: 34%
  - Reciprocating: 41%
  - Multiphase: 20%

- $11B Hicor Addressable Market
  - Multiphase: $4B
  - Reciprocating: $7B

High Pressure Vapor Recovery & Flare Avoidance
- >50,000 vapor recovery units will be needed to comply with EPA regulations
- Hicor enables unique no-recycle loops for high pressure vapor recovery at 2x conventional screw compressor discharge

Unconventional Midstream and Gathering
- Hicor is unique in wet gas and multiphase compression
- Existing recip market of >$7B which Hicor can outcompete on a package-package level

Wellhead Production Enhancement Onshore/Offshore
- Hicor 2016 field trials
- Demonstrates ability to increase production from liquid loaded and backpressured wells
- Untapped market of >$4B/yr

Offshore and Subsea
- Emerging major markets, with first subsea unit by Statoil in 2015
- Major fields, example with Gullfaks C w/ 22M barrels @ $160M compressor CAPEX
Management Team

Bill Sayre  
Chief Executive Officer  
25+ yrs in gas compression & processing  
Former Exterran VP of Compression  
Industry leadership, marketing and sales,  
gas compression senior executive  
and field service expertise

Jeremy Pitts  
Senior VP of Engineering  
Career in mechanical products  
development including Raytracker  
(acquired by First Solar)  
1st Employee at Hicor  
Caltech; MIT mechanical engineering

Jeff Martini  
Chief Operating and Financial Officer  
15yrs in oilfield finance experience in  
private equity-backed companies  
Former VP of Finance at  
Stewart & Stevenson  
Field operations + support background

Pedro Santos  
Founder / Director  
15+ yrs in compression industry  
Founded Hicor in 2009 while completing  
graduate degree at MIT  
Entrepreneurial engineering and business  
development background
ENERGY TECHNOLOGY DEVELOPMENT AND COMMERCIALIZATION PROCESS
Elements to Develop an Energy Technology Company

- Technical economic advantage
  - 10x benefit to your customer

- Big problem
  - >$10B market

- Applicable skills
  - Sales
  - Technology
  - Field

- Passion
  - You’ll need it when doing >100hrs/wk
Fundraising and Building out your Entrepreneurial Path

**Fundraising**
- Start with the problem
- Sell the future
- Address difficulties upfront
- Build a strong team

**Fundraising tips**
- Series A valuation is roughly the same
- Simple terms beats high valuation
- Things cost more and take longer
- Keep burn low for as long as possible and until you get paying customers
- Have internal and external plans
- Pitch first to friends, then to investors from whom you don’t want money

**Career recommendations**
- Work for an entrepreneur
  - Be ready to roll up your sleeves
- Fail miserably at sales, but try again and again until you become good at it
- Always reflect on your losses, will be many

**General observations about technology entrepreneurship**
- Don’t romanticize entrepreneurship
  - Uber
  - Apps
  - Energy
- Be ready to work hard for little money
- If you’re ok being poor and unloved, and will run through a brick wall, then go for it
It's more fun to be a pirate than to join the navy
—Steve Jobs