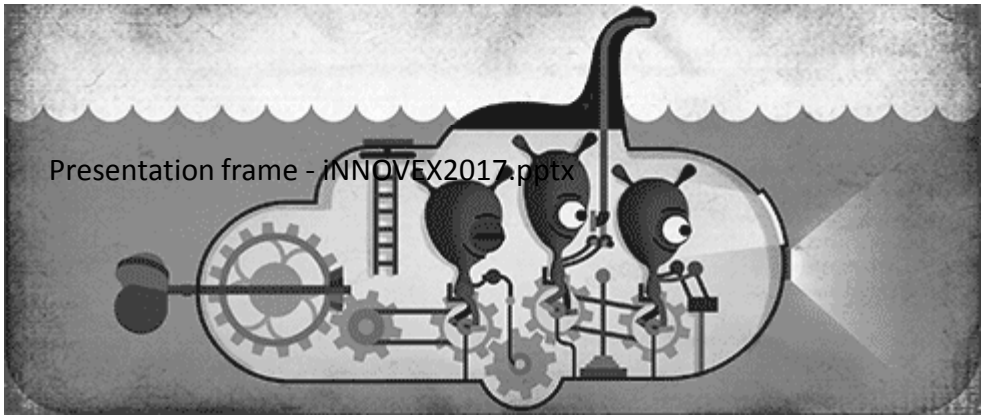
"Autonomic vehicle for water pipes inspection from the inside“



Dr. Menashe Rajuan

iNNOVEX2017

February 8, 2017

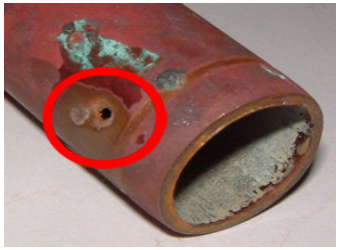
(Abbey) Road Map

- The need
- The market
- The vision
- The technology
- The net

The Need

While you are reading this sentence, 5000 cubic meter of fresh water are lost due to leaks in water pipes!!!

The UN estimates water lost due to water pipes malfunctions by 12Bm3/y!!!

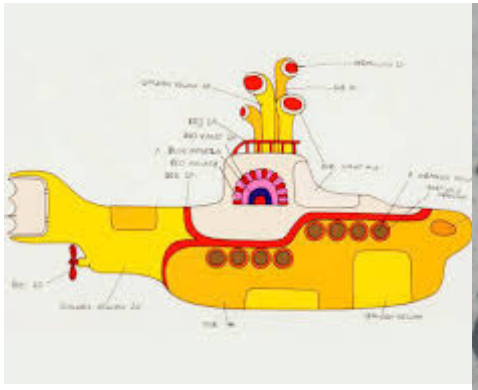


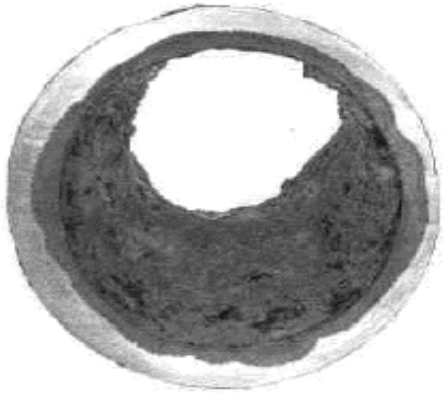
Water distribution networks – which are mostly underground - are the world's largest engineering infrastructures (100's millions km**) that do not receive direct periodical examinations.**

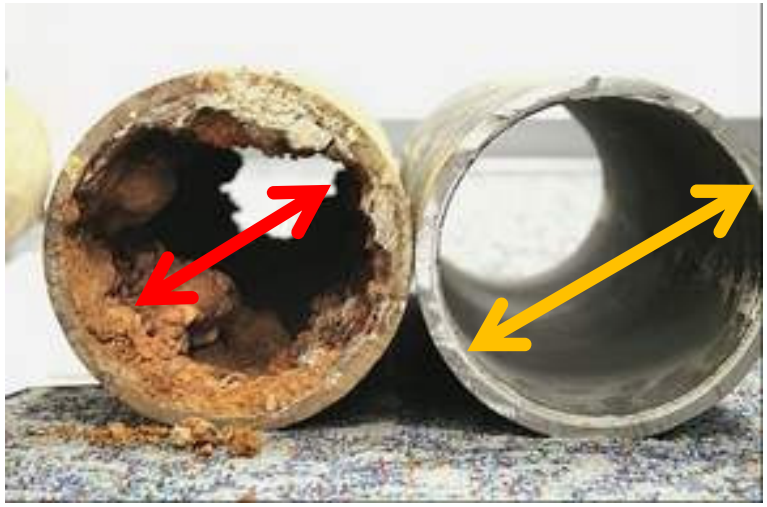
The Need

- Leaks:
  - 3%-5% in new systems (in Israel 5% ~ 75Mm3/y ~ Ashkelon)
  - 10%-20% regular
  - up to 50% in very old systems (sometimes in well developed countries)
- Pirate connections
- Pipe's condition – regular vs. break maintenance
- Valves conditions (Energy)
- Malfunctions study (evolution)
- Regulations – pipes' renew every 40 years (2.5% /y), ~ 2M $/km

PIPES Malfunctions







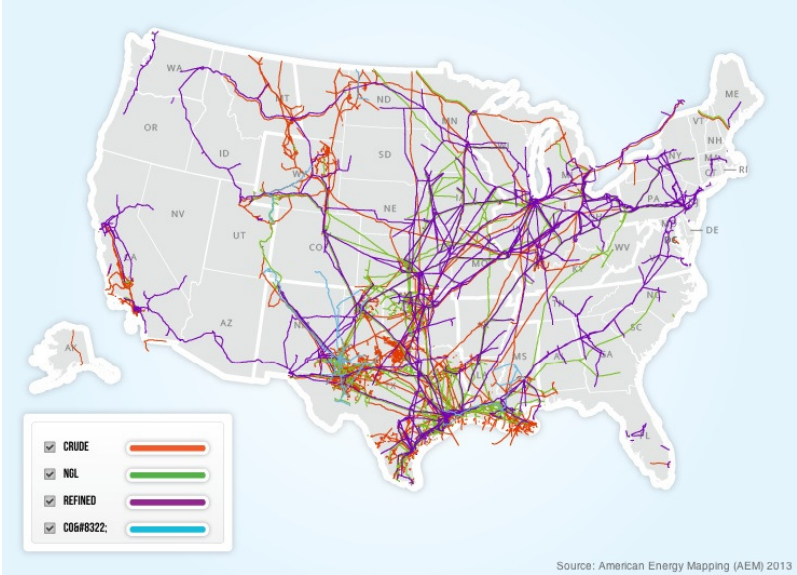
D1

D2

S1/S2 = SQR D1/D2

The Market

- **Prices**
  - **Inspection: ~2500$/km**
  - **Renew: ~2M$/km**
- **The world**
  - Hundreds of million km around the world
  - US about 100 million km (➔ **250$ trillion**)
- **Israel (Beta site)**
  - Mekorot 11,000 km (10” and up ➔ 250 km ➔ 500 M$) + 20 M$ (Energy)
  - “Hagihon” (Jerusalem) – 300 km (8” – 16”) ➔ 7.5 km ➔ 15 M$ (infrastructure)
  - About 50 public companies (average 100km/company): Total 500 M$



The Vision

A system continuously perform visual, audio, electro magnetic and ultrasonic inspection of fresh water pipes while in duty from the inside
to effectively and safely decrease water loses, detects pirate connections and prevents hazardous contaminates from developing inside the pipes

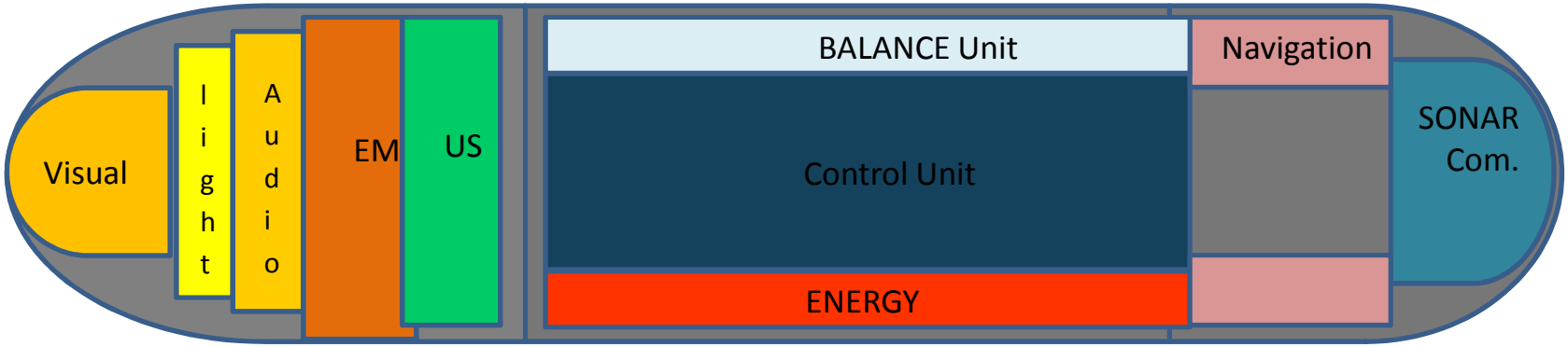
Operationally & cost effective, safe, saves water & energy resources

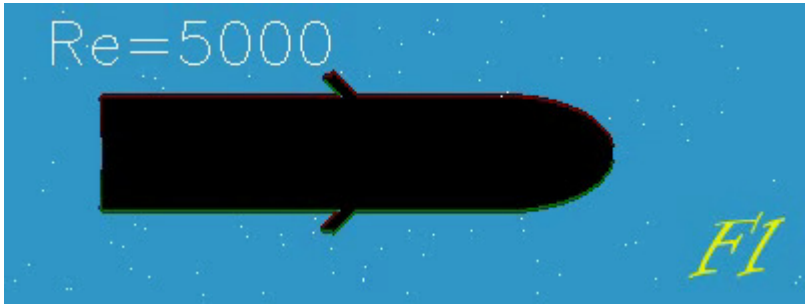
The Platform

The system consist of the following:

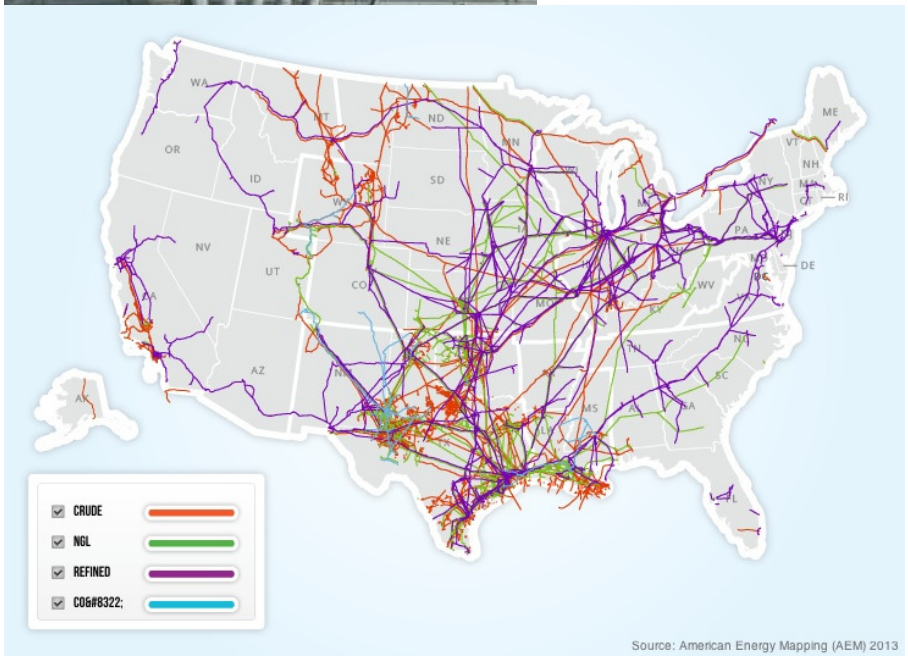
- An autonomic platform (the “Submarine”)
  - carrying a variety of sensors and data possessors,
  - capable of self navigation
  - a remote connection to the operation station
- Loading and un-loading systems
- Data Analysis system

The Platform





The NET


CRUDE
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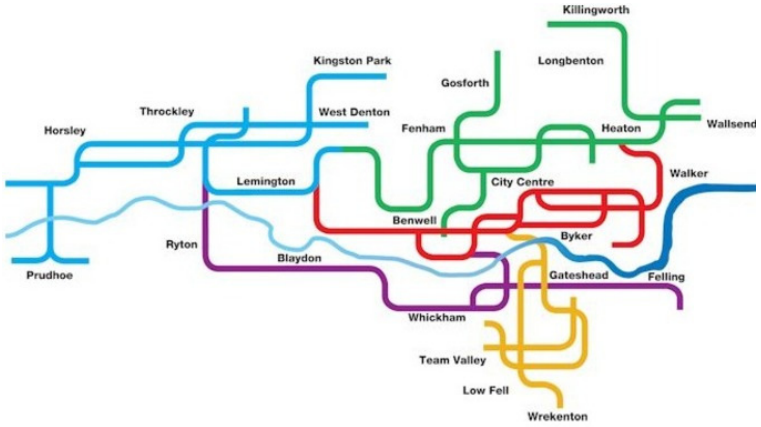
REFINED
COG#8322;
Source: American Energy Mapping (AEM) 2013


Killingworth
Kingston Park
Longbenton
Gosforth
Throckley
West Denton
Horsley
Fenham
Heaton
Wallsend
Lemington
City Centre
Walker
Benwell
Byker
Ryton
Blaydon
Prudhoe
Gateshead
Felling
Whickham
Team Valley
Low Fell
Wrekenton

The NET

- A train - Clusters (a swarm) of designated platforms moving together
- A net of sensors inside the pipes
- A net of load / unload terminals
- A net of recharge / download / comm. stations

Thank You

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