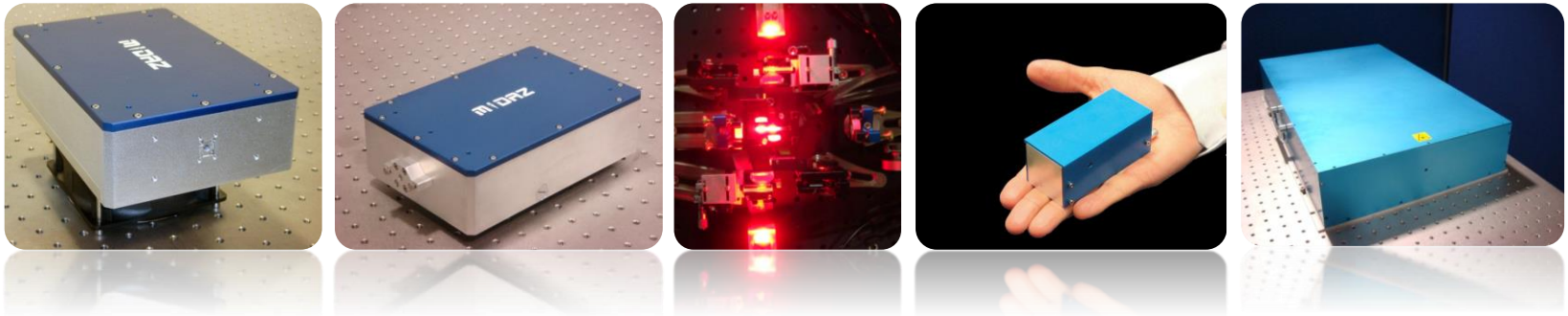
Imperial College London

MIDAZ

A Commercial Story:

Midaz Lasers Ltd – *from Research to Product to Exit*



Michael Damzen
Founder
Director & CTO

Presentation to “Siegman International School of Lasers”

10th August 2017

Academic → Spin-Out → Exit → Academic

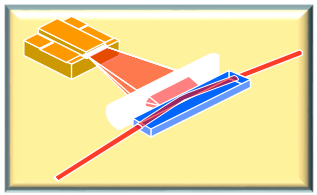
1983
PhD Laser Physics

1984
Lecturer

Research

High Power Lasers & Nonlinear Optics

Technology



1999 : Micro-slab amplifier

2004
Professor

Midaz Lasers Ltd

Spin-Out

2006

Imperial Innovations invests in Midaz Lasers

Midaz Lasers, a spin-out from Imperial College London, UK, is joining the race to provide high-power DPSS lasers for the booming part-marking sector. Imperial Innovations Group (IIG), UK, a technology-transfer company, has founded and invested £150000 (€220000) in the firm as part of a £300000 funding round.

According to Midaz, low manufacturing costs will make its laser

Joining the race: Ara Minassian (left) and Michael Damzen from Midaz Lasers.

sized or smaller – and a wall-plug efficiency of above 30%. Units will also have the option of being air- or water-cooled.

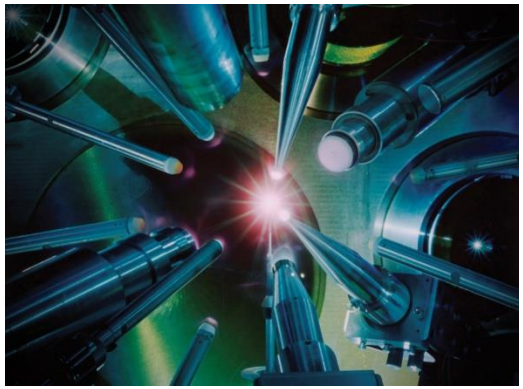
Damzen becomes the technology director of Midaz and is joined by his colleague Ara Minassian, the firm's co-founder and chief scientific officer. The board is strengthened further by the addition of IIG's non-executive director Paul Atherton as chairman.

2012

Exit

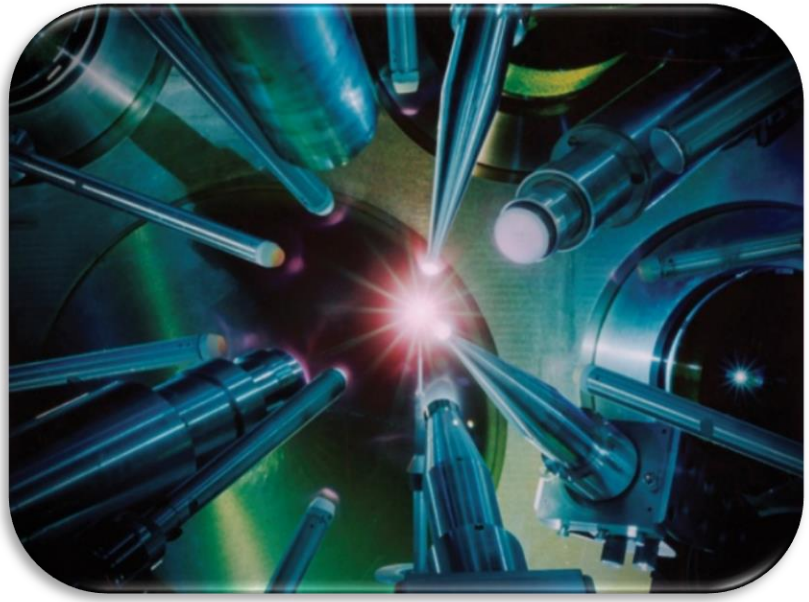
2013
Head of Photonics

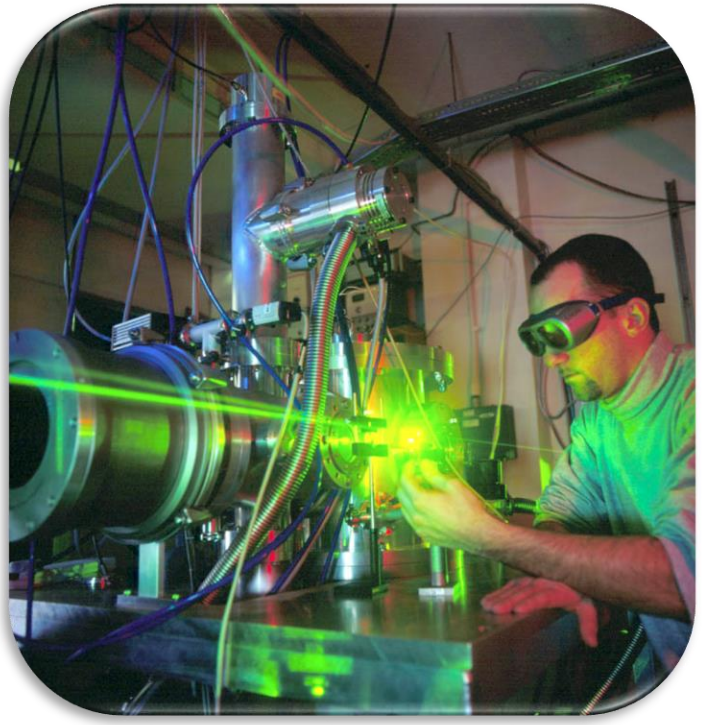
Mike Damzen – “the academic”



- Professor of Experimental Laser Physics @ Imperial College London
- Academic researcher for 30 years
  - Fellow of the Institute of Physics (IoP)
  - Fellow of the Optical Society of America (OSA)
  - 150 peer-reviewed journal papers
  - ~250 conference presentations
  - 2 books & 6 book chapters
  - 6 patents
  - ~ 40 successfully completed PhD students

Lasers = exciting science + enabling technology

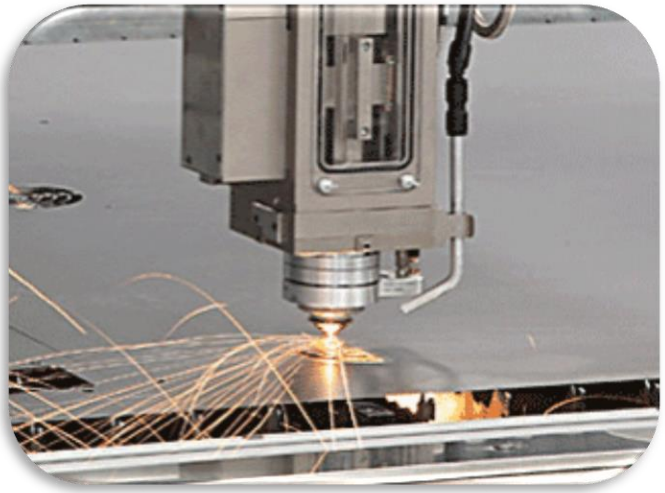




Lasers – Enable Our Modern World

Communication

Manufacture



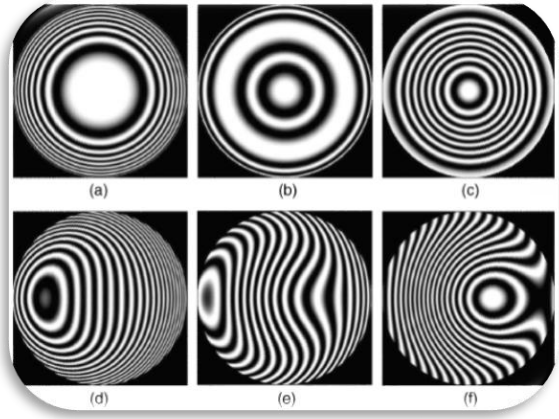
Medical

Limitless potential of Light!

Sensing

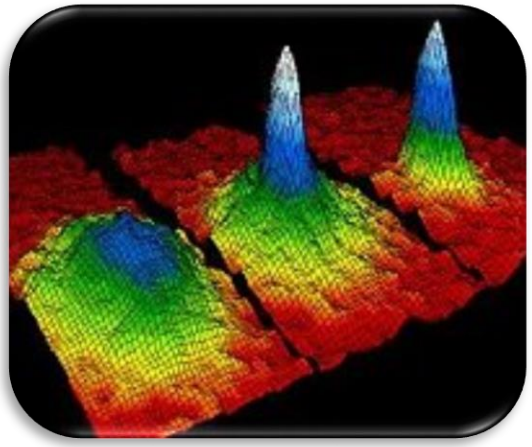
Projection

Metrology



Energy

Fundamental science

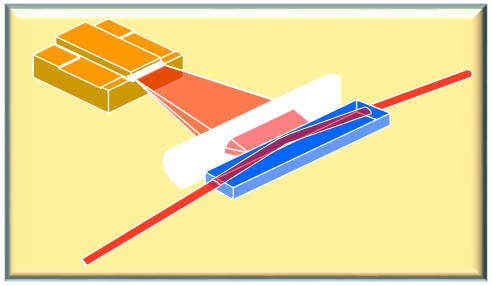


Defence

The Road to Spin-Out (1/2)

Technology

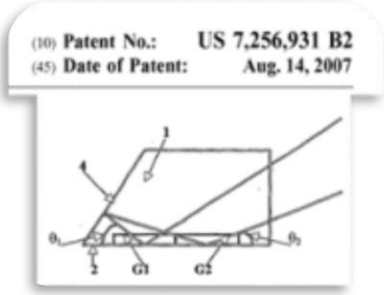
Micro-slab ultra-high gain laser amplifier technology (1999)



Ultra-high efficiency, high power lasers built since 2001

IP

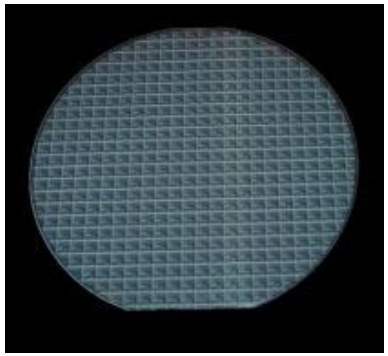
Key Patent Filed (2002)



Further Filings prior to company formation (2006)

Drive for Spin-Out

Strong Interest from multi-billion $ US company (2005)



The Road to Spin-Out (2/2)

Formation of Team:

Founder (CTO)
Co-founder (CSO)
Chairman (Business Angel)
Business Development Manager
Imperial Innovations (Director)
Finance Officer /Secretary

Formation of a Business Plan

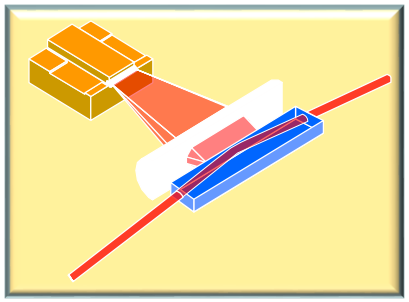
Freedom to operate secured

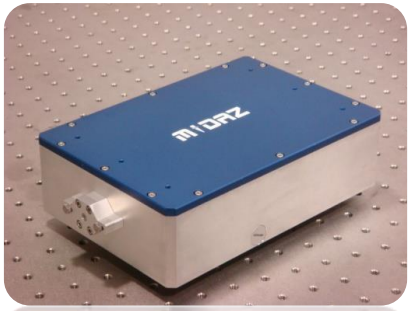
Pitch to Investors

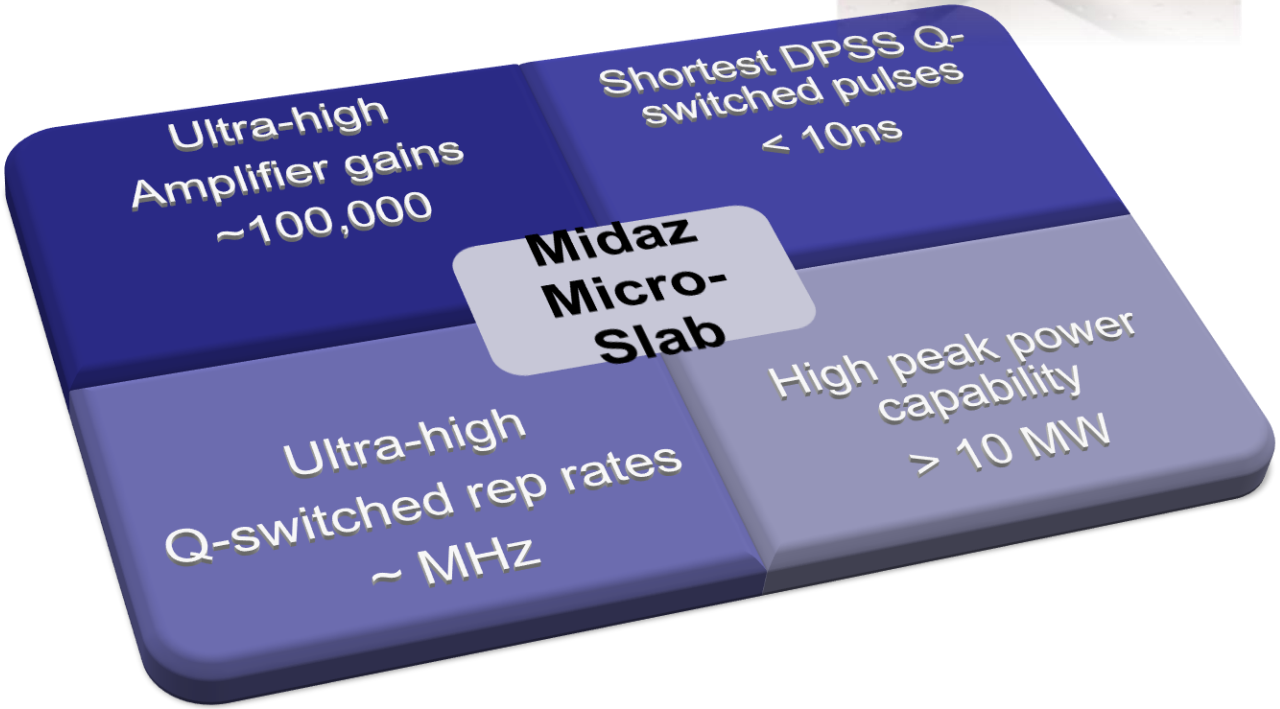
Investment & Company Operation Started June 2006

Performance breakthrough

World's highest gain solid-state laser amplifier





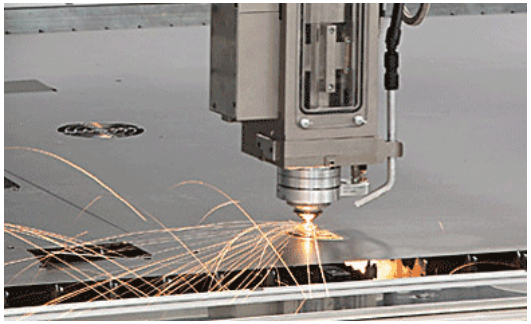


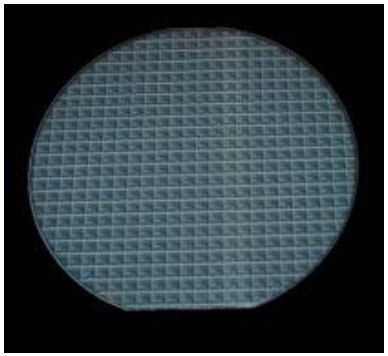

Carlsberg
ALC 4% VOL

Midaz Micro-Slab Technology

Key market: laser industrial manufacturing (~$2.5B)

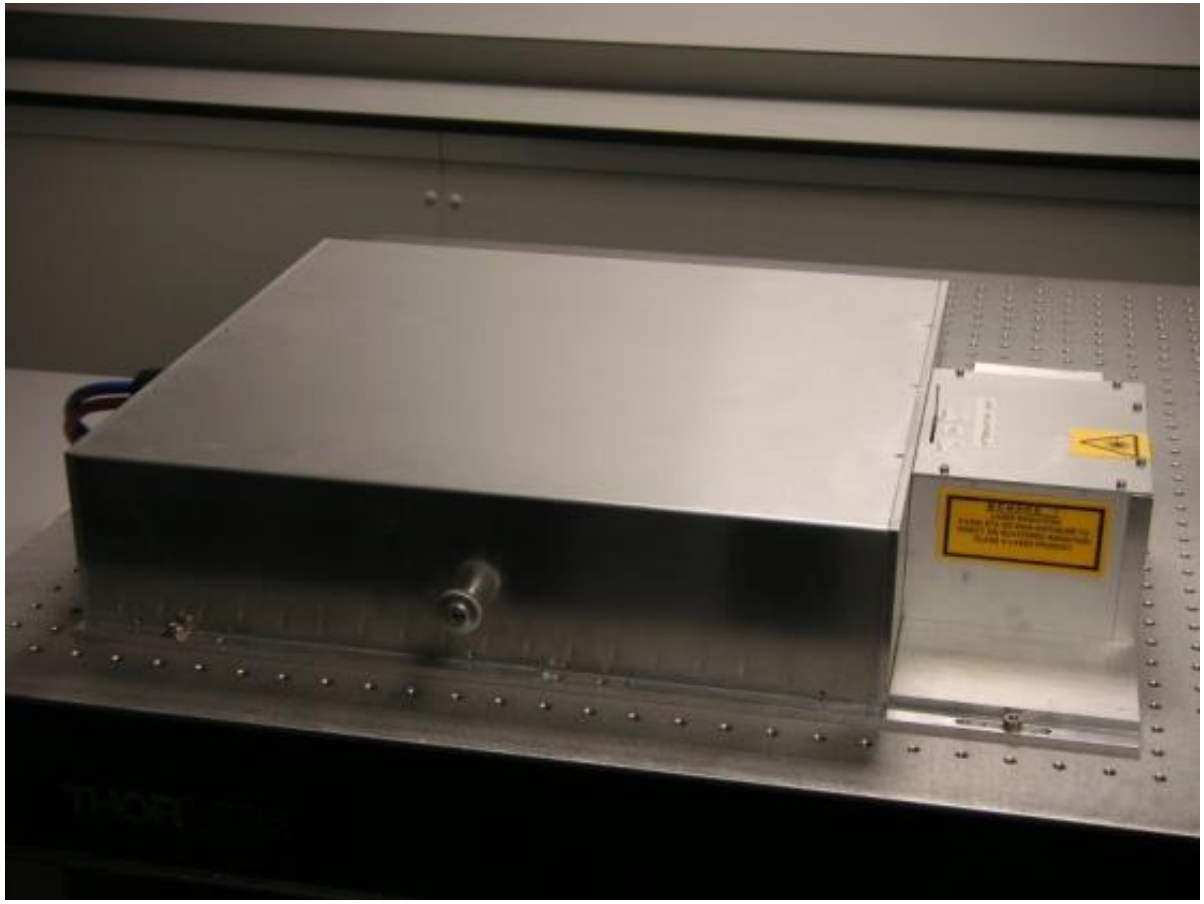
"where our superior laser peak power (MW) & performance leads to ***faster (x5)****,* ***smaller (x5) & significantly lower cost (x5)*** *manufacturing of high-tech products."*





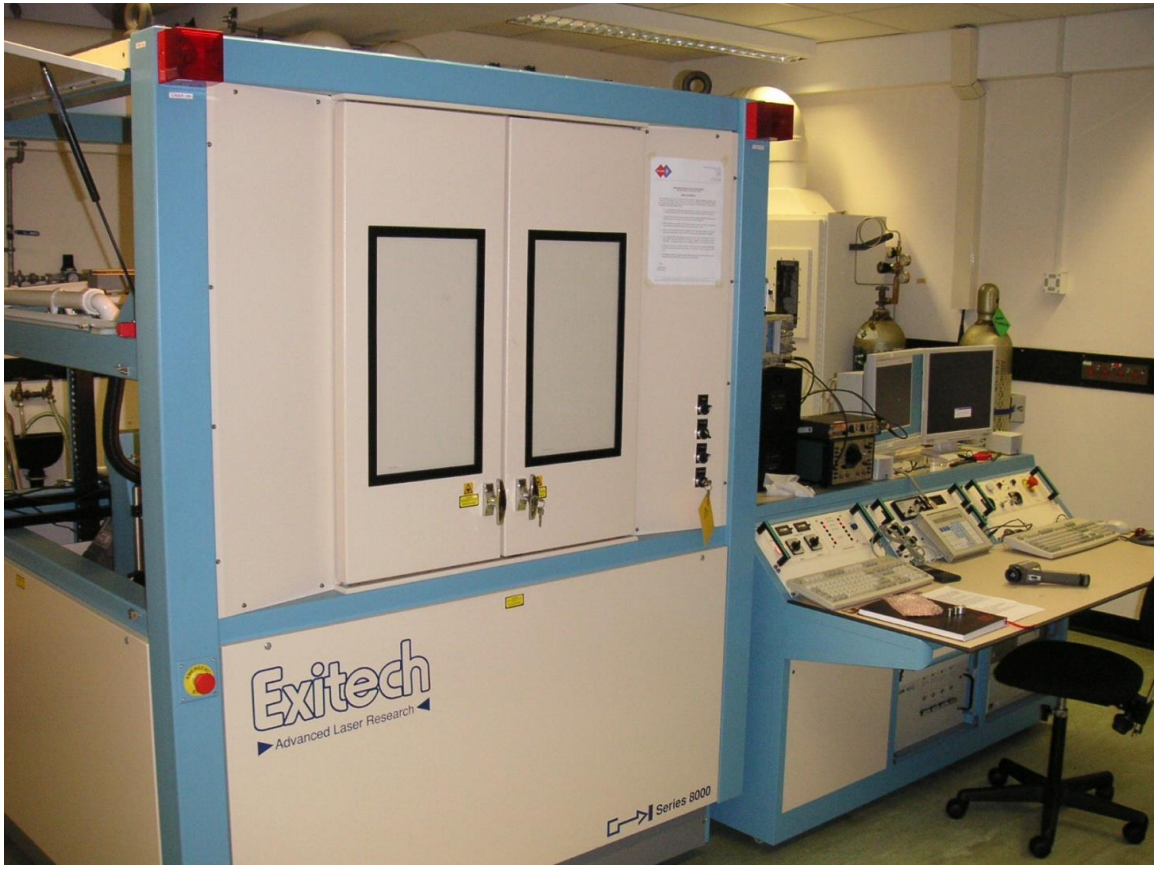
Operating in Imperial Incubator

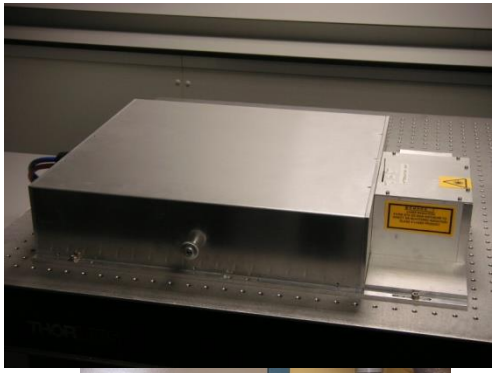
First Packaged Laser – Aug 2006

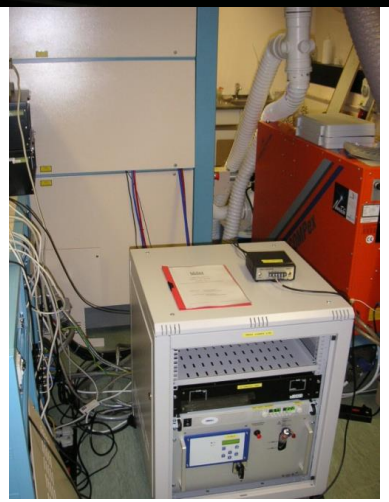


First Installation – August 2006

Driven in departmental transit van – to North Wales!

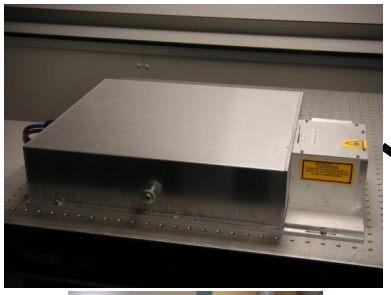


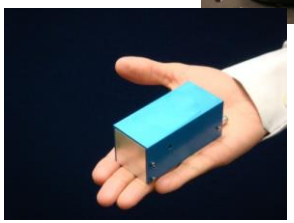


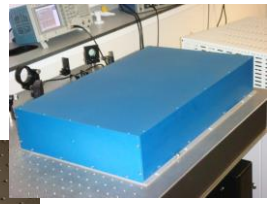


First Revenue – after 2 months operation!!

Product Evolution







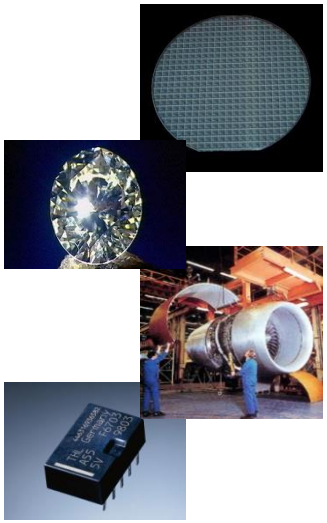
Challenge 1: Know customer needs (1/2)

Engage with end-user (customer) as soon as possible!

In our case end-user was an industrial customer or Systems Integrator

Challenge 1: Know customer needs (2/2)

Midaz engaged with customers in several HIGH VALUE market sectors:



- Silicon cutting and scribing (& defect inspection)
- Diamond processing (industrial & gemstones)
- Automotive/Aerospace (e.g. turbine blades)
- Laser ID Marking of high tech products
- Solar cells
- Touch panel displays
- Medical micromachining (e.g. stents)

Challenge 2: Packaging Technology (1/3)

We built many laser prototypes to engage with early customers

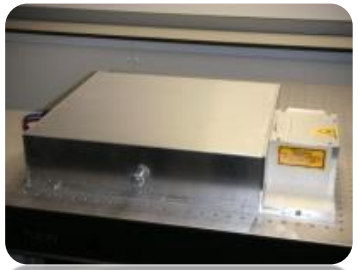
but....

a challenging step to engineer production units

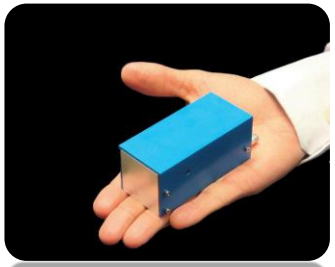
Challenge 2: Packaging Technology (2/3)

Early Prototypes – to engage with customers

- Early prototypes helped us engage early with customers
- Customer engagement enabled us to try to develop technology along market-driven route

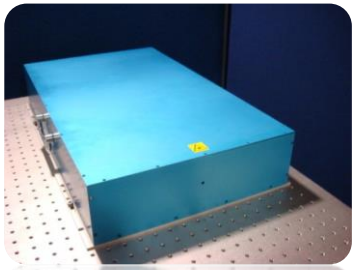


High energy laser for general processing applications



Our smallest - 25W "matchbox" laser

Our first air-cooled laser for laser marking market

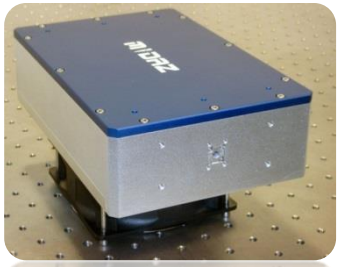


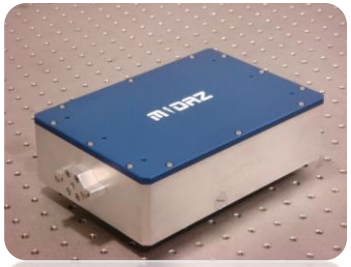
UV laser for processing silicon & touch-screens

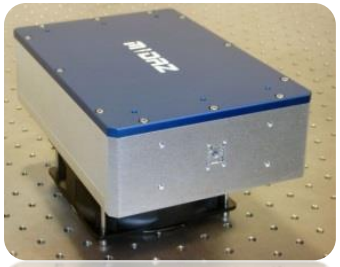
Challenge 2: Packaging Technology (3/3)

Engineered “production” unit

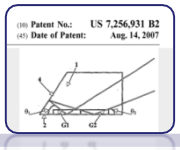
- Packaging complex technology is hard
- Don’t forget: Safety / CE marking / regulations
- Reduce Build Cost!!







Product Family - Modular Design



Core Technology

Midaz Amplifier

Engineered Designs

Amplifier Design

Laser Design(s)

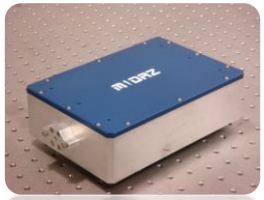
Product

Water cooled (A70-W)

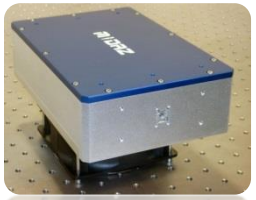
Air Cooled (A50-A)

Flair-20 Marking Laser

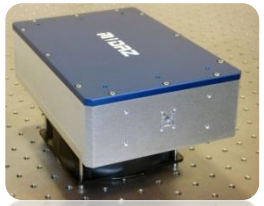
Mega-Pulse Micromachining Laser (Prototype)



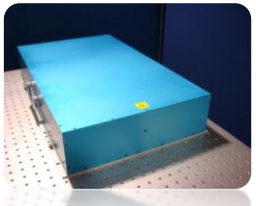
Product: A70-W



Product: A50-A



Product: Flair-20



Prototype: MP-15-355

Midaz Achievements

- **Designed & engineered cutting-edge laser technologies**
  - Ultra-high gain bulk amplifier (~10^6)
  - Ultra-high (MHz) rep rate Q-switch pulsed lasers
- **Products sold world-wide**
- **Responsive innovations to meet customer needs**
- **New Technologies trialled & other Contracted work**
  - Adaptive coherent beam combining
  - Diode-pumped Alexandrite lasers

How to do the next step?

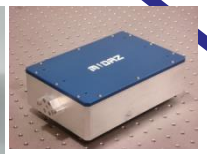
How to scale up production to meet volume orders?

1. **Invest in manufacturing facility ourselves**
2. **Strategic partnership for manufacturing**
3. **(Trade) Sale to company valuing our technology/IP**

Successful Trade Sale in 2012!

Midaz Lasers Ltd

2006



2012

Trade Sale to Coherent Lasers

- **Technology proven to work**
- **Good IP**
- **"No Skeletons in the closet"**

- **Good return on investment**
  - **low personnel & expenditure ("slow-burn")**
  - **revenue generation + grant/contract work**

Difficulty for Academic to Spin-Out

- **Lack of Business (Market) Knowledge**
- **Shift from Curiosity-driven Science to need to generate Product and Revenue**
- **Giving away 'control' & stepping back as technology matures**
- **Not being able to publish your (best) work**

Lessons I learnt!

- **Technology business is really hard work**
  - Small team managing all the company's needs
  - Packaging complex technology
  - Engaging with customers
  - Cash-flow = deadlines…!!!
- **Time always too short – investment always too small**
- **Preferably have a platform technology**
  - "first product is unlikely to be the right one"

What about you?

- Know-how
- Patent
- Licence
- Start-Up Company
- Consultancy

- Or Not