We Manufacture Reliable Optical Products

Vision of B&A: Specialist on Photon Technology
CHAPTER 1

Who is B&A?
COMPANY INTRODUCTION

2004.9.28
Founded in Shanghai
By Dr. Topson

2007.3
The 1st commercialized EYDFA in FTTH in China

2013
EDFA qualified by Oplink & ZTE

2017
The Largest supplier of FTTX EYDFA in China

2018
Improved subsystem product line

2020
Improved OCT components and Lidar components product line

Other High light:
- Product Qualified by True of Thailand, Telefonica, Claro and some biggest CATV operators.
- 30 million RMB credit line of Bank of Nanjing.

17 years of operation
17 years of manufacturing
17 years of independent R&D
Market Segments

The Engine of Fiber

- Communication
- Telecommunication Solution Providers
- Fiber Sensor & OCT & Lidar application
- Research Institutes and Others
- Industrial Solution Providers
- Customization On Demand

Research Institutes and Others

Industrial Solution Providers

Telecommunication Solution Providers

Customization On Demand
**Finance**

### Revenue

- **2014**: $9.9 Million
- **2015**: $12.2 Million
- **2016**: $15.3 Million
- **2017**: $27.72 Million
- **2018**: $20.9 Million
- **2019**: $28.7 Million

### Net Profit

- **2014**: $0.70 Million
- **2015**: $0.86 Million
- **2016**: $1.41 Million
- **2017**: $2.34 Million
- **2018**: $1.52 Million
- **2019**: $3.35 Million

**B&A Technology**
Our Vision: Specialist on Photon Technology

- Continue and insist on Photon technology, concentrate our efforts and invests to technology breakthroughs, to be a respectful specialist on photon technology!

- Create values for Customers
- Create opportunities for Partners
- Create base of health and happiness for Employees
- Create wealth and prestige for Investors
- Create development for Suppliers

- Customer-Centric
- Persevering
- Integrity
- Self-perfection

- To inspire technical innovation
- To keep green and environmental-friendly
- To ensure healthy and safe
- To repay to the community and society
- To respect and comply traditions, rules and laws

Vision
Mission
Core Values
CSR
Domestic Market

- Northeast Region Branch
- Northwest Region Branch
- East China Region Branch
- South China Region Branch
- Southwest Region Branch

- 1st Commercial EYDFA
- 2 R&D Centers: Shanghai, Chengdu
- 5 Region Branches
- 20+ Provinces business coverage
- 200+ Partners including: China Mobile, China Telecom, China Unicom, China State Grid, True, Viettel etc.
- 500,000 sets Commercially deployed
International Market: Success of Partners First

1000,000 sets + Commercially Deployed with OEM brands
B&A keep investments on R&D, insist on strict quality control and follow ISO9001:2015 quality Standards, continue to provide products with high stability, leading technical innovation.

- Total 45 patents in the EDFA, High Power EDFA, Communication system, Sensor field and others, including 20 invention patents.
CHAPTER 2

What B&A Can Do?
From Requirements to Products

Passion Team, Capability of Rapid Design & Mass Production

- System Design
- Software Design
- Optical Design
- Mechanical Design
- Hardware Design

- CATV HFC
- OPTICAL TRANSMISSION
- PON ACCESS
- INDUSTRIAL FIBER LASER
- LIDAR AND FIBER SENSING
Optical Design

- Optical design and simulation software Optisystem, Oasix.
- Unique active fiber processing patent
- Bellcore 1312, GR468, GR1221, ITU-T G.977 and other standards of reliability design

CATV / Telecom / Utility Optical System
- High-speed Digital/Analog Signal high-power Amplifier

Industrial Fiber Laser/Optical Sensor
- Kilo-watt High Power Pulse Laser Lidar Supporting Optical System
- Optical Fiber Sensing System

Aerospace Grade Reliability
- Participated China Shen Zhou Spaceship and Tian Gong Space Station Projects

Submarine Optical Experience
- Submarine Optical Amplifier Communication Experience
Thermal Design Capacity of multi-layer Thermal Analysis and Simulation Based on FLOHERM

High Complexity, High Precision Design Capability

Mechanical Reliability Design Based on IEC60068 / GJB150

Mechanical Structural Design and Analysis Based on ProE, AutoCAD, Solidworks

Mechanical Design & Development
Hardware Design & Development

1. High-speed digital and analog circuit designs
2. Laser driving circuit and temperature control Patents
3. EMC Design following IEC61000 \GJB\GJB151A152A
4. The high-speed circuit design capabilities based on single chip, ARM, multi-core, FPGA, DSP etc
5. Product Safety Design following CE, UL, RoHS
6. Low power consumption and high electro-optical efficiency

Based on XILINX Zynq 7000 platform, TI C67xx Series circuit processing platform design and algorithm processing. Based on TCP/IP with UDP network application development capabilities.
Software Design & Development

- Embedded operating systems and software
- TCP / IP & UDP network protocol stack process
- 10G Policy Routing software design
- Design network management software
- Database and application software
What B&A Offer Now?

CHAPTER 3
Optical Amplifier Modules

- CATV EDFA
  - FGA & Raman Module
    - VGA & ASE Source
      - MSA module
      - EYDFA Module
      - MSA EYDFA: MAX30dBm
      - HA Module: MAX40dBm
    - EYDFA Module
    - XFP, CFP2, CFP Module
  - Subsystem Equipment
    - Supermini EDFA
  - General EDFA
    - Subpluggable EDFA
  - Special EDFA
    - Pulse EDFA
    - C+L EDFA
    - C+L Raman Amplifier
    - PM EDFA
    - Aerospace EDFA
    - Submarine EDFA
    - EDFA Array
**Rackmount Products**

**CATV EDFA**
1. Support CATV distribution system
2. Max. output power 24dBm
3. Support mid-stage small signal amplification

**Telecom EDFA**
1. Support long distance transmission system
2. Min receiver sensitivity -40dBm
3. Max gain 20dB

**1RU FTTX EYDFA**
1. Support Max.16 PON access system
2. Max. output power 33dBm
3. Optical switch is optional

**CATV Transmitter**
1. Fiber/FBG/TDM is optional

**FEC**
1. Support: STM-1/4/16/64
2. Gain: 5dB/8dB

**2RU FTTX EYDFA**
1. Support Max.64 PON access system
2. Max. output power 33dBm
3. Optical switch is optional

**DCM**
1. Direct modulation and external modulation are optional
2. Max to 1.2Ghz
3. SBS max to 19dBm

**OLP**
1. Support: 1+1, 1:1, 1-1 OLP system
2. Max to 1.2Ghz
3. SBS max to 19dBm
## Multi-Functional Platform Products

### ISAP 5200
- **Height (U):** 5
- **Slot of Service Board:** 16 Max
- **Power Input:** DC -48V /AC 90~260V 1+1 Redundant design DC/AC hybrid
- **Power Consumption:** 600W (Ref)

### ISAP 2200
- **Height (U):** 2
- **Slot of Service Board:** 7 Max
- **Power Input:** DC -48V /AC 90~260V 1+1 Redundant design DC/AC hybrid
- **Power Consumption:** 200W (Ref)

### ISAP 1200
- **Height (U):** 1
- **Slot of Service Board:** 3 Max
- **Power Consumption:** 100W (Ref)

All boards are compatible and hot swappable.
Multi-Functional Platform for Telecom(2)

Services Boards—Diversified and Compact

Transmission
- Support all the optical transmission System

C/DWDM Board
EDFA Board
FEC Board
OSC Board

Transponder Board

C/DWDM Board
EDFA Board
FEC Board
OSC Board

Transmitter Board
Video Combiner
PON Repeater Board

EYDFA Board

WSS Board
OCM/OPM
PS Board
EDFA Array

TDM Board
OLP Board
OTDR Board

Services Boards
- Diversified and Compact

ACCESS
- Support FTTX end to end solution

Open ROADM
- Support part of ROADM system

Others
- Support custom development
IDC Solution Introduction

- Support plug and play
- Combine OTU, Mux/DeMux, EDFA, OLP, OSC etc. in one unit
- Support FE/GE/10GE LAN, 10GE WAN, stm-1 ~ 64, etc
- 8*10G board card can be inserted and unplugged
- Support maximum 80km, and OLA can extend the distance
- OLP 1+1 (optional)
- Support dual power supply
In some ultra-long occasions, deploying physical sites or REG in the middle is not a right cost-effective choice.

- Based on restricted factors of real network, B&A provide comprehensive long SPAN solution including BA/LA/PA, RAMAN,FEC,DCM,ROPA etc.
- Unified management system
- High compatibility: SDH/PTN/WDM network of various providers
- Widely commercially deployed in Telcom Operators, TV Operators and Utility companies in China

### Table: Traffic with Single Wavelength

<table>
<thead>
<tr>
<th>Solution</th>
<th>Traffic with Single Wavelength</th>
<th>Lab Test Result(Max)</th>
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<tr>
<td>BA</td>
<td>PA+DCM</td>
<td>2.5G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10G</td>
</tr>
<tr>
<td>FEC+BA</td>
<td>PA+DCM+FEC</td>
<td>2.5G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10G</td>
</tr>
<tr>
<td>FEC+BA</td>
<td>RFA+PA+DCM+FEC</td>
<td>2.5G</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10G</td>
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</table>
CATV Overlay Sub System

- MSO Operators merging with Telecom Operators
- CATV Overlay solution helping the merging smoothly.

B&A CATV Overlay:
- Fully compatible with GPON/EPON/XGPON/XGSPON OLT of mainstream providers
- Unified NMS
- Embedded high power amplifier to support 1000 users (Splitter 1:32) in single set
- Support 1+1 CATV signal input backup
Era of Co-existing of GPON and XGPON

- With the soaring of high bandwidth traffic, such as OTT video, 4kTV, 8kTV, AR, VR, 10GPON is coming.
- Long-term co-existing of GPON and XGPON will be the market trend. Standalone WDM1r will be widely deployed in the co-existing networks.
- B&A provide standard WDM1r with high port-density (max 64 ports in 1U) and high wavelength isolation to guarantee high reliability for TELECOM operators.
Optical Protection Solution

B&A OLP – Sufficient Optical Fiber Resources

1+1

1:1

B&A OBP—Single Point of Failure

- Low insert loss: ≤5dB
- Low handover time: ≤25ms

- Low insert loss: ≤3dB
- Low handover time: ≤50ms

Uninterrupted: When site off power, the traffic service no interruption
Open ROADM Introduction

WSS card
- ROADM allows for remote configuration and reconfiguration
- Support max 9 dimension

OCM card
- Supervise every optical channel power
Precise detection and ranging technology is widely used, including Autonomous vehicles, Mapping, Home/Industrial Robots etc. B&A provide compact laser source and high power amplifier solution for LiDAR suppliers.

**Light Detection and Ranging**

**Compact Integrated Pulse-Source for LiDAR**

- **Dimension**: 80*45*20mm
- **Power Consumption**: 8W
- **Peak Power Output**: 10KW+
Swept source for OCT

The products uses MEMS-VCSEL to achieve continuous wavelength tuning with single-mode optical spectrum and narrow Linewidths at MHz scan rate.

### OCT Application:

![Diagram of OCT system]

<table>
<thead>
<tr>
<th>Parameters</th>
<th>符号</th>
<th>最小值</th>
<th>典型值</th>
<th>最大值</th>
<th>单位</th>
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<tbody>
<tr>
<td>Center wavelength</td>
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<td>1035</td>
<td>1050</td>
<td>1065</td>
<td>nm</td>
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<tr>
<td>Scan Range</td>
<td>R</td>
<td>50</td>
<td>---</td>
<td>80</td>
<td>nm</td>
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<tr>
<td>Output power</td>
<td>Po</td>
<td>10</td>
<td>20</td>
<td>40</td>
<td>mw</td>
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<tr>
<td>Swept rate BIDI</td>
<td>Fi</td>
<td>------</td>
<td>100</td>
<td>300</td>
<td>Khz</td>
</tr>
<tr>
<td>Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VCSEL</td>
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</table>
Number of employees

- R&D: Total 35 employees
- Production: Total 45 employees
- Quality: Total 11 employees

Total 120 employees
Average age is less than 35 years old

Young, Passion, Customer-Centric
Manufacturing and Quality

Quality Policy and Quality Objective:

Quality first, Technology leading, Market oriented, Continuous improvement

Manufacturing Address: Shanghai, Chengdu
Product Area: Total 4000 m²
Production capacity: +2000pcs module and +1000 Rackmount device per month
Delivery cycle: 4~6 weeks
High Reliability Design

1. Bellcore GR1312 Generic Requirements for Optical Fiber Amplifier
2. IEC60068-2-1 Environmental testing of Electrotechnical Products
3. ETSI EN 300 019 Environmental Conditions and Environmental Tests for Telecommunications Equipment
4. IEC61000-4 Electromagnetic Compatibility Testing and Measurement
5. IEC/EN 60950 60825 Information technology equipment - Safety
6. GR-468-CORE GR-1221-CORE GR-326-CORE Reliability Assurance for Optoelectronic Devices
Supply Chain
Well-known suppliers, Quality Control, Low

Long-term win-win partnership with suppliers, more than 10 years, grow up together, face the challenges together.
Concentration, Customization, Specialization

1. No.1 high power EYDFA manufacturer in PON
2. 40% market share of OLP sub-system in China
3. Tier-1 Optical Components Manufacturer

R&D Capability  |  Support  |  Cost-Effective  |  Delivery
CHAPTER 5

Planning
Planning

ROADMAP

ISAP Board

Software

OTDR

- Research
- Alpha
- Beta
- Pilot

Transponder

- Research
- Alpha
- Beta
- Pilot
- Mas

Muxponder

- Research
- Alpha
- Beta
- Pilot
- Mas

gRPC

- Research

Netconf/Yang

- Research
- Alpha