The CENALT
Key dates of the French tsunami warning centre project

November 2005: first international meeting on tsunami alert systems in the Mediterranean
April 2006: CEA is requested by the ministry of the interior to implement a tsunami warning centre in the Mediterranean
November 2007: France announces during ICG IV its decision to establish a warning centre for the Western Mediterranean

- **22nd September 2009**: signature of the agreement between the ministry of the interior and the ministry of sustainable development and CEA, SHOM and CNRS, tasking them to develop and implement the tsunami warning centre

- **1st July 2012**: tsunami warning centre is operational
The CENALT: national mandate and international objectives

- **Warns French civil security authorities, within fifteen minutes of a potentially tsunamigenic event occurring in the West Mediterranean Sea or in the North Eastern Atlantic Ocean, transmitting pertinent parameters of the event**

- **Advises within 15 minutes NEAM candidate tsunami watch providers, national tsunami warning centres and tsunami focal points,**

- **Sends confirmation/cancellation messages: latency related to the tide gauge data availability**
Tsunami Alert System – Operational Part

1. Earthquake Detection
   => Seismological monitoring network

2. Tsunami Detection
   => Sea level monitoring network

3. Data analysis, threat evaluation

4. Monitoring of the whole system capability

5. Elaborate and transmit alert messages
   => Alert Centre(s) – Alert, exercises and test procedures
Upgrade of existing seismic stations

Before 2008 (CEA)
2008 (CEA)
2009 (INSU-CEA)
2010 (INSU-CEA)
Upgrade of tide gauges (SHOM)

- Upgrade of 34 stations equipped with high sampling rate and real-time transmission
- Direct connection to the CENALT through VPN
Secured operational network

Optimal cooperation between seismic station network operators
Cooperation in progress for tide gauge network operators

Private telecommunication network for data transmission and message dissemination
Operation of the centre

Seismic data and sea level stations

Data acquisition

Real time automatic data analysis

Internal alert

Detection

Location

Magnitude of event

Tsunami amplitude

Results validation

Transmission of alert messages

24/7 presence of operator

Need for a 24/7 operator on duty
The CENALT, automatic detection and interactive processing

Earthquake detection in real time: time origin, association, automatic location, magnitude calculation

- Data and communications flow
- Archiving of raw data
- Data format conversion

Continuous sea-level data reception
Historical events database

Continuous sea-level signal reception (Atlantic ocean, Channel, Mediterranean sea)
<table>
<thead>
<tr>
<th>Level of warning</th>
<th>INTERNATIONAL</th>
<th>FRANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5.5 \leq M_w \leq 6.0$</td>
<td><img src="image1.png" alt="International Map" /></td>
<td>YELLOW</td>
</tr>
<tr>
<td>$6.0 \leq M_w \leq 6.5$</td>
<td><img src="image2.png" alt="International Map" /></td>
<td>YELLOW</td>
</tr>
<tr>
<td>$6.5 \leq M_w \leq 7.0$</td>
<td><img src="image3.png" alt="International Map" /></td>
<td>ORANGE</td>
</tr>
<tr>
<td>$M_w \geq 7.0$</td>
<td><img src="image4.png" alt="International Map" /></td>
<td>RED</td>
</tr>
</tbody>
</table>
Estimation of tsunami arrival times

Map of arrival times for a given event
Alert Simulation

Implementation of a new automatic system:

- Predefine all potentially tsunamigenic faults
- Simulate corresponding tsunamis, database of precalculated scenarios, automatic estimation of zones under threat within a few minutes
The CENALT, real time hazard assessment and scenario database

Exploiting the precalculated scenario database, determining min and max sea levels
Creating a map of the event

Example with the Boumerdes 2003 earthquake
Timing

T0 earthquake
T0 + 3 min Localisation and magnitude
T0 + 5 min Simulation of arrival times
T0 + 15 min Sending of messages
T0 + 2 à 3 h Simulation with real-time focal mechanism
Network capability monitoring

Sea level information delay

Event location accuracy

Seismic detection delay
The CENALT: a unique training exercise

- Need to hire a team of 7 analysts for the shifts

- Need to train them intensively over a 6-month period in:
  - Seismology, tectonics
  - Signal processing
  - Earthquake and tsunami hazard
  - Sea-level measurement
  - Use of CENALT software

- Need to evaluate the training:
  - Heavy load of hands-on exercises
  - Tests based on real events

- Three months of complete testing (April – June 2012)

- In the future, ensure continuous training although the team is taking shifts
From July 1st to August 31, 2012

CENALT Operation since July 1st 2012

1. Earthquake Detection

2. Tsunami Detection
   No tsunami in NEAM region

3. Data analysis, threat evaluation
   22 events* in the NEAM region (3.0 < Mw < 5.1)
   407 events* at a global scale

4. Monitoring of the whole system capability

5. Elaborate and transmit alert and test messages
   2 routine communication tests
   - August : 4 recipients – 4 Member States
   - September : 10 recipients – 7 Member States

* From July 1st to August 31, 2012
We are looking forward to developing fruitful collaborations with everyone involved and we would be happy to welcome you at our new facilities!