

The occasion

Following the **Rotary Interclub meeting** with the 14 Clubs of the Etna area participating in the **Free Plastic Waters District Project**, held on Friday 25th October 2019, at the Castello Ursino in Catania (Sicily), in the presence of the **Governor of District 2110, Valerio Cimino**, and in conjunction with the closing ceremony of the **Area National Meeting of the Italian Fleets of the International Yachting Fellowship of Rotarians**, Giuseppe Mancini, professor at the University of Catania and speaker at the meeting, formulated the proposal to create a **strong European Partnership** to address, through a sustainable technological and holistic approach, the **problem of plastic islands in the oceans and in the Mediterranean**. The proposal was appreciated by the Governor of District 2110 Valerio Cimino - who is energetically engaging, through numerous actions over the all district territory, a hard fight against the dispersion and the improper use of plastic - and from the former Assessor to the Environment of the Sicily Region **Rossana Interlandi**, speaker in the meeting also on behalf of the MEP **Pietro Fiocchi - Member of the Environment Commission**. Appreciation to the proposal was also expressed by the main speaker of the evening, the **Past International Commodore IYFR Sergio Santi** and by the coordinator of the event, **Sebastiano Catalano, President of the Rotary Club of Catania**. This important appreciation and the sharing of the idea among the participating Rotarians has led to investigating, more in deep, the chance of undertaking the proposed action.

Potential interested parties

The proposal of an **international partnership** could be launched by **Rotary International**. The idea was presented a few days before by the same prof. Mancini during the **BLUE SEA LAND event - Mediterranean and Middle Eastern Cluster Expo** (Mazara del Vallo 17-20 October 2019) in the session **“Sustainability of innovative technologies and green guidelines of today for the blue environment of tomorrow”** arousing the interest of the speakers of **Fincantieri (Alberto Maestrini)** and **Cetena**. Specifically the Cetena representative at the initiative is another Sicilian Rotarian member, Ing. **Salvatore Vacante**. The **major European players in the field of shipbuilding** could indeed be interested, with an enormous and positive return of image, in participating in the formation of a partnership able to launch a concrete challenge to one of the three most shared environmental momentum in the world (in addition to global warming and to

the need of circular economy) i.e. the huge dispersion of the plastic in the oceans and in our seas and the consequent **continuous feeding** of these monstrous islands, **daily growing** in surface and number.

In addition to the most important shipbuilders, great interest could be addressed to the proposal by the **manufacturers of high technology-readiness-level solutions (pyrolysis-gasification commercial reactors)** for the sustainable energy conversion of mixed plastics and floating waste into liquid and gaseous fuels.

Finally, a certain interest to the partnership is expected by the **most important European and international research centers and Universities**, aimed at optimizing and **tailoring the existing commercial technologies** for the specific purposes of the proposed solution, focusing both on the **collection system requirements, pre-treatment solution and technical-economic sustainability assesment** as well as on the **environmental overall balance**.

This partnership could also participate to the **European Community's forthcoming calls in the area of Blue Growth**, also exploiting and in combination with the **traditional strength of Rotarians in fundraising for concrete projects with specific worldwide goals**.

The assumptions

The proposal for a partnership building, aimed at pursuing the project idea that will be fully described below, is born from the awareness that all the really important actions already undertaken, at global or local level, for the reduction of the consumption of both single-use and re-usable plastics, the conversion of traditional plastic products into biodegradable products, the correct environmental culture and formation, the fight against the wild dispersion and all further actions aimed at reducing the continuous intake of plastic into the oceans will not, at least in the short term, reverse the current trend in feeding these large plastic clusters. This also considering the new global realities in enormous growth (Asia and then Africa) that, at least in the coming years, will certainly continue to increase the use and therefore the dispersion of plastic on their territories. In parallel and synergistically with these fundamental measures, it is therefore necessary to think to a sound solution that, as quickly and efficiently as possible, can attack these large and ever-increasing plastic clusters, preventing them from the marine fauna grazing and from the consequent bioaccumulation in the trophic chain.

The project idea— Let turn Plastic Islands into Energy

The project idea, to be refined through the intervention of all the actors within the partnership, aims to directly attack the large islands of debris in the oceans, currently in formation also in the Mediterranean Sea.

It is certainly not a new idea and many systems have been proposed in the past receiving (some) also great attention and great funding from the world community, unfortunately not always with proportional successes in terms of proven effectiveness.

Some of the elements underlying the failures are due to:

- ✓ The doubtful efficacy of only apparently simpler but less resilient solutions, in particular to the fast ever-changing conditions of marine turbulence.
- ✓ The issue of collected debris management involving the transportation to land (due to low debris density, even when subjected to compaction with consequent high transportation and environmental costs)

- ✓ The critical issues in material recovery (recycling) due to the heterogeneity, low density and cross-contamination of the debris and the consequent low market value of the few obtainable products.
- ✓ The lack of an effective assessment of economic and overall sustainability (including a holistic environmental balance)

On the basis of the aforementioned issues, the proposed project idea is based on the principle of an **on-site collection and processing management**. Yes, but which one and how?

The idea on which (just) starting the works of the partnership focus on an industrial solution capable of **collecting and transforming on-site the collected debris into commercial fuels** to be used **to feed the same collection-processing system** (the fleet and the industrial process) and possibly (to be verified) also a series of **commercial ships** whose trade routes are close to the “treatment area”. In doing so the mass of debris could represent, instead of a continuous threat to the marine environment, a **useful energy resource**, able to avoid the equivalent fossil fuels consumption, production and related emissions. The chance of a partial recovery of material to be sent to land for recycling may also be verified. However, it must be considered that the heterogeneity of the materials, their contamination and also the quality of the materials themselves subjected to severe aging conditions do not allow to presume great chances of material recovery at least within a sustainable market approach. Moreover, the low degree of compaction to which these materials can be subjected and therefore their low maximum achievable density would create issues of economic and environmental sustainability in their transport on land that should be carefully evaluated by the partnership as well. Conversely the transformation on site and the next use of the fuel produced could be much more sustainable also thanks to the higher density of the fluid fuel as compared to the one of the potential recoverable material.

Since debris tends to accumulate in areas with lower circulation corresponding to the center of the large oceanic vortices, it is proposed that the debris clusters will be faced from their interior (with a countercurrent spiral-like action of the fleet) where the marine currents are less strong and the vessels can maintain their position or move with a lower energy consumption. The collection and transformation system acting from the “center” can then possibly make use of a means of transfer (tanker) as a refueling system to feed other ships on the trade routes.



The actual collection of “plastic” (but not only plastic) debris should be entrusted to **satellite means of adequate power and versatility** which, despite a lower tonnage, should be able to face the most adverse marine conditions. The use of **tugboats** - certainly reliable - is a first hypothesis, but the partnership will evaluate both the use of **minor re-functionalized military ships** as well as the use of more common but equally valid **deep-sea fishing boats**. A **specifically tailored collection system** is already under study that, based on a **multiple action**, should be able, on one hand to take into account the granulometric distribution of the different fractions -thus maximizing the yield- and, on the other hand, to preserve the aquatic flora and fauna as much as possible.

The further element of sustainability here proposed, and which requires the **constructive competence of the best players in the field of shipbuilding** in Europe, is the **functional recovery of disused vessels**. A first hypothesis is to refer to **units of the Navy** (Italian and other European countries) in the near future disposal condition. Among the examples proposed there are the units of the “Santi class” (given that the three units have the names of three saints), consisting of three amphibious warships of the Landing Platform Dock (LPD) type: **the San Giorgio, the San Marco and the San Giusto**. The three ships mentioned, for example, will be disposed of in 2019, 2020 and 2022 respectively;

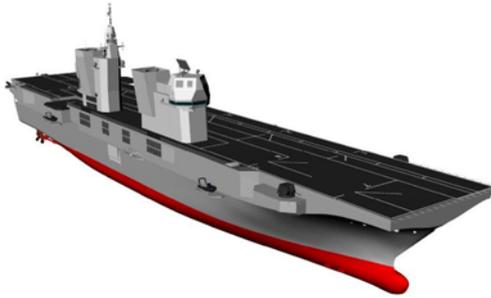


A proposal even more ambitious and in some ways more 'high-sounding', could be to refunctionalize another marvel of the Navy as an aircraft carrier but an alternative solution could also, perhaps with greater simplicity, be based on the light transformation of a more common oil tanker ship.



The re-functionalization of the naval vehicle, whatever it will be the final choice of the recovered vehicle, involves the **installation on board of the debris recovery system** (from the minor vessels), of the **pre-treatment system** (comminution and homogenization with separation of the undesired elements) and of the **system for the conversion of debris into liquid and / or gaseous fuel**. We consider a pyro-gasification system whose technology is well-established at the industrial and commercial scale, requiring only the least efforts to adapt the technology to the specific feed. This task could be carried out in synergy between companies, universities and research centers involved in the partnership. A preliminary research activity should include the collection of some first loads of debris to verify – on the land and at the full scale - the qualitative characteristics of the produced fuel and the necessary management of the debris feeding.

Functional recovery and installation of the Pyro-gasification reactor



Basically, what we aim to achieve is an equivalence 1) between the debris mass and an **oil deposit at sea** and 2) between the system used for its exploitation (satellite collection means, the proposed re-functionalized mean, the tanker for accumulation and refueling in sea) and a **fuel distribution network**, with the **fundamental difference** that, in this case, it is fully accomplished the concept of circular economy as the energy recovery would take place not from a fossil fuel but from a waste dispersed in the environment and already dangerous for the same ecosystem, **thus contributing to obtain an additional energy source while avoiding or limiting an evident and progressive environmental disaster.**

Similarities to the proposed solution



Prof. Giuseppe Mancini

University of Catania

Giuseppe Mancini



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