

Mail

From: "Mail" <mail@integener.com>
To: "IntegEner-W" <mail@integener.com>
Sent: Saturday, January 30, 2010 6:38 AM
Subject: Fw: The Evolution of Rotor and Blade Design July 2000 . NREL/CP -500-28410

This series of messages below is reproduced here essentially as sent with but a few revisions to soften the occasional harshness. It was never intended to give them wide distribution. What is being said is directed more to the background set of attitudes and accepted standards that have brought matters to where they stand and not to the individuals themselves. I have been becoming well known as a fan of the Greek philosopher Plato who wished to move others outside of the dark cave of shadows on the cave walls and into the bright daylight of true understanding. Other philosophies, perhaps even better ones, prevail such as existentialism or "existence before essence" wherein a "unity in diversity" is advocated in which everyone is seen as holding correct views but mainly within different spheres, their own. I truly apologize to the addressees below who may feel slighted by this effort and remind everyone that the tools given us now by the computer and the internet make free, and sometimes fickle, expression much more widespread than ever before, reflecting on the capabilities of the source as well as those of the recipients.

Tony Chessick
 IntegEner-W
 Tehachapi, CA
<http://www.integener.com> last update: 1/21/2010

----- Original Message -----

From: [Mail](#)
To: [NREL - James L. Tangler](#) ; [Knight&Carver-Gary Kanaby](#)
Cc: [WorkingDesign - Les King](#) ; [WndProdTe-Phil Stahlheber](#) ; [Exquadrum-KevinEMahaffy](#) ; [ClipperWP-SharonDonohoe](#) ; [SandiaWindGroup](#) ; [NREL - Scott Schreck](#) ; [NREL - Walt Musial](#) ; [AirfoilsCom - Dan Somers](#) ; [UMassRERL-JamesFManwell](#) ; [UMassRERL-ARogers](#) ; [AETexas-Kenneth Starcher](#) ; [NREL - Sandy Butterfield](#) ; [DurhamUniv - Grant Ingram](#)
Sent: Friday, January 29, 2010 7:14 AM
Subject: Re: The Evolution of Rotor and Blade Design July 2000 . NREL/CP-500-28410

What is so bothersome in wind energy is the suggestion that it is just a collection of "windmills" with blades the same as airplane wings. That it is "lift" and "drag" which drives them to turn.

These ideas, commonly held, are how decisions are made, not, as is believed, the guidance of those who have looked into wind flow matters, if this observation may be made. The risk is to devolve the technology into just so many "wiki" debates (what is, despite its noble purposes, the contentiousness seen on internet wikipedia websites over detailed questions) by the experts. Unanimity is far more important.

Take the question of drag. In Abbott and von Doenhoff in article 7.5 on pages 148 and 149, what is stated is quite correct. Most of the drag seen by aircraft wings is the induced drag, which is the drag penalty of lift. The remaining drag or "minimum drag" is moderately affected by wing thickness ratio but is of lesser importance.

Here is what is missing. The blades of wind turbines see no induced drag. Induced drag does not exist in wind energy technology. This statement needs to be explained and made perfectly clear to all, expert and lay persons alike, who are involved in the technology and everyone not. It should be common knowledge, taught in schools the world over.

However, drag *is* important in wind energy, the blade drag that is remaining and is not induced drag. It acts to net out the driving force and so defeats the purpose of generating energy. When blades are designed to have a low thickness ratio, this drag is what is being reduced. A belief persists in general by even those who should know better that airfoil thinness is not of great importance, which is true but mainly for aircraft wings,

where it is the induced drag which predominates and is little affected by airfoil thickness. For wind turbines on the other hand, our tests on our small units have proven to us that blade thickness makes a remarkable difference beyond any doubt, creating the impression for us that something more needs to be said throughout the technology in relation to its aerodynamics.

We have had grants that we have applied for turned down for reasons stated that held credence to this misconception. It is not something that one ever forgets.

A few new names have been added to the addressee list above and we hope these take the time to read over what has been said in earlier messages below.

Tony Chessick
IntegEner-W
Tehachapi, CA
<http://www.integener.com> last update: 1/21/2010

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From: [Mail](#)
To: [NREL - James L. Tangler](#) ; [Knight&Carver-Gary Kanaby](#)
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Sent: Thursday, January 28, 2010 1:44 PM
Subject: Re: The Evolution of Rotor and Blade Design July 2000 . NREL/CP-500-28410

Having in mind the President's State of the Union address last evening and with regard to technical and economic urgencies, etc. on wind energy matters, a better word than "pussyfooting" (see below) might be found. It is clear that the STAR concept has another purpose and that is to accomplish power regulation in place of what has always been assigned this task - progressive stall. Since the pitch angle of the blade is effectively altered, no or little turbulence is introduced into the wind flow around the blade, thus saving the remaining energy for possible use by another turbine downwind.

A wind project operating during strong wind conditions when most all the turbines are in the stall condition would otherwise create everywhere the wasteful condition of turbulence.

It remains true, however, that wind energy has yet to find the breakthrough in power generation efficiency that it so sorely needs. The harking back to aircraft aerodynamics is doing more harm than good. It only takes a little imagination to rid wind energy forever of the entirely useless terms of "lift" and "drag" and replace them with the terms "tangential" and "axial" force, which are, of course, the blade driving and bendback forces.

The book, Abbott and von Doenhoff, never adequately makes clear the basic fact that wings only create one force in one direction and it is only the two right angle vector components of this single force that are the lift and drag. The overuse of particularly abstruse mathematics so fully embraced on the pages within can be said to be at least partly responsible for this difficulty.

Let me say this. The Coanda Effect has its limits. It is wonderful that it exists within the scope of what it can do. To try to manipulate wings and blades in such a way as to stretch the phenomenon beyond its limits as if to say that even the interactions between air molecules can be somehow adjusted for some benefit thereunto begs to be questioned. I can quote page references on this.

So much more reasonable is to redirect flow, which is the entire purpose of the processes being studied, by means of flow boundaries that do the work instead of relying on the Coanda Effect. Take the example of sailboats and tell me why the jib sails have been found to be so useful if it isn't for this purpose exactly.

The [PAX Streamline](#) organization of California is one of the bodies involved with the DOD ARPAE study

mentioned below.

If, of course, a need surfaces for additional review of the science and the math relating to these studies on a professional level, I am quite able to add my own insights.

Tony Chessick
IntegEner-W
Tehachapi, CA

<http://www.integener.com> last update: 1/21/2010

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From: [Mail](#)

To: [NREL - James L. Tangler](#) ; [Knight&Carver-Gary Kanaby](#)

Cc: [WorkingDesign - Les King](#) ; [WndProdTe-Phil Stahlheber](#) ; [Exquadrum-KevinEMahaffy](#) ; [ClipperWP-SharonDonohoe](#) ; [SandiaWindGroup](#) ; [NREL - Scott Schreck](#) ; [NREL - Walt Musial](#) ; [AirfoilsCom - Dan Somers](#)

Sent: Monday, January 18, 2010 7:32 AM

Subject: Re: The Evolution of Rotor and Blade Design July 2000 . NREL/CP-500-28410

To the above -

Typical of blade and aero studies, it is the "hot button" items that receive attention. A [\\$3 million grant](#) to Georgia Tech from DOD ARPA-E will look at pneumatic systems to increase wind turbine blade lift with compressed air through blade slots.

In my capacity as small business entrepreneur of IntegEner-W, I vouchsafe the opinion that a better approach than either this or the STAR project concept is to passive pitch the leading edges of blades, that is, to add to the blades a separate leading edge flap that is pitchable with a somewhat long and thin trailing edge that is not. That is the "short" and the "long" of it. No sense in going into great detail.

In the theory to which I subscribe, lift occurs as a result of deflection of the airflow (sometimes called more elaborately "circulation") and this is the same as flow in a pipe or hose going around a bend in it, causing forces within. End of story.

What would need to be watched with great diligence, however, is the lateral force bending the blade back, which increases dramatically when the blades are called upon to produce more power.

Here are pics of a small test setup we have here now for checking blade profiles and concepts:



After doing baseline with the original blades, some of our own concepts are to be tried. We have had great success with the "yardstick" idea and that might come out as the "air shovel" concept. What these have proven to us is that blades need to be thin. Some of our review of the aerodynamics references, as documented on the [IntegEner-W](http://www.integener.com) website, have led us to the conclusion that 12% thick is high and unproductive.

Tony Chessick
 IntegEner-W
 Tehachapi, CA
<http://www.integener.com> last update: 12/15/2009

----- Original Message -----

From: [Mail](#)
To: [NREL - James L. Tangler](#) ; [Knight&Carver-Gary Kanaby](#)
Cc: [WorkingDesign - Les King](#) ; [WndProdTe-Phil Stahlheber](#) ; [Neil Dennis](#)
Sent: Thursday, January 07, 2010 6:49 AM
Subject: Re: The Evolution of Rotor and Blade Design July 2000 . NREL/CP-500-28410

To the above -

It is tempting to splash this question out to many others via these emails, peers in this business who have the background to form opinions on it, but, no, the above close circle will do for the moment.

What is happening here is typical of much else. Companies in businesses such as building beautiful yachts for those with the necessary income wait for their moment to buy into new technologies such as wind energy only to find when they do that they have landed themselves into technical heights beyond their competence. It is one thing to admit difficulties and quite another to pretend that all is well.

It is as Shakespeare said back circa 1600 that "simple truth" is often called a "simplicity" and left to die by those who lack even the curiosity to take some of this math and science up another notch. Things haven't changed much in some of this human psychology since then at all.

Somebody needs to do something here.

I go around these days here in Tehachapi riding a bicycle, for heaven's sake, on the new bike trails here. I have little inclination to drive down to San Diego.

Tony Chessick
IntegEner-W
Tehachapi, CA
<http://www.integener.com> last update: 12/15/2009

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From: [Mail](#)

To: [NREL - James L. Tangler](#) ; [Knight&Carver-Gary Kanaby](#)

Cc: [WorkingDesign - Les King](#) ; [WndProdTe-Phil Stahlheber](#) ; [Neil Dennis](#)

Sent: Wednesday, January 06, 2010 6:53 AM

Subject: Re: The Evolution of Rotor and Blade Design July 2000 . NREL/CP-500-28410

James Tangler and now Gary Kanaby as well -

Continuing in this mode of "letting it all hang out" in the belief that the times are appropriate for such talk, the subject of the 750 kw STAR rotor with blades constructed by Knight and Carver and installed as a test here in Tehachapi by GE might be mentioned.

According to theory, the well known Betz limit formulation derivation has as a step in the mathematics the calculation of the entire force across the rotor disc as a function of both the energy change and momentum change of the wind across it. What is clear is that this so-called lateral or "bend back" force is proportional to the energy produced by the rotor. Reduce one and the other is reduced as well.

The STAR concept seems therefore to be (and this is the only word that fits) "pussyfooting" around this problem. We see plainly here in watching the turbine the advanced wide variation in rotor rotation rate, etc. but are not fully impressed with the concept. It is true for example that small changes in pitch angle out near the blade tips have a marked effect on energy conversion and so the increased energy from the one is only being nullified by the decreased energy from the other.

The world is looking for nothing less than breakthroughs. Even costly ones will do. If those involved with this project are not able to go further with these ideas, then it is time to leave it to someone else.

Why doesn't Knight and Carver put this turbine and/or rotor up for sale? Ideas are marketable and someone else might be better able to go on with these studies. We see no progress being made as it stands at the moment.

Again, something needs to be done to increase the capability of blade rotors to absorb the lateral force beyond just the bending moment of the blades at the root.



It is recognized that words are much easier to write than wrenches are to be turned and so no harm is meant.

Tony Chessick
 IntegEner-W
 Tehachapi, CA
<http://www.integener.com> last update: 12/15/2009

----- Original Message -----

From: [Mail](#)

To: [NREL - James L. Tangler](#)

Cc: [WorkingDesign - Les King](#) ; [WndProdTe-Phil Stahlheber](#)

Sent: Tuesday, December 29, 2009 8:12 PM

Subject: Re: The Evolution of Rotor and Blade Design July 2000 . NREL/CP-500-28410

Mr. Tangler -

Somehow importance is attached to "letting it all hang out" in some of these matters at this time in current events. The matter of blade support of these big three bladers has always bothered me. I recently heard that Clipper Wind was making some progress in doing a 10 MW turbine with 70 meter long blades for the UK and this encourages me to say a bit about some of these attempts.

I would do large turbines like this in pairs with one turbine facing another nearby and have the blade tips of each connected to those of the other. They could no longer yaw but I have come to see yawing as something of a problem. Also, if the connections between the blades so stated are horizontal airfoils of some length, voila!, we then have a horizontally oriented vertical axis rotor between the two horizontal axis rotors, if this can be visualized.

The problem of directionality is now solved. Such a configuration will run without yawing and yet take wind from all directions.

I could say much more but will end here.

Tony Chessick
IntegEner-W
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<http://www.integener.com> last update: 12/15/2009

----- Original Message -----

From: [Mail](#)
To: [NREL - James L. Tangler](#)
Cc: [WorkingDesign - Les King](#) ; [WndProdTe-Phil Stahlheber](#)
Sent: Monday, December 28, 2009 7:31 AM
Subject: The Evolution of Rotor and Blade Design July 2000 . NREL/CP -500-28410

Mr. Tangler -

Just a short note, having found an email address in the Internet lookups that might be current for reaching you, to mention that the subject paper in .pdf format under your authorship has been added to the [IntegEner-W](#) website (on the home page in the Wind Theory section) as a gratuitous download for dissemination and review. We take no position in favor of its validity nor against but only make it available for others to see, a series of thoughts about which everyone may form their own opinions.

I, in particular, have the notion that wind energy as a technology has yet to feel the full weight of engineering discipline applied to it, some fear being prevalent that too many dissenting views still exist within it for any significant gains to take place to take it beyond, for example, past aviation practice.

Tony Chessick
IntegEner-W
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<http://www.integener.com> last update: 12/15/2009