

1983 – 2013



30 Years after the LCA's launch

advantage, gained through much honest labour, could be “trumped” by something cheaper and more innovative. Lee Begin’s team of Northrop NF/156/T-38-F-5/F-20 did brilliant work on the very important area of transonic manoeuvrability. The LEX and high AOA became fashionable with the F-5E/F-17. The advantages of all this work was rather neatly, if not trumped, at least much reduced by the HMS and cue-able IR seeker. The point to ponder is whether we should go for catching up on ‘technology’ as we seem to be doing, or should we go for developing people who can surely deliver what is wanted. This needs serious debate because perhaps for India it is a little too late for “catching up” and we are important enough as a nation to have our own view of things. Lending relevance to this debate is that there could be a change in the wind.

Change in the Wind?

Such change will come because in the decades ahead, the West may fail in arms exports. In the nineteenth century, it was Northern Germany that was in the decades ahead, centre of the wool trade. Successive generation of finer and finer wool breeding led to wool so fine that they began breaking in the looms. The less crimped Australian wool took over. The F-35/F-22 is irrelevant by being “too fine”. The F-35 would perhaps have worried the Russians sleepless but cause no concern to the Afghans and other assorted militias. For the West it is not enough to produce a successful military aeroplane. It must produce the *commercially successful* military aeroplane. The English Electric Lightning was the last British fighter because it failed to sell. The F-35 is there because the F-15 made the money. The mediocre Starfighter, sold in thousands to NATO without any major US buying, shows how important the commerce is and how hard the ‘sell’. Failures in terms of technology, time, cost,

A Change of Tack

The LCA programme has generated much debate about its outcomes. The fact that thirty years since launch of the programme, there is acrimony and debate would indicate that perhaps the programme has not quite gone the way it was hoped. Definitely there was much that could have been avoided. The entrusting of a crucial weapons-system replacement programme to an yet-to-exist agency was asking for trouble. This however is not the theme of the present review. The LCA programme relied on the hypothesis that if we caught up with the current technologies, we would be self reliant in military aviation. The antithesis

would be : should we have focussed on creating *people* rather than *technology*? This needs debate because we shall have more programmes and as Einstein so famously said, “It is stupidity to repeat the same things and expect different results”.

The ‘essential technology’ approach has long ago reached the point of diminishing returns and probably never made sense anyway. It is more the result of commercial manipulations. Seasoned aviation analysts talk of many expensive technologies that turned out to be almost fraudulent in their claims. Perhaps the more important point is that much of the advertised technical

numbers or combinations thereof in the B.787, A.380, F-22 or F-35 are probable and could devastate. The DC-10 showed how slender can the margin be between success and failure. It was a good and well designed aircraft. However failure to anticipate lapses in *field maintenance* practices led to two accidents and broke the back of Douglas, a repeat of De Havilland's Comet. Failure of the F-22/F-35 to achieve break even could change the entire approach to fighter specifications. If the F-22/-35 indeed fails, the funds will just not be available to develop thought-controlled FBW via electrodes planted in the pilot's brain which will have certain doubtful advantages ? It is also bemusing to ponder, despite impressive 'life cycle cost' analyses, as to what will happen to the present crop of large stealth fighters when they are past their prime? Will we be able to use them for close support duties as happens to all obsolescing fighters? That is not very likely. Is it possible that cheap "stealth-stripping" technology will make all these "wonder buses" look a bit silly ? We may see a swing not to higher technology fighters, and damn the consequent size, but to a line of thought which will be "what is the best we can do with an airframe no bigger than this", at least as a major supplement to 'shock and awe' brigade. In that emerging scenario India may have a role to play - if we decide to think our own way.

Sinking a groove in the paper

That "India can do it" has been repeated so often it has probably sunk a groove in the paper it has been printed on ! The unsung ALH is an example. This was a project with its own share of advanced technologies – glass cockpit, hingeless rotors and composites. It had its share of serious specification changes including a change from single to twin engines fairly late in the game. It had its share failures and delays and suffered from lack of funding and embargos and yet the product was ready, an acceptable performer with some truly record breaking feats and with over a hundred *in service* and a modest beginning in exports. There are now a stream of derivatives coming out. It is the classic picture of a successful project competently and *quietly*, one may add, handled by professional engineers who had grown up in the bran tub of Indian aviation. One wishes some of its project contemporaries

were similarly handled. The point, and we will return to it, is that all this was achieved by men who were amongst the poorest paid of the state sector employees, who worked a six day 48-hour week and retired without even a pension. Though no supersonics are involved, helicopters can be nasty things to design. Weight is always a problem.

recovery was a problem but this can be tackled by other aerodynamic means. Or else a change of base from Bidar to Tambaram. Interesting? Ask me 'why' after you ask me 'what's yours?!'

Starting at external shadows

It is heartening to note that the arms dealer



The vibrations can cause sleepless nights and air conditioning a helicopter is like air conditioning a glass house. Weapons firing is like Errol Flynn shooting whilst swinging from a chandelier.

The fact is, in aviation, even 'simple' things can have all the elements of a detective novel. The HPT-32's persistent engine problem is another example. HAL has 'struggled' for twenty years to solve the problem. Let me put a 'teaser". I have absolutely no inside information but it is quite possible the HPT-32 engine failures are not due to the engine installation and fuel feed at all. The aeroplane needs a strong drag improvement programme including a new smaller fin-yes I know spin

or 'agent' has usually not succeeded when a home grown product of acceptable quality was available. One mentions this because it has become automatic to accuse anyone demanding better accountability of failures as somehow being in foreign pay. In fact the problem is that the vectors for local development and the import lobby are evenly matched and resulting in a stalemate. A small change in the performance of one can make a big difference in the other. Usually it is the decision making technostucture, not the arms dealers, that have *allowed* more damage. The Canadians have not forgotten abandonment of the Avro Arrow and the English restrain themselves when talking of the TSR-2 where Whitehall and Labour allegedly "let the side down".

The Australian Victa, a superb trainer, lost when Australian legislations made imports even cheaper. The dealer succeeds through *administrative* deficiencies. The same goes about strident claims of how the customer services are ‘uncooperative’. It is not their job to be ‘cooperative’ and 1962 should have taught us that. The problem with accepting the Arjun MBT wholeheartedly may lie in the fact that the tank is excellent but the entire logistics, of bridging equipment *et al*

who is right? The Air Force is damned for being ‘finicky’. Had the Navy faced a situation where there was a possibility of losing a frigate with all hands due to half-baked equipment, they would bring back keel hauling. The actual situation is reasonable. Though there is absolutely no truth in the rumour that the first test on a new howitzer is to throw it off a thirty foot cliff, the Services, who allegedly even break wind by numbers (!) have well

Pinaka, the ‘unrequited’ wait for the Trishul and wait for the Akash and, significantly, the IOC-1 of the LCA Mk1 whilst being badly overweight and a decade overtime is a good indication of just how far the Armed Forces will bend over backwards to accept something - if it has the least bit of promise. The benefits of having a local supply chain is clear as daylight to any serviceman. The supremacy of the customer as a reason for existence of the supplier is taken for granted in the private sector. However, one suspects, in the government everyone remembers those recommendations of the last Pay Commission and where exactly the ‘other’ is ranked.

Higher pay is *not* the answer

Improving pay packets is ‘knee jerk’ reaction. The issue is not of salary as of the perceived *fairness*. Without a ‘weeding’ out or sidelining of non performers the benefits of any increase in pay packets is counter productive as it rewards the non-performer by paying him more for continuing not to perform. When the SA-6 missile programme had failures, the Head, the very respected (the design bureau was much later named after him) Tikhomirov, was replaced after *just three years*, since it was felt that the ‘trot’ rate of the project was not good enough. Let us not say that the USSR was knee deep with people of the capabilities of Tikhomirov. In India we have nurtured failures. A secure tenure encourages bias in assessment based on interpersonal rather than net worth. In the private sector, bias in evaluation can be present but to a significantly lesser degree is owed to an all round lack of ‘security’ and shareholder pressure.

A Division of the Tasks

It is difficult to get good designers. It is difficult to get good managers. It is impossible to get both in one person because the passion, focus, and time devoted for knowledge acquisition required for the one contradicts the other. The great engineers - Platz, Messerschmitt, Camm, Petter, Castoldi, Wallis *et al* - varied in temperament from polite stubbornness to geniuses just this side of barking mad. It was the task that ‘blinkered’ them so. They delivered because they were backed by an excellent management team who did the ‘staff work’. The initial rapid progress of the HJT-36 prototype was owed to the fact



HAL Cheetah in Ladakh



Arjun MBT on parade

may make offensive operation difficult to integrate. Could a lighter tank-an improved Tank X for example a la Centurion to Vijayanta, which were supposed to have many common systems - be quickly cobbled together or should we keep arguing about

tried procedures for everything including induction. This is why we have always inducted fairly good equipment. This cannot be changed. That the customer has a stake in getting the deal through has to be accepted. The induction of the Insas, the Arjun, the

that the able chief designer (who was a quiet type!) was backed by a seasoned and extremely capable management team – one of the best in India. Unfortunately government organisations too often can end up with a good PR man on top who wins the job because of his interpersonal skills and loses the thread because he could not have had the focus to acquire the knowledge aspects. The other lacuna is not being seasoned in regards to industry practise.

An IAS can surely 'run' the 3/3 Gurkhas but will it then remain 3/3 GR? You need soldiering experience for that. This penchant of looking for a combined engineer and a leader was a problem in the private sector too and I remember one of the legends of modern thinking in the private sector of the eighties telling me, *après liberalisation*, rather ruefully, I thought, "We are trying to make engineering a rewarding profession" - and he was not prioritising pay!

The contours of the engineering leader

This quest for 'managerial' ability has sometime had the unfortunate effect of losing valuable innovators. One case from personal experience was of someone I shall call MB. MB was an engineer who had worked on avionics in the UK. In India, much respected, he developed and cleared to tight time scales many new airborne power electronics items. He then diversified into gyro-based land navigation systems. For twenty five years he spearheaded development of several generations of new equipment. Promotions came his way but when it came to the top slot, the Head of the Division it was felt –and I be no judge- that his rather informal, approachable style of leadership would not be suitable for such a 'management' job. The upshot was that on being denied the Divisional Head's job MB resigned and left. Looking back, both the contenders were sympathetic, honest and had the best interest of the concern at heart and yet both lost. MB lost the job he was passionate about and the company lost an incredibly rare resource.

Creating people

Creating people by launching a set of carefully graded tasks may seem to be impracticably long processes but actually it is really not more than ten to fifteen years.

Even during this period a lot of serviceable equipment can be developed. After all we import 70% of our needs so why not take the band between 31 to 66 percent of equipment for creating our 'Next-gen' leaders? The case of Sir Stanley Hooker merits elaboration. Dr. Hooker at the age of 31 went to work for Rolls Royce in 1938 where –possibly overqualified and "not much of an engineer" (his boss's words) - he was left alone to make himself useful. He started work on improving the supercharger of the Merlin engine. He was brilliantly successful which led to his being involved in the design, in 1940, of the Whittle jet engine's centrifugal compressor. Note both the connection and the change. By 1945 he had started work on the axial flow Avon and following development troubles with the Avon in 1951 for which he felt he was being blamed, he left RR to work with Bristol Siddeley, where the 'Grecian' engines – Proteus, Orpheus, Olympus and the Pegasus followed. Incidentally like Petter, Hooker's had a strong 'India' connection through the Nene, Avon, Orpheus and the Pegasus, not forgetting the Merlin and Griffon. After his retirement from Bristol Siddeley, RR was not too proud to call him back to set right the problems of the RB211 which had bankrupted RR. Incidentally Hooker – whom people argue was one of Britain's greatest Engineers rivalling Brunel – never became Director of Engine development and when he died his obituary (and someone old and knowledgeable told me this) got less notice than the poet John Betjeman who happened to die on the same day.

The important ingredients of this story are of freedom to indulge in a passion, freedom to move to related field after rigorous proving (Whittle Compressor) rapid censure (Avon problems) despite near legendary (Merlin work) status, moving and contributing in different organisations (Bristol) and not mixing up management with engineering. Note also the proving and re-proving of the man in short term crucial challenges during which Hooker contributed significantly to the survival of the RAF and Britain itself. Of course Hooker was not anointed to succeed; there were many 'also rans' but they were allowed to fade away when they failed the punishing pace. There is a lesson in that. "The private sector should

take over" is not a magic bullet in itself but the private sector has the advantage in that admittedly all processes are quicker but a major factor is no one is proof from firing or at least 'pasturing'. The assessment is continuous, remorseless and if needed, career wise, lethal.

It is the fairness that succeeds.

Song of the sirens

Investments in technology are directed not towards crying needs of operations but by the needs of marketing. The heralded technology menus of the 'sixties such for example VG today seem either 'con' jobs or impractical dead ends. High technology, stemming from requirements of international marketing is as necessary to us as the change of hockey rules in 1959 when we allowed the game to be taken out of our hands. Recent wars reinforce doubts of the need for technology. The Afghan mujahadeen, usually not avid readers, are not only unaware and unimpressed but are dictating the agenda. The Iran UAV affair provokes thought about the 'invincibility' both of stealth and UAVs. Here was a small stealthy craft which was located, identified and then downed. Further work will open the way for the Predator to be *cheaply* downed by a mix of optics, signal monitoring and crude 'Sidewinder level' technology. I say crude because a ground based system does not have to have the same Pk as an AAM. Launch a salvo of semi stupid missiles and get the bu**er! Capital *plus* Casualties presents World Power ! The US by compulsion, is trying to substitute Capital for Casualties and they are already on the wrong side of the drag curve. We have no needs, no means and no justifications. It would be much better for us to prioritise the development of leaders first and technology afterwards.

Desirability of small bottoms

As no doubt instantly grasped, the heading refers only to the days of capital ships when the big debate was the proportion of the budget to be spent on small ships. Capital ships generated sea power but the 'small bottoms' nurtured a *pool* of seasoned commanders. The problem with big defence projects is that they create a financial drought which favour the select few excessively but fail to create the larger pool. The bigness of the projects made the process exclusive. We could not finance the creation of more leaders.

The question may be raised that does a small project have sufficient 'bite' to challenge the leader? Yes, because in any design there are two elements : one is the definite quantifiable aspects related to the technological problems which can be tackled by increasing the size of the team. The other is which we may call the unquantifiable 'spiritual' aspect of the decision making process. This requires acute knowledge of the 'technical ecology' in which the design must serve. It is this 'spiritual' aspect which is the more elusive, difficult and which is identical in its quality irrespective of whether the project is big or small. Prof. Kurt Tank of the Marut, Max Holste of the Bandeirante and the Russians of the Brahmos supplied the spiritual aspect of these successful projects. If this 'spiritual' skill is not there, one can have a light trainer being overweight and long delayed just as much as one can have a jet fighter overweight and long delayed.

Developing this 'spiritual' aspect is vital because in design the answer is right only in relation to its *technical ecology*. The Me-109 used stressed skin, the Hurricane had steel tubes and the Lavochkin La-3 used delta derevezina-resin and bakelite impregnated birch ply for the airframe. Despite such a variety of answers, they were not fully competitive nor were they the 'right' answer for their technical ecology. The Bucker Jungmann/Jungmeister and the Pitts Special were superb aerobatic biplanes. In the quest for lightness the designer of the Jungmann used *nineteen* sizes of tubing for his fuselage. The Pitts used four. Who was right? The answer is that both were right and displayed mature understanding of the technical ecology in which their designs would have to survive. Such skills require nurturing and development and small time bound projects are actually better for this.

Broad basing of leadership

Small, low-cost projects gives opportunity to a greater number of people so that finally we have a pool of seasoned leaders identified not by 'connections' but on results. The beneficiaries from the present dispensation would argue that a light aircraft cannot lead on to much. History proves them wrong ! In the 1920s, Camm, Yakovlev and Messerschmitt were designing two seat aircraft : the

Hawker Cygnet, the AIR-1 and the M17 (170 kg, 25 kW!) which today would be considered as micro lights! Ten years later they were onto designing what were cutting edge technology fighters : Me-109, the Hurricane and the Yak-1, via a succession of small projects. In the 'forties they were onto jets. The fifties and sixties saw them onto VTOL jets which are as complex as one can get. Note the thirty year time period from ultra light to VTOL, same as our LCA project ! They succeeded because it was the small projects and *small stakes* which had steadily honed their skills and self confidence possibly (even better than big projects) which would create awe and overwhelm skills of the inexperienced. In the 'sixties Russia impressed the world with the boldness, extent and quality of its rotorcraft programme. This was the result of careful *single minded* strategic planning. In the preceding fifteen years, Russia had built no fewer than nine different 'low-cost' prototypes which explored various facets of vertical flight technology. Each programme was fairly small e.g. Kamov's Ka-10 had his trademark co-axial rotors seen on our Naval Kamovs but was powered by a 34 hp engine similar to that of the BMW motorcycle! Each project had a time scale of about three years. Four successful survivors from these pioneers, Bratukhin, Kamov, Mil and Yakovlev (who happened to be much favoured by one Tavarich Iosif Dugashavilli) were only then given official requirements to be met. Of these two, Yakovlev and the academician Brathukin tried, came second and were quickly relegated. The other two went on to serve *en bien merite*. The key management points were: the process was ruthless, inclusive, determined and fair. The Soviet Union did not back losers nor did they have only Brathukin. In comparison the efforts to develop an Indian tank engine was confined to CVRDE without competitive participation of VF Jubbalpore or GRSE or even within CVRDE, let alone the private sector. Without competition, without time lines, projects can become a version of MGNREGA (rural employment generation) schemes for people concerned. There should be a shift from big mega projects with infinite and independent time lines to numerous smaller 'tighter'

projects. And remember, Tikhomirov was moved out after three years.

The China Model

As long as the present dispensation has 'the mandate of the Heavens', China has two great advantages. One is the vast in-country market. When the Chinese ARJ-21 with its shrewdly selected technical menu is cleared for service there will be no dearth of orders. If we were to develop an airliner, we can only count on a few dozen-odd compulsory orders from the Air Force. With that kind of a production run there will be no price advantage and no private airline will buy just to 'buy Indian'. The other great advantage is that the Chinese Government, having no elections to fund, is in full control in the same way the Nehru cabinet was in the 'Fifties. So whilst Chinese technical strategy can be applied, we need to remember their ecology is significantly different and this needs to be factored in our planning.

There are no international standards

Much is made of 'international' standards but the truth is each nation has significantly modified the rules according to its technical ecology. For example in the West, nine seats are what is permitted in a single-engine aircraft. There are safety reasons based on the surface transport speeds obtaining in the West. In Russia they have no such limits and An-2s operated with 14 people in certain roles. The British home builder has to use a certified welder and in America they do not bother. Are US homebuilts unsafe? The Russians rely on GOST and do not have a 'release note' for materials. The US allows use of standard automotive components if it suits the designer. Without a study and understanding of the ecology we end up by with a 'least area' approach which trammels development of our own thoughts and philosophies. The Western rules are in any case made for the World Market and so our own rules for our conditions, can be a judicious *subset* of theirs to make flying more affordable.

What could be the projects?

The main purpose would be to generate the people and will fail if people are allowed lifetime tenures. Like Tikhomirov or even Sir Stanley, non 'trotters' have to be weeded out or posted out and the project given a new leader. The max time allowed

till first prototype flight would be three years; this is reasonably tight but very possible. The average budget would be less than a few hundred crores. The projects will focus on developing the 'spiritual' aspects by using proven technologies. My *abridged* pipedream list would be the

Light aeroplane engine

Difficulties with 100LL Avgas are such we may soon stop having flying clubs. The aim would be to use existing automotive diesel engine technologies to create a 60-250 hp range of low cost light aviation motors. Interestingly at HVF we have the technology of the most proven of all aviation diesels, the Junkers Jumo 205. Upgraded with current technology e.g. CRDI, improved turbocharger and new *mastered* metallurgy, it could be the basis for the smaller designs. Automotive-based Mogas engines can be developed despite known problems such as vapour lock which can be tackled by innovative system design. The Shvetsov M11F, 5 cylinder radial of 115 /160 hp is worth mentioning. It was some thirty percent heavier than contemporary US engines but could run with unflinching reliability on poor quality, 45 octane petrol and 136,000 were built over three decades.

An upgraded Avro 748

Essence of the idea would be to convert the airframe to use current technology turboprop engines and propellers plus any other systems which can be upgraded within the given budget and time scale. Given the improved propulsive and weight efficiencies a fuselage stretch to increase the seating capacity to 70-100 could be incorporated in the same style that Baasler has modified old Dakota airframes.

An upgraded Orpheus

There should be a paper study as to what will be the gains if all the current *mastered* technologies - hybrid mechanical/ electronic fuel controls if not FADEC, new afterburner, air blast combustors, new materials, SC blading, gear box PTO etc - were applied to the veteran Orpheus? By a rough estimate a cold thrust of 30kN and a TBO double the old figure with a 20% improvement of SFC would be possible. If the results look good a prototype could be built and tested. If it lags as usual then the project could be shelved within three years as there would be no requirement to fulfil. It might appear silly to dig up the old Orpheus but this was basically a simple engine and would respond well

to new technologies. Importantly there would be enough old engines available to at least bench run a few prototypes and to remember is that the 'product' sought is *leaders* who can deliver within time rather than the *engine*. Generally anything completely made in India will be between five to ten times cheaper than any western engine of similar thrust. Do you really need 5000 hr TBO if you get a bird hit or FOD at low level every 700 hrs or so? What about work on low level survival ability of turbine engines? But please, it should be a focussed programme.

A basic trainer

Given the 'point one percent' rule i.e. each flying hour costs one tenth of one percent of the purchase price of the aircraft the Pilatus PC-7 will soon go the way of all jet training i.e. too expensive for weeding out the 'two left feet and two left hand' type of no-hopers. My personal choice would be a state of the art all-metal, Tiger Moth or a Bucker Jungmann-type with safe docile handling and good aerobatic capability for those who are so inclined. It could use the

By introducing and enabling a large part of the population to be involved in the joys of aviation, its net impact on the shaping of airpower must have been profound.

An all metal glider

Instead of trying to equal the work of the Germans on *glasflugels* and delaying forever, what is needed is a simple sturdy all metal glider of sufficient performance, a circuit of the airfield after a winch launch so as to introduce the youth of our country to the thrills of flying at the lowest cost .

This list is only an indication of the way to go in developing the 'spiritual' aspects of leadership. Since they are not tied to any specific re-equipment need, they can be closed instead of continuing funding. Obviously the project should be given essentially to existing organisations including those in the private sector and those industries not currently associated with defence or aerospace work.

Our current approach, based on the ill conceived plan that the one high tech project will succeed if persisted with has not been too successful. Come 2017, with



Artist's depiction of the proposed Avro 748 rear loader tactical transport

light aircraft engines mentioned above. Here the Yak-18 philosophy is worth a mention. It's structure appeared crude, its performance was hardly spectacular but the engineering was very sound and very sturdy. Though a *basic* trainer, it was comprehensively equipped with retractable undercarriage, pneumatic brakes and flaps and full blind flying instruments. It was stressed for full aerobatics including flick rolls and reportedly had beautifully harmonised controls. Built in huge numbers it provided at low cost a vast pool of trained pilots and mechanics for the Soviet forces.

the Bisons gone, the IAF may have to use the Hawk for the close support role. The Hawk may do so adequately (if with heavy losses) but that was not what we planned for. It is stupidity to repeat past mistakes and expect different results. *We must change tack*. We must make the process more "democratic". We must stop the failures early. In all military technology we must 'grow' leaders first and technology will follow. This is the quicker and more certain way to success.

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